TM 11-6130-385-34

TECHNICAL MANUAL

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL

INVERTER, STATIC POWER PP-7274/A (NSN 6125-00-148-8342)

AND

PP-7274 A/A (NSN 6130-01-093-3077)

This copy is a reprint which includes current pages from Change 1.

HEADQUARTERS, DEPARTMENT OF THE ARMY

19 MARCH 1976

CHANGE No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *8 May 1981*

Direct Support and General Support Maintenance Manual
INVERTER, STATIC POWER
PP-7274/A (NSN 6125-00-148-8342) AND
PP-7274A/A (NSN 6130-01-093-3077)

TM 11-6130-385-34, 19 March 1976 is changed as follows:

1. Title is changed as shown above.
2. New or changed materials indicated by a vertical bar in the margin. An illustration change is indicated by a miniature painting hand.
3. Added or revised illustrations are indicated.
4. Remove and insert pages as indicated below:

Remove	*Insert*
None	A and B (front of manual)
i and ii	i and ii
Blank/1-0 through 1-2	Blank/l-O through l-2
3-1 and 3-2	3-1 and 3-2
3-5 and 3-6	3-5 and 3-6
3-9 and 3-10	3-9 and 3-10
3-13 and 3-14	3-13 and 3-14
3-17 and 3-18	3-17 and 3-18
3-33 and 3-34	3-33 and 3-34
A-1/(A-2 Blank)	A-1/(A-2 Blank)
FO-7	FO-7

5. Retain this sheet in front of the manual for reference purposes.

By Order of the Secretary of the Army:

E. C. MEYER
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Major General, United States Army
The Adjutant General

DISTRIBUTION:

To be distributed in accordance with DA Form 12-31, Direct Support and General Support for requirements of Section VI AH-IG and AH-IS Aircrafts.

WARNING

Dangerous voltages exist in this equipment (115 volts AC). Serious injury or DEATH may result from contact with terminals carrying these voltages. Make sure all switches or circuit breakers supplying power to the PP-7274 (#)/U are in the "OFF" position before connecting or disconnecting the input or output power cables from the unit or starting any maintenance procedures. Do not attempt internal service or adjustment unless another person capable of rendering first aid and resuscitation is present. Follow the five emergency steps for electric shock.

5 SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

1 DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL

2 IF POSSIBLE, TURN OFF THE ELECTRICAL POWER

3 IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH, OR LIFT THE PERSON TO SAFETY USING A WOODEN POLE OR A ROPE OR SOME OTHER INSULATING MATERIAL

4 SEND FOR HELP AS SOON AS POSSIBLE

5 AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION

TECHNICAL MANUAL
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Direct Support and General Support Maintenance Manual

INVERTER, STATIC POWER PP-7274/A

(NSN 6125-00-148-8342) AND

PP-7274A/A (NSN 6130-01-093-2077)

REPORTING OF ERRORS

You can help improve this manual by calling attention to errors and by recommending improvements and stating your reasons for the recommendations. Your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) should be mailed direct to the Commander, US Army Electronics Command, ATTN: DRSEL- ME-MQ, **Fort Monmouth NJ 07703. A reply will be furnished direct to you.**

LIST OF ILLUSTRATIONS

LIST OF TABLES

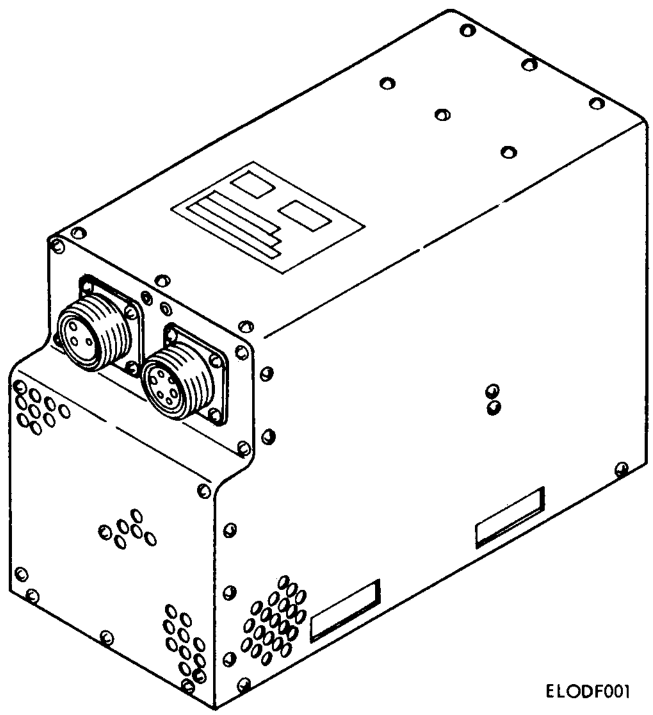

Figure 1-1. Static Power Inverter PP-7274/A and PP-7274A/A.

CHAPTER 1
INTRODUCTION

Section 1. GENERAL

1-1. scope

This manual contains information for direct support and general support maintenance of Static Power Inverter PP-72741A and PP-7274A/A (static inverter). The unit is a 750-va, 3-phase inverter which converts a nominal 28-vdc input to a regulated 115-vac, 400-Hz power for use in aircraft. The maintenance allocation chart (MAC) for the static inverter is located in TM 11-1520-221-20 and TM 11-1520-236-20.

NOTE

Throughout the manual, reference to the PP-7274/A also refers to the PP-7274A/A unless otherwise indicated.

1-2. Indexes of Publications

a. DA Pam 310-4. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b, DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

1-3. Forms and Records

a. *Reports of Maintenance and Unsatisfactory Equipment*. Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

b. Report of Packaging and Handling Deficiencies. Fill out and forward SF 364 (Report of Discrepancy (ROD) as prescribed in AR 735-11-2/ DLAR 4140.55/NAVMATINST 4355.73/AFR 400-54/MCO 4430.3E.

c. *Discrepancy in. Shipment Report (DISREP) (SF 361)*. Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33B/AFR 75-18/ MCO P4610.19C, and DLAR 4500.15.

1-4. Destruction of Army Materiel

Refer to TM 750-244-2 for procedure to be used for this equipment.

1-5. Reporting Equipment Improvement Recommendations (EIR)

Equipment Improvement Recommendations (EIR) can and must be submitted by anyone who is aware of an unsatisfactory condition with the equipment design or use. It is not necessary to show a new design or list a better way to perform a procedure; just simply tell why the design is unfavorable or why a procedure is difficult. Equipment Improvement Recommendations EIR may be submitted on SF 368 (Quality Deficiency Report). Mail direct to Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703. A reply will be furnished to you.

Section II. DESCRIPTION AND DATA

1-6. Description

Static inverter (fig. 1-1) converts a nominal +28 dc input to a regulated 115-volt ac, 400 ±7 Hz, 3-phase output. The unit provides output power of 750-va, 3-phase, 250-va per phase at 41 amperes. The inverter is designed for use in aircraft.

1-7. Technical Data

The electrical and physical characteristics of the static inverter are given in tables 1-1 and 1-2.

Table 1-1. Electrical Characteristics

	Parameters and conditions	*Values*
Input Voltage:	Nominal.	***28*** vdc
	Normal Operation...	24-30 vdc
Input Current:	At 28 vdc, full load.	41 amp max
output Voltage:	Nominal.	115 vac true rms
	27 to 30 vdc input, unity PF, + .85 PF, – .95 PF, 0 to 30,000 feet, –55° C. to 71° C. Per MIL-57D-810 Notice 4, Method 507, 508, 509, 510, and 511	112.5 -117.5 vac
Output Power:	Maximum continuous operation...	750 VA 3Ø, 250 VA per Ø at 41 amp and 28 vdc input
Output Frequency:	24-30 vdc input, unity PF, + .85 PF, – .95 PF, 0 to 30,000 feet, –55° C. to 71° c.	400 ± 7 hertz
output Distortion:	Normal operating conditions of 28 vdc input, unity PF, sea level and 25° C. ±15° C.	5 % total harmonic distortion max
Load Power Factor:	(For 5% max total harmonic distortion)	0.95 leading (min) to 0.85 lagging (min)
overload:	At 200% rated current for 5 seconds...	50 vac min
Short Circuit:	Internal protection is provided at 250% rated current for 5 seconds minimum into a short circuit, automatic current limiting then occurs	Will not damage unit. Unit will recover automatically (into any rated load) within 2 seconds upon removal of short circuit (or overload)
Reduced Input Voltage:	18-23 vdc.	Unit will provide 100-117.5 vac (at any rated load)
	0-23 vdc.	Unit will not be damaged
Excessive Input Voltage:	29-32 vdc.	No damage with full load for 5-minute period.

Table 1-2. Physical Characteristics

Parameters and conditions	*Specifications*
Overall Dimensions:	Height: 8.00 in. max Width: 5.50 in. max Length: 11.50 in. max
Weight:	23.6 lb. max
Operating Temperature Range:	–55 °C. to 71° C.
Cooling:	Internal fan

CHAPTER 2

FUNCTIONING OF EQUIPMENT

2-1. Dc Power

(fig. 2-1)

Dc power is applied to the input filter which attenuates ripple voltage from the power source and eliminates radio magnetic interference emitting from the power supply. Power from the input filter is fed to a capacitor bank which provides power to the dc voltage regulator board to obtain regulated dc supply for the various circuits throughout the unit.

2-2. Oscillator Function

The oscillator signal is applied to countdown circuits to develop high frequency square waves and 400-Hz sine waves. The square and sine waves are directed to the modulator boards and the sine wave is also conducted to the recovery drive circuits.

2-3. Modulator Function

The modulator boards receive the high frequency square wave and process it through a ramp generator and a square wave generator. These inputs are processed through the modulator circuit and a data generator circuit to produce the data output. The modulator boards also receive a 400-Hz sine wave feedback from the output filter.

2-4. Overcurrent Sense and Foldback Function

The A phase modulator board provides an overcurrent sense and foldback circuit to limit the output short circuit current. This circuit folds back the current to a safe level if overloads persist in excess of 5 seconds.

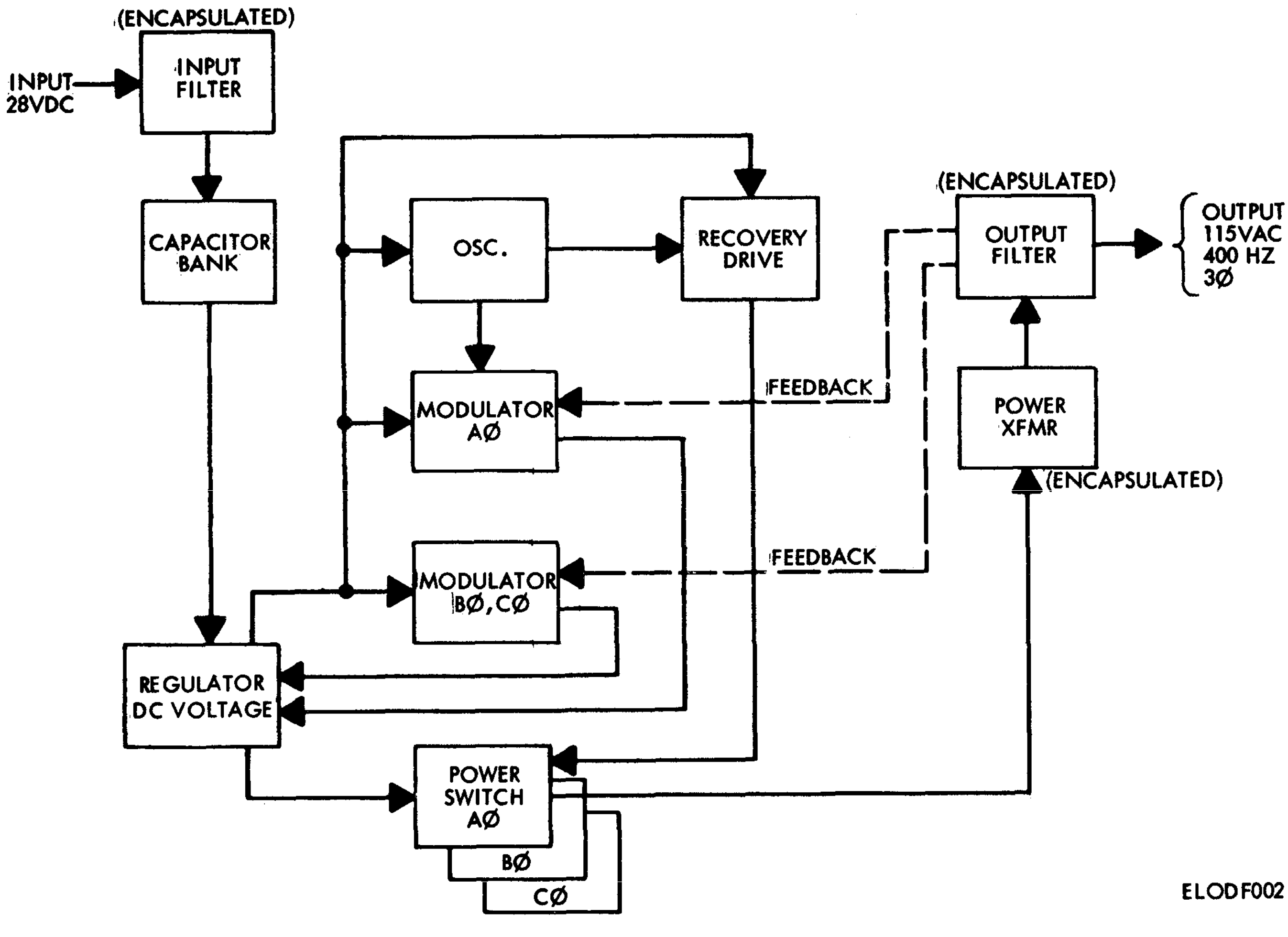

Figure 2-1. Simplified block diagram

2-5. Dc Voltage Regulator

a. The dc voltage regulator board provides 8-volt, 2.5- and 5-volt regulators and a negative 3.4-signal for negative bias. A high and low input voltage detector circuit senses high and low input voltages and disables the system output when required.

b. The dc regulator board also receives data from the modulator boards which is augmented in the output drive circuit and conducted to the power switch boards. Data from the dc regulator board is received on the base drive circuits of the power switch boards.

2-6. Power Switch Function

On the three power switch boards, transistor power switches conduct the signal through an inductor to the power transformer and then out to the filter. There are boards for A phase, B phase, and C phase.

