DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

TM 11-5062

TO 16-35PP712-5

FREQUENCY SHIFT CONVERTERS

CV-182/GRC-26A AND CV-182A/GRC-26A

AND POWER SUPPLIES

PP-712/GRC-26A AND PP-712A/GRC-26A

DEPARTMENTS OF THE ARMY AND THE AIR FORCE

AUGUST 1952

FREQUENCY SHIFT CONVERTERS CV-182/GRC-26A, CV-182A/GRC-26A, AND CV-182B/GRC-26A AND POWER SUPPLIES PP-712/GRC-26A AND PP-712A/GRC-26A

TM 11-5062
TO 31R2-2GRC26-41
CHANGES No. 3

DEPARTMENTS OF THE ARMY
AND THE AIR FORCE
WASHINGTON 25, D.C., *17 October 1962*

TM 11-5062/TO 31R2-2GRC26-41, 22 August 1952, is changed as follows:

Page 68. Add section IV.1 after section IV.

Section IV.1. FOURTH ECHELON TESTING PROCEDURES

55.1. General

a. Testing procedures are prepared for use by Signal Field Maintenance Shops and Signal Service Organizations responsible for fourth echelon maintenance to determine the acceptability of repaired signal equipment. These procedures set forth specific requirements that repaired signal equipment *must* meet before it is returned to the using organization. The testing procedures may also be used as a guide for testing equipment repaired at third echelon if the proper tools and test equipment are available. A summary of the performance standards is given in paragraph 55.11.

b. Each test depends on the preceding one for certain operating procedures and, where applicable, for test equipment calibrations. Comply with the instructions preceding the body of each chart before proceeding to the chart. Perform each test in sequence. *Do not vary the sequence.* For each step, perform all the actions required in the *Test equipment control settings* and *Equipment under test control settings* columns; then perform each specific test procedure and verify it against its performance standard.

55.2. Test Equipment, Materials, and Other Equipment

All test equipment, materials, and other equipment required to perform the testing procedures given in this section are listed in the following chart and are authorized under TA 11-17 (Signal Field Maintenance Shops), TA 11-100 (11-17) (Allowances of Signal Corps Expendable Supplies for Signal Field Maintenance Shop, Continental United States), and TOE 11-158D (Signal Depot Company) and TA 11-101 (11-158) (Allowances of Signal Corps Expendable Supplies for Signal Depot Company); or are repair items of the subject equipment authorized for stockage at fourth echelon level. Specific models and types of test equipment were used to perform the fourth echelon testing procedures. If these testing procedures are performed with other models or types of the test equipment, an allowance must be made for any test connections or control settings that may differ from those given in these test procedures.

a. Test Equipment.

Nomenclature	Federal stock No.	Technical manual
Multimeter ME-26(*)/U[a].		TM 11-6625-200-12
Voltmeter, Electronic ME-30(*)/U[b].	6625-669-0742	TM 11-6625-320-12
Rf Signal Generator AN/URM-25F.	6625-570-5719	TM 11-5551E
Transformer CN-16(*)/U[c].	5950-235-2086	None
Frequency Meter AN/TSM-16.	6625-542-1666	TM 11-6625-218-12
Electric Light Assembly MX-1292/PAQ.	6695-537-4470	TM 11-5540

[a] Indicates Multimeter, ME-26A/U (Federal stock No. 6625-360-2493) or ME-26B/U (Federal stock No. 6625-646-9409).
[b] Indicates Voltmeter, Meter ME-30A/U, or Voltmeter, Electronic ME-30B/U or ME-30C/U.
[c] Indicates Transformer CN-16/U, CN-16A/U, or CN-16B/U.

b. Materials and Other Equipment.

Nomenclature	Federal stock No.	Technical manual
Power Supply PP–712(*)/GRC–26A[a].	5820–548–1682	TM 11–5062
Frequency Shift Converter CV–182(*)/GRC–26A[b].	5820–240–3295	TM 11–5062
Headset HS–30–U	5965–164–7259	None
Connector, Adapter UG–514/U.	5935–351–4620	TM 11–6625–261–12
Connector, Adapter UG–274B/U.	5935–201–2411	None
Resistor, variable 2,500 ohms (2 each)[c].	5905–235–7873	None
Resistor, composition 100 ohms[d].	5905–101–8606	None
Hookup wire, #20 AWG insulated (approx 9 feet)[e].	6145–160–5300	None
Tape, pressure-sensitive, adhesive, crepe-paper-backed (1-inch x 60 yds)[f].	7510–266–6712	None

[a] Required if equipment under test is Frequency Shift Converter CV–182/GRC–26A, CV–182A/GRC–26A, or CV–182B/GRC–26A.
[b] Required if equipment under test is the Power Supply PP–712/GRC–26A or PP–712A/GRC–26A.
[c] Must be able to dissipate 10 watts or more.
[d] Must be able to dissipate ¼ watt or more.
[e] Any #20 AWG insulated hookup wire may be used.
[f] Masking, cellophane, or friction tape may be used.

55.3. Special Requirements

a. If the unit under test is the CV–182(*)/GRC–26A and a power supply is not available to supply operating voltages, obtain a PP–712(*)/GRC–26A.

b. If the unit under test is the PP–712(*)/GRC–26A and a suitable load is not available, obtain a CV–182(*)/GRC–26A.

c. Connect Multimeter ME–26B/U between terminals 2 and 3 of 2,500 ohm variable resistors R1 and R2 (figs. 51.1 through 51.4) and adjust them to the following values before performing the procedures for the tests in paragraphs 55.6 and 55.8 through 55.10: R1, 2,000 ohms; R2, 1,800 ohms.

Note. Reference designations R1 and R2 are arbitrarily assigned to facilitate identification of resistors used for these fourth-echelon testing procedures only; they do not represent reference designations assigned to parts of the equipment being tested.

55.4. Modification Work Orders

Perform all applicable Modification Work Orders pertaining to this equipment before making the tests specified. DA Pam 310–4 lists all current MWO's.

55.5. PP–712(*)/GRC–26A Physical Tests and Inspections

a. Test Equipment. Electric Light Assembly MX–1292/PAQ.

b. Test Connections and Conditions.

(1) No connections are required for the PP–712(*)/GRC–26A.

(2) Connect the MX–1292/PAQ to 115VAC; connect the lamp to 245V for MV lamp receptacle; and install the wide transmission filter.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test and inspection procedure	Performance standard
1	N/A	Controls may be set in any position.	*a.* Inspect all controls and mechanical assemblies for loose or missing screws, bolts, or nuts. *b.* Inspect hinge of front panel cover plate, and all connectors, sockets, and receptacles, for looseness and damage. *c.* Inspect fuses for proper seating and rating.	*a.* Screws, nuts, and bolts will be tight; none missing. *b.* No looseness or damage evident. *c.* Fuses are seated properly; F–301 and F–302 must be 3 amperes, and F–401 must be 1 ampere.
2	N/A	No change required.	*a.* Operate AC SUPPLY ON and PLATE ON switches to the on (up) and off (down) positions. *b.* Check case and chassis for damage, missing parts, condition of finish, and panel lettering. *Note.* Touchup painting is recommended in lieu of refinishing. Screwheads and receptacles will not be polished with abrasives.	*a.* Must operate positively without binding or scraping. *b.* No evidence of damage or missing parts. External surfaces intended to be painted will not show bare metal. Panel lettering will be legible.
3	N/A	No change required.	Check equipment for applicable modification work order (para. 55.4).	If MWO has been performed, MWO number appears on equipment. There should be no evidence of MFP on connector contacts.
4	*MX–1292/PAQ* 245V FOR MV LAMP: ON	No change required.	*a.* Expose chassis to direct rays of lamp and inspect parts, wiring, and chassis surfaces for evidence of MFP varnish. *Note.* MFP varnish glows grayish green when exposed to lamp. *b.* Turn off and disconnect lamp.	*a.* All parts, wiring, and chassis surfaces must be completely covered with MFP varnish. There should be no evidence: of MFP on connector contacts. *Note.* MFP varnish should not be applied to contacts or parts, that were not originally finished with MFP varnish. *b.* None.

			OFF and disconnect dc probe from E103. Operate ME–26B/U RANGE switch to 300V and connect dc probe to terminal 13 of E103.	
			e. Operate ON-OFF switch of CN–16B/U to ON and observe meter indication on ME–26B/U.	*e.* ME–26B/U indicates −160 volts dc ±15.
			f. Operate ON-OFF switch of CN–16B/U to OFF and disconnect test lead from E103.	*f.* None.
5	*ME–26B/U* Function: AC RANGE: 300V *CN–16B/U* ON-OFF: ON	No change required.	*Regulation test* *a.* Connect equipment as shown in A, figure 51.1 and adjust dial of CN–16B/U to indicate 103 volts ac on ME–26B/U.	*a.* None.
			b. Operate ON-OFF switch of CN–16B/U to OFF and connect equipment as shown in C, figure 51.1. Operate ME–26B/U FUNCTION switch to +.	*b.* None.
			c. Operate ON-OFF switch of CN–16B/U to ON and observe indication on ME–26B/U.	*c.* ME–26B/U indicates +150 volts dc ±7.
			d. Operate ON-OFF switch of CN–16B/U to OFF, connect equipment as shown in A, figure 51.1, and operate ME–26B/U FUNCTION switch to AC.	*d.* None.
			e. Operate ON-OFF switch of CN–16B/U to ON and adjust dial of CN–16B/U to indicate 127 volts ac on ME–26B/U.	*e.* None.
			f. Operate ON-OFF switch of CN–16B/U to OFF, connect equipment as shown in C, figure 51.1, and operate ME–26B/U FUNCTION switch to +.	*f.* None.
			g. Operate ON-OFF switch of CN–16B/U to ON and observe indication on ME–26B/U.	*g.* ME–26B/U indicates +150 volts dc ±7.
			h. Operate ON-OFF switch of CN–16B/U to OFF and disconnect equipment.	*h.* None.

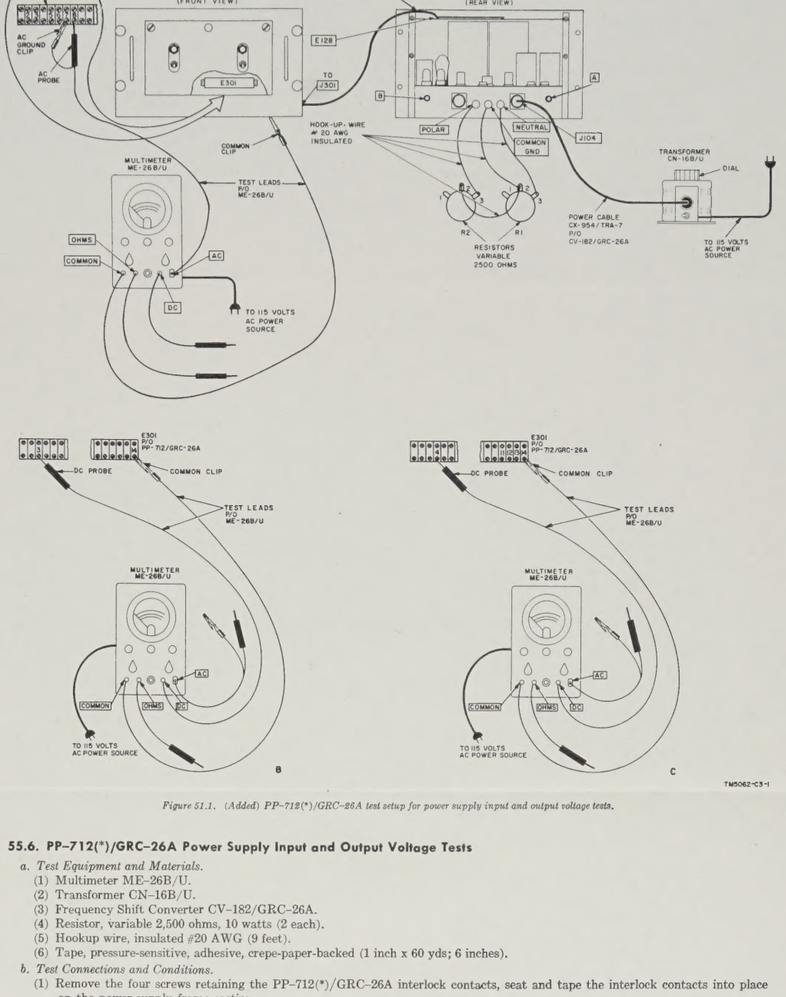


Figure 51.1. (Added) PP-712(*)/GRC-26A test setup for power supply input and output voltage tests.

55.6. PP-712(*)/GRC-26A Power Supply Input and Output Voltage Tests

a. Test Equipment and Materials.
(1) Multimeter ME-26B/U.
(2) Transformer CN-16B/U.
(3) Frequency Shift Converter CV-182/GRC-26A.
(4) Resistor, variable 2,500 ohms, 10 watts (2 each).
(5) Hookup wire, insulated #20 AWG (9 feet).
(6) Tape, pressure-sensitive, adhesive, crepe-paper-backed (1 inch x 60 yds; 6 inches).

b. Test Connections and Conditions.
(1) Remove the four screws retaining the PP-712(*)/GRC-26A interlock contacts, seat and tape the interlock contacts into place on the power-supply frame section.
(2) Connect the equipment as shown in A, figure 51.1; adjust R1 and R2 (par. 55.3c).
(3) Turn on the equipment and allow a 15-minute warmup before proceeding.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*CN-16B/U* OFF-ON: ON Dial: Maximum counterclockwise. *ME-26B/U* FUNCTION: AC RANGE: 300V *CV-182/GRC-26A* OUTPUT: MARK METER B: POLAR NEUTRAL OUTPUT: Midposition. MARK HOLD LEVEL: Midposition. POLAR OUTPUT MARK: Midposition.	*PP-712(*)/GRC-26A* AC SUPPLY: ON PLATE SUPPLY: ON	*Ac input test* *a.* Adjust dial of CN-16B/U for 115-volt indication on ME-26B/U. *b.* Adjust CV-182(*)/GRC-26A POLAR OUTPUT MARK control for +25 indication on METER B (CV-182(*)/GRC-26A). *c.* Operate CV-182(*)/GRC-26A METER B switch to NEUTRAL and adjust NEUTRAL OUTPUT control for +60 indication on meter B (CV-182(*)/GRC-26A). *d.* Operate OFF-ON switch of CN-16B/U to OFF, disconnect test leads from E301, and connect ac ground clip to terminal 2 and ac probe to terminal 3 of E301.	*a.* ME-26B/U indicates 115 volts ac. *b.* None. *c.* None. *d.* None.
2	*ME-26(*)/U* FUNCTION: AC RANGE: 10V	No change required.	*Ac output test* *a.* Operate ON-OFF switch of CN-16B/U to ON and observe indication on ME-26B/U. *b.* Operate ON-OFF switch of CN-16B/U to OFF, disconnect test leads from E301, and connect ac ground clip to terminal 5 and ac probe to terminal 6 of E301. *c.* Operate ON-OFF switch of CN-16B/U to ON and observe meter indication on ME-26B/U. *d.* Operate ON-OFF switch of CN-16B/U to OFF, disconnect test leads from E301, and connect equipment as shown in B, figure 51.1.	*a.* ME-26B/U indicates 6.3 volts ac ±0.3. *b.* None. *c.* ME-26B/U indicates 6.3 volts ac ±0.3. *d.* None.
3	*ME-26B/U* FUNCTION: + RANGE: 300V	No change required.	*Positive dc output test* *a.* Operate ON-OFF switch of CN-16B/U to ON and observe meter indication of ME-26B/U. *b.* Operate ON-OFF switch of CN-16B/U to OFF and connect equipment as shown in C, figure 51.1. *c.* Operate ON-OFF switch of CN-16B/U to ON and observe meter indication on ME-26B/U. *d.* Operate ON-OFF switch of CN-16B/U to OFF, and disconnect test lead from E301 and connect dc probe of ME-26B/U to terminal 11 of E301.	*a.* ME-26B/U indicates +280 volts dc ±15. *b.* None. *c.* ME-26B/U indicates +150 volts dc ±5. *d.* None.
4	*ME-26B/U* FUNCTION: − RANGE: 300V	No change required.	*Negative dc output test* *a.* Operate ON-OFF switch of CN-16B/U to ON and observe indication on ME-26B/U. *b.* Operate ON-OFF switch of CN-16B/U to OFF and disconnect test lead from E301. Operate ME-26B/U RANGE switch to 1000V and connect dc probe of ME-26B/U to terminal 12 of E103. *c.* Operate ON-OFF switch of CN-16B/U to ON and observe indication on ME-26B/U. *d.* Operate ON-OFF switch of CN-16B/U to OFF and disconnect dc probe from E103. Operate ME-26B/U RANGE switch to 300V and connect dc probe to terminal 13 of E103. *e.* Operate ON-OFF switch of CN-16B/U to ON and observe meter indication on ME-26B/U. *f.* Operate ON-OFF switch of CN-16B/U to OFF and disconnect test lead from E103.	*a.* ME-26B/U indicates −152.5 volts dc ±7.5. *b.* None. *c.* ME-26B/U indicates −400 volts dc ±20. *d.* None. *e.* ME-26B/U indicates −160 volts dc ±15. *f.* None.
5	*ME-26B/U* Function: AC RANGE: 300V *CN-16B/U* ON-OFF: ON	No change required.	*Regulation test* *a.* Connect equipment as shown in A, figure 51.1 and adjust dial of CN-16B/U to indicate 103 volts ac on ME-26B/U. *b.* Operate ON-OFF switch of CN-16B/U to OFF and connect equipment as shown in C, figure 51.1. Operate ME-26B/U FUNCTION switch to +. *c.* Operate ON-OFF switch of CN-16B/U to ON and observe indication on ME-26B/U. *d.* Operate ON-OFF switch of CN-16B/U to OFF, connect equipment as shown in A, figure 51.1, and operate ME-26B/U FUNCTION switch to AC. *e.* Operate ON-OFF switch of CN-16B/U to ON and adjust dial of CN-16B/U to indicate 127 volts ac on ME-26B/U. *f.* Operate ON-OFF switch of CN-16B/U to OFF, connect equipment as shown in C, figure 51.1, and operate ME-26B/U FUNCTION switch to +. *g.* Operate ON-OFF switch of CN-16B/U to ON and observe indication on ME-26B/U. *h.* Operate ON-OFF switch of CN-16B/U to OFF and disconnect equipment.	*a.* None. *b.* None. *c.* ME-26B/U indicates +150 volts dc ±7. *d.* None. *e.* None. *f.* None. *g.* ME-26B/U indicates +150 volts dc ±7. *h.* None.



55.7. CV–182(*)/GRC–26A Physical Tests and Inspections

a. Test Equipment. Electric Light Assembly MX–1292/PAQ.

b. Test Connections and Conditions.

(1) No connections required for the CV–182(*)/GRC–26A.

(2) Connect the MX–1292/PAQ to 115 volts ac; connect the lamp to 245V MV lamp receptacle; and install the wide transmission filter.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test and inspection procedure	Performance standard
1	N/A	Controls may be in any position.	*a.* Inspect all controls and mechanical assemblies for loose or missing screws, bolts, or nuts. *b.* Inspect hinge of front panel cover plate, all connectors, sockets, and receptacles, including fuseholders for looseness and damage.	*a.* Screws, nuts, and bolts will be tight; none missing. *b.* No looseness or damage evident.
2	N/A	No change required.	Check case and chassis for damage, missing parts, condition of finish, and panel lettering. *Note.* Touchup painting is recommended in lieu of refinishing. Screwheads and receptacles will not be polished with abrasives.	No evidence of damage or missing parts. External surfaces intended to be painted will not show bare metal. Panel lettering will be legible.
3	N/A	No change required.	Check equipment for applicable modification work order (par. 55.4).	If MWO is performed, find number on equipment.
4	N/A	No change required.	*a.* Expose chassis to direct rays of lamp and inspect parts, wiring, and chassis surfaces for evidence of MFP. Inspect connector contacts for absence of MFP varnish. *Note.* MFP varnish glows grayish green when exposed to lamp. *b.* Turn off and disconnect lamp.	*a.* All parts, wiring, and chassis surfaces must be completely covered with MFP varnish. There should be no evidence of MFP on connector contacts. *Note.* MFP varnish should not be applied to contacts or parts, that were not originally finished with MFP varnish. *b.* None.

			ON, adjust MICROVOLT control for 500-microvolt indication on output meter of AN/URM-25F, and observe meter indication on ME-30A/U.	volts ac for 500-microvolts signal input.
			b. Operate ON-OFF switch of CN-16B/U to OFF, connect equipment as shown in C, figure 51.2 and adjust ATTENUATOR control of AN/URM-25F to 100K.	*b.* None.
			c. Operate ON-OFF switch of CN-16B/U to ON and adjust MICROVOLT control of AN/URM-25F for .2 volt ac indication on ME-30A/U.	*c.* None.
			d. Operate ON-OFF switch of CN-16B/U to OFF and connect equipment as shown in B, figure 51.2.	*d.* None.
			e. Operate ON-OFF switch of CN-16B/U to ON and observe meter indication on ME-30A/U.	*e.* ME-30A/U indicates 6-volts ac ±2.
6	No change required.	METER B: +275V	*METER B tests* *a.* Observe indication on meter B of CV-182(*)/GRC-26A.	*a.* Meter B indicates +55 ±9.
			b. Operate METER B control to REG +150V and observe indication on meter B of CV-182(*)/GRC-26A.	*b.* Meter B indicates +30 ±10.
			c. Operate METER B control to REG-150V and observe indication on meter B of CV-182(*)/GRC-26A.	*c.* Meter B indicates −30 ±10.
			d. Operate METER B control to −150V and observe indication on METER B of CV-182(*)/GRC-26A.	*d.* Meter B indicates −30 ±10.
			e. Operate METER B control to −400V and observe indication on meter B of CV-182(*)/GRC-26A.	*e.* Meter B indicates −80 ±15.
			f. Operate ON-OFF switch of CN-16B/U to OFF and disconnect equipment.	*f.* None.

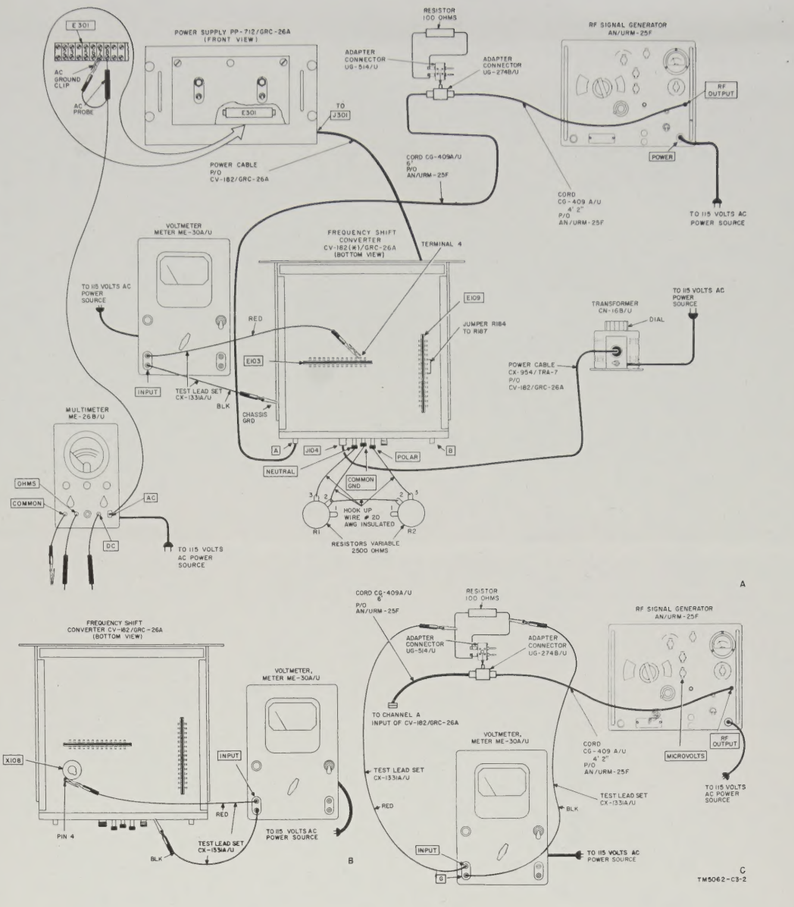


Figure 51.2. (Added) *CV–182(*)/GRC–26A test setup for converter input, limiter, and meter B tests.*

55.8. CV–182(*)/GRC–26A, Converter Input, Limiter, and Meter B Tests

Note. It is advisable but not mandatory that this test be made in a screen room such as Electromagnetic Shielding Inclosure MX–1761/G or equivalent.

a. Test Equipment and Materials.
(1) RF Signal Generator AN/URM–25F.
(2) Voltmeter, Meter ME–30A/U.
(3) Multimeter ME–26B/U.
(4) Transformer CN–16B/U.
(5) Power Supply PP–712/GRC–26A.
(6) Connector, Adapter UG–274B/U.
(7) Connector, Adapter UG–514/U.
(8) Resistors, variable 2,500 ohms (2 each).
(9) Resistor, composition 100 ohms.
(10) Hookup wire #20 AWG insulated (9 feet).

b. Test Connections and Condition .
(1) Remove the bottom cover from the CV–182(*)/GRC–26A under test.
(2) Connect the equipment as shown in A, figure 51.2; adjust R1 and R2 (par. 55.3c).
(3) Operate the equipment and allow a 15-minute warmup before proceeding.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*CN–16B/U* ON-OFF: ON Dial: Fully counterclockwise *PP–712/GRC–26A* AC SUPPLY: ON PLATE: ON *ME–26B/U* FUNCTION: AC RANGE: 300V *AN/URM–25F* SET RF OUTPUT: Fully counterclockwise. % MOD: Fully counterclockwise. METER READS RF OUTPUT: CW. ATTENUATOR: 100K MICROVOLTS: Fully clockwise. BAND SWITCH: 220–600 KILOCYCLES. TUNING: To converter under test input freq. (440–510 kc). *ME–30A/U* Range selector switch: 30 VOLTS. Power switch: ON	*CV–182(*)/GRC–26A* CHANNEL A FINE TUNING: Midposition. CHANNEL A OPERATE-DISABLED: OPERATE CHANNEL B FINE TUNING: Midposition. CHANNEL B OPERATE-DISABLE: OPERATE. METER B: CHAN B BANDWIDTH: NARROW *Note.* Remaining controls in any position.	*Channel A input test* *a.* Adjust dial of CN–16B/U for 115-volt indication on ME–26B/U. *b.* Rotate AN/URM–25F SET RF OUTPUT control clockwise until output meter indicates in red arc. *c.* Adjust AN/URM–25F TUNING control for zero indication on METER A of CV–182/GRC–26A and observe meter indication on ME–30A/U. *d.* Operate BANDWIDTH switch of CV–182(*)/GRC–26A to WIDE and observe indication on ME–30A/U. *e.* Remove cable from channel A input connector and connect it to channel B input connector of CV–182(*)/GRC–26A.	*a.* None. *b.* None. *c.* ME–30A/U indicates 17.5 volts ac ±7.5. *d.* ME–30A/U indicates 22.5 volts ac ±7.5. *e.* None.
2	*ME–30A/U* Range selector switch: 100 VOLTS.	No change required.	*Channel B input test* *a.* Adjust AN/URM–25F TUNING control for zero indication on meter B of CV–182(*)/GRC–26A, and observe meter indication on ME–30A/U. *b.* Operate BANDWIDTH switch of CV–182(*)/GRC–26A to NARROW and observe meter indication on ME–30A/U.	*a.* ME–30A/U indicates 30 volts ac ±10. *b.* ME–30A/U indicates 17.5 volts ac ±7.5.
3	*ME–30A/U* Range selector switch: 10 VOLTS. *AN/URM–25F* ATTENUATOR: 30 MICROVOLTS: Fully counterclockwise.	METER B: INPUT.	*Channel B sensitivity test* *a.* Rotate AN/URM–25F MICROVOLTS control until meter B of CV–182(*)/GRC–26A indicates +50. *b.* Observe meter indications on AN/URM–25F and ME–30A/U. *c.* Remove cable from channel B input connector and connect it to channel A connector of CV–182(*)/GRC–26A.	*a.* None. *b.* AN/URM–25F indicates not more than 20 microvolts and ME–30A/U indicates not more than 6 volts. *c.* None.
4	No change required.	No change required.	*Channel A sensitivity test* *a.* Adjust AN/URM–25F TUNING control for zero indication on meter A of CV–182(*)/GRC–26A. *b.* Rotate AN/URM–25F MICROVOLT control until METER B of CV–182(*)/GRC–26A indicates +50. *c.* Observe meter indications on AN/URM–25F and ME–30A/U. *d.* Operate ON-OFF switch of CN–16B/U to OFF and connect ME–30A/U to CV–182(*)/GRC–26A as shown in B, figure 51.2.	*a.* None. *b.* None. *c.* AN/URM–25F indicates not more than 30 microvolts and ME–30A/U indicates not more than 6 volts. *d.* None.
5	*AN/URM–25F* ATTENUATOR: 1K	No change required.	*Limiter tests* *a.* Operate ON-OFF switch of CN–16B/U to ON, adjust MICROVOLT control for 500-microvolt indication on output meter of AN/URM–25F, and observe meter indication on ME–30A/U. *b.* Operate ON-OFF switch of CN–16B/U to OFF, connect equipment as shown in C, figure 51.2 and adjust ATTENUATOR control of AN/URM–25F to 100K. *c.* Operate ON-OFF switch of CN–16B/U to ON and adjust MICROVOLT control of AN/URM–25F for .2 volt ac indication on ME–30A/U. *d.* Operate ON-OFF switch of CN–16B/U to OFF and connect equipment as shown in B, figure 51.2. *e.* Operate ON-OFF switch of CN–16B/U to ON and observe meter indication on ME–30A/U.	*a.* ME–30A/U indicates not less than 3.5 volts ac for 500-microvolts signal input. *b.* None. *c.* None. *d.* None. *e.* ME–30A/U indicates 6-volts ac ±2.
6	No change required.	METER B: +275V	*METER B tests* *a.* Observe indication on meter B of CV–182(*)/GRC–26A. *b.* Operate METER B control to REG +150V and observe indication on meter B of CV–182(*)/GRC–26A. *c.* Operate METER B control to REG–150V and observe indication on meter B of CV–182(*)/GRC–26A. *d.* Operate METER B control to −150V and observe indication on METER B of CV–182(*)/GRC–26A. *e.* Operate METER B control to −400V and observe indication on meter B of CV–182(*)/GRC–26A. *f.* Operate ON-OFF switch of CN–16B/U to OFF and disconnect equipment.	*a.* Meter B indicates +55 ±9. *b.* Meter B indicates +30 ±10. *c.* Meter B indicates −30 ±10. *d.* Meter B indicates −30 ±10. *e.* Meter B indicates −80 ±15. *f.* None.





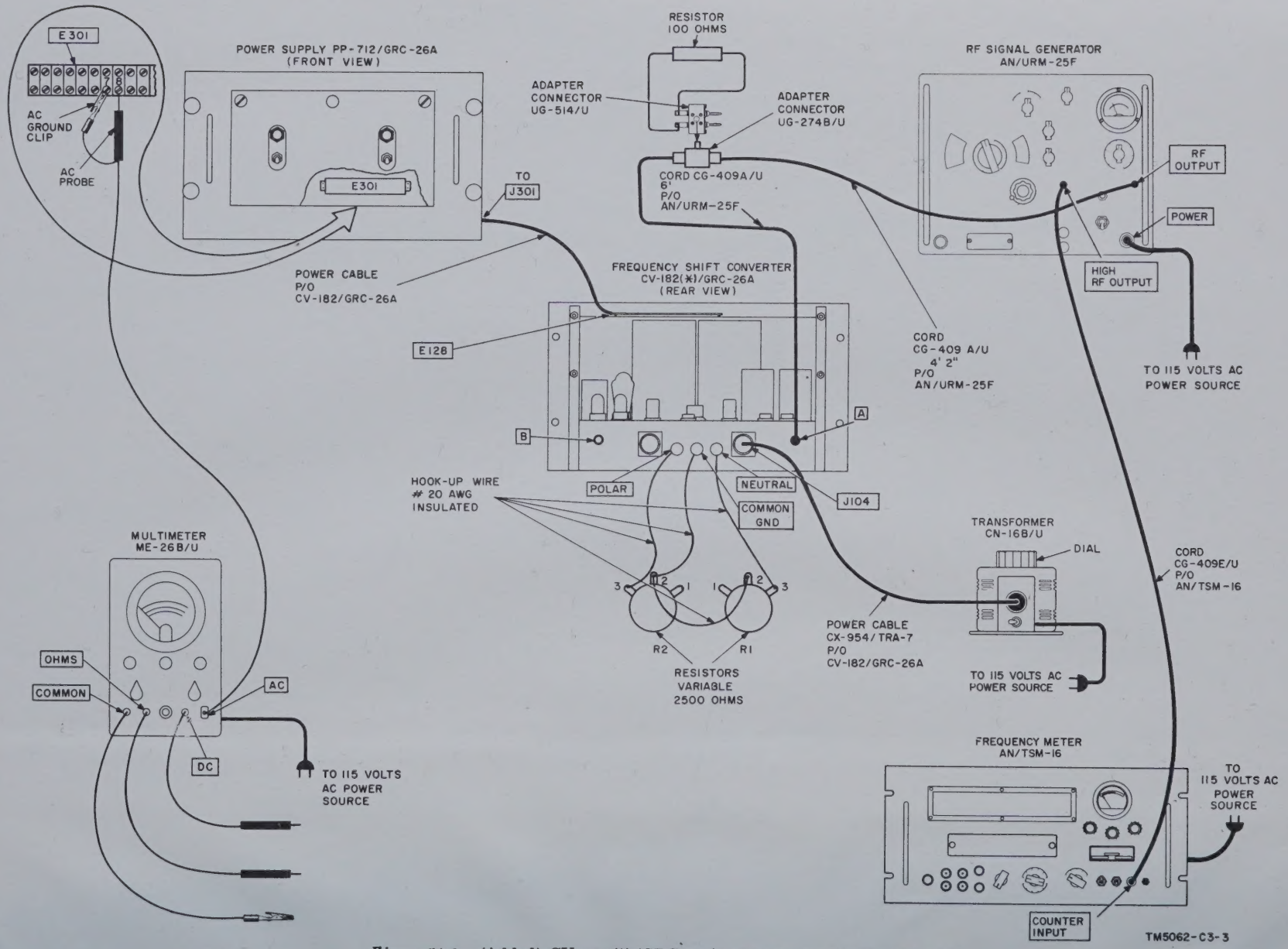


Figure 51.3. (Added) *CV-182(*)/GRC-26A, test setup for discriminator tests.*

	frequency (400–510 kc). *AN/TSM–16* POWER-STANDBY-OFF: POWER. MULTIPLY FREQUENCY BY: 1. FUNCTION: TEST RESET: Up AUTO-MANUAL: AUTO SENSITIVITY: Fully counterclockwise. TRIGGER VOLTAGE: Fully counterclockwise. DISPLAY TIME: Midposition. INT.-EXT.: INT.		182(*)/GRC–26A and observe converter input frequency indicated on AN/TSM–16. *e.* Adjust AN/URM–25F TUNING control to indicate 425-cycle increase on AN/TSM–16, and observe indication on meter A of CV–182(*)/GRC–26A. *f.* Adjust AN/URM–25F TUNING control to indicate 850-cycle decrease on AN/TSM–16, and observe indication on meter A of CV–182(*)/GRC–26A. *g.* Disconnect cable from channel A input and connect it to channel B input of CV–182(*)/GRC–26A.	*e.* Meter A deflects right and indicates 50 ±10. *f.* Meter A deflects left and indicates 50 ±10. *g.* None.
2	No change required.	METER B: CHAN B	*Channel B test* *a.* Adjust AN/URM–25F TUNING control for zero indication on meter B of CV–182(*)/GRC–26A, and observe frequency indicated on AN/TSM–16. *b.* Adjust AN/URM–25F TUNING control to indicate 425-cycle increase on AN/TSM–16, and observe indication on meter B of CV–182(*)/GRC–26A.	*a.* None. *b.* Meter B deflects right and indicates 50 ±10.
	No change required.	No change required.	*c.* Adjust AN/URM–25F TUNING control to indicate 850-cycle decrease on AN/TSM–16, and observe indication on meter B of CV–182(*)/GRC–26A. *d.* Operate ON-OFF switch of CN–16B/U to OFF and disconnect equipment.	*c.* Meter B deflects left and indicates 50 ±10. *d.* None.

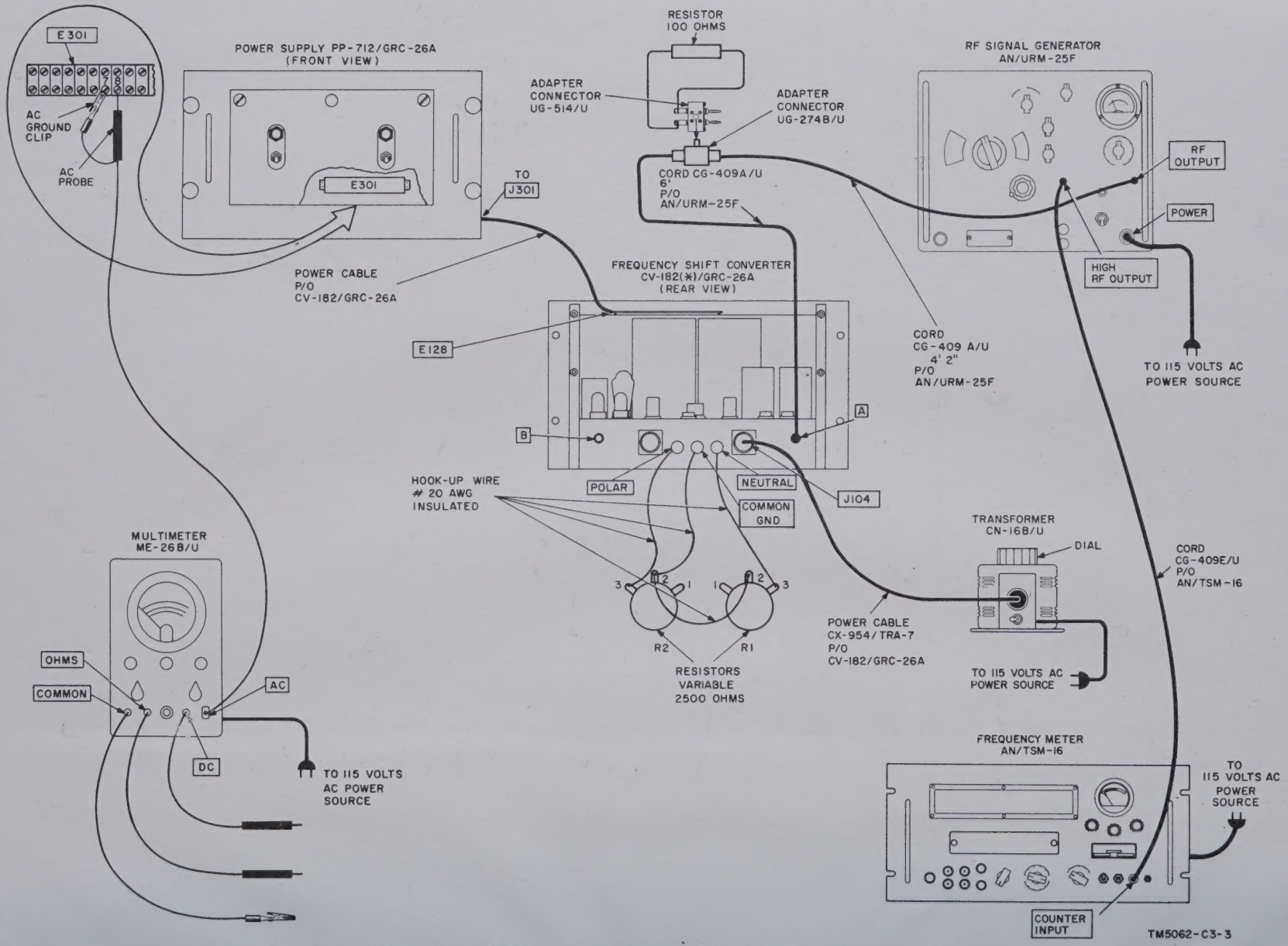


Figure 51.3. (Added) *CV-182(*)/GRC-26A, test setup for discriminator tests.*

55.9. CV–182(*)/GRC–26A, Discriminator Tests

a. Test Equipment and Materials.

(1) RF Signal Generator AN/URM–25F.
(2) Frequency Meter AN/TSM–16.
(3) Multimeter ME–26B/U.
(4) Transformer CN–16B/U.
(5) Resistors, variable 2,500 ohms, 10 watts (2 each).
(6) Power Supply PP–712/GRC–26A.
(7) Connector, Adapter UG–274B/U.
(8) Connector, Adapter UG–514/U.
(9) Resistor, composition 100 ohms, ¼ watt.
(10) Hookup wire #20 AWG insulated.

b. Test Connections and Conditions.

(1) Connect the equipment as shown in A, figure 51.3; adjust R1 and R2 (par. 55.3*c*).
(2) Turn on the equipment and allow a 15-minute warmup before proceeding.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*CN–16B/U* ON-OFF: ON Dial: Maximum counterclockwise. *PP–712/GRC–26A* AC SUPPLY: ON PLATE: ON *ME–26B/U* FUNCTION: AC RANGE: 300V *AN/URM–25F* SET RF OUTPUT: Fully counterclockwise. POWER ON-OFF: ON FUNCTION: CW ATTENUATOR: 100 MICROVOLT: Fully clockwise. BAND SWITCH: 220–600 KILOCYCLES. TUNING: To converter input frequency (400–510 kc). *AN/TSM–16* POWER-STANDBY-OFF: POWER. MULTIPLY FREQUENCY BY: 1. FUNCTION: TEST RESET: Up AUTO-MANUAL: AUTO SENSITIVITY: Fully counterclockwise. TRIGGER VOLTAGE: Fully counterclockwise. DISPLAY TIME: Midposition. INT.-EXT.: INT.	*CV–182(*)/GRC–26A* CHANNEL A FINE TUNING: Midposition. CHANNEL A OPERATE-DISABLE: OPERATE. CHANNEL B FINE TUNING: Midposition. CHANNEL B OPERATE-DISABLE: OPERATE. BANDWIDTH: WIDE	*Channel A test* *a.* Adjust dial of CN–16B/U for 115-volt indication on ME–26B/U. *b.* Rotate AN/URM–25F SET RF OUTPUT control until output meter indicates 50 microvolts. *c.* Prepare AN/TSM–16 for operation as follows: (1) Rotate TRIGGER VOLTAGE control clockwise and set it halfway between positions where indicators start counting and stop counting. (2) Counter indicates 100000 or 099999. (3) Operate FUNCTION control to SCAN COUNT and adjust SENSITIVITY control until INPUT METER indicates in green area. (4) Operate FUNCTION control to FREQ COUNT. *d.* Adjust AN/URM–25F TUNING control for zero indication on meter A of CV–182(*)/GRC–26A and observe converter input frequency indicated on AN/TSM–16. *e.* Adjust AN/URM–25F TUNING control to indicate 425-cycle increase on AN/TSM–16, and observe indication on meter A of CV–182(*)/GRC–26A. *f.* Adjust AN/URM–25F TUNING control to indicate 850-cycle decrease on AN/TSM–16, and observe indication on meter A of CV–182(*)/GRC–26A. *g.* Disconnect cable from channel A input and connect it to channel B input of CV–182(*)/GRC–26A.	*a.* None. *b.* None. *c.* None. *d.* None. *e.* Meter A deflects right and indicates 50 ±10. *f.* Meter A deflects left and indicates 50 ±10. *g.* None.
2	No change required. No change required.	METER B: CHAN B No change required.	*Channel B test* *a.* Adjust AN/URM–25F TUNING control for zero indication on meter B of CV–182(*)/GRC–26A, and observe frequency indicated on AN/TSM–16. *b.* Adjust AN/URM–25F TUNING control to indicate 425-cycle increase on AN/TSM–16, and observe indication on meter B of CV–182(*)/GRC–26A. *c.* Adjust AN/URM–25F TUNING control to indicate 850-cycle decrease on AN/TSM–16, and observe indication on meter B of CV–182(*)/GRC–26A. *d.* Operate ON-OFF switch of CN–16B/U to OFF and disconnect equipment.	*a.* None. *b.* Meter B deflects right and indicates 50 ±10. *c.* Meter B deflects left and indicates 50 ±10. *d.* None.



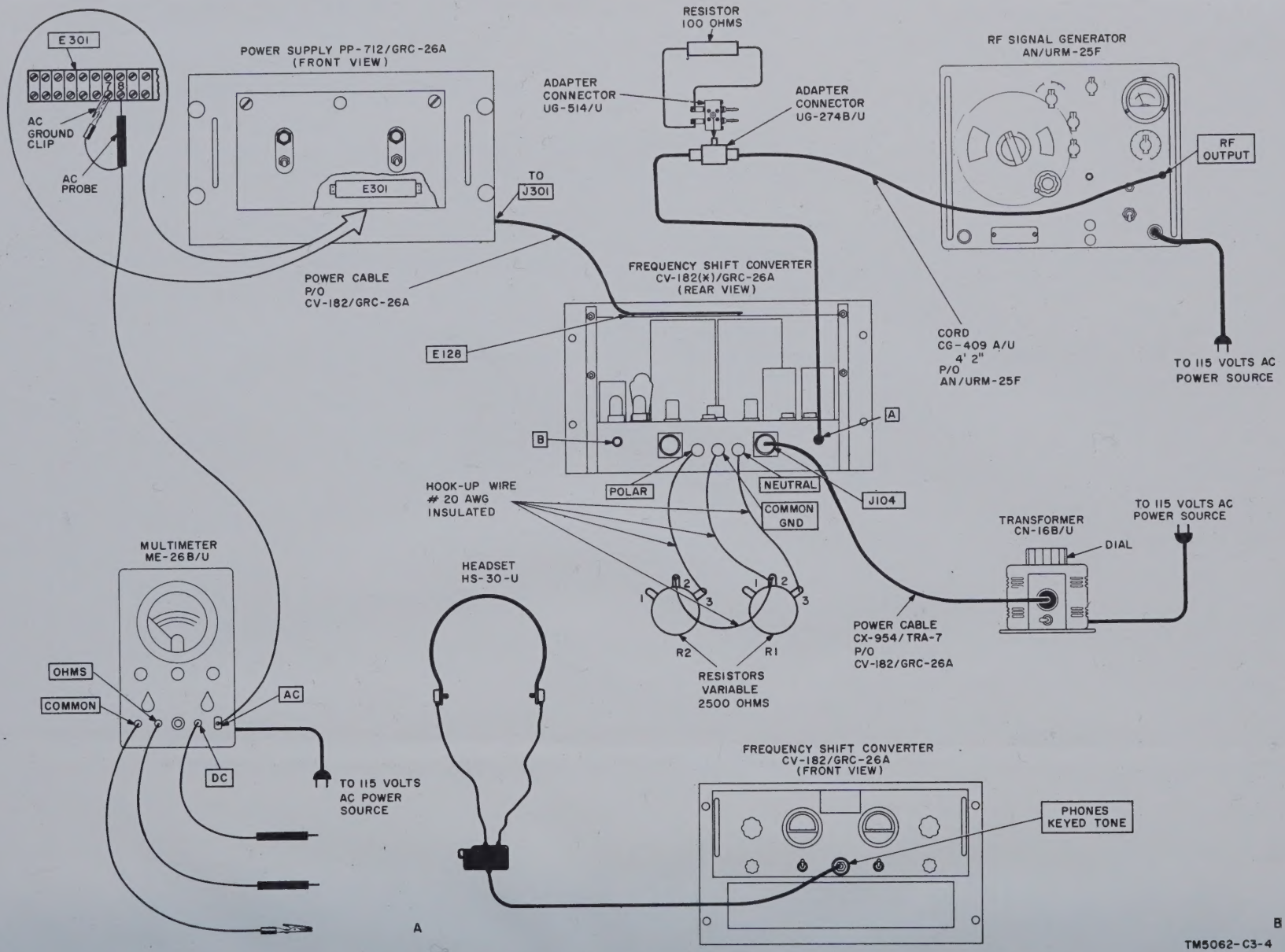


Figure 51.4. (Added) *CV-182(*)/GRC-26A test setup for drift compensator, output, and tone oscillator tests.*

55.10. CV–182(*)/GRC–26A Drift Compensator, Output, and Tone Oscillator Tests

a. Test Equipment and Materials.

(1) RF Signal Generator AN/URM–25F.
(2) Multimeter ME–26B/U.
(3) Power Supply PP–712/GRC–26A.
(4) Transformer CN–16B/U.
(5) Headset HS–30–U.
(6) Resistors, variable 2,500 ohms, 10 watts (2 each).
(8) Hookup wire, #20 AWG insulated.

			switch of CN–16B/U to OFF. *d.* Adjust R2 (variable resistor) to minimum resistance, (fully counterclockwise). Operate ON-OFF switch of CN–16B/U to ON, and observe indication on meter B of CV–182(*)/GRC–26A. *e.* Operate OUTPUT control to MARK and observe indication on meter B of CV–182/GRC–26A.	*d.* Meter B indicates not less than −40. *e.* Meter B indicates not less than +40.
3	No change required.	METER B: NEUTRAL NEUTRAL OUTPUT: Fully clockwise.	*Neutral output test* *a.* Observe indication on meter B of CV–182(*)/GRC–26A. *b.* Rotate NEUTRAL OUTPUT control fully counterclockwise. *c.* Operate ON-OFF switch of CN–16B/U to OFF and adjust R1 (variable resistor) to minimum resistance (fully counterclockwise). *d.* Operate ON-OFF switch of CN–16B/U to ON and observe indication on meter B of CV–182(*)/GRC–26A.	*a.* Meter B indicates not less than +60. *b.* None. *c.* None. *d.* Meter B indicates not less than +63.
4	No change required.	No change repuired.	*Tone oscillator test* *a.* Connect equipment as shown in B, figure 51.4 and listen for presence of tone from Headset HS–30–U. *b.* Operate OUTPUT switch of CV–182(*)/GRC–26A to SPACE and listen for presence of tone from Headset HS–30–U. *c.* Operate ON-OFF switch of CN–16B/U to OFF and disconnect all equipment.	*a.* Tone from HS–30–U is clear and free from hum, noise, and buzz. *b.* No tone is heard from HS–30–U. *c.* None.

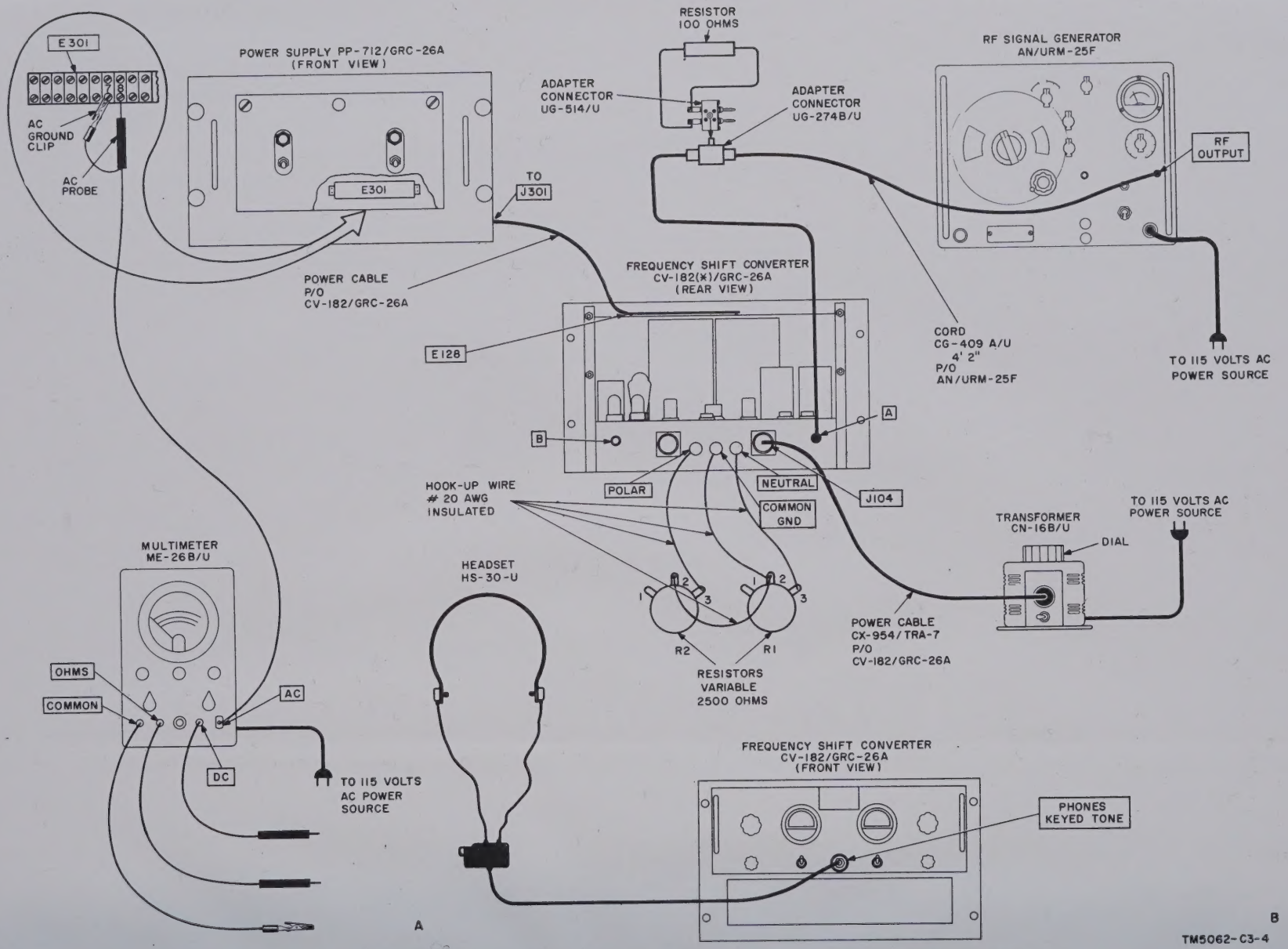


Figure 51.4. (Added) *CV-182(*)/GRC-26A test setup for drift compensator, output, and tone oscillator tests.*

55.10. CV–182(*)/GRC–26A Drift Compensator, Output, and Tone Oscillator Tests

a. Test Equipment and Materials.

(1) RF Signal Generator AN/URM–25F.
(2) Multimeter ME–26B/U.
(3) Power Supply PP–712/GRC–26A.
(4) Transformer CN–16B/U.
(5) Headset HS–30–U.
(6) Resistors, variable 2,500 ohms, 10 watts (2 each).
(8) Hookup wire, #20 AWG insulated.

b. Test Connections and Conditions.

(1) Connect the equipment as shown in A, figure 51.4; adjust R1 and R2 (par. 55.3c).
(2) Turn equipment on and allow a 15-minute warmup before proceeding.

c. Procedure.

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	*CN–16B/U* ON-OFF: ON Dial: Fully counterclockwise *ME–26B/U* FUNCTION: AC RANGE: 300V *AN/URM–25F* POWER ON-OFF: ON FUNCTION SWITCH: CW ATTENUATOR: 100 SET RF OUTPUT: Fully counterclockwise. % MOD: Fully counterclockwise. MICROVOLTS: Fully clockwise. BAND SWITCH: 220–600 KILOCYCLES. TUNING: To converter input frequency (440–510-kc). *PP–712/GRC–26A* AC SUPPLY: ON PLATE: ON	*CV–182(*)/GRC–26A* METER B: CHAN A+B BAND WIDTH: WIDE CHANNEL A FINE TUNING: Midposition. CHANNEL A OPERATE-DISABLED: OPERATE. CHANNEL B OPERATE-DISABLED: OPERATE. CHANNEL B FINE TUNING: Midposition. MARK HOLD LEVEL: OFF AMP GAIN: Fully counterclockwise. OUTPUT: NORMAL DRIFT COMPENSATOR: IN. LIMITER: Fully clockwise POLAR OUTPUT MARK: Fully counterclockwise. POLAR OUTPUT SPACE: Fully counterclockwise. COMP AMP: Fully counterclockwise. LP FIL IN: Down position COMP AMP: Fully counterclockwise.	*Drift compensator test* *a.* Adjust dial of CN–16B/U for 115-volt ac indication on ME–26B/U. *b.* Rotate AN/URM–25F SET RF OUTPUT control clockwise until output meter indicates in red arc. *c.* Adjust AN/URM–25F MICROVOLT control for 50-microvolt indication on output meter. *d.* Adjust AN/URM–25F TUNING control for zero indication on meter A, and zero ±5 indication on meter B of CV–182(*)/GRC–26A. *e.* Rotate BIAS A control of CV–182(*)/GRC–26A slowly until indication on meter B reverses direction and note position of BIAS A control. Reverse rotation of BIAS A control until indication on meter B again reverses direction and note position of BIAS A control. Estimate number of degrees between first and second positions noted of BIAS A control. *f.* Adjust BIAS A control midway between points of rotation noted in *e*. *g.* Rotate BIAS B control of CV–182(*)/GRC–26A slowly until indication on meter B reverses direction and note position of BIAS B control. Reverse rotation of BIAS B control until indication on meter B again reverses direction and note position of BIAS B control. Estimate number of degrees between first and second positions noted of BIAS B control. *h.* Adjust BIAS B control to midway between points of rotation noted in *g*. *i.* Rotate AMP GAIN control of CV–182(*)/GRC–26A clockwise slowly and rotate CHANNEL A FINE TUNING control back and forth (simulates mark and space keying) until meter B's indication reverses direction. Observe amount of rotation of AMP GAIN control. *j.* Rotate CHANNEL A FINE TUNING control to simulate a steady mark and space and adjust COMP AMP and COMP BAL controls of CV–182(*)/GRC–26 until meter B indicates +70±5 (mark) and −70±5 (space). Observe amount of rotation of COMP AMP control. *k.* Rotate CHANNEL A FINE TUNING control until meter B deflects right and adjust LIMITER control until meter B indicates +50. Observe position of LIMITER control. *l.* Rotate CHANNEL A FINE TUNING control until meter B deflects left. Observe indication on meter B.	*a.* None. *b.* None. *c.* None. *d.* None. *e.* Rotation of BIAS A control is less than 20°. *f.* None. *g.* Rotation of BIAS B control is less than 20°. *h.* None. *i.* AMP GAIN control is not more than 65% of full clockwise rotation. *j.* COMP AMP control is not more than 65% of full clockwise rotation. *k.* LIMITER control is less than 50% of full counterclockwise rotation. *l.* Meter B indicates −50 ±10.
2	No change required.	OUTPUT: MARK METER B: POLAR POLAR OUTPUT MARK: Fully clockwise. POLAR OUTPUT SPACE: Fully clockwise.	*Polar output test* *a.* Observe indication of meter B of CV–182(*)/GRC–26A. *b.* Adjust OUTPUT control to SPACE and observe indication on meter B. *c.* Rotate POLAR OUTPUT MARK and POLAR OUTPUT SPACE controls fully counterclockwise, and operate ON-OFF switch of CN–16B/U to OFF. *d.* Adjust R2 (variable resistor) to minimum resistance, (fully counterclockwise). Operate ON-OFF switch of CN–16B/U to ON, and observe indication on meter B of CV–182(*)/GRC–26A. *e.* Operate OUTPUT control to MARK and observe indication on meter B of CV–182/GRC–26A.	*a.* Meter B indicates not less than +25. *b.* Meter B indicates not less than −25. *c.* None. *d.* Meter B indicates not less than −40. *e.* Meter B indicates not less than +40.
3	No change required.	METER B: NEUTRAL NEUTRAL OUTPUT: Fully clockwise.	*Neutral output test* *a.* Observe indication on meter B of CV–182(*)/GRC–26A. *b.* Rotate NEUTRAL OUTPUT control fully counterclockwise. *c.* Operate ON-OFF switch of CN–16B/U to OFF and adjust R1 (variable resistor) to minimum resistance (fully counterclockwise). *d.* Operate ON-OFF switch of CN–16B/U to ON and observe indication on meter B of CV–182(*)/GRC–26A.	*a.* Meter B indicates not less than +60. *b.* None. *c.* None. *d.* Meter B indicates not less than +63.
4	No change required.	No change repuired.	*Tone oscillator test* *a.* Connect equipment as shown in B, figure 51.4 and listen for presence of tone from Headset HS–30–U. *b.* Operate OUTPUT switch of CV–182(*)/GRC–26A to SPACE and listen for presence of tone from Headset HS–30–U. *c.* Operate ON-OFF switch of CN–16B/U to OFF and disconnect all equipment.	*a.* Tone from HS–30–U is clear and free from hum, noise, and buzz. *b.* No tone is heard from HS–30–U. *c.* None.

55.11. Summary of Performance Standards

A typical chart that can be prepared to record test indications for the equipment being tested is given below.

Test	Performance standard	Test indication
1. PP–712(*)/GRC–26A, Power supply input and output voltage tests (par. 55.6).		
a. Ac input test	115 volts ac	_____
b. Ac output test		
(1) Test No. 1	6.3 volts ac ±0.3	_____
(2) Test No. 2	6.3 volts ac ±0.3	_____
c. Positive dc output test		
(1) Test No. 1	+280 volts dc ±15	_____
(2) Test No. 2	+150 volts dc ±5	_____
d. Negative dc output test		
(1) Test No. 1	−152.5 volts dc ±7.5	_____
(2) Test No. 2	−400 volts dc ±20	_____
(3) Test No. 3	−160 volts dc ±15	_____
e. Regulation test	+150 volts dc ±7 for 103- to 127-volt ac input	_____
2. CV–182(*)/GRC–26A, Converter input, limiter, and meter B tests (par. 55.8).		
a. Channel A input test		
(1) Test No. 1	17.5 volts ac ±7.5	_____
(2) Test No. 2	22.5 volts ac ±7.5	_____
b. Channel B input test		
(1) Test No. 1	30 volts ac ±10	_____
(2) Test No. 2	17.5 volts ac ±7.5	_____
c. Channel B sensitivity test	Not more than 20 microvolts input or 6 volts output.	_____
d. Channel A sensitivity test	Not more than 30 microvolts input or 6 volts output.	_____
e. Limiter tests		
(1) Test No. 1	Not less than 3.5 volts ac output for 500 microvolts input.	_____
(2) Test No. 2	6 volts ac ±2 output for 0.2 volts ac input	_____
f. Meter B tests		
(1) Test No. 1 (+275V)	+55 ±9	_____
(2) Test No. 2 (REG +150V)	+30 ±10	_____
(3) Test No. 3 (REG −150V)	−30 ±10	_____
(4) Test No. 4 (−150V)	−30 ±10	_____
(5) Test No. 5 (−400V)	−80 ±15	_____
3. CV–182(*)/GRC–26A, discriminator test (par. 55.9).		
a. Channel A test		
(1) Test No. 1	Meter A deflects right 50 ±10	_____
(2) Test No. 2	Meter A deflects left 50 ±10	_____
b. Channel B test		
(1) Test No. 1	Meter B deflects right 50 ±10	_____
(2) Test No. 2	Meter B deflects left 50 ±10	_____
4. CV–182(*)/GRC–26A, Drift compensator, output, and tone oscillator test (par. 55.10).		
a. Drift compensator test		
(1) Test No. 1 (BIAS A)	Less than 20° rotation	_____
(2) Test No. 2 (BIAS B)	Less than 20° rotation	_____
(3) Test No. 3 (AMP GAIN)	Less than 65% rotation of AMP GAIN control	_____
(4) Test No. 4 (COMP AMP)	Less than 65% rotation of COMP AMP control	_____
(5) Test No. 5 (LIMITER)	Less than 50% rotation of LIMITER control	_____
(6) Test No. 6 (LIMITER)	Meter B indicates −50 ±10	_____

Test	Performance standard	Test indication
b. Polar output test		
(1) Test No. 1	Meter B indicates not less than +25	
(2) Test No. 2	Meter B indicates not less than −25	
(3) Test No. 3	Meter B indicates not less than −40	
(4) Test No. 4	Meter B indicates not less than +40	
c. Neutral output test		
(1) Test No. 1	Meter B indicates not less than +60	
(2) Test No. 2	Meter B indicates not less than +63	
d. Tone oscillator test		
(1) Test No. 1	HS–30–U tone is clear, and free from hum, noise, and buzz.	
(2) Test No. 2	No tone is heard from HS–30–U	

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WARNING

HIGH VOLTAGE

is used in the operation of this equipment.

DEATH ON CONTACT

may result if operating personnel fail to observe safety precautions.



First Aid for Electric Shock

RESCUE.

In case of electric shock, shut off the high voltage at once and ground the circuits. If the high voltage cannot be turned off without delay, free the victim from contact with the live conductor as promptly as possible. Avoid direct contact with either the live conductor or the victim's body. Use a dry board, dry clothing, or other nonconductor to free the victim. An ax may be used to cut the high-voltage wire. Use extreme caution to avoid the resulting electric flash.

SYMPTOMS.

a. Breathing stops abruptly in electric shock if the current passes through the breathing center at the base of the brain. If the shock has not been too severe, the breath center recovers after a while and normal breathing is resumed, provided that a sufficient supply of air has been furnished meanwhile by artificial respiration.

b. The victim is usually very white or blue. The pulse is very weak or entirely absent and unconsciousness is complete. Burns are usually present. The victim's body may become rigid or stiff in a very few minutes. This condition is due to the action of electricity and is not to be considered rigor mortis. Artificial respiration must still be given, as several such cases are reported to have recovered. The ordinary and general tests for death should never be accepted.

TREATMENT.

a. Start artificial respiration immediately. At the same time send for a medical officer, if assistance is available. Do not leave the victim unattended. Perform artificial respiration at the scene of the accident, unless the victim's or operator's life is endangered from such action. *In this case only,* remove the victim to another location, but no farther than is necessary for safety. If the new location is more than a few feet away, artificial respiration should be given while the victim is being moved. If the method of transportation prohibits the use of the Shaeffer prone pressure method, other methods of resuscitation may be used. Pressure may be exerted on the front of the victim's diaphragm, or the direct mouth-to-mouth method may be used. Artificial respiration, once started, must be continued, without loss of rhythm.

b. Lay the victim in a prone position, one arm extended directly overhead, and the other arm bent at the elbow so that the back of the hand supports the head. The face should be turned away from the bent elbow so that the nose and mouth are free for breathing.

c. Open the victim's mouth and remove any foreign bodies, such as false teeth, chewing gum, or tobacco. The mouth should remain open, with the tongue extended. Do not permit the victim to draw his tongue back into his mouth or throat.

d. If an assistant is available during resuscitation, he should loosen any tight clothing to permit free circulation of blood and to prevent restriction of breathing. He should see that the victim is kept warm, by applying blankets or other covering, or by applying hot rocks or bricks wrapped in cloth or paper to prevent injury to the victim. The assistant should also be ever watchful to see that the victim does not swallow his tongue. He should continually wipe from the victim's mouth any frothy mucus or saliva that may collect and interfere with respiration.

e. The resuscitating operator should straddle the victim's thighs, or one leg, in such manner that:

(*1*) the operator's arms and thighs will be vertical while applying pressure on the small of the victim's back;

(*2*) the operator's fingers are in a natural position on the victim's back with the little finger lying on the last rib;

(*3*) the heels of the hands rest on either side of the spine as far apart as convenient without allowing the hands to slip off the victim;

(*4*) the operator's elbows are straight and locked.

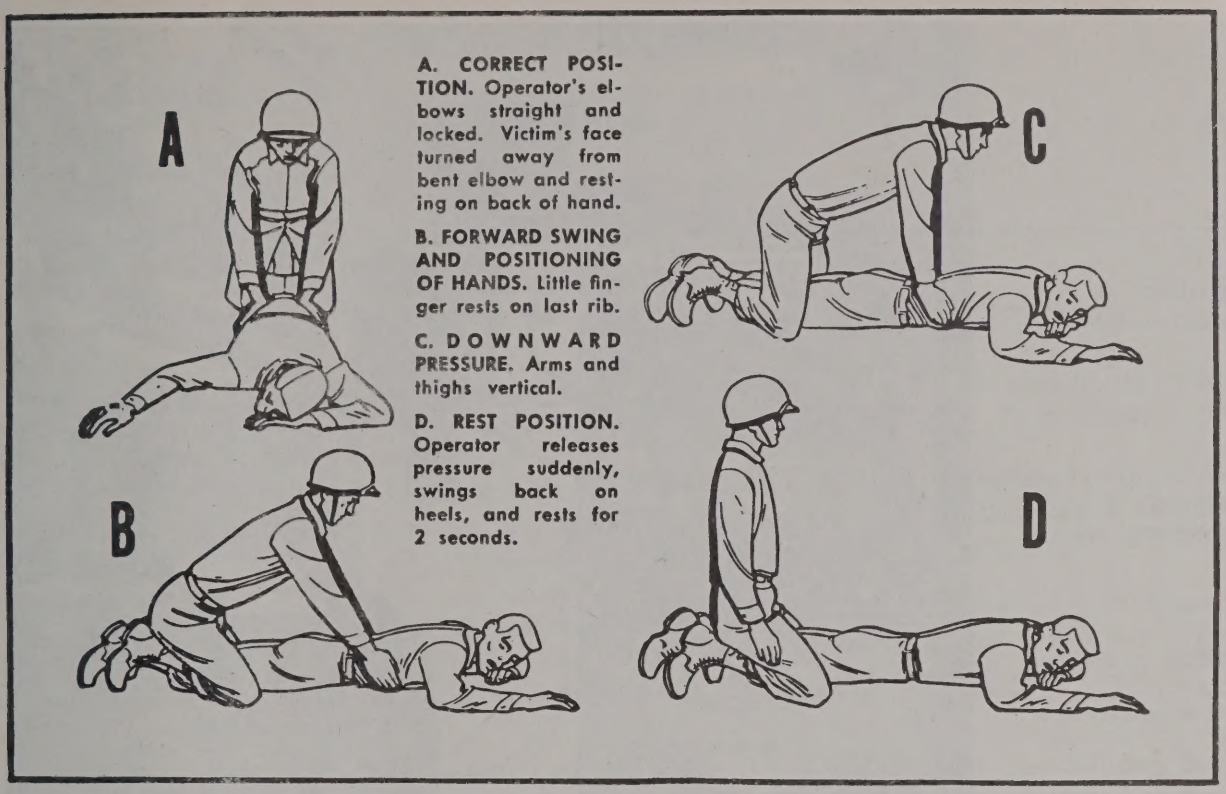
f. The resuscitation procedure is as follows:

(*1*) Exert downward pressure, not exceeding 60 pounds, for 1 second.

(*2*) Swing back, suddenly releasing pressure, and sit up on the heels.

(*3*) After 2 seconds rest, swing forward again, positioning the hands exactly as before, and apply pressure for another second.

g. The forward swing, positioning of the hands, and the downward pressure should be accomplished in one continuous motion, which requires 1 second. The release and backward swing require 1 second. The addition of the 2-second rest makes a total of 4



A. CORRECT POSITION. Operator's elbows straight and locked. Victim's face turned away from bent elbow and resting on back of hand.

B. FORWARD SWING AND POSITIONING OF HANDS. Little finger rests on last rib.

C. DOWNWARD PRESSURE. Arms and thighs vertical.

D. REST POSITION. Operator releases pressure suddenly, swings back on heels, and rests for 2 seconds.

seconds for a complete cycle. Until the operator is thoroughly familiar with the correct cadence of the cycle, he should count the seconds aloud, speaking distinctly and counting evenly in thousands. Example: one thousand and one, one thousand and two, etc.

h. Artificial respiration should be continued until the victim regains normal breathing or is pronounced dead by a medical officer. Since it may be necessary to continue resuscitation for several hours, relief operators should be used if available.

RELIEVING OPERATOR.