2-7. Modulator Circuit Description

a. The modulator circuit functions as follows: The high frequency 6.4-kHz square wave signal from oscillator board A 1 enters B phase modulator board A3 as two square waves 180° out of phase (fig. 3-23), They are capacitor-coupled to differentiate for the summing diode circuit CR305, CR306. The resultant 12 .8-kHz signal is introduced to the ramp generator (U305) and initiates the output data (ramp) to the output drive board. Ramp generator U305 also delivers a ramp reset blanking signal to Q309, Q310.

b. A 400-Hz sine wave feedback signal from the output filter is directed to the output voltage control. The feedback signal is also connected to a turn on sense output (at terminal 20) which is coupled to the overcurrent sense and foldback circuit on the A phase modulator board.

c. The output voltage control circuit (fig. 3-18) receives the feedback signal, Potentiometer R356 and the temperature compensator unit U310 develop the signal. The signal is then delivered, with dc input, to comparator U306. Transistor Q304 functions as an integrating amplifier with dc output and is applied to field effect transistor Q306 gate which controls amplitude of the sine wave input to the modulator and square wave generator circuit. FET Q306 functions as a voltage impedance device. Gate voltage impedance is as follows:

Gate voltage	*Impedance*
+2.5v	100 ohms
–3.4v	2 megohms

d. The square wave generator and modulator (fig. 3-25) compare ramp signal with sine wave and modulator output pulse length in accordance with relative amplitude of these signals. The outputs go to the data generator. The data generator (fig. 3-20) correlates the information for transmittal to the output drive board. Transistors Q309, Q310 disable output data during reset of ramp generator.

CHAPTER 3

DIRECT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

Section 1. GENERAL

3-1. Description

The inverter converts a nominal +28 vdc input to a regulated 115-vac, 400 ±7 Hz, 3-phase output through use of a pulse-width modulation technique. This static inverter is a solid state design and employs no moving parts except for an internal cooling fan.

3-2. Block Diagram and Schematic Diagrams

Figure FO-1 shows the sequential operation of the unit, the signal frequencies, waveforms, and test points. The schematic diagrams of the individual printed circuit boards are shown on the following figures:

Figure FO-2. Oscillator PCB Schematic Diagram (Al)

Figure FO-3. AØ Modulator PCB Schematic Diagram (A2)

Figure FO-4. BØ , CØ Modulator PCB Schematic Diagram (A3)

Figure FO-5. Dc Voltage Regulator PCB Schematic Diagram (A4)

Figure FO-6. Power Switch PCB Schematic Diagram (A7)

Figure FO-7. Interconnection Diagram shows all the wiring required for connecting the modules within the Inverter.

3-3. Numbering System Used in Design of Inverter

For the sake of clarity, the following numbering system is used. Discrete components on major module A1 are given a three digit number, for example R101, indicating R1 of major module Al (for A1R1). The next resistor on the A1 major module would be R102 (for A1R2). For major module A2 the first resistor is R201 (for A2R1), etc.

3-4. Continuity Tests

For continuity tests, refer to the following tables:

a. Table 3-1. Main Harness Wiring Data.

b. Table 3-2. Power Switch Wiring Data.

c. Table 3-3. Power Transformer to Filter Wiring Data.

d. Table 3-4. Power Harness Wiring Data.

Table 3-1. Main Harness Wiring Data

Wire number	Termination From	Termination To	Wire color	Wire size	Length (in.)
1	J503-1	A2-10	BRN	22	8.6
2	J503-2	A2-19	BLK	22	10.8
3	J503-3	A2-13	ORN	22	9.3
4	J503-4	A3-14	YEL	22	8.5
5	J503-5	A3-27	BLK/WHT	22	10.0
6	J503-6	A3-28	BLU/WHT	22	10.5
7	J503-7	A3-12	VIO	22	8.3
8	J503-8	A3-1	GRA	22	6.3
9	J503-9	A3-9	GRN/WHT	22	7.3
10	J503-14	B901-4	RED	22	8.2
*11	J503-15	S1-2	BLK/WHT	22	14.5
*12	S1-2	B901-1	GRA	22	17.9
13	A1-1	A2-18	RED	22	6.8
14	A2-18	A3-23	RED	22	9.9
15	A3-23	A4-17	RED	22	9.1
16	A1-2	A2-1	BLK	22	3.5
17	A2-1	A3-15	BLK	22	5.2
18	A3-15	A4-3	BLK	22	9.4
19	A4-3	A6-E8	BLK	20	14.5
20	A1-3	A3-10	ORN	24	5.6
21	A3-10	A4-13	ORN	24	4.9
22	A1-4	A3-8	YEL	24	5.4
23	A3-8	A4-12	YEL	24	4.7
24	A1-5	A3-25	GRN	24	7.9

*In PP-7274/A. In PP-7274A/A, J503-15 connected to B901-1.

Table 3-1 Main Harness Wiring Data- Continued

Wire number	*Termination From*	*Termination To*	*Wire color*	*Wire size*	*Length (in.)*
25	A3-25	A4-33	GRN	24	7.2
26	A1-6	A3-24	BLU	24	8.6
27	A3-24	A4-32	BLU	24	8.0
28	A1-7	A2-3	VIO	24	4.5
29	A2-3	A4-30	VIO	24	5.1
30	A1-8	A2-2	GRA	24	4.9
31	A2-2	A4-31	GRA	24	4.9
32	A1-9	A2-14	RED/WHT	24	8.0
33	A2-14	A3-19	RED/WHT	24	8.2
34	A3-19	A4-20	RED/WHT	24	7.8
35	A1-10	A3-3	WHT	24	5.6
36	A1-11	A3-4	BLK/WHT	24	6.6
37	A1-12	A3-16	BRN/WHT	24	9.0
38	A1-13	A3-17	BLU/WHT	24	8.7
39	A1-14	A2-8	ORN/WHT	24	7.7
40	A1-15	A2-11	YEL/WHT	24	8.8
41	A1-16	A4-36	RED	22	5.9
42	A4-1	ØCA7-7	RED	20	13.6
43	ØCA7-7	ØBA7-7	RED	20	6.1
44	ØBA7-7	ØAA7-7	RED	20	6.0
45	A1-16	T903-2	RED	24	8.6
46	T903-2	T902-2	RED	24	4.9
47	T902-2	T901-2	RED	24	4.7
48	A1-17	T901-3	BRN/WHT	24	10.2
49	A1-18	T901-1	ORN/WHT	24	11.4
50	A1-19	T902-3	YEL/WHT	24	9.7
51	A1-20	T902-1	GRN/WHT	24	10.9
52	A1-21	T903-3	BLU/WHT	24	9.4
53	A1-22	T903-1	VIO/WHT	24	10.7
54	A2-4	A4-16	YEL	24	6.5
55	A2-5	A3-11	RED/WHT	24	4.7
56	A3-11	A4-2	RED/WHT	24	6.9
57	A4-2	A6-E7	RED/WHT	20	9.8
58	A2-6	A3-7	BLU	24	4.2
59	A3-7	A4-19	BLU	24	5.7
60	A2-7	ØCA7-1	VIO	24	17.0
61	ØCA7-1	ØBA7-1	VIO	24	12.8
62	ØBA7-1	ØAA7-1	VIO	24	12.8
63	A2-9	ØCA7-2	WHT	22	16.5
64	ØCA7-2	ØBA7-2	WHT	22	10.9
65	ØBA7-2	ØAA7-2	WHT	22	10.9
66	A2-12	A3-2	GRN	24	5.5
67	A2-15	A4-23	GRN/WHT	24	8.5
68	A2-16	A3-5	VIO	24	6.4
69	A3-5	A4-18	VIO	24	6.6
70	A2-17	A4-22	BLU/WHT	24	9.2
71	A2-20	A3-20	WHT	24	6.5
72	A3-6	A4-5	YEL/WHT	24	4.9
73	A3-13	A4-6	ORN/WHT	24	5.2
74	A3-18	A4-7	VIO/WHT	24	7.0
75	A3-22	A4-21	WHT	24	8.1
76	A4-8	ØCA7-3	BRN	22	13.1
77	A4-9	ØCA7-4	BRN/WHT	22	12.2
78	A4-10	ØCA7-10	GRN	22	10.0
79	A4-11	ØCA7-11	GRN/WHT	22	11.3
80	A4-14	ØBA7-10	BLU	22	13.1
81	A4-15	ØBA7-11	BLU/WHT	22	12.4
82	A4-24	ØBA7-3	YEL	22	15.6
83	A4-25	ØBA7-4	YEL/WHT	22	15.1
84	A4-26	ØAA7-3	ORN	22	16.5
85	A4-27	ØAA7-4	ORN/WHT	22	17.5
86	A4-28	ØAA7-10	VIO	22	15.0
87	A4-29	ØAA7-11	VIO/WHT	22	14.7

Table 3-1. Main Harness Wiring Data- Continued

Wire number	Termination From	Termination To	Wire color	Wire size	Length (in.)
88	T903-4	ØCA7-5	YEL	24	14.8
89	T903-5	ØCA7-6	BLU	24	14.4
90	T903-6	ØCA7-8	GRA	24	13.1
91	T902-7	ØCA7-9	ORN	24	12.4
92	T902-4	ØBA7-5	BRN/WHT	24	17.5
93	T902-5	ØBA7-6	RED/WHT	24	17.1
94	T902-6	ØBA7-8	BLK/WHT	24	15.6
95	T902-7	ØBA7-9	ORN/WHT	24	15.3
96	T901-4	ØAA7-5	YEL	24	20.3
97	T901-5	ØAA7-6	BLU	24	19.7
98	T901-6	ØAA7-8	GRA	24	18.4
99	T901-7	ØAA7-9	ORN	24	18.0

Table 3-2. Power Switch Wiring Data

Wire number	Termination From	Termination To	Wire color	Wire size
1	E60	E65	BLK	
2	E61	E63	WHT	16
3	E62	E64	WHT	16
4	CR704 AD	Q711-C	BUS	16
5	CR703 AD	Q708-C	BUS	16
6	E58	Q704-B	WHT	20
7	E57	Q703-B	WHT	20
8	T701-4	E48	RED	20
9	T701-5	E49	BRN	20
10	T701-8	E53	RED	20
11	T701-7	E52	GRN	20
12	T701-6	E7	WHT/RED	20
13	T701-1	Q711-E	ORN	16
14	T701-11	Q709-E	ORN	16
15	L701-6	Q704-E	YEL	16
16	E59	L701-1	BRN	16
17	E66	L701-2	RED	16
18	L701-7	Q703-E	RED	16
19	E56	E9	WHT	20
20	E45	E5	GRN	20
21	L701-4	E2	VIO	22
22	E15	E2	VIO	20
23	E16	E1	BLU	20
24	E18	E3	GRN	20
25	E22	E4	YEL	20
26	E24	E7	RED	20
27	E25	Q708-E	BLK	20
28	E26	E10	ORN	20
29	E31	E11	BRN	20
30	L701-5	E13	GRN	22
31	L701-3	E14	BLU	22
32	E17	E48	BRN	20
33	E19	E46	YEL	20
34	E20	E49	RED	20
35	E23	E47	ORN	20
36	E27	E53	BLU	20
37	E29	E55	YEL	20
38	E30	E52	VIO	20
39	E32	E54	GRN	20
40	E33	E50	WHT	20
41	E34	Q710-B	BRN	20
42	E35	Q711-B	VIO	20
43	E36	Q708-E	BLK	20
44	E37	T701-2	YEL	18

Table 3-2. Power Switch Wiring Data- Continued

Wire number	Termination From	Termination To	Wire color	Wire Size
45	E38	T701-3	GRN	18
46	E39	E51	WHT	20
47	E40	Q709-B	BRN	20
48	E41	Q708-B	VIO	20
49	E42	Q710-E	BLK	20
50	E43	T701-10	YEL	18
51	E44	T701-9	GRN	18
52	E68	Q711-E	BLK	20
53	E69	E70	RED	18
54	E71	Q710-E	BLK	20

Table 3-3. Power Transformer to Filter Wiring Data

Wire number	Termination From	Termination To	Wire color	Wire size	Length (in.)
1	J504-1	A6-1	BRN	18	4.3
2	T1-13	A6-1	BRN	18	5.5
3	J504-2	A6-2	RED	18	6.5
4	T1-12	A6-2	RED	18	7.5
5	J504-3	A6-3	ORN	18	3.3
6	T1-17	A6-3	ORN	18	8.1
7	J504-4	A6-4	YEL	18	5.5
8	T1-16	A6-4	YEL	18	10.5
9	J504-5	A6-5	GRN	18	5.6
10	T1-21	A6-5	GRN	18	5.3
11	J504-6	A6-6	BLU	18	8.4
12	T1-20	A6-6	BLU	18	7.1

Table 3-4. Power Harness Wiring Data

Wire No.	Termination From	Termination To	Wire color	Wire size	Length (in.)
1 (AØ)	A7-6	T1-19	BLK	14	6.5
2 (AØ)	A7-7	T1-18	BLK	14	6.5
3 (BØ)	A7-6	T1-14	BLK	14	5.5
4 (BØ)	A7-7	T1-15	BLK	14	5.5
5 (CØ)	A7-6	T1-10	BLK	14	6.5
6 (CØ)	A7-7	T1-11	BLK	14	6.5

3-5. Tools and Test Equipment

The tools and test equipment required for maintenance of the inverter are listed in table 3-5. No special test equipment is needed.

Table 3-4. Power Harness Wiring Data

Part number	Manufacturer	Name	Army designation number
Type 465	Tektronix	Oscilloscope	AN/USM-281
Model 331A	Hewlett-Packard	Analyzer, Spectrum	TS-723/A
Model 8200A	John Fluke	Voltmeter, Digital	AN/GSM-64
Model 5512A	Hewlett-Packard	Counter, Electronic Digital Readout	AN/USM-207
Model 880	Simpson	Wattmeter	
Model 6456B	Hewlett-Packard	Power Supply	
MS3106R22-6S	Commercial	Input connector	
MS3450W22-5P	Commercial	Output connector	
Type 501	Staco	Variable transformer single phase, 120v (qty 3)	
	Commercial	Rotary switch, 4 position, 10-15A (qty 5)	
	Commercial	Toggle switch, 3 position, 10-15A (qty 3)	
	Commercial	Toggle switch, 2 position, 10-15A (qty 6)	
	Commercial	Calibrated resistor, 0.1 ohm, 100w	
	Commercial	Calibrated resistor, 0.1 ohm, 10w (qty 3)	
	Commercial	Resistor, 70.6±1% ohm, 200w (qty 3)	

Table 3-5. Test Equipment - Continued

Part number	Manufacturer	Name	Army designation number
	Commercial	Resistor, 52.9± 1% ohm, 250w (qty 6)	
	Commercial	Resistor, 55.7± 1% ohm, 250w (qty 3)	
	Commercial	Inductor, 32 ± 3% mh (qty 3)	
	Commercial	Capacitor, 2.3 ± 3% µ f, 150 vac (qty 3)	

Section II. TROUBLESHOOTING

3-6. General

a. Troubleshooting of the static inverter shall be in accordance with tables 3-6 and 3-7 and the waveforms shown on figure FO-1. Troubleshooting will be performed with a variable 0 to +40 vdc power supply source and with a dc voltmeter and a dc ammeter connected between the power supply and connector J2 of the static inverter. For a complete listing of test equipment, refer to table 3-5.

WARNING

Make sure all switches and circuit breakers supplying power to the PP-7274/A are in the OFF position before connecting or disconnecting the input and output power cables from the unit or before starting any maintenance procedure.

CAUTION

Although voltages in the static inverter are relatively low (e.g., ± 28 vdc and 115 vac), current levels are high (up to 41 amperes in normal operation, and much higher in short circuit situations where the input capacitor bank can discharge through the short). As a result, failures are often catastrophic; therefore, unless the symptoms of a failure are known, be extremely careful when troubleshooting the static inverter. Be sure to apply carefully monitored low voltages to the unit to insure that no further damage will occur. Examine and test the outside power supply source. Check to see that the outside power source will apply 0 to +31 voltages evenly as required.

b. Check the unit with covers intact per paragraphs 3-41 through 3-51 before removing the covers and proceeding with the following procedures. After the unit has been examined and tested with covers on as noted, open and visually inspect it for burned or otherwise damaged components. Where failed components are located, resistance and continuity checks should be performed to isolate the faulty circuits and to identify the cause of the failure. It will be necessary to remove protective coating from leads to take readings. Where certain problems are apparent during testing, proceed in accordance with table 3-6.

3-7. Detail Network Troubleshooting Location

The following is an abstract of data in table 3-7 to aid in locating the various detail troubleshooting procedures.

Table 3-7 Sequence No.	Network
1	5.1v regulator (A4)
2	2.5v regulator (A4)
3	Excessive input current (A6) (A4) (A5)
4	Hf oscillator (A1)
5	3Ø sine wave generator (A1)
6	8 vdc Regulator (A4)
7	Recovery Drive (A1) (A9)(A7)
8	A0 feedback and control (typical) (A2) (A5)
9	Output drive (A4) (A7) (A4) Loss of regulation, output, or high distortion, one or more phases
10	Power switch circuits (A7)
11	Low or high output voltage (unit) distortion and regulation within specified limits

Table 3-6. Sequence of Primary Steps in Troubleshooting, Using Table 3-7

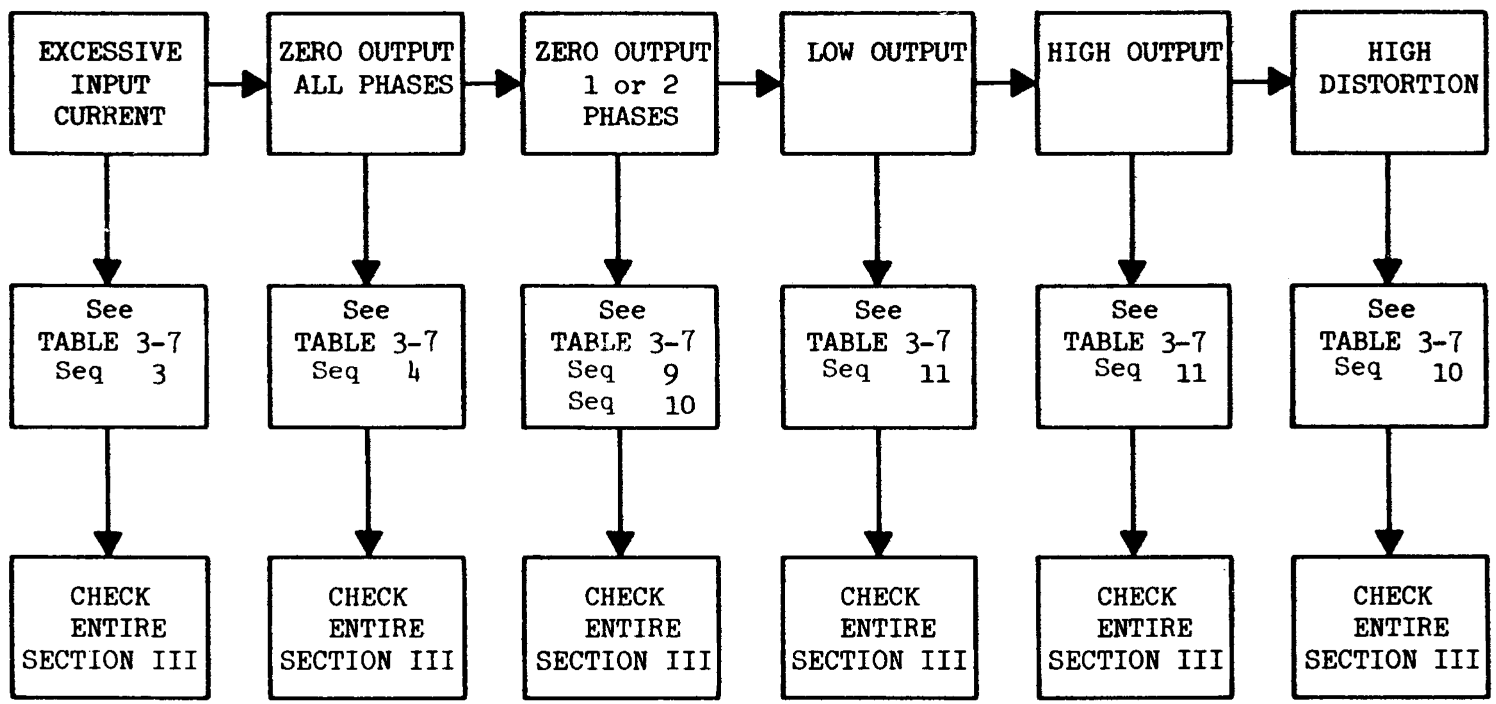

Table 3-7. Troubleshooting

Sequence	*Symptom*	*Test*	*Results*	*Solution*
1	+5v Regulator	A4		
1.1	Regulated output out of tolerance to 5.1v ±10%.	Visually examine associated circuitry for burned, broken, loose or incorrect parts.	*a.* Defect found	*a.* Repair or replace defective element.
			b. No visible defect	
1.2	Regulated output out of tolerance to 5.1v ±10%.	Monitor 28v input power at collector of Q406.	*a.* 28v input incorrect	*a.* Troubleshoot input power circuit.
			b. 28v input O.K.	*b.* 1.3
1.3	+5v low or zero	Measure CR406 and CR407 with ohmmeter.	*a.* Diode shorted	*a.* Replace defective diode.
			b. Diodes O.K.	*b.* 1.4
1.4	+5v low or zero.	Measure voltage across R414	*a.* Voltage less than .5v	*a.* Replace Q406.
			b. Voltage is .5 to .7v	*b.* 1.5
1.5	+5 v low or zero	Disconnect wire at terminal 17 of A4.	*a.* Voltage recovers to specified value.	*a.* Troubleshoot load circuits.
			b. Voltage remains low	*b.* 1.6
1.6	+5v low or zero	Substitute CR 405	*a.* Voltage recovers to 5v	*a.* Solder replacement Zener in circuit.
			b. Voltage remains low	*b.* 1.7
1.7	+5v low or zero	Remove C407	*a.* Voltage recovers to 5v	*a.* Replace C407.
			b. Voltage remains low	*b.* 1.8
1.8	+5v low or zero	Test resistance of R415	*a.* Resistance high.	*a.* Replace R415.
			b. Resistance O.K.	*b.* Repeat 1.1 through 1.8.
1.9	+5v high	Measure collector to emitter resistance of Q406.	*a.* Q406 shorted	*a.* Replace Q406 and 1.10.
			b. Q406 O.K.	*b.* 1.10
1.10	+5v high	Measure CR405 with ohmmeter	*a.* CR405 open.	*a.* Replace CR405
			b. CR405 O.K.	*b.* 1.11
1.11	+5v high	Measure CR406 and CR407 with ohmmeter.	*a.* Diode or diodes open	*a.* Replace defective diode.
			b. Diodes O.K.	*b.* 1.12
1.12	+5 vdc high	Parallel CR405 with substitute	*a.* Voltage in tolerance	*a.* Solder replacement into circuit.
			b. Voltage still high	*b.* Repeat 1.9 through 1.12.
2	+2.5v regulator	A4		
2.1	Regulated output not within 2.25 to 2.75v.	Visually examine associated circuitry for burned, broken, loose, or incorrect parts.	*a.* Defect found	*a.* Repair or replace defective element.
			b. No visible defect	*b.* 2.2
2.2	Regulated output not within 2.25 to 2.75v.	Monitor 28v input power at collector of Q405.	*a.* 28v input incorrect	*a.* Troubleshoot input power circuit.
			b. 28v input O.K.	*b.* 2.3
2.3	+2.5 low or zero	Measure CR403 and CR404 with ohmmeter.	*a.* Diode shorted	*a.* Replace defective diode.
			b. Diodes O.K.	*b.* 2.4
2.4	+2.5 low or zero	Measure voltage across R410	*a.* Voltage less than .5v	*a.* Replace Q405.
			b. Voltage is .5 to .7v	*b.* 2.5
2.5	+2.5v low or zero	Disconnect wire at terminal 20 of A4 board.	*a.* Voltage recovers to 2.5v	*a.* Troubleshoot load circuit.
			b. Voltage remains low	*b.* 2.6
2.6	+2.5v low or zero.	Substitute CR402	*a.* Voltage recovers to 2.5v	*a.* Solder replacement CR402 into circuit.
			b. Voltage remains low	*b.* 2.7
2.7	+2.5v low or zero	Remove C406	*a.* Voltage recovers to 2.5v	*a.* Replace C406.
			b. Voltage remains low	*b.* 2.8
2.8	+2.5v low or zero	Measure R411, R412, and R413	*a.* Resistance out of tolerance	*a.* Replace defective resistor.
			b. Resistance O.K.	*b.* Repeat 2.1 through 2.8

Table 3-7. Troubleshooting—Continued

Sequence	*Symptom*	*Test*	*Results*	*Solution*
2.9	+2.5v high	Measure collector to emitter resistance of Q405.	*a.* Q405 shorted *b.* Q406 O.K.	*a.* Replace Q405 and 2.10. *b.* 2.10
2.10	+2.5v high	Measure CR402 with ohmmeter	*a.* CR402 open *b.* CR402 O.K.	*a.* Replace CR402. *b.* 2.11
2.11	+2.5v output high	Measure CR403 and CR404 with ohmmeter.	*a.* Diode or diodes open *b.* Diodes O.K.	*a.* Replace defective diode. *b.* 2.12
2.12	+2.5 output high	Parallel CR402 with substitute	*a.* Voltage in tolerance *b.* Voltage remains high	*a.* Solder replacement into circuit *b.* Repeat 2.9 through 2.12
3	Excessive input current with high current loads disconnected.	A6, A5, T1, Various.		
3.1	Excessive input current with high current loads disconnected.	Visually examine capacitors C601 through C610, filter assembly and A4 for burned, broken, or otherwise damaged parts.	*a.* Defective part located *b.* No visible defects	*a.* Replace defective part. *b.* 3.2
3.2	Excessive input current with high current loads disconnected.	Disconnect filter module from main assembly and apply power to same (A5).	*a.* Input current is greater than 50 mA. *b.* Input current is less than 50 mA.	*a.* Replace module. *b.* 3.3
3.3	Excessive input current	Disconnect +28v and ground leads which supply power to circuit cards at capacitor bank (C601 through C610). Disconnect E61 from each A7 module.	*a.* Input current excessive *b.* Input current is less than 50 mA.	*a.* Capacitor bank or T1 defective. Locate and replace defective component. *b.* Load circuit is defective. Locate defective card/module and repair in accordance with appropriate paragraphs.
4	High frequency oscillator	A1		
4.1	Some or all hf osc signals defective.	Visually examine associated circuitry for burned, broken, loose, or otherwise damaged elements.	*a.* Defect found *b.* No visible defect	*a.* Repair defect. *b.* 4.2
4.1.1	Some or all hf osc signals defective.	Monitor terminals 3 through 8 for 6.4 kHz 3v square wave.	*a.* Some but not all signals missing or defective. *b.* All signals defective	*a.* 4.2 *b.* 4.2
4.2	Some hf oscillator signals defective.	Scrutinize circuit board for cracks or solder joints or other damage.	*a.* No visible defect *b.* Defect found	*a.* Replace I.C. associated with defective signal. *b.* Repair defect.
4.3	All hf oscillator signals defeective.	Monitor +5 v power	*a.* +5v power incorrect *b.* +5v power correct	*a.* Repair +5v power circuit *b.* 4.3.1
4.3.1	All hf oscillator signals defective	Monitor collector of Q101 for 38.4 kHz 3v square wave.	*a.* Signal present *b.* Signal not present	*a.* 4.3.2 *b.* 4.3.5
4.3.2	All hf oscillator signals defective	Test CR101, R112, and C116 with ohmmeter.	*a.* Defect located *b.* Components are good	*a.* Replace defective component. *b.* 4.3.3
4.3.3	All hf oscillator signals defective	Replace U103 and retest.	*a.* All signals present *b.* Problem persists	*a.* Solved. *b.* 4.3.4
4.3.4	All hf oscillator signals defective	Replace U104	*a.* All signals present *b.* Problem persists	*a.* Solved. *b.* Repeat 4.3.1 through 4.3.4.
4.3.5	All hf oscillator signals defective.	Monitor pin 4 of U102 for .4 v 38.4 kHz square wave.	*a.* Signal present *b.* Signal not present	*a.* Replace Q101. *b.* 4.3.6
4.3.6	All hf oscillator signals defective	Monitor pin 10 of U102 for 2.45 MHz sine wave.	*a.* Signal present *b.* Signal not present	*a.* 4.3.7 *b.* 4.3.8