The relief operator kneels beside the operator and follows him through several complete cycles. When the relief operator is sure he has the correct rhythm, he places his hands on the operator's hands without applying pressure. This indicates that he is ready to take over. On the backward swing, the operator moves and the relief operator takes his position. The relieved operator follows through several complete cycles to be sure that the new operator has the correct rhythm. He remains alert to take over instantly if the new operator falters or hesitates on the cycle.

STIMULANTS.

a. If an inhalant stimulant is used, such as aromatic spirits of ammonia, the individual administering the stimulant should first test it himself to see how close he can hold the inhalant to his own nostril for comfortable breathing. Be sure that the inhalant is not held any closer to the victim's nostrils, and then for only 1 or 2 seconds every minute.

b. After the victim has regained consciousness, he may be given hot coffee, hot tea, or a glass of water containing ½ teaspoon of aromatic spirits of ammonia. *Do not give any liquids to an unconscious victim.*

CAUTIONS.

a. After the victim revives, keep him LYING QUIETLY. Any injury a person may have received may cause a condition of shock. Shock is present if the victim is pale and has a cold sweat, his pulse is weak and rapid, and his breathing is short and gasping.

b. keep the victim lying flat on his back, with his head lower than the rest of his body and his hips elevated. Be sure that there is no tight clothing to restrict the free circulation of blood or hinder natural breathing. Keep him warm and quiet.

c. A resuscitated victim must be watched carefully as he may suddenly stop breathing. *Never leave a resuscitated person alone until it is CERTAIN that he is fully conscious and breathing normally.*

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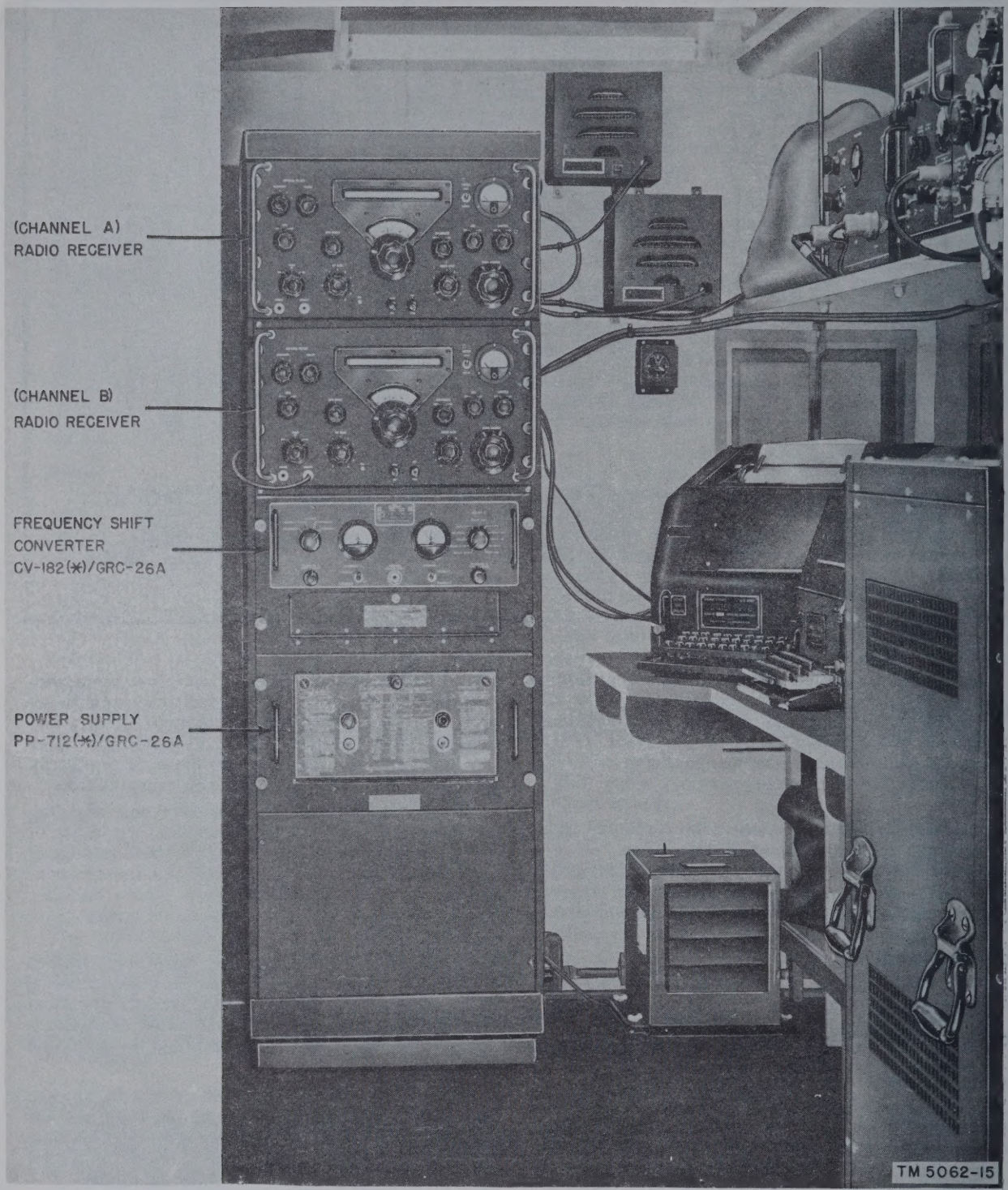


Figure 1. Typical installation utilizing Frequency Shift Converter CV-182(*)/GRC-26A and Power Supply PP-712(*)/GRC-26A.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. This technical manual contains a description of Frequency Shift Converters CV–182/GRC–26A and CV–182A/GRC–26A and Power Supplies PP–712/GRC–26A and PP–712A/GRC–26A (figs. 1, 3, and 4) and their operating controls, chapters covering organizational maintenance procedures and theory of operation, and instructions for field maintenance and repair of the equipment. In addition, this manual includes two appendixes covering a list of references and an identification table of parts.

b. Instructions for the installation, initial adjustment, and operation of the equipment are not included in this manual because of the adaptability of the equipment to various system applications. Installation, adjustment procedures, and operating instructions will be found in the technical manuals covering the particular systems with which the equipment is associated (par. 4).

c. Official nomenclature followed by the symbol (*) is used to indicate all models of the equipment discussed in this manual. Thus, Frequency Shift Converter CV–182(*)/GRC–26A represents Frequency Shift Converters CV–182/GRC–26A and CV–182A/GRC–26A and Power Supply PP–712(*)/GRC–26A represents Power Supplies PP–712/GRC–26A and PP–712A/GRC–26A.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army matériel and equipment.

a. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745–45–5 (Army), and AFR 71–4 (Air Force).

b. DA Form 468, Unsatfisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in SR 700–45–5.

c. USAF Form 54, Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Matériel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700–45–5 and AFR 65–26.

d. DA AGO Form 11–238, Operator First Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form.

e. DA AGO Form 11–239, Second and Third Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar), will be prepared in accordance with instructions on the back of the form.

f. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use

a. Frequency Shift Converter CV–182(*)/GRC–26A (figs. 3 and 33) is designed to convert frequency-shifted signals within the range of 440 to 510 kc (kilocycles) to polar and neutral d-c (direct-current) teletypewriter or telegraph signals. Two separate input channels are provided so that the converter can accept i-f (intermediate-frequency) outputs from two receivers which are operated on a dual-diversity basis. The application of the converter in a particular system is illustrated in figure 2 and discussed in paragraph 4.

b. Power Supply PP–712(*)/GRC–26A (fig. 4) consists of two sections: a power supply section and a tone-oscillator section. The power supply section supplies the voltages necessary for the operation of Frequency Shift Converter CV–182(*)/GRC–26A. The tone-oscillator section, included on a subchassis of the power supply, produces an audible monitoring tone when a *mark* signal is being produced by the converter, and contains a separate power supply for excitation of external receiver-disabling relays.

4. System Application

(fig. 2)

a. A block diagram showing the relationship of components comprising a typical radioteletype terminal is shown in figure 2. Radio Set AN/GRC–26A is one example of such a terminal utilizing Frequency Shift Converter CV–182(*)/GRC–26A and Power Supply PP–712(*)/GRC–26A.

b. The converter and its power supply are associated with two radio receivers and, through a control unit, with receiving teletypewriter equipment. Two antennas spaced several wavelengths apart are connected one to each receiver, and the receivers are operated on a dual-diversity basis. This system of diversity reception reduces the effects of selective fading. The signals picked up by the receivers are r-f (radio-frequency) signals which have been modulated, through frequency-shift keying, by the output of sending teletypewriter equipment. The output of each receiver is applied to the frequency-shift converter, which combines the frequency-shifted signals and produces d-c neutral and polar signals. The neutral signals are used to operate the printing mechanism of a monitoring teletypewriter directly, and the polar signals are sent over land lines to a control unit. The control unit converts the polar signals to neutral signals for operation of the other teletypewriters.

5. Technical Characteristics

a. Frequency Shift Converter CV–182(*)/GRC–26A.

Input frequency	440 through 510 kc frequency-shifted ±425 cycles.
Input impedance	108 ohms (aprx).
Sensitivity	500 microvolts (minimum).
Second intermediate frequency:	
Channel A	50 kc ±425 cycles.
Channel B	29.3 kc ±425 cycles.
Band pass:	
Narrow	1,500 cycles.
Wide	3,000 cycles.
Neutral output	Mark: .060 amp.
	Space: .0 amp.

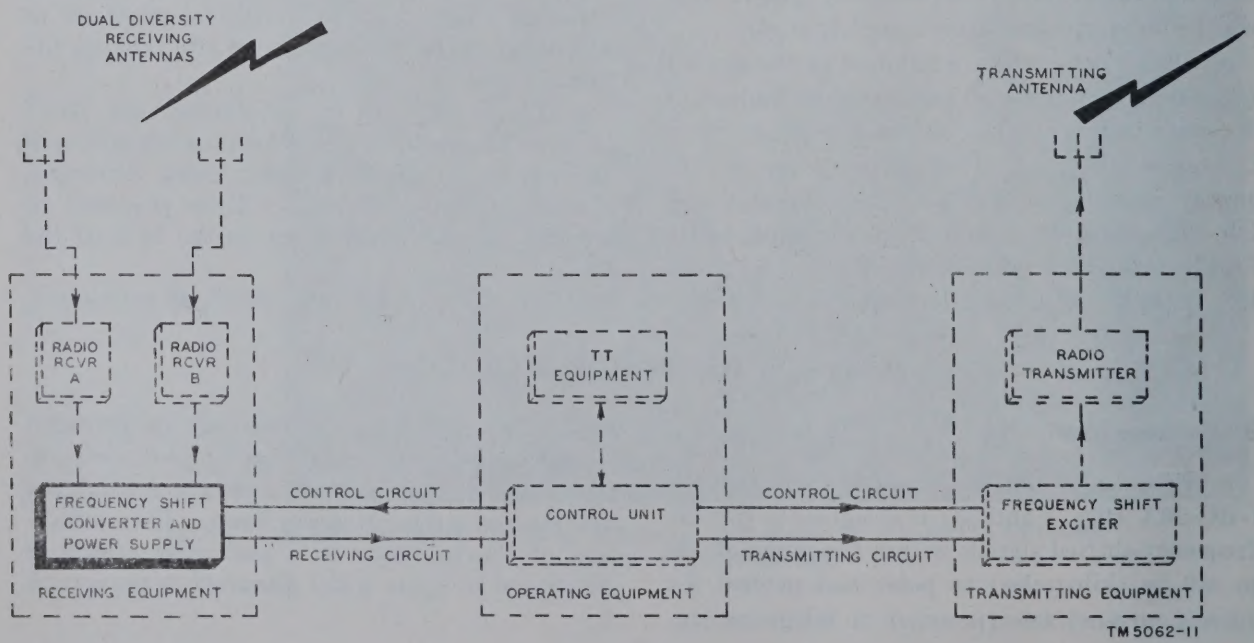


Figure 2. Block diagram of components comprising one terminal of radioteletype equipment.

Polar output	Mark: +.025 amp. Space: −.025 amp.
Number of tubes	18.
Power source	Power Supply PP–712(*)/GRC–26A.
Power consumption	175 watts (including drain of Power Supply PP–712(*)/GRC–26A.
Dimensions	10½ inches high by 16¼ inches deep by 19 inches long.
Weight	76.5 lb.

b. Power Supply PP–712(*)/GRC–26A (Including Tone Oscillator).

Power input	105/115/125 volts, 50 to 60 cps (cycles per second), single phase.
Number of tubes	8.
Output voltages	+275 v at 40 ma (milliamperes) dc. −150 v at 60 ma dc. −400 v at 10 ma dc. −150 v at 10 ma dc (regulated). +150 v at 35 ma dc (regulated). 6.3 v at 6 amp ac (alternating current). 6.3 v at 2.5 amp ac.
Tone-oscillator output.	850 cycles.
Power consumption (including drain of Frequency Shift Converter CV – 182 (*)/GRC–26A).	175 watts.
Dimensions	10½ inches high by 18 inches deep by 19 inches long.
Weight	65.5 lb.

6. Packaging Data

When Frequency Shift Converter CV–182(*)/GRC–26A and Power Supply PP–712(*)/GRC–26A are used in Radio Set AN/GRC–26A, they are shipped installed within the shelter which houses the set. If the units are supplied separately as replacement items, the method of packaging will depend on the supply channel.

7. Description of Frequency Shift Converter CV–182(*)/GRC–26A

(figs. 3 and 31)

a. The converter is a panel-chassis assembly which can be mounted in a standard 19-inch rack cabinet. Steel guide rails are mounted on each side of the chassis to permit the unit to slide easily on the mounting surface. The unit may be attached firmly to the cabinet by means of two knurled thumbscrews provided on each side of the front panel. The guide rails contain two stop latches which may be used to engage a stop bar for partial removal of the converter from the cabinet. Raising the two stop latches permits complete removal of the chassis from the cabinet. U-type handles are mounted at each end of the converter panel to facilitate removal of the chassis from the cabinet and for protecting the front panel controls when the converter is turned on its side for inspection or repair. The converter chassis is 10½ inches high, 18½ inches deep, and 19 inches long and weighs approximately 65 pounds.

b. The majority of the operating controls are located on the front panel (fig. 3) or behind a hinged door on the front panel (fig. 31). Four screw driver adjusted controls are located on top of the chassis and are accessible when the chassis is removed partially from the cabinet (fig. 6). The controls and switches located behind the hinged door on the front panel are used for initial adjustment of the converter and therefore are used only occasionally. All input and output receptacles are located on the rear of the chassis. A harnessed cable and connection plug extend from the converter unit for connection to Power Supply PP–712(*)/GRC–26A.

8. Description of Power Supply PP–712(*)/GRC–26A

(figs. 4, 27, and 28)

a. The power supply is a panel-chassis assembly designed to be mounted in a standard 19-inch rack cabinet. Two knurled thumbscrews are provided on each side of the front panel for securing the unit to the cabinet. Raceways are mounted on the chassis sides to permit partial withdrawal of the unit from the rack cabinet for adjustment purposes, or to permit complete withdrawal from the cabinet upon release of the raceway stop latches. U-type handles are mounted at each end of the front panel for protecting the front panel controls when the power supply is turned face down and for facilitating removal of the chassis from the cabinet. The power supply chassis is 10½ inches high, 16¼ inches deep, and 19 inches long. Its weight is approximately 76 pounds.

b. A subchassis on the power supply contains the tone-oscillator section (fig. 28). In addition to the oscillator, which is used for monitoring, the subchassis contains a relay, power supply, and

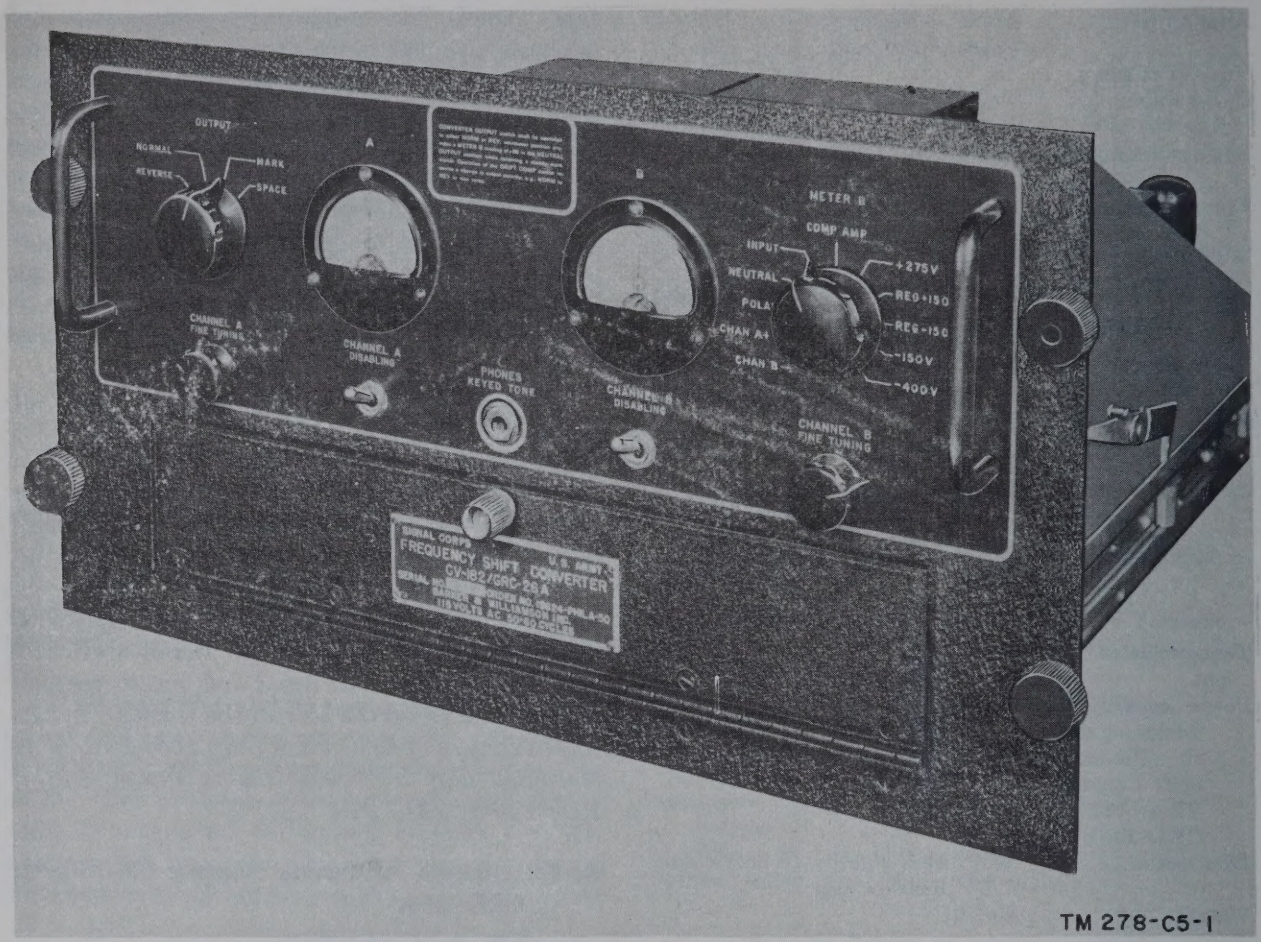


Figure 3. Frequency Shift Converter CV–182/GRC–26A, front view.

jacks which are used for receiver disabling and emergency keying.

c. The front panel of the power supply chassis contains control switches and indicating lights along with general over-all operating instructions for the converter unit and power supply. A hinged door on the front panel is held closed by two slotted (Dzus) screws located in the upper right- and left-hand corners of the panel. Turning these slotted fasteners a half-turn releases the door. Behind the door are two interlock safety switches, S301 and S302 (fig. 27). Opening this door permits easy access to the fuses, terminal strips, tube sockets and transformer, choke coil, and capacitor terminations for repair operations. A jack located on the rear of the main power supply chassis accepts the cable which connects the converter to the power supply.

9. Differences in Models

a. Frequency Shift Converter. Frequency Shift Converter CV–182/GRC–26A and Frequency Shift Converter CV–182A/GRC–26A are interchangeable and except for the minor electrical and mechanical differences outlined below there are no differences between the two units.

(1) Panel markings have been added to indicate the *operate* and *disabled* positions of the channel A and channel B receiver-disabling switches on some units of Frequency Shift Converter CV–182(*)/GRC–26A.

(2) The note which refers to the operation of OUTPUT switch S102 (fig. 5) has been clarified on Frequency Shift Converter CV–182A/GRC.

(3) Resistors R214 and R215, mounted on

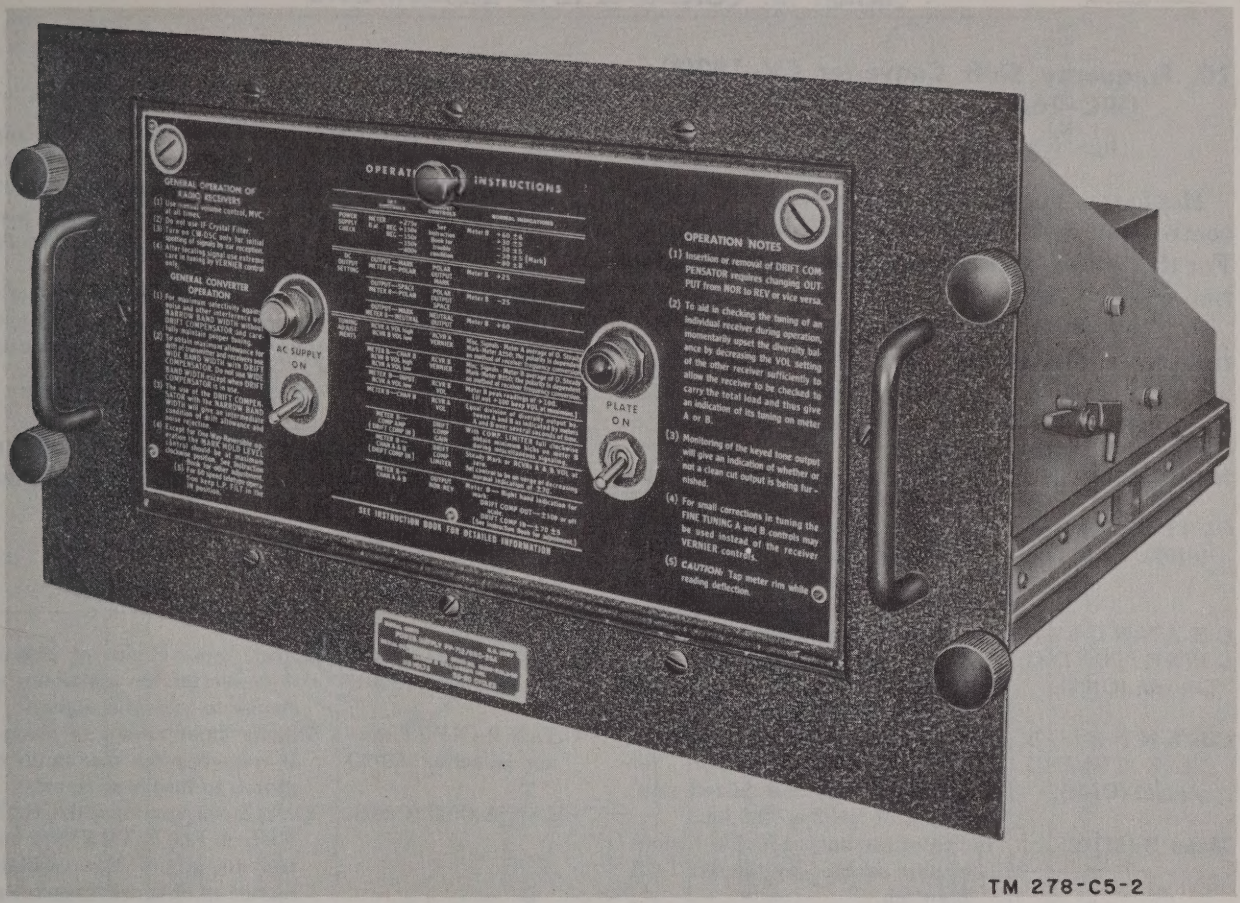


Figure 4. Power Supply PP–712(*)/GRC–26A, front view.

terminal board E103 in Frequency Shift Converter CV–182/GRC–26A are connected directly between pin 4 (control grid) and ground on tubes V107 and V108, respectively in Frequency Shift Converter CV–182A/GRC–26A.

(4) In Frequency Shift Converter CV–182A/GRC–26A, beginning with serial No. 793 through 839, meter A and meter B have an internal resistance of 260 ohms instead of the normal 775 ohms. A 470-ohm resistor has been added in series with meter A and is designated as R217. A similar resistor has been added in series with meter B and is designated as R218.

Note. When either meter is replaced with a meter of correct internal resistance, it will be necessary to remove the resistor in series with it.

b. Power Supply. Power Supply PP–712/GRC–26A differs from Power Supply PP–712A/GRC–26A in that improved type terminal boards E103, E105, E106, and E107 and different type tube clamps for V301 and V306 are used. Otherwise, both units are similar in function and electrical characteristics and are interchangeable.

10. Frequency Shift Converter CV–182(*)/GRC–26A

(figs. 5 and 6)

Haphazard operation or improper setting of the controls can cause damage to electronic equipment. For this reason, it is important to know the function of every control.

a. The following chart lists the front panel controls and indicates their functions.

Control	Function
Meter A (M101)	Indicates the output of the discriminator circuit for channel A.
OUTPUT switch (S102).	Selects the polarities of the output mark and space signals and establishes test mark and space output signals for adjustment purposes.
CHANNEL A FINE TUNING control (C102).	Provides for fine adjustment of the high-frequency oscillator for channel A. It is adjusted until output of V101 is 50 kc.
CHANNEL B FINE TUNING control (C104).	Provides for fine adjustment of the high-frequency oscillator for channel B. It is adjusted until output of V102 is 29.3 kc.
Meter B (M102)	Indicates the output of the various circuits selected by the METER B switch.
METER B switch (S105).	Connects various circuits to meter B. Positions and functions as follows: *Position* — *Function* CHAN B — Indicates the output of the discriminator circuit for channel B. CHAN A +B. — Indicates the combined output of the two channels. POLAR — Indicates the polar loop current. NEUTRAL — Indicates the neutral loop current. INPUT — Indicates the voltage applied to the mark-hold circuit. COMP AMP. — Indicates the feedback voltage from the drift compensator circuit. Five voltage positions: +275 v, REG+150 v, REG−150 v, −150 v, −400 v — Indicates the voltages supplied by Power Supply PP–712(*)/GRC–26A.
CHANNEL A OPERATE-DISABLED switch (S107).	Disables channel A input so that channel B may be alined separately. (Switch is marked DISABLING on some units; positions are not marked. See figures 3 and 31.)
CHANNEL B OPERATE-DISABLED switch (S108).	Disables channel B input so that channel A may be alined separately. (Switch is marked DISABLING on some units; positions are not marked. See figures 3 and 31.)
PHONES KEYED TONE jack (J105).	Provides for the connection of a headset for monitoring the keyed tone output of the tone oscillator.

b. The following chart lists the controls behind the hinged front panel door and indicates their functions.

Control	Function
CHAN A INPUT tuning capacitor (C101).	Adjusts input circuit of channel A converter for maximum response to incoming signals.
CHAN B INPUT tuning capacitor (C103).	Adjusts input circuit of channel B converter for maximum response to incoming signals.
CHAN A OSC (C105)	Works in conjunction with CHANNEL A FINE TUNING control to adjust the oscillator section of channel A converter.
CHAN B OSC (C106)	Works in conjunction with CHANNEL B FINE TUNING control to adjust the oscillator section of channel B converter.
DRIFT COMPENSATOR switch (S-104).	Connects the output of the discriminators to the drift-compensating circuit when the switch is at the IN position. Output distortion caused by drift of received signals is minimized by the action of the circuit.
LIMITER control (R-152).	Controls the amplitude of signals supplied to the driver circuit when DRIFT COMPENSATOR switch S104 is at the IN position, by regulating the conduction of limiter tube V112.
AMP GAIN control (R207).	Varies the amount of signal fed to drift-compensating a-c amplifier tube V104 from discriminator tubes V109 and V110. Effective only when DRIFT COMPENSATOR switch S104 is at IN position.
NEUTRAL OUTPUT control (R182).	Adjust neutral loop current to a normal value of 60 ma.

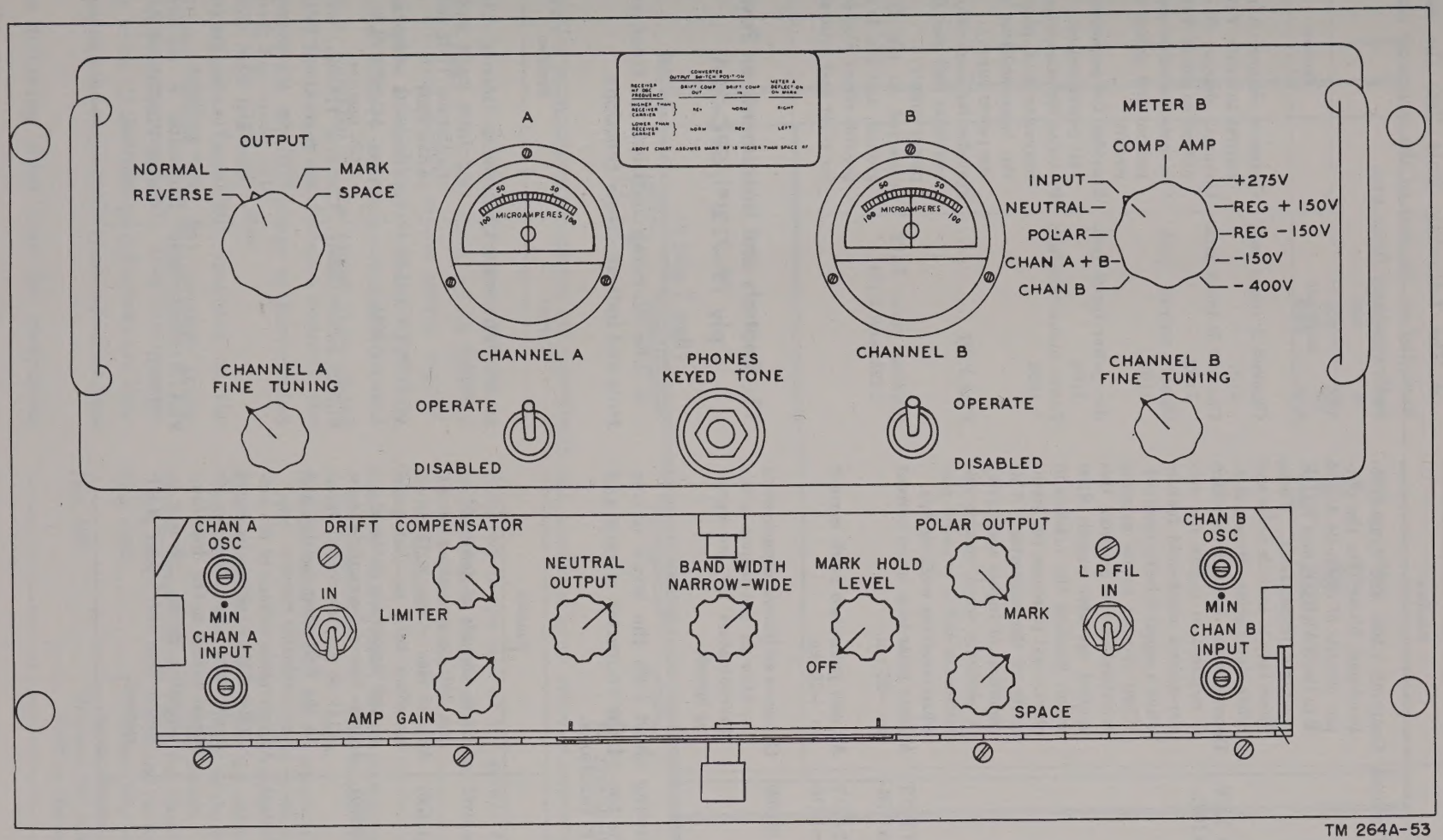


Figure 5. Frequencq Shift Converter CV-182(*)/GRC-26A, location of front panel controls.

Control	Function
BAND WIDTH switch (S101).	Connects 1,500- and 3,000-cycle band-pass filters into the output circuits of channels A and B in the NARROW and WIDE positions, respectively. These filters help to exclude noise and other interfering frequencies.
MARK HOLD LEVEL control (R109).	Determine the carrier level which is required to nullify the carrier-control mark-hold feature while a signal is being received. When rotated to its extreme counterclockwise position, this control operates switch S106 which disables the mark-hold circuit and increases the sensitivity of the converter. This condition of higher sensitivity is necessary when making adjustments and it is useful also when receiving weak signals.
POLAR OUTPUT SPACE control (R174).	Adjusts polar-loop space current to −25 ma.
POLAR OUTPUT MARK control (R171).	Adjusts polar-loop mark current to +25 ma.
L P FIL switch (S103).	Connects additional capacitors to the filter in the output of the discriminators for low-signaling speeds.

c. The following chart lists the screw driver controls on the top of the converter chassis and indicates their functions.

Control	Function
COMP AMP control (R145).	Adjusts amount of feedback to the drift-compensating circuit.
BIAS A control (R155)	Adjusts bias of the V113 driver amplifier tube so that polar output signals are unbiased.
BIAS B control (R160).	Adjusts bias of d-c amplifier tube V114 to provide correct input to the drift-compensating and tone-oscillator circuits.
COMP BAL control (R194).	Adjusts plate voltage of d-c amplifier V114 to obtain balanced mark and space signals for equal swings in the drift-compensating circuit. Works in conjunction with COMP AMP control.

d. The following chart lists the receptacles mounted on the rear of the converter chassis and indicates their functions.

Receptacle	Function
Channel A input jack J101.	Connects channel A receiver i-f output to mixer V101 input.
Channel B input jack J102.	Connects channel B receiver i-f output to mixer V102 input.
Signal output jack J103.	Connects converter output (both neutral and polar) to external circuit.
A-c power input jack J104.	Provides for connection to 115-volt power source.
Power connection jack J106.	Provides for connection between converter and plug P405 on the tone-oscillator section of the power supply.
Plug P107	Provides for connection between converter and jack J301 on the power supply.
Binding posts E122, E123, and E124.	Connected to pin B of J103, ground, and pin D of J103 to provide direct wire connections for polar and neutral loops.

11. Controls and Instruments on Power Supply PP–712(*)/GRC–26A

(figs. 7 and 8)

a. The following chart lists the front panel controls and indicates their functions.

Control	Function
AC SUPPLY switch (S303).	Connects 115-volt, 60-cycle a-c line from input jack J104 to transformer T302 and PLATE switch S304.
AC SUPPLY indicator lamp (I301).	Illuminates a white-faced jewel when AC SUPPLY switch is at ON position.
PLATE switch (S304).	Connects 115-volt, 60-cycle a-c line from AC SUPPLY switch S303 to transformer T301. The power unit then supplies plate and bias voltages for tubes in the converter and tone oscillator.
PLATE indicator lamp (I302).	Illuminates a red-faced jewel when PLATE switch is at ON position.

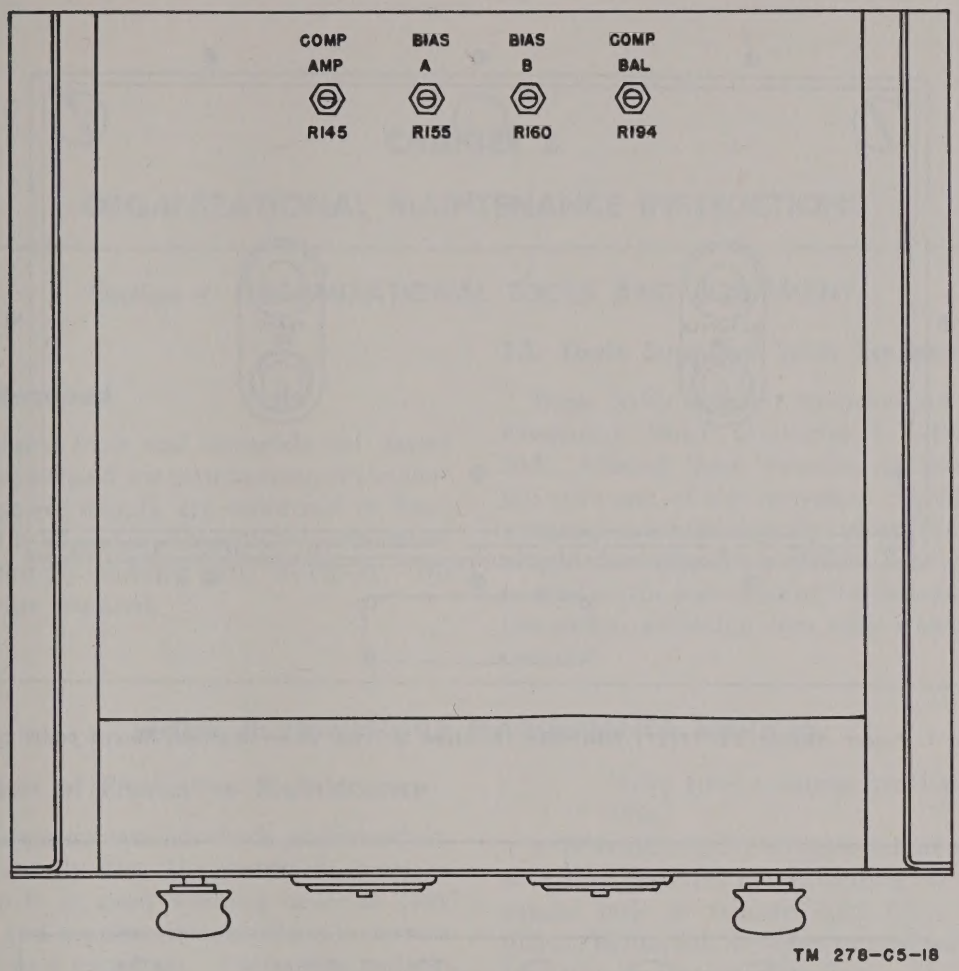


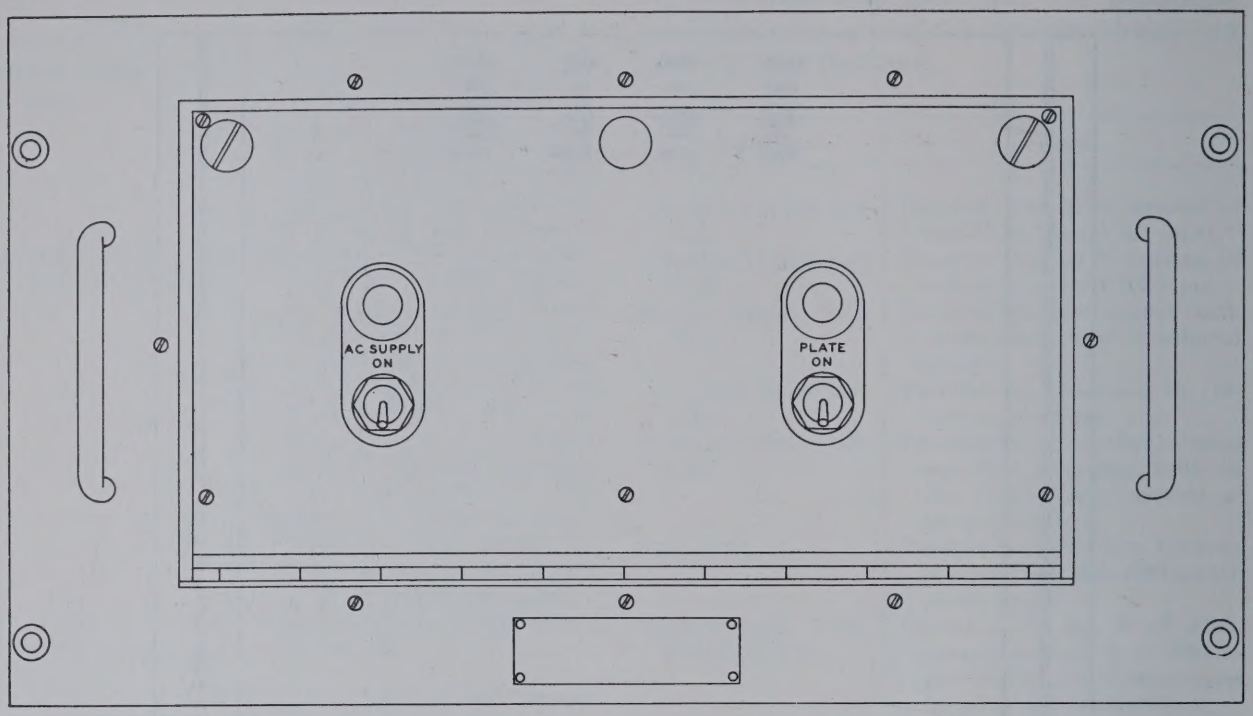
Figure 6. Frequency Shift Converter CV-182(*)/GRC-26A, location of screw driver adjustment controls.

b. The only controls behind the front panel door (fig. 8) are fuses F301 and F302, which fuse the 115-volt, 60-cycle supply to the power supply. F303 is a spare fuseholder and is not wired into any circuits. Safety interlock switches S301 and S302 are so mounted in the upper front panel door that if the door is not fastened securely, the 115-volt, 60-cycle supply voltage is disconnected automatically by these switches.

c. An additional fuse F401, mounted on the tone-oscillator chassis (fig. 35), protects transformer T401 against overload. This fuse is accessible only when all the front panel screws are loosened to permit the entire main chassis to slide forward.

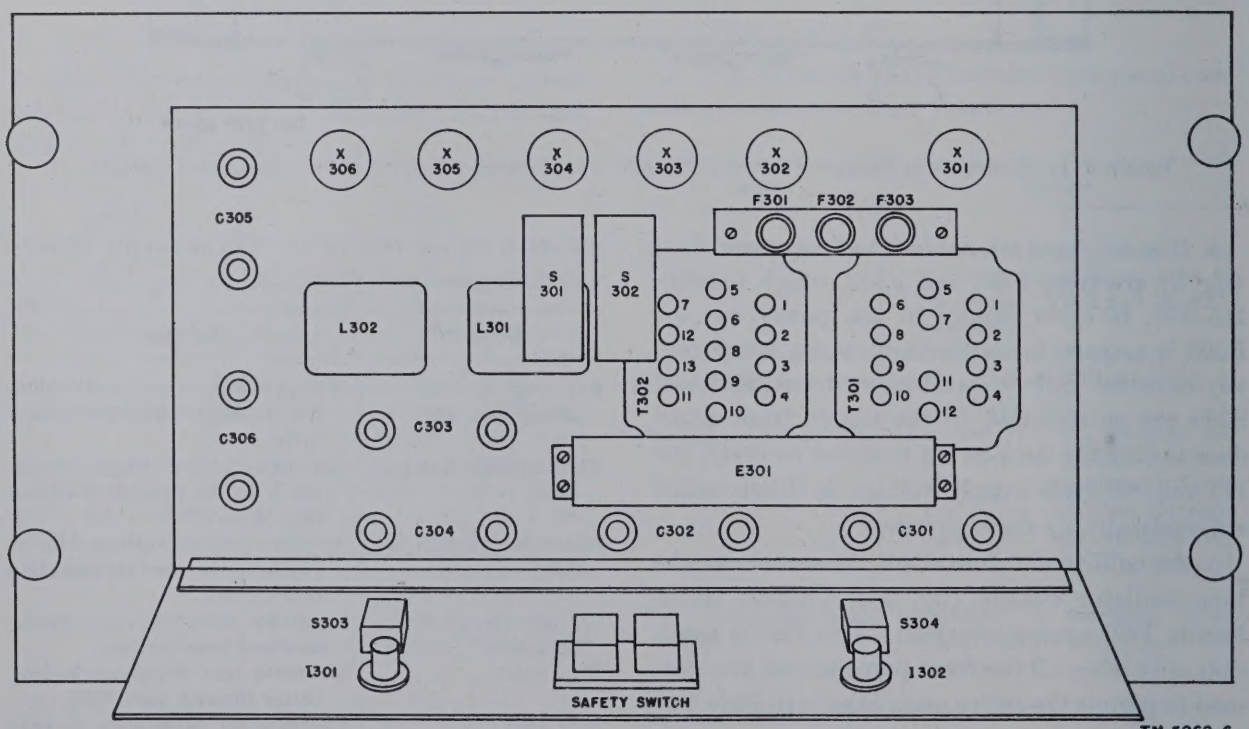
d. The following chart lists the receptacles mounted on the rear of the power supply chassis and indicates their functions.

Receptacle	Function
External receiver-disabling jack J401.	Breaks external receiver-disabling line through relay K401 contacts.
Receiver-disabling jack J402.	Applies a positive voltage through pin B to the receiver-disabling relay circuit.
Receiver-disabling jack J403.	Applies a positive voltage through pin B to the receiver-disabling relay circuit.
Control circuit input jack J404.	Input for disabling-relay operation and hand keying.
Plug P405	Connects tone oscillator to converter through jack J106.
Jack J301	Provides for connection to plug P107 on the converter.



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Figure 7. Power Supply PP–712(*)/GRC–26A, location of front panel controls, hinged panel closed.



TM 5062-6

Figure 8. Power Supply PP–712(*)/GRC–26A, location of controls behind hinged panel.

CHAPTER 2

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. ORGANIZATIONAL TOOLS AND EQUIPMENT

12. Tools Required

Organizational tools and materials not issued but which may be used for maintenance of the converter and power supply are contained in Tool Equipment TE–41 and are listed in Department of the Army Supply Catalog SIG 6–TE–41. No special tools are required.

13. Tools Supplied With Equipment

Three Allen setscrew wrenches are issued with Frequency Shift Converter CV–182(*)/GRC–26A. One of these wrenches is located on the top rear end of the converter chassis. Another wrench is mounted directly behind the front panel hinged door (figs. 31 and 33). A third wrench is located on the underside of the chassis, adjacent to the switch actuating cam with which it is associated.

Section II. PREVENTIVE MAINTENANCE SERVICES

14. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from trouble shooting and repair since its object is to prevent certain troubles from occurring. See AR 750–5.

15. General Preventive Maintenance Techniques

a. Use No. 0000 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning.

(1) If necessary, except for electrical contacts, moisten the cloth or brush with solvent dry-cleaning (SD); then wipe the parts dry with a cloth.

(2) Clean electrical contacts with a cloth moistened with carbon tetrachloride; then wipe them dry with a dry cloth.

Caution: Repeated contact of carbon tetrachloride with the skin, or prolonged breathing of the fumes, is dangerous. Make sure adequate ventilation is provided.

c. If available, dry compressed air may be used at a line pressure not exceeding 60 pounds per square inch to remove dust from inaccessible places; be careful, however, or mechanical damage from the air blast may result.

d. For further information on preventive maintenance techniques, refer to TB SIG 178.

16. Use of Preventive Maintenance Forms

a. The information in paragraph 17 is presented as a guide to the individual making an inspection of equipment in accordance with instructions on DA AGO Forms 11–238 and 11–239. The decision as to which items on the forms are applicable to this equipment is a tactical decision to be made in the case of first echelon maintenance by the communication officer/chief or his designated representative, and in the case of second and third echelon maintenance, by the individual making the inspection. Instructions for the use of each form appear on the reverse side of the form.

b. The first two columns in the table in paragraph 17 serve as a cross reference between the item numbers of DA AGO Forms 11–238 and

11–239 and the preventive maintenance information in this manual.

17. Performing Preventive Maintenance

Perform the following preventive maintenance operations at the intervals indicated, unless these intervals are reduced by the local commander.

Caution: Tighten screws, bolts, and nuts carefully. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

DA AGO Form 11–238 item No.	DA AGO Form 11–239 item No.	Preventive maintenance operations
		DAILY
1	1	Check for completeness and satisfactory condition of equipment.
2	2	Check suitability of location and installation for normal operation.
3	3	Remove dirt and moisture from headset, panel, jacks, and plugs.
4	4	Inspect seating of tubes, lamps, fuses and connectors for firmness.
5	5	Inspect all controls for binding, scraping, excessive looseness, and positive action.
6	6	Check the equipment for normal operation.
		WEEKLY
		Caution: Disconnect power before performing the following operations. Upon completion, reconnect power and check for satisfactory operation.
7	7	Clean interior of cabinet, exterior of chassis, and all parts accessible without removal from cabinet, and observe for evidence of rust (par. 20).
8	8	Inspect all visible terminals and connections and exposed metal surfaces for rust, corrosion, and moisture.
9	9	Inspect wires, cords, and cables for cracked, cut, and frayed insulation.
		MONTHLY
12	12	Inspect switches S101 through S108, S303, and S304, binding posts E122 through E124, and knobs for looseness (figs. 27 and 33). Check operation of interlocks S301 and S302.
14	14	Clean meter windows and jeweled assemblies.
15	15	Inspect meters for damaged cases.
	19	Inspect tubes for loose envelopes, cracked sockets and bases; check emission of tubes. Remove dirt and corrosion from bases (fig. 33).
		Note. Tubes including final letter W or Y in their nomenclature can replace tubes of the same type; for example, tube, type 6SN7W can replace tube, type 6SN7.
	21	Inspect filter capacitors C301 through C306 (power supply) for leaks, bulges, and corrosion, (figs. 8 and 27).
	22	Inspect relay K401 in the tone-oscillator section (fig. 28) for loose mountings, and burned, pitted, or corroded contacts.
	23	Inspect variable capacitors C101 and C103 for dirt, moisture, misalinement of plates, and loose mountings.
	24	Inspect resistors for blistering, discoloration, and other evidences of overheating.
	25	Inspect terminals of capacitors C301 through C306 in power supply for cracks and corrosion.
	26	Clean and tighten switches and terminal boards.
	27	Inspect terminal boards E128 (fig. 33) and E301 (fig. 27).
	29	Lubricate equipment as outlined in paragraph 18.
	31	Clean and tighten connections and mountings for transformers T301, T302, T401, and CR401 (figs. 27 and 28).
		Note. Potentiometers are not listed as they are adjusted during alinement of the converter. They may be considered as having permanent settings and should not be disturbed during preventive maintenance inspection.
	32	Inspect transformers T301, T302, T401, and choke coils L301 and L302.
	37	Check moistureproof and fungiproof coatings on equipment.

Section III. LUBRICATION AND WEATHERPROOFING

18. Lubrication

a. Once each month, apply a light film of oil, lubricating, preservative, special (PL) to the hinges of the front-panel doors on the converter and power supply.

b. Every 3 months, or at lesser intervals if necessary, remove all switch and control knobs and apply 1 or 2 drops of oil (PL Special) to rotary switch shafts and detents; wipe off excess oil with a clean cloth.

Caution: Do not allow oil to run into the electrical contacts of the wafer switches.

19. Weatherproofing

a. General. Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. Tropical Maintenance. A special moisture-proofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is explained in TB SIG 13 and TB SIG 72.

c. Winter Maintenance. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained in TB SIG 66 and TB SIG 219.

d. Desert Maintenance. Special precautions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are explained in TB SIG 75.

e. Lubrication. The effects of extreme cold and heat on materials and lubricants are explained in TB SIG 69. Observe all precautions outlined in TB SIG 69 and pay strict attention to all lubrication orders when operating equipment under conditions of extreme cold or heat.

20. Rustproofing and Painting

a. If the finish on the case has been scarred or damaged, rust and corrosion can be prevented by touching up the bared surfaces. Use No. 00 or No. 000 sandpaper to clean the surface down to the bare metal. Obtain a bright, smooth finish.

Caution: Do not use steel wool. Minute particles frequently enter the case and cause harmful internal shorting or grounding of circuits.

b. When a touch-up job is necessary, remove rust, finish the surface, and apply paint with a small brush; use solvent (SD) to soften rust and finish with sandpaper to complete the preparation for painting. Paint used will be authorized and consistent with existing regulations.

c. Instructions for refinishing badly marred panels on exterior cabinets are given in TM 9–2851.

CHAPTER 3

THEORY

Section I. POWER SUPPLY

21. Block Diagram of Power Supply
(fig. 9)

Power Supply PP–712(*)/GRC–26A furnishes the necessary operating voltages for Frequency Shift Converter CV–182(*)/GRC–26A. Outputs of +275, −150, and −400 volts dc unregulated, +150 and −150 volts dc regulated, and 6.3 volts ac are delivered by the power supply. The tone-oscillator section, mounted on the main power supply chassis, produces a tone that can be monitored in a headset at the converter. Circuits for disabling the two radio receivers, when required, are incorporated on the tone-oscillator chassis. Provisions for emergency frequency-shift keying of a radio transmitter are also part of the tone-oscillator section. A block diagram is shown in figure 9. Schematic diagrams of the power supply section and the tone-oscillator section are shown in figures 62 and 60, respectively.

22. Power Supply Input Circuit
(fig. 10)

a. The 115-volt, 60-cycle primary power source is connected by a cable assembly to receptacle J104 (fig. 33), which is mounted on the rear end of the converter chassis. The two power leads then are

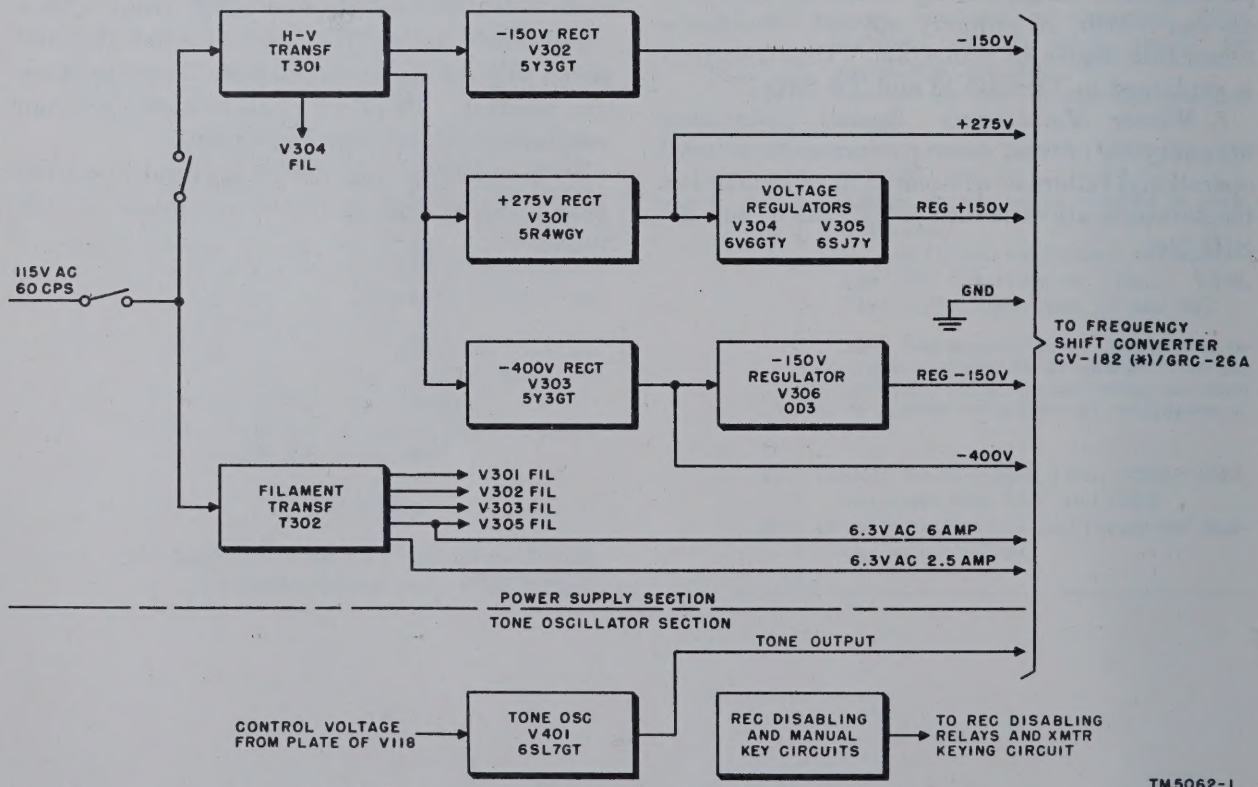
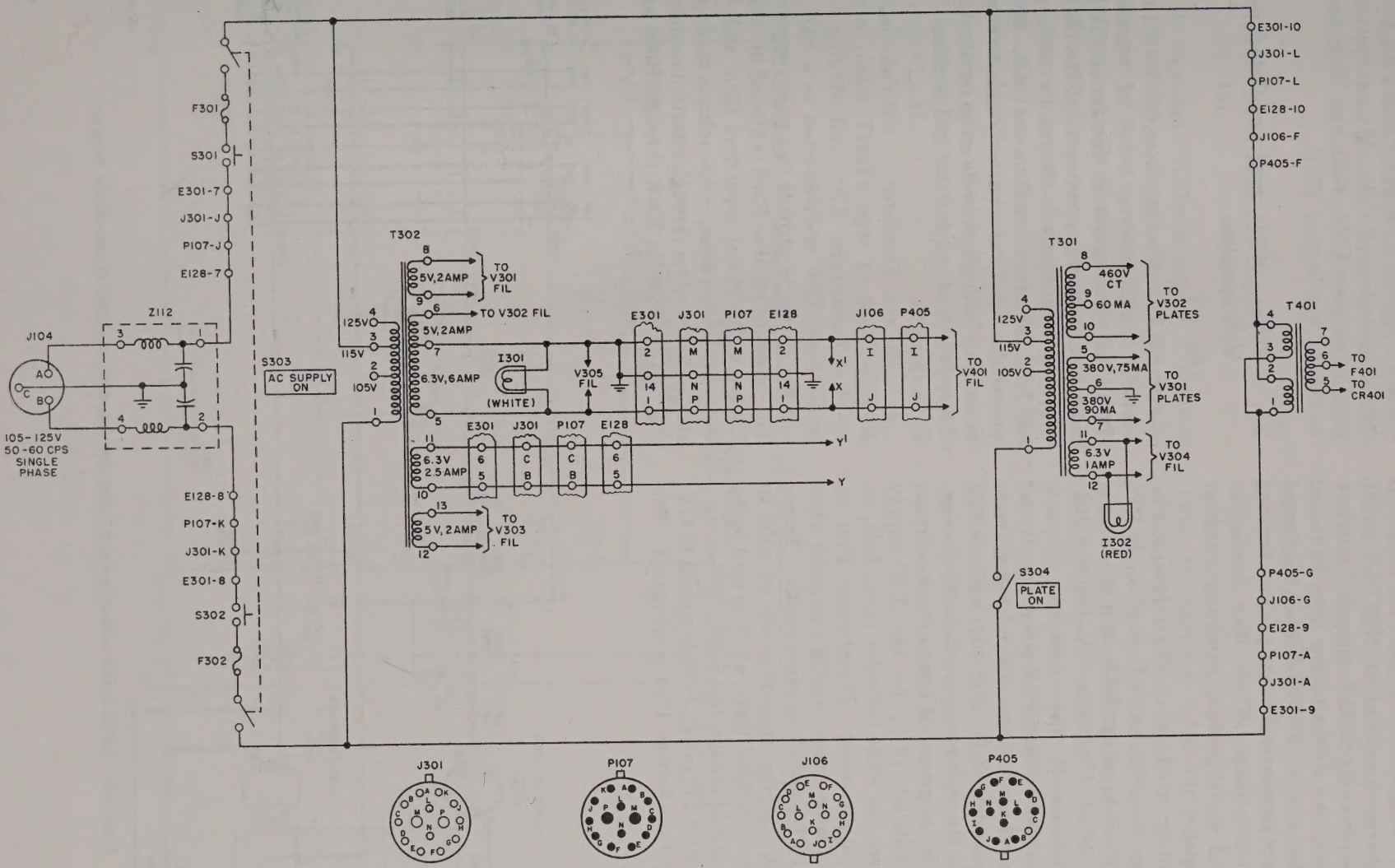


Figure 9. Power Supply PP–712(*)/GRC–26A, functional block diagram.



NOTES:

1. PARTS HAVE A DIFFERENT SERIES OF REFERENCE SYMBOLS, DEPENDING UPON THE UNIT IN WHICH THEY ARE LOCATED. THE LEGEND IS AS FOLLOWS:
   100 SERIES - CONVERTER UNIT
   300 SERIES - POWER SUPPLY UNIT
   400 SERIES - TONE OSCILLATOR SECTION
2. FOR PURPOSES OF SIMPLICITY, JACK, PLUG, AND TERMINAL CONNECTIONS ARE NOT SHOWN COLLECTIVELY. P107-J IS TERMINAL "J" ON P107, E128-8 IS TERMINAL "8" ON TERMINAL STRIP E128, ETC.

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Figure 10. Power Supply PP-712(*)/GRC-26A, power input circuit, functional schematic diagram.

connected to the power supply through filter Z112, plug P107, and receptacle P301. The a-c line is completed to the contacts of AC SUPPLY switch S303 on the power supply through safety interlock switches S301 and S302 and line fuses F301 and F302. When the AC SUPPLY switch is turned to ON, power is connected to the primary winding of filament transformer T302. Tap connections are provided on the primary winding for 125- or 105-volt input.

b. Secondary windings on T302 furnish filament voltage for all tubes in Power Supply PP–712(*)/GRC–26A, except V304, and all tubes in Frequency Shift Converter CV–182(*)/GRC–26A. Connection to the converter is made through receptacle J301 on the power supply and plug P107 on the converter. The 6.3-volt filament supply designated *XX′* (fig. 10) has one side grounded in the power supply; the supply designated *YY′* is not grounded within the power supply. The winding (7–5) for the *XX′* supply also energizes the white indicator lamp, I301, on the power-supply panel. Transformer T401 on the tone-oscillator chassis also is energized when the AC SUPPLY switch is turned to ON. Transformer T401 supplies approximately 23 volts to the disk-type rectifier, CR401, which is used in the receiver-disabling circuits (par. 38).

c. When PLATE switch S304 is turned to ON, the primary transformer T301 is energized. The red panel indicator I302 is lighted and filament voltage is applied to regulator tube V304 from the 6.3-volt secondary of T301. Plate voltage is supplied to rectifiers V301, V302, and V303 from the remaining windings of T301.

23. +275-, −400-, and Regulated −150-Volt Supplies

(fig. 11)

a. +275-Volt Supply. Rectifier V304 (a type 5R4GY tube), winding 5–6–7 of transformer T301, and winding 8–9 of transformer T302 are connected to provide a nonregulated 275-volt plate supply. This supply is filtered by series choke coil L301 and capacitors C301 and C302. The output of the supply is made available to the converter unit through connections on terminal board E301, jack J301, plug P107, and terminal board E128 (fig. 11).

b. −400 and Regulated −150-Volt Supplies. Rectifier V303 (a type 5Y3GT tube), winding 12–13 of transformer T302, and winding 6–7 of transformer T301 are connected in a half-wave rectifier circuit to provide two negative supplies. The output of rectifier V303 is filtered by resistors R301 and R302 and capacitors C305 and C306. Output from the filter, −400 volts, is made available to the converter through interunit connections (fig. 11). Resistors R303 through R306 are in

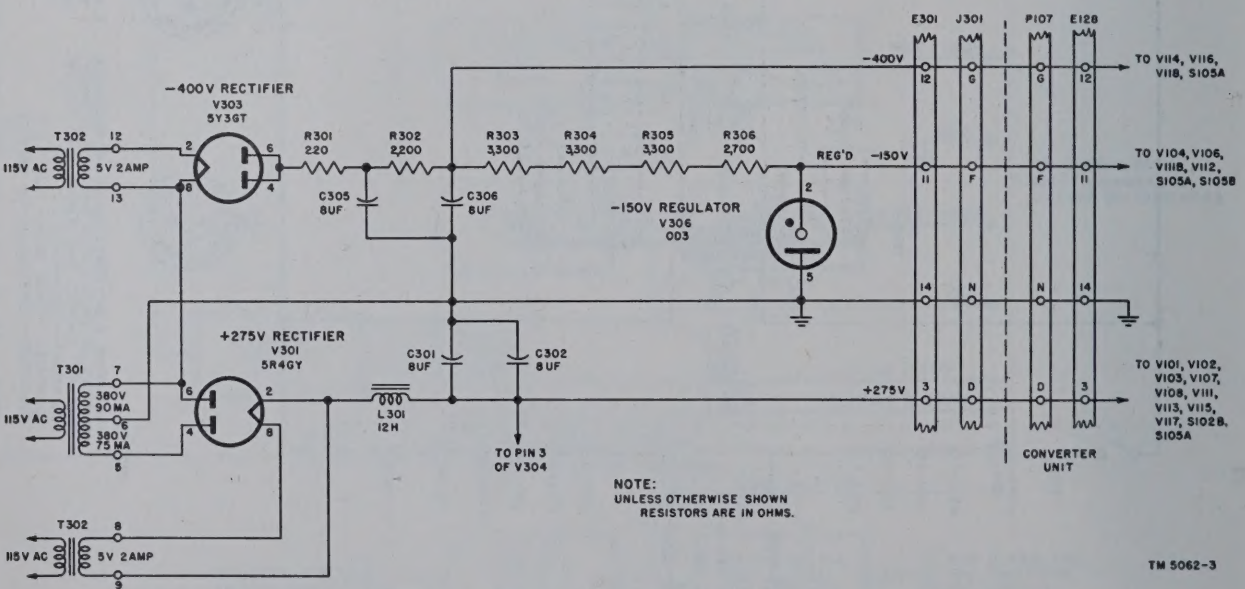


Figure 11. +275, −400, and regulated −150-volt supplies, functional schematic diagram.

series with regulator tube V306 (type OD3) between the −400-volt supply and ground. The regulated −150-volt potential at the cathode of V306 also is made available to the converter unit (fig. 11).

24. Regulated +150-Volt Supply
(fig. 12)

a. A regulated +150-volt supply is obtained from the +275-volt supply through the parallel combination of series resistors R318 to R321, inclusive, and variable impedance tube V304 (type 6V6GT). The impedance and plate current of tube V304 vary in proportion to the control-grid voltage. The potential at the control grid (pin 5) of V304 is influenced by the plate current of d-c amplifier tube V305 (type 6SJ7) which, in turn, is affected by the voltages on its screen grid and control grid.

b. The screen grid (pin 6) of tube V305 is connected to the junction of voltage divider resistors R309 and R310, which are connected from the +275-volt supply lead to ground. The control grid (pin 4) is connected to a voltage divider consisting of resistors R311 to R317, inclusive, which are in series between the regulated +150-volt and regulated −150-volt supplies. This circuit arrangement maintains the voltage difference between the regulated +150-volt and the regulated −150-volt outputs.

c. A tendency for the voltage of the screen or the control grid to become more positive results in a larger plate current for tube V305. The increased plate current produces a larger voltage drop across plate load resistor R308, which results in a less positive voltage on the control grid of tube V304. The reduction of the control-grid voltage on tube V304 is accompanied by a decreased plate current for this tube, or, conversely, an increase in

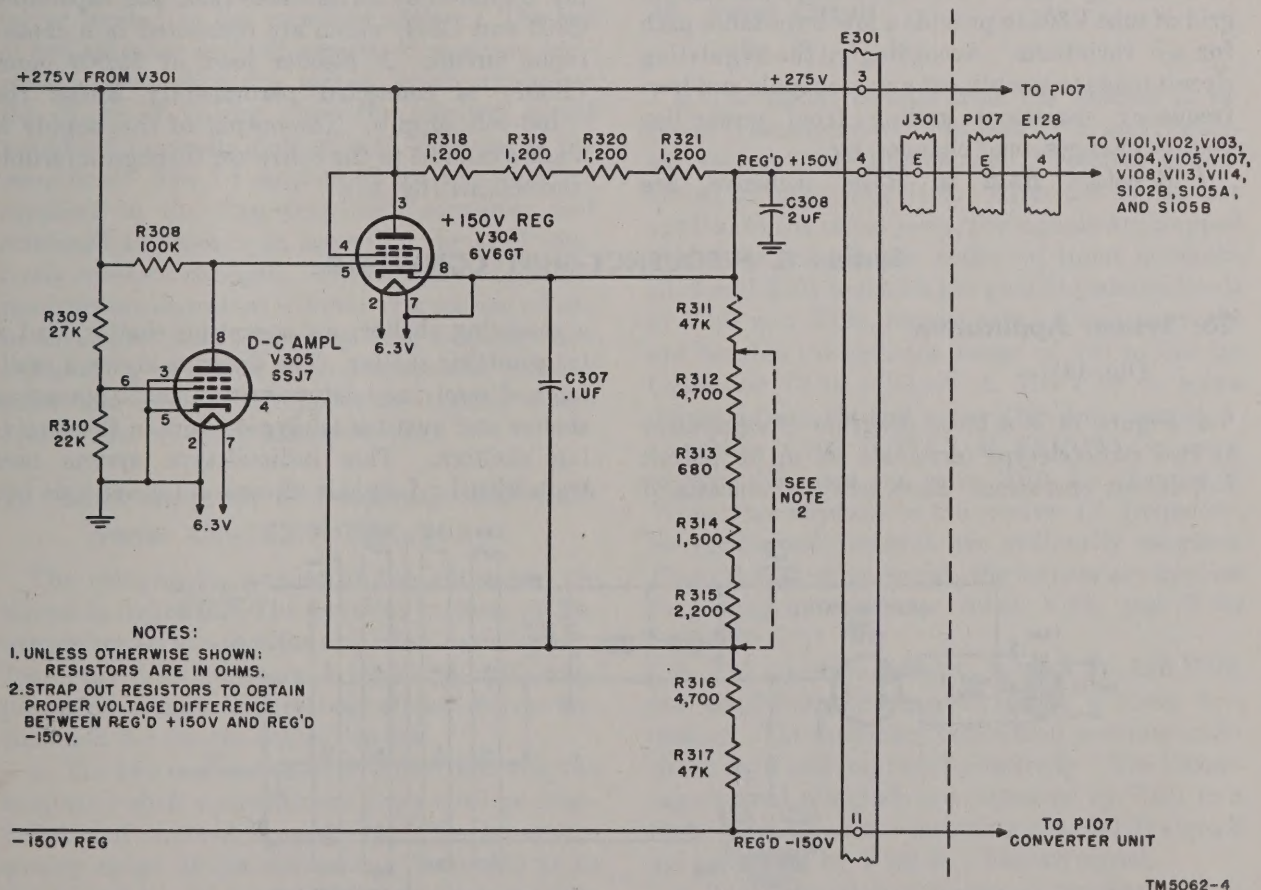


Figure 12. Regulated +150-volt supply, functional schematic diagram.

impedance. This reduces the tendency of the regulated +150-volt supply output to increase.

d. The preceding sequence of events occurs if the +275 volts tend to increase in a positive direction, or if the difference between the regulated +150-volt and the regulated −150-volt supply voltages tend to increase. The changes occur almost instantaneously, thereby holding the regulated +150 volts virtually constant.

e. An opposite effect is produced if the +275 volts tend to decrease, or if the regulated −150- or regulated +150-volt potentials tend to change in a direction that reduces the difference in voltage between the two. When this happens, however, the plate current of amplifier tube V305 is reduced, resulting in a higher plate voltage, which subsequently produces a higher grid voltage at tube V304. This increases the plate current of tube V304 and reduces the impedance of the tube, thus reducing the tendency of the regulated +150-volt supply to decrease. Capacitor C307 is connected from the regulated +150-volt lead to the control grid of tube V305 to provide a low-impedance path for a-c variations. Accordingly, the regulating circuit tends to smooth out any a-c ripple and low-frequency variations arising from power-line voltage changes, load changes, etc.

f. Resistors R312 to R316, inclusive, are strapped in the factory to provide a regulation which maintains the difference between the regulated +150-volt supply and the regulated −150-volt supply within ±3 volts. If necessary—as a result of replacing parts in the circuit, for example—these resistors can be strapped differently in the field to establish the regulation of +150-volt supply within the required limit. If the +150-volt supply voltage is too high, resistors R312 to R315 may be strapped out as required to meet the 3-volt limit. If the voltage is too low, the voltage may be raised by short-circuiting resistor R316. Then resistors R312 to R315 may be shorted out, as required, to meet the 3-volt tolerance.