Table 3-7. Troubleshooting—Continued

Sequence	Symptom	Test	Results	Solution
4.3.7	All hf oscillator signals missing	Monitor pin 14 of U102 for .4v 2.4 kHz square wave.	*a.* Signal present *b.* Signal not present	*a.* Replace Q101. *b.* Replace U102.
4.3.8	All hf oscillator signals missing	Test components in 2.45-MHz oscillator circuit with ohmmeter.	*a.* Defect located *b.* No defect found	*a.* Repair defect. *b.* 4.3.9.
4.3.9	All hf oscillator signals missing	Replace Y101 crystal unit and retest.	*a.* Oscillator functions *b.* Oscillator does not function	*a.* Solved. *b.* 4.3.10
4.3.10	All hf oscillator signals missing	Replace U101 and retest	*a.* Oscillator functions *b.* Oscillator does not function	*a.* Solved. *b.* Repeat 4.3.7 through 4.3.10.
5	3 Ø sine wave generator	A1		
5.1	Some or all outputs defective	Visually examine associated circuitry for burned, broken, loose, or otherwise damaged components.	*a.* Defect found *b.* No visible defect	*a.* Repair defect. *b.* 5.2
5.2	Some or all outputs defective	Monitor +2.5v and +5v input power.	*a.* Defective power source found *b.* Power inputs correct	*a.* Repair power source. *b.* 5.3
5.3	All outputs defective	Monitor pin 10 of U102 vor 2.4-MHz sine wave.	*a.* No singal present *b.* Signal present	*a.* 4.3.8 *b.* 5.4
5.4	All outputs defective	Monitor pin 14 of U102 for 2.4-kHz square wave.	*a.* No signal present *b.* Signal present	*a.* Replace U102. *b.* 5.5
5.5	All outputs defective	Monitor collector of Q102 for 4v 2.4-kHz square wave.	*a.* No signal present *b.* Signal present	*a.* Replace Q102. *b.* 5.6
5.6	All outputs defective	Test CR102, C117 and R113	*a.* Defective component found *b.* Components are good	*a.* Replace defective component. *b.* 5.7
5.7	All outputs defective	Replace U105	*a.* All signals present *b.* Problem persists.	*a.* Solved. *b.* Replace U104.
5.8	One or more but not all output signals defective.	Monitor U104 and U105 output pins for 3v 400-Hz square wave.	*a.* All signals present *b.* Some signals defective	*a.* 5.9 *b.* Replace associated I.C.
5.9	One or more but not all output signals defective.	Test (R106 through R111) resistor associated with defective output.	*a.* Resistor defective *b.* Resistors are good	*a.* Replace defective resistor. *b.* 5.10
5.10	One or more but not all output signals defective.	Disconnect load from output terminals.	*a.* Signal recovers *b.* Problem persists	*a.* Troubleshoot external circuit. *b.* 5.11
5.11	One or more but not all output signals defective.	Disconnect tuning capacitors and test same.	*a.* Defective capacitor found *b.* Capacitors are good	*a.* Replace defective capacitor. *b.* Replace transformer.
6	+8 vdc regulator	A4		
6.1	Regulated output out of tolerance (8v ± 1v).	Visually examine associated circuitry for burned, broken, loose, or otherwise damaged components.	*a.* Defect found *b.* No visible defect	*a.* Repair defect and 6. *b.* 6.2
6.2	Regulated output out of tolerance (7 to 9v).	Monitor +5v and +2.5v regulators for proper output.	*a.* +5v or +2.5v regulator defective *b.* +5v and +2.5v regulator operating normally.	*a.* Repair defective circuit. *b.* 6.3 or 6.4 as indicated by problem.
6.3	+8v regulator output low or zero.	Monitor pins 10 and 11 of U401 with oscilloscope or voltmeter.	*a.* Pin 10 voltage is equal or less than pin 11. *b.* Pin 10 voltage is greater than pin 11.	*a.* 6.3.1 *b.* 6.3.3
6.3.1	+8v regulator output low or zero.	Test CR415, R406, R407, R408, R409, and R442 with ohmmeter.	*a.* Defective component found *b.* No defect found	*a.* Replace defective component. *b.* 6.3.2
6.3.2	+8v regulator output low or zero	Replace U401	*a.* Output voltage recovers *b.* Problem persists	*a.* Solved *b.* Repeat 6.1 through 6.3.2.

Table 3-7. Troubleshooting—Continued

Sequence	*Symptom*	*Test*	*Results*	*Solution*
6.3.3	+8v regulator output low or zero	Disconnect external loads	*a.* Output voltage correct *b.* Problem persists	*a.* Troubleshoot external load circuitry. *b.* 6.3.4
6.3.4	+8v regulator output low or zero.	Monitor pin 13 of U401.	*a.* Voltage at pin 13 is less than .5vdc. *b.* Voltage at pin 13 is approximately .6vdc.	*a.* Replace Q404. *b.* 6.3.5
6.3.5	+8v regulator output low or zero.	Test R401, R402, Q401, Q402, Q403, CR401, C404, and L901 with ohmmeter.	*a.* Defective component found *b.* No defect found.	*a.* Replace defective component. *b.* Repeat 6.1 through 6.3.5.
6.4	+8v regulator output high	Disconnect external loads to prevent damage of same.		
6.4.1	8v regulator output high.	Test Q401, Q402, Q403, and Q404 with ohmmeter.	*a.* Defective component found *b.* No defect located	*a.* Replace defective component. *b.* 6.4.2
6.4.2	8v regulator output high	Monitor pins 10 and 11 of U401	*a.* Pin 10 equal to or higher than pin 11 voltage. *b.* Pin 10 lower than pin 11 voltage.	*a.* 6.4.3 *b.* 6.4.4
6.4.3	8v regulator output high	Test Q409, Q410, R406, R407, R408, R409, and CR415 with ohmmeter.	*a.* Defect located *b.* No defect located	*a.* Replace dfective part. *b.* Replace U401.
6.4.4	8v regulator output high	Monitor pin 13 of U401	*a.* Pin 13 less than .5 vdc.	*a.* Replace U401.
7	Recovery drive circuit not functioning properly.	A1		
7.1	Recovery drive circuit not functioning properly.	Visually examine associated circuitry for burned, broken, loose or otherwise defective elements.	*a.* Defective part located	*b.* Replace defective part.
7.2	Recovery drive circuit not functioning properly.	Monitor +5v, +2.5v and +8 to 12v power inputs and 3 Ø ac generator circuits for proper operation.	*a.* Defective power or signal source located. *b.* Power and signal normal.	*a.* Repair defective circuitry. *b.* 7.3
7.3	A Ø and B Ø recovery circuits inoperative, c Ø normal.	Monitor outputs of U106 (pins 1, 2, 13, and 14) for 7v 400-Hz square wave.	*a.* All or some outputs defective *b.* All signals correct	*a.* Replace U106. *b.* 7.5
7.4	C Ø recovery circuits inoperative, A Ø and B Ø normal.	Monitor outputs of U107 (pin 1 and 14) for 7v 400-Hz square wave.	*a.* One or both outputs defective *b.* Signals correct	*a.* Replace U107. *b.* 7.5
7.5	Some or all recovery outputs defective.	Monitor outputs of U108 are less than 5v 400-Hz square wave.	*a.* One or more signals missing *b.* All signals correct	*a.* Replace U108. *b.* 7.6
7.6	Some or all recovery outputs defective.	Test output transistors with ohmmeter.	*a.* Defective transistors located *b.* Transistors appear to be good	*a.* Replace defective transistors. *b.* 7.7
7.7	Some or all recovery outputs defective.	Test secondary of appropriate recovery transformer with ohmmeter.	*a.* Transformer open *b.* Transformer measures 8-10 ohm	*a.* Replace transformer. *b.* 7.8
7.8	Some or all recovery outputs defective.	Refer to A7 test recovery circuit elements in appropriate A7 module. Defective element in secondary circuit of recovery transformers can cause distortion or overloading of primary circuit (fig. 3-35).	*a.* Defect located *b.* A7 module appears to be correct	*a.* Repair defect. *b.* Replace recovery transformer T901, T902, or T903.
7.9	High voltage spikes at leading and/or trailing edge of recovery pulse	Visually examine associated circuitry for burned, broken, loose, or	*a.* Defective component found *b.* No defect found	*a.* Repair defect. *b.* 7.10

Table 3-7. Troubleshooting—Continued

Sequence	*Symptom*	*Test*	*Results*	*Solution*
7.10	High voltage spikes at leading and/or trailing edge of recovery pulse (primary of T901, T902, or T903).	Replace RC network on associated transformer.	*a.* Spike amplitude reduced	*a.* Solved.
8	A Ø feedback and control not performing properly.	A2		
8.1	A Ø will not regulate	Visually examine associated circuitry for burned, broken, loose, or otherwise defective component.	*a.* Defective component found *b.* No defect found	*a.* Replace defective component. *b.* 8.2
8.2	A Ø will not regulate	Monitor 5v, 2.5v and negative bias power input circuits.	*a.* Power source incorrect *b.* Power source correct	*a.* Repair power source. *b.* 8.3
8.3	A Ø will not regulate	Monitor terminals 10 and 13 for approx 35v p-p 400-Hz ac signal.	*a.* One or both signals missing *b.* Feedback signal O.K.	*a.* Replace filter assembly A5. *b.* 8.4
8.4	A Ø will not regulate	Monitor anodes of CR209 and CR213 for full wave rectified feedback signal.	*a.* Signal is ½ wave rectified or not present. *b.* Signal O.K.	*a.* 8.5 *b.* 8.6
8.5	A Ø will not regulate	Test CR209, CR213, R220, and R222 with ohmmeter.	*a.* Defect located *b.* No defect found.	*a.* Replace defective part. *b.* 8.5.1
8.5.1	A Ø will not regulate but has output.	Test CR205, CR206 with ohmmeter.	*a.* Defect located	Replace defective part.
8.6	A Ø will not regulate but has output	Monitor pin 8 of U203 for rectified feedback signal.	*a.* Signal not present *b.* Signal present	*a.* 8.6.1 *b.* 8.7
8.6.1	A Ø will not regulate but has output.	Test R228, R229, R233, R231, U207, and C213 with ohmmeter.	*a.* Defect found	*a.* Repair defect.
8.7	A Ø will not regulate but has output.	Monitor pin 9 of U203 to establish reference voltage, then monitor pins 8 and 14.	*a.* Pin 14 switches from positive 5v to near ground when pin 8 exceeds pin 9 voltage by 2 mV. *b.* Pin 14 does not switch as in A above.	*a.* 8.8 *b.* Replace U203.
8.8	A Ø will not regulate but has output.	While monitoring pin 14 of U203 and collector of Q203, vary R228.	*a.* When negative pulse width of pin 14 at U203 increases, voltage at collector of Q203 goes more positive. *b.* Pulse width of pin 14 of U203 has no effect on voltge at collector of Q203.	*a.* 8.9 *b.* 8.8.1
8.8.1	A Ø will not regulate but has output.	Test Q203, R234, R236, R237, R235, C214, C215, R238, R239, and CR210 with ohmmeter.	*a.* Defective component located.	*a.* Repair defect
8.9	A Ø will not regulate but has output	Monitor drain and source of Q205 with dual trace oscilloscope while varying R228, or load applied to Ø A.	*a.* Amplitude of 400-Hz signals at S and D of Q205 vary with adjustments. *b.* No variations at S or D noted.	*a.* 8.10 *b.* Replace Q205.
8.10	A Ø will not regulate but has output.	Monitor pins 1 and 7 of U201 with dual trace oscilloscope.	*a.* Pin 1 exhibits positive spikes of twice the hf osc frequency and pin 7 exhibits a sawtooth wave synchronized with spikes at pin 1. *b.* Pin 1 of U201 inputs as in a above but no sawtooth wave at pin 7. *c.* No signal or incorrect signal at pin 1 or pin 7 of U201.	*a.* 8.11 *b.* 8.10.1 *c.* *8.10.2*

Table 3-7. Troubleshooting—Continued

Sequence	*Symptom*	*Test*	*Results*	*Solution*
8.10.1	A Ø will not regulate but has output.	Test C203, R204, R205, C204	*a.* Defective component found *b.* No defect located	*a.* Replace defective component. *b.* Replace U201.
8.10.2	A Ø will not regulate but has output.	Test C201, C202, R201, R202, Cr201, and CR202.	*a.* Defective component found *b.* No defect located	*a.* Replace defective component. *b.* Troubleshoot hf oscillator circuit.
8.11	A Ø will not regulate but has output.	Monitor inputs and outputs of U203, U204, and U205. When the voltage at negative inputs exceed that at positive inputs by 2 mV, output should switch from high to low.	*a.* Defective signal located *b.* Defect not located	*a.* Replace associated I.C. *b.* 8.12
8.12	A Ø will not regulate but has output.	Test Q207 and Q208.	*a.* Defective transistor *b.* Transistors O.K.	*a.* Replace defective transistor. *b.* 8.13
8.13	A Ø will not regulate but has output.	Monitor pins 15 and 17 with dual trace oscilloscope and vary R228 on A Ø load.	*a.* Pulse width of signals vary with control or load variations (wider low-level pulse for greater output power or voltage). *b.* Pulse width doesn't vary with load or control variations.	*a.* Troubleshoot A4 or A7 circuit. *b.* Repeat section 8.
8.14	B Ø, C Ø will not regulate but have output.	Monitor pins 18 and 22 on A3 and vary R356 for B Ø. Monitor pins 6 and 13 on A3 and vary R309 for C Ø.	*a.* Pulse width of signals vary with control or load variations (wider low-level pulse for greater output power or voltage). *b.* Pulse width doesn't vary with load or control variations.	*a.* Troubleshoot A4 or A7 circuit. *b.* Repeat section 8.
9	Output drive signals defective.	A4		
9.1	Loss of regulation, output or high distortion, one or more phases.	Verify presence of +5vdc, 2.5v dc power and various signals from other circuit boards.	*a.* Power or signals missing *b.* All inputs correct	*a.* Troubleshoot appropriate circuit. See 1 through 3.3. *b.* 9.2
9.2	Loss of regulation, output or high distortion, one or more phases.	Monitor appropriate (see below) output terminals with oscilloscope for groups of 15 positive 1.2v pulses at a group repetition rate of 400 Hz. A Ø = 26, 27, 28, and 29 B Ø = 14, 15, 24, and 25 C Ø = 8, 9, 10, and 11	*a.* One or more outputs exhibit pulse groups as indicated but greater than 1.5v amplitude. *b.* One or more outputs exhibit pulse groups as indicated but approximately .6v amplitude. *c.* No output	*a.* Transistor in A7 module is open. *b.* Transistor in A7 module shorted. *c.* 9.3
9.3	Loss of regulation, output or high distortion, one or more phases.	Verify presence of 8v power at A7 modules.	*a.* 8v power correct *b.* 8v power incorrect	*a.* 9.4 *b.* Troubleshoot 8v power circuit.
9.4	Loss of regulation, output or high distortion, one or more phases.	Measure resistance between defective output and input of associated A7 module.	*a.* High resistance *b.* Short circuit	*a.* Repair broken wire. *b.* 9.5
9.5	Loss of regulation, output or high distortion, one or more phases.	Monitor output of associated U401, 402, 403, or 404 integrated circuit for positive 4v pulse groups.	*a.* Pulse groups present *b.* Pulse groups not present	*a.* Replace associated U405, 406 integrated circuit. *b.* Replace U401, 402, 403, or 404 integrated circuit.
10	Power switch circuits	A7		

Table 3-7. Troubleshooting—Continued

NOTES

1. If a steady high signal is applied to terminals E3, E4, E10, or E11 either due to failure of components on control boards or open input terminals, catastrophic failure of one or both transistors in affected Darlington pair will occur. If emitter to base junction is open on transistors Q701, Q707, Q706, or Q712, the associated signal source must be corrected prior to replacement and application of power to defective transistor circuit.
2. If catastrophic failure (i.e. burned components) has occurred in the power driver section, both visible and invisible defects must be repaired prior to full input power application or additional damage will result.
3. Care must be taken inattaching circuit board A7A1 to heat sink assembly to prevent pinching wires and creating short circuits.

Sequence	*Symptom*	*Test*	*Results*	*Solution*
10.1	Catastrophic failure (i.e. burned components)	Visually examine circuit components for obvious defects.	Defective components located	Replace defective components and 10.2
10.2	Catastrophic failure	Use ohmmeter to test all semiconductor devices, resistors and capacitors in affected circuit.	*a.* Defect located *b.* Circuit test O.K.	*a.* Replace defective component and 10.3 *b.* 10.3
10.3	Catastrophic failure power driver circuit.	While monitoring anodes of CR703 and CR704 with dual trace oscilloscope, slowly increase input voltage. Watch for positive dc voltage increase which will be switched on and off as system begins to function.	*a.* Oscilloscope indicates no increase in dc voltage at one or both test points. *b.* Voltage increases normally, one test point begins forming pulse groups which peak in center of each group. *c.* Voltage increases normally and both test points indicate formation of pulse groups which peak in center of group.	*a1.* Power transistor shorted in circuit which does not increase in voltage. Replace shorted device. *a2.* Power transformer T1 or commentions open. *b.* 10.4 *c.* 10.6
10.4	Catastrophic failure power driver circuit.	Monitor C707 and C706 positive terminals for formation of positive pulse groups of approximately one volt amplitude as input voltage is increased.	*a.* Pulse group forms on one but not both test points. *b.* Pulse group forms on both test points.	*a.* 10.4.1 *b.* 10.2
10.4.1	Catastrophic failure power driver circuit.	Monitor collector of Darlington pair associated with missing signal (Q713 & Q701 etc.) for 15v square wave pulse group.	*a.* Pulse group not present *b.* Pulse group present	*a.* Note 1 or defective T702. *b.* 10.4.2
10.4.2	Catastrophic failure power driver circuit.	Monitor secondary of T702	*a.* Pulse group not present *b.* Pulse group present	*a.* Replace T702. *b.* Replace associated diodes CR708 and CR715, etc.
10.5	High distortion, poor or loss of regulation (no visible damage).,	Monitor collector of each Darlington pair for 15v square wave pulse groups.	*a.* Low portion of pulse group above one volt, not rectangular, and top of pulse is rectangular. *b.* 15v square wave present	*a.* Darlington circuit burned open. See note 1. *b.* *10.5.1*

Table 3-7. Troubleshooting—Continued

Sequence	*Symptom*	*Test*	*Results*	*Solution*
10.5.1	High distortion, poor or loss of regulation (no visible damage).	Monitor secondary of T702 for 1.5-volt square wave.	*a.* One or both secondaries per section do not exhibit square wave. *b.* Both secondaries per section exhibit square wave.	*a.* Replace T702. *b.* 10.5.2
10.5.2	High distortion, poor or loss of regulation (no visible damage).	Monitor full wave rectifier output of each section.	½ wave rectification present.	Replace defective diode.
10.6	High distortion, poor or loss of regulation (no visible damage).	Monitor anodes of CR702 and CR704 with dual trace oscilloscope (fig. 3-1). Slowly increase input voltage.	*a.* Pulse train similar to that shown on figure 3-1 develops. *b.* Alternate pulse peaks are grossly different (less than 20%) in amplitude on one or both traces.	*a.* System operating normally. *b.* 10.7
10.7	High distortion, poor or loss of regulation (no visible damage).	Test recovery circuit components in defective section (i.e. Q702, Q703, CR717, CR701, R729, R701, R727) with ohmmeter.	*a.* Defect located *b.* All parts are good	*a.* Replace defective components. *b.* 7

NOTES

1. Visible damage in the form of burned components is generally the result of invisible defects. Locate and repair cause of burn outs prior to power application or additional damage will occur.
2. If major repairs are to be accomplished, all A7 modules should be disconnected from +8v and +28v power sources until all control cards have been proven to be operational. This may be accomplished by disconnecting wires at terminal E7 and terminals 6 and 7 of output current transformers.

11	Low or high output voltage, distoriton and regulation O.K.	Adjust applicable voltage control potentiometer A Ø = R228 B Ø = R356 C Ø = R309	*a.* Voltage recovers to specified value. *b.* Voltage cannot be adjusted to specified value.	*a.* Solved. *b.* Troubleshoot appropriate circuit. A Ø = A2 B Ø = A3 C Ø = A3
12	Hidden shorts of capacitors C 502, C 503, C505 or C 506 in Output Filter A5 (no visible damage)	Verify presence of approx. 58 Volts AC between ground and each of the pins B, C, E or F of Jack II	a. 58 Volts AC are measured between each of these pins and ground. b. Between one or more of the pins and ground 58 Volts AC cannot be measured.	a. Capacitors C 502, C 503, C 505 and C 506 are in order. b. One or more of the capacitors are shorted. Replace Ouput Filter A5.

3-8. Procedure Steps in Troubleshooting

Examine each circuit board and module for loose or broken components, foreign materials, etc. Check wire terminations for breakage or loose soldering. The red wire to pin 7 of each power switch board (A7), inductor L901, and the primary of the output transformer (T1) should be disconnected at this time.

3-9. Ohmmeter Tests

a. Measure dc input leads with ohmmeter. The correct polarity should measure greater than 350 ohms. See paragraph 3-24.

b. Reverse polarity should measure low resistance (but greater than 1 ohm). This is measured at forward impedance (Z) of CR501 (A5).

c. Disconnect J503, measure resistance of T501, T502, and T503 secondary windings (center tap to each side). Resistance should be approximately 25 ohms on each side. If not, replace filter module (A5). Reconnect J503.

d. Measure power transistors (Q703, Q704, Q708, Q709, Q710, Q711) for case to heatsink shorts. These measurements are made on the A7 module.

3-10. Power Applied Tests

CAUTION

Position all loose wires so that they will not come in contact with conductive elements. Check to see that the red wire to pin 7 of each power switch board (A7), inductor L901 and the primary of the output transformer (T1) is disconnected.

a. Test Equipment Setup.

(1) Connect decade resistance box (set at 820 ohms) in place of R442 cm A4 board.

(2) Connect oscilloscope or dc voltmeter between terminals 1 (+5v) and 2 (GND) of A1 board.

(3) Connect oscilloscope or dc voltmeter between terminals 9 (2. 5 v reference) and 2 (GND) of A1 board.

(4) Connect dc power source to input connector J1.

b. Power Tests.

(1) While monitoring dc input current, slowly increase input voltage to + 5 v. If input current does not exceed 1 amp, continue increasing input voltage to + 8 v while observing + 5 v monitor. The + 5 v regulator circuit on the A4 board should be 5 v ± .5. If output is incorrect, repair same before proceeding. See table 3-7, sequence 1.

(2) Monitor 2 .5 v reference voltage at terminal 9 of A1 board for 2.5 v ± 0.25. If output is incorrect, repair before proceeding. See table 3-7, sequence 2.

(3) If 5 and 2 .5 v regulators appear to function properly, increase input voltage to 28 vdc. If input current exceeds 2 amperes, locate and repair fault. See table 3-7, sequence 3.

3-11. A1 Board Test

a. Monitor terminals 3 through 8 with oscilloscope for square wave of approximately 3.5 v peak at 6.2 kHz. If signals are not present, repair before proceeding. See table 3-7, sequence 4.

b. Monitor terminals 10 through 15 with oscilloscope for a 400-Hz sine wave of approximately 1. 2 v peak to peak. If signals are not present, repair before proceeding. See table 3-7, sequence 5.

c. When all the above conditions have been met, remove power and connect L901 to terminals 34 and 35 of A4 board. Connect oscilloscope or dc voltmeter between terminal 35 (+8 to 12v) of A4 board and 2 (GND) of A4 board. Increase input voltage to + 15 v while observing the + 8 to 12 v monitor. If the observed voltage exceeds + 13 v, repair regulator circuit before proceeding. See table 3-7, sequence 6.

d. Continue increasing input voltage to + 28 vdc while observing +8 to 12 v monitor. Regulator should maintain 8 ± 1v at output. If not correct, repair before proceeding. See table 3-7, sequence 6.

e. Monitor pins 17 through 21 on the A 1 board for an approximately 15 v. 400 Hz square wave output. If signals are not present, repair before proceeding. See table 3-7, sequence 7.

3-12. Phase Adjustments Al Board

NOTE

This procedure is applicable only when T101 -3 or associated components have been changed.

a. For phase A, connect capacitance decade box in parallel with T101 terminals 1 and 2.

(1) Monitor T101 terminal 1 and U105 pin 5 (at R106) with dual trace oscilloscope.

(2) Adjust decade box capacitance until the square wave at U105 is in phase with sine wave at T101 (± 4.0° maximum deviation).

(3) Select capacitors C110 and C113 to equal the value indicated by the decade box.

b. For phase B select C111 and C114 as in A phase above, using test points applicable to phase B. For phase C, select C112 and C115 as in A phase above using test points applicable to phase C.

3-13. A2 Board Test

For A phase data output, monitor board terminals 15 and 17 with dual trace oscilloscope for groups of 15, a + 5 v level with 4 v negative-going pulses at a 400-Hz group repetition rate. The signal at terminal 15 should occur 180° out of phase with that at terminal 17. If signals are not present, repair before proceeding. See table 3-7, sequence 8.

3-14. A3 Board Test

For C phase data output, monitor terminals 13 and 6 as in A phase (para 3-13). For B phase data ouput, monitor terminals 22 and 18 as in A phase (para 3-13).

3-15. A4 Board Test

a. For C phase data, monitor terminals 8 through 11 with dual trace oscilloscope, for complementary pulse groups at a group repetition rate of 400 Hz. If either signal is not present, repair before proceeding. See table 3-7. sequence 9.

b. Proceed as in *a* above for the following remaining tests:

(1) For B phase data, monitor terminals 14, 15, 24, and 25 as in C phase data.

(2) For A phase data, monitor terminals 26 through 29 as in C phase data.

(3) For A phase data, monitor terminals 28 and 29 as in C phase data.

(4) Remove dc input power.

3-16. Module A7 Tests

Repeat this procedure for each phase.

a. Use clip leads to connect a resistor of 10 ohms greater than 2 watts in series with pin E7 and +8 vdc power lead (red). Apply 28-vdc input power.

b. Monitor terminals 7 and 8 of T701A with dual trace oscilloscope for presence of push-pull drive. If either signal is not present, repair appropriate circuit. See table 3-7, sequence 10. See waveform on figure 3-32.

(1) Monitor terminals 4 and 5 of T701B.

(2) Monitor positive terminals of C706 for rectified output of T701. If signal is not present, repair before proceeding. See table 3-7, sequence 10.4.

(3) Monitor positive terminal of C707 as in (2) above.

(4) Remove power, remove resistor from +8 v power source, clip + 8 v direct to pin 7. Reapply power and repeat (2) and (3) above. Upon completion of tests remove power.

c. Repeat a *and b* above for other A7 modules.

3-17. Single Phase Closed Lop Test

a. For this test, make the following connections:

(1) Connect +8 vdc to pin E7 fo A7 phase A with clip lead.

(2) Connect appropriate primary winding of T101 to output terminals 6 and 7 of A7 with clip leads (fig. FO-7).

b. Monitor anodes of CR703 and CR0704 with oscilloscope. Slowly increase input voltage while observing input current and output voltage meters. Input current should fold back at less than 10 amperes and output voltage should regulate at approximately 110 vac. If not, repair before proceeding. See table 3-7, sequence 10.3.

c. The waveform should approximate that shown in figure FO- 1 for anode of CR703.

(1) Measure and record distortion. Distortion should be less than 6 percent.

(2) Apply 125-watt load. Distortion should remain under 6 percent.

(3) Apply 250-watt load. Distortion should remain under 6 percent. Remove power and clip leads.

d. Test phase B and phase C as in A phase *(a, b,* and *c* above). If distortion readings exceeded 6 percent,refer to table 3-7, sequence 10.3. Replace all wiring.

3-18. Systems Test Procedure

NOTE

See paragraphs 3-41 through 3-51 on unit checkout.

a. Slowly increase input voltage to 28 vdc while visually scanning test monitors.

(1) Dc input current should increase to approximately 10 amperes then drop as input voltage is increased.

(2) Ac output voltages should increase evenly to approximately 110 ac and then stabilize.

b. After a 5-minute warmup period at 28-vdc input voltage, adjust output voltage controls for 116 v.

(1) Adjust R228 on A2 board for phase A.

(2) Adjust R309 on A3 board for phase C.

(3) Adjust R356 on A3 board for phase B.

c. Test static inverter as follows:

(1) If distortion is out of specified limits or grossly different phase to phase, adjust decade resistance (in place of R442) for minimum distortion within a voltage range of + 6.5 to 8 vdc out of the dc regulator circuit.

(2) If distortion is still out of specified limits, connect capacitance trimmer fixture (para 3-41) in place of C617, C618, and C619 (fig. FO-1). Adjust trimmer for approximately 4 percent distortion and minimal dc input current but do not exceed 0.5 μf difference between phases of 40-ampere input at full load (resistive) and 28 v.

(3) If trimmer capacitors must be used, readjust output voltage as required (b above).

d. Install trimmer capacitors C617, C618, and C619 in accordance with selection made in *c* (2) above. Install R442 in accordance with requirement as indicated by resistance decade box setting. **Remove power.**

3-19. Module Level Troubleshooting Summary

If requirements of preceding paragraphs have been met, the major module troubleshooting test procedure is complete. If not, correct deficient areas in accordance with detailed troubleshooting techniques as shown in table 3-7.

Section III. DISASSEMBLY AND REASSEMBLY

3-20. Disassembly and Reassembly Procedures

a. Disassembly. For rapid and efficient access to various modules, proceed as follows:

(1) Remove the two covers.

(2) Remove filter (A5).

(3) Remove power switch boards (A7) and hookup wiring.

(4) Remove wiring harness (W1).

(5) Remove PCB deck (A2 through A4).

(6) Remove capacitor assembly (A6).

(7) Remove wire assemblies (W2 and W3).

(8) Remove fan bulkhead assembly (A9).

(9) Remove power transformer (T1).

b. Reassembly. Te reassembly sequence is the reverse of disassembly (*a* above).

3-21. Parts Location

Refer to figures 3-1 through 3-9 for parts location and identity. Refer to figure 3-1 (2 sheets) for exploded view of unit and attaching parts. Disassemble the static inverter in the sequence of index numbers which follow and as shown on figure 2-1.