25. −150-Volt Supply

(fig. 13)

Rectifier V302 (a type 5Y3GT tube), winding 6–7 of transformer T302, and winding 8–9–10 of transformer T301 are connected to provide a non-regulated −150-volt supply (fig. 13). This supply is filtered by series choke L302 and capacitors C303 and C304, which are connected in a choke-input circuit. A bleeder load of 33,000 ohms (R307) is connected permanently across the −150-volt supply. The output of this supply is made available to the converter through interunit connections (fig. 13).

Section II. FREQUENCY-SHIFT CONVERTER

26. System Application

(fig. 14)

a. Figure 14 is a block diagram of equipment at two radioteletype terminals set up to permit full-duplex operation. Each terminal consists of a receiving shelter, an operating shelter, and a transmitting shelter. The diagram shows a sending and receiving teletypewriter in each operating shelter and monitor teletypewriters in the receiving shelters. This radioteletype system uses transmitted r-f signals of constant amplitude but

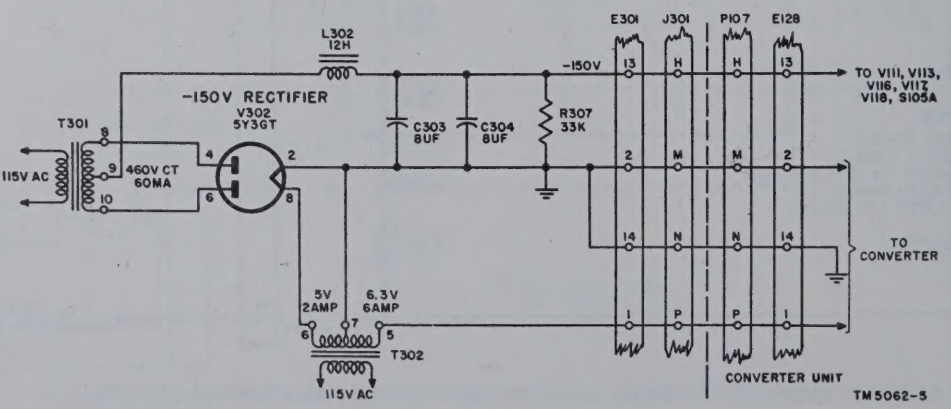


Figure 13. —150-volt supply, functional schematic diagram.

of shifted frequency. C-w (continuous-wave) telegraph signals may be transmitted using a hand telegraph key or a code tape transmitter. The receiving station may be equipped to receive keyed tones or neutral signals which may be copied manually or recorded automatically on a typing reperforator.

b. Opening and closing of the sending contacts at the teletypewriter operating station produces signals which are transformed electronically into polar signals by the control unit. The polar signals are transmitted over a field wire to control a frequency-shift exciter which, in turn, controls the mark and space frequencies of the transmitted signals. During mark intervals, the radio transmitter operates on a nominal assigned frequency plus 425 cycles. During space intervals, this transmitted frequency is reduced by 850 cycles.

c. At the receiving station, duplicate incoming r-f signals are received on two different antennas spaced several wavelengths apart. Each antenna is connected to a separate superheterodyne receiver located in the receiving shelter. The use of two antennas and two associated receivers comprise a *space diversity system* which minimizes the effects of fading, since the received signal would not normally fade at both antennas at the same time. The i-f outputs of the receivers are supplied to the frequency-shift converter and combined to produce an operating signal of relatively constant strength. The i-f signals from the receivers are converted to lower frequencies which, in turn, are demodulated by two frequency-discriminating networks to reproduce the original polar and neutral teletypewriter signals which operate the receiving teletypewriters.

27. Block Diagram of Frequency Shift Converter CV–182(*)/GRC–26A

The component circuits of the converter are shown in figure 15. The circuitry consists of frequency converters, limiter amplifiers and clippers, frequency discriminators, a frequency-drift compensating circuit, a mark-hold circuit, driver circuit, and d-c output control circuit.

a. The two receivers used in connection with the frequency-shift converter are designated as channel A and channel B receivers. The input-frequency range of the converter is from 440 kc to 510 kc and the i-f output of the receivers must be within this range. The i-f output of the radio receivers is sent through separate mixing channels, combined, sent through a peak-clipping limiter circuit, and detected in a frequency-discriminator circuit. The output of the discriminator circuit is sent to the output control stages of the converter where the d-c neutral and polar signals are produced. The frequency-drift compensating circuit acts on the i-f signals of the converter to minimize the effects of frequency variations that may be caused by changes in the carrier frequency. The mark-hold circuit maintains a steady marking condition automatically should the transmitter carrier disappear or fail.

b. Power Supply PP–712(*)/GRC–26A, which contains a tone-oscillator subchassis, supplies all filament and plate voltages required by the frequency-shift converter and the tone oscillator. The oscillator unit produces an audible tone in a headset at the converter unit when a mark signal is being produced.

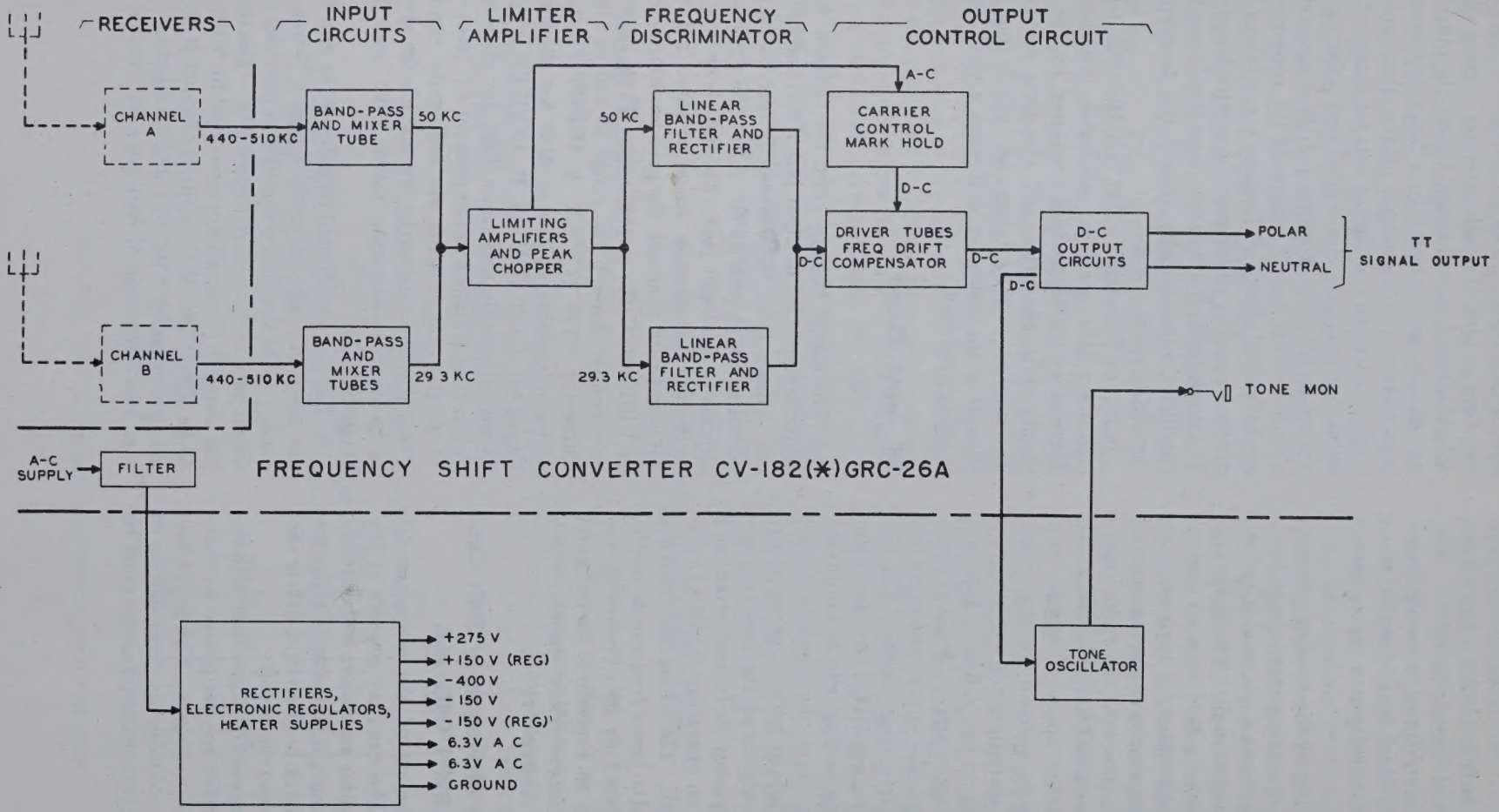
28. Input Circuit

(fig. 16)

a. The signal voltage from the channel A receiver is connected to input jack J101, and the signal voltage from the channel B receiver is connected to input jack J102. After the signals are applied to the input jacks, the signals are stepped up by the transformer action of input networks Z103 and Z101 to match the grid impedance levels of V101 and V102, respectively. These networks are tunable through the range of 440 to 510 kc. Capacitor C101 (CHAN A INPUT) is screw driver adjustable and tunes Z103 for channel A. Capacitor C103 (CHAN B INPUT) is screw driver adjustable and tunes Z101 for channel B. When once adjusted to the receiver i.f. frequency, no further adjustments are ordinarily required. From the input networks, the signals are applied to pentagrid converter tubes V101 and V102 (types 6SA7).

b. The signals applied to tubes V101 and V102 are amplified and heterodyned to a lower frequency. The frequency conversion provides additional gain and improved selectivity. The incoming channel A signals are converted by V101 to a 50-kc signal, and the incoming channel B signals are converted by V102 to a 29.3-kc signal.

c. The conversion of frequency for channel A is



POWER SUPPLY PP-712(*)/GRC-26A

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Figure 15. Frequency Shift Converter CV-182(*)/GRC-26A, functional block diagram.

effected in the following manner. The screen grid, control grid, and cathode (pins 4, 5, and 6) of tube V101, together with tuned circuit Z104 and capacitors C102 and C105, comprise a Hartley oscillator, having a frequency range of 490 to 560 kc. The screen grid acts as the plate of the oscillator, and is held at r-f ground potential by capacitor C109. When used with radio receivers having a 500-kc i.f., this oscillator is tuned to 550 kc which, when mixed with the 500-kc incoming i. f. (connected to injector-grid pin 8), produces a 50-kc output signal. For channel B, the screen grid, control grid, and cathode (pins 4, 5, and 6) of tube V102, together with tuned circuit Z102 and capacitors C104 and C106, form a similar oscillator having a frequency range of 470 to 540 kc. When used with receivers having a 500-kc i.f., the channel B oscillator is tuned to 529.3 kc which, when mixed with the incoming i.f. (connected to injector grid pin 8), produces a 29.3-kc output signal. To prevent any inversion of the mark and space signals, these oscillators are always tuned to a frequency higher than the incoming i.f.

d. Capacitors C105 and C106 (CHAN A OSC AND CHAN B OSC) are the coarse adjustments for their respective oscillators (fig. 5). The CHANNEL A FINE TUNING and CHANNEL B FINE TUNING controls are capacitors C102 and C104, respectively.

e. To reject certain noise frequencies and interference from nearby transmitting stations, the bandwidth should be limited to a value not to exceed that which is adequate for the particular signals received. Accordingly, by turning BAND WIDTH switch S101 to NARROW or WIDE, the outputs of mixer tubes V101 and V102 are connected to either a narrow-band or a wide-band filter. The association of the switch positions, the channels, the filters, and the frequency bandwidths are as follows:

Channel	S101 switch position	Filter	Frequency range
A	NARROW	Z107	50 kc ±750 cps.
A	WIDE	Z108	50 kc ±1,500 cps.
B	NARROW	Z105	29.3 kc ±750 cps.
B	WIDE	Z106	29.3 kc ±1,500 cps.

f. Channel A and channel B are separate and distinct through the band-pass filters and up to the grid circuit of first limiter amplifier tube V103 (type 6SJ7). At the grid of V103, the two frequencies of channels A and B are combined across resistor R203 in series with R205 (WIDE bandwidth) or resistor R202 in series with R204 (NARROW bandwidth).

29. Limiter Amplifier

(fig. 17)

a. Frequency-shifted telegraph signals, radiated from the transmitting antennas, vary in frequency in accordance with the original d-c marking and spacing telegraph signals, but are virtually constant in amplitude. In the radio link between the transmitter and the receiver, these signals may encounter static disturbances, noise, and fading effects which produce variations in signal amplitudes. Another source of variations in signal amplitudes is oscillator drift in the receiver. A limiter amplifier is provided in the frequency-shift converter circuit to eliminate undesirable amplitude variations in the incoming signals before they are connected to the discriminator for detection. The limiter-amplified circuit produces relatively square waves of a constant magnitude by cut off action and plate-current saturation which prevent the signals from being amplified beyond an established limit.

b. The combined signals of channels A and B are received from the input circuit and consist of 50-kc and 29.3-kc carrier currents, each frequency-shifted by the same original telegraph signals. These combined signal outputs from tubes V101 and V102 are applied to the grid (pin 4) of tube V103 through grid-current-limiting resistor R106. The tube, (type 6SJ7Y) is operated at a point on the characteristic curve that allows the low-level positive and negative signals to be amplified. The high-level signals, however, cause tube V103 to be driven to cut-off and plate saturation, on negative and positive peaks, respectively. At the point of plate saturation, grid current flows through resistor R106 and develops a negative bias which effectively reduces positive peak input signals. On high negative peaks, the tube is cut off. Therefore, any undesired voltage peaks impressed on the carrier are clipped. The operating point is set by cathode-bias resistor, R107, which is bypassed by capacitor C115A. A regulated +150-volt potential is supplied to the screen (pin 6) through dropping resistor R108. Capacitor

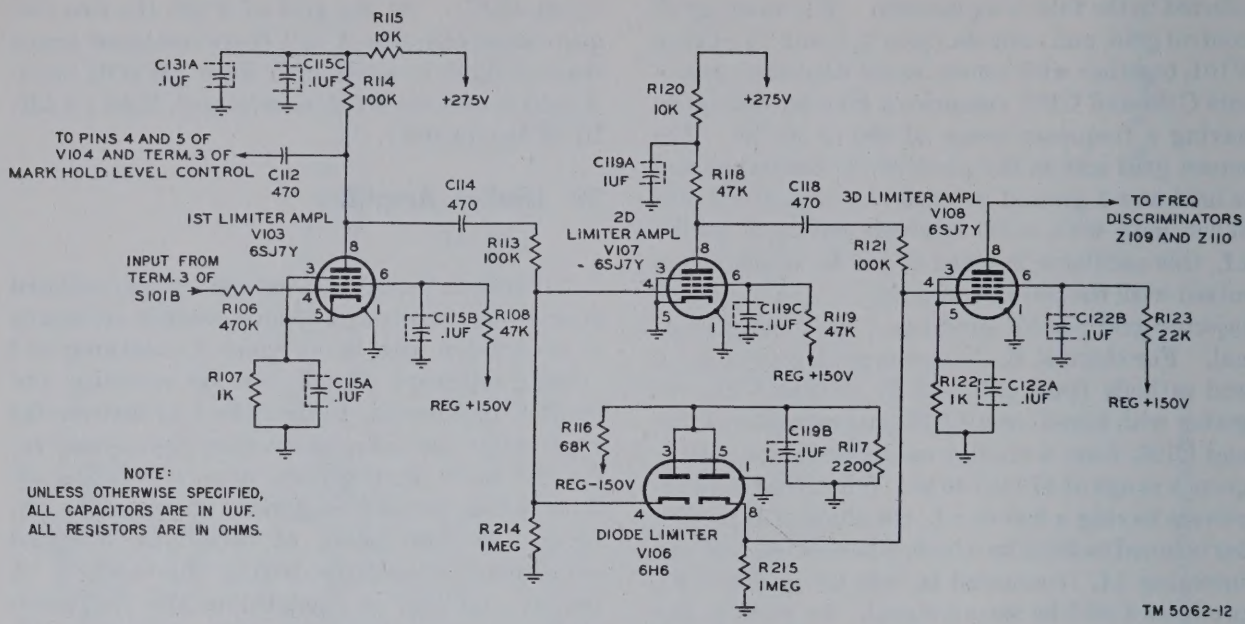


Figure 17. Limiter amplifier, functional schematic diagram.

C115B bypasses the screen to ground. Plate voltage is applied through load resistor R114 and decoupling resistor R115 from the +275-volt supply. Capacitors C115C and C131A decouple the plate circuit.

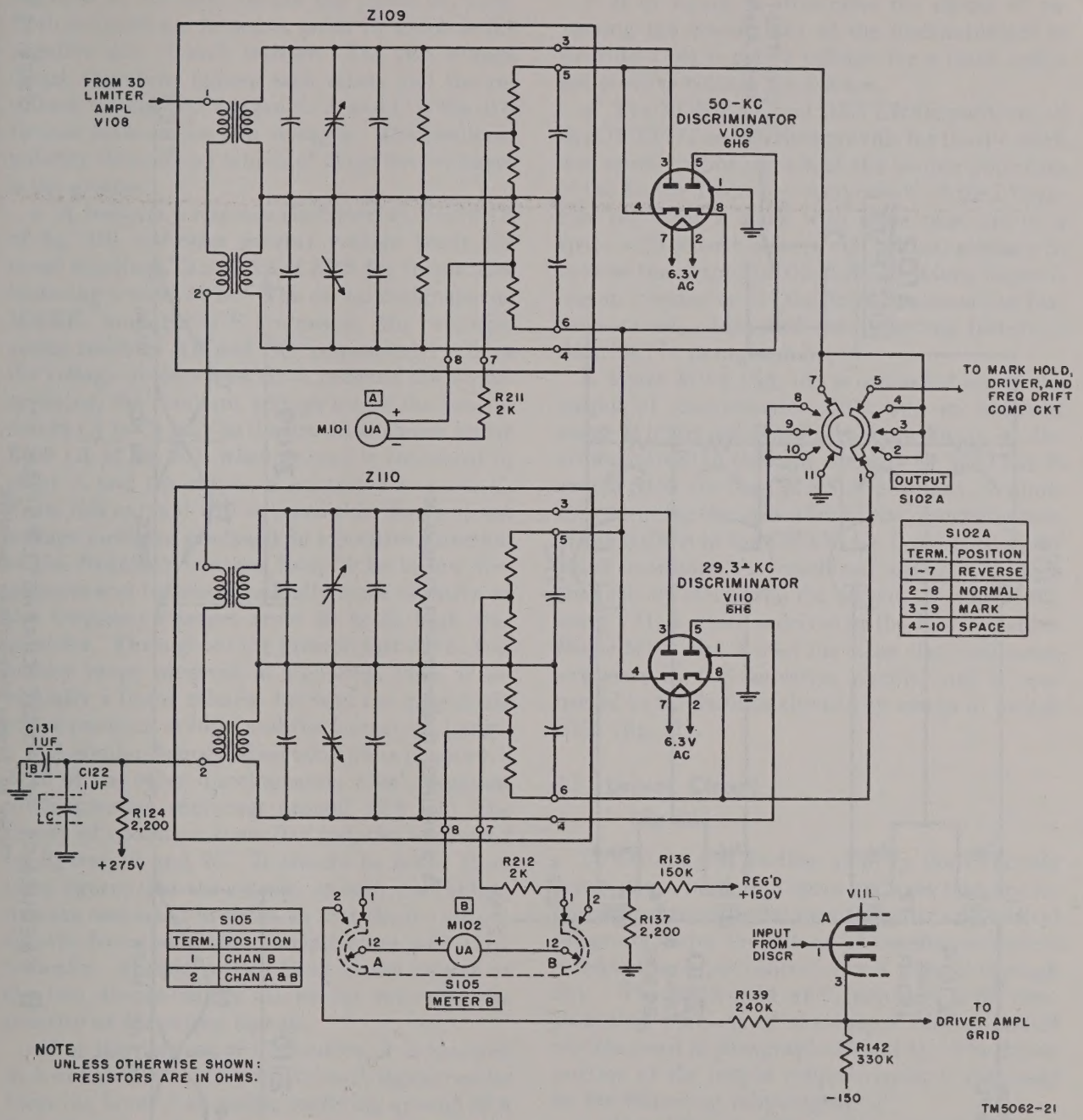
c. The output from the plate of tube V103 is coupled to the carrier-control mark-hold and frequency-compensating circuits through capacitor C112. The functions of these circuits are to keep steady marking signals on the d-c telegraph loops when the carrier is shut down or when no signal is coming through, and to minimize signal bias during drift. These circuits are discussed more fully in paragraph 32. The output from the plate of tube V103 is also applied to the grid (pin 4) and cathode (pin 4) of tubes V107 and V106, respectively, through coupling capacitor C114 and resistor R113. Tube V107 (type 6SJ7Y) is a sharp cut-off pentode, and tube V106 (type 6H6) is a duo-diode with the plates connected together.

d. The low-level signals, too small to cause plate saturation or cut-off, are amplified by tube V107. The higher level signals have the undesired negative peaks clipped by the operation of one section of tube V106. A negative voltage is applied to the plates of this tube through resistor R116. A strong negative peak from the plate of tube V103 causes the cathode (pin 4) to become more negative than the plate. This condition causes current to flow and thus removes the negative peaks. The positive peaks, after amplification in tube V107, become negative peaks at the plate of V107 because of the 180° phase reversal between the control grid and plate. This strong negative peak is applied to the other cathode (pin 8) of tube V106 through coupling capacitor C118 and resistor R121. The negative peaks make the cathode more negative than the plate, causing current to flow through the tube and thus remove the negative peaks. All the signals, now at approximately the same level, are applied to the grid (pin 4) of tube V108.

e. The third limiter amplifier, V108 (type 6SJ7Y), functions in the same general manner as V103 and V107 but provides limiting action only on extremely high-level signals. The output, consisting of 50-kc and 29.3-kc frequency-modulated signals, is applied to discriminator networks Z109 and Z110 for demodulation.

30. Linear Discriminator

a. The discriminator circuit interprets the frequency variations of the FS signals in terms of d-c telegraph marking and spacing signals. One of the two discriminators interprets the frequency-shifted signals received over channel A, and the other interprets the FS signals received over channel B.

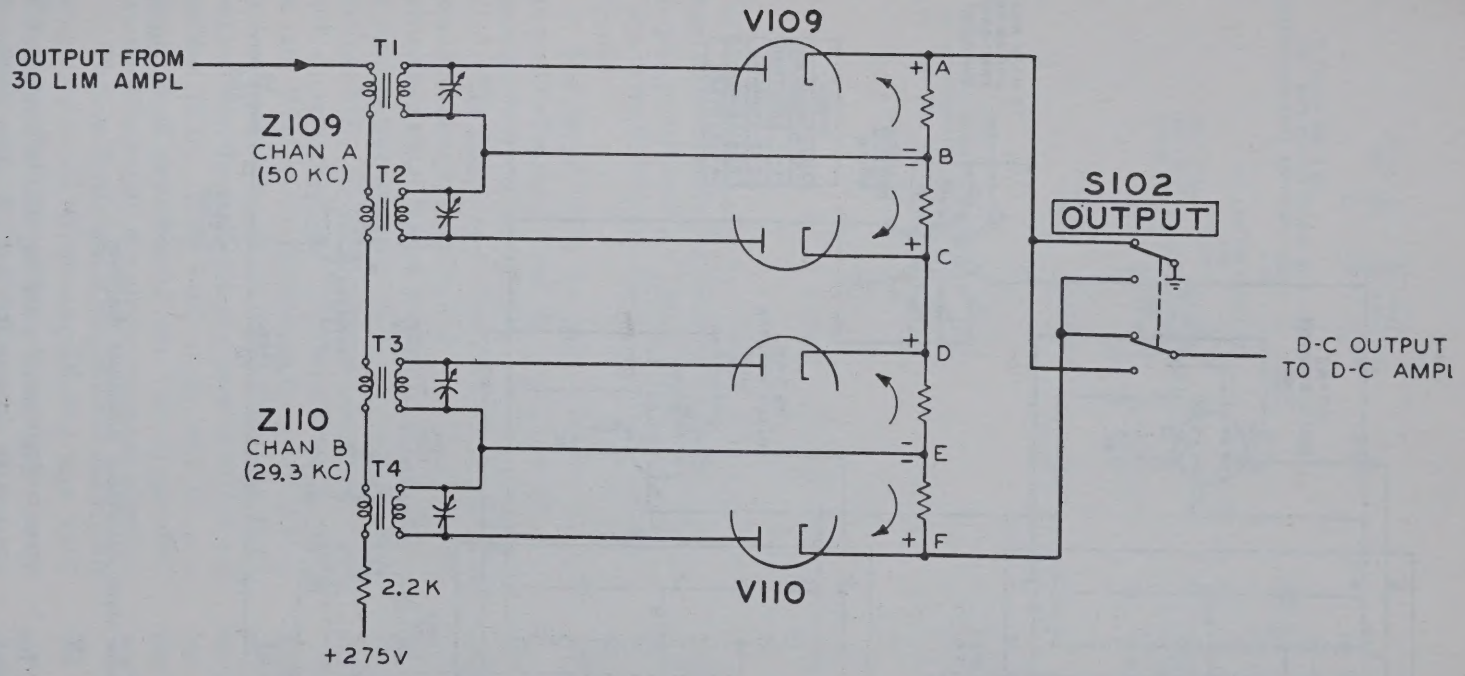


S102A	
TERM.	POSITION
1-7	REVERSE
2-8	NORMAL
3-9	MARK
4-10	SPACE

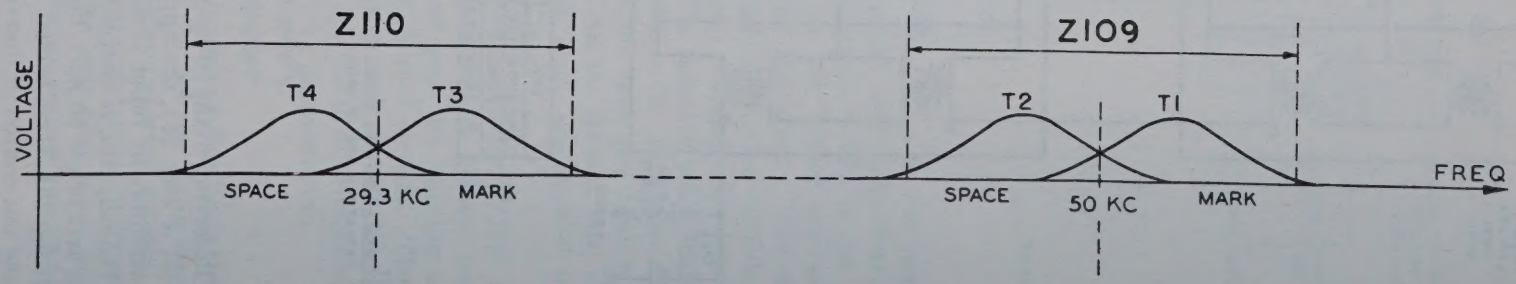
S105	
TERM.	POSITION
1	CHAN B
2	CHAN A & B

Figure 18. Linear discriminator stage, functional schematic diagram.

b. Referring to the 50-kc discriminator used for channel A (fig. 18), the upper and lower secondary windings of input transformer of Z109 are tuned to resonate, respectively, at a few kilocycles above and below 50 kc. The upper winding, T1 (A of fig. 19), is connected in series with resistor AB and one section of duo-diode tube V109 (type 6H6). The lower winding, T2, is connected in series with resistor BC and the other section of duo-diode tube V109. With the two diode sections connected as illustrated (A of fig. 19), the currents of the two circuits flow in the direction indicated by the arrows. The polarities of the voltage drops across resistors AB and BC are posi-



A SIMPLIFIED DISCRIMINATOR SCHEMATIC



B FREQUENCY RESPONSE CHARACTERISTICS

Figure 19. Linear discriminator operation.

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tive at the ends toward the cathodes of V109, and negative at the ends toward the plates of V109. Both resistors are joined at point B, which is the negative side of each resistor. The two voltage drops, therefore, oppose each other, and the resultant voltage between points A and C is the difference between the two voltages. The resultant polarity depends on which of these two voltages is the greater.

c. A frequency-response characteristic curve (B of fig. 19) indicates general voltage levels for tuned windings T1 and T2 of Z109 for frequencies centering around 50 kc. The curves designated as MARK and SPACE represent the voltages across resistors AB and BC, respectively. Since the voltage drops across these resistors are series-opposing, the resultant voltage across the two resistors (A to C) may be illustrated as shown under Z109 (A of fig. 20), when ground is connected to point A and the output is connected to point C. From this curve it will be noted that the resultant voltage increases gradually in a positive direction as the frequency changes from 50 kc to low frequencies and becomes gradually more negative as the frequency changes from 50 kc to high frequencies. Throughout the greater part of the frequency range involved in signaling, there is essentially a linear relation between the magnitude of the resultant voltage and the frequency change.

d. A similar demodulation takes place in network Z110 of the other discriminator, which responds to frequencies centering around 29.3 kc. The theory of operation is similar and also is covered by figures 19 and 20. It should be noted from these figures that the outputs of both discriminators are connected in series, so that the d-c output signals from both the discriminators add algebraically. Output switch S102 in the output of the two discriminators allows for reversing the polarity of the output signals.

e. For the purpose of illustration, it is assumed in A of figure 20 that a positive mark signal results from the lower frequencies centering around 29.3 kc and 50 kc. Depending on the relative locations of the frequencies, a larger voltage E is produced in the lower part of each discriminator and a smaller voltage e is produced in the upper part. The voltages add to produce a net positive voltage $(+2E-2e)$ or a net negative voltage $(-2E+2e)$. Under the conditions assumed for this illustration, the positive voltage represents a mark, and the negative voltage represents a space.

f. B of figure 20 illustrates the effects of reversing the connections of the discriminators to provide a net negative voltage for a mark and a net positive voltage for a space.

g. The NORMAL and REVERSE positions of the OUTPUT switch thus provide for the d-c mark and space output signals of the proper polarities if the higher frequency components of the i-f carrier represent a mark with some receivers or a space with other receivers. It is also necessary to reverse the output of the discriminators, depending on whether or not the drift-compensating feature is used. This drift-compensating feature is described in paragraph 34.

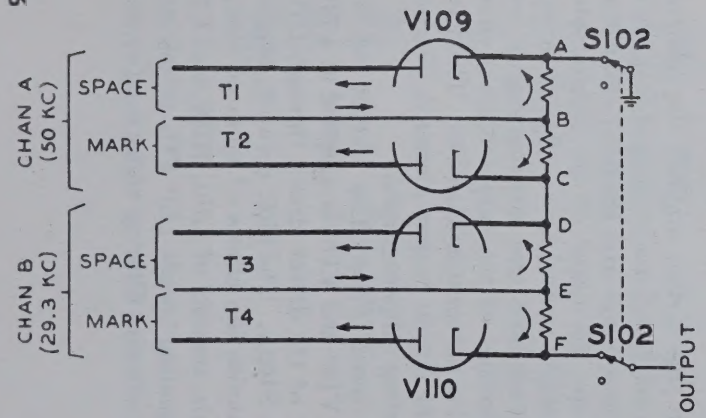
h. Meter M101 (fig. 18) is connected across the output of discriminator Z109, and an identical meter M102 is connected across the output of discriminator Z110 through contacts of METER B switch S105 (in the CHAN B position), to allow for observing the operation of the discriminators. When S105 is in the CHAN A+B position, meter M102 monitors the combined outputs of both channels by measuring the output of cathode follower V111A which is driven by the discriminators. Meter M102 also is used for other electrical measurements in the converter circuit, and is connected to the various circuits by means of switch S105 (fig. 57).

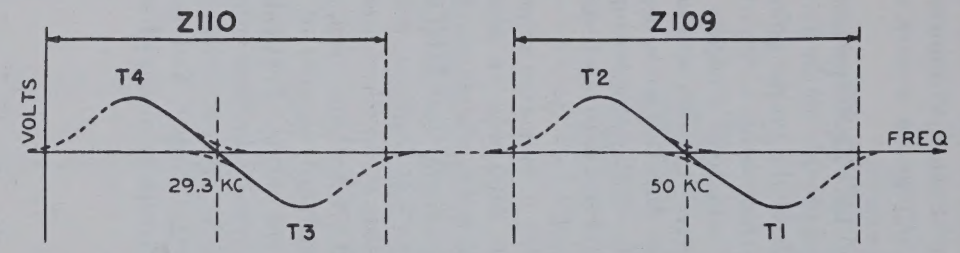
31. Driver Circuit

(fig. 21)

To sustain and further amplify the relatively square-wave mark and space voltages that are required for transmission over the polar and neutral telegraph loops, the output of the discriminators is fed to the output control circuit (figs. 21 through 24). The mark-hold and frequency-drift compensating portions of the output control circuit are discussed in paragraphs 35 and 34. The driver portion of the output control circuit is discussed in the following subparagraphs.

a. Signal-Speed Filter. The output of discriminators V109 and V110 is supplied to a filter in the input of the driver circuit through OUTPUT switch S102A. The filter network, which is used to minimize the effects of noise on the received signals, consists of L101, R129, and C127 for high signaling speeds (LP FIL switch S103 open). For effective filtering under conditions of

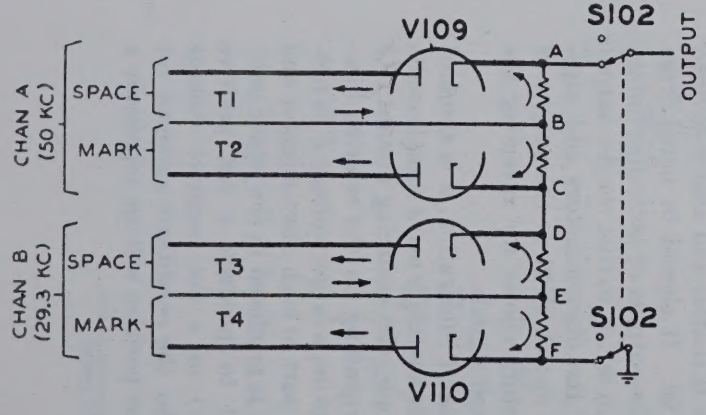


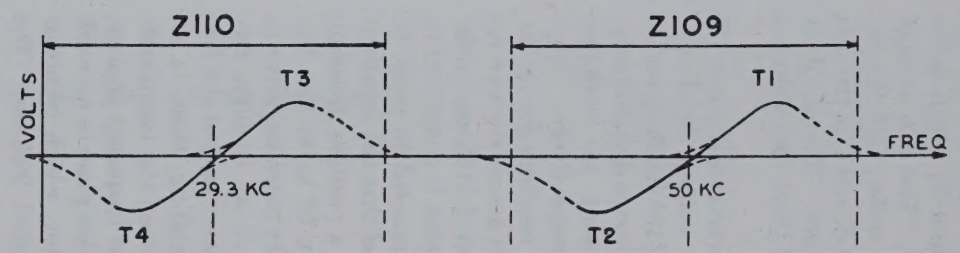


RESISTOR	MARK VOLTAGE	SPACE VOLTAGE
A-B, B-C	-e, +E → +E-e	-E, +e → -E+e
D-E, E-F	-e, +E → +E-e	-E, +e → -E+e
TOTAL A-F	+2E-2e VOLTS	-2E+2e VOLTS

POSITIVE MARK SIGNALS (SWITCH S102 IN POSITION 1)

A





RESISTOR	MARK VOLTAGE	SPACE VOLTAGE
A-B, B-C	+e, -E → -E+e	+E, -e → +E-e
D-E, E-F	+e, -E → -E+e	+E, -e → +E-e
TOTAL A-F	-2E+2e VOLTS	+2E-2e VOLTS

NEGATIVE MARK SIGNALS (SWITCH S102 IN POSITION 2)

B

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Figure 20. Linear discriminator theory diagram.

low signaling speeds, capacitors C125 and C126 may be added to the circuit by operating the LP FIL switch to the IN position.

b. Driver.

(1) With the drift-compensating circuit disconnected, the d-c output voltage of the discriminators is applied to the grid (pin 1) of cathode-follower V111A (part of a type 6SL7GT tube) through the elements of the signal-speed filter, DRIFT COMPENSATOR switch S104, and the REVERSE or NORMAL contacts of OUTPUT switch S102B. The signals are developed across resistor R138, the d-c grid return of V111A. For operation with the drift compensator connected, an a-c amplifier (part of V104) is inserted before the cathode-follower. Circuit details are given in paragraph 34. A positive signal at the grid of V111A will result in a positive voltage at the cathode of V111A across resistor R142. Conversely, a negative grid voltage will result in a negative output voltage. Normally, a mark signal will result in a positive signal at this point in the circuit and a space signal will result in a negative signal. If the equipment with which the converter is used should cause the polarities to be reversed, OUTPUT switch S102 can be used to invert the signals at the output of the discriminator. The NORMAL and REVERSE positions of the switch are provided to effect this inversion. For purposes of making adjustments on the converter while no input signals are being received, provision is made to supply positive and negative test signals to the grid of the cathode-follower. These test signals may be applied from the regulated +150-volt and −150-volt supplies through the MARK and SPACE positions, respectively, of OUTPUT switch S102B. The output of the cathode-fol-

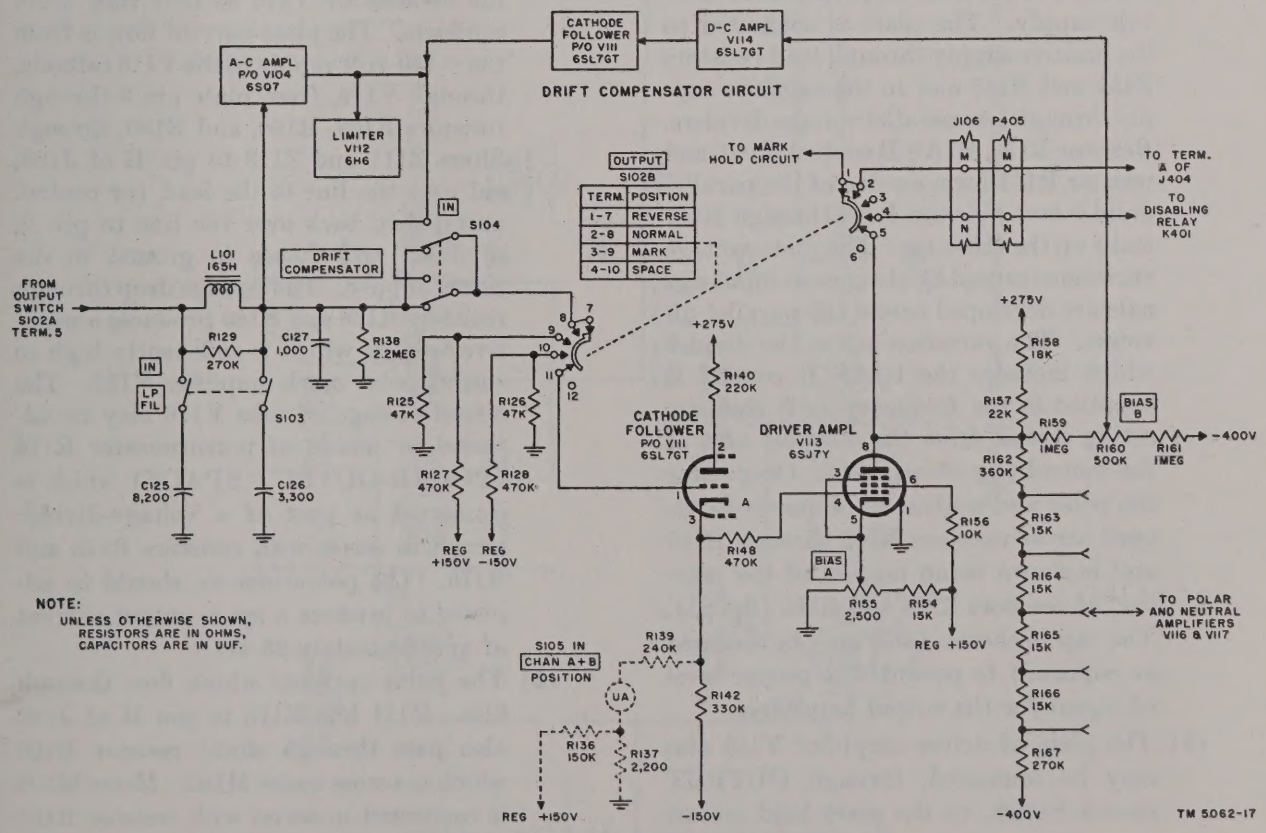


Figure 21. Driver circuit, functional schematic diagram.

lower, in phase with the input, is applied to the grid of driver-amplifier stage V113.

(2) Tube V113 (a type 6SJ7Y) controls the polar and neutral output amplifiers (pars. 32 and 33). When a positive signal is supplied to its grid, V113 develops a negative signal in the plate circuit for driving the output amplifiers. Conversely, a negative input signal results in a positive output signal. Bias for the driver amplifier is developed across resistor R154 and BIAS A control R155 in the cathode circuit of V113. The setting of the BIAS A control establishes the operating point for V113 so that equal negative and positive voltage excursions are produced at the plate for mark and space signals, respectively. The regulated +150-volt supply used as a source of bias is used also to supply screen voltage to V113 through resistor R154. Plate voltage for V113 is furnished from a voltage divider between the +275-volt supply and the −400-volt supply. The plate is connected to the positive supply through load resistors R157 and R158 and to the negative supply through two parallel voltage dividers. Resistor R159, BIAS B control R160, and resistor R161 form one leg of the parallel divider and resistors R162 through R167 make up the other leg. The plate-voltage variations caused by changes in input signals are developed across the parallel dividers. The variation across the divider which includes the BIAS B control is supplied to the frequency-drift compensating circuit from the movable arm of the control (fig. 23, par. 34). Output for the polar and neutral amplifiers is developed across resistors R162 through R167 and is shown being tapped off the junction of resistors R164 and R165 (fig. 21). The tap is chosen (and may be changed as required) to provide the proper level of signal for the output amplifiers.

(3) The plate of driver amplifier V113 also may be connected, through OUTPUT switch S102B, to the mark-hold circuit (par. 35), to the received-disabling circuit (par. 38), and to the emergency keying circuit (par. 39).

32. Polar Output Amplifier
(fig. 22)

a. Purpose. The polar output amplifiers V116 and V115, control the direction and amount of current flow through a loop circuit external to the converter. The reception of a space signal causes polar space amplifier V116 to conduct current through the loop in one direction while polar mark amplifier is cut off. Similarly, the reception of mark signals causes the polar mark amplifier to conduct current through the loop in the opposite direction while the polar space signal is cut off.

b. Space Signals.

(1) Polar space amplifier V116 (a type 6V6GT) normally is cut off when no signals are being received. When a space signal is received, the d-c output voltage from the driver amplifier V113 is positive with respect to the −150 volts on the cathode of V116 so that tube V116 conducts. The plate-current flow is from the −150-volt supply to the V116 cathode, through V116, from plate pin 3 through resistors R169, R168, and R190, through filters Z111 and Z113 to pin B of J103, out over the line to the load (or control unit), then back over the line to pin A of J103, and thence to ground in the power supply. The voltage drop through resistors R168 and R169 produces a negative voltage which is sufficiently high to cut off polar mark amplifier V115. The screen voltage of tube V116 may be adjusted by means of potentiometer R174 (POLAR OUTPUT SPACE) which is connected as part of a voltage-divider circuit in series with resistors R173 and R175. The potentiometer should be adjusted to produce a space output current of approximately 25 ma.

(2) The polar currents which flow through filters Z111 and Z113 to pin B of J103 also pass through shunt resistor R190 which is across meter M102. Meter M102 is connected in series with resistor R191 and will read milliamperes directly when

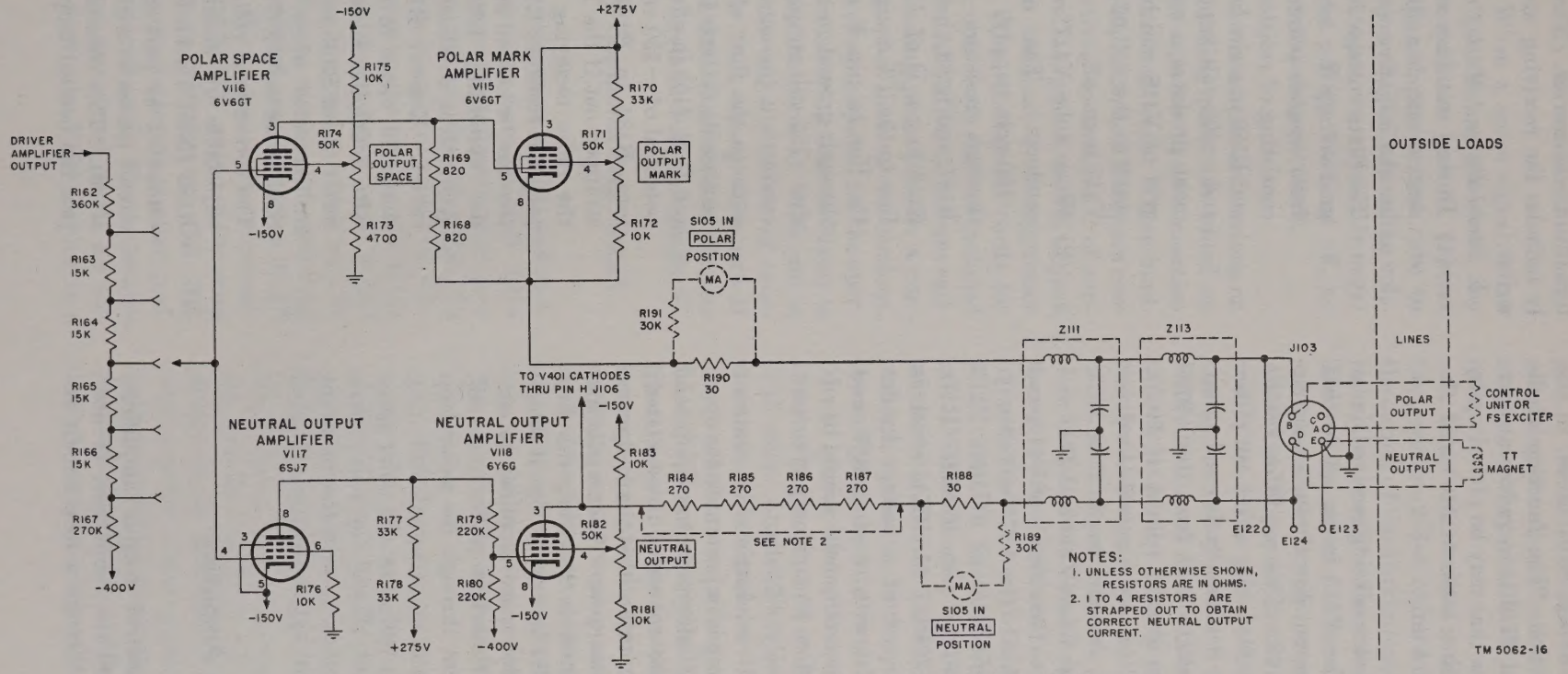


Figure 22. Polar and neutral output circuit, functional schematic diagram.

METER B switch S105 is set in the POLAR position. The function of filters Z111 and Z113 is to reduce any extraneous noise that may be picked up by the control line between J103 and the load or control unit.

c. Mark Signals.

(1) When no signals are being received, polar space amplifier V116 is cut off so that there is no current flow through resistors R169 and R168. This condition results in zero bias for polar mark amplifier V115 so that it normally is conducting. The flow of electrons is from the +275-volt supply to ground (pin A of J103), through the line to the outside load (or control unit), and back to pin B of J103, thence through filters Z113 and Z111 and resistor R190 to the cathode of V115, and through the tube to the +275-volt supply. The screen-grid voltage of tube V115 may be varied by potentiometer R171 (POLAR OUTPUT MARK), which is connected as part of a voltage-divider circuit in series with resistors R170 and R172. This potentiometer should be adjusted to produce a mark output current of approximately +25 ma.

(2) This normal conduction of current through the loop is important to the operation of the teletypewriter equipment with which the converter is associated; that is, it is important that the equipment should never *run open*. When a teletypewriter characted is received, the first (start) impulse is a space signal which causes the polar space amplifier to conduct, the polar mark amplifier to cut off, and the current through the polar loop to reverse. Any mark signal, following a space signal, will cause the polar space amplifier to cut off and the polar mark amplifier to conduct, with the resultant current flow through the loop as indicated in (1) above.

33. Neutral Output Amplifiers

(fig. 22)

a. Purpose. The neutral output amplifiers, V117 and V118, control the conduction or nonconduction of current through a loop circuit external to the converter. The loop circuit normally includes the receiving magnets of a teletypewriter.

b. Stand-By and Mark Conditions.

(1) During stand-by and mark conditions, neutral output amplifier V117 is cut off by the negative potential on its grid. The plate voltage for tube V117 and the grid voltage for tube V118 are obtained from separate points on a voltage divider consisting of resistors R177, R178, R179, and R180 in series between the +275-volt and −400-volt supplies. This arrangement produces a voltage at the control grid of V118 which is positive with respect to the cathode voltage when tube V117 is cut off.

(2) When tube V117 is cut off, tube V118 conducts. The electrons leave the −150-volt supply, flow through V118, through resistors R184, R185, R186, R187, and R188, through filters Z111 and Z113 to pin D of J103, out through the line to the TT equipment, back through the line to pin E of J103, and thence through ground in the converter unit to the −150-volt supply. When tube V118 conducts, it presents a very small resistance to the flow of plate current, and because its cathode is tied to −150 volts, pin D at J103 in effect assumes the same potential of −150 volts. The four resistors, R184 to R187 inclusive, are not strapped out if the TT is located within the radio receiving station. By strapping out resistors R184 to R187, the station can be located at the end of a circuit not exceeding 1,800 ohms resistance (equivalent to about a mile of 19-gage cable). Resistor R188 acts as a meter shunt for meter M102. M102, in series with multiplier R189, is connected across meter shunt R188 to indicate directly in milliamperes when METER B switch S105 is set on NEUTRAL (position 4). The screen-grid voltage of tube V118 is adjustable by means of potentiometer R182 (NEUTRAL OUTPUT) which is connected as part of a voltage-divider circuit (in series with resistors R181 and R183). This control is provided to adjust the neutral loop current to a value

of approximately 60 ma for mark signals.

c. Space Signals. When a space signal is received, the relatively positive output from the driver amplifier overcomes the bias on neutral output amplifier V117 and causes that tube to conduct. The conduction of V117 causes the voltage at the grid of V118 to become sufficiently negative to cut off the tube. With V118 cut off, no current flows in the neutral output circuit.

d. Connections.

(1) In addition to the output connections on J103, three binding posts are added on the rear of the unit for direct connection of polar and neutral loops. These binding posts, E122, E123, and E124, are connected respectively to terminal 2 of suppressor filter Z113, pins A and E of jack J103, and to terminal 4 of suppressor filter Z113. When the special cords for the converter unit (such as those included with Radio Set AN/MRC–2) are unavailable, these binding posts provide a convenient means for making connections.

(2) The control voltage required for the operation of the monitoring tone oscillator is obtained from the plate of V118 and is supplied to the cathode circuit of tone-oscillator tube V401 through terminals H of J106 and P405. Operation of the tone oscillator is explained in paragraph 37.

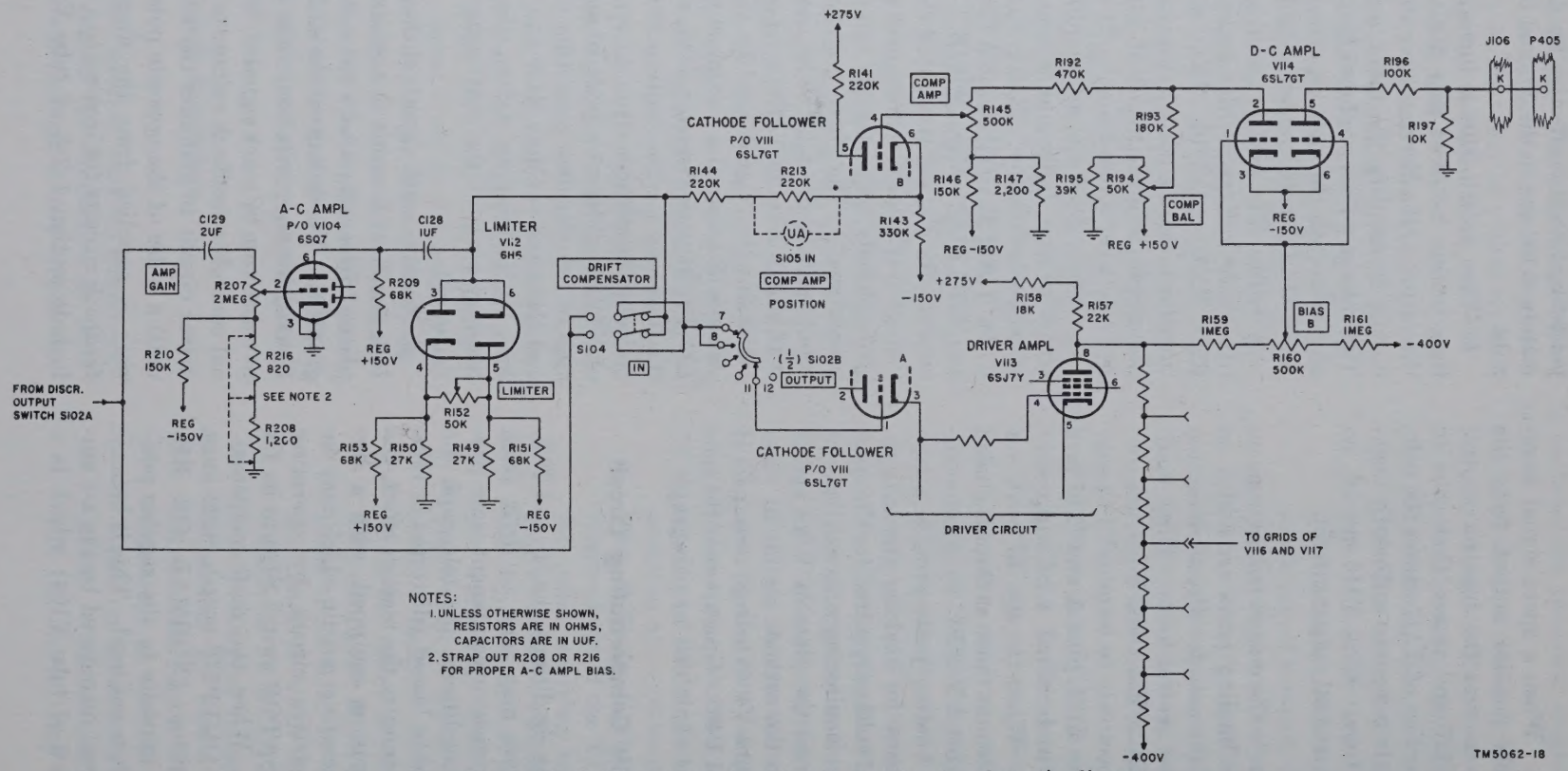
34. Frequency-Drift Compensating Circuit (fig. 23)

a. Under operating conditions, the 50- and 29.3-kc carrier frequencies may tend to drift from normal. If no compensator equipment were provided under such conditions, the telegraph d-c output signals would be biased (distorted in relative length). To minimize the biasing effect, the output control circuit is equipped with a frequency-drift compensating circuit which may be connected to the driver circuit by operating DRIFT COMPENSATOR switch S104 to its IN position (fig. 23). When the drift-compensating circuit is used, OUTPUT switch S102 must be turned to a position (NORMAL OR REVERSE) which is opposite to the regular position when the circuit is not used. This is because of the voltage reversal introduced by the a-c amplifier (section 2–3–6 of tube V104) which is a part of the drift-compensating circuit. The compensating circuit is effective for drifts of approximately ±150 cps in the 50- and 29.3-kc input signals.

b. When switch S104 is turned to the IN position, section 2–3–6 of tube V104 is connected to the output of the discriminator ahead of the driver circuit to amplify the mark and space signals. The voltage pulses produced by the discriminator are connected through capacitor C129 and the AMP GAIN potentiometer R207 to the grid of tube V104. The grid is biased a few volts negative by the voltage divider consisting of resistors R208, R216, and R210. The AMP GAIN potentiometer is set at a point to provide proper voltage changes at the grid (pin 2) of V104; for example, +.25 volt for a mark and −.25 volt for a space.

c. Output from the a-c amplifier is developed across resistor R209 and is coupled to the grid of cathode-follower V111A through capacitor C128, DRIFT COMPENSATOR switch S104, and OUTPUT switch S102B. Capacitor C128 removes the d-c component of the signal so that voltage variations corresponding to mark and space signals may be made symmetrical about a 0-volt level. The plate voltage variations for input signals of ±.25 volts are approximately ±15 volts. Limiter V112 (a type 6H6 duo-diode) maintains this signal level by clipping peaks of pulses which exceed a maximum value of 15 volts. LIMITER potentiometer R152, which determines the threshold for the limiting action, is connected between the cathode (pin 4) and plate (pin 5) of V112, and between positive and negative voltages of two dividers consisting of resistors R150 and R153 and resistors R149 and R151. The limiter, by its clipping action, also minimizes the recovery time of the drift-compensating circuit (*f* below).

d. Positive mark signals at the grid of cathode-follower V111A result in negative signals at the plate of driver amplifier V113 as described in paragraph 31. The voltage at the slider arm of BIAS B potentiometer, therefore, is also driven in a negative direction by mark signals. This negative signal controls a feedback voltage to the input of the driver circuit to maintain the voltage conditions until a pulse of the opposite polarity (space signal) is supplied from the discriminator. The feedback circuits for locking in a signal condition include section 1–2–3 of tube V114 and section



NOTES:
1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. STRAP OUT R208 OR R216 FOR PROPER A-C AMPL BIAS.

Figure 23. Drift-compensating circuit, functional schematic diagram.

4–5–6 of tube V111. Because the slider arm of potentiometer R160 is connected directly to grid 1 of tube V114, this tube will conduct less, and the voltage at its plate and at the slider arm of potentiometer R145 (COMP AMP) will increase. The slider arm of potentiometer R145 is connected to grid 4 of V111B, a cathode-follower. When the grid of the cathode-follower is driven positive, the cathode also will be more positive and because the cathode is connected to grid 1 of V111A through resistors R213 and R144 and through switches S104 and S102, the grid (pin 1) of tube V111A will be held positive, even after the duration of the positive pulse from the plate of tube V104. Thus, the positive pulse, corresponding to a mark signal, will lock the driver circuit in the mark condition until a negative (space) signal is received. A negative pulse output from the plate (pin 6) of tube V104, corresponding to a space signal, will drive grid 1 of V111A negative, thereby reversing the polarities throughout the drift-compensating circuit, and providing a negative voltage at (pin 6) of V111B to hold the driver circuit in the space condition.

e. BIAS B potentiometer is adjusted to obtain equal positive and negative voltage excursions for space and mark signals, respectively. The COMP BAL and COMP AMP potentiometers are adjusted to produce ±15-volt variations at grid 1 of V111 A (assuming that signal pulses in the order of ±15 volts are transmitted through capacitor C128). The COMP BAL potentiometer adjusts the voltage variations on plate 2 of V114 to produce equal mark and space swings, while the COMP AMP potentiometer adjusts the gain through section 4–5–6 of tube V111 to provide the proper voltage levels at cathode 6; for example, ±15 volts for mark and space signals. Meter B is connected across resistor R213 when METER B switch S105 is turned to the COMP AMP position. If the drift-compensating circuit is adjusted properly, the plate swings of tube V104 and the feedback voltage at cathode 6 of V111 are equal, as indicated by zero or small deflections of meter B when miscellaneous signals are received.

f. The foregoing information shows that, in response to a momentary pulse of mark-signal voltage (±15 volts), the feedback path produces a steady state potential of about +15 volts which locks until a space voltage pulse of the same magnitude, but of opposite polarity (−15 volts), is received. The circuit then locks in a similar manner for the space condition and awaits a mark pulse to unlock it. Occasionally, it is possible for a steady signaling condition (either mark or space) to change without unlocking the voltage established by the drift-compensating circuit. This can occur during testing or adjusting procedures, and results in the first signal-voltage pulse being of the same polarity as the locked-in voltage. The first signal-voltage pulse is, therefore, ineffective. Because of the time constant of the circuit, a comparatively long time is required to discharge capacitor C128 to a voltage low enough for a single-voltage transition to unlock the circuit. Several voltage transitions, therefore, may be lost if the signal speed is rapid. The limiter stage (*c* above) protects the circuit against such a condition by clipping the peaks of pulses which exceed a maximum value of about ±15 volts; thus the time required to resume normal keying is minimized.

g. Section 4–5–6 of twin-triode V114 normally is not used in Army installations. The voltage variations at terminal K of J106 are utilized in certain Navy carrier-bay equipments (Frequency Shift Receiver-Converter Equipment model FRF, for example) to key or cut off a tone oscillator circuit when mark and space signals are received. The plate (pin 5) of V114 is at zero potential while the grid is negative with respect to the cathode (pin 6). When the grid voltage is positive with respect to the cathode, V114 conducts and the current flow from ground through plate load resistor R196 causes the voltage at the junction of R196 and R197, and terminal K of P405 to increase in a negative direction.

35. Mark-Hold Circuit

(fig. 24)

This circuit serves the purpose of maintaining a mark condition on the d-c output loops if the carrier should fail or be cut off for any reason. The mark-hold circuit provides a sustaining voltage at the plate pin (pin 8) of driver-amplifier tube V113 which establishes a simulated mark condition on the line.

a. The plate of mark-hold tube V105 is connected to the plate of driver amplifier V113 through OUTPUT switch S102B (fig. 24). This tube (V105) can be held in a cut-off condition, so that

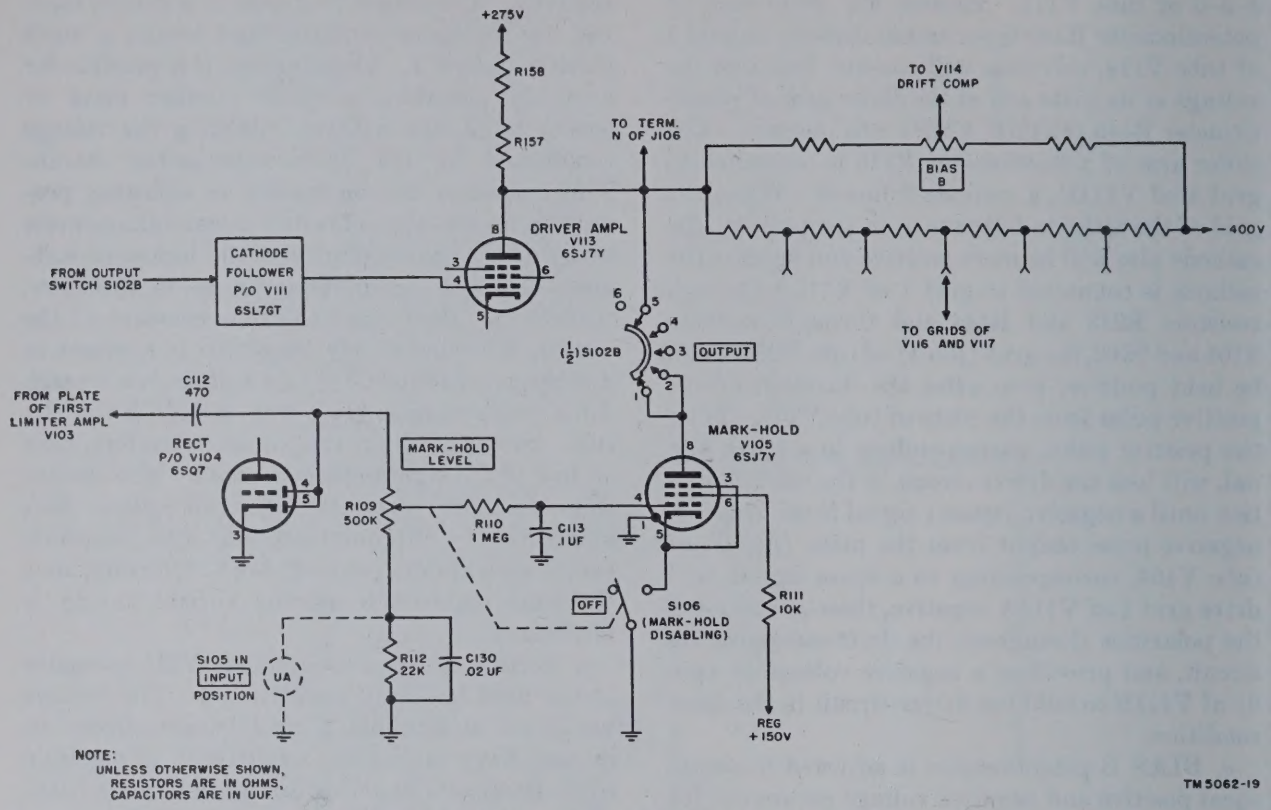


Figure 24. Mark-hold circuit, functional schematic diagram.

it has no effect on the operation of converter, through two different actions:

(1) If the MARK-HOLD LEVEL control is turned to the OFF position, switch S106 in the cathode circuit of V105 is opened and the tube is inoperative.

(2) If switch S106 is closed and a negative voltage is developed across the MARK-HOLD LEVEL control, tube V105 will be held in a cut-off condition. This is the normal functioning of the circuit while a carrier is being received. The negative voltage is developed by the rectifying action of the diode portion of V104, input to the diode being the i-f output of limiter stage V103 (figs. 17 and 24). The rectified signal also is used to obtain a metering indication on METER B M102 when switch S105 is placed in the INPUT position.

b. While a carrier is being received, the nature of the input signal (mark or space) determines the nature of the signal at the plate of driver amplifier Y113. Normally, the plate-voltage swing is positive for a space signal and negative for a mark signal. If the carrier should fail, the plate of V113 would swing positive and the d-c output loops would *run open* if it were not for the mark-hold tube. The failure of the carrier, however, results in no signal output from limiter stage V103 and loss of bias on mark-hold tube V105. Tube V105 then conducts and produces a voltage drop in the plate circuit of V113 to simulate a mark condition.

Note. The sensitivity of Frequency Shift Converter CV-182(*)/GRC-26A is reduced when the mark-hold feature is being utilized. Therefore, it will be to the advantage of the operator to disable the mark-hold circuit during adverse receiving conditions.

36. Metering Circuits

The frequency-shift converter is provided with microammeters M101 and M102 for checking the operation of the various circuits. Meter M101 is connected permanently, in series with current limiting resistor R211, across terminals 7 and 8 (output) of discriminator Z109. This meter measures the channel A discriminator output current (fig. 18). Meter M102 is connected to terminals 12 of

the A and B sections of METER B switch S105. This switch has the following 11 positions (fig. 57):

a. Chan B. In position 1, meter M102 measures the relative discriminator output from channel B (transformer Z110). It is connected, in series with current limiting resistor R212, across terminals 7 and 8 of Z110.

b. Chan A+B. In position 2, meter M102 provides a relative indication of the cathode current of V111A. This current is composed of the added outputs of both the A and B channels. The voltage applied to the grid of driver amplifier V113 is directly proportional to this cathode current.

c. Polar. In position 3, meter M102 measures the d-c current of the polar output loop. Terminals 3 of switch S105 are connected across the meter in series with shunt R190 and multiplier R191. The full polar output current flows through R190.

d. Neutral. In position 4, meter M102 measures the d-c neutral loop current. The meter, in series with multiplier R189, parallels shunt R188. The full neutral loop current (60 ma) flows through R188.

e. Input. In position 5, meter M102 is shunted across resistor R112 in the grid circuit of the mark-hold tube (V105). It indicates the input voltage applied to the mark-hold circuit.

f. Comp Amp. In position 6, meter M102 is connected across resistor R213. If the drift-compensating circuit is adjusted properly, the voltages at the cathode of V111B and at the R213 end of R144 will be equal. This will show up as zero (or small) deflection on meter M102 while miscellaneous (or RY tape) signals are being received.

g. +275 V. In position 7, meter M102 is connected across meter shunt R206 and, through multiplier R135, to the positive 275-volt supply. The meter indicates the output voltage of this supply.

h. Reg +150 V. In position 8, meter M102 is connected to the regulated +150-volt supply through multiplier R134. It indicates the output voltage of this supply.

i. Reg −150 V. In position 9, meter M102 is connected to the regulated −150-volt supply through multiplier R133. It indicates the output voltage of this supply.

j. −150 V. In position 10, meter M102 is connected to the unregulated −150-volt supply through multiplier R132. It indicates the output voltage of this supply.

k. −400 V. In position 11, meter M102 is connected across meter shunt R131 and, through multiplier R130, to the negative 400-volt supply. It indicates the output voltage of this supply.

Section III. TONE-OSCILLATOR AND RECEIVER-DISABLING CIRCUITS

37. Tone-Oscillator Circuit V401

(fig. 25)

a. The tone-oscillator section of Power Supply PP–712(*)/GRC–26A is mounted on the power supply chassis and is connected electrically to the frequency-shift converter through multiple connectors P405 and J106. Tube V401 (6SL7GT) produces an audible tone at monitoring jack J105 (PHONES KEYED TONE) on the converter unit when the converter is producing a mark signal. Neutral output amplifier tube V118 supplies the operating voltage necessary for keying tone-oscillator tube V401.

b. Filament voltage for V401 is supplied through terminals I and J of connectors J106 and P405 to terminals 7 and 8 of the tube. A connection is made from the plate (pin 3) of neutral output amplifier V118 to the cathodes (pins 3 and 6) of V401 through terminals H of multiple connectors J106 and P405. The plates (pins 2 and 5) of V401 are connected to ground through plate load resistors R401 and R402 and elements R403 and R404 of the audio-output filter; hence no d-c voltage is applied to the plates of V401. Tube V401, with no voltage applied to its cathodes is nonconducting because there is no potential difference between the plate and cathodes. A mark signal causes tube V118 to conduct and the relatively negative voltage developed at its plate is applied to the cathodes of tube V401. When a negative potential is applied to the cathodes of tube V401, a difference in potential between the plates and cathodes of V401 exists which causes the plates to become positive with respect to the cathodes and, under these conditions, tube V401 will conduct. Feedback voltage necessary for oscillation is applied from the plate of one section of V401 to the grid of the other section and vice versa as in a basic free-

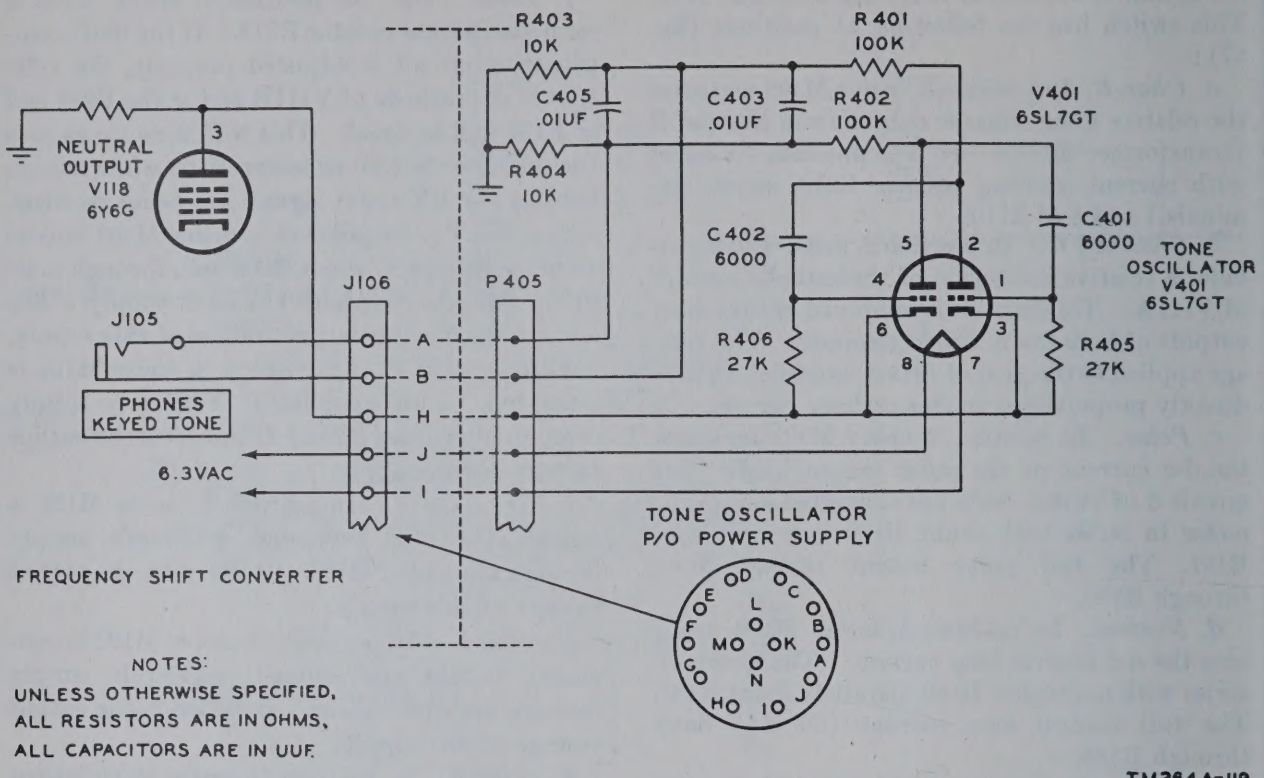


Figure 25. Power Supply PP-712(*)/GRC-26A, tone-oscillator circuit, functional schematic diagram.

running multivibrator. The frequency of oscillation is determined by the time constant of coupling capacitors C401 and C402 and grid leak resistors R405 and R406. Audio output is taken from the junction of R402 and R404 and the junction of R401 and R403 and is applied to the PHONES KEYED TONE jack (J105) through terminals A and B of multiple connectors P405 and J106. Capacitors C403 and C405 bypass the high harmonic frequencies developed by this type oscillator; this results in an output which is essentially sine wave.