Callouts for fig. 3-1:

1 Screw	15 Regulator board	29 Wire assy
2 Cover	16 Spacer	30 Lug
3 Label	17 BØ, CØ board	31 Lug
4 Screw	18 Spacer	32 Lug
5 Panel	19 AØ board	33 Screw
6 Filter	20 Insulator	34 Capacitor assy
7 Nut	21 Nut	35 Screw
8 Screw	22 Stud	36 Transformer
9 Lockwasher	23 Screw	37 Screw
10 Screw	24 Spacer	38 Washer
11 Power switch module	25 Oscillator board	39 Bus
12 Truss	26 Fan-capacitor assy	40 Base
*13 Thermostat	27 Wire assy	41 Capacitor
14 Harness assy	28 Washer	

***Not used in PP-7274/A. Not part of PP-7274A/A.**

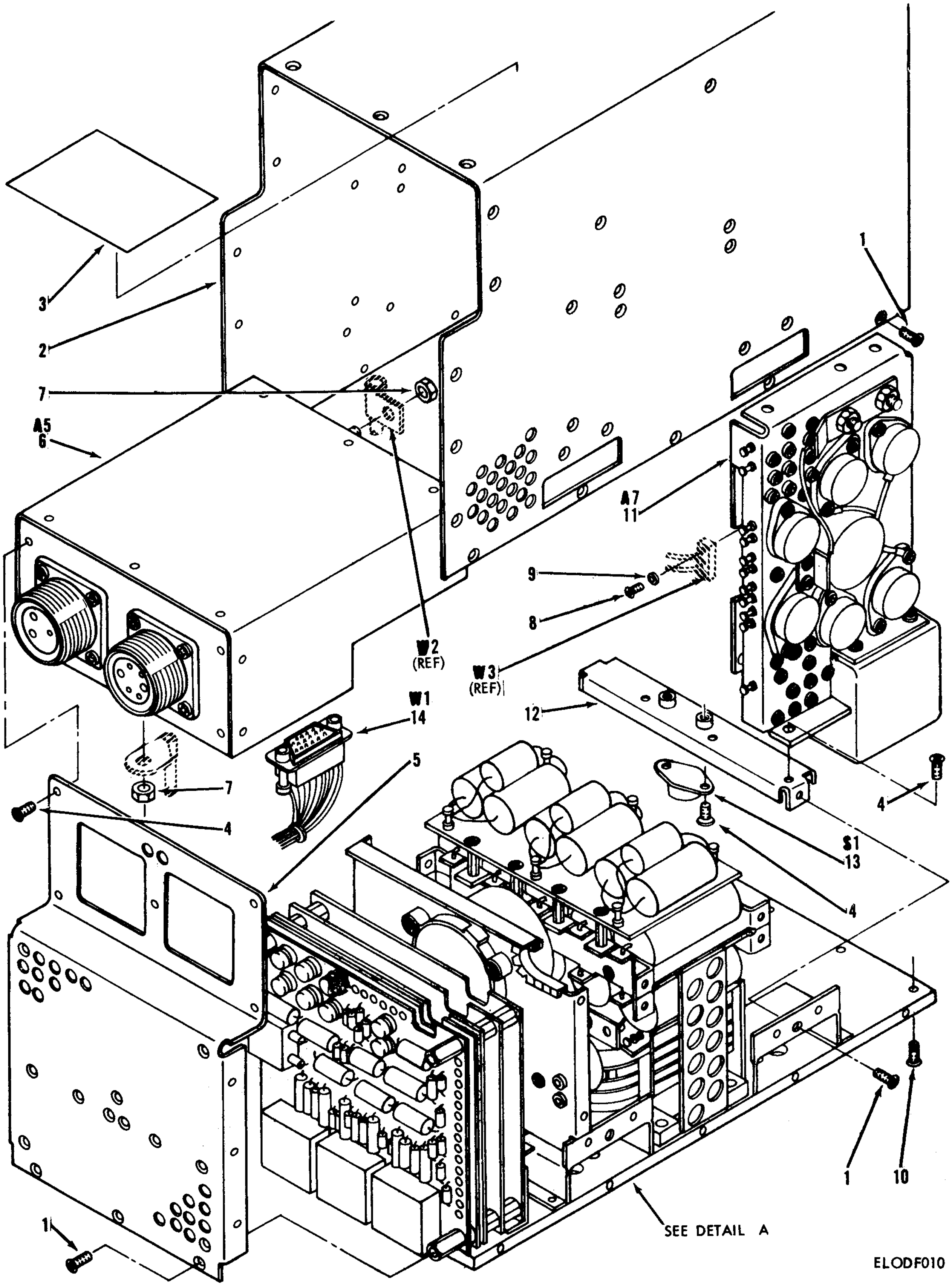

Figure 3-1 ①. General assembly of static inverter (sheet 1 of 2).

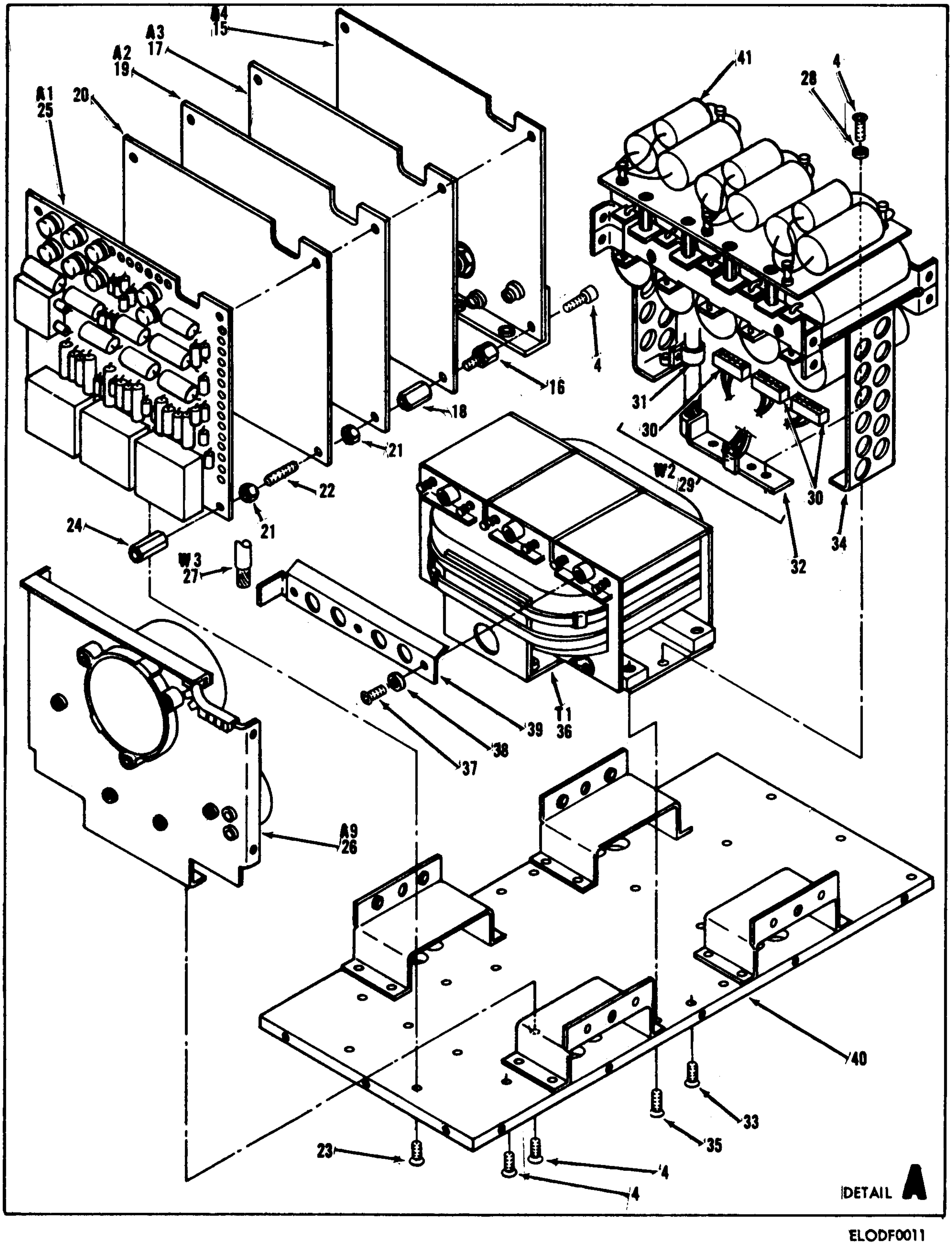

Figure 3-1 ②General assembly of static inverter (sheet 2 of 2).

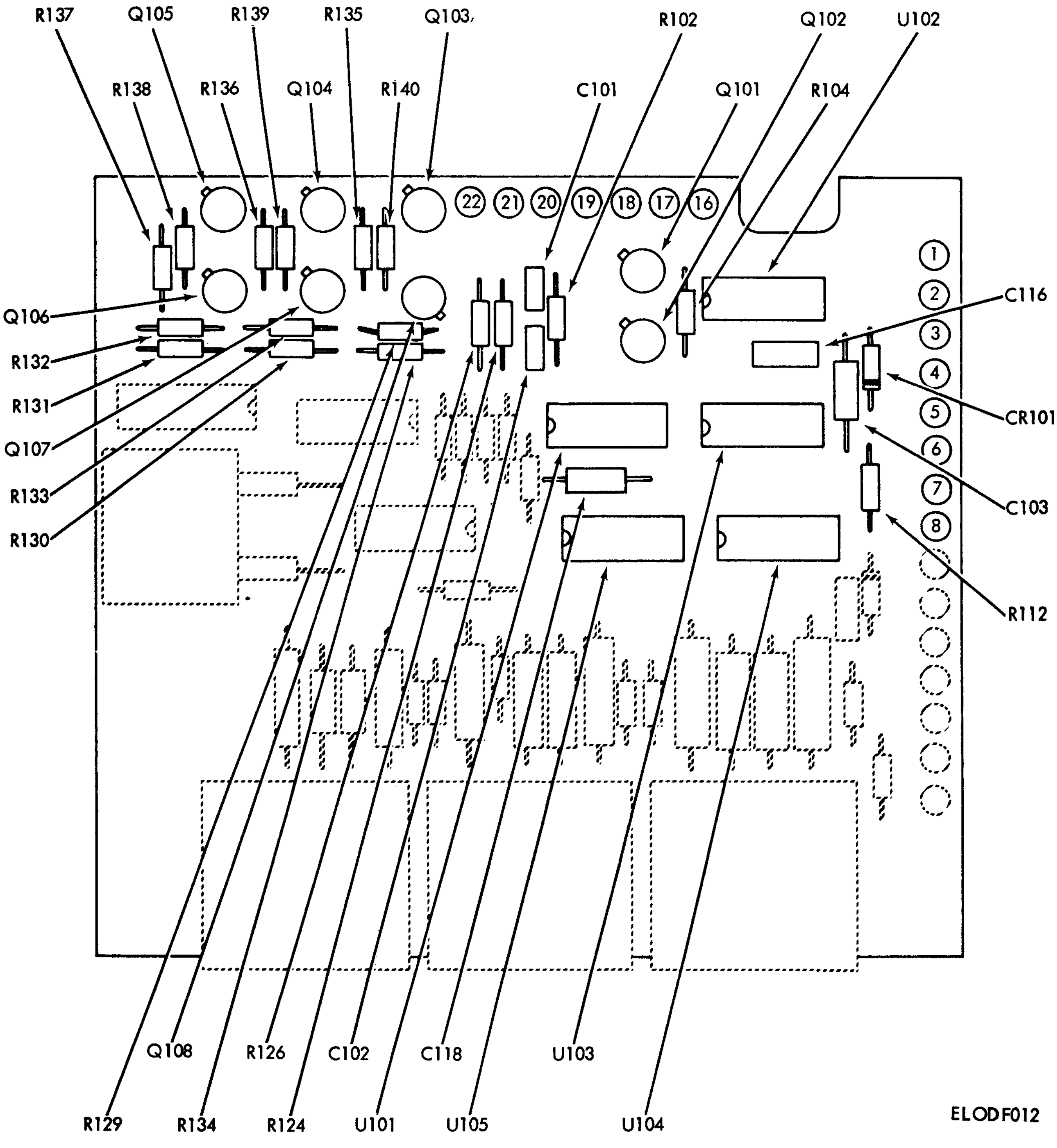

Figure 3-2 ①. Oscillator printed circuit board assembly (A1) (sheet 1 of 2).

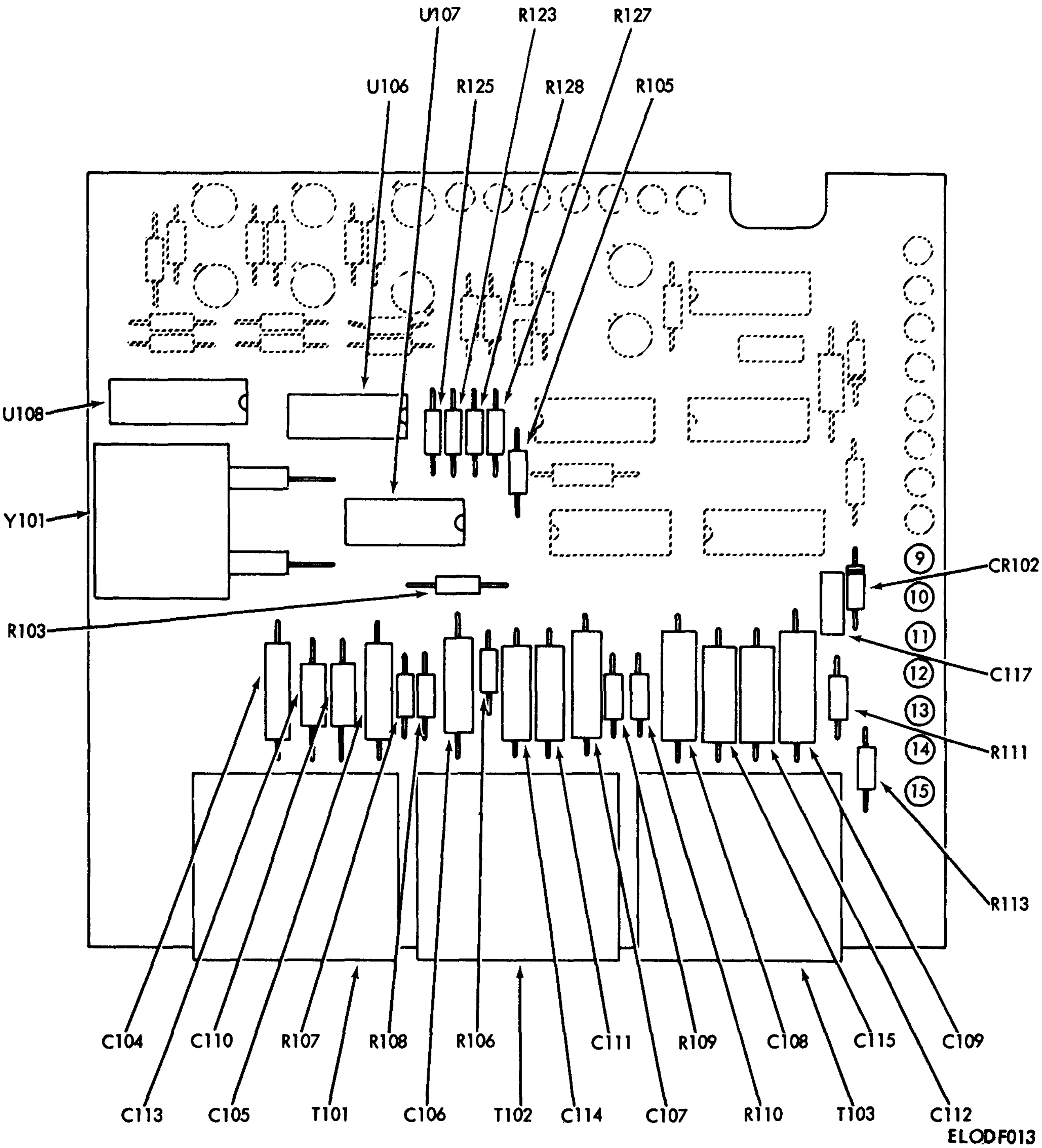

Figure 3-2 ②. Oscillator printed circuit board assembly (A1) (sheet 2 of 2).

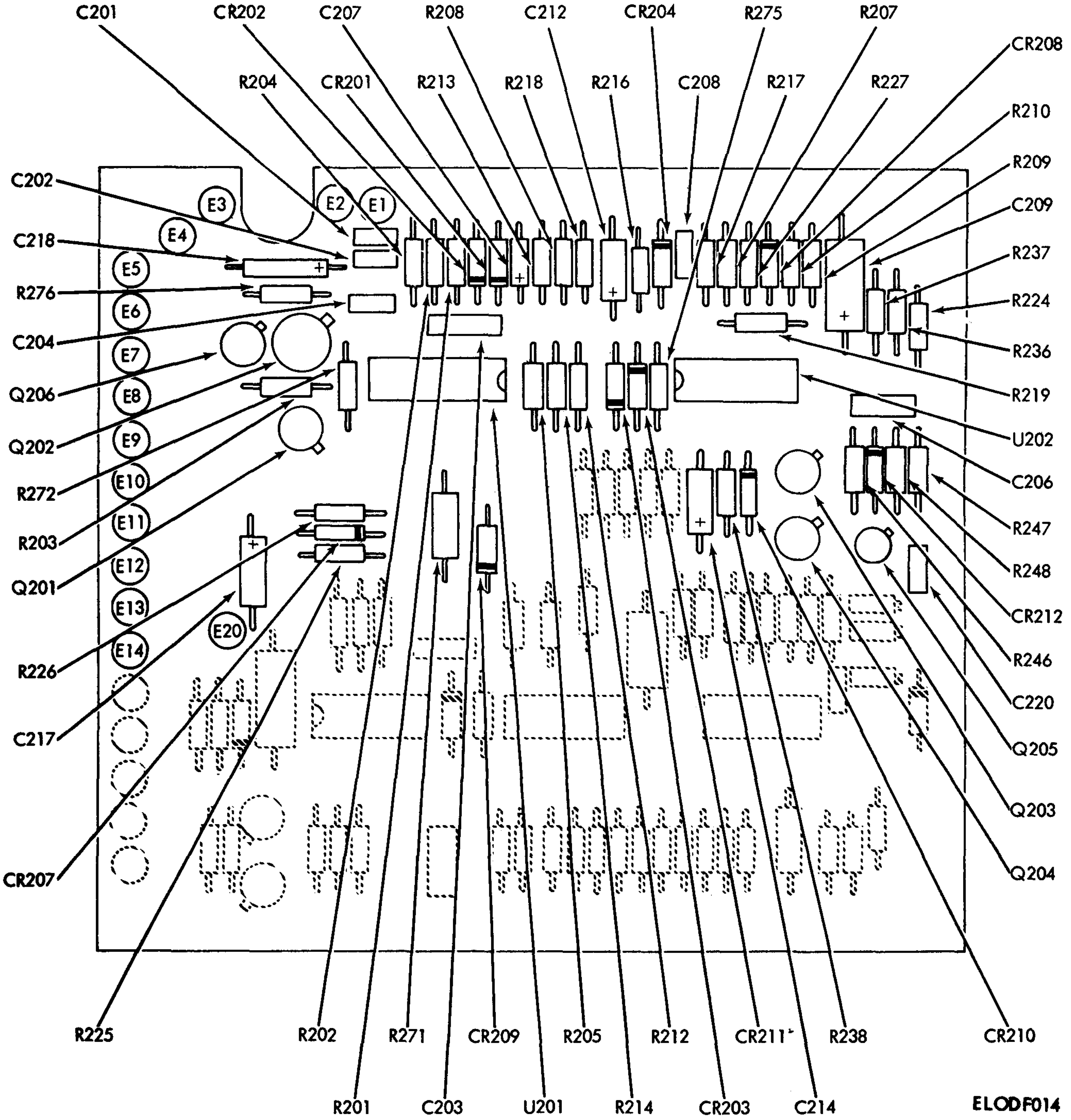

Figure 3-3 ①. AØ modulator and current sense printed circuit board assembly (A2) (sheet 1 of 2).

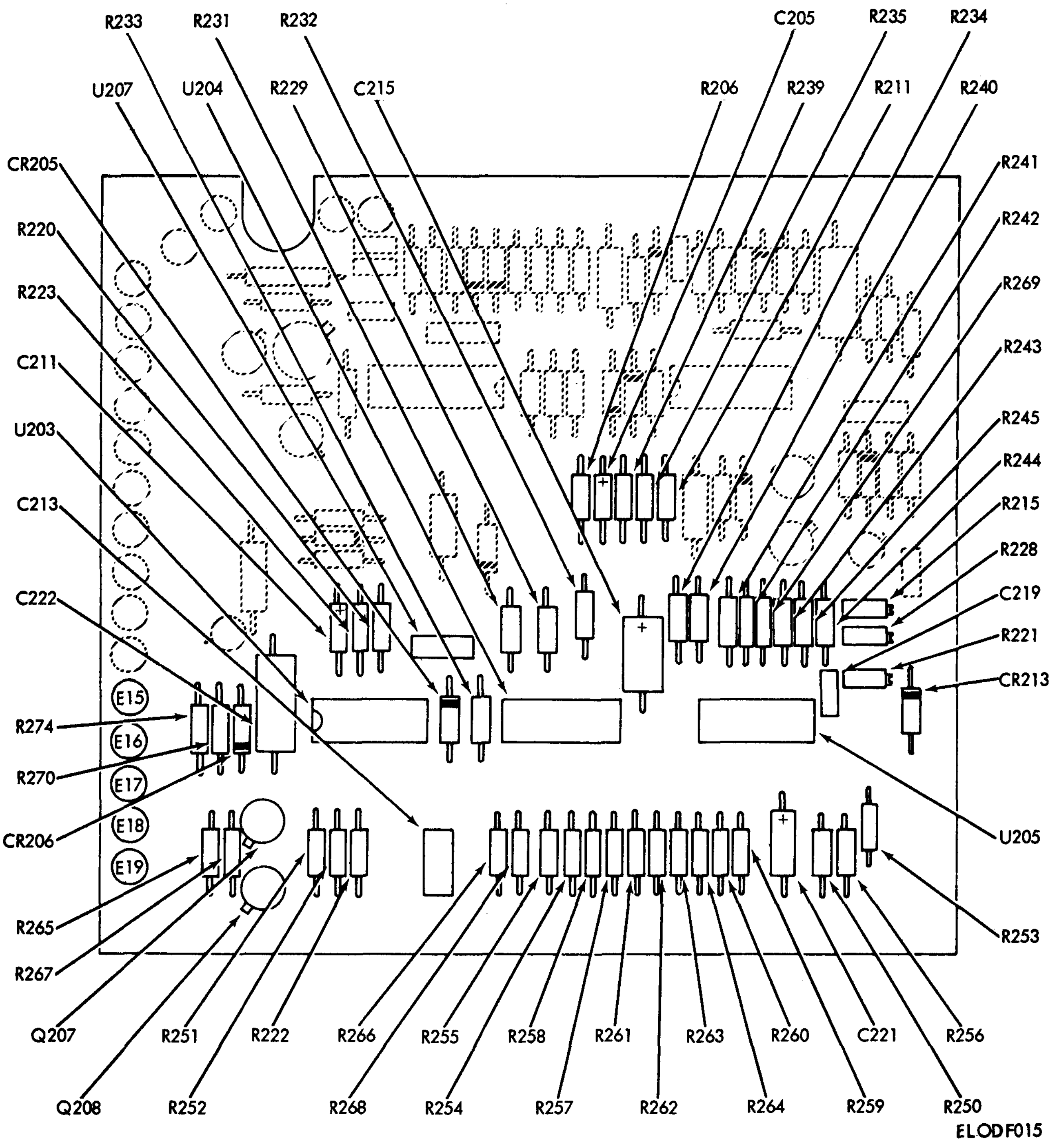

Figure 3-3 ②AØ modulator and current sense printed circuit board assembly (A2) (sheet 2 of 2).

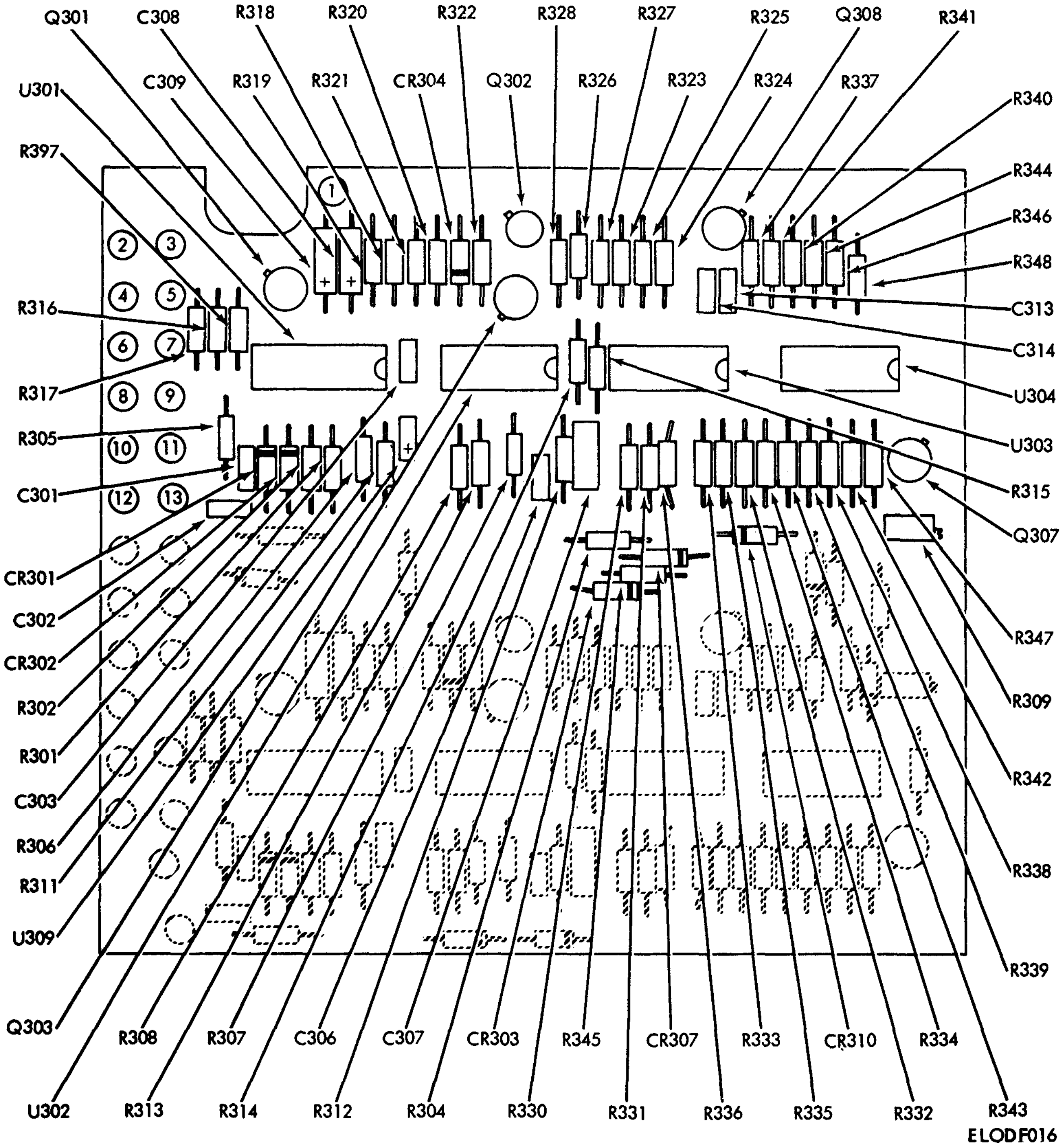

Figure 3-4 ①. BØ CØ modulator printed circuit board assembly (A3) (sheet 1 of 2).