38. Receiver-Disabling Circuits
(fig. 26)

a. When operating on a one-way reversible basis (transmission and reception on the same frequency), it is essential that the radio receivers be disabled during periods of transmission to prevent damage to the receiver input circuits. The use of disabling relays to short-circuit the antenna input terminals of the receivers during transmission provides effective protection. Rectifier CR401 and relay K401 are provided on the tone-oscillator chassis of the power supply to control the operation of the disabling relays in the receivers.

b. Relay K401 and the disabling relays of the two radio receivers normally are not operated. In this state, the radio receivers are connected for reception. With one-way reversible operation, the *service switch* on the control unit is set at *one way* before operation is started. One end of the winding of relay K401 is connected to the regulated +150-volt supply through current limiting resistor R409. The other end of the winding is connected through pins C and D of jack J404 and through the contacts of the *service* switch in the control unit to ground. Relay K401, therefore, will operate, and its contacts connect the disabling relays of the two radio receivers to about 20 volts, developed across resistor R410 by the output of a small, full-wave, disk-type rectifier, CR401. The disabling relays in the radio receivers thus are operated to short-circuit the receiving antenna.

c. Disk-type rectifier CR401 is connected to the 50- to 60-cycle secondary voltage of transformer T401, when the contacts of relay K401 are closed in the operated (energized) position. The a-c

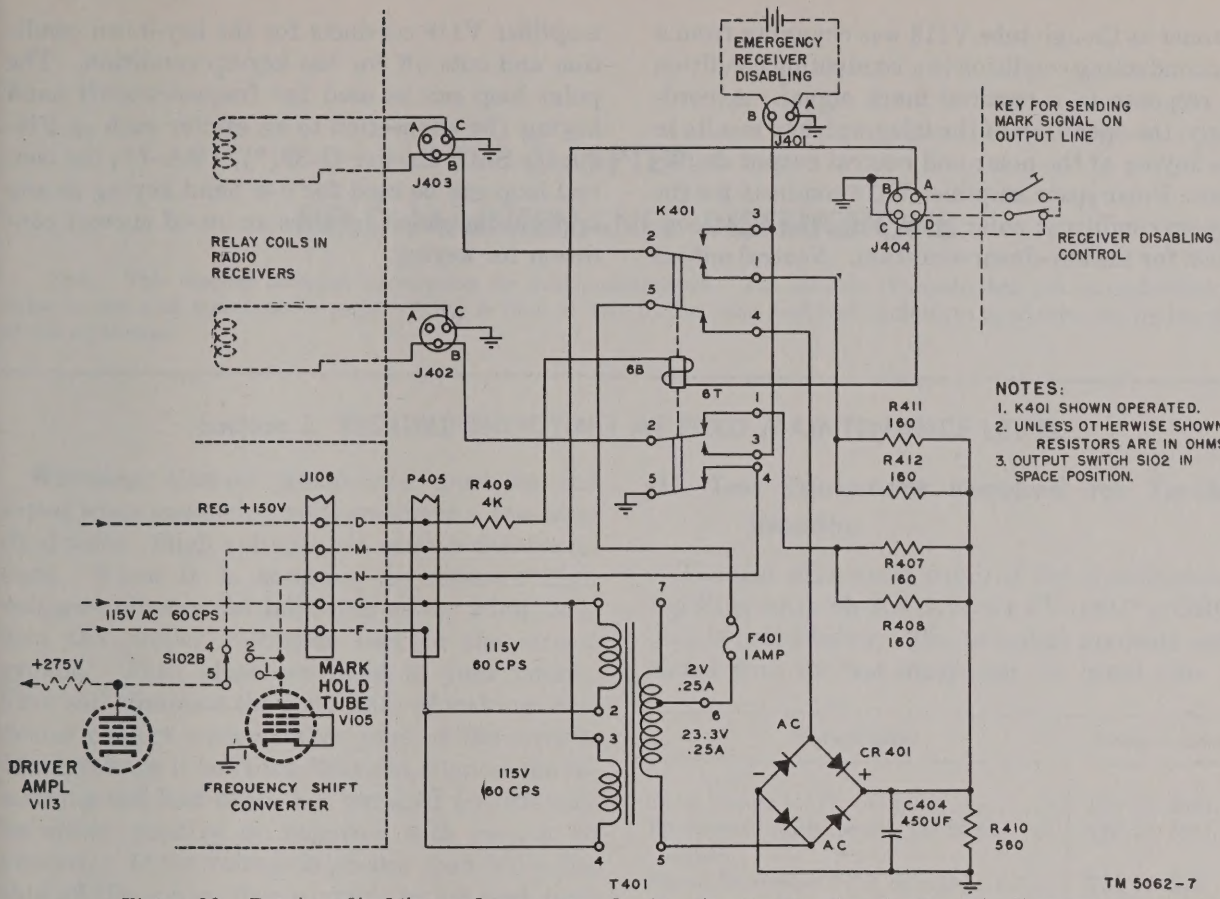


Figure 26. Receiver-disabling and emergency keying circuits, functional schematic diagram.

secondary supply is protected by fuse F401 (fig. 28). The primary a-c voltage for transformer T401 is furnished from the normal 115-volt, 50- to 60-cycle supply in the converter unit through terminals F and G of multiple connectors J106 and P405. This 115-volt supply is opened and closed by the contacts of the AC SUPPLY switch on the power supply (fig. 10).

d. The lower contact (4) of relay K401 places ground on plate pin 8 of tube V105, through the N contacts of P405 and J106, when the relay is operated. This insures that a steady marking condition is established on TT loops when the receiving circuits are cut off.

39. Emergency Hand Keying

(figs. 26 and 22)

a. For emergency hand keying, OUTPUT switch S102 on the converter unit must be operated to the SPACE position. This position of S102 connects the grid (pin 1) of V111 to the junction point of resistors R126 and R128 which are connected in series between ground and the regulated −150-volt supply (fig. 21). The negative voltage across resistor R126 cuts off tube V111, which in turn cuts off tube V113, and a space condition is established on the d-c loops. As shown in figure 26, the plate of tube V113 is connected through contacts 4–5 of OUTPUT switch S102B to the contacts of a telegraph key. Operating OUTPUT switch S102 to SPACE also removes the plate voltage from mark-hold tube V105 which is supplied from the +275-volt supply through V113 plate load resistors R157 and R158 and terminals 5–1 of OUTPUT switch S102B. This prevents tube V105 from establishing a steady mark condition on the d-c loops when the carrier is shut off.

b. The operation of a telegraph key places ground on the plate pin of driver tube V113 (if switch S102 is in the SPACE position), thus changing the plate potential from a positive value to a less positive value in approximately the same

manner as though tube V113 was changing from a nonconducting condition to a conducting condition in response to a received mark signal. Accordingly, the operation of the telegraph key results in the keying of the polar and neutral output amplifiers. Polar space amplifier V116 conducts for the key-up condition; polar mark amplifier V115 conducts for the key-down condition. Neutral output amplifier V118 conducts for the key-down condition and cuts off for the key-up condition. The polar loop can be used for frequency-shift hand keying (by connection to an exciter such as Frequency Shift Exciter O–39(*)/TRA–7); the neutral loop can be used for c-w hand keying in any application which requires an on-off current condition for keying.

CHAPTER 4

FIELD MAINTENANCE INSTRUCTIONS

Note. This chapter contains information for field maintenance. The amount of repair that can be performed by units having field maintenance responsibility is limited only by the tools and test equipment available, and by the skill of the repairman.

Section I. TROUBLE SHOOTING AT FIELD MAINTENANCE LEVEL

Warning: Certain precautions must be followed when measuring voltages above a few hundred volts. High voltages can cause a fatal accident. When it is necessary to measure high voltages, observe the following rules: First, connect the proper voltmeter lead to the circuit ground. Then place one hand in your pocket. This will eliminate the possibility of making accidental contact with another part of the circuit. If the voltage is less than 300 volts, connect the remaining test lead to the hot terminal (which may be either positive or negative with respect to ground). If the voltage is greater than 300 volts, shut off the power; then connect the hot lead, turn on the power, and note the reading on the voltmeter. Do not touch any part of the voltmeter, particularly when it is necessary to measure the voltage between two points both of which are at some potential with respect to ground. Before touching any part after the power is shut off, short the part to ground.

40. Trouble-Shooting Procedures

The first step in trouble shooting a defective frequency-shift converter is to sectionalize the fault. To sectionalize means to trace the fault to the *major circuit* responsible for the abnormal operation of the equipment. The second trouble-shooting step is to localize the fault. To localize means to trace the fault to the defective *part* responsible for the abnormal operation. Some faults, such as burned-out resistors, r-f arcing, and shorted transformers, often can be located by sight, smell, and hearing. The majority of troubles, however, must be located by checking voltage and resistance and then comparing the observed results with the voltage and resistance charts.

41. Test Equipment Required for Trouble Shooting

The test equipment required for trouble-shooting Frequency Shift Converter CV–182(*)/GRC–26A is listed below. The technical manuals associated with the test equipment are listed also.

Test equipment	Technical manual
Tube Tester I–177, or equal	TM 11–2627.
Electronic Multimeter TS–505/U, or equal.	TM 11–5511.
Signal Generator I–72, or equal	TM 11–307.
Oscilloscope OS–8A/U, or equal	NAVSHIPS 91, 272.
Decibel Meter TS–399/U, or equal	TM 11–2045.
Frequency Meter Set SCR–211–(*), or equal.	TM 11–300.
Headset, 2,000- to 4,000-ohm impedance.	
Variable resistor, 3,000 ohms, 10 watts.	
Variable resistor, 2,000 ohms, 10 watts.	

42. Visual Inspection

a. Failure of the equipment to operate properly usually will be caused by one or more of the following faults:

(1) Defective power cable.
(2) Worn, broken, or disconnected cords or plugs.
(3) Burned-out fuse.
(4) Wires broken because of excessive vibration.
(5) Loose or defective tubes.

b. When failure is encountered, and the cause is not immediately apparent, check as many of the items above as is practicable before disassembling

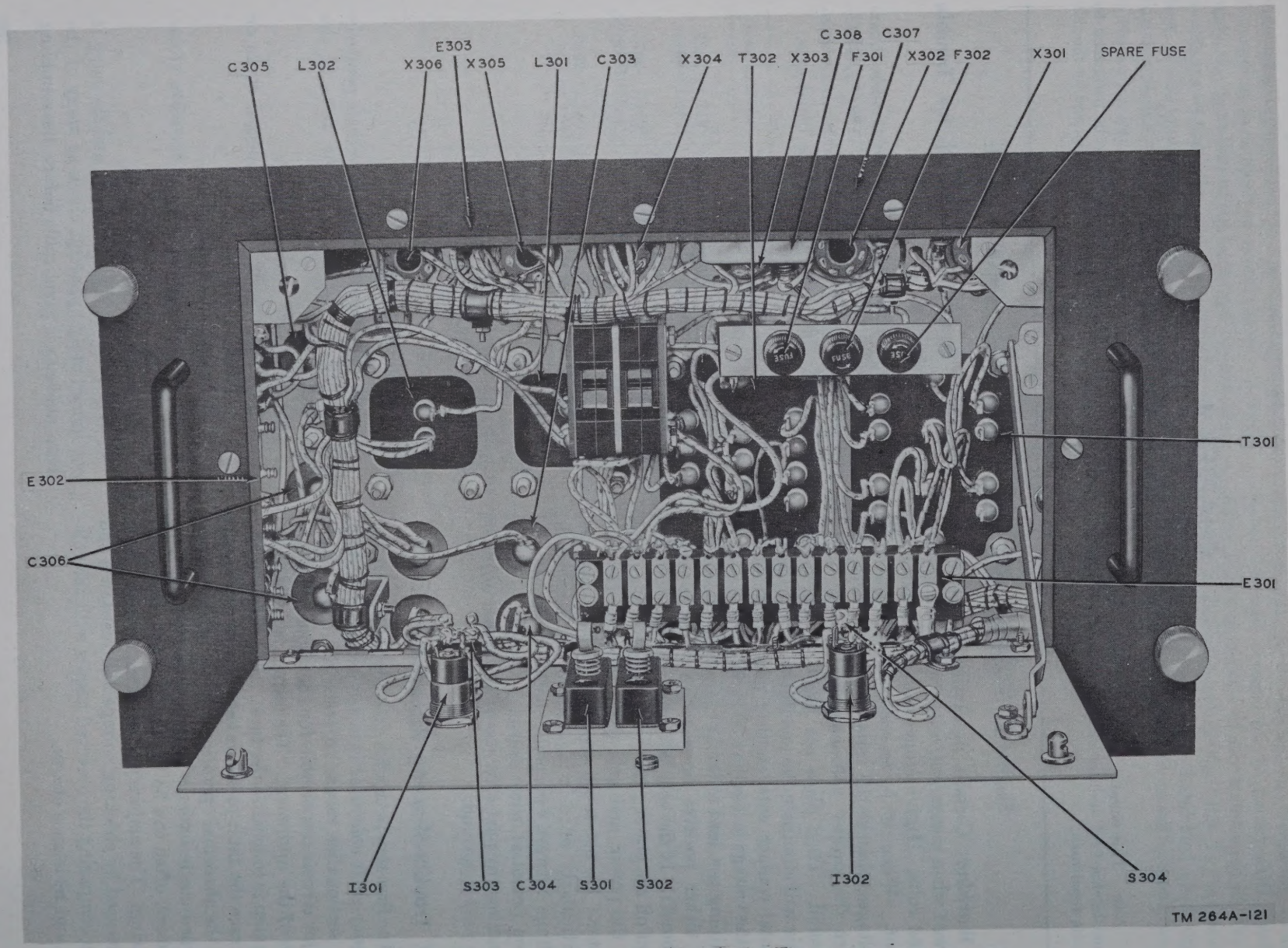


Figure 27. Power Supply PP-712(*)/GRC-26A, front view of chassis with door open.

the equipment for detailed examination. If possible, obtain information from the operator regarding performance at the time trouble occurred. Refer to figures 27 through 29, 31 through 33, and 35 for location of parts.

43. Checking High-Voltage Circuits for Shorts

a. Trouble within the frequency-shift converter often may be detected by checking the resistance of the high-voltage circuits to ground before applying power to the equipment, thus preventing damage to the power supply. Check for the following resistance readings between terminals of E301 and ground in the power supply (fig. 27) before attempting to put the unit into operation. Leave the main power cable disconnected while taking the measurements and leave the power supply and converter interconnected.

(1) From terminal 3 (+275-volt supply), the resistance should be 6,700 ohms.

(2) From terminal 4 (regulated +150-volt supply), the resistance should be 3,700 ohms.

(3) From terminal 11 (regulated −150-volt supply), the resistance should be 19,000 ohms.

(4) From terminal 13 (−150-volt supply), the resistance should be 15,000 ohms.

(5) From terminal 14 (ground), the resistance should be zero.

(6) From terminal 12 (−400-volt supply), the resistance should be 30,600 ohms.

b. If the measured resistances differ materially from the values listed, first check the filter capacitors associated with the particular supply. Then look in the associated circuits of the converter for leaky or shorted capacitors, or for resistors that have changed values.

44. Test Set-Up and Operational Checks

a. General. An operating Power Supply PP-712(*)/GRC-26A, or a unit capable of supplying

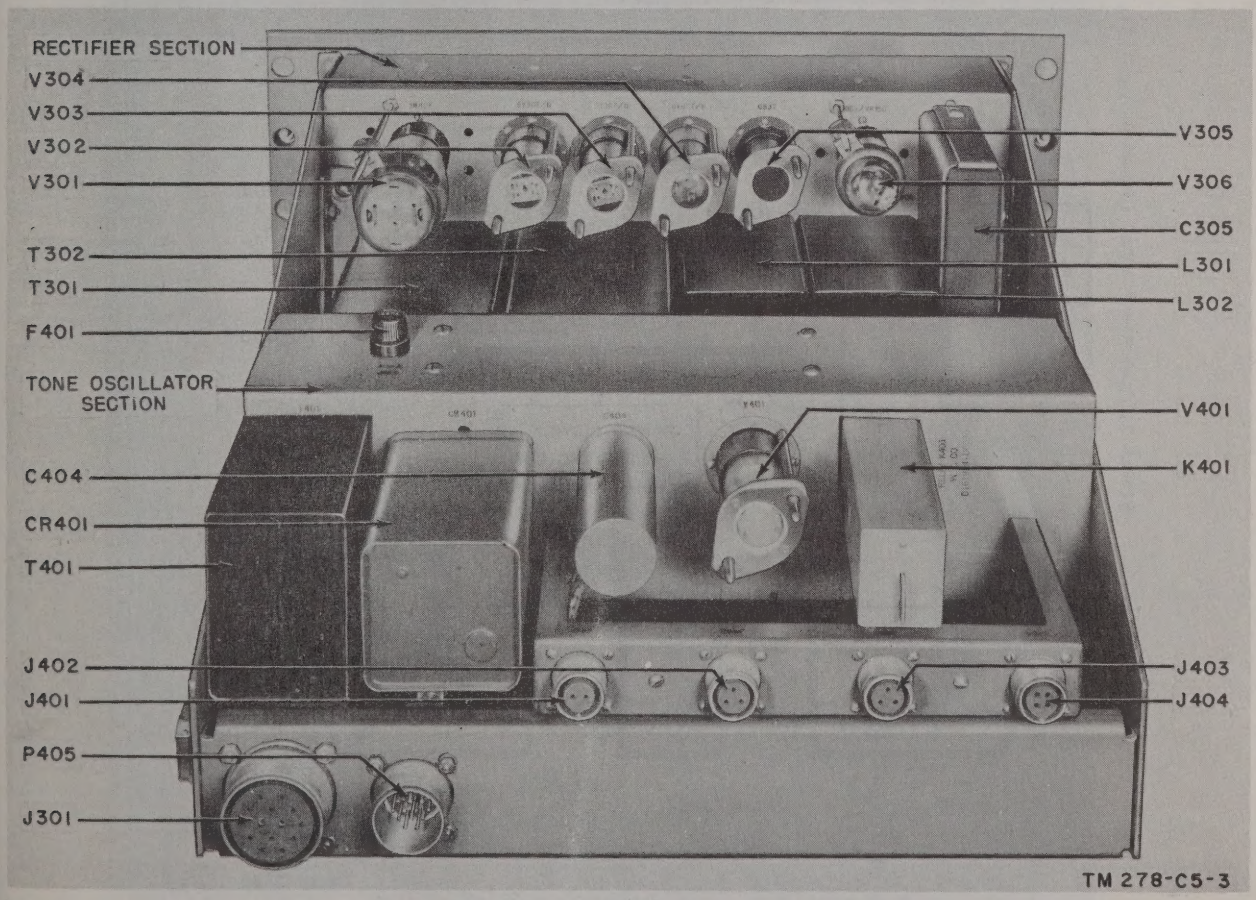


Figure 28. Power Supply PP-711(*)/GRC-26A, rear view of chassis.

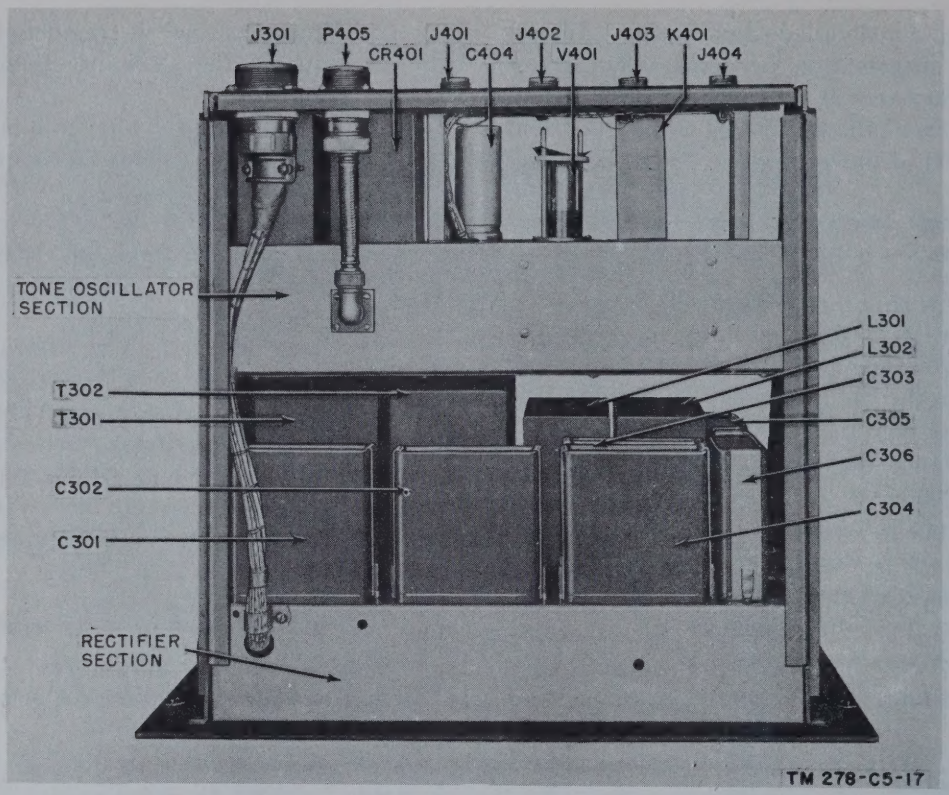


Figure 29. Power Supply PP-712(*)/GRC-26A, bottom view of chassis.

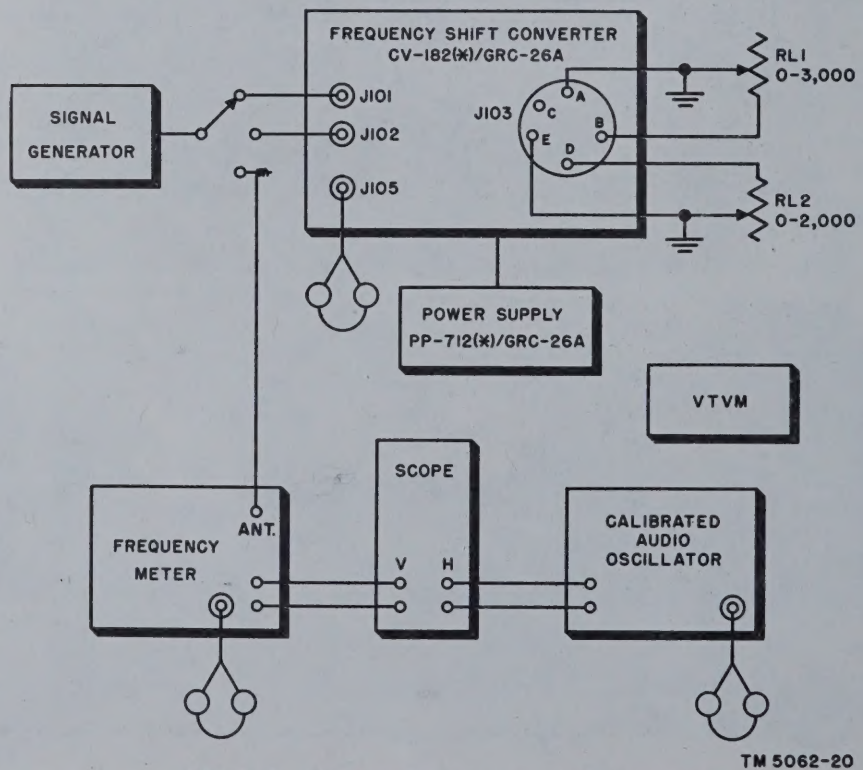


Figure 30. Test bench set-up for operational tests.

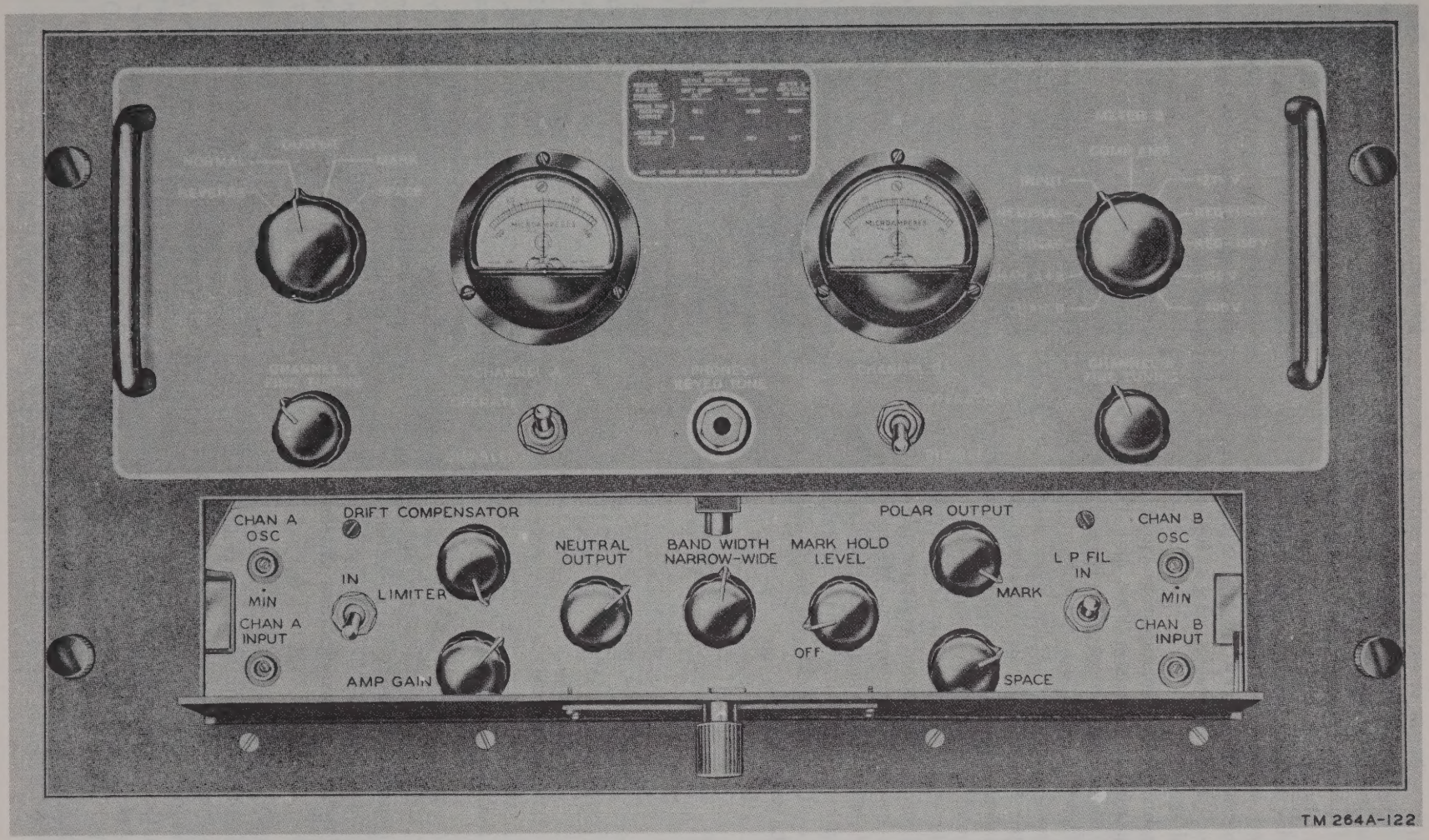


Figure 31. Frequency Shift Converter CV-182(*)/GRC-26A, view of front panel.

the same output voltages, is required for making operational tests of the converter. The test set-up shown in figure 30 is recommended. Controls used in making adjustments are indicated in figure 31.

b. Voltage checks. The satisfactory operation of the converter depends upon the proper voltages being applied to the various tube elements. These voltages may be checked on METER B of the converter. First, however, check for correct input voltage.

(1) Measure the input voltage to the primary of power transformers T301 and T302 and adjust this voltage at the time of installation to 105, 115, or 125 volts. Check to see that connections are made to the proper taps on the primaries of these transformers so that the voltage will correspond to the voltage actually supplied to the equipment when in use.

(2) To check the output voltages of the power supply unit, turn the METER B knob successively to the positions indicated in the following chart and see that the readings are within the limits shown in the chart below.

METER B switch position	E301 terminal No. to ground	Actual voltage E	METER B reading
+275V	3	+280±15	E/5±9
REG +150V	4	(*)	E/5±10
REG −150V	11	−145 to −160	E/5±10
−150V	13	−150±10	E/5±10
−400V	12	−400±20	E/5±15

*Within ±3 volts of the REG −150 volts, but of a positive polarity.

c. Input Circuit. Set CHANNEL A and CHANNEL B FINE TUNING capacitors C102 and C104 at their midpositions. The locations of screw driver controls C101, C105, C103, and C106 involved in the procedures which follow are shown in figure 31.

(1) Connect the signal generator to CHAN A receptacle J101 of the converter and set the signal generator frequency to a value corresponding to that of the i-f input from the radio receiver (500 kc for Radio Receiver R–388/URR). Set the input at 1 volt. This voltage requirement is based on the use of a signal generator of 100-ohm output impedance. Do not connect an input to CHAN B receptacle J102 while making tests on channel A.

(2) Connect a VTVM (vacuum-tube voltmeter) from terminal 3 of network Z103 to ground and adjust CHAN A INPUT capacitor C101 with a screw driver for maximum indication on the voltmeter (13 to 22 volts).

(3) Connect the VTVM from terminal 2 of network Z104 to ground, and check to see that the voltage at this point is 1.75 to 3.5 volts throughout the complete range of CHAN A OSC capacitor C105.

(4) Connect the VTVM from terminal 3 of BAND WIDTH switch S101B to ground, or from terminal 4 of E103. Turn the BAND WIDTH knob to NARROW. Set the test oscillator output at .1 volt and adjust CHAN A OSC capacitor C105 to give a maximum voltage indication (10 to 25 volts).

(5) Repeat the steps outlined in (4) above with the BAND WIDTH control at WIDE. Check to determine that the voltage indication is between 20 and 40 volts.

(6) Connect the signal generator to CHAN B receptacle J102 of the converter and set the signal frequency to a value corresponding to that of the i-f input from the radio receiver. Set the signal generator output at 1 volt. Do not connect an input to CHAN A receptacle J101 while making tests on channel B.

(7) Connect a VTVM from terminal 3 of network Z101 to ground and adjust CHAN B INPUT capacitor C103 for a maximum indication on the voltmeter (13 to 22 volts).

(8) Connect the VTVM from terminal 2 of network Z102 to ground and check to see that the voltage at this point is 1.75 to 3.5 volts throughout the complete range of CHAN B OSC capacitor C106.

(9) Connect the VTVM from terminal 3 of BAND WIDTH switch S101B to ground. Turn the BAND WIDTH knob to NARROW. Set the test oscillator output at .1 volt and adjust CHAN B OSC capacitor C106 to give a maximum voltage indication (8 to 25 volts).

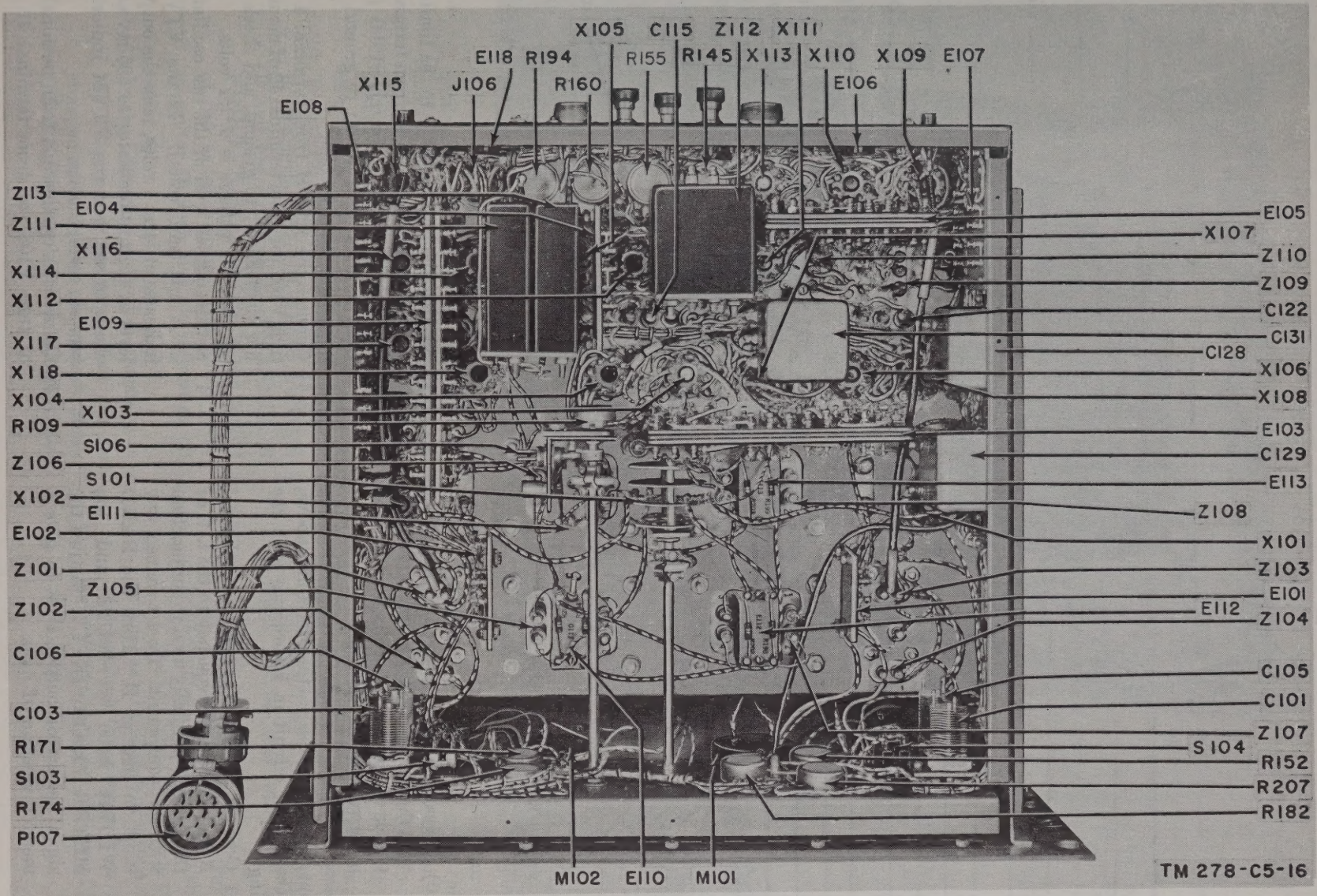


Figure 32. Frequency Shift Converter CV-182 (*)/GRC-26A, bottom view of chassis.

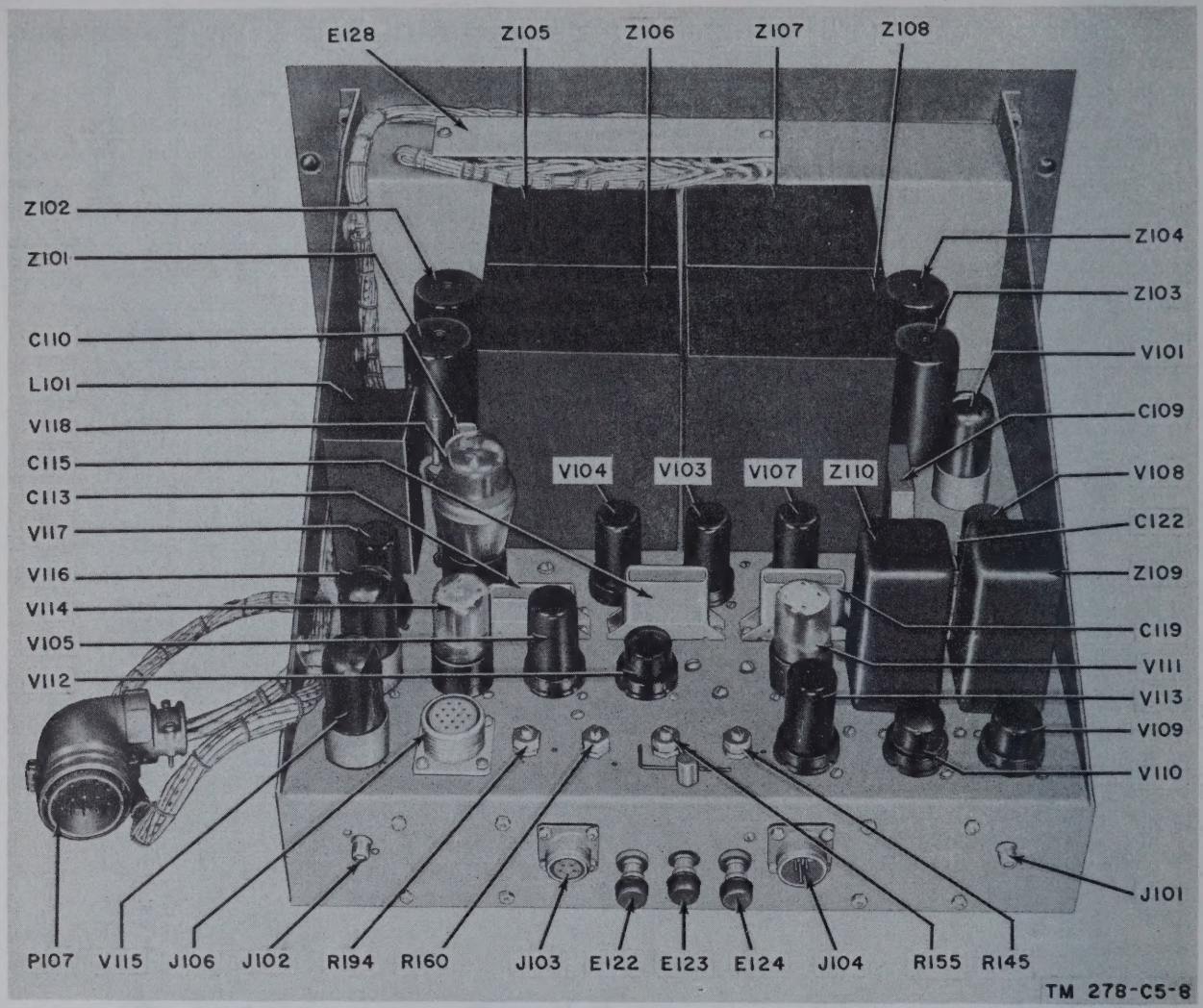


Figure 33. Frequency Shift Converter CV-182(*)/GRC-26A, top rear view.

(10) Repeat the steps outlined in (9) above with the BAND WIDTH knob at WIDE. Check to see that the voltage indication is between 15 and 40 volts.

d. Limiter Circuit. After alining and checking the input circuit according to the procedures above, check the limiter circuit in accordance with the following:

(1) Connect the signal generator to channel A and adjust its frequency to the i. f. of the receiver normally used in conjunction with this equipment. Do not connect any input to channel B. Turn the BAND WIDTH knob to WIDE and the METER B knob to INPUT. Adjust the signal generator output level to give a meter indication of +50.

(2) See that the input voltage to the limiter, as measured by the VTVM from terminal 3 of BAND WIDTH switch S101B (or from terminal 4 of V103) to ground, is not greater than 6 volts.

(3) Connect the VTVM from terminal 4 of tube V108 (or from terminal 42 of mounting strip E103) to ground, and check to see that the voltage is 6 ±2 volts.

(4) Set the output level of the test oscillator at .5 mv (millivolts). If the VTVM indicates at least 4 volts, raise the output level of the test oscillator to 500 mv and check to see that the VTVM indicates between 4 and 8 volts.

(5) Connect an oscilloscope from terminal 4 of tube V108 (or from terminal 42 of

mounting strip E103) to ground. Use a saw-tooth sweep frequency suitable to obtain a 3-cycle pattern. Observe that the waveform of the 50-kc signal is approximately as shown in A of figure 34.

(6) Transfer the signal generator from channel A input to channel B input. Do not connect any input to channel A. Repeat the steps outlined in (1) through (5) above. The oscilloscope pattern should now change, approximately, to that shown in B of figure 34.

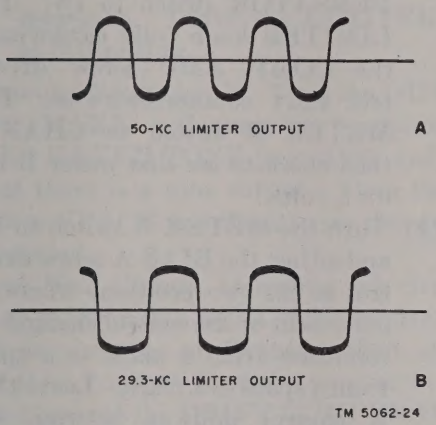


Figure 34. Signal waveform of limiter output circuits.

e. Discriminator Circuit.

(1) Connect the signal generator to channel A. Set the signal generator to the operating frequency and adjust its output to 50 mv. Set the CHANNEL A FINE TUNING knob to the middle of its range. Adjust CHAN A OSC capacitor C105 until a point is found where a slight movement in either direction causes an off-scale reading on meter A. Set capacitor C105 at the position which gives a 0 indication on meter A.

(2) Transfer the signal generator to channel B. Turn the METER B knob to CHAN B and check to see the CHANNEL B FINE TUNING knob is set at the middle of its range. Adjust CHAN B OSC capacitor C106 to give a 0 indication on meter B.

(3) In the following tests, it is necessary to use a source of frequency that can be changed by 850 cycles. Frequency Meter BC–221–(*) may be used; however, the dial on it must be reset each time the frequency is changed and must be calibrated against an audio oscillator (fig. 30). Alternately, a Frequency Shift Exciter O–39(*)/TRA–7 may be used as a signal generator to accomplish the desired results. When using the latter unit, couple the output of the frequency-shift exciter to the radio receiver. Tune the exciter to 2.0 mc (megacycles) and set the SHIFT dial for an 850-cycle shift; then tune the radio receiver to the exciter output with the TEST key of the exciter thrown to MARK.

(4) Connect the frequency meter (or the radio receiver output) to channel A. Decrease the frequency of the applied signal by 425 cycles (or to 2 mc −425 cycles) to simulate a spacing signal. Check to determine that meter A indicates 50 (±10) to the left of 0. Increase the applied frequency 850 cycles (or 2 mc +425 cycles) for a marking signal. Check to make certain the marking signal causes meter A to indicate 50 (±10) to the right of 0.

(5) Transfer the output from the frequency meter or the radio receiver to channel B. Repeat the steps outlined in (3) and (4) above, using meter B in the CHAN B position.

f. Output Circuit. The locations of the screw driver controls (COMP AMP, BIAS A, BIAS B, and COMP BAL) involved in the following procedures are shown in figure 6. The four controls can be adjusted from the top by using the potentiometer adjusting tool or a screw driver.

(1) Turn the OUTPUT switch to MARK. Turn the METER B knob to CHAN A+B and check to see that meter B indicates +55±10.

(2) Turn the OUTPUT knob to SPACE and check to see that meter B indicates −55±10.

(3) Turn the BIAS A screw driver control fully counterclockwise. Turn the OUTPUT knob to SPACE. Use a voltmeter which has a resistance of 20,000 ohms per volt to check the voltage from pin 8 of tube V113 to ground. It should be +250 ±20 volts.

(4) Turn the OUTPUT knob to MARK. Check the voltage from pin 8 of tube V113 to ground. It should be less than +20 volts. Check the voltage between pin 4 and pin 5 of tube V117. If the voltage between pins 4 and 5 of tube V117 is not -65 ± 10 volts, reconnect the lead from pin 4 of tube V117 (which also is connected to pin 5 of tube V116) to the junction of the two resistors (among R162 through R167) which provides a voltage nearest to −65 volts.

(5) Turn the MARK-HOLD LEVEL control to the OFF position and check the voltage from pin 8 of tube V117 to ground. It should be $+185 \pm 20$ volts. Next, turn the OUTPUT knob to SPACE and check to see that the voltage changes to -145 ± 10 volts. Return the MARK-HOLD LEVEL control to the ON position.

(6) Check to determine that the operation of the OUTPUT switch to MARK and to SPACE results in keying the polar and neutral loop circuits. To do this, attach two rheostats to J103 as shown in figure 30. These rheostats simulate the output loops so that the dual-diversity converter may be tested under simulated operating conditions.

(*a*) With the METER B knob at POLAR, determine that the POLAR OUTPUT MARK and SPACE potentiometers can be adjusted to produce loop currents as follows:

Simulated loop resistance in ohms between terminals A and B of jack J103	Meter indication in ma*
0	Less than ±20.
2,000 approximately	More than ±25.

*Deflection to the right for MARK and deflection to the left for SPACE.

(*b*) Turn the METER B switch to NEUTRAL. With the rheostat across pins D and E of jack J103 (fig. 30), adjusted as in the chart below, determine that the NEUTRAL OUTPUT potentiometer can be adjusted to produce neutral currents as follows:

Simulated loop resistance in ohms between terminals D and E of jack J103	Meter indication in ma
0	Less than +40.
800	More than +60.

g. Drift Compensator Circuit. To test this circuit, set the controls and make the adjustments as follows:

(1) Turn the OUTPUT knob to NORMAL, and the AMP GAIN knob fully counterclockwise. Operate the DRIFT COMPENSATOR switch to IN. Turn the LIMITER knob fully clockwise. Turn the COMP AMP screw driver control fully counterclockwise. Turn the METER B switch to CHAN A+B; then check to see that meter B indicates 0 ± 5 volts.

(2) Turn the METER B switch to POLAR, and adjust the BIAS A screw driver control to the two positions where a slight movement of the control changes the loop condition from a mark to a space, and from a space to a mark. Leave the BIAS A control midway between the two positions.

(3) Turn METER B switch to CHAN A+B. Turn the COMP AMP screw driver control in a clockwise direction until the meter B reading is increased by 5 to the right or to the left, depending on whether the indication in (1) above is to the right or to the left. Adjust the BIAS B screw driver control to a position where, with a slight movement of the control, the meter B reading just mentioned changes back and forth between positive and negative readings.

(4) Set the COMP AMP screw driver control at its midposition. Turn the AMP GAIN control clockwise until the d-c loop currents can be changed from a mark to a space by the CHANNEL A (or B) FINE TUNING knob, when and i-f input is connected to the CHAN A (or CHAN B) receptacle (J101 or J102).

(5) Adjust the screw driver COMP BAL and COMP AMP controls until meter B indicates +70 ±5 for a mark (OUTPUT switch at MARK) and −70 ±5

for a space (OUTPUT switch at SPACE). These readings should be steady. Wait several seconds, if necessary, to obtain steady meter indications. Slowly turn the LIMITER knob counterclockwise until the meter reading of +70 for a mark is reduced to +50 and, at the same time, the meter reading of −70 for a space reduces to a value between −40 and −60. Turn the LIMITER knob fully clockwise; then turn the knob slowly counterclockwise until the meter indication is just on the verge of being decreased. Leave the LIMITER knob at this setting.

h. Tone-oscillator circuit. Turn the OUTPUT knob to MARK. Connect a headphone to PHONES KEYED TONE jack, J105, and make sure that there is a tone output. Turn the output knob to SPACE and check to see that there is no tone output.

i. Mark-Hold Circuit. In testing this circuit, a frequency-shift exciter and a radio receiver may be used as a source of frequency-shift signals. Connect the i-f output from the receiver to channel A and operate the DRIFT COMPENSATOR switch to OUT and the OUTPUT switch to REVERSE. Tune the frequency-shift exciter to 2.0 mc and set the SHIFT dial for an 850-cycle shift. Then tune the radio receiver to the exciter output with the TEST key of the exciter thrown to MARK. Turn the METER B switch to INPUT and adjust the input to the converter to give an indication of 50 on meter B. Adjust the MARK-HOLD LEVEL knob until the output circuit just remains spacing. Check to determine that the output restores to marking when the input from the radio receiver is reduced to zero. Connect the i-f output from the radio receiver to channel B and adjust the i-f input from the radio receiver to channel B to give an indication of 50 on meter B. Check to see that the output circuit just remains spacing. Reduce the input from the radio receiver to zero and make sure that the output restores to marking.

45. Trouble-Shooting Chart

When the indicated results are not obtained during one or more of the operational checks described in the preceding paragraph, consult the trouble-shooting chart below. Connect a signal generator to J101 or J102 as shown in A or B of figure 30. Also, make the connections to J103 with rheostats as shown in figure 30. These rheostats simulate the output loops so that the dual-diversity converter may be tested under simulated operating conditions. The signal generator should be set to the frequency normally fed to input jacks J101 and J102 by the radio receivers used with the converter in actual operation.

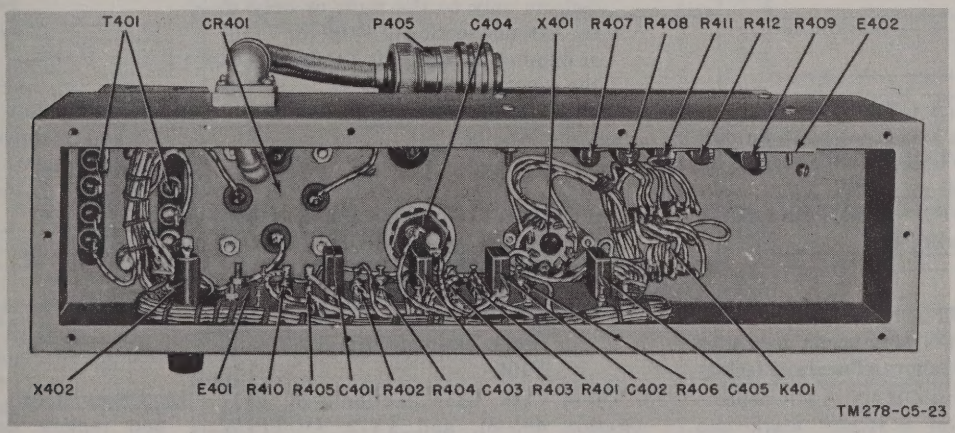


Figure 35. Tone oscillator section, bottom view.

Symptom	Probable trouble	Correction
1. White pilot fails to light when AC SUPPLY switch is turned to ON.	1. A-c line, safety switches S301 and S302, transformer T302, fuses F301 and F302, AC SUPPLY switch S303, receptacle J104, pilot lamp I301, or filter Z112.	1. Check wiring and repair or replace defective apparatus.
2. Red pilot fails to light when PLATE switch is turned to ON.	2. Pilot lamp I302, transformer T301, or plate switch S304.	2. Check wiring and repair or replace defective apparatus.
3. All voltages too high or too low	3. Meter B, or tap connections on transformers T301 and T302.	3. Check and replace defective apparatus.
4. +275V does not read in range of +47 to +65 on meter B.	4. T301 winding 5–6–7, choke L301, T302 winding 8–9, capacitors C301 and C302, or tube V301.	4. Check and replace defective apparatus.
5. REG +150V does not read +20 to +40 on meter B.	5. Tubes V304 or V305, capacitors C307 or C308, T301 winding 11–12, T302 winding 5–7, or resistors R308 to R321.	5. Check and replace defective apparatus.
6. REG −150V indication not −20 to −40 on meter B.	6. Tubes V303 or V306, capacitors C305 or C306, T302 winding 12–13, or resistors R301 to R306.	6. Check and replace defective apparatus.
7. −150V indication not −20 to −40 on meter B.	7. Tube V302, resistor R307, T301 winding 8–9–10, capacitors C303 or C304, choke L302, or T302 winding 6–7.	7. Check and replace defective apparatus.
8. −400V indication not −65 to −95 on meter B.	8. Circuit wiring. V303, R301, R302, C305, C306, T302 winding 12–13, T301 winding 6–7.	8. Check continuity.
9. Meter B on INPUT fails to give an indication.	9. Tubes V104 (section 3–4–5), V103, or V101 and V102, or associated circuit elements.	9. Check wiring and repair or replace defective apparatus.
10. Meter B switched to INPUT gives an indication, but no output is indicated on meter A (or meter B) when the latter meter is switched to CHAN B.	10. Limiter amplifier tubes V106, V107, V108 or the associated circuits.	10. Check circuits and apparatus and replace defective apparatus.
11. Meter A (or meter B on CHAN B) indicates an output while meter B (or meter A) indicates no output.	11. Tubes V101 (or V102) and V109 (or V110), or the associated circuits. If meter A (or meter B on CHAN B) deflects only to the right or only to the left, one section of V109 (or V110) or one-half of Z109 (or Z110) may be the cause of the trouble.	11. Check circuits and apparatus and replace defective equipment.
12. Meter B on CHAN A+B fails to indicate an output while an output is obtained on meter A (or meter B) on CHAN B.		12. Check circuit and apparatus and replace defective equipment.
a. DRIFT COMPENSATOR turned off.	*a.* Tube V111 (section 1–2–3), OUTPUT switch S102, DRIFT COMPENSATOR switch S104, or associated circuits.	
b. DRIFT COMPENSATOR turned to ON after meter indication for *a* above is found satisfactory.	*b.* Tube V104 (section 2–3–6) or other circuit elements associated with V104.	
13. Meter B on CHAN A+B deflects near zero on a steady mark and steady space (drift compensator circuit fails to lock in).	13. Tubes V113, V114 (section 2–3), V111 (section 4–5–6), and V112, OUTPUT switch S104, DRIFT COMPENSATOR switch S102, or associated circuit.	13. Check circuit and apparatus and replace defective equipment.
14. No output indication with meter B at POLAR or NEUTRAL, and no tone with OUTPUT switch at MARK.	14. Tubes V11 (section 1–2–3), V113, or associated circuit elements. (If meter B on CHAN A+B indicates an output from V111, the trouble may be with V113 or its associated circuit.)	14. Check circuit and apparatus and replace defective equipment.

Symptom	Probable trouble	Correction
15. Steady mark (d-c indication on meter B at POLAR and NEUTRAL, and steady tone) with OUTPUT switch at SPACE and an i-f input connected to J101 or J102.	15. Tube V105 or associated circuit elements.	15. Check circuit and apparatus and replace defective equipment.
16. D-c neutral (or polar) output, but no polar (or neutral) output.	16. Tubes V115 and V116 (or V117 and V118) or associated circuit elements.	16. Check circuit and apparatus and replace defective equipment.
17. Imperfect polar output	17. Neutral loop open	17. Check to see that a monitoring teletypewriter is connected to the TT RED and BLACK jacks or that the normally made contacts of these jacks are closed.
18. With tube V114 in its socket, and the OUTPUT switch operated alternately to MARK and SPACE, alternate tone on and tone off signals are not produced.	18. Tube V401 or associated circuit elements.	18. Check circuit and apparatus and replace defective equipment.

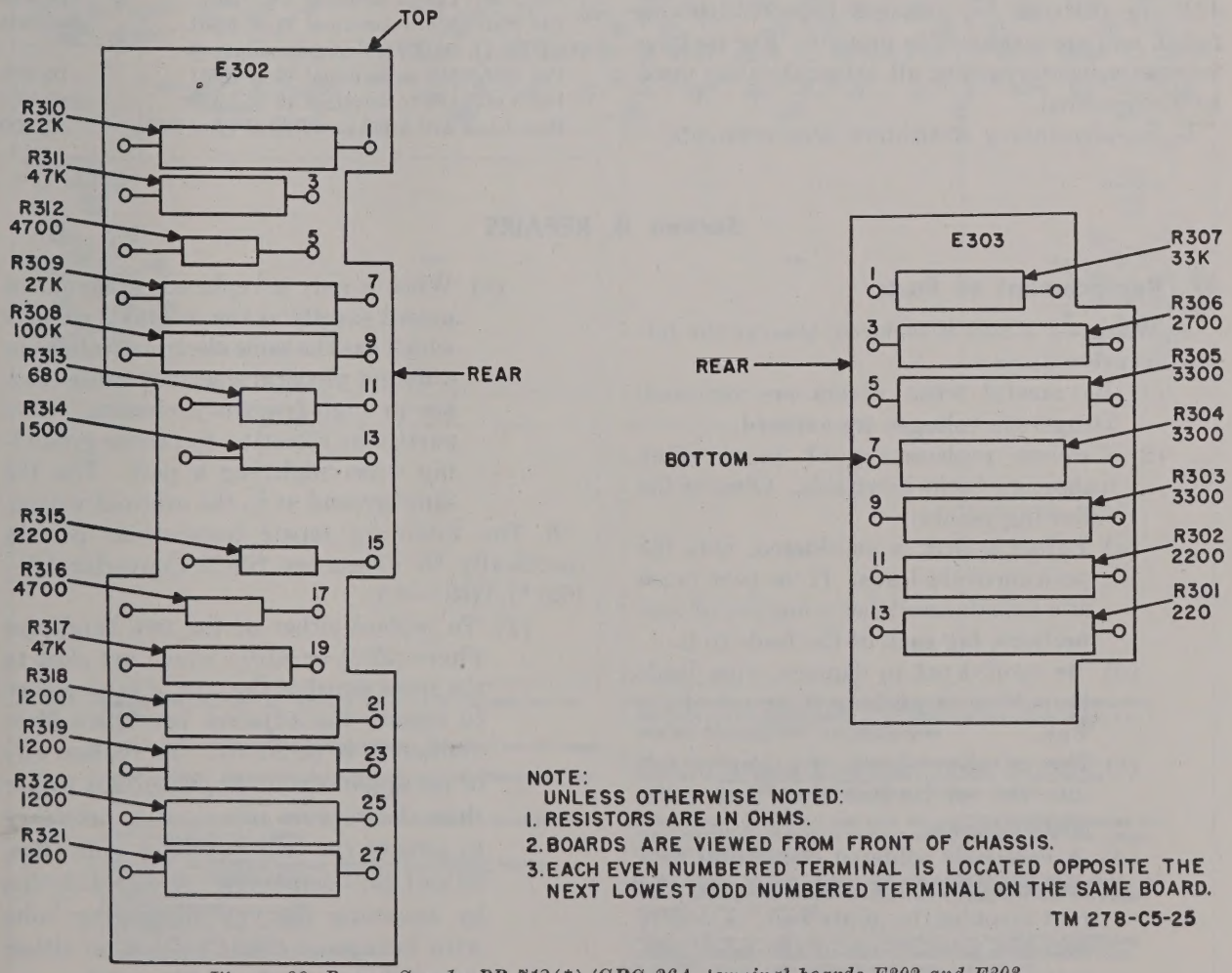


Figure 36. Power Supply PP-712(*)/GRC-26A terminal boards E302 and E303.

46. Aids for Rapid Servicing

To assist maintenance personnel in the rapid servicing of defective units, tube-socket voltage and resistance diagrams, a supplementary voltage measurement chart, terminal board diagrams, and photographs of the interior of the frequency-shift converter and power supply are included in this manual.

a. Tube-Socket Voltage and Resistance Diagrams. When checking the voltages in the frequency-diversity converter and power supply, remove the input cables from receptacles J101 and J102 and leave the power supply and converter interconnected. Operate the AC SUPPLY switch to ON, the PLATE switch to ON, the DRIFT COMPENSATOR switch to IN, and the OUTPUT switch to NORMAL or REVERSE. All other switches may be set at any of the designated positions. All values given (figs. 37, 38, 39 and 42) are positive d-c voltages unless otherwise noted, and are measured to ground. For making resistance measurements, all external cables must be disconnected.

b. Supplementary Resistance Measurements.

Connections and junctions	Measurements (ohms)
Pin 4 of V101 to terminal 4 of E301	4, 700
Pin 4 of V102 to terminal 4 of E301	4, 700
AMP GAIN control at minimum: Pin 2 of V104 to ground	1, 300
OUTPUT switch at NORMAL:	
Between pins 3 and 5 of V109	5
Between pins 4 and 8 of V109	200, 000
Between pins 3 and 5 of V110	16
Between pins 4 and 8 of V110	200, 000
OUTPUT switch at MARK or SPACE	
COMP AMP control at maximum: Between pin 4 of V111 and terminal 14 of E301	470, 000
LIMITER control in midposition:	
Pin 4 of V112 to terminal 4 of E301	1, 700
Pin 5 of V112 to terminal 11 of E301	2, 500
BIAS A at maximum: Pin 8 of V113 to terminal 12 of E301	70, 000
BIAS B at minimum: Pins 1 and 4 of V114 to terminal 12 of E301	62, 000
COMP BAL at minimum:	
Pin 2 of V114 to terminal 4 of E301	18, 000
Pin 2 of V114 to terminal 11 of E301	200, 000
NEUTRAL OUTPUT at minimum:	
Pin 4 of V118 to terminal 13 of E301	10, 000
Pin 5 of V118 to terminal 12 of E301	140, 000
Pins 4 and 6 of V303 to terminal 12 of E301	2, 400

Section II. REPAIRS

47. Replacement of Parts

a. Whenever a unit is serviced, observe the following precautions:

(1) Be careful when covers are removed. Dangerous voltages are exposed.

(2) Careless replacement of parts often makes new faults inevitable. Observe the following points:

(*a*) Before a part is unsoldered, note the position of the leads. If the part (such as a transformer) has a number of connections, tag each of the leads to it.

(*b*) Be careful not to damage other leads by pulling or pushing them out of the way.

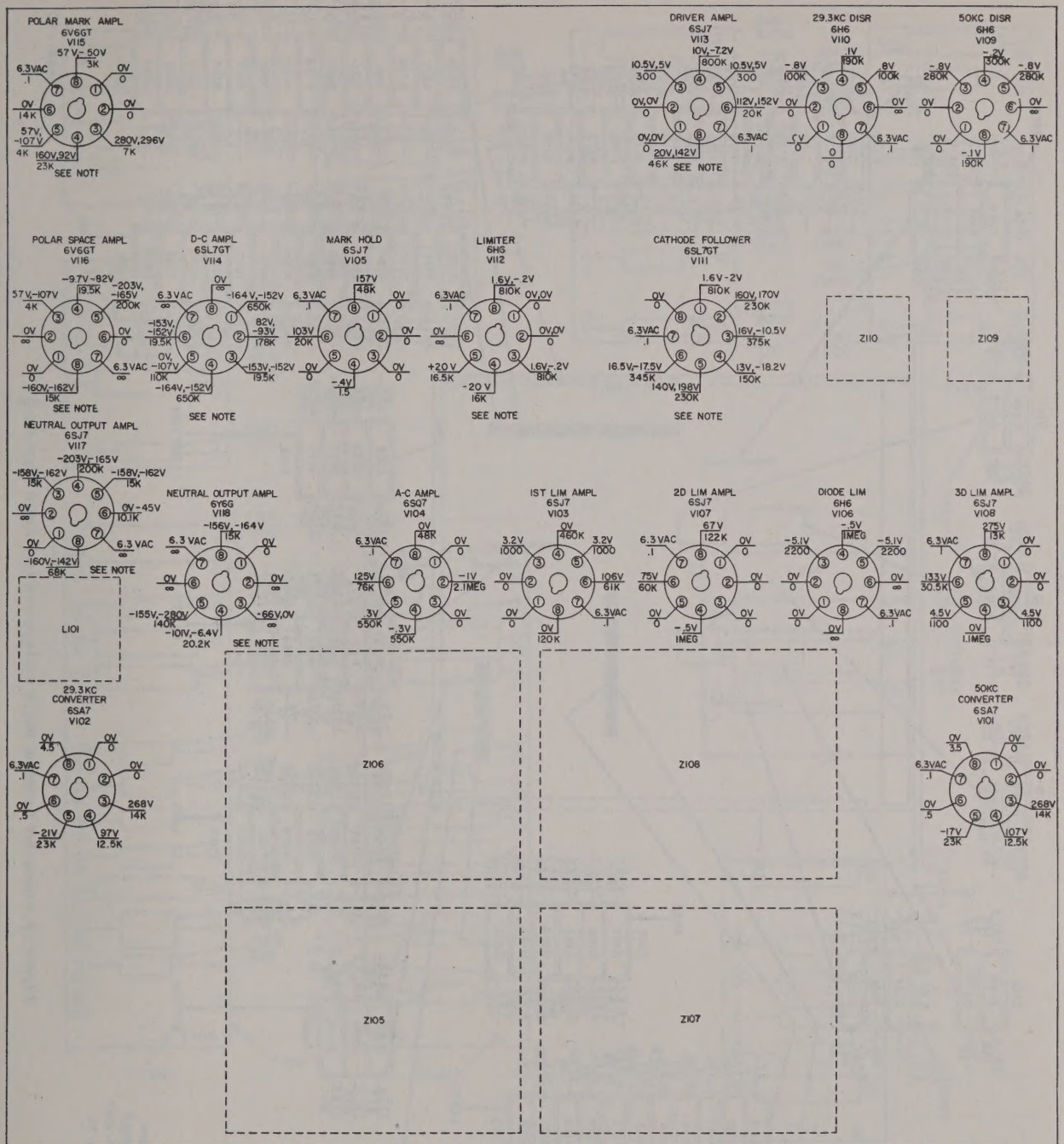
(*c*) Do not allow drops of solder to fall into the set because they may cause short circuits.

(*d*) A carelessly soldered connection may create a new fault. It is very important to solder the joints well. A poorly soldered joint is one of the most difficult faults to find.

(*e*) When a part is replaced, it should be placed exactly as the original. A part which has the same electrical value, but different physical size, may cause trouble in high-frequency circuits. Give particular attention to proper grounding when replacing a part. Use the same ground as in the original wiring.

b. The following repair instructions pertain specifically to Frequency Shift Converter CV–182(*)/GRC–26A:

(1) To replace either of the two band-pass filters (Z105 or Z107) which are close to the front panel of the unit, it is necessary to remove the adjacent band-pass filter (either Z106 or Z108). To replace any of the apparatus in the power unit (other than the vacuum tubes), it is necessary to remove the tone oscillator unit (figs. 28 and 29) completely. Accomplish this by loosening the two supporting bolts with hexagonal heads located on either side of the panel. In addition, it is neces-

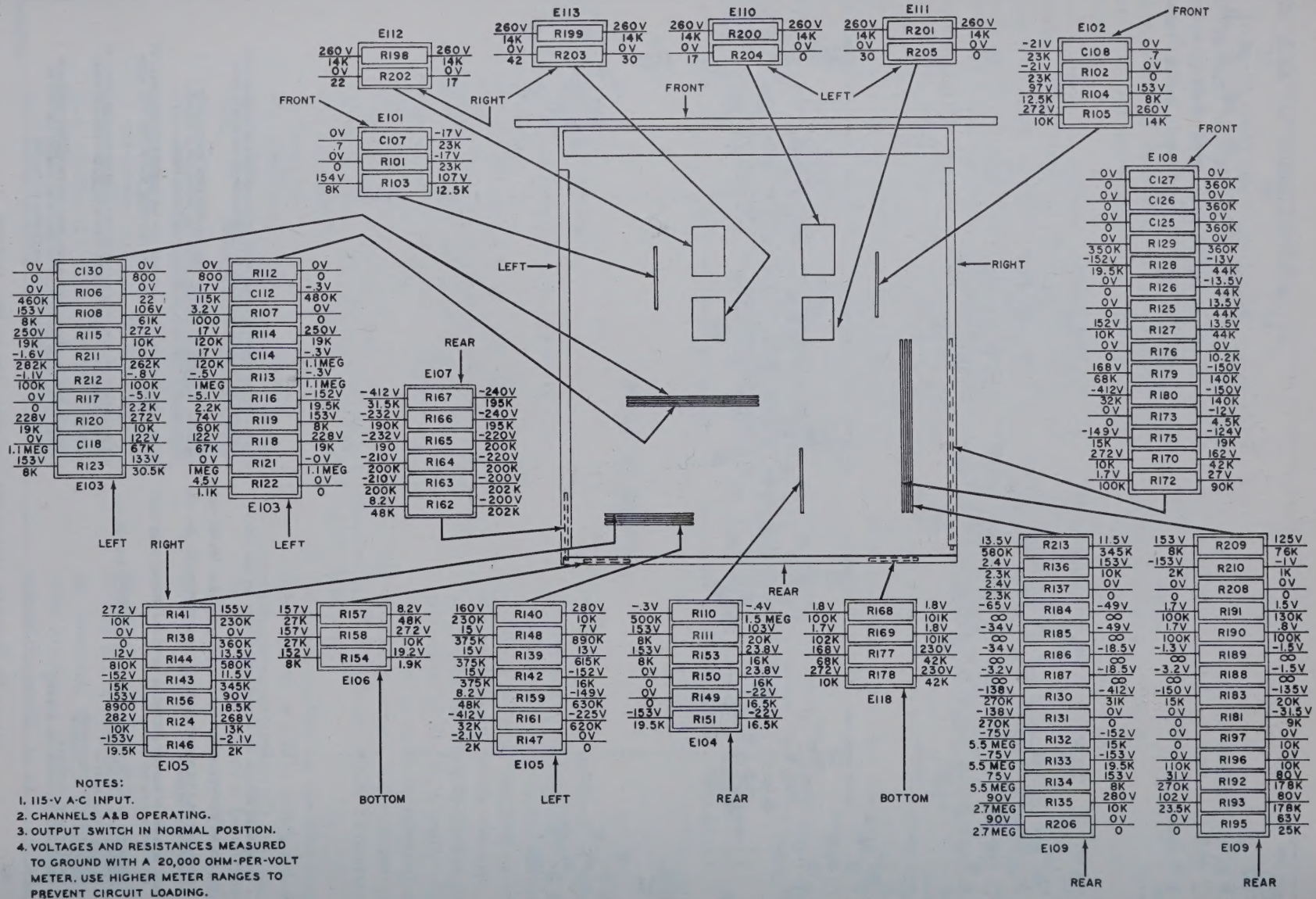


NOTES:

1. WARNING; BEFORE MEASURING ANY RESISTANCE REMOVE THE AC LINE CORD FROM THE OUTLET.
2. VOLTAGE AND RESISTANCE MEASUREMENTS ARE BETWEEN TUBE SOCKET PINS AND CHASSIS.
3. POSITIVE POTENTIALS ARE INDICATED UNLESS OTHERWISE NOTED. RESISTANCES LESS THAN 1 OHM ARE SHOWN AS ZERO.
4. ALL MEASUREMENTS ARE MADE WITH A 20,000 OHM PER VOLT METER. USE HIGHER CIRCUIT METER RANGES TO PREVENT LOADING.
5. A. CHANNEL A AND CHANNEL B DISABLING SWITCHES IN THE OPERATE POSITION.
   B. OUTPUT SWITCH IN NORMAL POSITION.
   C. LIMITER CONTROL SWITCH IN.
   D. DRIFT COMPENSATOR FULL CLOCKWISE.
   E. AMP GAIN CONTROL FULL CLOCKWISE.
   F. METER B SWITCH SET TO INPUT.
   G. MARK HOLD LEVEL CONTROL FULL CLOCKWISE.
6. THE FIRST VOLTAGE READINGS APPEARING ON THE TERMINALS OF TUBES V111 TO V118 (INCLUSIVE) WERE TAKEN WITH THE OUTPUT SWITCH IN THE MARK POSITION. THE SECOND READING WAS TAKEN WITH THE OUTPUT SWITCH IN THE SPACE POSITION.
7. VOLTAGE READINGS FOR TUBES V111 TO V114 (INCLUSIVE) WERE TAKEN WITH THE METER B SWITCH SET TO COMP AMP AND THE COMP AMP CONTROL ADJUSTED FOR AN INDICATION OF ±70 ON METER B AND BIAS A CONTROL SET IN THE NORMAL POSITION.
8. VOLTAGE READINGS FOR TUBE V115 WERE TAKEN WITH THE POLAR OUTPUT MARK CONTROL SET TO GIVE A READING OF +25 ON METER B (METER B SET TO POLAR) WITH 3000 OHMS ACROSS TERMINALS B AND A OF JACK J103.
9. VOLTAGE READINGS FOR TUBE V116 WERE TAKEN WITH THE POLAR OUTPUT SPACE CONTROL SET TO GIVE A READING OF -25 ON METER B (METER B SET TO POLAR) WITH 3000 OHMS ACROSS TERMINALS B AND A OF JACK J103.
10. VOLTAGE READINGS FOR TUBES V117 AND V118 WERE TAKEN WITH THE NEUTRAL OUTPUT MARK CONTROL SET TO GIVE A READING OF +50 MA FOR MARK SIGNAL ON METER B (METER B SET TO NEUTRAL) WITH 800 OHMS ACROSS TERMINALS B AND A OF JACK J103.

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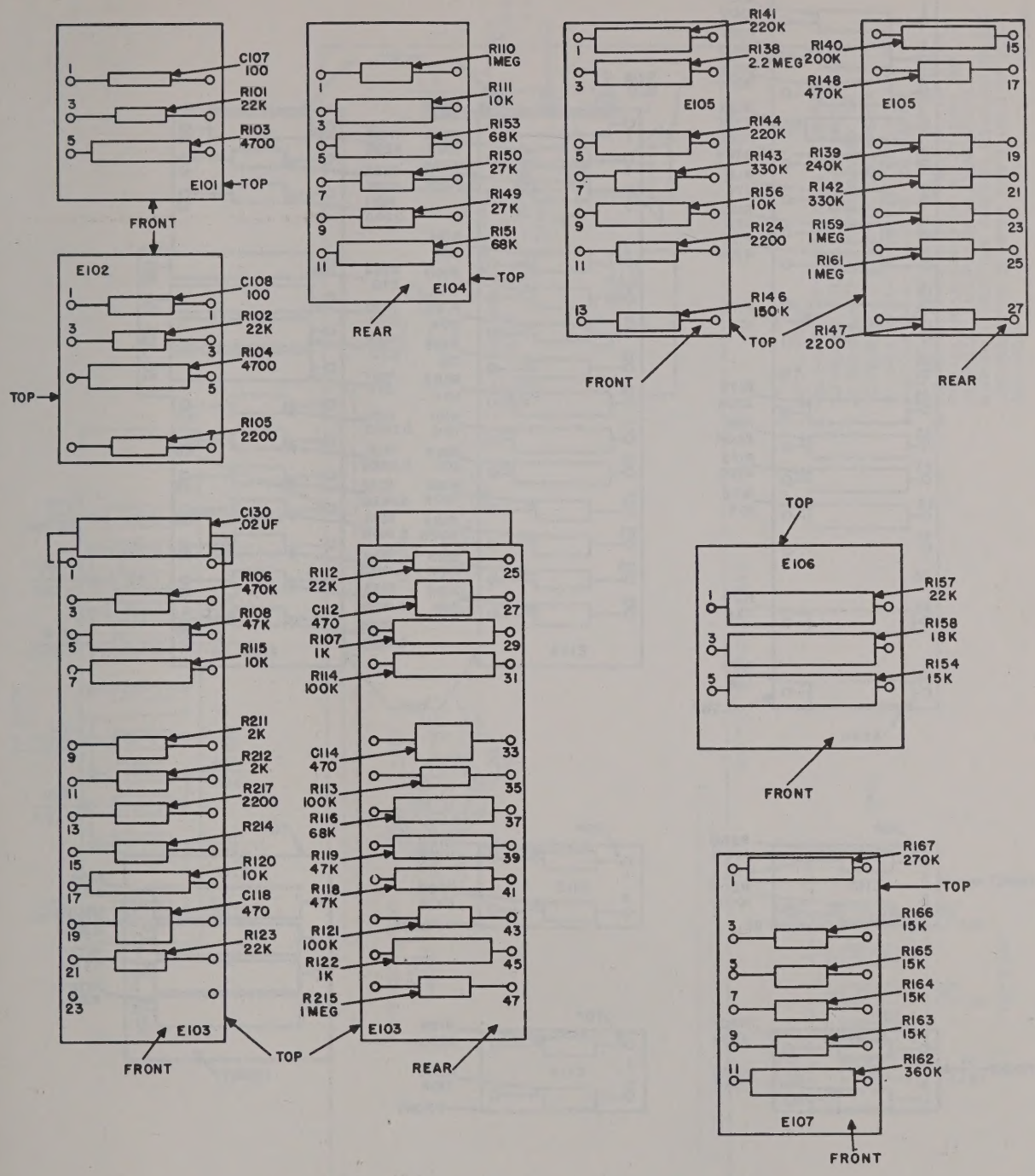
Figure 38. Converter tube-socket resistance and voltage diagram.



NOTES:

1. 115-V A-C INPUT.
2. CHANNELS A&B OPERATING.
3. OUTPUT SWITCH IN NORMAL POSITION.
4. VOLTAGES AND RESISTANCES MEASURED TO GROUND WITH A 20,000 OHM-PER-VOLT METER. USE HIGHER METER RANGES TO PREVENT CIRCUIT LOADING.

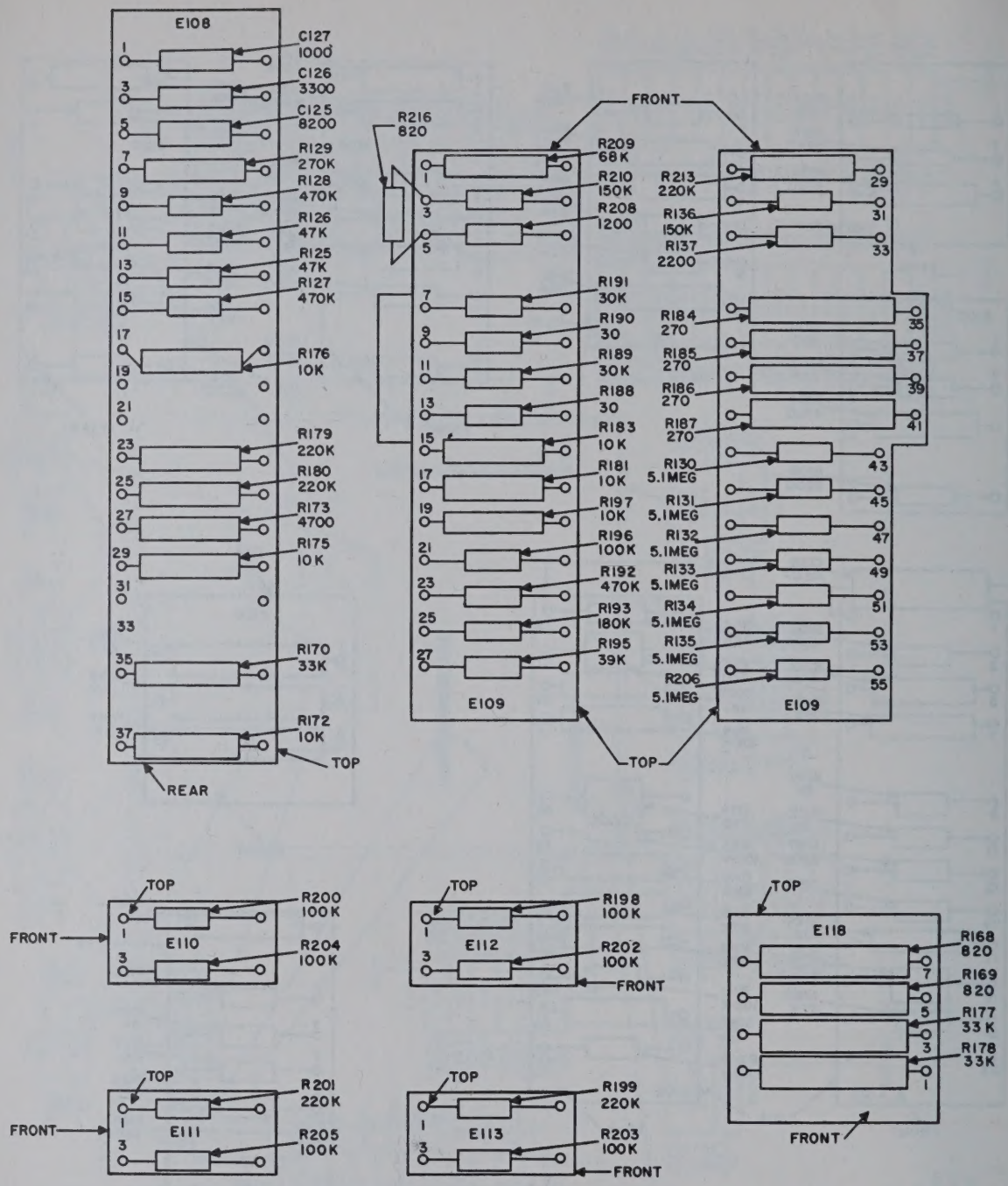
Figure 39. Converter terminal board voltage and resistance diagram.



NOTE:
UNLESS OTHERWISE NOTED.
1. RESISTORS ARE IN OHMS.
2. CAPACITORS ARE IN UUF.
3. BOARDS ARE VIEWED FROM BOTTOM OF CHASSIS, FACING FRONT PANEL.
4. EACH EVEN NUMBERED TERMINAL IS LOCATED OPPOSITE THE NEXT LOWEST ODD NUMBERED TERMINAL ON THE SAME BOARD.

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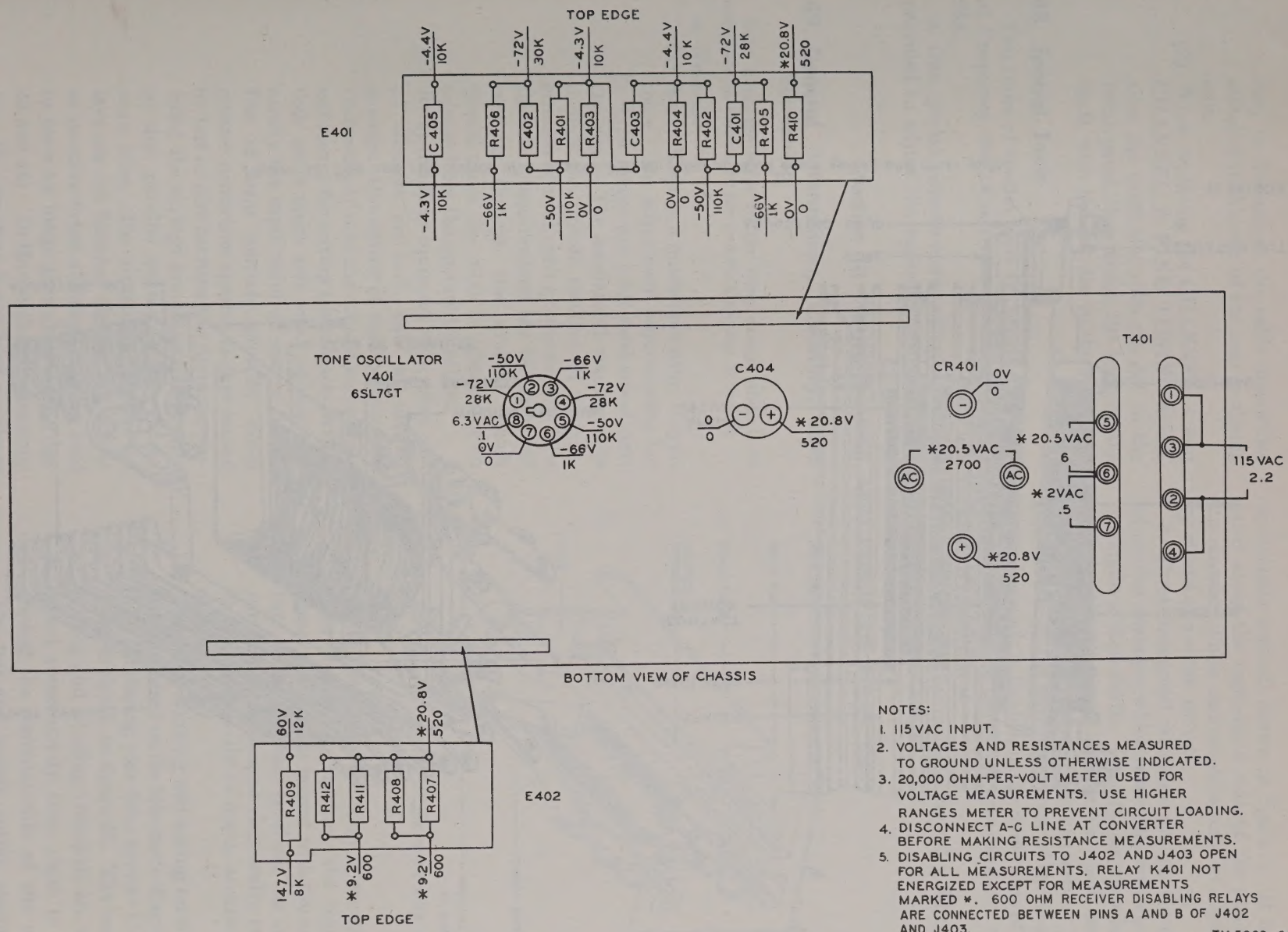
Figure 40. Frequency Shift Converter CV-182(*)/GRC-26A, terminal boards E101 through E107.



NOTE:
UNLESS OTHERWISE NOTED:
1. RESISTORS ARE IN OHMS.
2. CAPACITORS ARE IN UUF.
3. BOARDS ARE VIEWED FROM BOTTOM OF CHASSIS, FACING FRONT PANEL.
4. EACH EVEN NUMBERED TERMINAL IS LOCATED OPPOSITE THE NEXT LOWEST ODD NUMBERED TERMINAL ON THE SAME BOARD.

TM 278-C5-22

Figure 41. Frequency Shift Converter CV-182(*)/GRC-26A, terminal boards E108 through E113 and E118.



NOTES:

1. 115 VAC INPUT.
2. VOLTAGES AND RESISTANCES MEASURED TO GROUND UNLESS OTHERWISE INDICATED.
3. 20,000 OHM-PER-VOLT METER USED FOR VOLTAGE MEASUREMENTS. USE HIGHER RANGES METER TO PREVENT CIRCUIT LOADING.
4. DISCONNECT A-C LINE AT CONVERTER BEFORE MAKING RESISTANCE MEASUREMENTS.
5. DISABLING CIRCUITS TO J402 AND J403 OPEN FOR ALL MEASUREMENTS. RELAY K401 NOT ENERGIZED EXCEPT FOR MEASUREMENTS MARKED *. 600 OHM RECEIVER DISABLING RELAYS ARE CONNECTED BETWEEN PINS A AND B OF J402 AND J403.

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Figure 42. Tone-oscillator section, tube socket and terminal board voltage and resistance diagram.

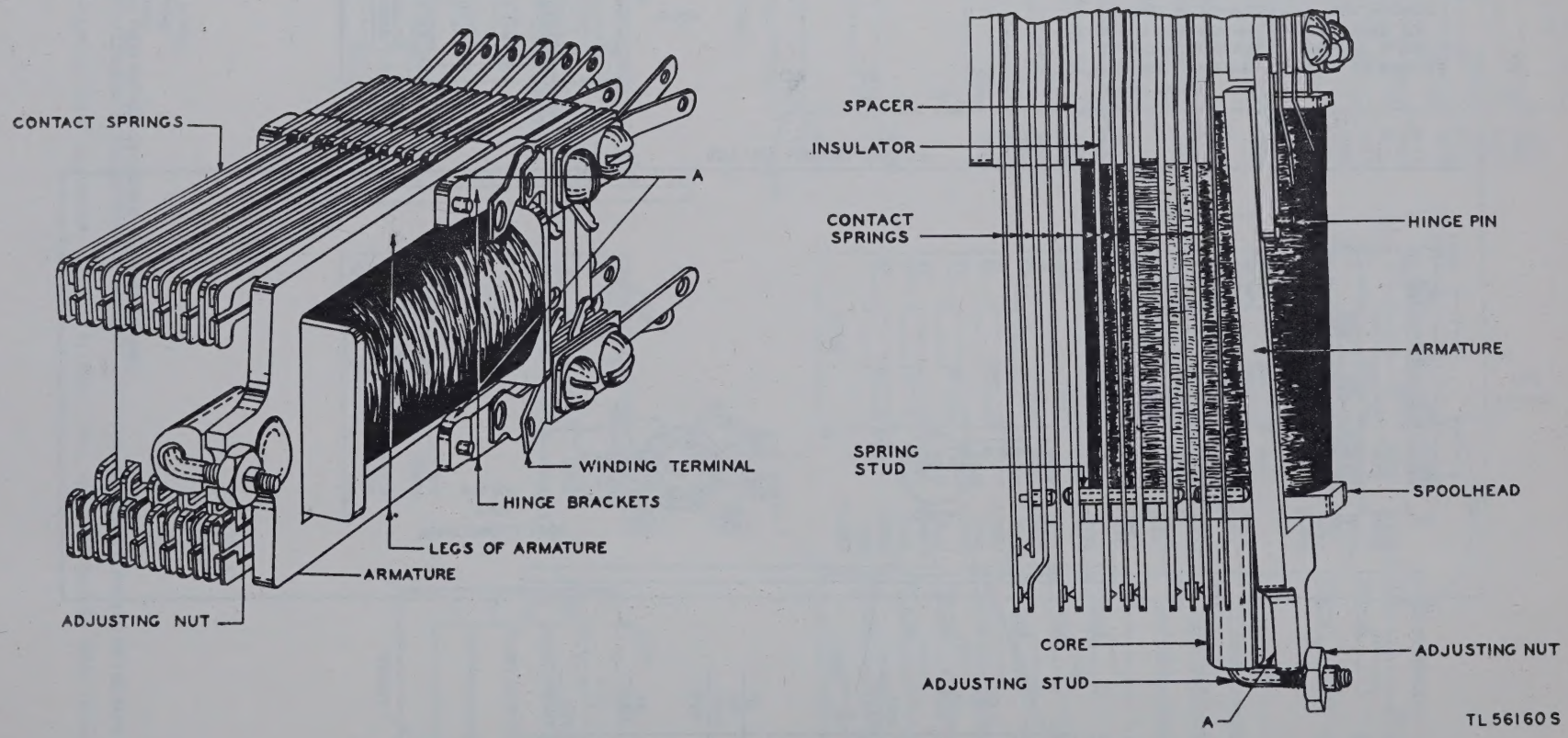


Figure 43. Top and side views of a typical U-type relay without cover spring and cover guide.

sary to disconnect the cable assemblies attached to the rear of the tone oscillator unit.

(2) When replacing the CHANNEL A and CHANNEL B FINE TUNING knobs, aline the shaft slot with the dot on the front panel, then fasten the knob on the shaft with the pointer to the right.

48. Special Tools

Two types of special tools are provided as part of Frequency Shift Converter CV–182(*)/GRC–26A.

a. One special potentiometer adjusting tool is provided to adjust the various screw driver potentiometer controls shown in figure 5. It is located along the right-hand side of the panel of the chassis. These controls also may be adjusted by means of a screw driver.

b. Three hexagonal wrenches are provided to adjust the setscrews which retain the various control knobs to their shafts. One of these wrenches is located under the lower hinge cover which covers the controls on the front of the converter. The second is located at the extreme rear of the chassis. A third wrench is located on the under side of the chassis, adjacent to the switch actuating cam with which it is associated.

c. Special tools for maintaining relay K401 are listed in paragraph 49*a*(4).

Section III. MAINTENANCE AND REPAIR OF RELAY K401

49. General Information, Cleaning, and Burnishing

Note. Keep the cover on the relay except when it is necessary to remove it for trouble shooting or repair.

a. General.

(1) Relay K401 is a quick operating U-type relay. The adjustment requirements for U-type relays are both mechanical and electrical. The mechanical requirements include the proper position of springs, armature travel, spring tensions, etc. The electrical requirements are the specified currents through the winding which should cause the relay to operate or to release from the operated position.

(2) Relay K401 is equipped with twin sets of contacts on each pair of mating springs. One spring of each pair is split (bifurcated) near the contact end to permit means for setting the contacts so that both pairs make and break at approximately the same point of spring travel. Use of twin contacts provides much greater protection against failure caused by lint or dirt between the contacts, provided the springs are adjusted properly so that parallel contacts make at the same time. The armatures of these relays are not fastened rigidly at the rear as in other types of relays, but are held in place by hinge pins (bearings) (figs. 43 and 44). In this method of construction, the armature is not fixed rigidly as to position unless the relay is energized. Therefore, when checking the requirements which must be met with the armature in the operated position, the armature must be operated electrically rather than mechanically to insure accuracy of gaging.

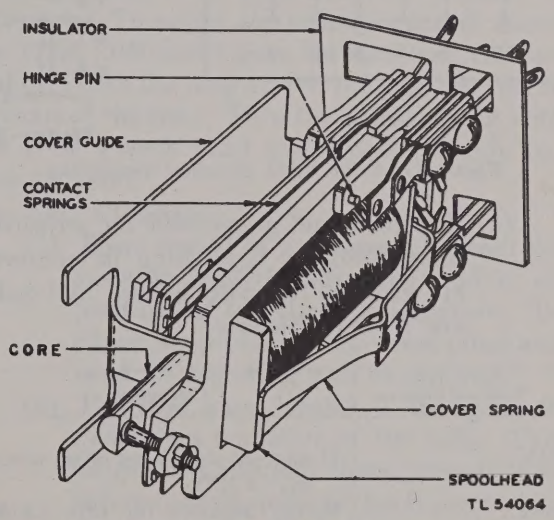


Figure 44. Side view of typical U-type relay with cover spring.

(3) The relay winding and spring terminals are numbered on the schematic diagrams. The numbering plan for a typical U-type relay is shown in figure 45. The contact spring and winding terminals are numbered consecutively from right to left, facing the terminal side of the relay. The top and bottom spring assemblies

of the relay each are numbered in sequence. The schematic diagrams show the top and bottom relay spring pile-ups, respectively, above and below the relay core and winding. A relay-winding terminal is followed by the letter T or B to indicate whether it is alined with the top or bottom spring-terminal pile-ups.

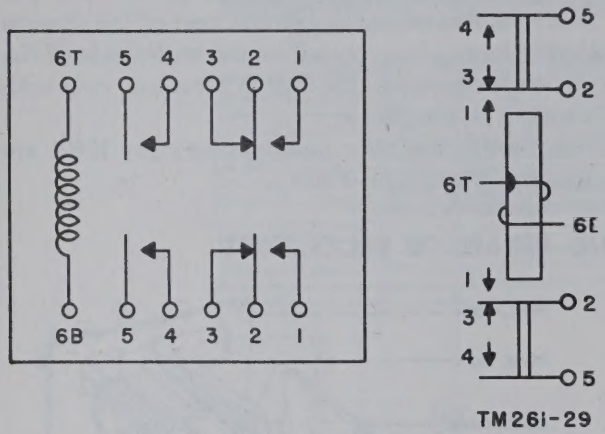


Figure 45. Relay K401, terminal numbering.

(3) The tools and gages used for adjusting relay K401, or burnishing its contacts, are given in the chart below. All codes are Western Electric.

Tools and gages	Description
474A	Hexagonal closed-end offset wrench (3/16" x 1/4").
505A	Spring adjuster for thin (.013") springs.
507A (2 required).	Spring adjusted for springs other than .013".
265C	Contact burnisher.
Gage TL–560/U	50–0–50 gram gage.
132R-type	Thickness gage.
KS–6528	Cleaning tape.
KS–6320	Orange stick.

b. Cleaning.

(1) Failure of a circuit may be traced to particules of dirt or lint between contacts, or to dirty parts of a relay. A cover is provided to reduce, as far as possible, the entry of foreign materials and their accumulation on the working parts of the relay. When the cover is replaced on the relay, it should be replaced right side up, as determined by the designations on the cover, so as to avoid depositing dirt and lint from the bottom of the cover on the relay contacts and parts. When relays are cleaned, the inside of the cover should be wiped clean with a lint-free cloth.

(2) Carbon tetrachloride may be used, if available, to remove grease or oil from contacts. Deposit small drops of the carbon tetrachloride on the contacts with a toothpick. Do not rub. Be careful not to spill any of the liquid on the spoolheads and insulators. After contacts have thoroughly dried, burnish them to remove all foreign matter.

(3) Clean the armature and adjusting nut by passing a piece of WE No. KS–6528 cleaning tape back and forth between the armature and adjusting nut and around the adjusting stud.

c. Burnishing.

(1) To burnish the contacts, use a clean No. 266 blade of the 265 C contact burnisher. It is very important that thickness gages and the blades of contact burnishers be kept clean. These tools should be wiped off frequently with a clean, dry cloth before being placed against each contact, and if the contacts are greasy, the tools should be wiped off frequently with a clean cloth dampened with carbon tetrachloride.

(2) To burnish normally open contacts, place the blade of the burnisher between the contacts, and press the contacts together with the KS–6320 orange stick (fig. 46) to give a slight pressure against the blade of the burnisher. At the same time, move the blade back and forth. The desired result usually is obtained by rubbing the burnisher between the contacts two or three times. In the case of normally closed contacts, the tension of the springs themselves usually will furnish sufficient pressure against the burnisher. On springs which have heavy tension, lift one of the springs away to insert the burnisher. After burnishing, note whether the requirements covering contact make and break and contact separation are still met, since repeated burnishing tends to

increase the contact separation and to reduce the contact make. If necessary, correct as outlined in paragraph 52.

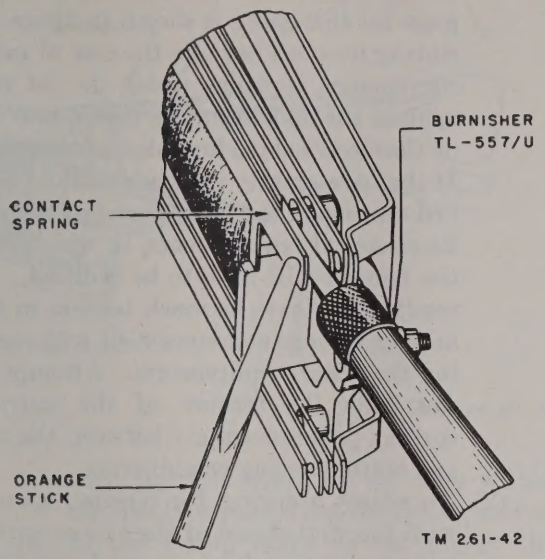


Figure 46. Burnishing the contacts.

50. Adjustments of Relay

a. Armature Back Tension.

(1) Apply Gage TL–560/U as shown in figure 47. If the back tension is not as specified in figure 50, adjust the armature.

(2) If the armature is not held against the adjusting nut with the pressure specified in figure 50 or if the portion of this pressure in one spring combination is more than two and one-half times that of the other spring combination, alter as necessary, the tension of the A springs which are tensioned against the armature; use the 505A or 507A spring adjuster. In making this adjustment, first increase the tension of the A spring (farthest from the armature) whose tension is transmitted to the armature through one or more studs. If the requirement cannot be met by this means alone, adjust the other springs (as required) which hold the armature against the adjusting nut. It is not necessary to distribute the tensions of the A springs equally, but the combined pressure of the studs against the top and bottom legs of the armature should meet the specified requirement.

b. Armature Travel (fig. 48). The armature travel (or gap between the core and the armature when the relay is in the unoperated position) is .047 inch. To adjust the armature travel, insert the 132R (.047-inch) gage between the armature and core with the long axis of the gage parallel to the axis of the core. Turn the adjusting nut with the 474A wrench until the gage fits snugly but does not bend.

c. Stud Clearance.

(1) There should be a clearance between the armature and the adjusting stud in all positions of travel of the armature. To adjust, use a pair of long-nosed pliers and bend the adjusting stud as required.

(2) The stud gaps labeled T in figure 48 should be a minimum of .006 inch. This insures that normally closed contacts close before the armature reaches the end of its travel when the relay releases.

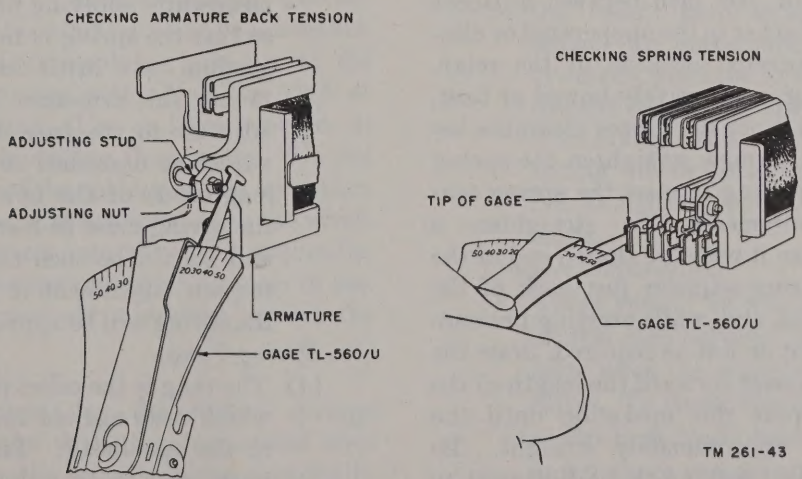


Figure 47. Use of Gage TL–560/U.

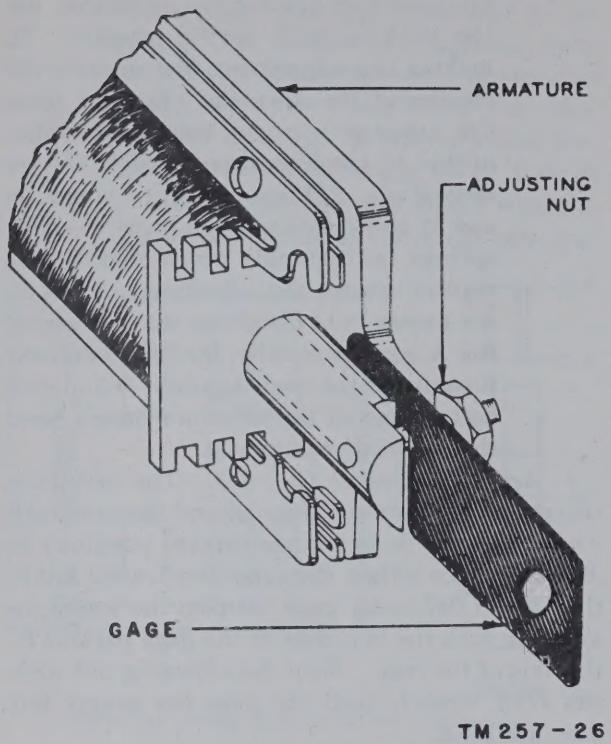


Figure 48. Armature travel adjustment.

51. Spring Adjustments

Note. Use the 505A spring adjuster for adjusting the thin springs, and use the 507A spring adjuster for the thicker springs.

a. Straightness of and Separation Between Springs.

(1) All springs should be free of sharp bends or kinks. A gradual bow in a spring is permissible. There should be a minimum clearance of .008 inch between adjacent springs whether in the unoperated or electrically operated position of the relay.

(2) If a spring is excessively bowed or bent, or if there is not the proper clearance between the springs, straighten the spring before adjusting to meet the spring tension requirements. To straighten a spring, span it with the slotted end of the proper spring adjuster just back of the bow or bend, and, while exerting pressure to the right or left as required, draw the spring adjuster forward the length of the bow. Repeat this operation until the spring is approximately straight. Be careful when making this adjustment to avoid tilting the spring to either side.

b. Spring Tension.

(1) Spring tensions are specified in figure 50 on a minimum basis. Use of a TL–560/U gage for this check is shown in figure 47. Spring tensions have, in the case of moving springs (springs which do not rest against the spoolhead), a direct bearing on the electrical performance of the relay. If they are greatly in excess of the specified minimum, the relay may fail to meet its electrical requirements, in which case the tension will have to be reduced. In readjusting, have as much tension in the moving springs as is consistent with meeting the other requirements. Attempt to distribute the tension of the moving springs proportionately between the top and bottom spring combination.

(2) To adjust a spring for tension, span it with the slotted end of the power spring adjuster just back of the stud and slide the adjuster to the base of the spring (fig. 49). Adjust the spring by applying, at the handle end of the tool, slight sidewise pressure to the right or left as required, thus tending to bend the spring at its base. Do not disturb adjacent springs and avoid twisting the spring.

(3) If the desired tension cannot be obtained by adjusting as outlined in (2) above without bowing the spring too much, apply the proper spring adjuster to the spring just back of the stud and slide it back to the base of the spring. Draw the adjuster forward the length of the spring, meanwhile applying pressure as required so that the spring is formed into a slight gradual bow with its concave surface facing the armature. Then move the adjuster to the base of the spring and adjust as described in (2) above. The magnitude of the bow to be formed in the spring must be learned by experience and should be such that when the final tension adjustment is made at the base, the spring will be approximately straight.

c. Spring Tang.

(1) The tang is the offset portion of a spring which rests against the side of the slots in the spoolhead. The tang should be positioned so that the free end extends behind the front face of the spoolhead,

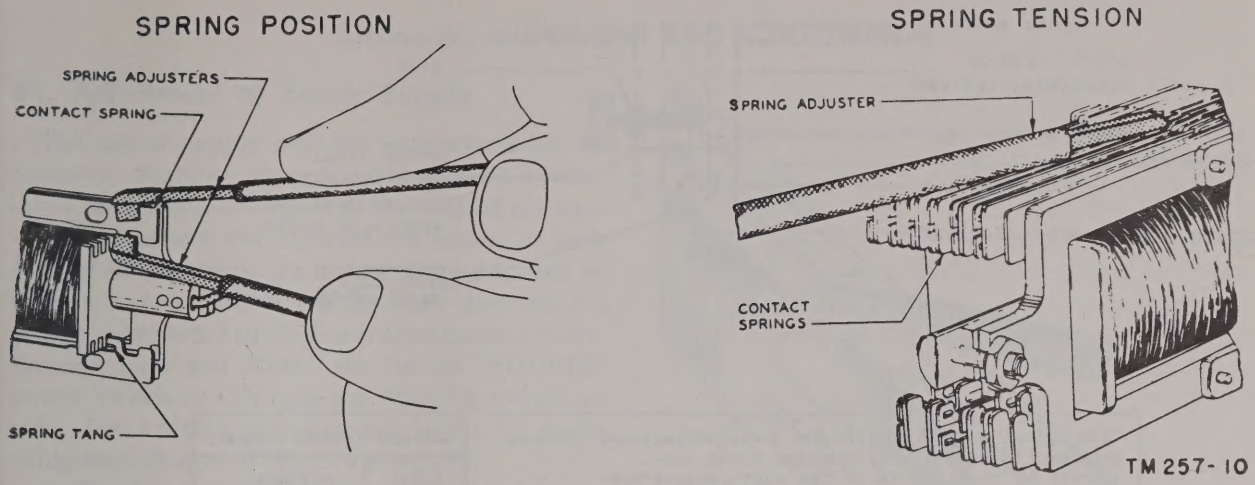


Figure 49. Spring adjustments.

with the full width of the tang within the spoolhead slot when the spring moves.

(2) If the spring tangs do not engage the spoolhead satisfactorily, replace the relay.

(3) To adjust the position of springs to meet contact-separation, stud-gap, and contact-make requirements, adjust the spring tangs resting against the spoolhead. To do this, hold the spring with one 507A spring adjuster placed above the spring tang and adjust the tang to the right or left, as required, with another 507A adjuster as shown in figure 49.

52. Contact Adjustments

a. Contact Alinement. If the centers of the contacts are directly opposite each other, the contacts are alined. If contacts are out of alinement, attempt to correct by applying pressure to the free ends of the springs with either the 505A or 507A spring adjuster. Use as little pressure as possible to avoid damaging the springs. Do not attempt alinement of the springs as one operation, but preferably as a successive series of twists which will bring the contacts into alinement gradually. Figure 49 shows the spring adjusting tools in use. If contacts are excessively misalined, replace the relay.

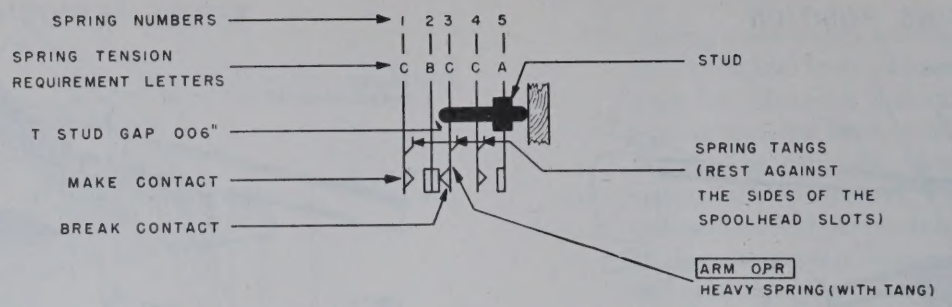
b. Contact Make.

(1) Both contacts on the forked springs should make with their associated contacts when the relay is in the electrically operated position for normally open contacts and in the unoperated position for normally closed contacts.

(2) For reliable operation of the relay, make contacts must make *before* the armature has reached its operated position fully when the relay is operated electrically. This is provided for by the contact make requirement. See that the contact makes, as follows: Insert the .008-inch blade of the thickness gage between the armature and the core and at least one of the twin contacts of each pair of contacts should make when the relay is energized electrically. If the requirement is not met, readjust the springs. After the adjustment is made, insert the .004-inch blade of the thickness gage between the armature and the core and electrically energize the relay; both twin contacts should make. To make sure that the contacts are made, press the top of the solid spring toward its mating spring with the KS–6320 orange stick (fig. 51). If the solid spring moves perceptibly without moving its mating spring, the contact is not made.

c. Contact Separation.

(1) There should be a minimum separation of .005 inch between normally open contacts when the relay is energized electrically. To check the requirement, insert a .004-inch blade between the armature and the core and operate the relay electrically. With the gage in position, all



TENSION ALL SPRINGS TOWARD THE ARMATURE. MEASURE TENSION WITH GAGE TL-560/U. APPLY THE GAGE TO THE THIN SPRINGS SO THAT THE TIP OF THE GAGE ENGAGES BOTH PRONGS OF THE FORKED END OF THE SPRING. APPLY THE GAGE TO THE HEAVY SPRING IN FRONT OF THE CONTACT. MEASURE TENSION OF SPRING MARKED ARM. OPR. WITH THE ARMATURE IN THE OPERATED POSITION; MEASURE TENSION OF ALL OTHER SPRINGS WITH THE ARMATURE IN THE NON-OPERATED POSITION.	MINIMUM TENSION (GRAMS)	
	TEST	READJUST
ARMATURE BACK TENSION MEASURED AS THE ARMATURE LEAVES THE ADJUSTING NUT.	18	22
THE SPRINGS DESIGNATED "A" HAVE NO DEFINITE TENSION REQUIREMENT, OTHER THAN THAT THE COMBINED PRESSURES OF THE TOP AND BOTTOM "A" SPRINGS WHICH PRODUCE PRESSURE AGAINST THE ARMATURE SHALL BE SUFFICIENT TO MEET THE ARMATURE BACK TENSION REQUIREMENT ABOVE.		
TENSION OF "B" SPRINGS MEASURED AS THE CONTACTS BREAK.	18	20
TENSION OF "C" SPRINGS MEASURED AS THE SPRING TANGS LEAVE THE SIDES OF THE SPOOLHEAD SLOTS.	25	30

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Figure 50. Spring arrangements and spring tension requirements.

break contacts should break and clear by .005 inch.

(2) If the requirement is not met, adjust as outlined in paragraph 51*c*.

53. Electrical Requirements and Adjustments

a. The electrical requirements for relay K401 are as follows:

Relay K401	
Operate	15–17 ma.
Release	9–11.5 ma.

b. Use Test Set I–181, if available, to apply the above current values to the relay. If a test set is not available, connect a d-c milliammeter and a variable resistance in series with the winding of the relay and a dry-cell battery (about 15 volts). Adjust the current to the operate value; the relay should operate. Reduce the current to the release value; the relay should release.

c. If the relay fails to meet the test current requirements, adjust it. Always make the relay meet the readjust current requirements, if any adjustments are changed.

d. If the relay fails to meet the operate requirements after the mechanical adjustments have been made, decrease the tension of the moving springs toward the minimum. If the relay still does not operate, increase the stud gap. If the relay fails to meet the release requirements, increase the tension of the moving springs. In all cases, keep the tension within the requirements given in figure 50.

54. Adjustment of Power Supply

The power supply and the converter must be connected together, since the 115-volt a-c power-input jack, J104, is located at the rear of the converter. Connect the 115-volt a-c source to jack J104 of the converter by means of a cord, such as Cord CX–954/TRA–7. Make sure that the a-c power is connected to the power terminals of transformers T301 and T302. Set the AC SUPPLY power switch to ON and the PLATE switch to ON. Use a 20,000 ohms-per-volt meter for measuring the voltages of the power supply.

a. Regulated −150-Volt Supply.

(1) In the converter, connect a 2,000-ohm resistor between binding posts E122 and E123 (or pins A and B of J103). Connect a 1,800-ohm resistor between binding posts E124 and E123 (or pins D and E of J103); strap out resistors R184 through R187.

(2) Set the OUTPUT switch to MARK and the METER B switch to POLAR, and adjust the POLAR OUTPUT MARK control so that meter B registers +25. Set the OUTPUT switch to SPACE and METER B switch to NEUTRAL, and adjust the NEUTRAL OUTPUT control so that meter B registers +60.

(3) Connect the voltmeter between terminal 11 of terminal strip E301 and ground of the power supply.

(4) The voltmeter should indicate between −145 and −160 volts when the two conditions indicated in (1) and (2) above are satisfied.

b. Regulated +150-Volt Supply.

(1) Repeat the steps in *a*(1) and (2) above.

(2) In the converter, set the CHANNEL A and CHANNEL B disabling switches to OPERATE.

(3) Connect the voltmeter between terminal 4 of terminal strip E301 and ground.

(4) If the voltage is more than 3 volts greater than the voltages indicated in *a*(4) above (disregarding the polarity), strap out portions of resistance provided by resistors R312 through R315 until the terminal 4 voltage matches the terminal 11 voltage within 3 volts.

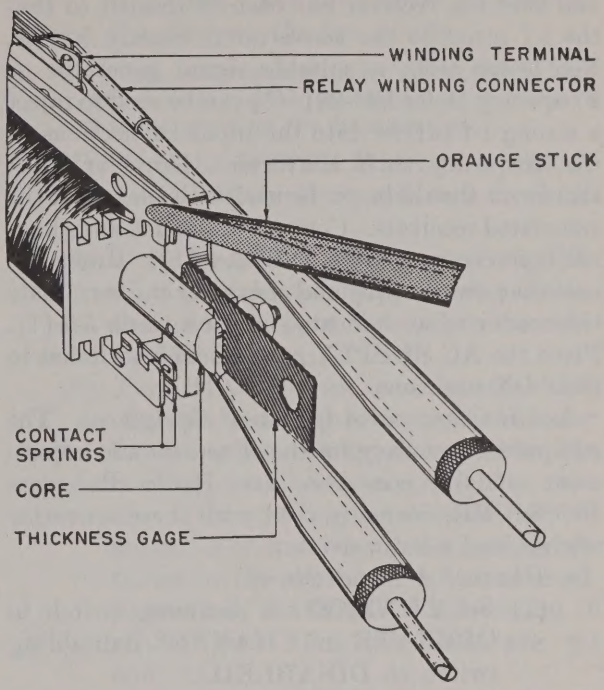


Figure 51. Contact make check.

(5) If the voltage is more than 3 volts less than the voltage indicated in *a*(4) above (disregarding the polarity), strap out resistor R316 first and then strap out resistors R312 through R315 as required to match the voltages.

c. Bias Voltage for Output Tubes.

(1) Connect the voltmeter between pin 5 of V116 (or terminal 7 of E105) and the junction point of two of the series of resistors (R162 through R167). Check for equal readings when S102 is switched from SPACE to MARK.

(2) Repeat the above procedure at different junction points until the equal readings are obtained.

(3) Move the lead coming from the grids of V116 and V117 to junction point determined by the above tests.

55. Alinement and Adjustment of Converter

a. General. In the following instructions, it is assumed that the radio receivers already have been alined so that the i-f output stages of the receivers are peaked at 500 kc. The following alinement

procedures will be based on a steady r-f carrier being fed into receiver A (or receiver B, if desired) and that the receiver has been calibrated so that the i-f input to the converter is exactly 500 kc. For bench tests, a suitable signal generator or Frequency Meter BC–221–(*) can be used to inject a strong i-f carrier into the input connections of the frequency shift converter. However, final alinement should be performed with the use of the associated receivers. Connect channel A and channel B receivers to jacks J101 and J102. Interconnect the power supply and converter and terminate the converter as indicated in paragraph 54*a*(1). Place the AC SUPPLY and PLATE switches to their ON positions.

b. Alinement and Adjustment Equipment. The equipment necessary for the alinement and adjustment of the converter are Radio Receivers R–388/URR, normally used with these converter models, and a screw driver.

c. Channel A Input Circuit.

(1) Set CHANNEL A disabling switch to OPERATE and CHANNEL B disabling switch to DISABLED.

(2) Turn the METER B switch to the INPUT position with the CHANNEL A FINE TUNING control pointer in the straight-up position.

(3) Open the hinged door on the front panel (fig. 31) and adjust capacitor C105 (CHAN A OSC) with a screw driver for a maximum indication on meter B and a zero indication on meter A. This indicates the center of the 50-kc discriminator characteristics and may be verified on meter A by rotating the CHANNEL A FINE TUNING control 90° to the left and to the right of the straight-up position. The meter indicator will deflect approximately equal amounts to the left and to the right of zero in unison and in phase with the control pointer.

(4) After the oscillator frequency adjustment has been made, adjust the CHANNEL A input circuit. With a screw driver, adjust capacitor C101, CHAN A INPUT, for a maximum indication on meter B. If meter B goes off scale, decrease the setting of r-f gain control of receiver A.

(5) Repeat the alinement of capacitor C105 as in (3) above.

(6) When proper adjustments have been made, it will be possible to turn the CHANNEL A FINE TUNING control to either side of the straight-up position and obtain deflections on meter A. The input-level indication on meter B should be maximum when meter A indicates zero. The level should decrease slightly as meter A travels away from zero in either direction. The same results should be obtained when the receiver tuning control is rotated to either side of the position of exact frequency.

(7) Check to see that meter A deflects to the left when the CHANNEL A FINE TUNING control is turned to the left and deflects to the right when the CHANNEL A FINE TUNING control is turned to the right. If the meter deflections are reversed, it will be necessary to repeat the steps in (3) through (7) using a different settting of C105. The correct setting of C105 is the setting which produces a second maximum peak on meter B.

d. Channel B Input Circuit. The method of adjusting channel B is identical to that used for channel A except that the input level and the discriminator output cannot be read simultaneously. Both are read on meter B, depending on the position of the METER B switch.

(1) Turn the r-f gain control of receiver B to maximum and CHANNEL A disabling switch to DISABLED and the CHANNEL B disabling switch to OPERATE.

(2) Set METER B switch to INPUT and locate the approximate oscillator frequency by adjusting capacitor C106, CHAN B OSC (fig. 33), to obtain a maximum reading on meter B.

(3) With a screw driver, adjust capacitor C103 (Chan B INPUT) to obtain a maximum reading on meter B.

(4) Turn METER B switch to CHAN B. Set the CHANNEL B FINE TUNING control to the straight-up position. Readjust oscillator capacitor C106 (CHAN B OSC) to obtain a zero reading on meter B; thus indicating the center of the 29.3-kc discriminator characteristic. Vary the CHANNEL B FINE TUNING control 90° to either side of zero. Check to

see that the indicator of meter B deflects to the right of zero when the CHANNEL B FINE TUNING control is turned to the right and deflects to the left of zero when the CHANNEL B FINE TUNING control is turned to the left.

(5) Return METER B switch to INPUT and again vary the CHANNEL B FINE TUNING control 90° to either side and note that the input level is maximum when the control is straight up and decreases only a small amount as the control is moved 90° to either side of the straight-up position.

(6) Restore operation of channel A by placing the CHANNEL A disabling switch in the OPERATE position.

e. Output Circuits. The following adjustments should be made with a strong i-f signal input to the frequency shift converter. The alinement procedure in (1) through (3) below, however, can be performed with no signal input if the MARK HOLD LEVEL switch is set to the OFF position.

(1) Set the OUTPUT switch at MARK and the METER B switch at NEUTRAL. Adjust the NEUTRAL OUTPUT control knob for a reading of +60 on meter B.

(2) Turn the METER B switch to POLAR and adjust the POLAR OUTPUT MARK control knob for a reading to +25 on meter B.

(3) Turn the OUTPUT knob to SPACE and adjust the POLAR OUTPUT SPACE knob for a reading of −25 on meter B.

(4) Turn the OUTPUT knob to NORMAL or REVERSE, and turn the DRIFT COMPENSATOR switch to IN. Turn the LIMITER knob to the maximum clockwise position, and turn the AMP GAIN knob and the COMP AMP screw driver control fully counterclockwise.

(5) Feed a strong, steady 500-kc signal into channel A of the converter and adjust the signal strength so that with the CHANNEL A FINE TUNING control pointer in the straight-up position, meter A will indicate zero (center of discriminator output).

(6) Return the METER B switch to POLAR and adjust BIAS A screw driver control R155 (fig. 33) to a point where the polar output current indicated on meter B just changes from mark to space, and then vice versa. Set the control to midposition between the two points.

Note. This adjusts the d-c output loop to have an operating point corresponding to about a 0-volt output from the discriminator.

(7) Turn the METER B switch to CHAN A+B. Meter B should read 0 within ±10.

(8) Turn the COMP AMP control (fig. 33) slightly clockwise until meter B indicates about five divisions higher than the reading obtained in (7) above.

(9) Turn BIAS B screw driver control R160 (fig. 33) back and forth until the meter B reading just changes from 5 below the reading established in (7) above to 5 above the reading established in (8) above. For instance, if the reading obtained in (7) above was +6 and the adjustment of the COMP AMP control (8 above) gave +11, the limits are +1 and +11.

(10) Set the BIAS B control halfway between the points which provide the limit readings. With the BIAS A and BIAS B screw driver controls set and the METER B knob at CHAN A+B, turn the COMP AMP screw driver control until meter B indicates +70 or −70.

(11) Turn the AMP GAIN knob clockwise until the output can be changed from a mark to space, or vice versa, by a fast movement of the CHANNEL A (or CHANNEL B) FINE TUNING knob. Restore the CHANNEL A (or CHANNEL B) FINE TUNING knob to the straight-up position (zero reading on meter A).

(12) Turn the COMP AMP screw driver control (R145) for a reading of +70 or −70 on meter B, then turn the COMP BAL screw driver control (R194) for balance. Repeat until alternate equal indications are obtained of +70 and −70 when CHANNEL A FINE TUNING knob is given a fast movement.

(13) Slowly turn the LIMITER knob counterclockwise until the indication on meter B starts to drop below 70. Set the

LIMITER knob at the point where the meter reading is just barely starting to reduce.

(14) The final adjustment of the AMP GAIN control requires an input of miscellaneous keying.

(*a*) Turn the METER B switch to the COMP AMP position.

(*b*) Turn the AMP GAIN knob fully counterclockwise and then, while miscellaneous signals are being received, slowly turn the knob clockwise while observing METER B for a minimum of irregular deflections or kicks. The normal setting usually will be 30° or 40° from the counterclockwise stop for 850-cycle frequency shift. Set the AMP GAIN knob in a position which provides a keyed tone output from the converter and results in minimum kicks on METER B. A more accurate setting of the AMP GAIN knob may be found if the LIMITER knob is turned first fully clockwise.

(*c*) Turn the METER B switch to the CHAN A+B position.

(*d*) Verify that the deflection on meter B, on a steady mark signal, is 70 to the right of zero, and during a steady mark signal, reset the LIMITER knob to a position which causes the 70 indication to just start to decrease.

(*e*) Connect a headphone to the PHONES KEYED TONE jack, and verify that clear distinct tones are produced. Clear distinct tones indicate the absence of noise peaks or distortion caused by improper tuning.

Section V. FINAL TESTING

56. General

This section is intended as a guide to be used in determining the quality of Frequency Shift Converter CV–182(*)/GRC–26A repaired at higher echelon levels. The minimum test requirements outlined in the following paragraphs may be performed by maintenance personnel with adequate test equipment and the necessary skills. Repaired equipment meeting the specifications in the paragraphs below will furnish uniformly satisfactory results during operation. The tests given in paragraphs 59 through 66 should be performed in the order given.

57. Test Equipment Required

In addition to the items listed in paragraph 44*a*, the following items of test equipment are required to perform the tests covered in this section:

Distortion Test Set TS–383/GG or equal.
Teletypewriter TT–55/MGC or equal.
Variac (175 watts).
2-2,000-ohm resistors.
1-1,800-ohm resistor.
2-60-ohm resistors.
Adapters, cables, and patch cords for above equipments.

58. Preliminary Operations

a. Check to see that all switch detents operate properly.

b. The pointers on the C102 and C104 knobs should point to the left when the capacitors are meshed fully.

c. Check to see that T301 and T302 are connected for 115-volt operation.

d. Make up the leads shown in figure 52. Resistors should have a rating of at least 5 watts.

59. Converter Stage Voltage Tests

a. Connect the input power cord of the variac to a 115-volt source. Connect J104 to the variac. Throw the AC SUPPLY switch to the ON position. The white pilot lamp should light. Adjust the converter line voltage to 115 volts by means of the variac.

b. Place a shorting clip between terminal 4 of V117 and terminal 12 of terminal strip E301 (−400-volt input lead). Leave terminal 4 of V117 connected to terminal 5 of V116 but remove the connection between these grid leads and the R162 to R167 resistor string.

c. Throw the PLATE switch to ON. The red pilot lamp should light.

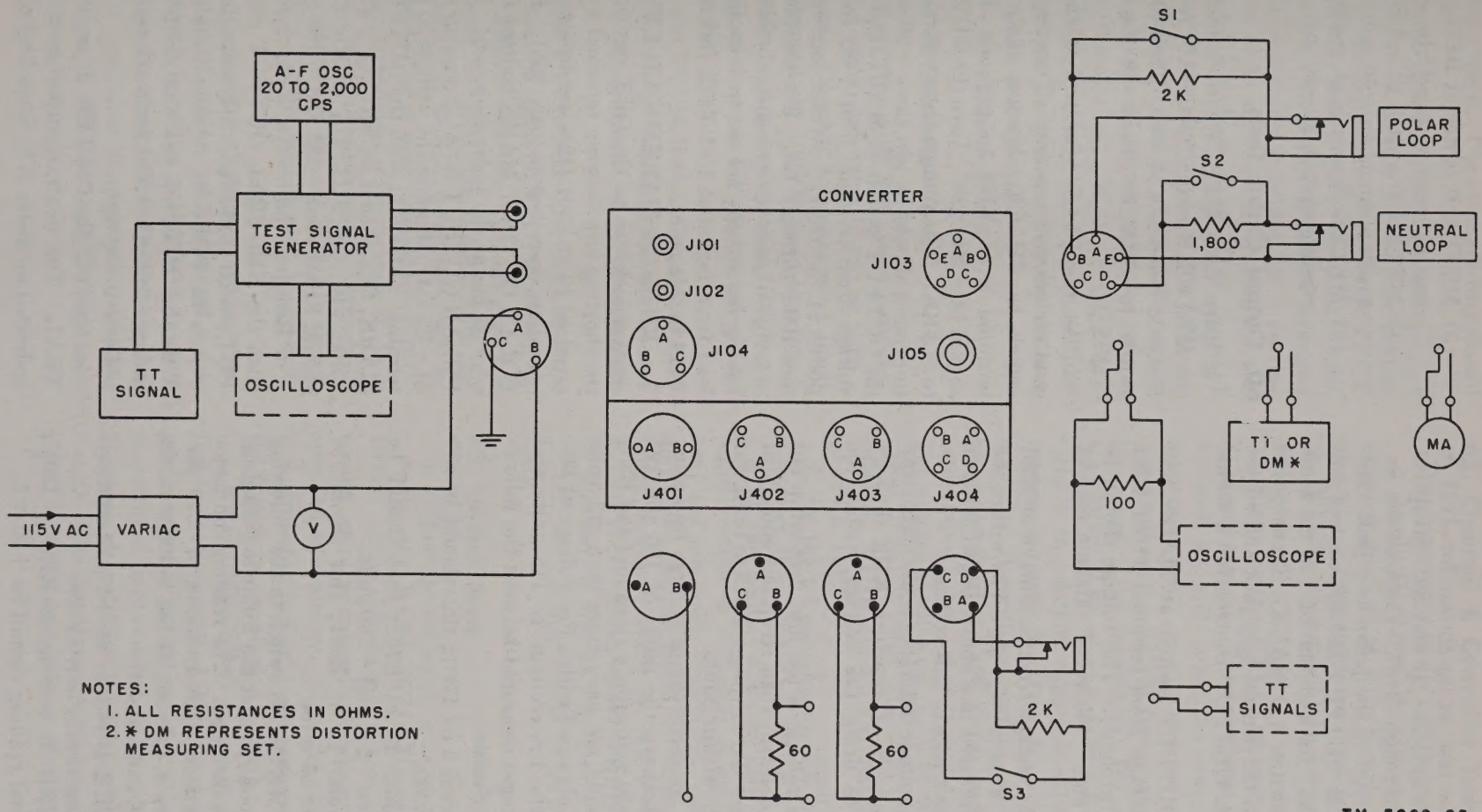


Figure 52. Test set-up for final testing.

d. Connect the test set-up shown for J103 in figure 52. Open switches S1 and S2. Strap out resistors R184 through R187. Connect the external milliammeter to the polar-loop jack. Adjust the POLAR OUTPUT-MARK control (on the converter unit) for a current of +25 ma while the OUTPUT switch is at MARK. Transfer the milliammeter to the neutral-loop jack and adjust the NEUTRAL OUTPUT control for a 60-ma reading.

e. Set the OUTPUT switch at MARK and measure the voltage from terminal 11 of E301 to the chassis (ground). The voltage should be between −145 and −160 volts. Make a note of this voltage.

f. Measure the voltage from terminal 4 of E301 to the chassis. This voltage should be within ±3 volts of that measured in *e* above, but of positive polarity. Make a note of this voltage.

(1) If the voltage difference is too high, strap out enough of resistors R312 through R315 to bring the voltage within the 3-volt limit.

(2) If the voltage is too low, first strap out resistor R316; then strap out enough of resistors R312 through R315 to bring the voltage within limits.

g. Vary the converter input voltage by means of the variac between the limits of 103 and 127 volts. The +150-volt supply (terminal 4 of E301 to ground) should not vary more than ±3 volts from the value obtained with a line voltage of 115.

h. Adjust the line voltage to 115 volts and record the voltages measured between the following points and chassis:

(1) Terminal 3 of E301; this should be 280 ±15 volts.

(2) Terminal 13 of E301; this should be between −145 and −160 volts.

(3) Terminal 12 of E301; this should be −400±20 volts.

i. Turn the METER B switch to the following positions and observe that the following readings on meter B are obtained. The readings on meter B should be within ±5.0 divisions, or ±10 percent, whichever is greater, of the voltage values recorded in *e*, *f*, and *h* above.

(1) METER B switch at +275V; nominal reading should be +55 ±6.

(2) METER B switch at REG +150V; nominal reading should be +30 ±5.

(3) METER B switch at REG −5. nominal reading should be −30 ±5.

(4) METER B switch at −150V; nominal reading should be −30 ±5.

(5) METER B switch at −400V; nominal reading should be −80 ±8.

60. Output Circuit Tests

a. Turn the OUTPUT switch to MARK and the METER B switch to CHAN A+B. Meter B should indicate +55 ±10. Turn the OUTPUT switch to SPACE. Meter B should indicate −55 ±10.

b. Set the BIAS A control to the maximum counterclockwise position. Turn the OUTPUT switch to SPACE. Measure the voltage from terminal 8 of V113 to ground. This voltage should be +250 ±20. Turn the OUTPUT switch to MARK. The voltage from terminal 8 of V113 to ground should be less than +20 volts. Leave the OUTPUT switch on MARK and measure the voltage from terminal 5 of V117 to the various points of the voltage divider consisting of resistors R162 through 167. Use the 250-volt range of a 20,000 ohms-per-volt meter. Select the point having the voltage nearest to −65 and solder the lead from terminal 4 of V117 and terminal 5 of V116 to this point.

c. Rotate the MARK HOLD LEVEL control counterclockwise to the OFF position. Remove the shorting clip between terminal 4 or V117 and terminal 12 of E301 (this was inserted during the operation described in par. 59*b*). Readjust the POLAR OUTPUT MARK control for a reading of +25 ma at the polar-loop jack. Readjust the POLAR OUTPUT SPACE control for a reading of −25 ma. Measure the voltage to ground from terminal 8 of V117; with the OUTPUT switch at MARK, this should be between +210 and +165 volts; with the OUTPUT switch at SPACE, it should be between −135 and −160 volts.

d. Readjust the neutral-loop current to 60 ma with the NEUTRAL OUTPUT control (OUTPUT switch at MARK). Operate the METER B switch to POLAR; it should indicate 25 ±3. With the OUTPUT switch at SPACE, it should indicate to the left and for mark signals it should indicate to the right.

e. Operate the METER B switch to NEUTRAL. The neutral output current should be indicated on meter B by a reading of 60 ±5 for a

mark and 0 for a space. The mark reading should be to the right.

f. With switch S1 of the J103 circuit open, it should be possible to adjust for a polar output current of ±30 ma or greater. With the OUTPUT switch on MARK, switch S2 of the J103 circuit open, and resistors R184 through R187 strapped out, it should be possible to adjust for a neutral output current of 63 ma or greater. Remove the strap from across R184 through R187 (applied during the operations described in par. 59*d*).

g. Close switches S1 and S2 of the J103 circuit. It should be possible to adjust the polar output currents to ±20 ma or less. With the OUTPUT switch on MARK, it should be possible to adjust the neutral output current to +40 ma or less. Readjust the polar and neutral loop currents for ±25 ma and +60 ma, respectively.

61. Channel A Converter Tests

a. Apply no input to J102 while testing channel A. Set the r-f signal generator to 440 kc with a 1,000-mv output. Connect it to channel A input jack J101. Connect the VTVM from terminal 3 of Z103 to ground. Adjust capacitor C101 for a maximum indication on the VTVM; this should be between 13 and 22 volts.

b. Connect the VTVM from terminal 2 of Z104 to ground. The voltage should be between 1.5 and 3.5 volts over the complete range of capacitor C105.

c. Connect the VTVM from terminal 4 of E103 to ground. Set the BAND WIDTH switch to NARROW. Adjust capacitor C105 to give a 0 reading on meter A. This should occur with the converter A oscillator section operating at 490 kc and capacitor C105 set at nearly maximum capacitance. Set the r-f oscillator to 100-mv output. The voltage read on the VTVM should be between 10 and 25 volts. Move the BAND WIDTH switch to WIDE. The VTVM should read between 20 and 40 volts.

d. Set the r-f signal generator to 510 kc. Set the BAND WIDTH switch to NARROW. Adjust tuning capacitors C105 and C101 to give a maximum voltage reading. This should occur at a converter A oscillator frequency of 560 kc. With an r-f input of 100 mv, the VTVM should read between 10 and 25 volts.

62. Channel B Converter Tests

Apply no input to J101 while testing channel B.

a. Apply the 1,000-mv, 440-kc signal to J102. Connect the VTVM from terminal 3 of Z101 to ground. Adjust capacitor C103 for maximum on the VTVM; this should be between 13 and 22 volts.

b. Connect the VTVM between terminal 2 of Z102 and ground. The voltage should be between 1.5 and 3.5 volts over the complete range of capacitor C106.

c. Connect the VTVM from terminal 4 of E103 to ground. Set the BAND WIDTH switch to NARROW. Turn the METER B switch to CHAN B. Adjust capacitor C106 to give a 0 reading on meter B. This should occur with the converter B oscillator section operating at 469.3 kc and capacitor C106 set at nearly maximum capacitance. Set the r-f oscillator at 100 mv. The voltage reading on the VTVM should be between 10 and 25 volts. Move the BAND WIDTH switch to WIDE; the VTVM should read between 20 and 40 volts.

d. Set the r-f signal generator to 510 kc. The converter B oscillator section will give a 29.3-kc i. f. at two points: 539.3 kc and 480.7 kc. The higher oscillator frequency is used; this will be near the minimum capacitance settings of C106 and C103. Adjust these two capacitors for maximum voltage reading on the VTVM; with the BAND WIDTH switch at NARROW, this should be between 10 and 25 volts; with the switch at WIDE, the reading should be between 20 and 40 volts.

63. Limiter Tests

a. Adjust the r-f signal generator to 500 kc.

b. Set the BAND WIDTH switch at NARROW. Aline the channel A input and oscillator tuning as in paragraph 61, using the frequency specified in *a* above. Aline the channel B input and oscillator tuning as in paragraph 62, using the frequency specified in *a* above.

c. Set the METER B switch at INPUT. Adjust the output level of the r-f signal generator to give a meter B indication of +50. There should be no input to channel B. The voltage measured at terminal 4 of E103 should not be greater than 6 volts. The signal required for the meter B reading of +50 should not be greater than 20 mv.

d. Without changing the input level to channel A, connect the VTVM from terminal 42 of E103 to ground. The reading should be 6±2 volts.

e. Adjust the signal input to channel A to .5 mv. The VTVM should read more than 3.5 volts. Adjust the signal input to 500 mv; the VTVM should read 6±2 volts.

f. Connect the oscilloscope from terminal 42 of E103 to ground. Make certain that the high input side of the oscilloscope is connected to terminal 42. Shunt the vertical input with a 100-ohm resistor. Use a saw-tooth sweep frequency suitable to obtain a 3-cycle pattern. Observe that the waveform of the 50-kc signal output from the limiter is close to that shown in A of figure 34.

g. Repeat the tests in *c* through *f* above on channel B. Observe that the waveform of the 29.3-kc signal output from the limiter is close to that shown in B of figure 34. Remove the oscilloscope connections from terminal 42 of E103.

64. Discriminator Tests

a. Apply an input of 50 mv at 500 kc to channel A. Set trimmer capacitor C102 at half capacitance. Adjust capacitor C105 to give a zero indication on meter A (center of discriminator range).

b. Apply an input of 50 mv at 500 kc to channel B (no input to channel A). Set trimmer capacitor C104 to half capacitance and adjust tuning capacitor C106 to give a zero indication on meter B with METER B switch at the CHAN B position. Use the higher frequency of the local oscillator to avoid inversion of the discriminator output in this channel.

c. Operate the test signal circuit to spacing with a frequency shift of 850 cps. By readjustment of the test oscillator frequency, center the mark and space readings of meter B around zero. Meter B shall give equal indication of 50 ±10 either side of zero and shall indicate to the left for space. Shift the input from CHAN B to CHAN A, without readjustment of the r-f signal generator tuning controls, and check to see that the above limits are met on meter A.

65. Drift-Compensating Circuit

a. Adjust the signal generator for an input of 50 mv to CHAN A and no input to CHAN B.

b. With the DRIFT COMPENSATOR switch at IN, the OUTPUT switch at NORMAL, and the AMP GAIN control at its maximum counterclockwise position, turn the COMP AMP control to its extreme counterclockwise position. Turn the LIMITER control to its maximum clockwise position. Set the METER B switch at CHAN A+B. Meter B shall read 0 ±5. Note this reading. Adjust the BIAS A control to a point where a marking or spacing loop condition may be obtained by just a slight movement of the BIAS A control as observed on meter B in the polar-loop circuit. Adjust the BIAS A control to a point about halfway between the positions where the polar output changes from mark to space and from space to mark.

c. Set the METER B switch at CHAN A+B. Turn the COMP AMP control in a clockwise direction until the meter B reading is increased by 5 to the right or left depending on whether the circuit is in a marking or spacing condition. This reading will be to the right or left, depending on the condition of the output circuits at the time the adjustment is made.

d. Turn the BIAS B control slowly to the two positions where meter B deflects to the right and to the left of the readings noted in *b* above. Set the BIAS B control midway between these two positions.

e. Set the COMP AMP control at midposition. Advance the AMP GAIN control until sending a mark or space from the test signal generator results in keying of the output loops. The OUTPUT switch should be at NORMAL. With METER B switch at CHAN A+B, meter B shall indicate to the right for mark and left for space.

f. Adjust the COMP BAL and COMP AMP controls to provide steady meter B readings of +70 ±5 for mark and −70 ±5 for space. (Allow several seconds for each reading to stabilize.)

g. With the LIMITER control at maximum clockwise position, measure the voltage to ground from terminals 4 and 5 of V112 (use a d-c voltmeter). These voltages shall be plus and minus 24 ±3 volts, respectively. With the COMP AMP control adjusted to give meter B indications of +70 ±5 for mark signals and −70 ±5 for space signals, slowly reduce the LIMITER control until the meter B reading drops to +50 for mark. With this setting the reading for space shall be −50 ±10. Turn the LIMITER control fully clockwise and then slowly counterclockwise until the meter B reading just begins to decrease.

h. Operate the DRIFT COMPENSATOR switch to *out*, the OUTPUT switch to REVERSE, and METER B switch to CHAN B. Set the test set sending circuit to give centered deflections of the meters in the discriminator outputs. Set the MARK HOLD LEVEL switch to *on*. Send a steady space into either CHAN A or CHAN B at such a level to give a reading of 50 on meter B with the METER B switch at INPUT. Adjust the MARK HOLD LEVEL control until the output circuit just remains spacing. Set the input levels into A and B so that an input reading of 50 on meter B is obtained from either input alone. Apply this level to both channels A and B. Observe that the loop circuit is in a spacing condition but restores to a marking condition when the inputs to both A and B are reduced to zero.

i. With the converter adjusted for diversity balance as in f above, connect a receiving teletypewriter to the neutral loop circuit. Send miscellaneous signals from test generator on channel A, channels A+B, and channel B alone. Observe that the teletypewriter prints correct copy as the neutral loop current is varied between 55 and 65 ma at a converter input line voltage of 115 volts. Repeat for line voltages of 103 and 127 volts.

j. Place the OUTPUT switch at MARK and with neutral loop currents of 55 and 65 ma, operate the receiving teletypewriter keyboard and see that correct copy is printed. Repeat for line voltages of 103 and 127 volts.

Note. If the requirements of *i* and *j* above cannot be met, refer to paragraph 59*b* and select the point on the voltage divider to provide the next lower voltage on terminal 4 of V117. Connect the lead to this point and recheck as in *i* and *j* above.

66. Over-all Transmission Tests

The minimum performance requirements for checking the over-all performance of the equipment are outlined in the following paragraphs and are standard for Frequency Shift Converter CV–182(*)/GRC–26A. A typical test bench setup is shown in figure 52. If suitable test equipment is available, follow the operations outlined in the order given.

a. Discriminator Output Waveforms. Figure 53 shows the waveshapes obtained on an oscilliscope connected between pin 3 of V111 and ground for dot frequencies of 20, 65, and 130. An input signal to the converter of 50 mv at 500 kc, 850 cps shift should be used for checking these waveshapes.

(1) With the OUTPUT switch at REVERSE, DRIFT COMPENSATOR and LP FIL out of circuit, and BANDWIDTH switch set to NARROW it should be possible to obtain, for 20-cycle reversals, waveforms similar to that shown in A of figure 53 when testing channel A and channel B separately.

(2) At a dot frequency of 65, the waveform shall appear as in B of figure 53.

(3) With LP FIL switched to IN, the waveform shall appear as in C of figure 53.

(4) At a dot frequency of 130, and LP FIL switched to *out*, the waveform should appear as in D of figure 53.

(5) Check that both channel A and B give approximately the same waveshape.

b. Polar and Neutral Output Waveforms.

(1) Adjust oscilliscope sweep to obtain a pattern as shown in figure 54 at a dot frequency of 20.

(2) With LP FIL at *out*, and with input signal frequencies set to give equal plus and minus discriminator outputs, bias shall not exceed 6 percent as measured on the oscilliscope.

(3) For 200-cycle dots, the bias shall not exceed 10 percent.

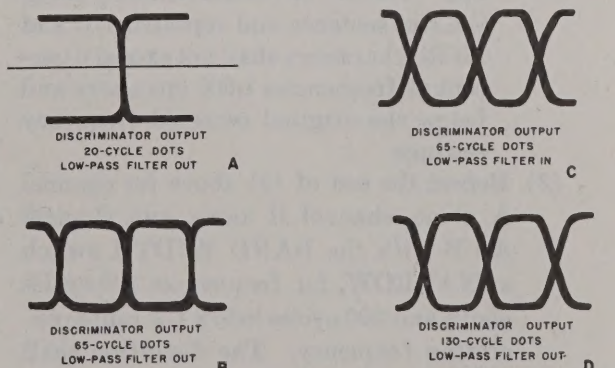


Figure 53. Discriminator output waveforms.

c. Output Distortion Measurements.

(1) Send a steady mark from the test circuit. Adjust input to channel A to 10 mv. Slowly raise the level into channel B until meter B reads equal to meter A. Check meter A and B for approximately same

readings on space. A 2:1 ratio is considered satisfactory.

(2) Calibrate the distortion measuring set for minimum distortion, using the local d-c loop of the teletypewriter at 60-ma loop current.

(*a*) Send the test sentence and record the distortion in both the polar and neutral loops for channels A, A+B, and B. The maximum distortion over any half-minute period shall not exceed 6 percent.

(*b*) Operate DRIFT COMPENSATOR to IN, OUTPUT switch to NORMAL, and BAND WIDTH switch to NARROW. With meter B at COMP AMP, note that minimum kicks are indicated on meter B when the test sentence is being transmitted. The distortion measured in the polar and neutral loops for channels A, A+B, and B while the test sentence is being transmitted shall not exceed 6 percent. The distortion in the polar loop for repeated BL and LTRS characters shall not be more than 6 percent.

(*c*) Set the test oscillator to have frequencies of 1,000 cps above and below the centered frequencies used in (*b*) above. With BAND WIDTH switch set to WIDE, the shift should remain at 850 cps. Distortion measurements using the test sentence and repeated BL and LTRS characters shall not exceed 6 percent at frequencies 1,000 cps above and below the original centered frequency settings.

(3) Repeat the test of (*c*) above for channel A alone, channel B alone, and channel A+B with the BAND WIDTH switch at NARROW, for frequencies 300 cycles above and 300 cycles below the center operating frequency. The distortion shall not exceed 5 percent.

d. Low Signal Input Tests.

(1) Make the adjustments specified in *a* above at a signal input level to channel A and B of .5 mv at 500 kc.

(2) Operate LP FIL switch to IN and without changing the input level to channel A and B make the tests of teletypewriter signal distortion (miscellaneous signals only) specified in *c* (1), (2), and (3) above. The distortion shall not exceed 6 percent.

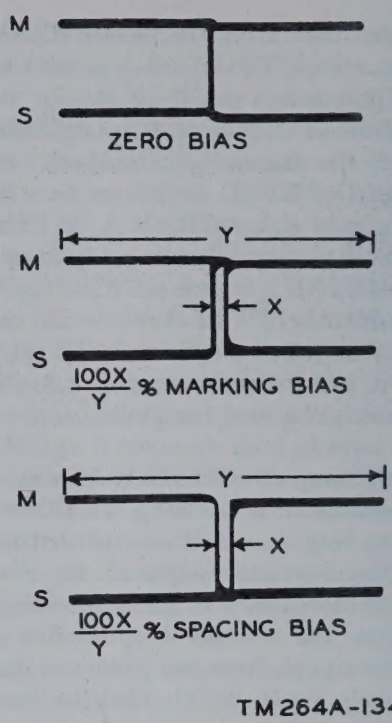


Figure 54. Frequency Shift Converter CV-182(*)/GRC-26A, bias waveforms.

e. Low Frequency Shift Tests. Make the test specified in *c* above for channel A only and then for channel B only using a 100-cycle frequency shift instead of an 850-cycle shift (miscellaneous signals only). The output from the test signal generator shall be 2 mv for channel A and B. The distortion shall not exceed 5 percent.

f. Tone-Oscillator and Control-Relay Tests.

(1) Relay K401 should operate on a current of 15 to 17 ma and should release on a current of 9.0 to 11.5 ma.

(2) The receiver-disabling relay circuit voltage, as measured across the 60-ohm resistors connected across J402 and J403 (fig. 52), shall be between 9.0 and 10.25 with relay K401 operated (line adjusted to 115 volts.)

(3) A tone signal should be heard on a headset (2,000 ohms) connected to the PHONES KEYED TONE jack on the converter when the 60-ma loop of the converter is in a marking condition.

(*a*) The tone voltage, obtained at the PHONES KEYED TONE jack, shall be 1 ±.5 volt as measured with a VTVM. Check both sides to ground.

(*b*) The tone frequency shall be 850 ±100 cps.

(*c*) No tone shall be heard for a space condition.

(4) Operate OUTPUT switch to REVERSE and DRIFT COMPENSATOR to *out*. Apply a 50 mv space signal to both channel A and B. Operation of relay K401 shall change the loops to a marking condition.

(*a*) Operate DRIFT COMPENSATOR switch to IN and OUTPUT switch to NORMAL (in this order). Operating relay K401 shall again change the loops from space to mark. This last test cannot be repeated again without first restoring the circuit by operating the OUTPUT switch to REVERSE and back to NORMAL.

(*b*) Operate the OUTPUT switch to SPACE. Connect a source of teletypewriter signals to the signal generator. The distortion measured in the polar and neutral loops shall not exceed 5 percent.

CHAPTER 5

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

67. General

The exact procedure in repacking for shipment or limited storage depends upon the material available and the conditions under which the equipment is to be shipped or stored.

68. Repacking for Shipment or Limited Storage

Whenever practicable, place a dehydrating agent, such as silica gel, inside the chests. Protect the chest with a waterproof paper barrier. Seal the seams of the paper barrier with a waterproof sealing compound or tape. Pack the protected chests in a padded wooden case, providing at least 3 inches of excelsior padding or some similar material between the paper barrier and the packing case.

Section II. DEMOLITION OF MATÉRIEL TO PREVENT ENEMY USE

69. General

The demolition procedures outlined in paragraph 70 will be used to prevent the enemy from using or salvaging the equipment. Demolition of the equipment will be accomplished only upon order of the commander.

70. Methods of Destruction

a. Smash. Smash the controls, tubes, switches, capacitors, transformers and case, using sledges, axes, handaxes, pickaxes, hammers, crowbars, or other heavy tools.

b. Cut. Cut chassis wiring, using axes, handaxes, or machetes.

c. Burn. Burn resistors, capacitors, wiring, and technical manuals, using gasoline, kerosene, oil, flame throwers or incendiary grenades.

d. Bend. Bend panels, cabinet, and chassis.

e. Explosives. If explosives are necessary, use firearms, grenades, or TNT.

f. Disposal. Bury or scatter the destroyed parts in slit trenches, fox holes, or other holes, or throw them into streams.

g. Destroy everything.

APPENDIX I

REFERENCES

Note. For availability of items listed, check SR 310–20–3, SR 310–20–4, and SR 310–20–5. Check Department of the Army Supply Catalog SIG I for Signal Corps Supply Catalog pamphlets.

1. Army Regulations

AR 380–5	Military Security (Safeguarding Military Information).
AR 750–5	Maintenance of Supplies and Equipment (Maintenance Responsibilities and Shop Operation).

2. Supply Bulletins

SB 11–6	Dry Battery Supply Data.
SB 11–47	Preparation and Submission of Requisitions for Signal Corps Supplies.

3. Auxiliary Equipment and Test Equipment

NAVSHIPS 91269	Electronic Multimeter ME–6A/U.
NAVSHIPS 91272	Oscilloscope OS–8/U.
TM 11–300	Frequency Meter Sets SCR–211–A, B, C, D, E, F, J, K, L, M, N, O, P, Q, R, T, AA, AC, AE, AF, AG, AH, AJ, AK, AL.
TM 11–307	Signal Generators I–72–G, H, J and K.
TM 11–472	Repair and Calibration of Electrical Measuring Instruments.
TM 11–2217	Distortion Test Set TS–383/GG and TS–383A/GG.
TM 11–2524	Oscillators I–151–A and I–151–E.
TM 11–2627	Tube Tester I–177 and I–177–A.
TM 11–2684A	Audio Oscillator TS–382A/U.
TM 11–5527	Multimeter TS–352/U.

4. Painting, Preserving, and Lubrication

TB SIG 13	Moistureproofing and Fungiproofing Signal Corps Equipment.
TB SIG 69	Lubrication of Ground Signal Equipment.
TM 9–2851	Painting Instructions for Field Use.

5. Camouflage, Decontamination, and Demolition

FM 5–20	Camouflage, Basic Principles.
FM 5–25	Explosives and Demolitions.
TM 3–220	Decontamination.

6. Other Publications

FM 24–18	Field Radio Techniques.
SR 310–20–3	Index of Training Publications.
SR 310–20–4	Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Tables of Organization, and Tables of Equipment.
SR 310–20–5	Index of Administrative Publications.
SR 700–45–5	Unsatisfactory Equipment Report (Reports Control Symbol CSGLD–247).

SR 745–45–5 NAV DEPT SERIAL 85P00 AFR 71–4	Report of Damaged or Improper Shipment (Reports Control Symbols CSGLD–66 (Army), SandA–70–6 (Navy), and AF–MC–U2 (Air Force)).
TB SIG 25	Preventive Maintenance of Power Cords.
TB SIG 66	Winter Maintenance of Signal Equipment.
TB SIG 72	Tropical Maintenance of Ground Signal Equipment.
TB SIG 75	Desert Maintenance of Ground Signal Equipment.
TB SIG 123	Preventive Maintenance Practices for Ground Signal Equipment.
TB SIG 178	Preventive Maintenance Guide for Radio Communication Equipment.
TB SIG 219	Operation of Signal Equipment at Low Temperatures.
TB SIG 223	Field Expedients for Wire and Radio.
TM 9–2857	Storage Batteries Lead-Acid Type.
TM 11–262	Control Units C–292/TRA–7, C–292A/TRA–7, C–292B/TRA–7.
TM 11–264	Radio Set AN/GRC–26.
TM 11–314	Antennas and Antenna Systems.
TM 11–333	Telephones EE–8, EE–8–A, and EE–8–B.
TM 11–453	Shop Work.
TM 11–455	Radio Fundamentals.
TM 11–466	Radar Electronic Fundamentals.
TM 11–483	Suppression of Radio Noises.
TM 11–486	Electrical Communication Systems Engineering.
TM 11–661	Electrical Fundamentals (Direct Current).
TM 11–680	Teletypewriter Circuits and Equipment (Fundamentals).
TM 11–681	Electrical Fundamentals (Alternating Current).
TM 11–4000	Trouble Shooting and Repair of Radio Equipment.

APPENDIX II

IDENTIFICATION TABLE OF PARTS

Note. The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as a specific T/O & E, T/A, SIG 7 & 8, list of allowances of expendable material, or another authorized supply basis. The Department of the Army Supply Catalog applicable to the equipment covered in this manual is SIG 7 & 8–AN/GRC–26A. For an index of available supply catalogs in the Signal portion of the Department of the Army Supply Catalog, see the latest issue of SIG 1.

1. Identification Table of Parts for Frequency Shift Converters CV–182/GRC–26A and CV–182A/GRC–26A

Ref. symbol	Model No. CV-182	Model No. CV-182A	Description	Function	Stock No.
			FREQUENCY SHIFT CONVERTERS CV–182/GRC–26A and CV–182A/GRC-26A: 2 channels; freq 440 to 510 kc; 115 v, 50–60 cyc, single phase, ac; steel cabinet; approx 20″ lg x 19″ wd x 10½″ h.	Converts received radioteletype signals from two receivers on same frequency to d-c pulses for teletype operation.	2C722–182
M101, M102	(*)	(*)	AMMETER, DC: 40 scale div; marked "MICROAMPERES" and "DIRECT CURRENT"; 100 to 0 to 100; JAN type MR26W1H1DCUA.	M101: Measures output of 50 kc discriminator. M102: Measures output of 11 circuits selected by METER B switch S105.	3F1100–5
E110	(*)	(*)	BOARD, terminal: 4 term.; 2″ lg x 1″ wd x 3/32″ thk; stamped "E110".	Resistor mounting strip	2Z9404.264
E111	(*)	(*)	BOARD, terminal: 4 term.; 2″ lg x 1″ wd x 3/32″ thk; stamped "E111".	do	2Z9404.263
E112	(*)	(*)	BOARD, terminal: 4 term.; 2″ lg x 1″ wd x 3/32″ thk; stamped "E112".	do	2Z9404.261
E113	(*)	(*)	BOARD, terminal: 4 term.; 2″ lg x 1″ wd x 3/32″ thk; stamped "E113".	do	2Z9404.262
E101	(*)	(*)	BOARD, terminal: 6 term.; 2⅛″ lg x 2″ wd x 3/32″ thk.	Resistor and capacitor mounting	2Z9406.250
E106	(*)	(*)	BOARD, terminal: 6 term.; 2½″ lg x 2½″ wd x 3/32″ thk.	Resistor mounting	2Z9406.251
E118	(*)	(*)	BOARD, terminal: 8 term.; 2½″ lg x 2½″ wd x 3/32″ thk; stamped "E118".	do	2Z9408.194
E102	(*)	(*)	BOARD, terminal: 8 term.; 2 9/16″ lg x 2″ wd x 3/32″ thk.	Resistor and capacitor mounting	2Z9408.192
E104	(*)	(*)	BOARD, terminal: 12 term.; 3 7/16″ lg x 2″ wd x 3/32″ thk.	Resistor mounting	2Z9412.199
E107	(*)	(*)	BOARD, terminal: 12 term.; 3 7/16″ lg x 2″ wd x 3/32″ thk.	do	2Z9412.200
E105	(*)	(*)	BOARD, terminal: 14 term.; 3⅞″ lg x 2″ wd x 3/32″ thk; stamped "R124".	do	2Z9422.23

Ref. symbol	Model No. CV-182	Model No. CV-182A	Description	Function	Stock No.
E105	(*)	(*)	BOARD, terminal: 14 term.; 3⅞" lg x 2" wd x 3/32" thk; stamped "R140".	Resistor mounting	3Z12531-2.31
E128	(*)	(*)	BOARD, terminal: 14 screw type w/#6-32 thd Bind H screw; 6⅞" lg x 1 11/32" wd x ½" thk.	Terminal strip	3Z12531-40.1
E103	(*)	(*)	BOARD, terminal: 22 term.; 5⅝" lg x 2" wd x ⅝" thk; stamped "R106".	Resistor and capacitor mounting	2Z9422.22
E103	(*)	(*)	BOARD, terminal: 22 term.; 5⅝" lg x 2" wd x 3/32" thk.	Resistor and capacitor mounting	3Z12531-45
E109	(*)	(*)	BOARD, terminal: 28 term.; 6 15/16" lg x 2½" wd x 3/32" thk; stamped "R210".	Resistor mounting	2Z9428-29
E109	(*)	(*)	BOARD, terminal: 28 term.; 6 15/16" lg x 2½" wd x 3/32" thk; stamped "R130".	Resistor and capacitor mounting	2Z9428-30
E108	(*)	(*)	BOARD, terminal: 38 term.; 9⅛" lg x 2" wd x 3/32" thk.	do	2Z9438-17
	(*)	(*)	CABLE, RF: RF Cable RG-11A/U; coax; 75 ohm impedance; spec JAN-C-17.	Connection from receiver output	1F425-11A
C107, C108	(*)	(*)	CAPACITOR, fixed: mica; 100 μμf ±5%; 500 vdcw; JAN type CM20C101J.	C107: Grid coupling to V101. C108: Grid coupling to V102.	3K2010132
C112, C114, C118	(*)	(*)	CAPACITOR, fixed: mica; 470 μμf ±5%; 500 vdcw; JAN type CM20D471J.	C112: Rectifier plate coupling to diode section of V104. C114: Grid coupling to V107. C118: Grid coupling to V108.	3K2047142
C127	(*)	(*)	CAPACITOR, fixed: mica; 1000 μμf ±5%; 500 vdcw; JAN type CM30D102J.	Signal speed filter	3K3010242
C126	(*)	(*)	CAPACITOR, fixed: mica; 3300 μμf ±5%; 500 vdcw; JAN type CM30D332J.	Low-pass filter	3K3033242
C125	(*)	(*)	CAPACITOR, fixed: mica; 8200 μμf ±10%; 500 vdcw; JAN type CM35C822K.	do	3K3582231
C130	(*)	(*)	CAPACITOR, fixed: paper; 20,000 μμf ±10%; vdcw; JAN type CP26A1EF203K.	Meter-shunt bypass for INPUT setting of S105.	3DA20-167
C109, C113	(*)	(*)	CAPACITOR, fixed: paper; 100,000 μμf ±20%; 600 vdcw; JAN type CP69B1EF104V.	C109: Bypass for grids 2 and 4 of V101. C113: Low-pass filter for input to V105.	3DA100-535
C115A, B, C; C119A, B, C; C122A, B, C.	(*)	(*)	CAPACITOR, fixed: paper; 3 sect.; 100,000 μμf +20% −10% ea sect.; 600 vdcw; JAN type CP69B5EF104V.	C115A: Cathode bypass for V103. C115B: Screen grid bypass for V103. C115C: Plate circuit decoupling, V103. C119A: Plate circuit decoupling, V107. C119B: Plate bypass for V106. C119C: Screen grid bypass for V107. C122A: Cathode bypass for V108. C122B: Screen bypass for V108. C122C: Plate circuit decoupling, V108.	3DA100-673

Ref. symbol	Model No. CV-182	Model No. CV-182A	Description	Function	Stock No.
C110A, B	(*)	(*)	CAPACITOR, fixed: paper; 2 sect.; 100,000 μμf+20%−10% ea sect.; 600 vdcw; JAN type CP69B4EF104V.	C110A: Grid 4 bypass for V102 C110B: R-f ground return, filters Z105 through Z108.	3DA100–533
C131A, B	(*)	(*)	CAPACITOR, fixed: paper; 2 sect.; 1 μf +20%−10%; 600 vdcw; JAN type CP53B4EF-105V.	C131A; Plate circuit decoupling, V103. C131B: Plate circuit decoupling, V108.	3DB1–186
C128	(*)	(*)	CAPACITOR, fixed: paper; 1 μf +20%−10%; 600 vdcw; JAN type CP54B1EF105V.	Coupling capacitor to V111	3DB1–91
C129	(*)	(*)	CAPACITOR, fixed: paper; 2 μf+20%−10%; 600 vdcw; JAN type CP54B1EF205V.	Coupling to V104	3DB2–146
C101, C103, C105, C106.	(*)	(*)	CAPACITOR, variable: air; single sect., pl meshing type; 135 μμf max, 9 μμf min; JAN type CT1C135.	C101: for CHAN A INPUT trimmer. C103: for CHAN B INPUT, trimmer. C105: for CHAN A OSC, trimmer. C106: for CHAN B OSC, trimmer.	3D9135V–4
C102, C104	(*)	(*)	CAPACITOR, variable: air; single sect., pl meshing type, 135 μμf max, 9 μμf min; JAN type CT1E135.	C102: CHANNEL A, FINE TUNING. C104: CHANNEL B, FINE TUNING.	3D9135V–5
	(*)	(*)	CLAMP, electrical: for ¼″ dia max cable; Tinnerman Prod #A3049A–4A.	Secures cable	2Z2642.497
	(*)	(*)	CLAMP, electrical: for 5/16″ dia max cable; Tinnerman Prod #A3049–5.	do	2Z2642.522
	(*)	(*)	CLAMP, electrical: for ⅜″ dia max cable; Tinnerman Prod #A3049–6A.	do	2Z2642.498
	(*)	(*)	CLAMP, electrical: for 7/16″ dia max cable; Tinnerman Prod #A3049A–7.	do	2Z2642.496
	(*)	(*)	CLAMP, electrical: for ½″ dia max cable; Tinnerman Prod #A3049A–8A.	do	2Z2642.620
	(*)	(*)	CLAMP, electrical: for ¾″ dia max cable; Tinnerman Prod #A3049A–12–27.	do	2Z2642.632
	(*)	(*)	CLAMP, electrical: 1 5/16″ lg x 1⅝″ wd x 1⅝″ h; AN type AN–3057–16.	Secure plug to wiring harness	2Z2646.15
	(*)	----	CLIP, fuse: 5/16″ wd x 15/32″ h; Littelfuse #101001.	Holds Allen wrenches	3Z1013.24
		(*)	CLIP, fuse: 2 9/64″ h x 11/32″ wd	do	3Z1013.6
L101	(*)	(*)	COIL, telephone retardation: single wnd; HS metal case.	Discriminator output filter	3C1988–85
		(*)	COLLAR, spacing: brass; ⅞″ lg x ¼″ OD; Hallicrafters part/dwg #73B714.	Spacer for capacitor mounting	2Z2935–181

Ref. symbol	Model No. CV-182	Model No. CV-182A	Description	Function	Stock No.
J101, J102	(*)	(*)	CONNECTOR, receptacle: Connector UG–87/U; 1 rd female cont, coax; straight; approx 1 3/16" lg o/a less cont, w/3/4" sq mtg fl.	Receive RF Cable RG–11A/U from A and B receivers.	2Z7390–87
J104	(*)	(*)	CONNECTOR, male: receptacle; 3 rd pol cont; straight type; ANA type AN–3102A–16S–6P.	Receives power input cable	2Z3023–3
J103	(*)	(*)	CONNECTOR, female: receptacle; 5 rd pol cont; straight type; ANA type AN–3201A–14S–5S.	Connects to teletype control circuits.	2ZK7409–20
J106	(*)	(*)	CONNECTOR, female: receptacle; 14 rd pol cont; straight type; ANA type AN–3102A–20–27S.	Receives cable from tone oscillator.	2Z8684–5
P107	(*)	(*)	CONNECTOR, male: plug; 16 pol cont; 90° angle type.	Connects to Power Supply PP–712 (*)/GRC–26A.	2Z7226–Q249A
	(*)	(*)	COUPLING, flexible: shaft type	For BANDWIDTH control	2Z3290
	(*)	(*)	DOOR: steel; 14 9/16" lg x 2 5 9/64" wd x 4 9/64" thk o/a; Hallicrafters part/dwg #41D16551.	Provides access to controls	2Z3825
Z105	(*)	(*)	FILTER, bandpass: 28.55 to 30.05 kc bandwidth.	1.5-kc filter to first limiter	2Z4376.27
Z106	(*)	(*)	FILTER, bandpass: 27.8 to 30.8 kc bandwidth.	3-kc filter to first limiter	2Z4376.28
Z107	(*)	(*)	FILTER, bandpass: 49.25 to 50.75 kc bandwidth.	1.5-kc filter to first limiter	2Z4376.26
Z108	(*)	(*)	FILTER, bandpass: 48.5 to 51.5 kc bandwidth.	3-kc filter to first limiter	2Z4376.25
		(*)	INSULATOR, plate: plastic; 6 15/16" lg x 2" wd x 1/16" thk; Hallicrafters part/dwg #8C1269.	Part of terminal board E109	3G320–337
		(*)	INSULATOR, plate: plastic; 3 7/8" lg x 2" wd x 1/16" thk; Hallicrafters part/dwg #8B1283.	Part of terminal board E105	3G320–338
		(*)	INSULATOR, plate: plastic; 5 5/8" lg x 2" wd x 1/16" thk; Hallicrafters part/dwg #8C1290.	Part of terminal board E103	3G320–336
		(*)	INSULATOR, plate: plastic; 2 1/2" lg x 2 1/2" wd x 3/32" thk; Hallicrafters part/dwg #8B1293.	Part of terminal board E106	3G320–339
		(*)	INSULATOR, plate: plastic; 8 1/16" lg x 1 3/4" wd x 1 1/16" thk; Hallicrafters part/dwg #8C1485.	H-v caution indicator	3G320–335
J105	(*)	(*)	JACK JJ–034: for 2 cond plug .250" dia.	PHONES KEYED TONE receptor.	2Z5534
	(*)	(*)	KNOB: rd; black bakelite; for 1/4" dia shaft; white line index marking; 1" dia x 5/8" lg; Molded Insul part #K868236–1.	For DRIFT COMPENSATOR, LIMITER, and AMP GAIN controls NEUTRAL OUTPUT control, BAND WIDTH control, MARK HOLD LEVEL control, POLAR OUTPUT SPACE-MARK controls, CHANNEL A FINE TUNING and CHANNEL B FINE TUNING controls.	2Z5822–167

Ref. symbol	Model No. CV-182	Model No. CV-182A	Description	Function	Stock No.
J105	(*)	(*)	KNOB: rd; black bakelite; for ¼" dia shaft; white line index marking; 1½" dia x 13/16" lg; Molded Insul part #P712336–5.	For OUTPUT selector and METER B switches.	2Z5822–166
		(*)	MAINTENANCE PARTS KIT: c/o shaft and cam assem, knob, catch plate, dowel pin and door bushing; Hallicrafters part/dwg #59X021.	For front panel door lock	2Z5727–178
		(*)	PLATE, identification: marked with caution note and control identifications; 15" lg x 2.984" wd x .032" thk; Hallicrafters part/dwg #7D292.	Control panel overlay	2Z7090.203
		(*)	PLATE, identification: marked with control and operating identifications; 17" lg x 5⅝" wd x .05" thk; Hallicrafters part/dwg #7D267.	Front panel overlay	2Z7090.204
E122, E123, E124.	(*)	(*)	POST, binding: screw type	E122: Polar output terminal E123: Common ground terminal. E124: Neutral output terminal.	3Z286
R188, R190	(*)	(*)	RESISTOR, fixed: comp; 30 ohms ±5%; ½ w; JAN type RC20BF300J.	Shunts for M102 for NEUTRAL and POLAR settings of S105.	3RC20BF300J
R184 through R187.	(*)	(*)	RESISTOR, fixed; comp; 270 ohms ±10%; 2 w; JAN type RC42BE271K.	Neutral loop current limiters	3RC42BE271K
R168, R169	(*)	(*)	RESISTOR, fixed: comp; 820 ohms ±10%; 2 w; JAN type RC42BE821K.	Polar loop current limiters	3RC42BE821K
R216	(*)	(*)	RESISTOR, fixed: comp; 820 ohms ±10%; ½ w; JAN type RC20BF821K.	Bias voltage divider for grid of V104.	3RC20BF821K
R107, R122	(*)	(*)	RESISTOR, fixed: comp; 1,000 ohms ±10%; 1 w; JAN type RC30BF102K.	R107: Cathode bias for V103. R122: Cathode bias for V108.	3RC20BF102K
R208	(*)	(*)	RESISTOR, fixed: comp; 1,200 ohms ±5%; ½ w; JAN type RC20BF122J.	Grid bias voltage divider for V104.	3RC20BF122J
R211, R212	(*)	(*)	RESISTOR, fixed: comp; 2,000 ohms ±5%; ½ w; JAN type RC20BF202J.	R211: Current limiting for M101. R212: Current limiting for M102 for CHAN B setting of S105.	3RC20BF202J
R105, R117, R124, R137, R147.	(*)	(*)	RESISTOR, fixed: comp; 2,200 ohms ±10%; ½ w; JAN type RC20BF222K.	R105: Plate decoupling for V101 and V102. R117: Plate biasing, V106. R124: Plate decoupling for V108. R137: Voltage divider for M102 for CHAN A+B setting of S105. R147: Grid bias voltage divider for VIII.	3RC20BF222K
R103, R104, R173.	(*)	(*)	RESISTOR, fixed: comp; 4700 ohms ±10%; 1 w; JAN type RC30BF472K.	R103: Oscillator plate decoupling, V101. R104: Oscillator plate decoupling, V102. R173: Screen grid voltage divider for V116.	3RC30BF472K

Ref. symbol	Model No. CV-182	Model No. CV-182A	Description	Function	Stock No.
R111, R115, R120, R156, R172, R175. R176, R181, R183, R197.	(*)	(*)	RESISTOR, fixed: comp; 10,000 ohms ±10%; 1 w; JAN type RC30BF103K.	R111: Screen voltage dropping for V105. R115: Plate decoupling for V103. R120: Plate decoupling for V107. R156: Screen voltage dropping for V113. R172: Screen voltage divider for V115. R175: Screen voltage divider for V116. R176: Screen voltage dropping resistor for V117. R181 and R183: Screen grid voltage dividers for V118. R197: Plate load for V114.	3RC30BF103K
R163 through R166.	(*)	(*)	RESISTOR, fixed: comp; 15,000 ohms ±10%; ½ w; JAN type RC20BF153K.	Plate output voltage dividers for V113.	3RC20BF153K
R154	(*)	(*)	RESISTOR, fixed: comp; 15,000 ohms ±10%; 2 w; JAN type RC42BE153K.	Cathode bias voltage divider for V113.	3RC42BE153K
R158	(*)	(*)	RESISTOR, fixed: comp; 18,000 ohms ±10%; 2 w; JAN type RC42BE183K.	Part of plate load for V113.	3RC42BE183K
R101, R102, R112, R123.	(*)	(*)	RESISTOR, fixed: comp; 22,000 ohms±10%; ½ w; JAN type RC20BF223K.	R101: Grid bias for oscillator, V101. R102: Grid bias for oscillator, V102. R112: M102 SHUNT for INPUT setting of S105. R123: Screen voltage dropping for V108.	3RC20BF223K
R157	(*)	(*)	RESISTOR, fixed: comp; 22,000 ohms±10%; 2 w; JAN type RC42BE223K.	Part of plate load for V113	3RC42BE223K
R149, R150	(*)	(*)	RESISTOR, fixed: comp; 27,000 ohms±5%; ½ w; JAN type RC20BF273J.	R149: Plate bias voltage divider for V112. R150: Cathode bias voltage divider for V112.	3RC20BF273J
R189, R191	(*)	(*)	RESISTOR, fixed: comp; 30,000 ohms±5%; ½ w; JAN type RC20BF303J.	Current limiting resistors for M102 for NEUTRAL and POLAR settings of S105.	3RC20BF303J
R170	(*)	(*)	RESISTOR, fixed: comp; 33,000 ohms±10%; 1 w; JAN type RC30BF333K.	Screen voltage divider for V115	3RC30BF333K
R177, R178	(*)	(*)	RESISTOR, fixed: comp; 33,000 ohms±10%; 2 w; JAN type RC42BE333K.	Plate loads for V117	3RC42BE333K
R195	(*)	(*)	RESISTOR, fixed: comp; 39,000 ohms ±10%; ½ w; JAN type RC20BF393K.	Plate voltage divider for V114	3RC20BF393K
R125, R126	(*)	(*)	RESISTOR, fixed: comp; 47,000 ohms ±10%; ½ w; JAN type RC20BF473K.	Grid bias voltage divider for V111	3RC20BF473K

Ref. symbol	Model No. CV-182	Model No. CV-182A	Description	Function	Stock No.
R108, R118, R119.	(*)	(*)	RESISTOR, fixed: comp; 47,000 ohms ±10%; 1 w; JAN type RC30BF474K.	R108: Screen grid voltage dropping for V103. R118: Plate load for V107. R119: Screen grid voltage dropping for V107.	3RC30BF473K
R151, R153	(*)	(*)	RESISTOR, fixed: comp; 68,000 ohms ±5%; 1 w; JAN type RC30BF683J.	R151: V112 plate circuit voltage divider. R153: V112 cathode circuit voltage divider.	3RC30BF683J
R116, R209	(*)	(*)	RESISTOR, fixed: comp; 68,000 ohms ±10%; 1 w; JAN type RC30BF683K.	R116: Plate biasing, V106. R209: Plate load for V104.	3RC30BF683K
R113, R121, R196, R198, R200, R202, through R205.	(*)	(*)	RESISTOR, fixed: comp; 100,000 ohms ±10%; ½ w; JAN type RC20BF104K.	R113: Grid limiting of V107. R121: Grid limiting of V108. R196: Plate output voltage divider for V114. R198: Input load of Z107. R200: Input load of Z105. R202: Output load of Z107. R203: Output load of Z108. R204: Output load of Z105. R205: Output load of Z106.	3RC20BF104K
R114	(*)	(*)	RESISTOR, fixed: comp; 100,000 ohms ±10%; 1 w; JAN type RC30BF104K.	Plate load of V103	3RC30BF104K
R136, R146, R210.	(*)	(*)	RESISTOR, fixed: comp; 150,000 ohms ±10%; ½ w; JAN type RC20BF154K.	R136: Cathode bias voltage divider for V111. R146: Grid bias voltage divider for V111. R210: Grid bias voltage divider for V104.	3RC20BF154K
R193	(*)	(*)	RESISTOR, fixed: comp; 180,000 ohms ±10%; ½ w; JAN type RC20BF184K.	Plate load for V114	3RC20BF184K
R199, R201	(*)	(*)	RESISTOR, fixed: comp; 220,000 ohms ±10%; ½ w; JAN type RC20BF224K.	R199: Input load for Z108. R201: Input load for Z106.	3RC20BF224K
R140, R141, R144, R213, R179, R180.	(*)	(*)	RESISTOR, fixed: comp; 220,000 ohms ±10%; 1 w; JAN type RC30BF224K.	R140 and R141: Plate loads for V111. R144: Coupling cathodes of V111 and V112. R213: V111 and V112 cathode current meter shunt. R179: Grid coupling for V118. R180: Grid bias for V118.	3RC30BF224K
R139	(*)	(*)	RESISTOR, fixed: comp: 240,000 ohms ±5%; ½ w; JAN type RC20BF244J.	M102: Current limiting for CHAN A–B setting of S105.	3RC20BF244J
R129, R167	(*)	(*)	RESISTOR, fixed: comp; 270,000 ohms ±5%; 1 w; JAN type RC30BF274J.	R129: Signal speed filter. R167: Plate output voltage divider of V113.	3RC30BF274J
R142, R143	(*)	(*)	RESISTOR, fixed: comp; 330,000 ohms ±10%; ½ w; JAN type RC20BF334K.	R142 and R143: Cathode load for V111.	3RC20BF334K
R162	(*)	(*)	RESISTOR, fixed: comp; 360,000 ohms ±5%; 1 w; JAN type RC30BF364J.	Part of plate output voltage divider of V113.	3RC30BF364J

Ref. symbol	Model No. CV-182	Model No. CV-182A	Description	Function	Stock No.
R106, R127, R128, R148, R192.	(*)	(*)	RESISTOR, fixed: comp; 470,000 ohms ±10%; ½ w; JAN type RC20BF474K.	R106: Grid limiting for V103. R127 and R128: Grid bias voltage dividers for V111. R148: Coupling between V111 and V113. R192: Coupling between V114 and V111.	3RC20BF474K
R110, R159, R161, R214, R215.	(*)	(*)	RESISTOR, fixed: comp; 1 meg ±10%; ½ w; JAN type RC20BF105K.	R110: Grid resistor for V105. R159 and R161: Plate output voltage dividers for V113. R214: Grid return for V107. R215: Grid return for V108.	3RC20BF105K
R138	(*)	(*)	RESISTOR, fixed: comp; 2.2 meg ±10%; 1 w; JAN type RC30BF225K.	R138: Grid resistor for V111	3RC30BF225K
R130 through R135, R206.	(*)	(*)	RESISTOR, fixed: comp; 5.1 meg ±5 percent; ½ w; JAN type RC20BF515J.	Multiplier resistors for M102	3RC20BF515J
R155	(*)	(*)	RESISTOR, variable: comp; 2500 ohms ±20 percent; 2 w; JAN type RV4ANSA252B.	Driver amplifier BIAS A adjust	3RV32518
R152, R171, R174, R182.	(*)	(*)	RESISTOR, variable: comp; 50,000 ohms ±10 percent; 2 w; JAN type RV4ATSA503A.	R152: Adjustment for drift compensator. (LIMITER). R171: POLAR OUTPUT MARK adjust. R174: POLAR OUTPUT SPACE adjust. R182: NEUTRAL OUTPUT adjust.	3RV42520
R194	(*)	(*)	RESISTOR, variable: comp; 50,000 ohms ±20 percent; 2 w; 1 1/16" dia x 9/16" d; AB type J.	COMP BAL adjust	3Z7450–55
R109	(*)	(*)	RESISTOR, variable: comp; 500,000 ohms ±10 percent; 2 w; JAN type RV4ATSD504A.	MARK HOLD LEVEL adjust	3RV55054
R145, R160	(*)	(*)	RESISTOR, variable: comp; 500,000 ohms ±20 percent; 2 w; JAN type RVAPSA504B.	R145: COMP AMP adjust. R160: D-c amplifier bias adjust. (BIAS B)	3RV5502
R207	(*)	(*)	RESISTOR, variable: comp; 2.5 meg ±10 percent; 2 w; JAN type RV4ATSA255C.	A-c AMP GAIN adjust	3RV62530
	(*)	(*)	RETAINER, electron tube: hat type; 2 9/16" lg x 2 1/8" wd x 3/4" h; Times Facsimile #4 Hat.	Holds tube V118	2Z2643.138
	(*)	(*)	SHIELD, electrical connector: Receptacle Hood MX–195/U; 7/8" lg x 1 1/16" wd x 1 1/16" h.	For Connector UG–87/U	2Z7415–195
X101 through X118.	(*)	(*)	SOCKET, tube: octal; 1 piece saddle mtg; JAN type TS101PO1.	For tubes V101 through V118	2Z8670.33
	(*)	(*)	STUD, threaded: 3 3/4" lg x 5/32" dia; Times Facsimile #32 Post.	Holds tube retainer	2Z6820.368
Z111, Z113	(*)	(*)	SUPPRESSOR, electrical noise: capacitor and coil type.	Attenuate electrical interference in output of converter unit.	3Z1892–5.1
Z112	(*)	(*)	SUPPRESSOR, electrical noise: capacitor and coil type.	Attenuates electrical interference	3Z1891–47.39
S101	(*)	(*)	SWITCH, rotary: 2 positions; 2 sect.; std index action; Oak type DH.	BANDWIDTH selector	3Z9825–66.110

Ref. symbol	Model No. CV-182	Model No. CV-182A	Description	Function	Stock No.
S102	(*)	(*)	SWITCH, rotary: 4 position; 2 sect.; std index action; Oak type DH.	OUTPUT selector	3Z9825–66.109
S105	(*)	(*)	SWITCH, rotary: 11 position; 2 sect.; std index action; Oak type DH.	METER B range selector	3Z9825–66.111
S103, S104	(*)	(*)	SWITCH, toggle: DPDT; JAN type ST22N.	S103: LP FIL control S104: DRIFT COMPENSATOR control.	3Z9863–22N
S106	(*)	(*)	SWITCH, toggle: SPST; normally open; AH&H type 26994–WL.	MARK HOLD DISABLING switch.	3Z9857.63
S107, S108	(*)	(*)	SWITCH, toggle: SPST; locking action; JAN type ST42A.	S107: CHANNEL A DISABLING. S108: CHANNEL B DISABLING.	3Z9863–42A
	(*)	(*)	THUMBSCREW: steel; #12–28 thd; 31/64" lg; Hallicrafters part/dwg #73B691.	Panel fastener	6L17112–8.8K
	(*)	(*)	TOOL: screw driver bit type; 3½" lg x 5/16" OD; WECo part #BA463617.	Alinement tool	6Q335–4
Z109	(*)	(*)	TRANSFORMER, discriminator: freq range 48 to 52 kc; B&W part #70–2–68C.	50-kc discriminator network	2Z9641.246
Z101, Z103	(*)	(*)	TRANSFORMER, IF: 440 kc to 510 kc; B&W part #70–2–151C.	Z101: Input to V102 Z103: Input to V101.	2Z9641.324
Z102	(*)	(*)	TRANSFORMER, IF: 470 kc to 540 kc; B&W part #70–2–152C.	Oscillator network, V102	2Z9641.325
Z104	(*)	(*)	TRANSFORMER, IF: 490 kc to 560 kc; B&W part #70–2–153C.	Oscillator network, V101	2Z9642.142
Z110	(*)	(*)	TRANSFORMER, discriminator: freq range 27.3 to 31.3 kc; B&W part #70–2–69C.	29.3-kc discriminator network	2Z9641.247
V101, V102	(*)	(*)	TUBE, electron: type 6SA7GTY	V101: 50-kc converter. V102: 29.3-kc converter.	2J6SA7GTY
V103, V105, V107, V108, V113, V117.	(*)	(*)	TUBE, electron: type 6SJ7Y	V103: First limiter amplifier. V105: Mark hold amplifier. V107: Second limiter amplifier. V108: Third limiter amplifier. V113: Driver amplifier. V117: Neutral output amplifier.	2J6SJ7Y
V104	(*)	(*)	TUBE, electron: type 6SQ7	A-c amplifier and mark-hold signal amplifier.	2J6SQ7
V106, V109, V110, V112.	(*)	(*)	TUBE, electron: type 6H6	V106: Diode limiter. V109: 50-kc discriminator. V110: 29.3-kc discriminator. V112: Drift compensating limiter.	2J6H6
V111, V114	(*)	(*)	TUBE, electron: type 6SL7WGT	V111: Cathode follower. V114: D-c amplifier.	2J6SL7WGT
V115, V116	(*)	(*)	TUBE, electron: type 6V6GTY	V115: Polar mark amplifier. V116: Polar space amplifier.	2J6V6GTY
V118	(*)	(*)	TUBE, electron: type 6Y6G	V118: Neutral output amplifier.	2J6Y6G
	(*)	(*)	WRENCH: double end box; 5/16"–¼" hex. openings; WECo part #474A.	Control nut locking	6R41274A
	(*)	(*)	WRENCH: "L" shape; .050" across flats; Allen type No. 4.	For adjusting set screws	6R55499
	(*)	(*)	WRENCH: "L" shape; 5/64" across flats; Allen type No. 8.	For adjusting set screws	6R57400

2. Identification Table of Parts for Power Supplies PP–712/GRC–26A and PP–712A/GRC–26A

Ref symbol	Model		Name of part and description	Function of part	Signal Corps stock No.
	PP–712	PP–712A			
			POWER SUPPLIES PP–712/GRC–26A and PP–712A/GRC–26A: electronic type; DC output +275 v at 40 ma, −150 v at 60 ma and −400 v at 10 ma unregulated, −150 v at 10 ma and +150 v at 35 ma regulated, AC output 6.3 v AC at 6 amp and 6.3 at 2.5 amp unregulated; input 105/115/125 v AC 50/60 cyc single ph; full wave; filter incl; mts in std 19″ rack w/four #12–24 thumbscrews; approx 18″ lg x 19″ wd x 10–½″ h.	Power source for all converter functions. Generates audio tone; disables receivers when transmitting on one-way reversible basis.	3H4497–712
			Technical Manual TM 11–5062	Describes Frequency Shift Converters CV–182/GRC–26A and CV–182A/GRC–26A, and Power Supplies PP–712/GRC–26A and PP–712A/GRC–26A.	Order through AGO.
E301	(*)	(*)	BOARD TERMINAL: general purpose; bakelite; fourteen "¾ w" solder type term.; 6⅞″ lg x 1½″ wd x ½″ h; Jones HB #14–141–¾ W MSX.	Termination between rectifier outputs and J301.	3Z12531–40.1
E402	(*)	(*)	BOARD TERMINAL: 12 brass tin pl turret type term.; 5½″ lg x 3″ wd x ½″ h; WECo part #461830.	Resistor mounting in tone oscillator unit.	2Z9412.201
E303	(*)	(*)	BOARD, terminal: 14 swaged type term.; 4⅜″ lg x 2½″ wd x approx ⅜″ thk; Sig dwg SC–B–34307.	Mounts resistors in power supply section.	2Z9414.102
E401	(*)	(*)	BOARD, terminal: 24 turret type term.; 7⅜″ lg x 2″ wd x ½″ h; Hallicrafters part #88C717.	Resistor and capacitor mounting in tone oscillator unit.	2Z9424–42
E302	(*)	(*)	BOARD, terminal: 28 swaged type term.; 7⅞″ lg x 2½″ wd x ½″ h; WECo part B–461579.	Mounts resistors in power supply unit.	2Z9428–32
	(*)	(*)	BRACKET: co approx 5″ lg x 29/32″ wd; JAN type CPO7–SC3.	For mounting capacitors C301 through C306.	2Z1239.154
C401, C402	(*)	(*)	CAPACITOR, fixed: paper; 6000 uuf ±20%; 600 vdcw; JAN type CN35A602M.	C401: V401 grid 1 to plate 4 coupling capacitor. C402: V401 grid 4 to plate 2 coupling capacitor.	3DA6–67
C403, C405	(*)	(*)	CAPACITOR, fixed: paper; 10,000 μμf ±20%; 600 vdcw; JAN type CN35A103M.	Harmonic output filters for tone oscillator.	3DA10–367
C307	(*)	(*)	CAPACITOR, fixed: paper; 100,000 μμf +20%−10%; 600 vdcw; JAN type CP54B1EF104V.	V305 grid filter	3DA100–744
C308	(*)	(*)	CAPACITOR, fixed: paper; 2 μf+20% −10%; 600 vdcw; JAN type CP54B1EF205V.	Regulated +150-volt output filter.	3DB2–146

Ref symbol	Model		Name of part and description	Function of part	Signal Corps stock No.
	PP-712	PP-712A			
C301 through C306.	(*)	(*)	CAPACITOR, fixed; paper, 8 μf +20% −10%; 600 vdcw; JAN type CP70E1EF805V.	C301 and C302: Output filter capacitors for +275-volt supply. C303 and C304: Output filter capacitors for −150-volt supply. C305: Input filter capacitor in −400-volt supply. C306: Output filter capacitor in −400-volt supply.	3DB8–202
C404	(*)	(*)	CAPACITOR, fixed: electrolytic; 450 μf; 50 vdcw; JAN type CE41C451G.	Receiver disabling control circuit output filter.	3DB450–3
		(*)	CLAMP, electrical: ¾″ lg x ⅜″ wd; Tinnerman Prod type #A3049A–4.	For ¼-inch cable	2Z2642.339
	(*)	------	CLAMP, electrical: 13/16″ lg x ½″ wd; Commercial Plastics Co #CPC–742–4.	For ¼-inch cable	8P1–101–1
		(*)	CLAMP, electrical: ¾″ lg x 9/16″ wd; Tinnerman Prod type #A3049A–5.	For 5/16-inch cable	2Z2643.55
	(*)	------	CLAMP, electrical: cable; 15/16″ lg x ½″ wd; Commercial Plastics Co part #CPC–742–6.	For ⅜-inch cable	2Z2642.434
		(*)	CLAMP, electrical: cable; ⅞″ lg x ⅜″ wd; Tinnerman Prod type #A3049A–7.	For 7/16-inch cable	2Z2642.496
		(*)	CLAMP, electrical: cable; 1″ lg x 1 1/16″ wd; Tinnerman Prod type #A3049A–8.	For ½-inch cable	2Z2643.53
	(*)	------	CLAMP, electrical: cable; 1 1/16″ lg x ½″ wd; Commercial Plastics Co part #CPC–742–8.	For ½-inch cable	2Z2642–447
	(*)	------	CLAMP, electrical: 1 9/16″ wd x 2 3/16″ lg x 1 1/16″ h; Times Facsimile Co part #3T hat.	Tube retainer for V306	2Z2712.228
	(*)	------	CLAMP, electrical: 1⅞″ wd x 2 7/16″ lg x ¾″ h; Times Facsimile Co part #4T hat.	Tube retainer for V301	2Z7780–152
L301, L302	(*)	(*)	COIL, telephone retardation: single wnd; HS metal case; 3 11/32″ lg x 2 9/16″ wd x 4⅜″ h; Chi Trans part #14305.	L301: Filter choke for +275-volt supply. L302: Filter choke for −150-volt supply.	3C1988–88
	(*)	(*)	CONDUIT, electrical: ½″ size; Amphenol type #9733–6.	For electrical shielding of external cabling.	6Z2252.5
	(*)	(*)	CONDUIT FITTING: 15/16″ open ID, ⅜″ closed ID; screw connection one end, 1 7/16–18 NEF thd connection other end; 1 5/16″ lg x 1⅞″ max dia; AN type #AN–3057–16.	Conduit coupling	2Z2646.15.
P401	(*)	(*)	CONNECTOR, plug: 2 rd male cont, pol; 90° angle type; 2⅛″ lg x 1 25/32″ wd x 1⅛″ dia shell; AN type #AN–3108A–14S–9P.	For installation of external circuit for receiver disabling purposes.	2Z3022–2.
J401	(*)	(*)	CONNECTOR, receptacle: 2 rd female cont, pol; straight type; 1¾″ lg x 1 3/16″ wd x 1 3/16″ h; AN type #AN–3102A–14S–9S.	Connection for external receiver disabling circuit.	2Z3063–8.

Ref symbol	Model		Name of part and description	Function of part	Signal Corps stock No.
	PP-712	PP-712A			
J402, J403	(*)	(*)	CONNECTOR, receptacle: 3 rd female cont, pol; straight type; 1 1/16" lg x 1 3/16" wd x 1 3/16" h; AN type #AN-3102A-14S-1S.	D-c output connectors for A and B receiver disabling relays.	2Z8673.20.
J404	(*)	(*)	CONNECTOR, receptacle: Socket SO-231; 4 rd female cont, pol; straight type; 1 1/16" lg x 1 13/16" wd x 1 13/16" h; AN type #AN-3102A-14S-2S.	Connection to control circuit for FS hand keying and receiver-disabling control.	2Z8799-231.
J301	(*)	(*)	CONNECTOR, receptacle: 14 rd female cont, pol; straight type; 2 5/16" lg x 2" wd x 2" h; AN type #AN-3100A-28-2S.	Receives P107 from converter unit.	2Z8684-9.
P405	(*)	(*)	CONNECTOR, receptacle: 14 rd male cont, pol; straight type; 2 3/16" lg x 1 1/2" wd x 1 1/2" h; AN type AN-3100B-20-27P.	Interconnection between tone oscillator and power supply sections.	2ZK7130.7.
	(*)	(*)	COVER, electrical relay: steel; 4 17/64" lg x 1 3/8" wd x 1 21/32" d; WECo spec #D-162264-3.	Protective cover for relay K401.	4Z3504.
	(*)	(*)	FASTENER, Dzus: c/o fastener, grommet, and spring; 1 9/16" lg x 9/16" wd x 5/8" h; Hallicrafters part/dwg #41X16527.	For hinged front panel cover.	6Z3809-30.
	(*)	(*)	FERRULE: .573" OD x 7/16" thk o/a; AN spec #AN-3050-6.	Terminates flexible conduit at connector shell.	6ZK3821-5.
	(*)	(*)	FERRULE: 1.105" OD x 7/16" thk; Breeze #11-4-6.	Terminates flexible conduit at connector shell.	6ZK3821-2.
	(*)	(*)	FITTING, conduit: 3/4"-20 thd; 7/16" lg x 21/32" OD; Amphenol #AN-3054-6.	Coupling nut for 3/8-inch conduit.	6Z7249-5.
	(*)	(*)	FITTING, conduit: 1 3/16"-18 thd; 7/8" lg x 1 5/16" OD; Amphenol #AN-3054-12.	Coupling nut for 3/4-inch conduit.	6ZK7249-11.
F301, F302	(*)	(*)	FUSE FU-37: 3 amp; 9/32" dia x 1 1/4" lg o/a; Littelfuse part #413003.	A-c line fuses	3Z1937-37.
F401	(*)	(*)	FUSE FU-64: 1 amp; 9/32" dia x 1 1/4" lg o/a; Littelfuse part #413001.	Overload protection for disabling relay power source.	3Z1964
X309, X310, X311, X402.	(*)	(*)	FUSE POST FU-39: extractor post type; for 9/32" dia x 1 1/4" lg fuses; 3/4" dia x 2 3/8" lg; Buss type #HCM.	X309: Retainer for fuse F301. X310: Retainer for fuse F302. X311: Retainer for spare fuse. X402: Retainer for fuse F401.	3Z1939
	(*)	(*)	HOLDER, door: steel; two 3 9/16" lg arms; Amer Cabt Hdwe part #3202 C Left Hand.	Front panel door fall support.	
I301, I302	(*)	(*)	LAMP LM-52: 6 to 8 v, .15 amp; miniature bayonet base, GE type #47.	I301: Indicator lamp for AC SUPPLY ON switch. I302: Indicator lamp for PLATE ON switch.	2Z5952
	(*)	(*)	LENS, indicator light: red; 3/8" dia; 1 1/4" lg x .828" dia; Dialco type #DP-H red.	Indicator light lens of the polaroid-dimmer type.	2Z5991-83
	(*)	(*)	LENS, indicator light: white; 3/8" dia; 1 1/4" lg x .828" dia; Dialco type #DP-H.	Indicator light lens of the polaroid-dimmer type.	2Z5991-79

Ref symbol	Model		Name of part and description	Function of part	Signal Corps stock No.
	PP-712	PP-712A			
X308	(*)	(*)	LIGHT, indicator: w/red lens; for miniature bayonet base, T-3-1/4 lamp; 2⅜" lg x 15/16" dia; Dialco type #932210-111.	Houses indicator lamp for PLATE ON switch.	2Z5991-81
X307	(*)	(*)	LIGHT, indicator: w/white lens; for miniature bayonet base, T-3-1/4 lamp; 2⅜" lg x 15/16" dia; Dialco type #932210-117.	Houses indicator lamp for AC SUPPLY ON switch.	2Z5991-81
	(*)	(*)	OVERLAY, marking: aluminum; flat rectangular; 13/16" lg x 6 13/16" wd x .04" thk; Hallicrafters part #70265.	Front panel overlay	
	(*)	------	POST, supporting: 3¼" lg x. 164" dia; Times Facsimile part #32.	For supporting tube clamp	2Z7259-85
	(*)	------	POST, supporting: 4⅞" lg x .164" dia; Times Facsimile part #52.	For supporting tube clamp	2Z7259-120
CR401	(*)	(*)	RECTIFIER, METALLIC: selenium; input 36 v rms single ph; output 20 v DC, .5 amp; 2 1/16" lg x 2 1/16" wd x 3 13/16" h; WECo spec #KS-13126.	Full-wave bridge rectifier in disabling relay power supply.	3H4860-46
K401	(*)	(*)	RELAY, ARMATURE: 1A1C, 1A1C; single wnd, 48 v DC, .018 amp, 700 ohm resistance; 4 17/32" lg x 1 7/16" wd x 1 3/16" h; WECo type #U6030 per spec D-161984.	Receiver disabling control	2Z7589-145
R407, R408, R411, R412.	(*)	(*)	RESISTOR, fixed: WW; 160 ohm ±5%; 2 w; JAN type RW55J161.	Current limiting resistances in receiver disabling relay circuit.	3RW19516
R301	(*)	(*)	RESISTOR, fixed: comp; 220 ohm ±10%; 2w; JAN type RC42BE221K.	—400-volt supply filter	3RC42BE221K
R410	(*)	(*)	RESISTOR, fixed: comp; 560 ohm ±10%; 1 w; JAN type RC30BF561K.	Disabling-relay power-supply bleeder.	3RC30BF561K
R313	(*)	(*)	RESISTOR, fixed: comp; 680 ohm ±10%; ½ w; JAN type RC20BF681K.	Part of voltage divider circuit for control tube V305.	3RC20BF681K
R318 through R321.	(*)	(*)	RESISTOR, fixed: comp; 1200 ohm ±10%; 2 w; JAN type RC42BE122K.	Bypass portion of load current around regulator tube V304.	3RC42BE122K
R314	(*)	(*)	RESISTOR, fixed: comp; 1500 ohms ±10%; ½ w; JAN type RC20BF152K.	Part of grid voltage-divider circuit for control tube V305.	3RC20BF152K
R315	(*)	(*)	RESISTOR, fixed: comp; 2200 ohms ±10%; ½ w; JAN type RC20BF222K.	Part of grid voltage-divider circuit for control tube V305.	3RC20BF222K
R302	(*)	(*)	RESISTOR, fixed: comp; 2200 ohms ±10%; 2 w; JAN type RC42BE222K.	Filter for —400-volt supply	3RC42BE222K
R306	(*)	(*)	RESISTOR, fixed: comp; 2700 ohms ±10%; 2 w; JAN type RC42BE272J.	Current limiting, V306	3RC42BE272J
R303, R304, R305.	(*)	(*)	RESISTOR, fixed: comp; 3300 ohms ±10%; 2 w; JAN type RC42BE332K.	Current limiting, V306	3RC42BE332K
R409	(*)	(*)	RESISTOR, fixed: WW; 4000 ohms ±5%; 10 w; JAN type RW56J402.	Limits current through receiver-disabling control relay.	3RW27925
R312, R316	(*)	(*)	RESISTOR, fixed: comp; 4700 ohms ±10%; ½ w; JAN type RC20BF472K.	Parts of grid voltage divider circuit for control tube V305.	3RC20BF472K
R403, R404	(*)	(*)	RESISTOR, fixed: comp; 10,000 ohms ±10%; ½ w; JAN type RC20BF103K.	Parts of plate load and output filter for V401.	3RC20BE103K
R310	(*)	(*)	RESISTOR, fixed: comp; 22,000 ohms ±10%; 2w; JAN type RC42BE223K.	Part of screen voltage divider for V305.	3RC42BE223K

Ref symbol	Model		Name of part and description	Function of part	Signal Corps stock No.
	PP-712	PP-712A			
R405, R406	(*)	(*)	RESISTOR, fixed: comp; 27,000 ohms ±10%; ½ w; JAN type RC20BF273K.	R405: D-c grid return resistor (V401, triode terminals 1–2–3). R406: D-c grid return resistor (V401, triode terminals 4–5–6).	3RC20BF273K
R309	(*)	(*)	RESISTOR, fixed: comp; 27,000 ohms ±10%; 2 w; JAN type RC42BE273K.	Part of screen voltage divider for V305.	3RC42BE273K
R307	(*)	(*)	RESISTOR, fixed: comp; 33,000 ohms ±10%; 1 w; JAN type RC30BF333K.	Bleader, resistor for −150-volt supply.	3RC30BF333K
R311, R317	(*)	(*)	RESISTOR, fixed: comp; 47,000 ohms ±10%; 1 w; JAN type RC30BF473K.	Part of grid voltage-divider circuit for control tube V305.	3RC30BF473K
R401, R402	(*)	(*)	RESISTOR, fixed: comp; 100,000 ohms ±10%; 1 w; JAN type RC30BF104K.	R401: Plate load of V401 (triode terminals 1–2–3). R402: Plate load of V401 (triode terminals 4–5–6).	3RC30BF104K
R308	(*)	(*)	RESISTOR, fixed: comp; 100,000 ohms ±10%; 2 w; JAN type RC42BE104K.	Plate load for V305	3RC42BE104K
		(*)	RETAINER, electron tube: 2⅜″ lg x 1⅞″ wd x 3⅜″ h; WECo type #D–152558–B.	Retains V306	2Z7780–20
		(*)	RETAINER, electron tube: 2⅝″ lg x 2¼″ wd x 4⅜″ h; WECo type #D–152560.	Retains V301	2Z7780–19
	(*)	(*)	RETAINER, electron tube: 2 mtg posts 3/16″ dia x 3⅝″ lg, mtg ring 1 1/16″ OD; WECo spec #D–152370KK, dwg #BR–16793.	Retains V302 through V305, V401.	2Z7780–84
	(*)	(*)	SCREW, thumb: steel; rd; black; 61/64″ lg o/a Hallicrafters part #73B691.	Front panel fastener	
	(*)	(*)	SHELL, electrical connector: 1 17/32″ lg x 1 1/16″ wd x 25/32″ h; Amphenol type #97–190–6.	Shield for cable	2Z8276–7
X301 through X306, X401.	(*)	(*)	SOCKET, electron tube: octal; one piece saddle mtg; 1 13/16″ lg x 1⅜″ wd x ⅝″ h; JAN type TS101P01.	Sockets for V301 through V306, V401.	2Z8670.33
S301, S302	(*)	(*)	SWITCH, push: SPST; 2⅜″ lg x 1⅝″ h x ¾″ wd; GE type #7460330G4.	Door interlock switches	3Z9824–29.15
S303	(*)	(*)	SWITCH, toggle: DPST: JAN type ST52K.	AC SUPPLY switch	3Z9863–52K
S304	(*)	(*)	SWITCH, toggle: SPST: JAN type ST42A.	PLATE supply switch	3Z9863–42A
T302	(*)	(*)	TRANSFORMER, power: step-down; fil type; input, 105/115/125 v 50/60 cyc single ph; secd #1, 5 v at 2 amp, secd #2, 6.3 v at 2.5 amp, secd #3, 5 v at 2 amp, secd #4, tapped, 5 v at 2 amp between term. 6–7, 6.3 v at 6 amp between term. 5–7; HS metal case; 5 5/16″ lg x 4 19/32″ wd x 3 7/16″ h; Chi Trans spec #14304.	Supplies heater potentials for rectifier tubes and also for the tubes in the frequency shift converter.	2Z9611.423

Ref symbol	Model		Name of part and description	Function of part	Signal Corps stock No.
	PP-712	PP-712A			
T401	(*)	(*)	TRANSFORMER, power: step-down; fil type; 115 v or 230 v 50/60 cyc single ph; secd 24 v at .25 amp tapped at 22 v; HS metal case; 4 9/32" lg x 3 9/32" wd x 2 7/32" h; Chi Trans spec #14306.	Supplies power for operation of disabling relays in receivers.	2Z9607–27
T301	(*)	(*)	TRANSFORMER, power: step-down and step-up; fil and plate type; input, 105/115/125 v 50/60 cyc single ph; secd #1, 6.3 v at 1 amp, secd #2, 460 v at .060 amp CT, secd #3, 760 v at .1 amp CT; HS metal case; 5 5/16" h x 3 7/16" d x 4 19/32" wd; Chi Trans spec #14303.	Provides plate voltage for rectifiers and heater voltage for regulator tube V304.	2Z9613.512
V306	(*)	(*)	TUBE, electron: type OD3	Regulator for −150-volt supply.	2JOD3
V301	(*)	(*)	TUBE, electron: type 5R4WGY	Rectifier for +275-volt supply.	2J5R4WGY
V302, V303	(*)	(*)	TUBE, electron: type 5Y3GT	V302: Rectifier for −150-volt supply. V303: Rectifier for −400-volt supply.	2J5Y3GT
V305	(*)	(*)	TUBE, electron: type 6SJ7Y	Control tube for +150-volt regulated supply.	2J6SJ7Y
V401	(*)	(*)	TUBE, electron: type 6SL7WGT	Relaxation type tone oscillator.	2J6SL7WGT
V304	(*)	(*)	TUBE, electron: type 6V6GTY	Regulator for +150-volt regulated supply.	2J6V6GTY

GLOSSARY

Section I. ABBREVIATIONS

a-c	alternating-current
a-f	audio-frequency
bfo	beat-frequency oscillator
cps	cycles per second
c-w	continuous-wave
cyc	cycles
db	decibels
dbm	decibels referred to 1 milliwatt in 600 ohms
d-c	direct-current
DPDT	double-pole, double-throw
DX	duplex
f-m	frequency-modulated
h-f	high-frequency
h-v	high-voltage
i-f	intermediate-frequency
K	kilo or 1,000
kc	kilocycle
l-f	low-frequency
ma	milliampere
mc	megacycle
mh	millihenry
ms	millisecond
mv	millivolt
mw	milliwatt
pl	plated
r-f	radio-frequency
rms	root mean square
RTT	radioteletype
SD	Solvent, dry-cleaning
SLC	straight line capacity
SOP	standing operating procedure
SPST	single-pole, single-throw
TD	transmitter-distributor
term	terminal
ua	microampere
uf	microfarad
uuf	micromicrofarad
uv	microvolt
v or V	volt
VTVM	vacuum-tube voltmeter
w	watt
wpm	words per minute

Section II. DEFINITIONS

For explanation of the terms used in this manual, refer to TM 11–455, TM 11–499, TM 11–680, and the following list:

Bias distortion. This term is used in relation to the distortion of the square-wave teletypewriter keying signal. If the positive and negative d-c pulses are not of equal length and of square shape, they are said to have bias distortion. See TM 11–680.

Carrier shift keying. An elementary form of frequency modulation in which a c-w signal is shifted in frequency a small number of cycles. One frequency corresponds to key closed and the other frequency to key open.

Current-limiting resistor. A series resistor which will take almost the full voltage drop of the power source if the component with which it is in series drops to a low impedance.

Dot cycles per second. A measure of the equivalent frequency band covered by the keying of teletypewriter code signals.

Decoupling capacitor. A bypass capacitor so placed in a circuit that the a-f or r-f currents of that circuit are prevented from going into the power supply or to another stage on the common voltage supply.

Decoupling resistor. A resistor used in a filter network to prevent the a-f or r-f currents in the network from appearing in the B+ or common voltage supply lead.

Frequency-shift keying. A method of sending c-w signals where one frequency corresponds to key-closed conditions and another, separated by an audio amount, to key-open conditions. Usually the keying is by teletypewriter. (This is similar to carrier shift keying.)

Full DX. An extension circuit that can be operated in both directions simultaneously.

Hypersil core. A special silicon steel transformer core.

Keying polarity. The d-c pulses arriving from a teletypewriter keyboard (or tape transmitter)

are either positive with respect to ground or negative with respect to ground, in neutral keying. This is their polarity.

Lissajous figures. Symmetrical designs on an oscilloscope screen showing the frequency ratio of two applied voltages.

Low-pass filter. An r-f filter circuit which strongly attenuates all frequencies above a certain frequency. Often used for harmonic suppression.

Loop. A closed extension circuit, generally containing one or more teletypewriter components.

Mark. Closed-key condition on a teletypewriter circuit.

Mark frequency. The frequency of the signal emitted by a frequency-shifting oscillator or a transmitter which coresponds to the closed-key condition of the teletypewriter circuit.

Neutral keying. Square-wave d-c pulses which have a single polarity with respect to ground. The individual pulses correspond to the mark contact closures of the associated teletypewriter equipment.

1/2 DX. A series extension circuit that can receive or transmit at one position; cannot do both simultaneously.

Polar keying. A system of d-c keying where pulses of one polarity (with respect to ground) are mark signals (closed-key) and pulses of the opposite polarity are space signals (open-key).

Shift. The number of cycles between the mark and space (closed- and open-key) frequencies.

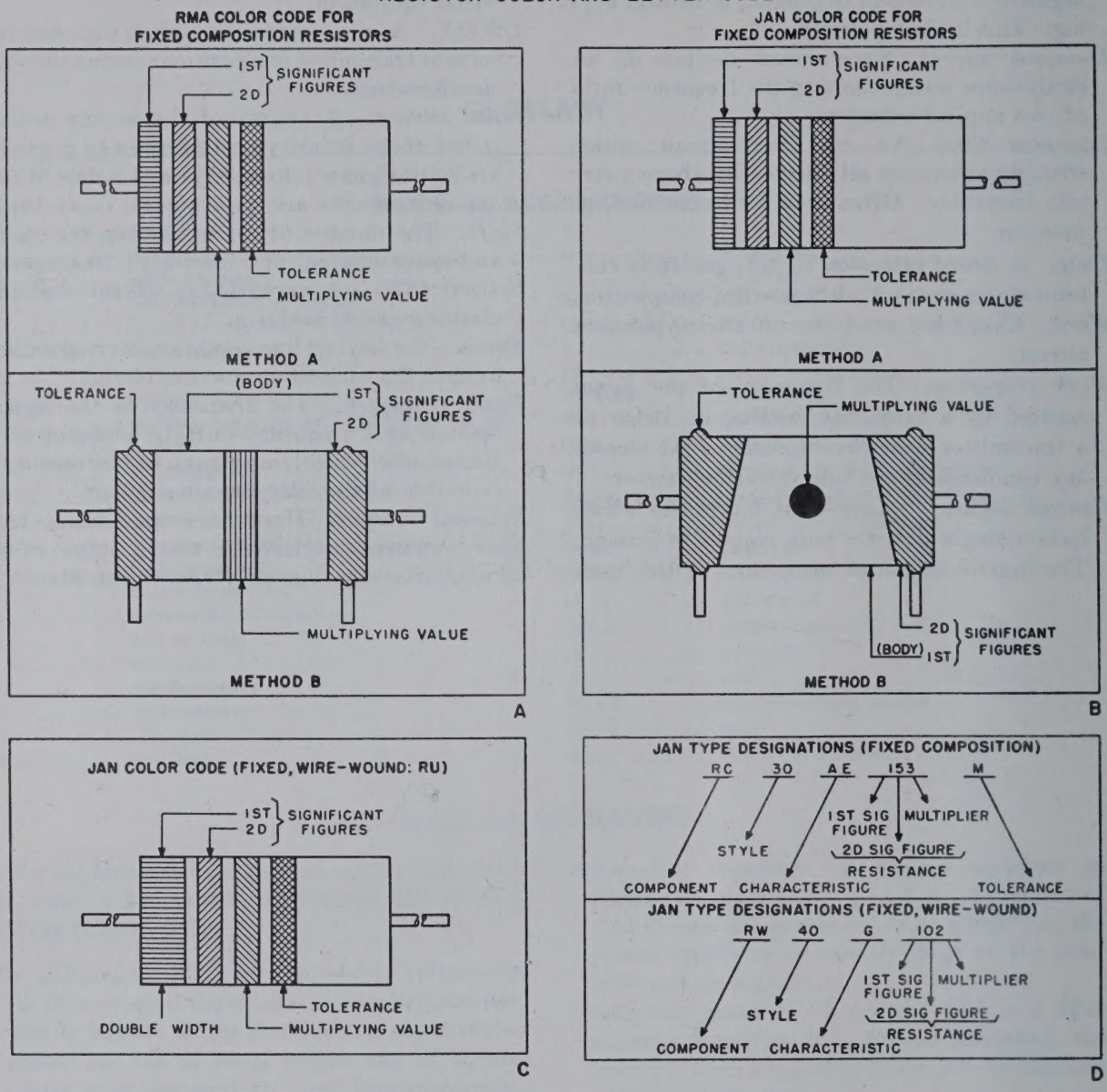
Solvent (SD). A dry-cleaning solvent used for cleaning greasy surfaces.

Space. The keying line condition corresponding to open key on a teletypewriter circuit.

Space frequency. The frequency of the signal emitted by a frequency-shifting oscillator or a transmitter which coresponds to the open-key condition of the teletypewriter circuit.

Spurious output. Harmonics, parasitics, and other undesired frequencies in the r-f output of an r-f oscillator, signal generator, or transmitter.

RESISTOR COLOR AND LETTER CODE



STANDARDS				
COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE	TOLERANCE (%)	JAN LETTER TOLERANCE
BLACK	0	1	—	—
BROWN	1	10	± 1	F
RED	2	100	± 2	G
ORANGE	3	1,000	± 3	—
YELLOW	4	10,000	± 4	—
GREEN	5	100,000	± 5	—
BLUE	6	1,000,000	± 6	—
VIOLET	7	10,000,000	± 7	—
GRAY	8	100,000,000	± 8	—
WHITE	9	1,000,000,000	± 9	—
GOLD	—	0.1	± 5	J
SILVER	—	0.01	±10	K
NO COLOR	—	—	±20	M

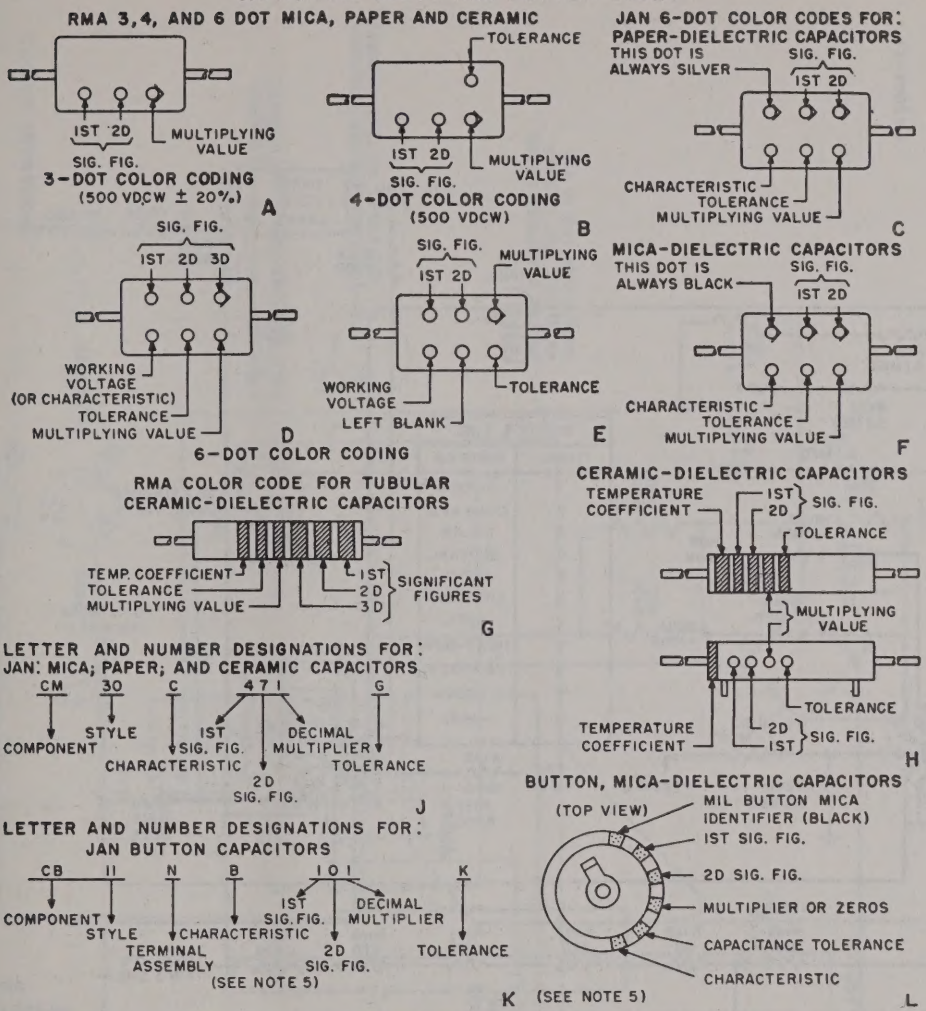
NOTES:

1. RESISTORS WITH AXIAL LEADS ARE INSULATED. RESISTORS WITH RADIAL LEADS ARE NON-INSULATED.
2. RMA: RADIO MANUFACTURERS ASSOCIATION.
3. JAN: JOINT ARMY-NAVY.
4. THESE COLOR AND NUMBER CODES GIVE ALL RESISTANCE VALUES IN OHMS.
5. RESISTIVE COMPONENTS USED FOR LETTER TOLERANCES ARE: RC, RN, AND RU.
6. WATTAGE FOR RW TYPES IS FOUND IN THE JAN SPECIFICATIONS UNDER CHARACTERISTICS.

TM RC

Figure 55. Resistor color and letter code.

CAPACITOR COLOR AND LETTER CODES



- STANDARDS -					JAN MICA-CM		JAN PAPER-CM		JAN CERAMIC-CC					
										CAP. TOL. FOR MORE THAN 10 UUF		CAP. TOL. FOR 10 UUF OR LESS		
COLOR	SIG. FIG.	DECIMAL MULTIPLIER	% TOL.	VDCW	LETTER TOL.	CHARAC-TERISTIC	LETTER TOL.	CHARAC-TERISTIC	DEC. MULT.	%	LETTER DESIG-NATION	UUF	LETTER DESIG-NATION	CHARAC-TERISTIC
BLACK	0	1	±20	500	M	A	M	A	1	±20	M	±2.0	G	C
BROWN	1	10	± 1	100	-	B	-	E	10	± 1	F	-	-	H
RED	2	100	± 2	200	G	C	-	H	100	± 2	G	-	-	L
ORANGE	3	1,000	± 3	300	-	D	N*	J	1,000	-	-	-	-	P
YELLOW	4	10,000	± 4	400	-	E	-	P	-	-	-	-	-	R
GREEN	5	100,000	± 5	500	-	F	-	R	-	± 5	J	±0.5	D	S
BLUE	6	1,000,000	± 6	600	-	G	-	S	-	-	-	-	-	T
VIOLET	7	10,000,000	± 7	700	-	-	-	T	-	-	-	-	-	U
GRAY	8	100,000,000	± 8	800	-	-	-	-	0.01	-	-	±0.25	C	B
WHITE	9	1,000,000,000	± 9	900	-	-	-	-	0.1	± 10	K	±1.0	F	SL
GOLD	-	0.1	± 5	1,000	J	-	-	-	-	-	-	-	-	A
SILVER	-	0.01	±10	2,000	K	-	K	-	-	-	-	-	-	-
NO COLOR	-	-	±20	500	-	-	-	-	-	-	-	-	-	-
*. THE TOLERANCE OF THIS CAPACITOR IS ±30%, NOT ±3%														

NOTES

JAN: JOINT ARMY-NAVY
RMA: RADIO MANUFACTURERS ASSOCIATION

1. THESE COLOR AND LETTER CODES GIVE CAPACITANCES IN MICROMICROFARADS
2. THIS TABLE IS ADAPTED FOR JAN AND RMA COLOR AND JAN LETTER TYPE DESIGNATIONS
3. CERAMIC AND MICA CAPACITORS, BOTH JAN AND RMA, ARE GENERALLY 500 VDCW
4. BUTTON CAPACITORS ARE GENERALLY 300 VDCW
5. READ BUTTON CAPACITOR TOLERANCE UNDER CERAMICS OF MORE THAN 10 UUF
6. CHARACTERISTICS ARE AVAILABLE IN JAN CAPACITOR SPECIFICATION MANUALS
7. THE COMPONENTS USED ABOVE FOR JAN LETTER TYPE DESIGNATIONS ARE:
   CB MICA BUTTON: *CC* CERAMIC; *CM* MICA MOULDED: *CN* PAPER MOULDED

TM CC

Figure 56. Capacitor color and letter code.

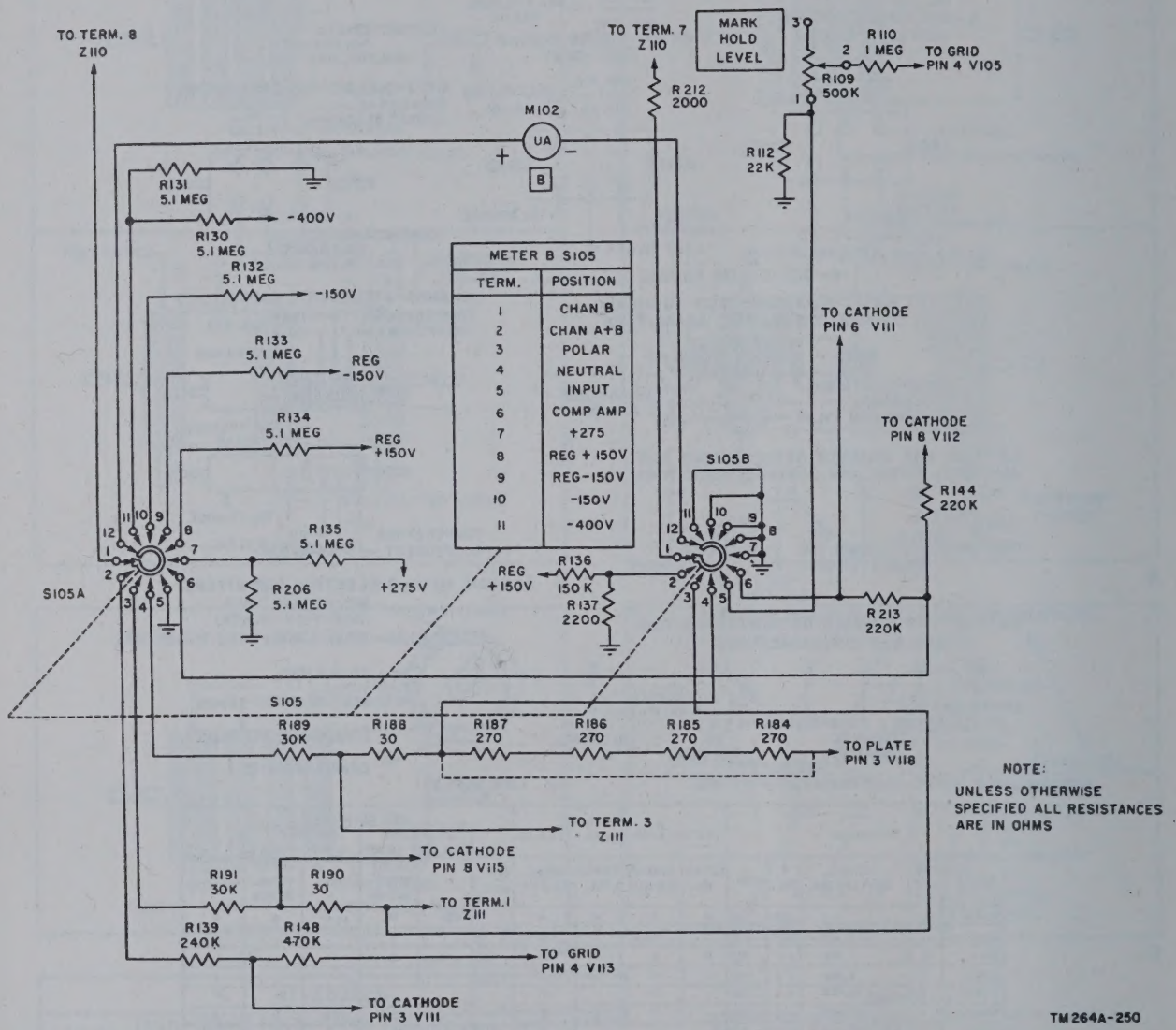


Figure 57. Frequency Shift Converter CV-182(*)/GRC26A, metering circuit.

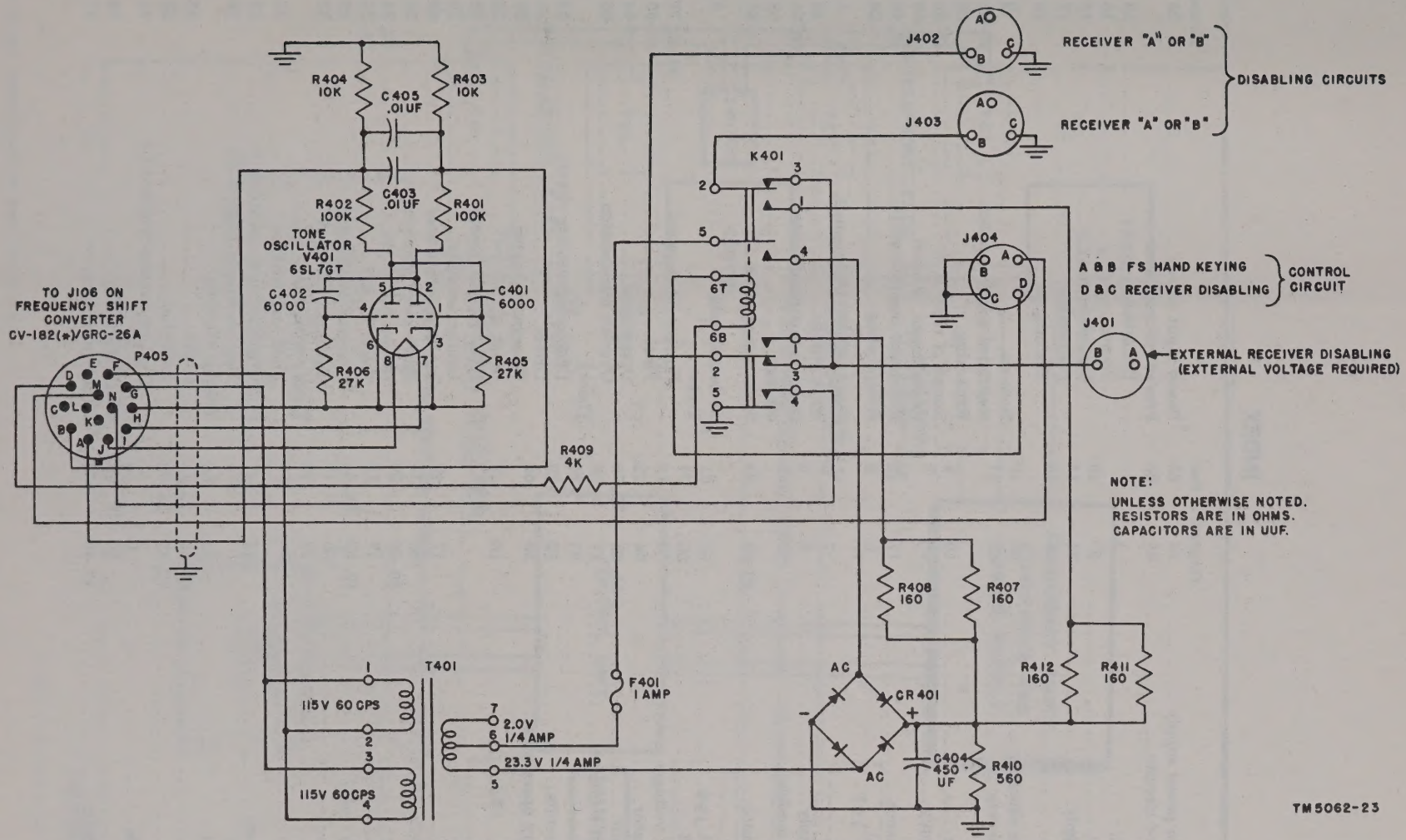
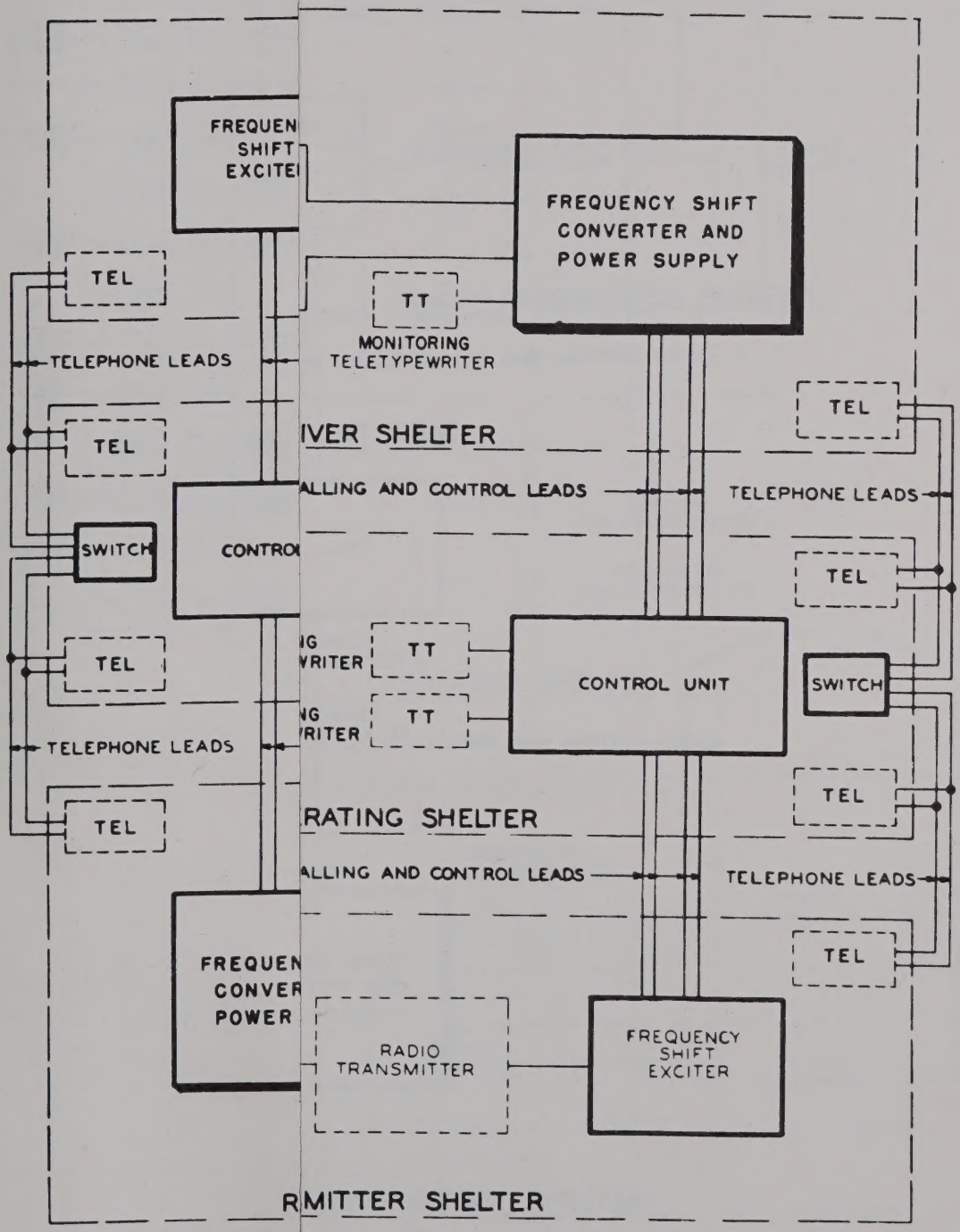


Figure 60. Power Supply PP-712(*)/GRC-26A, toneoscillator schematic diagram.

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Theory:		
Drift-compensating circuit	34	31
Driver	31	25
Emergency keying	39	37
Input circuit (r-f)	28	19
Input circuit (power)	22	14
Limiter amplifier	29	21
Linear discriminator	30	22
Mark-hold circuit	35	33
Output amplifiers	32, 33	28, 30
Power supply	21–25	14
Receiver-disabling	38	36
Tone oscillator	37	35
Tools required for:		
Field maintenance	48	59
Organizational maintenance	12	11
Maintenance of relay K401	49	59
Trouble shooting:		
Chart	45	49
Procedure	40	39
Test equipment required for	41	39
Weatherproofing	19	13
Weekly maintenance	17	12

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Driver	31	25
Emergency keying	39	37
Input circuit (r-f)	28	19
Input circuit (power)	22	14
Limiter amplifier	29	21
Linear discriminator	30	22
Mark-hold circuit	35	33
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Weatherproofing	19	13
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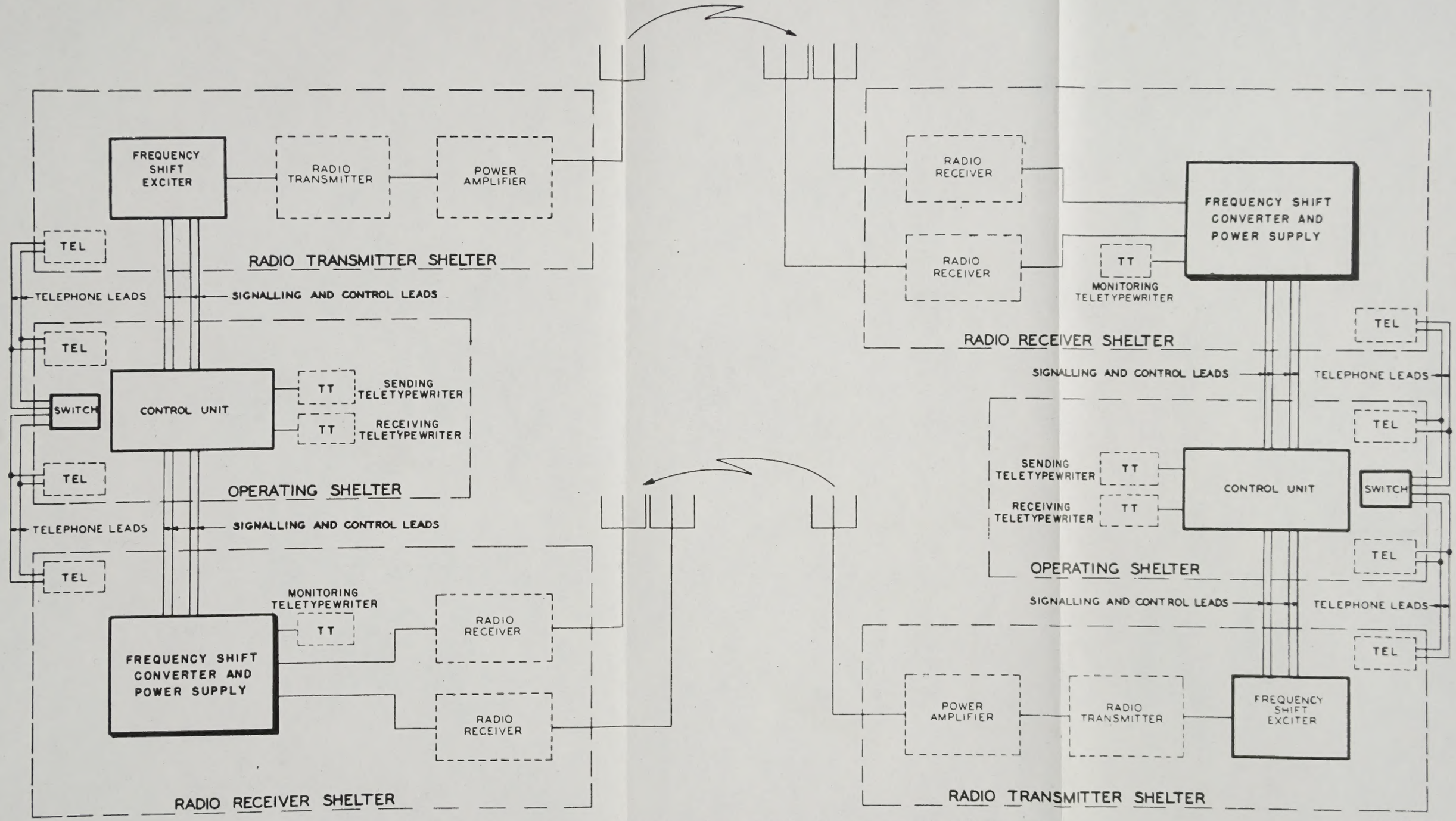
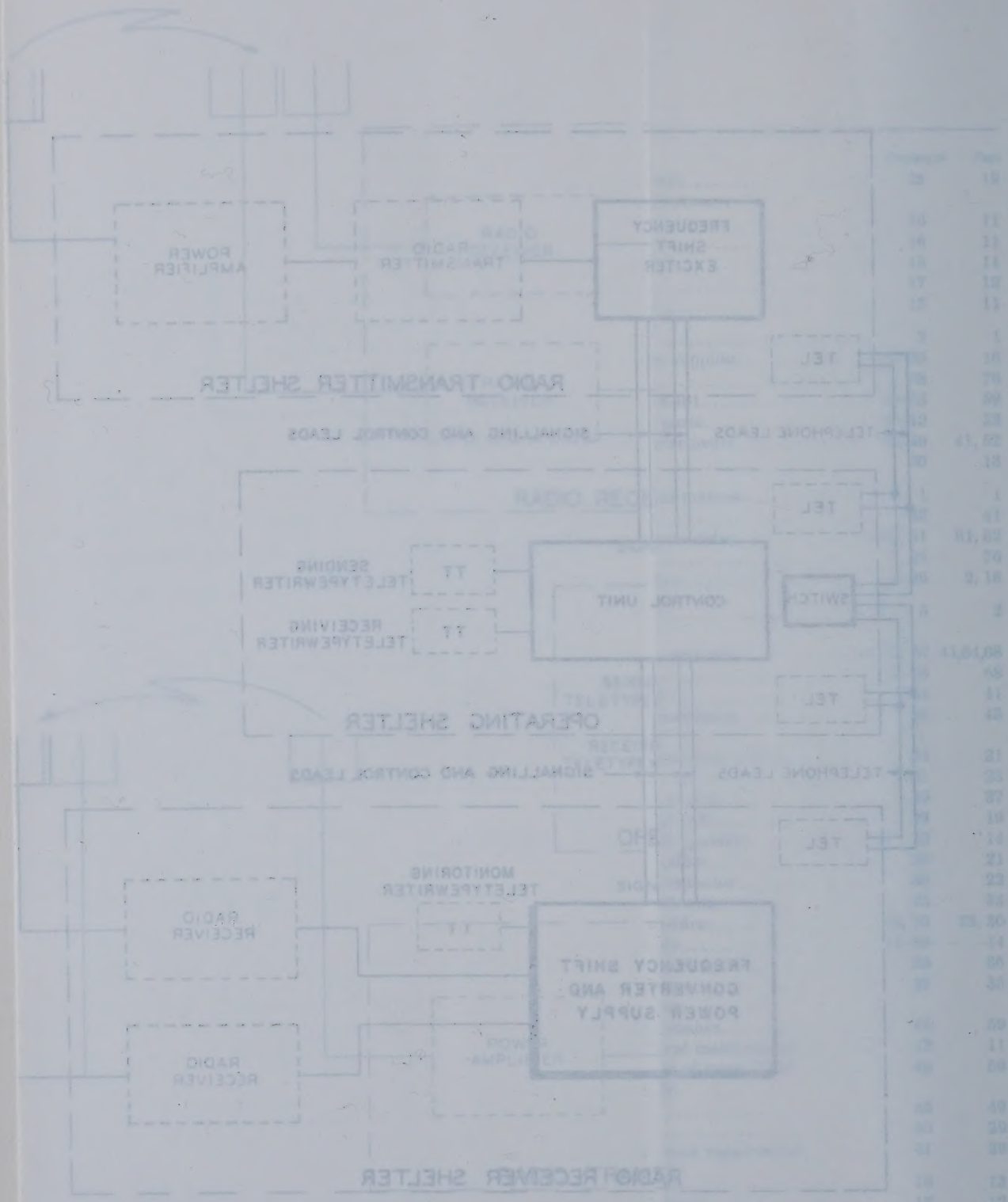
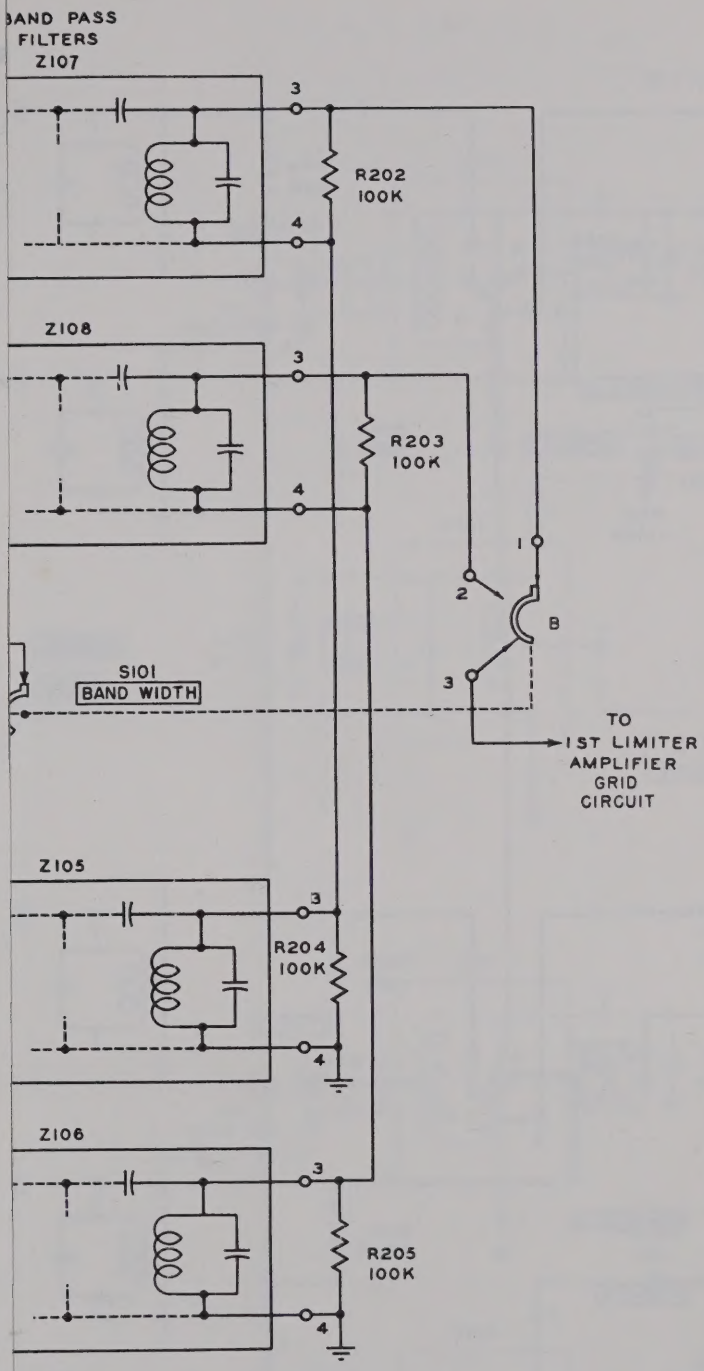


Figure 14. Block diagram of two typical radioteletype Radio Set AN/GRC-26A terminals arranged for full-duplex operation

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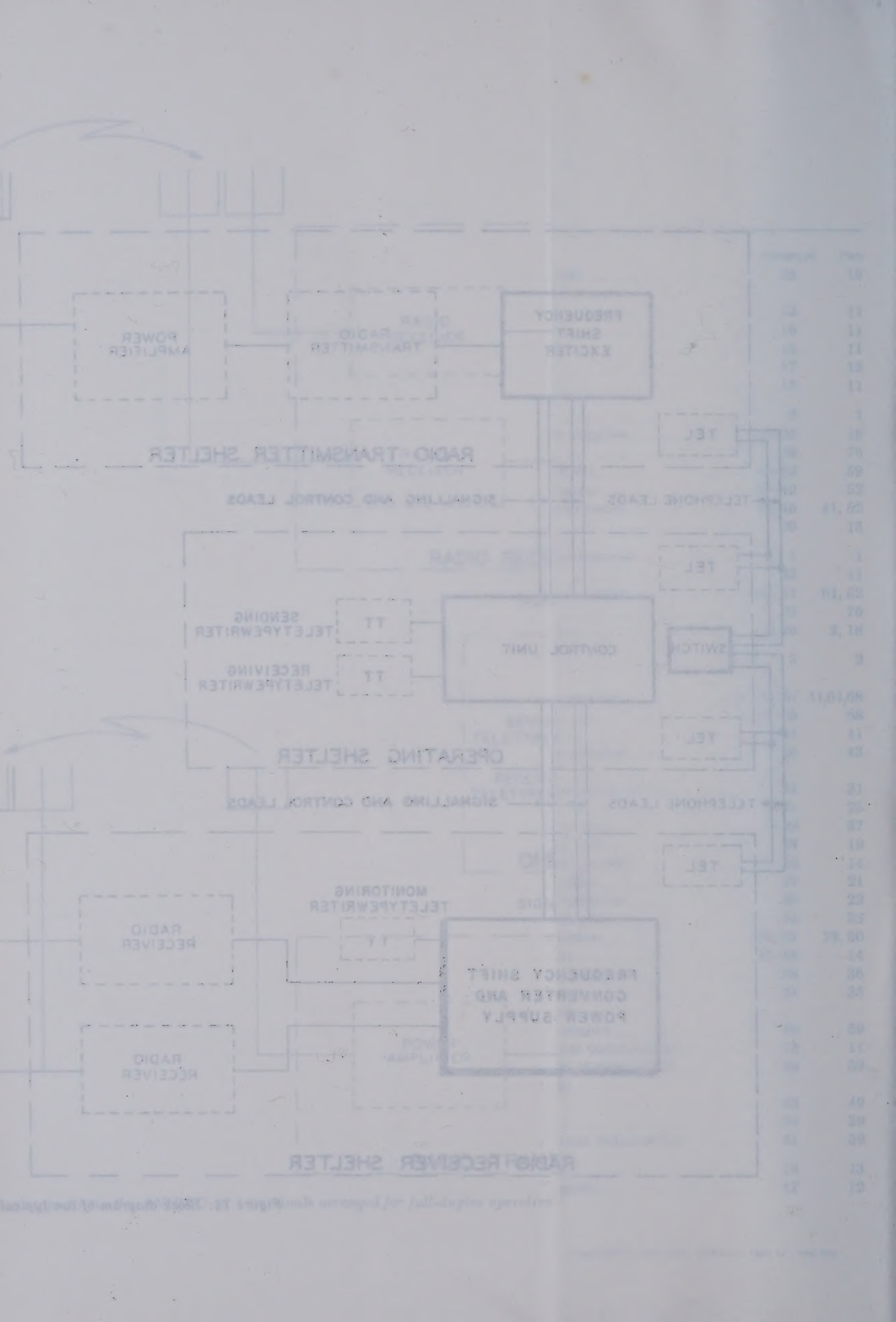

POWER AMPLIFIER
RADIO TRANSMITTER
FREQUENCY SHIFT EXCITER
TEL
RADIO TRANSMITTER SHELTER
SIGNALLING AND CONTROL LEADS
TELEPHONE LEADS
SENDING TELETYPEWRITER
TT
RECEIVING TELETYPEWRITER
TT
CONTROL UNIT
SWITCH
OPERATING SHELTER
MONITORING TELETYPEWRITER
RADIO RECEIVER
RADIO RECEIVER
FREQUENCY SHIFT CONVERTER AND POWER SUPPLY
RADIO RECEIVER SHELTER

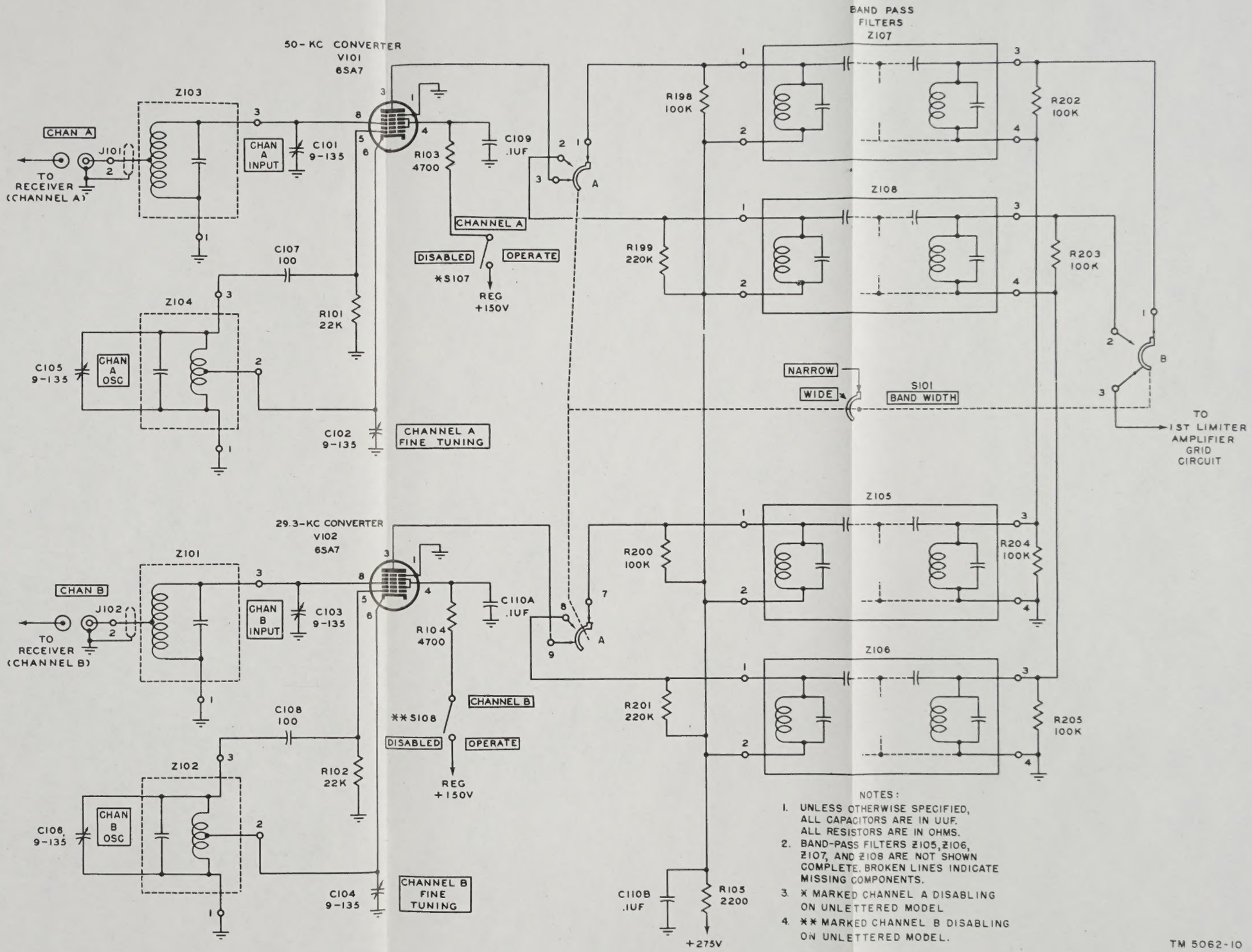


NOTES:

)THERWISE SPECIFIED,
CITORS ARE IN UUF.
STORS ARE IN OHMS.
S FILTERS Z105, Z106,
) Z108 ARE NOT SHOWN
E. BROKEN LINES INDICATE
COMPONENTS.
D CHANNEL A DISABLING
TTERED MODEL
ED CHANNEL B DISABLING
TTERED MODEL.

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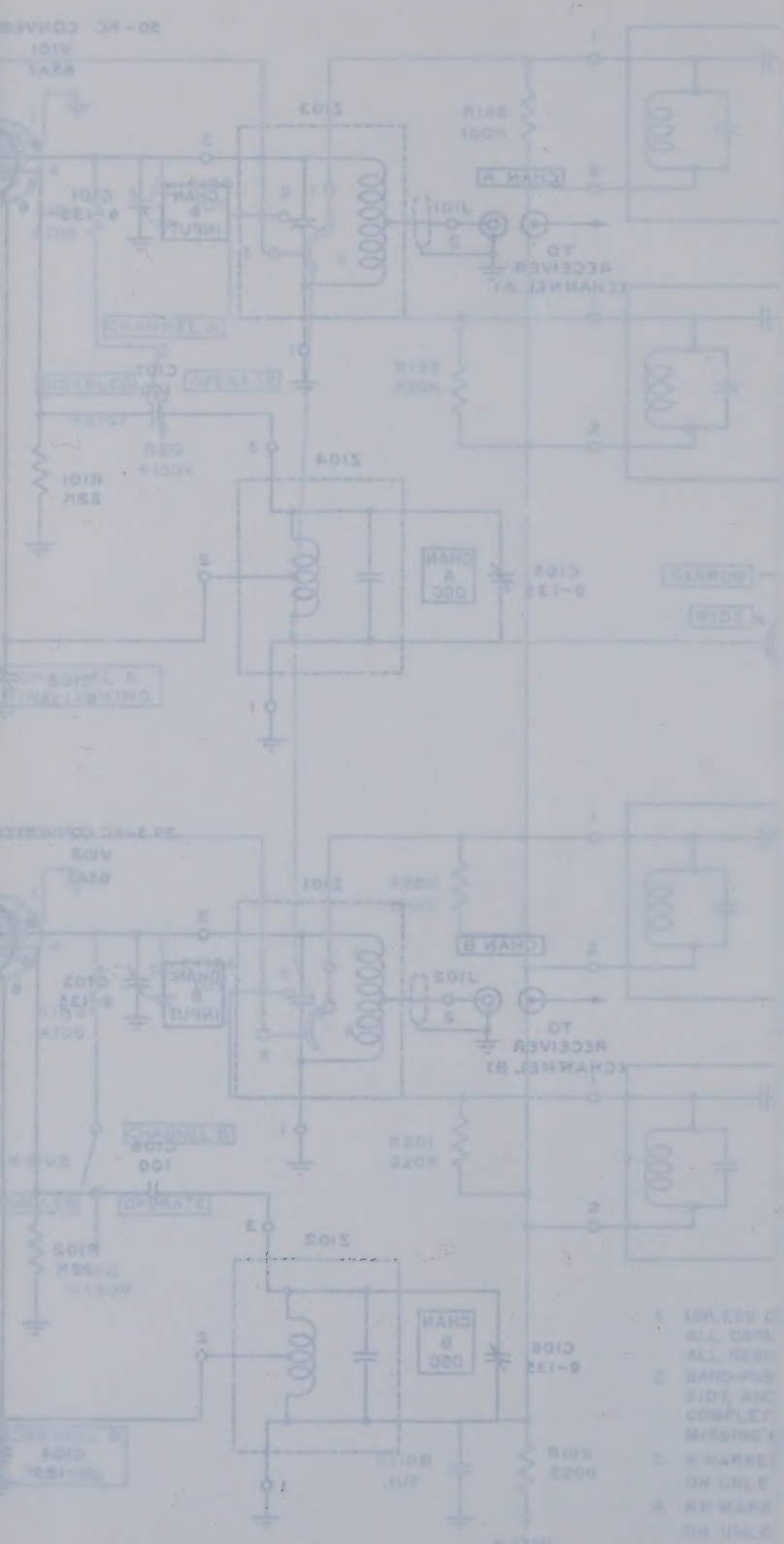


NOTES:

1. UNLESS OTHERWISE SPECIFIED, ALL CAPACITORS ARE IN UUF. ALL RESISTORS ARE IN OHMS.
2. BAND-PASS FILTERS Z105, Z106, Z107, AND Z108 ARE NOT SHOWN COMPLETE. BROKEN LINES INDICATE MISSING COMPONENTS.
3. * MARKED CHANNEL A DISABLING ON UNLETTERED MODEL
4. ** MARKED CHANNEL B DISABLING ON UNLETTERED MODEL.

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Figure 16. Converter input circuit, functional schematic diagram.



REFER TO TEXT BEFORE MAKING VOLTAGE OR RESISTANCE MEASUREMENTS.

POWER SUPPLY CONNECTED TO FREQUENCY SHIFT CONVERTER AND TONE OSCILLATOR FOR ALL MEASUREMENTS.

20,000 OHM PER VOLT METER USED FOR VOLTAGE MEASUREMENTS. USE HIGHER RANGES TO PREVENT CIRCUIT LOADING.

ALL MEASUREMENTS MADE FROM GROUND UNLESS OTHERWISE INDICATED.

DO NOT ATTEMPT TO MAKE RESISTANCE MEASUREMENTS WITHOUT FIRST DISCONNECTING THE AC LINE AT THE FREQUENCY SHIFT CONVERTER.

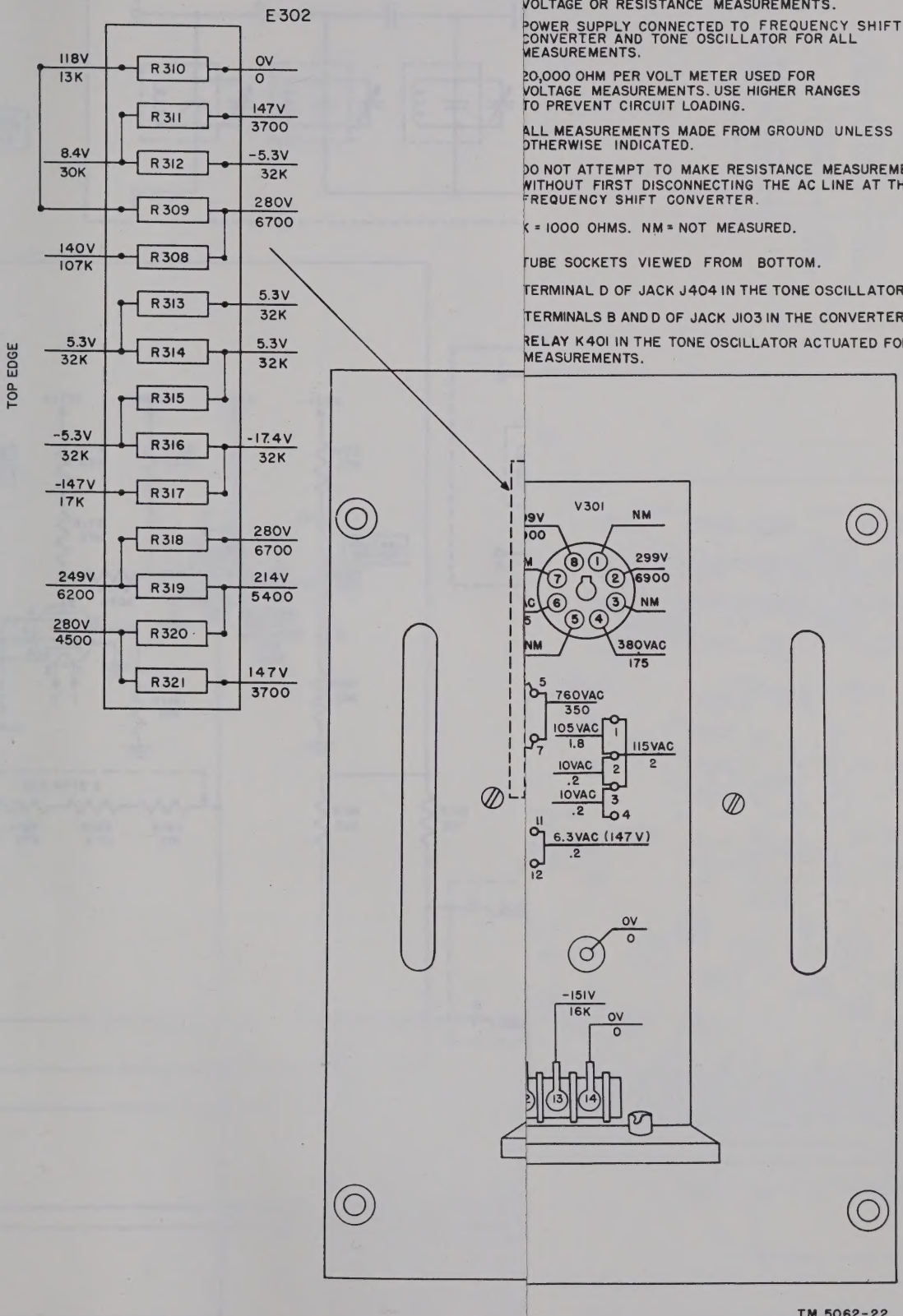
K = 1000 OHMS. NM = NOT MEASURED.

TUBE SOCKETS VIEWED FROM BOTTOM.

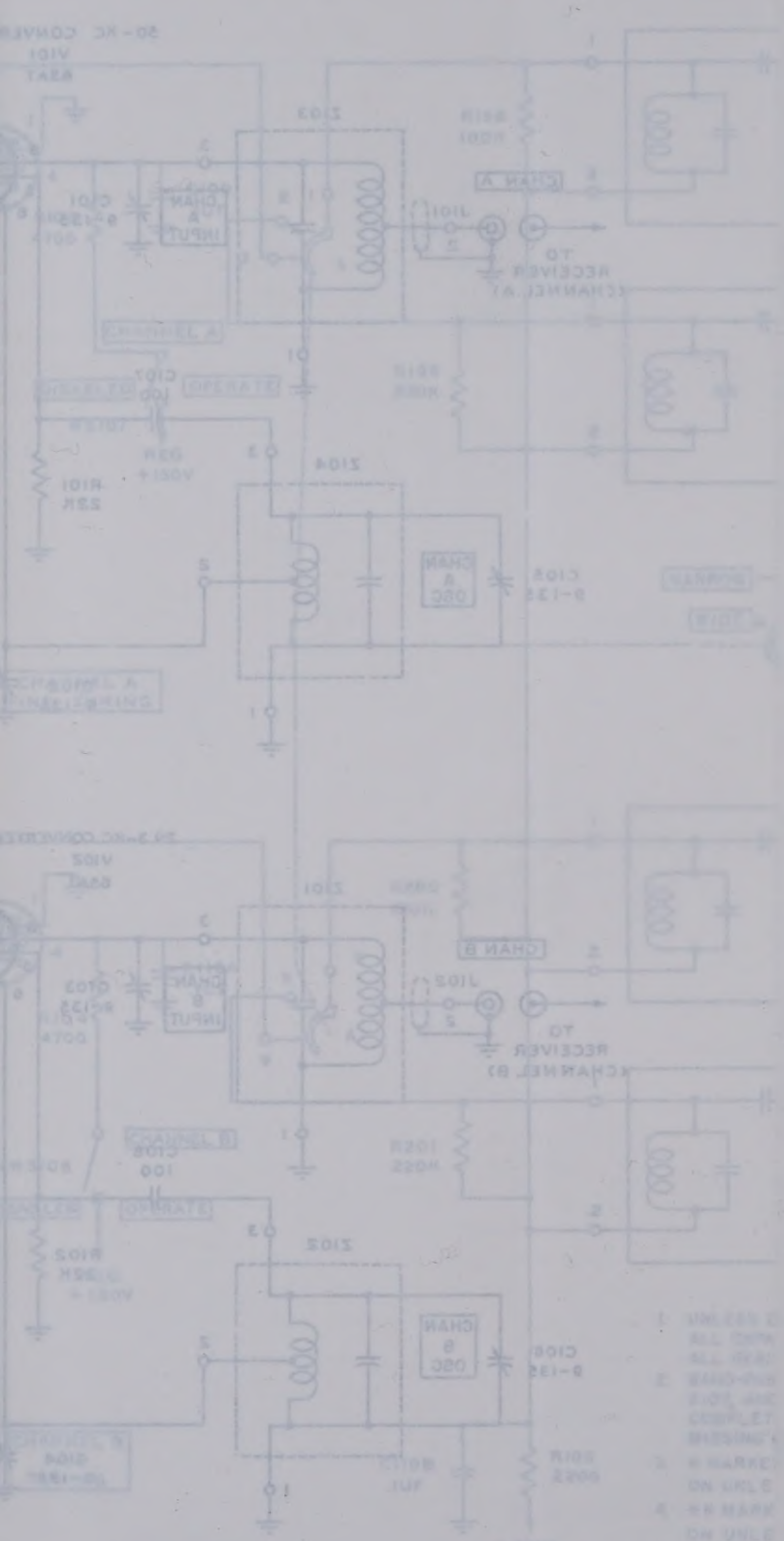
TERMINAL D OF JACK J404 IN THE TONE OSCILLATOR GROUNDED.

TERMINALS B AND D OF JACK J103 IN THE CONVERTER GROUNDED.

RELAY K401 IN THE TONE OSCILLATOR ACTUATED FOR VOLTAGE MEASUREMENTS.



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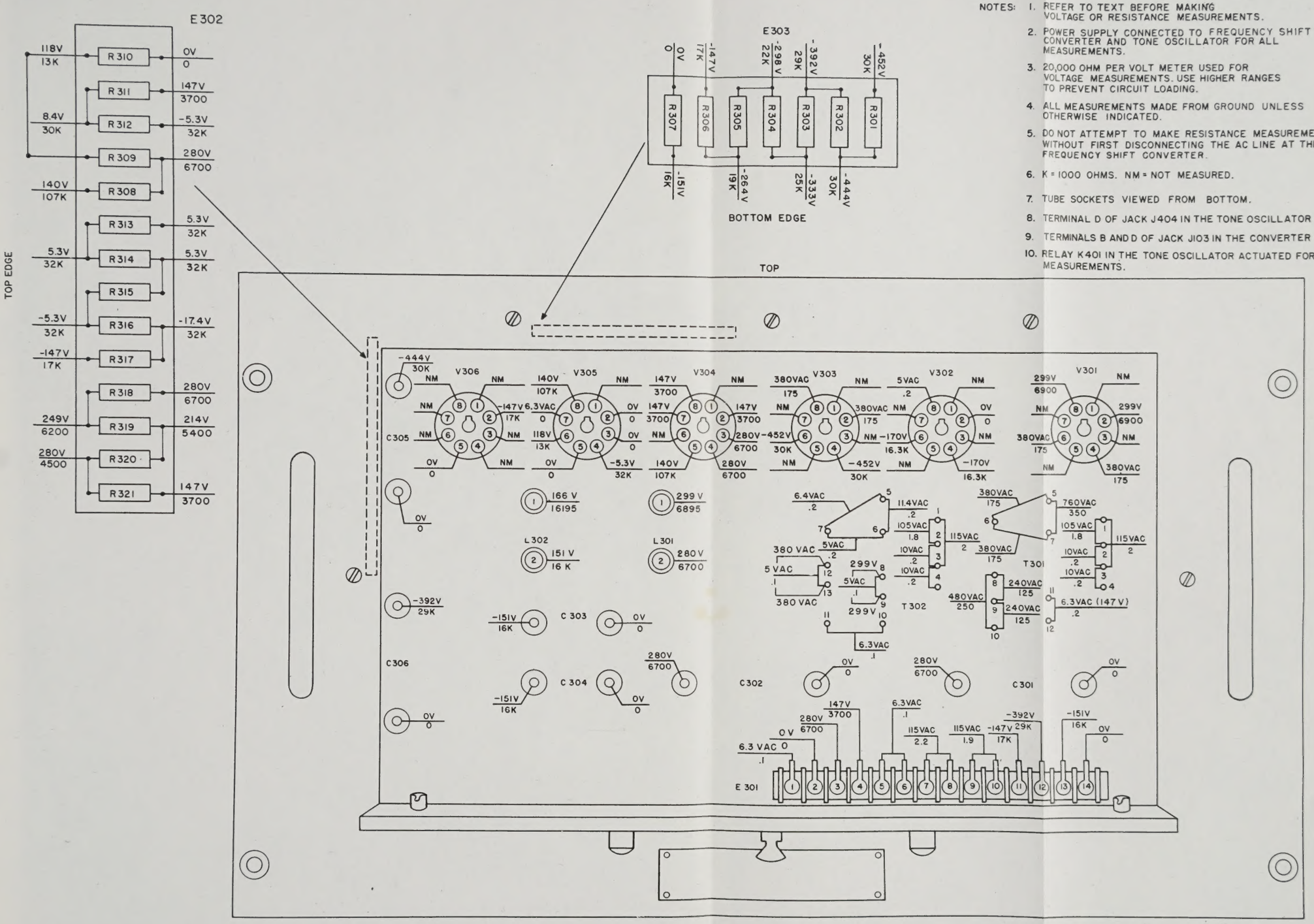
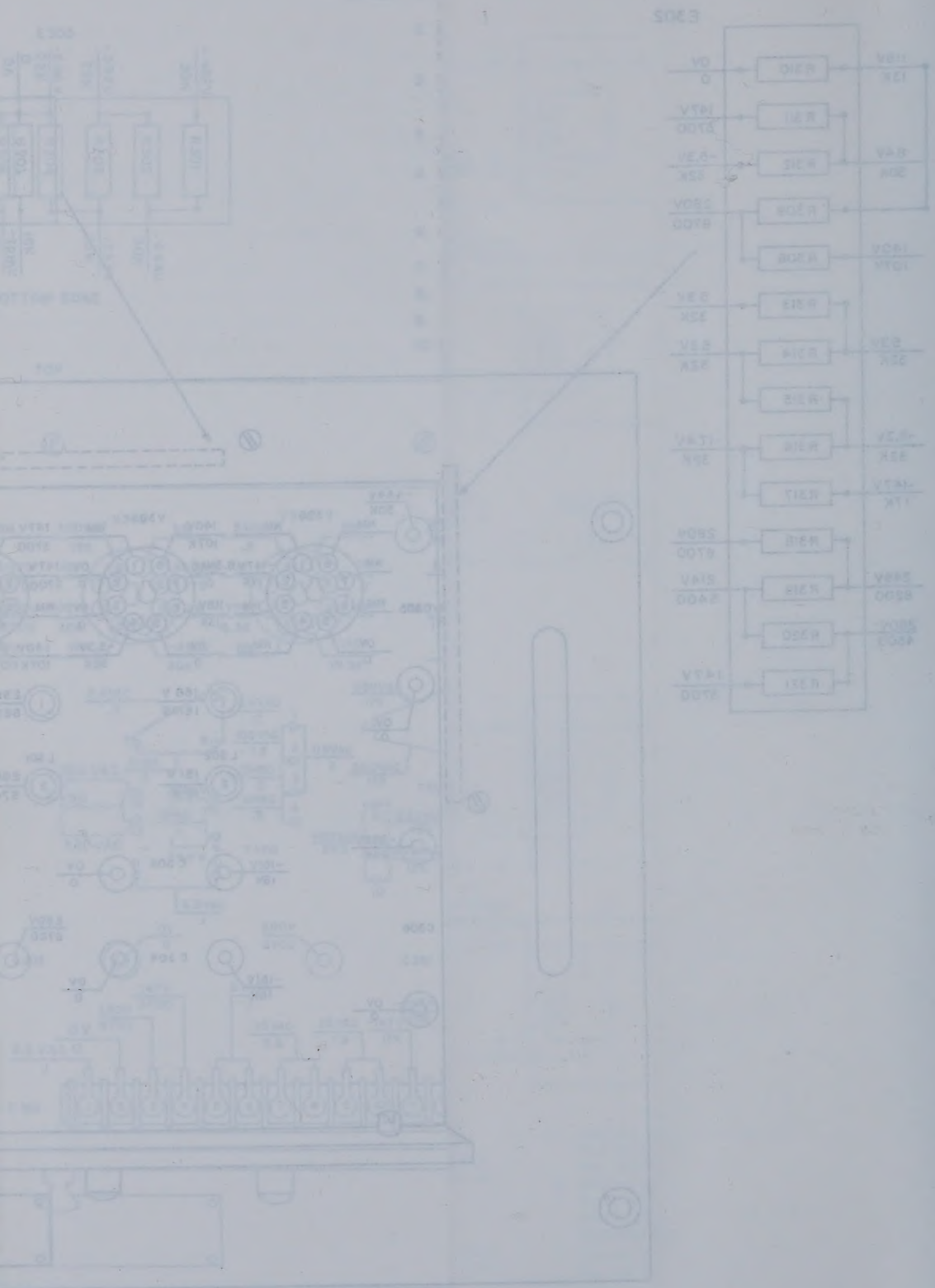
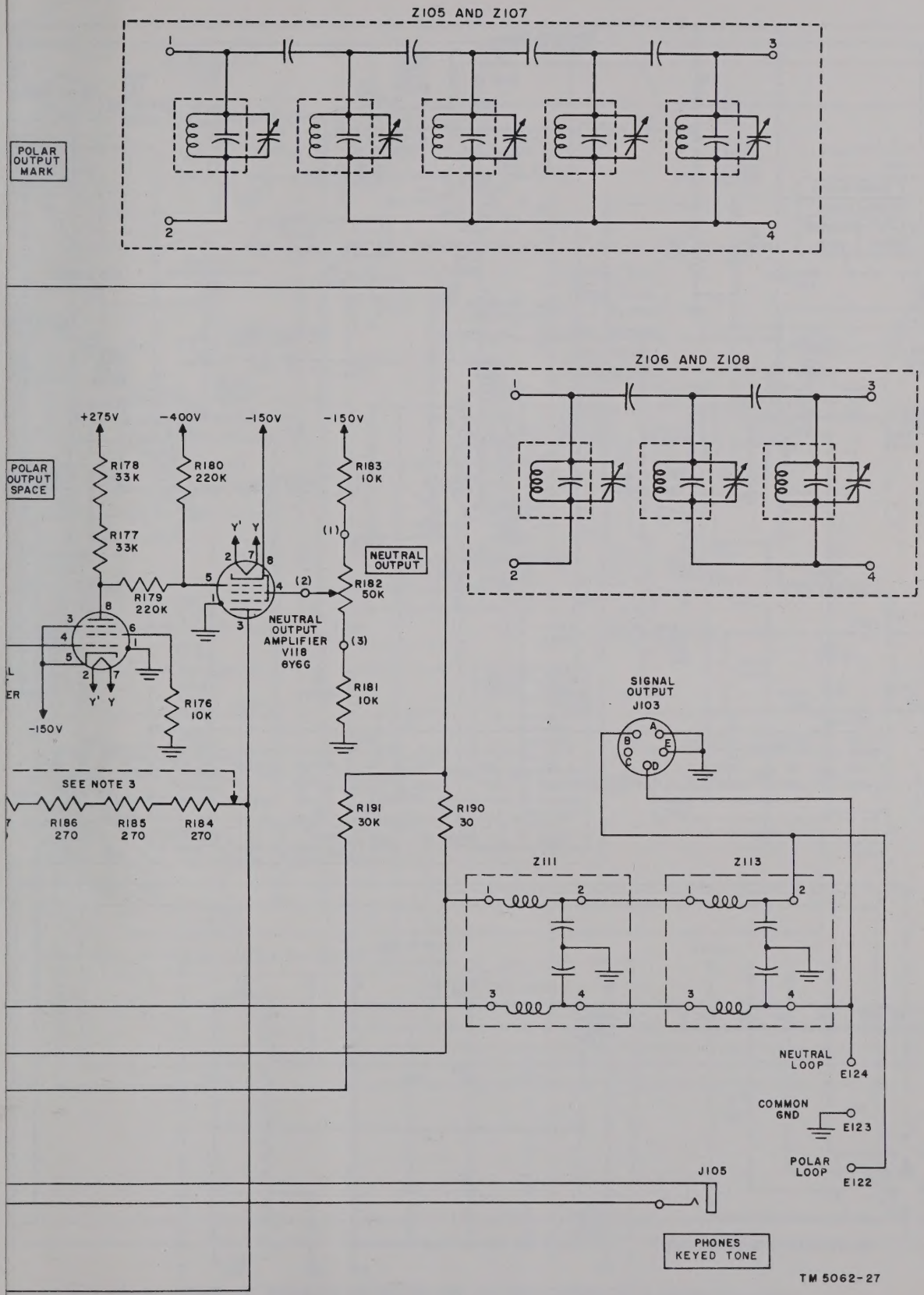
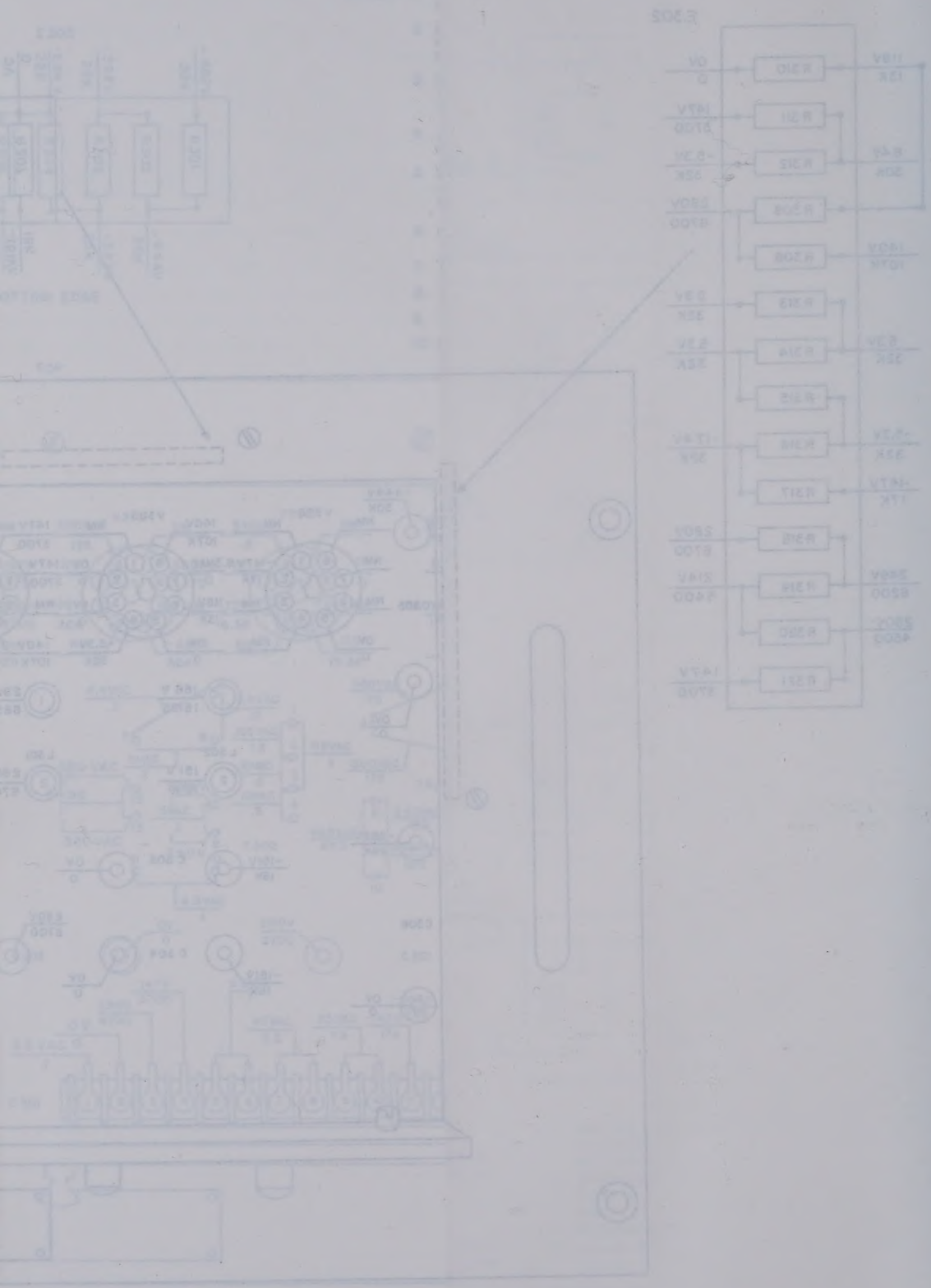


Figure 37. Power Supply PP-712(*)/GRC-26A, socket voltage and resistance measurements.

TM 5062-22




Z105 AND Z107
POLAR OUTPUT MARK
Z106 AND Z108
+275V
-400V
-150V
-150V
POLAR OUTPUT SPACE
R178 33K
R180 220K
R183 10K
R177 33K
R179 220K
R182 50K
NEUTRAL OUTPUT
NEUTRAL OUTPUT AMPLIFIER V118 6Y6G
R176 10K
R181 10K
-150V
SEE NOTE 3
R186 270
R185 270
R184 270
R191 30K
R190 30
SIGNAL OUTPUT J103
Z111
Z113
NEUTRAL LOOP
E124
COMMON GND
E123
POLAR LOOP
E122
J105
PHONES KEYED TONE
TM 5062-27



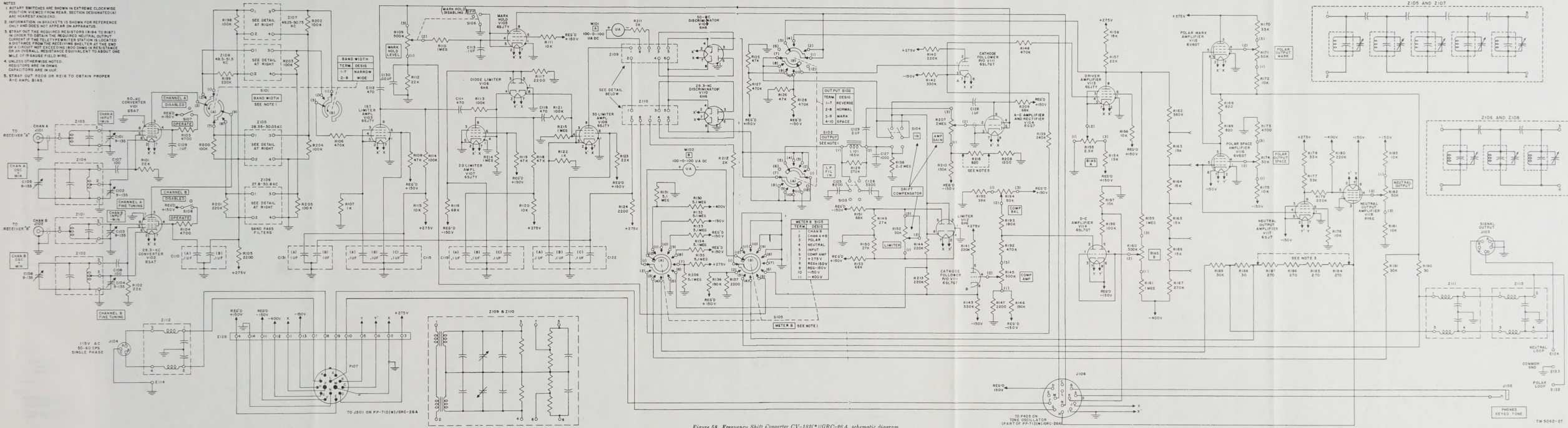
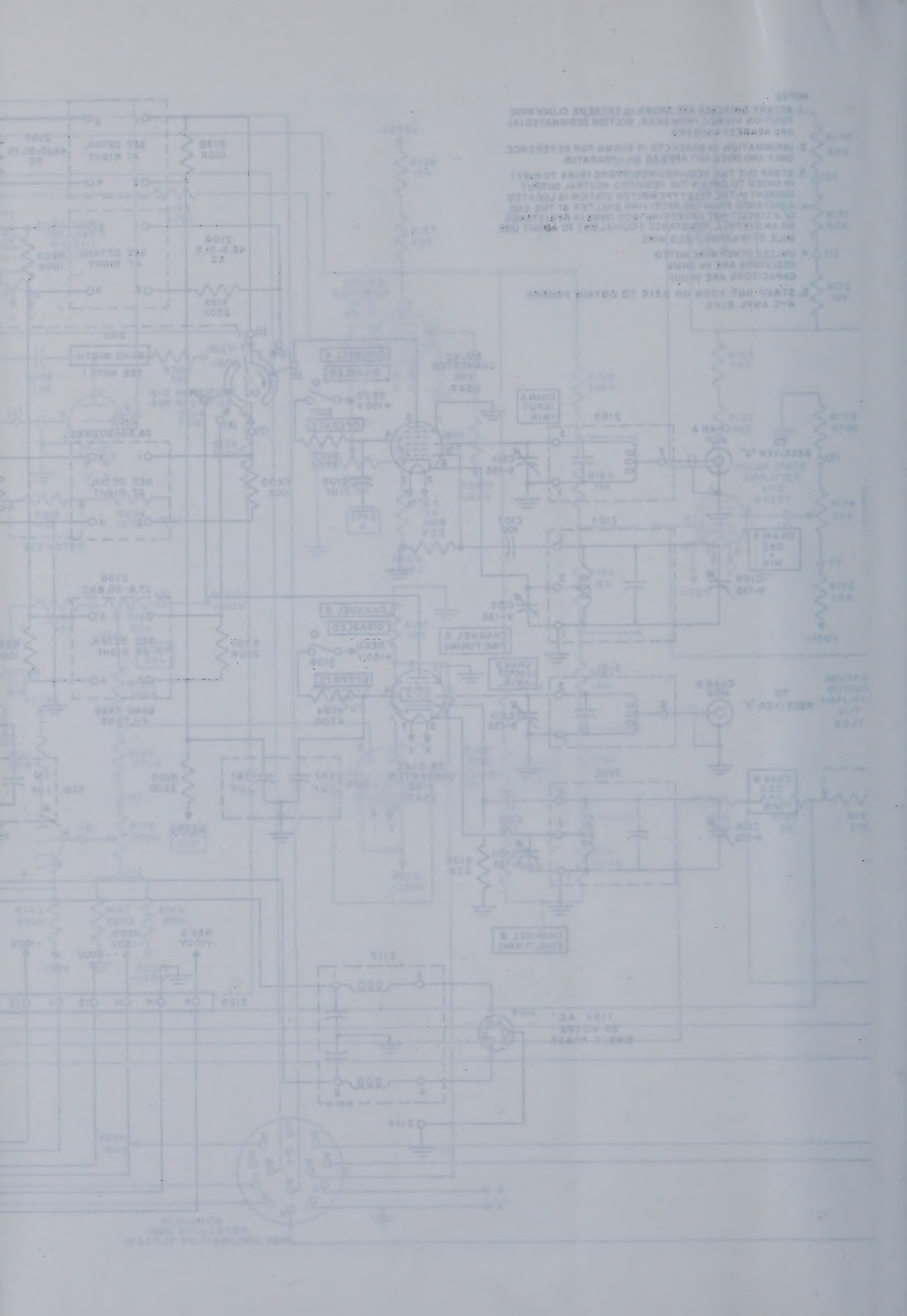
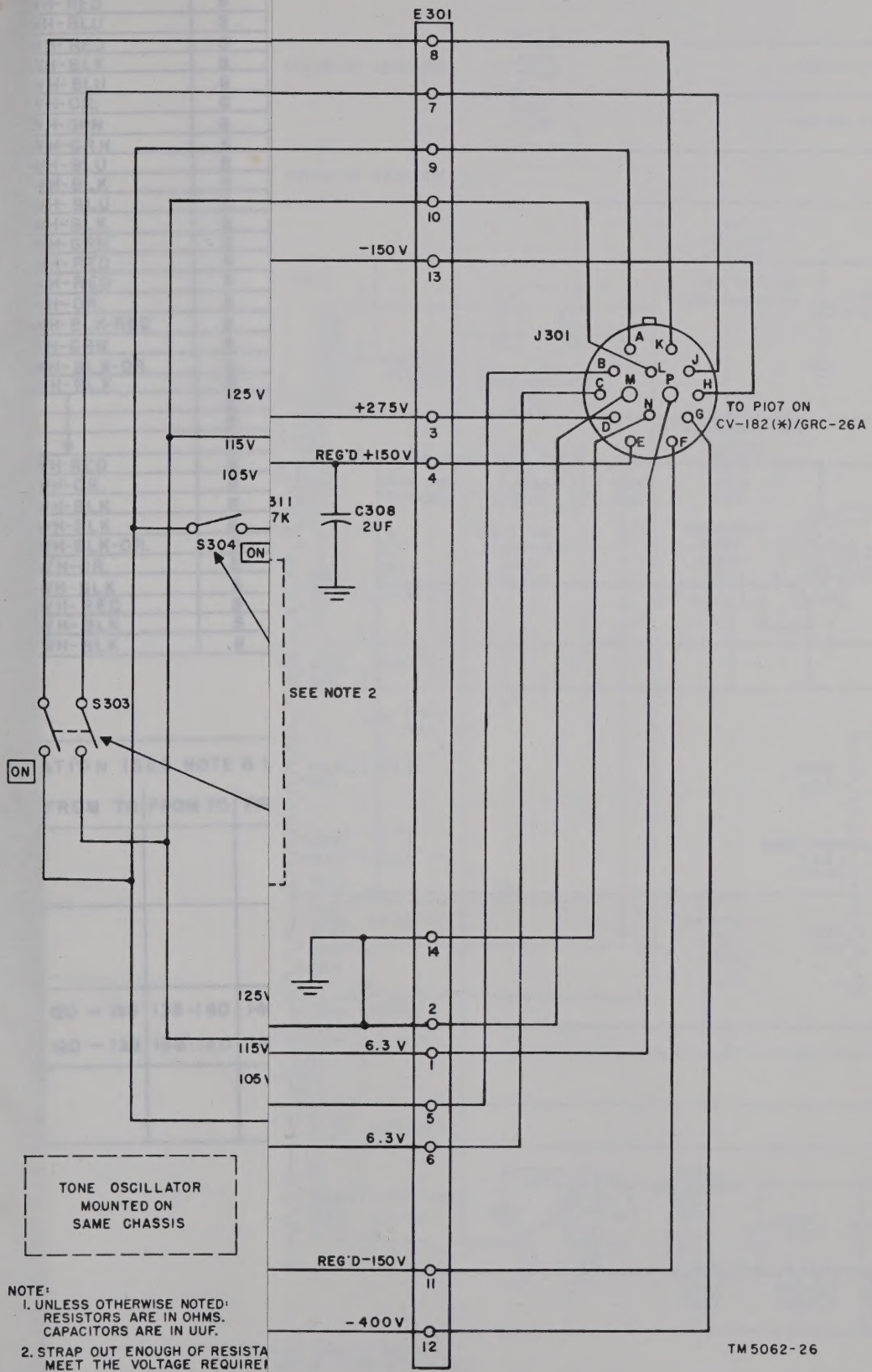
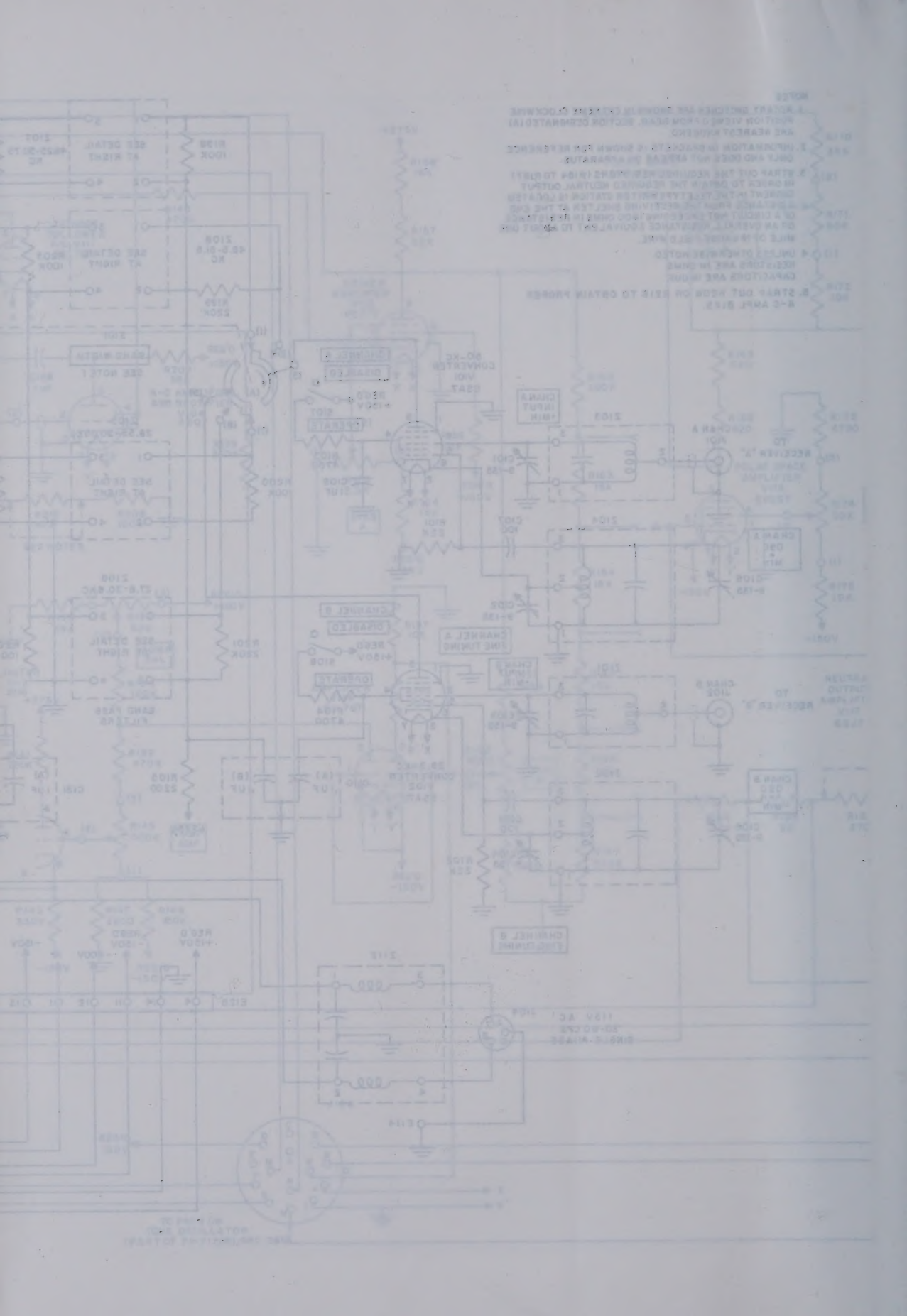


Figure 68. Frequency Shift Converter CV-182(*)/GRC-26A, schematic diagram.




E301
8
7
9
10
-150 V
13
J301
A
K
B
L
J
C
M
P
H
N
G
D
E
F
TO P107 ON
CV-182(*)/GRC-26A
125 V
+275V
3
115V
REG'D +150V
105V
4
311
7K
C308
2UF
S304
ON
SEE NOTE 2
S303
ON
14
125V
2
115V
6.3 V
1
105V
5
6.3V
6
TONE OSCILLATOR
MOUNTED ON
SAME CHASSIS
REG'D-150V
11
-400V
12
NOTE:
1. UNLESS OTHERWISE NOTED:
RESISTORS ARE IN OHMS.
CAPACITORS ARE IN UUF.
2. STRAP OUT ENOUGH OF RESISTA
MEET THE VOLTAGE REQUIRE
TM 5062-26



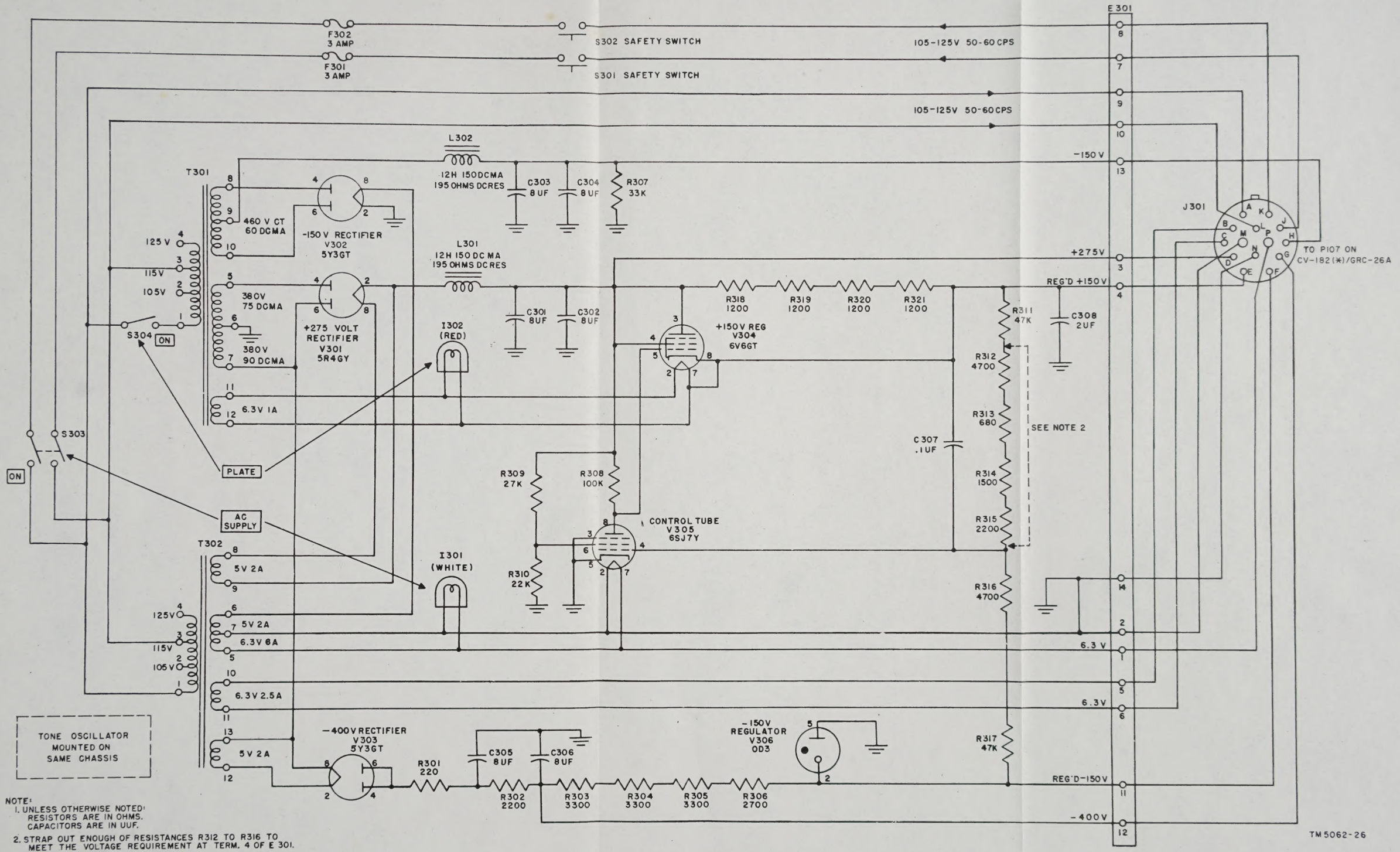
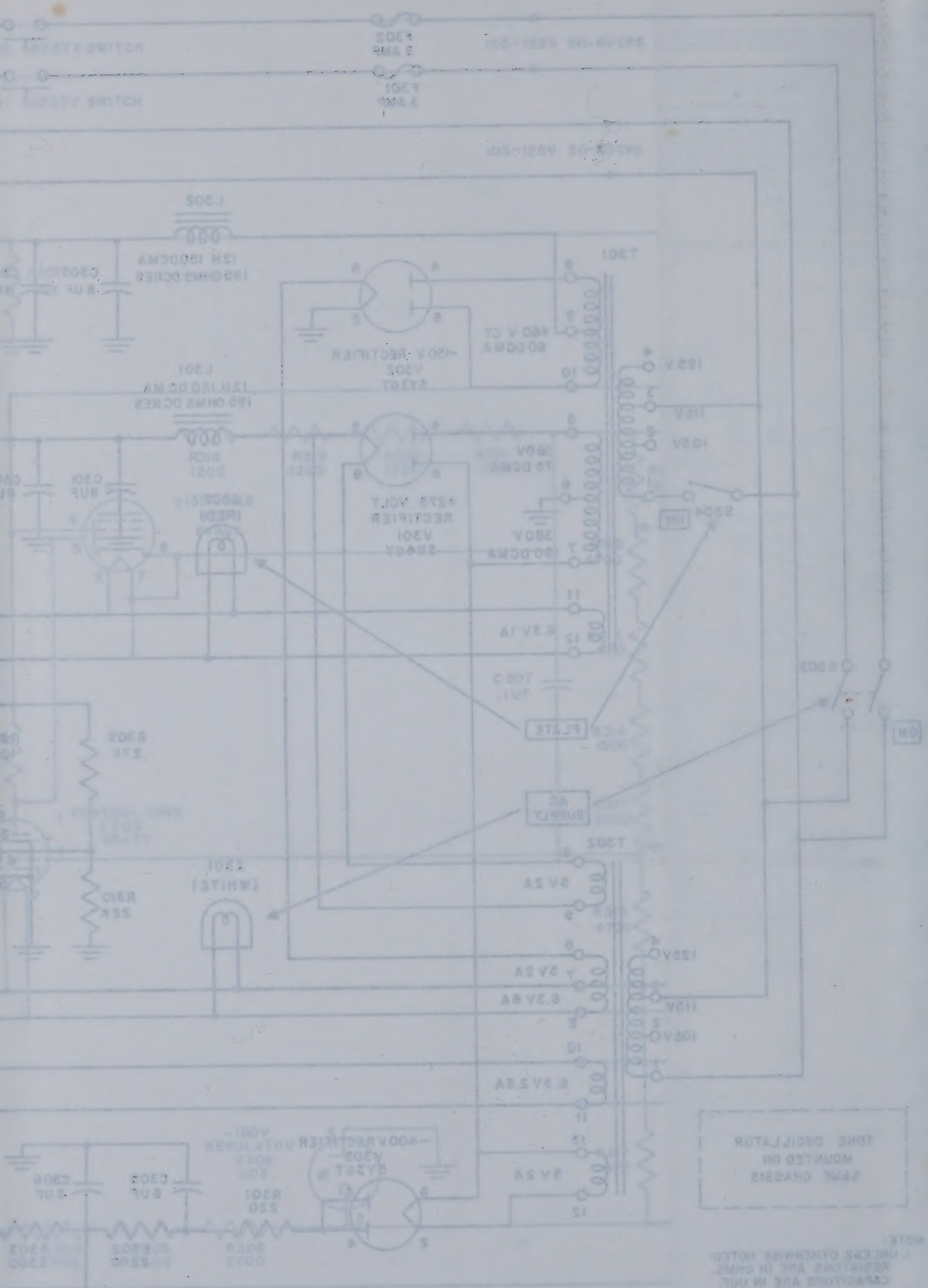


Figure 59. Power Supply PP-712(*)/GRC-26A, less tone oscillator, schematic diagram.


PLATE
AC SUPPLY
ON
TONE OSCILLATOR MOUNTED ON SAME CHASSIS

WH-BRN	8
WH-BLK	8
OR.-BLK	8
WH-RED	8
WH-RED	8
WH-BLU	8
WH-RED	8
WH-BLK	8
WH-BLU	8
WH-OR.	8
WH-GRN	8
WH-GRN	8
WH-BLU	8
WH-BLK	8
WH-BLU	8
WH-BLK	8
WH-GRN	8
WH-RED	8
WH-RED	8
WH-OR.	8
WH-BLK-RED	8
WH-GRN	8
WH-BLK-OR.	8
WH-BLK	8
	8
	8
	8
WH-RED	8
WH-OR.	8
WH-BLK	8
WH-BLK	8
WH-BLK-OR.	8
WH-OR.	8
WH-BLK	8
WH-RED	8
WH-BLK	8
WH-BLK	8

	9		10
	10		11
X101	1	X101	GND
X102	1	X102	GND
X103	1	X103	GND
X104	1	X104	GND
	3		GND
	4		5
X105	1	X105	GND
X106	1	X106	GND
X107	1	X107	GND
	3		GND
	5		GND
X108	1	X108	GND
X109	1	X109	GND
X110	1	X110	GND
X112	1	X112	GND
X113	1	X113	GND
X115	1	X115	GND
X116	1	X116	GND
X117	1	X117	GND
X118	1	X118	GND
Z105	1	E110	1
	2		2
	3		3
	4		4
Z106	1	E111	1
	2		2
	3		3
	4		4
Z107	1	E112	1
	2		2
	3		3
	4		4
Z108	1	E113	1
	2		2
	3		3
	4		4

ATION (SEE NOTE 6)

FROM TO	FROM TO	FROM TO	FROM TO	FROM TO	FROM TO	FROM TO
120 — 138	138-140	140-149	149—151	151—154	154—162	67—88
120 — 138	138-140	140-149	149—151	151—154	154—162	64—88

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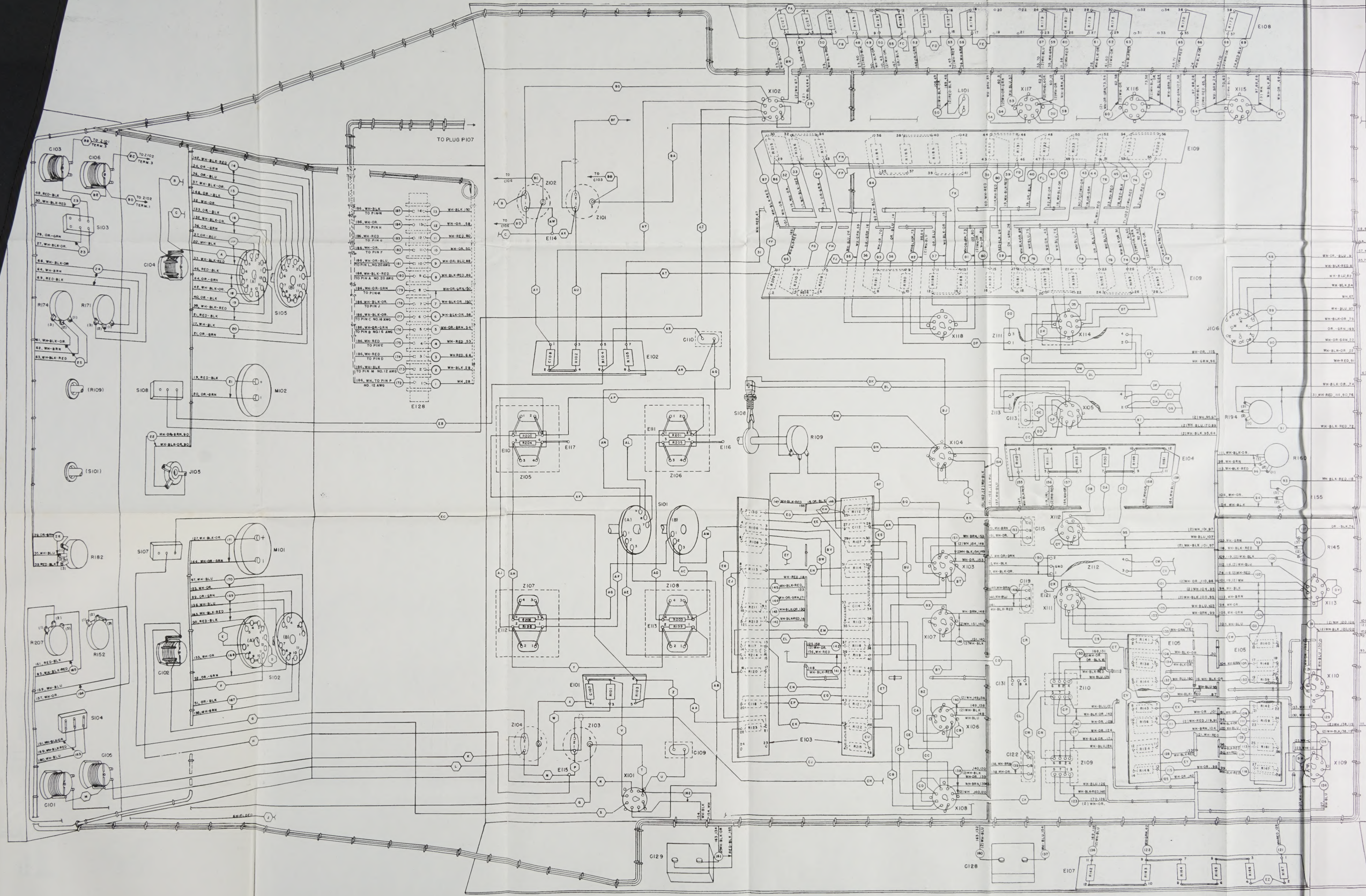
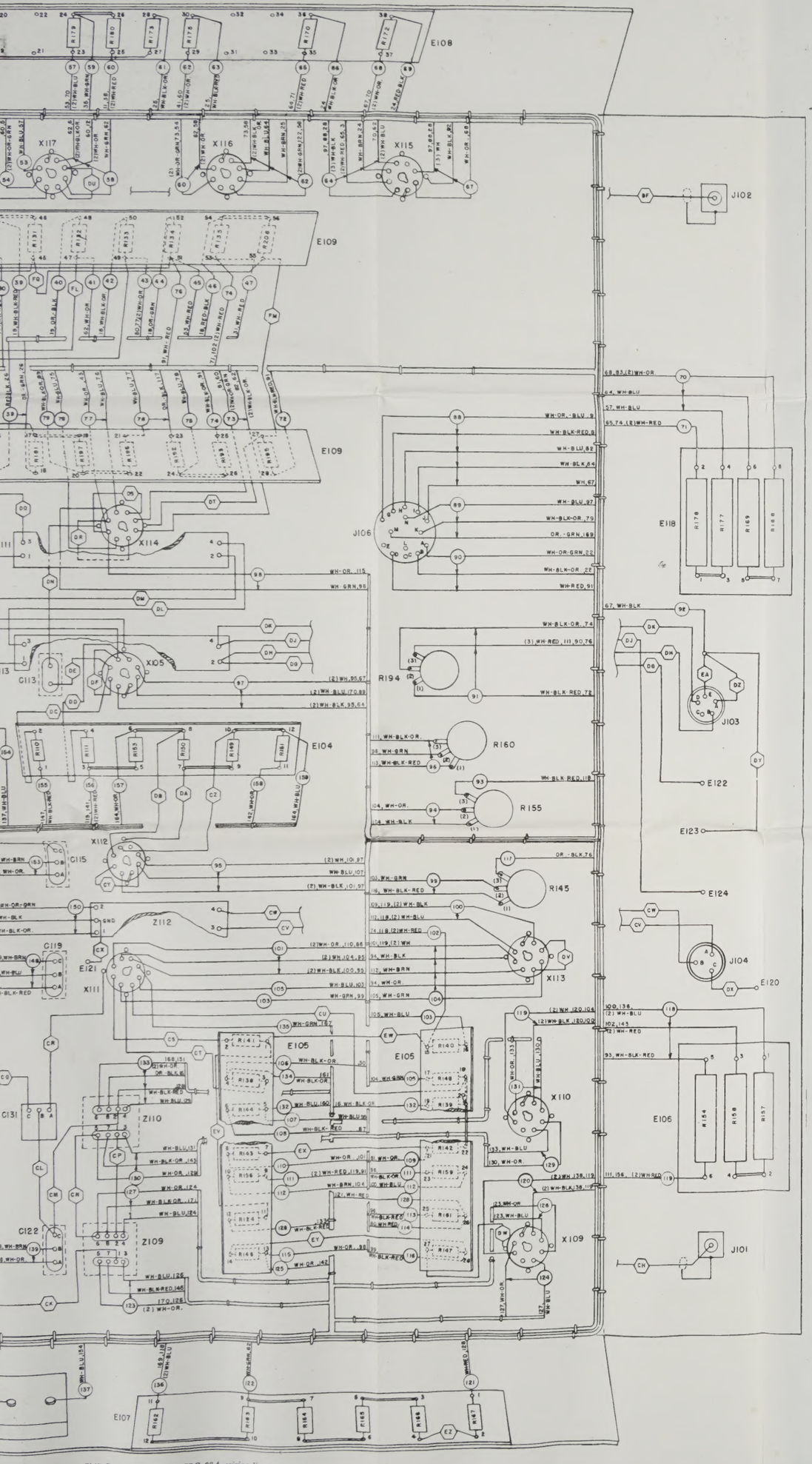
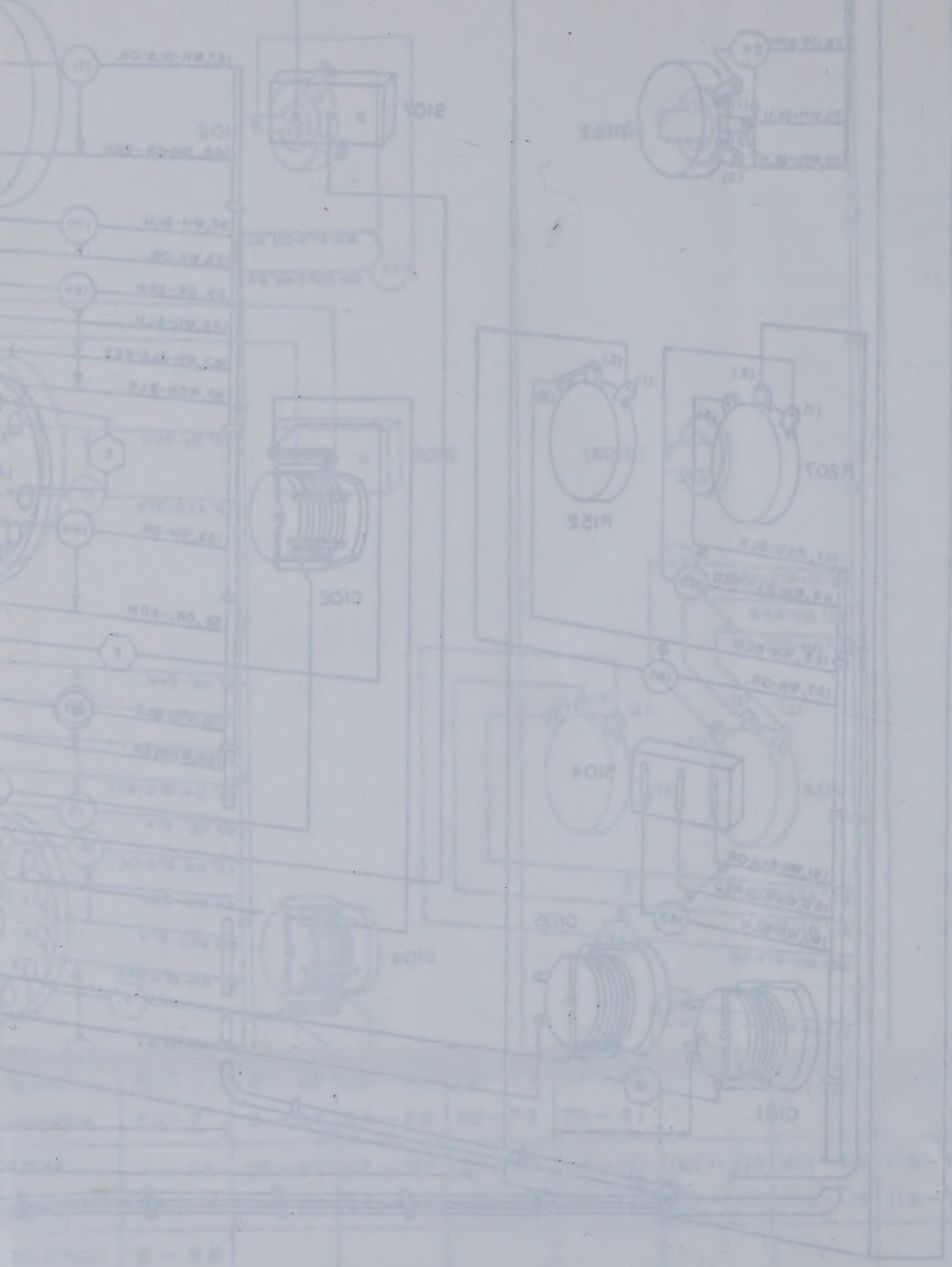
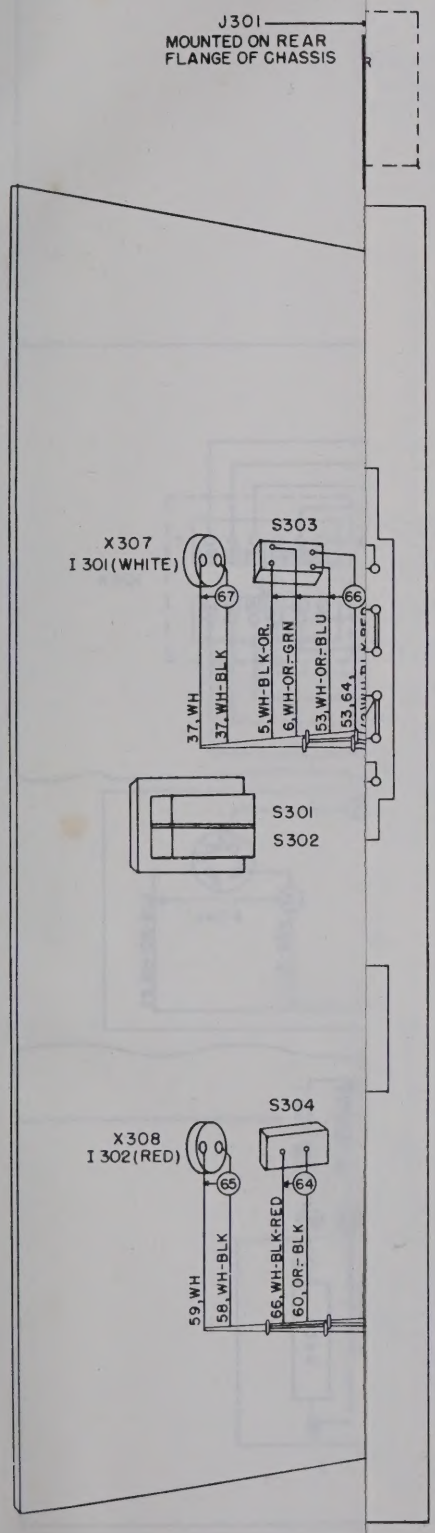


Figure 61. Frequency Shift Converter CV-188(*)/GRC-86A, wiring diagram.


E108
E109
E109
E104
E105
E105
E106
E107
E110
E111
E112
E113
E114
E115
E116
E117
E118
E120
E121
E122
E123
E124
J101
J102
J103
J104
J106
P107
TO E128
X105
X109
X110
X111
X112
X113
X114
X115
X116
X117
R160
R155
R145
R194
Z109
Z110
Z112
C113
C115
C119
C122
C131
175, WH-RED TO TERM.4
174, WH-RED, TO TERM.3
177, WH-BLK-OR, NO.16 AWG TO TERM.6
173, WH-BLK TO TERM.2 NO12AWG
176, WH-OR-GRN TO TERM.5 NO.16 AWG
180, WH-BLK-RED TO TERM.9 NO.20AWG
181, WH-OR-BLU TO TERM.10 20AWG
179, WH-OR-GRN TO TERM.8
178, WH-BLK-OR, TO TERM.7
172, WH TO TERM.1 NO.12 AWG
184, WH-OR, TO TERM.13
183, WH-RED TO TERM.12
185, WH-BLK TO TERM.14
182, WH-OR, TO TERM 11
68,83,(2)WH-OR
64, WH-BLU
57, WH-BLU
65,76,(2)WH-RED
WH-OR,-BLU,9
WH-BLK-RED,8
WH-BLU,82
WH-BLK,84
WH,67
WH-BLU,97
WH-BLK-OR,79
OR,-GRN,169
WH-OR-GRN,22
WH-BLK-OR,28
WH-RED,91
67, WH-BLK
WH-BLK-OR,74
(3) WH-RED, 111, 90, 76
WH-BLK-RED,78
WH-BLK-RED,118
(2)WH,95,67
(2)WH-BLU,70,83
(2)WH-BLK,55,64
111, WH-BLK-OR,
28, WH-GRN,
13, WH-BLK-RED
104, WH-OR,
64, WH-BLK
OR-BLK,76
100, WH-GRN
16, WH-BLK-RED
69,119,(2)WH-BLK
112,118,(2)WH-BLU
74,118,(2)WH-RED
101,119,(2) WH
34, WH-OR
105, WH-GRN
105, WH-BLU
(2)WH-OR ,110,86
(2)WH,104,85
(2)WH-BLK,100,85
WH-BLU,103
WH-GRN,99
WH-GRN,167
WH-BLK-OR
WH-BLK-OR
WH-BLK-RED
WH-BLU,160
16,WH-BLK-OR
WH-BLU,161
WH-BLK-RED 87
WH-OR ,101
91,WH-OR,
(2)WH-RED,119,91
WH-BRN,104
WH-BLK-RED
WH-BLU
WH-BLK-RED
WH-OR ,38
WH-BLK-RED
WH-OR,-BLU,9
WH-BLK-RED,8
WH-BLU,82
WH-BLK,84
WH,67
WH-BLU,97
WH-BLK-OR,79
OR,-GRN,169
WH-OR-GRN,22
WH-BLK-OR,28
WH-RED,91
WH-BLK-OR,115
WH-GRN,95





1. (1) CIRCLED NUMBERS REPRESENT INDIVIDUAL WIRES OF CABLES. NUMBERS NEAR THE LACED PART OF CABLES INDICATE THE STATION TO WHICH THAT WIRE IS RUN. ALL WIRES IN CABLES ARE #20 AWG, UNLESS OTHERWISE SPECIFIED.
2. (2) NUMBERS IN PARENTHESIS PRECEDING THE COLOR CODING, INDICATE THE NUMBER OF LIKE WIRES AT THAT STATION.
3. BARE STRAP WIRES, SHOWN AS DOUBLE LINES, SHALL BE NO. 20 AWG RUN AS SHORT AND DIRECT AS POSSIBLE.
4. (A) LETTERS ENCLOSED BY HEXAGON REPRESENT STRANDED JUMPER WIRES AND SHALL BE NO. 20 AWG. (SEE TABLE FOR COLOR.)
5. "P" REPRESENTS PAIRED WIRES IN CABLE AND ARE TWISTED TOGETHER APPROXIMATELY 4 TURNS PER FOOT. (SEE TABLE FOR STATION NOS & COLOR)
6. RUN WIRE LOOSE AND DRESSED BACK AGAINST THE CHASSIS IN THE MOST CONVENIENT MANNER.
7. RUN WIRE DIRECTLY FROM TERMINAL TO TERMINAL, IN THE SHORTEST POSSIBLE MANNER, WITH SUFFICIENT SLACK TO PREVENT BREAKAGE UNDER VIBRATION.
8. JUMPER "R" IS USED TO ADJUST REGULATED POWER SUPPLY BY SHORTING OUT RESISTORS AS DETERMINED AT THE TIME OF TESTING, (R312 TO R316).

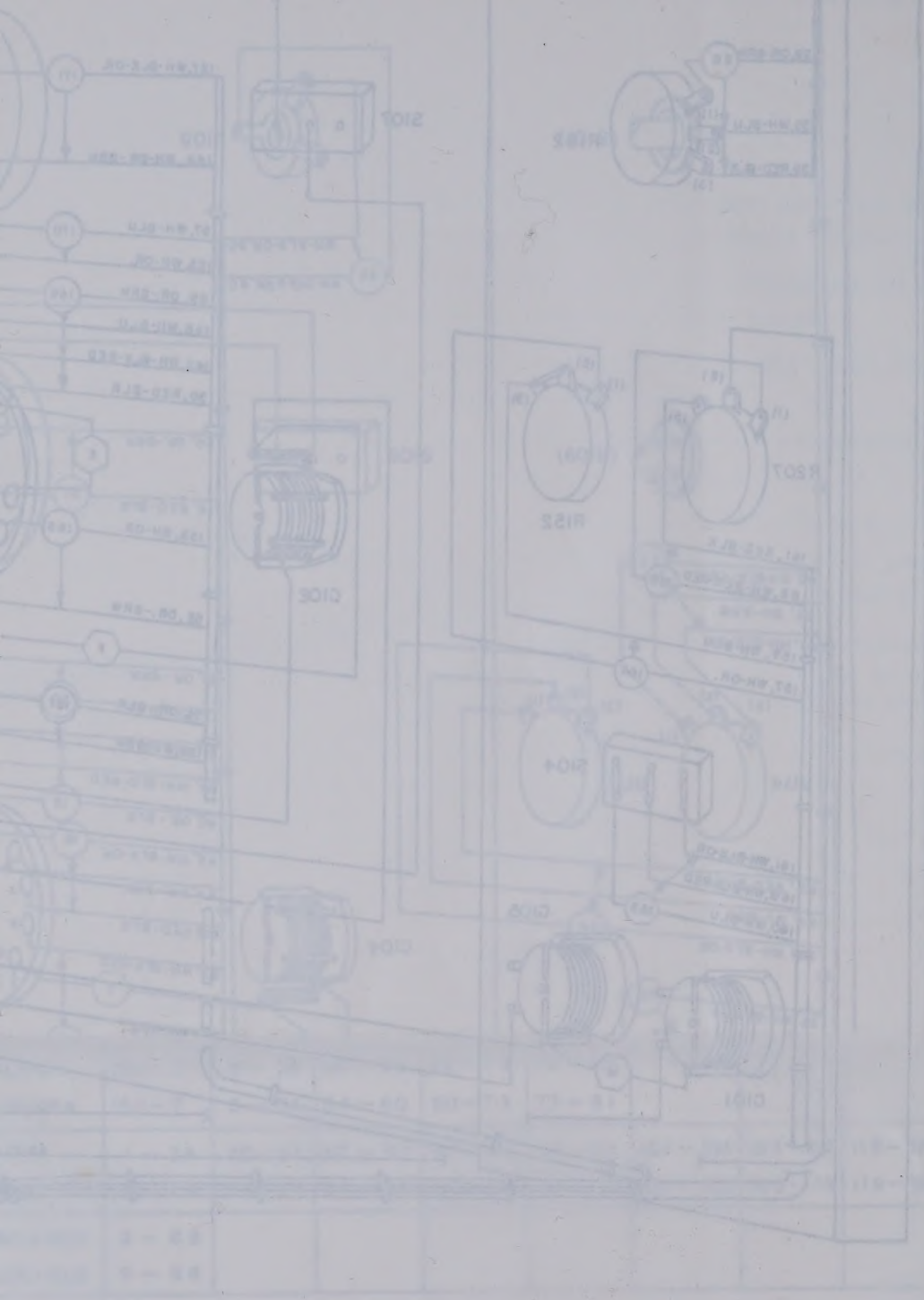
NO. 20 AWG BARE STRAP WIRES

FROM		TO	
PART	TERM.	PART	TERM.
E302	2	E302	4
	7		9
	10		12
	13		15
	14		16
	17		19
	22		24
	23		25
	26		28
E302	3	E302	5
	6		8
	7		9
	10		12
	11		13
X301	1	X301	GND
X302	1	X302	GND
X303	1	X303	GND
X304	1	X304	GND
X304	3	X304	4
X304	7	X304	8
X305	1	X305	GND
X305	5	X305	GND
X306	1	X306	GND
X306	5	X306	GND

NO. 20 AWG JUMPER WIRES

JUMP.	COLOR	NOTE
A	WH-BRN	7
B	WH-GRN	7
C	WH-RED	7
D	WH	7
E	WH-BLK-OR.	6
F	WH-OR-GRN	6
G	WH-BLK	7
H	WH-BLU	7
J	WH-OR-BLU	6
K	WH-BLK-OR.	6
L	WH-OR-BLU	6
M		6
N		6
P		6
Q	WH	6
R	WH-BLK-OR.	8

	COLOR	PAIRED WIRE RUNS-STATION TO STATION (SEE NOTE 5)					
		FROM TO	FROM TO	FROM TO	FROM TO	FROM TO	FROM TO
"P"	WH	4-46	9-59	14-45	14-37	37-67	59-65
	WH-BLK	4-39	9-58	14-39	14-37	37-67	58-65
"P"	WH-OR-BLU	7-41	53-66				
	WH-BLK-RED	7-40	53-66				
"P"	WH-OR-GRN	1-47	6-66	42-44			
	WH-BLK-OR.	1-48	5-66	49-43			



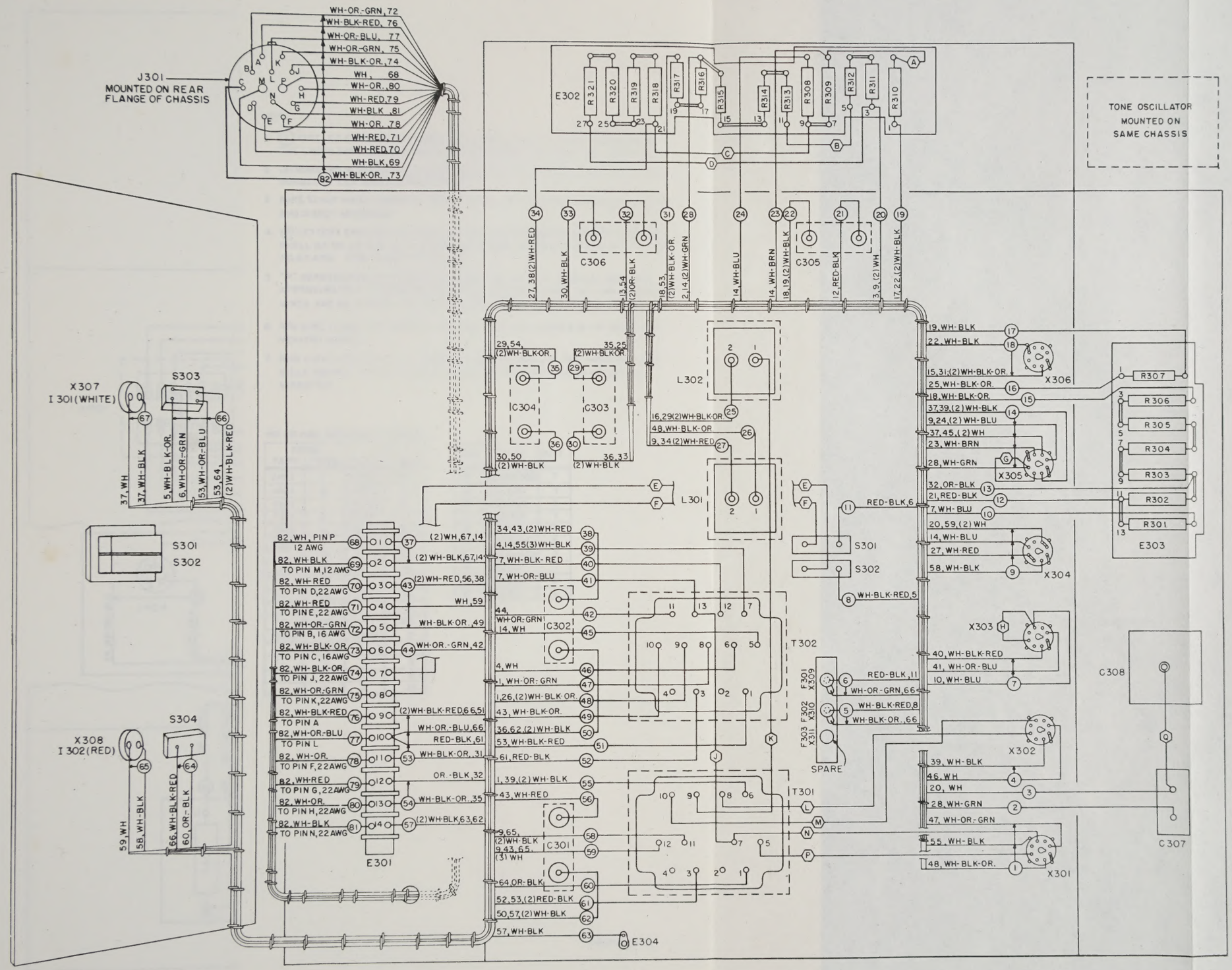


Figure 62. Power Supply PP-712(*)/GRC-26A, less tone-oscillator section, wiring diagram.

1. (1) CIRCLED NUMBERS REPRESENT INDIVIDUAL WIRES OF CABLES. NUMBERS NEAR THE LACED PART OF CABLES INDICATE THE STATION TO WHICH THAT WIRE IS RUN. ALL WIRES IN CABLES ARE #20 AWG, UNLESS OTHERWISE SPECIFIED.
2. (2) NUMBERS IN PARENTHESIS PRECEDING THE COLOR CODING, INDICATE THE NUMBER OF LIKE WIRES AT THAT STATION.
3. BARE STRAP WIRES, SHOWN AS DOUBLE LINES, SHALL BE NO. 20 AWG RUN AS SHORT AND DIRECT AS POSSIBLE.
4. (A) LETTERS ENCLOSED BY HEXAGON REPRESENT STRANDED JUMPER WIRES AND SHALL BE NO. 20 AWG. (SEE TABLE FOR COLOR.)
5. "P" REPRESENTS PAIRED WIRES IN CABLE AND ARE TWISTED TOGETHER APPROXIMATELY 4 TURNS PER FOOT. (SEE TABLE FOR STATION NOS & COLOR)
6. RUN WIRE LOOSE AND DRESSED BACK AGAINST THE CHASSIS IN THE MOST CONVENIENT MANNER.
7. RUN WIRE DIRECTLY FROM TERMINAL TO TERMINAL, IN THE SHORTEST POSSIBLE MANNER, WITH SUFFICIENT SLACK TO PREVENT BREAKAGE UNDER VIBRATION.
8. JUMPER "R" IS USED TO ADJUST REGULATED POWER SUPPLY BY SHORTING OUT RESISTORS AS DETERMINED AT THE TIME OF TESTING, (R312 TO R316).

NO. 20 AWG BARE STRAP WIRES

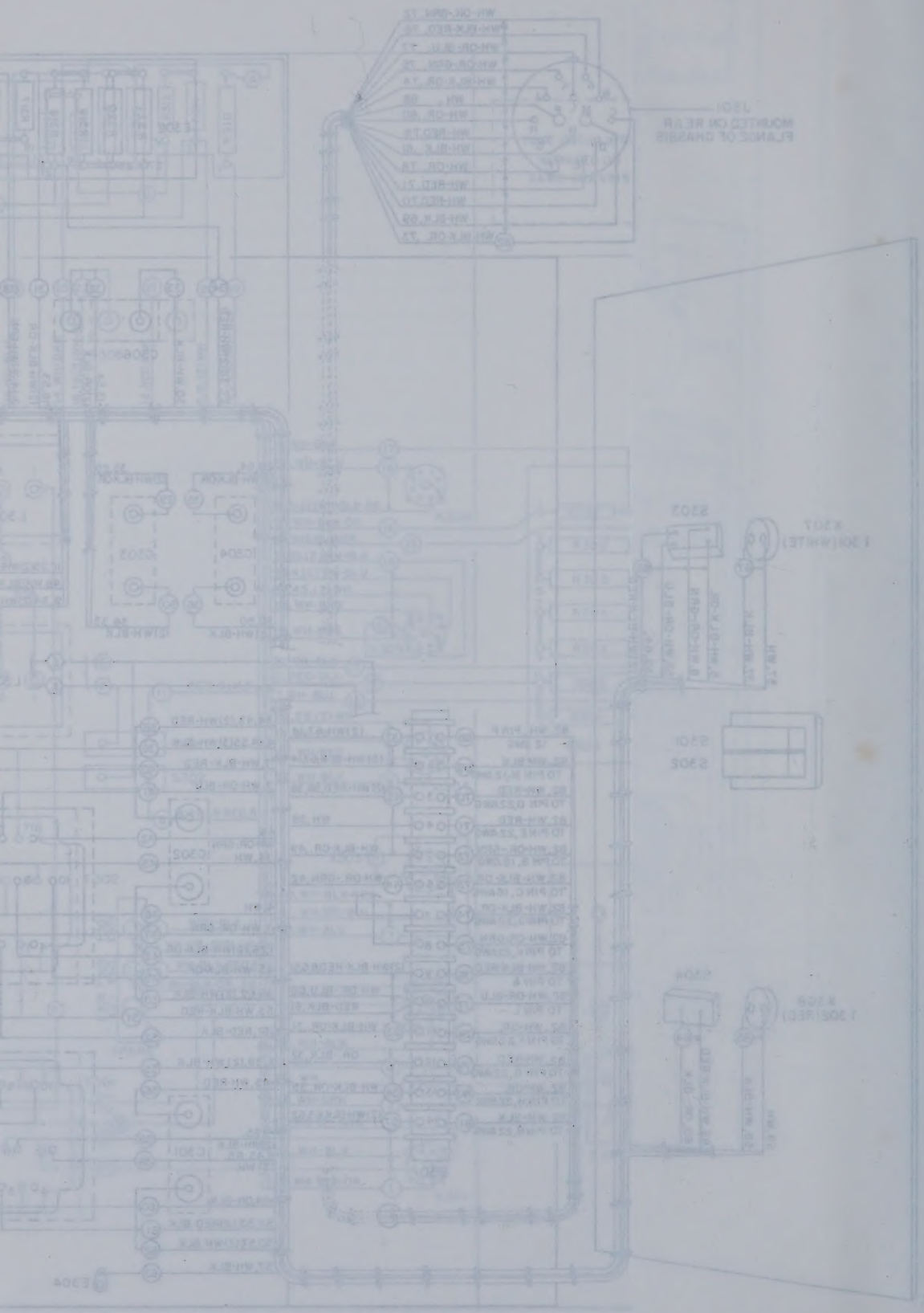
FROM PART	FROM TERM.	TO PART	TO TERM.
E302	2	E302	4
	7		9
	10		12
	13		15
	14		16
	17		19
	22		24
	23		25
	26		28
E302	3	E302	5
	6		8
	7		9
	10		12
	11		13
X301	1	X301	GND
X302	1	X302	GND
X303	1	X303	GND
X304	1	X304	GND
X304	3	X304	4
X304	7	X304	8
X305	1	X305	GND
X305	5	X305	GND
X306	1	X306	GND
X306	5	X306	GND

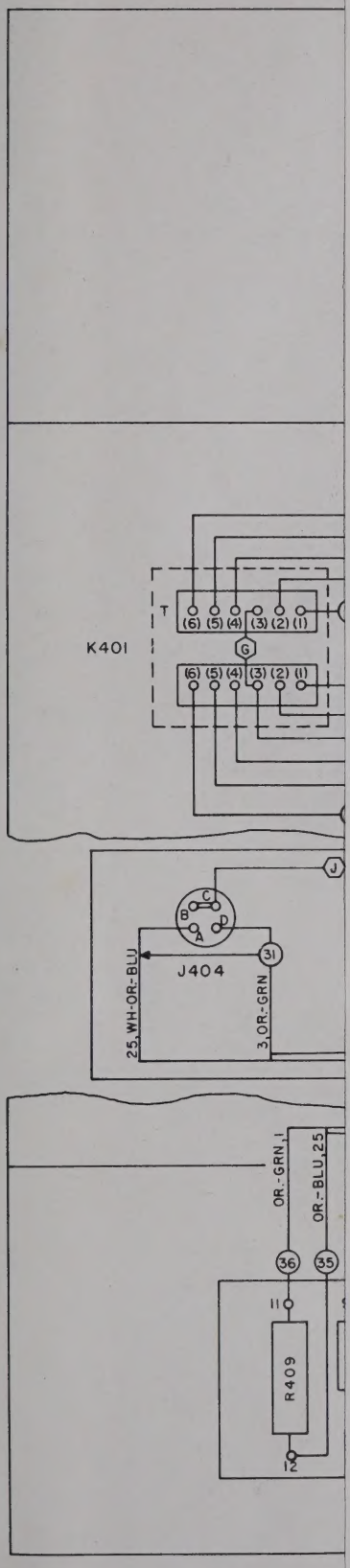
NO. 20 AWG JUMPER WIRES

JUMP	COLOR	NOTE
A	WH-BRN	7
B	WH-GRN	7
C	WH-RED	7
D	WH	7
E	WH-BLK-OR	6
F	WH-OR-GRN	6
G	WH-BLK	7
H	WH-BLU	7
J	WH-OR-BLU	6
K	WH-BLK-OR	6
L	WH-OR-BLU	6
M		6
N		6
P		6
Q	WH	6
R	WH-BLK-OR	8

	COLOR	PAIRED WIRE RUNS-STATION TO STATION (SEE NOTE 5) FROM TO	FROM TO	FROM TO	FROM TO	FROM TO	FROM TO
"P"	WH	4-46	9-59	14-45	14-37	37-67	59-65
	WH-BLK	4-39	9-58	14-39	14-37	37-67	58-65
"P"	WH-OR-BLU	7-41	53-66				
	WH-BLK-RED	7-40	53-66				
"P"	WH-OR-GRN	1-47	6-66	42-44			
	WH-BLK-OR.	1-48	5-66	49-43			

TM 278-C5-30





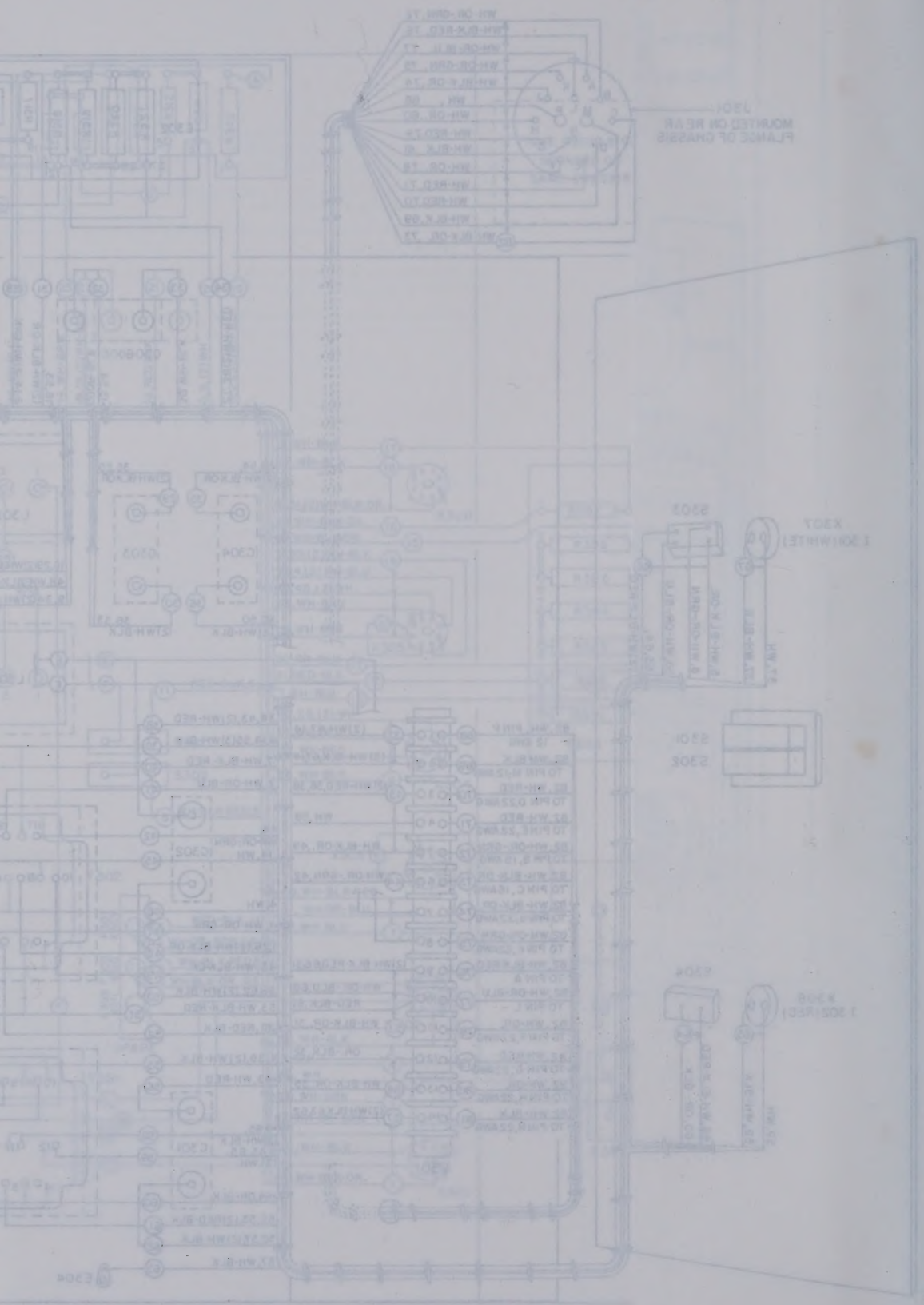
NOTE

1. (1) CIRCLED NUMBERS REPRESENT INDIVIDUAL WIRES OF CABLE. NUMBER NEAR THE LACED PART OF CABLE INDICATES THE STATION TO WHICH THAT WIRE IS RUN.
2. (2) NUMBERS IN PARENTHESIS PRECEDING THE COLOR CODING INDICATE THE NUMBER OF LIKE WIRES AT THAT STATION.
3. BARE STRAP WIRES, SHOWN AS DOUBLE LINES, SHALL BE NO. 20 AWG RUN AS SHORT AND DIRECT AS POSSIBLE.
4. (A) LETTERS ENCLOSED BY HEXAGON REPRESENT STRANDED JUMPER WIRES AND SHALL BE NO. 22 AWG, WITH EXCEPTIONS TO WH & WH-BLK WIRES WHICH ARE NO. 20 AWG. (SEE TABLE FOR COLOR)
5. "P" REPRESENTS PAIRED WIRES IN CABLE, WHICH ARE TWISTED TOGETHER APPROXIMATELY 4 TURNS PER FOOT AND ARE NO. 20 AWG. ALL WH & WH-BLK WIRES ARE NO. 20 AWG. ALL OTHER WIRES IN THE CABLE ARE NO. 22 AWG.
6. RUN WIRE LOOSE AND DRESSED BACK AGAINST THE CHASSIS IN THE MOST CONVENIENT MANNER.
7. RUN WIRE DIRECTLY FROM TERMINAL TO TERMINAL, IN THE SHORTEST POSSIBLE MANNER, WITH SUFFICIENT SLACK TO PREVENT BREAKAGE UNDER VIBRATION.

NO. 20 AWG BARE STRAP WIRES

FROM		TO	
PART	TERM.	PART	TERM.
J403	C	E403	GND
J404	B	J404	C
T401	1	T401	3
T401	2	T401	4
X401	8	X401	GND
E401	7	E401	9
"	17	"	19
"	6	"	8
"	10	"	12
"	12	"	14
"	16	"	18
"	20	"	22
E402	3	E402	5
"	5	"	7
"	7	"	9
"	4	"	6
"	8	"	10

JUMP	COLOR	NOTE
A	WH-BLK-RED	7
B	OR-GRN	7
C	WH-BLK	7
D	WH-BLK	7
E	WH-OR.	7
F	OR.-GRN	7
G	WH-BLK-OR.	7
H	WH-OR.	7
J	WH-BLK	6
K	WH-BLK	6



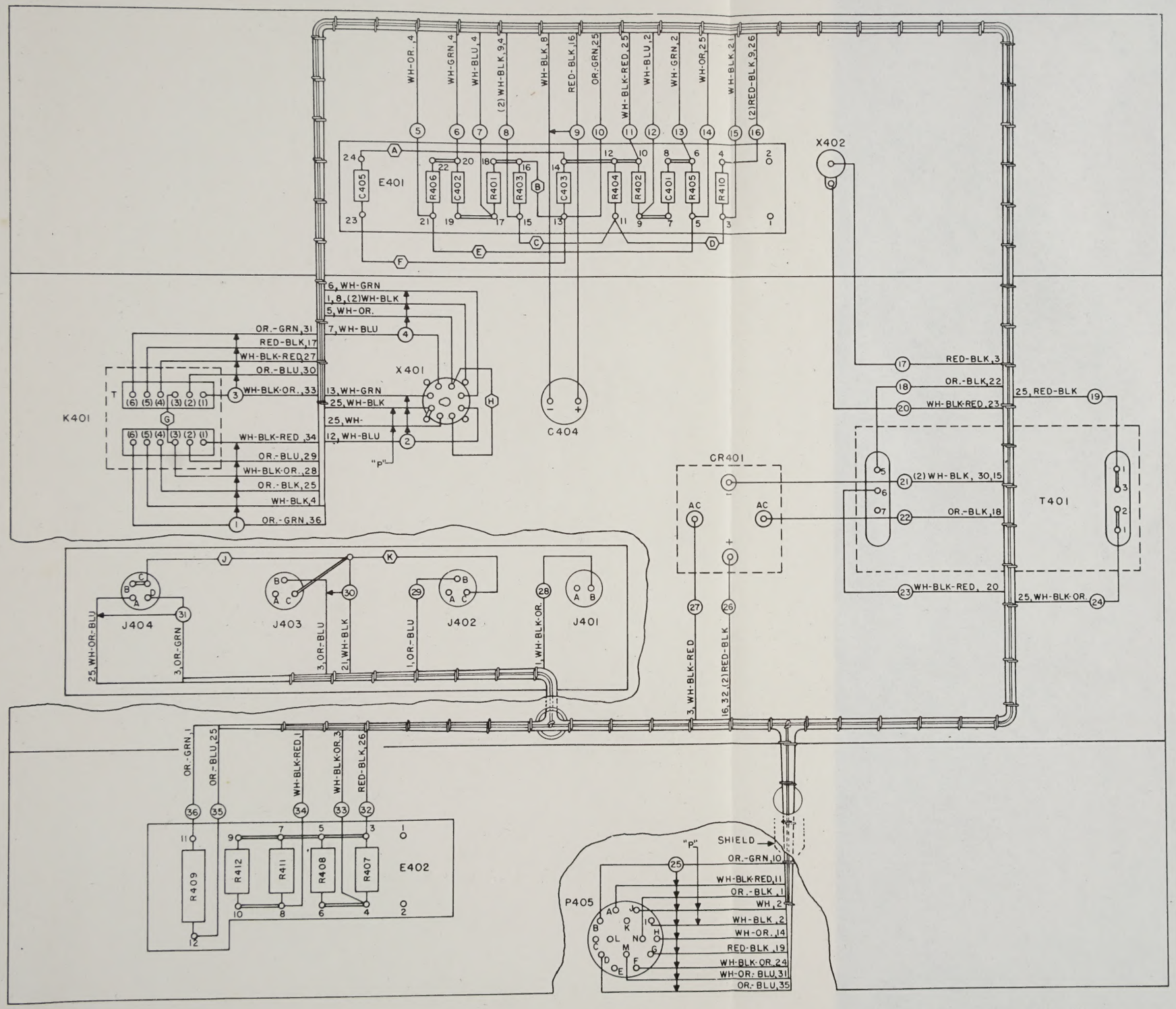


Figure 63. Power Supply PP-712(*)/GRC-26A, tone-oscillator section, wiring diagram.

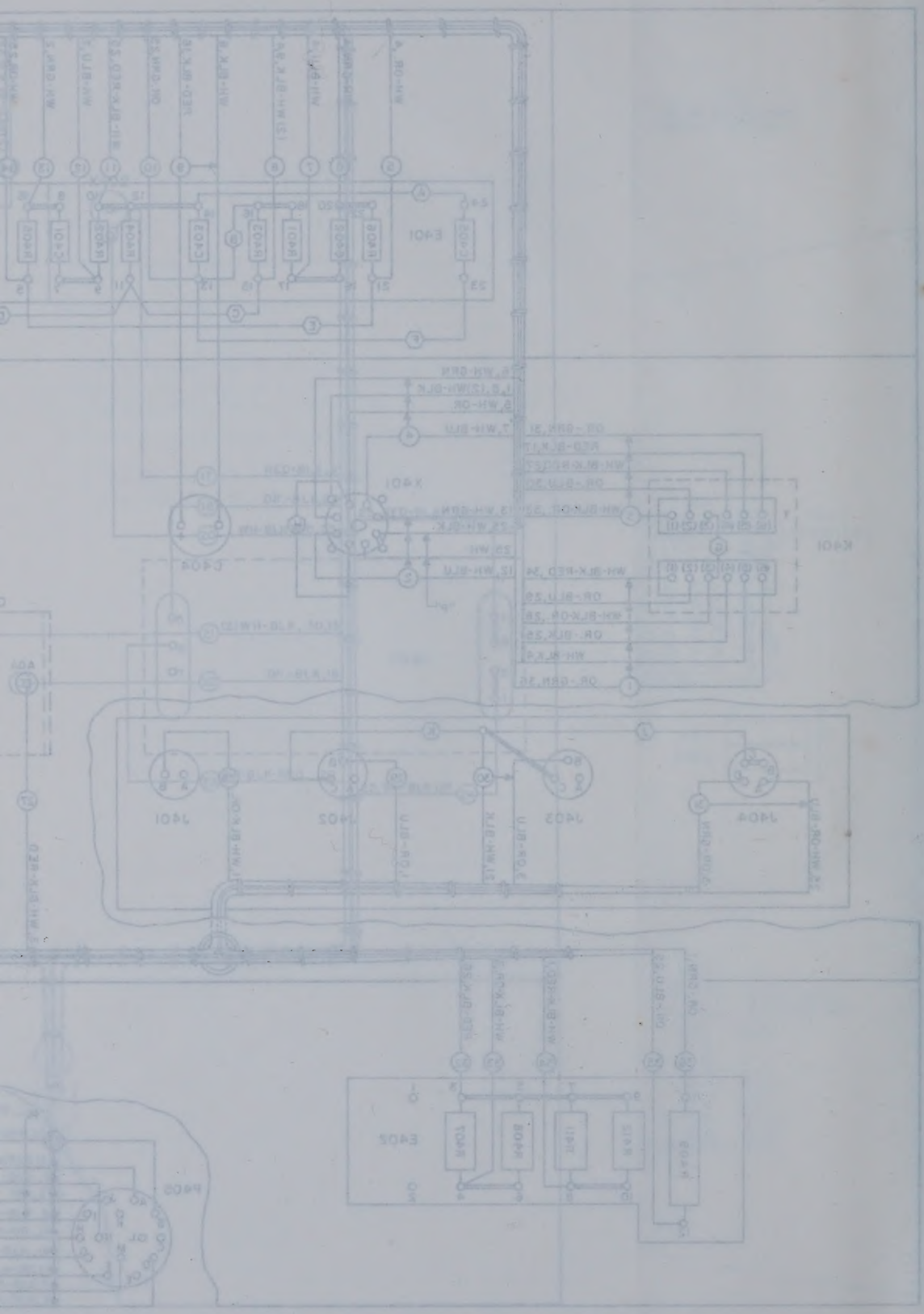
NOTE

1. (1) CIRCLED NUMBERS REPRESENT INDIVIDUAL WIRES OF CABLE. NUMBER NEAR THE LACED PART OF CABLE INDICATES THE STATION TO WHICH THAT WIRE IS RUN.
2. (2) NUMBERS IN PARENTHESIS PRECEDING THE COLOR CODING INDICATE THE NUMBER OF LIKE WIRES AT THAT STATION.
3. BARE STRAP WIRES, SHOWN AS DOUBLE LINES, SHALL BE NO. 20 AWG RUN AS SHORT AND DIRECT AS POSSIBLE.
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5. "P" REPRESENTS PAIRED WIRES IN CABLE, WHICH ARE TWISTED TOGETHER APPROXIMATELY 4 TURNS PER FOOT AND ARE NO. 20 AWG. ALL WH & WH-BLK WIRES ARE NO. 20 AWG. ALL OTHER WIRES IN THE CABLE ARE NO. 22 AWG.
6. RUN WIRE LOOSE AND DRESSED BACK AGAINST THE CHASSIS IN THE MOST CONVENIENT MANNER.
7. RUN WIRE DIRECTLY FROM TERMINAL TO TERMINAL, IN THE SHORTEST POSSIBLE MANNER, WITH SUFFICIENT SLACK TO PREVENT BREAKAGE UNDER VIBRATION.

NO. 20 AWG BARE STRAP WIRES

FROM PART	FROM TERM.	TO PART	TO TERM.
J403	C	E403	GND
J404	B	J404	C
T401	1	T401	3
T401	2	T401	4
X401	8	X401	GND
E401	7	E401	9
"	17	"	19
"	6	"	8
"	10	"	12
"	12	"	14
"	16	"	18
"	20	"	22
E402	3	E402	5
"	5	"	7
"	7	"	9
"	4	"	6
"	8	"	10

JUMP	COLOR	NOTE
A	WH-BLK-RED	7
B	OR-GRN	7
C	WH-BLK	7
D	WH-BLK	7
E	WH-OR.	7
F	OR-GRN	7
G	WH-BLK-OR	7
H	WH-OR.	7
J	WH-BLK	6
K	WH-BLK	6



TM 11–5062/TO 16–35PP712–5 FREQUENCY SHIFT CONVERTERS CV–182/GRC–26A AND CV–182A/GRC–26A AND POWER SUPPLIES PP–712/GRC–26A AND PP–712A/GRC–26A—1952