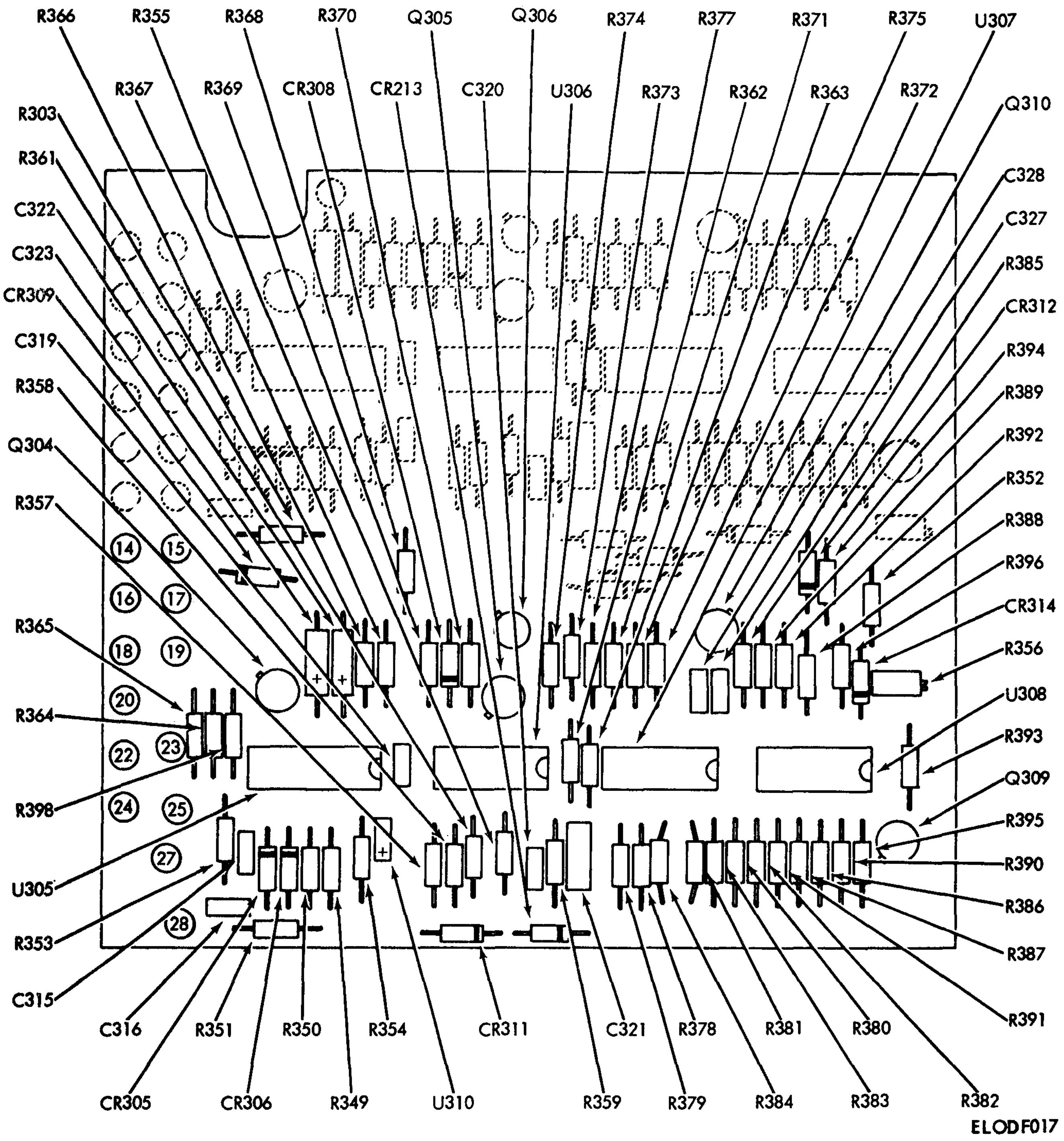

Figure 3-4 ② BØ, CØ modulator printed circuit board assembly (A3) (sheet 2 of 2).

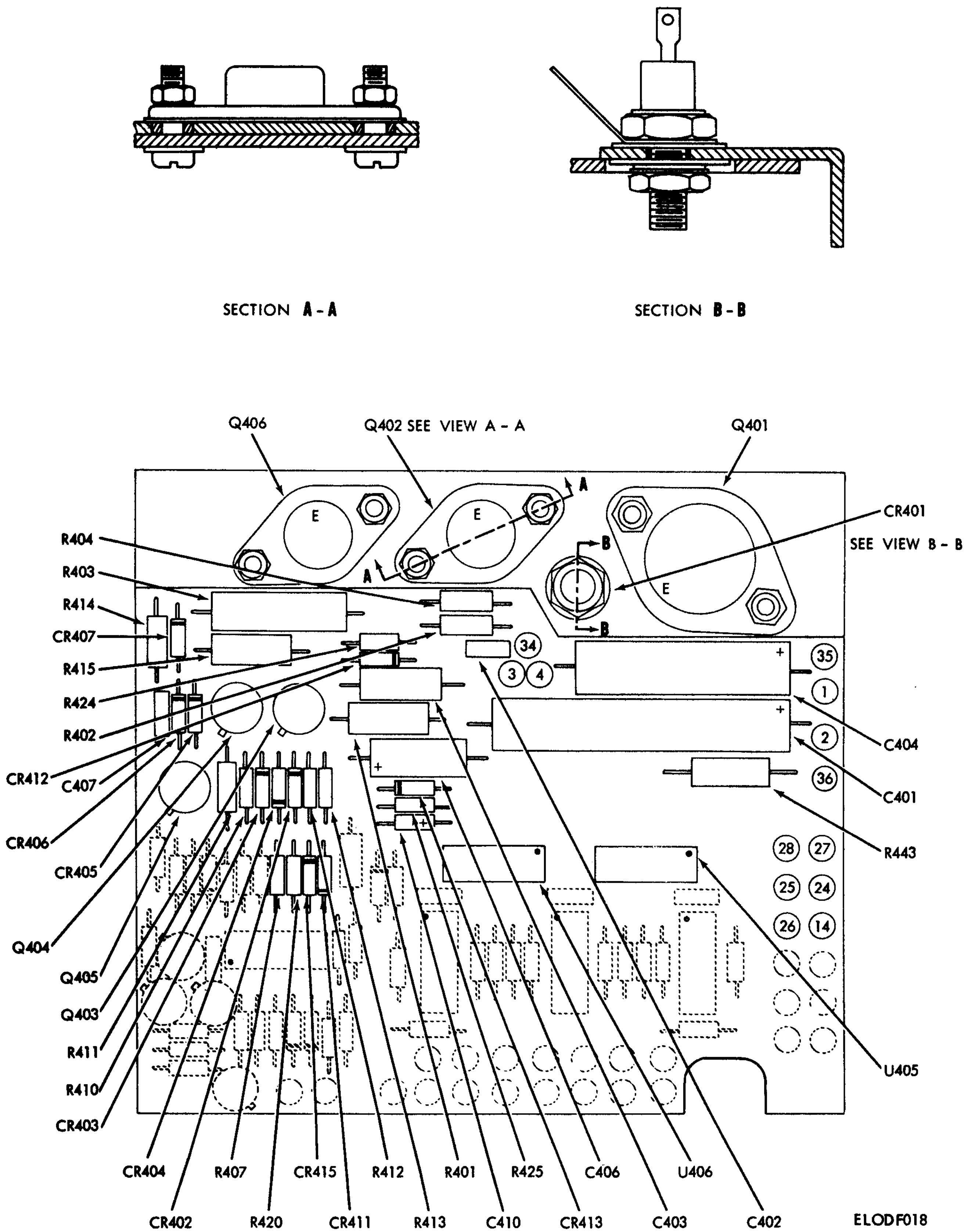

Figure 3-5 ①. Dc voltage regulator and data drive printed circuit board assembly (A4) (sheet 1 of 2).

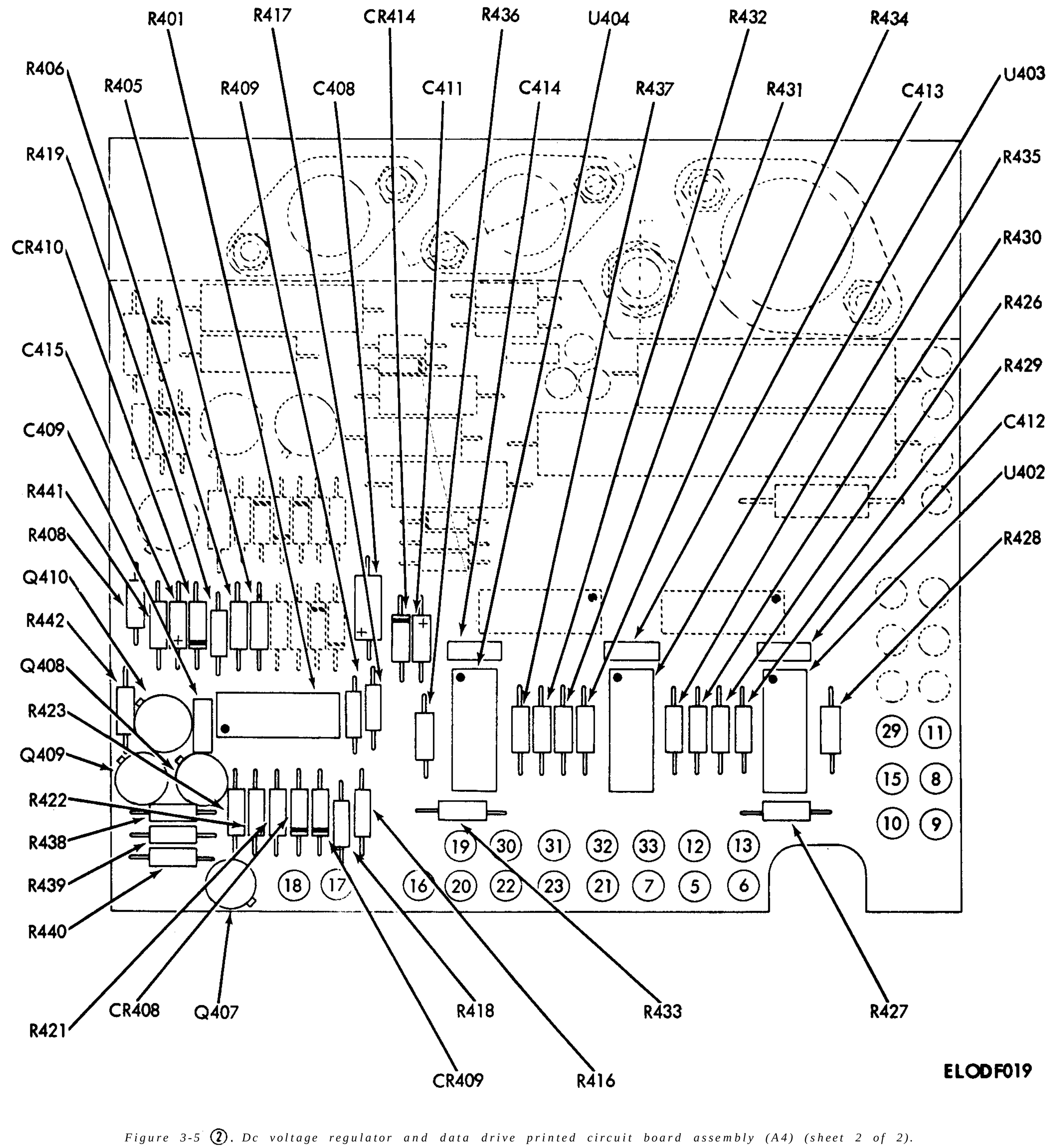

Figure 3-5 (2). Dc voltage regulator and data drive printed circuit board assembly (A4) (sheet 2 of 2).

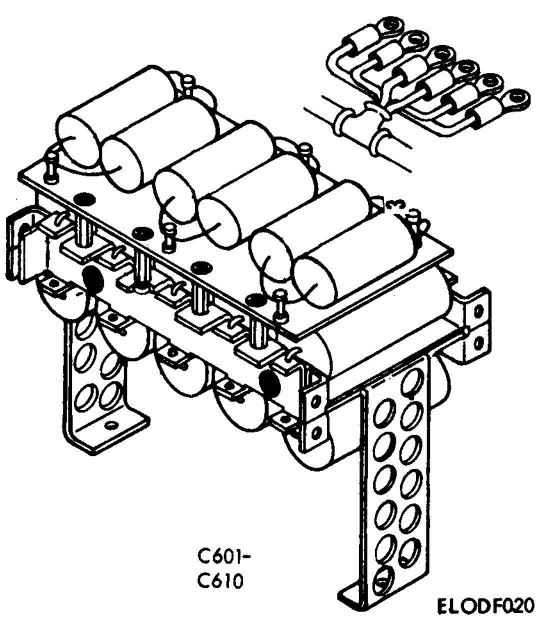

Figure 3-6. Capacitor assembly (A6).

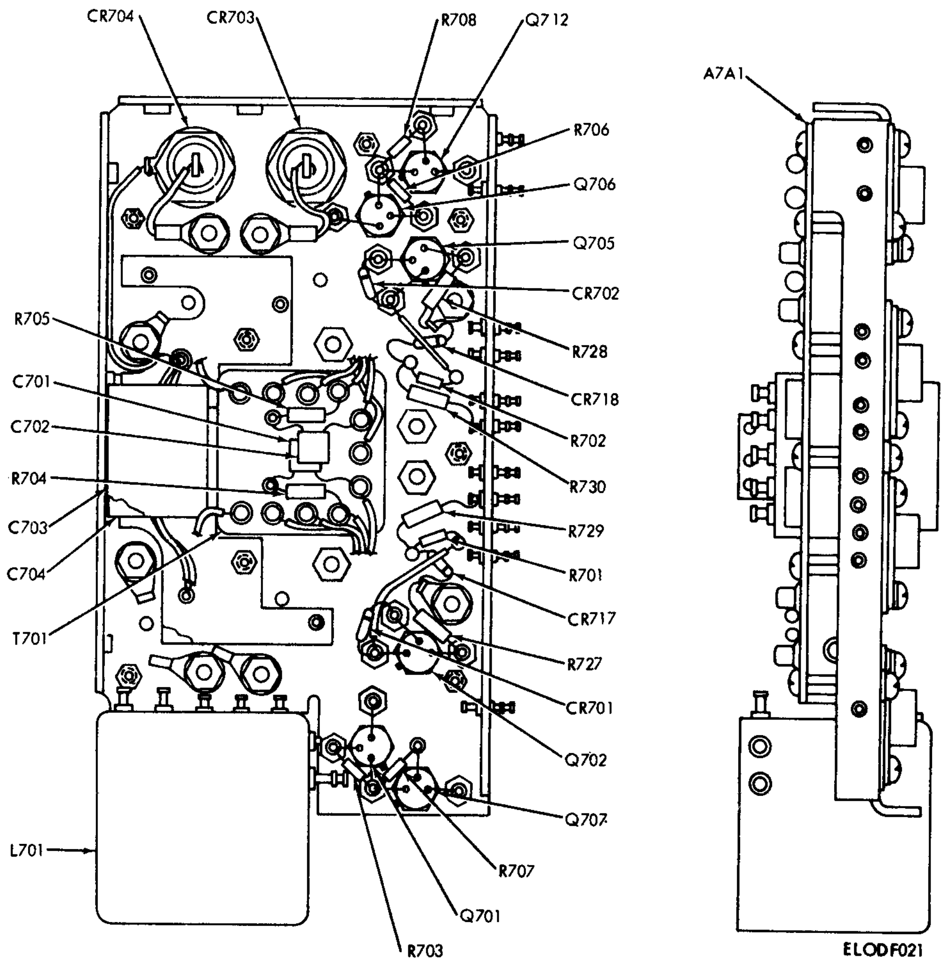

Figure 3-7 (1). Power switch module (A7) (sheet 1 of 2).

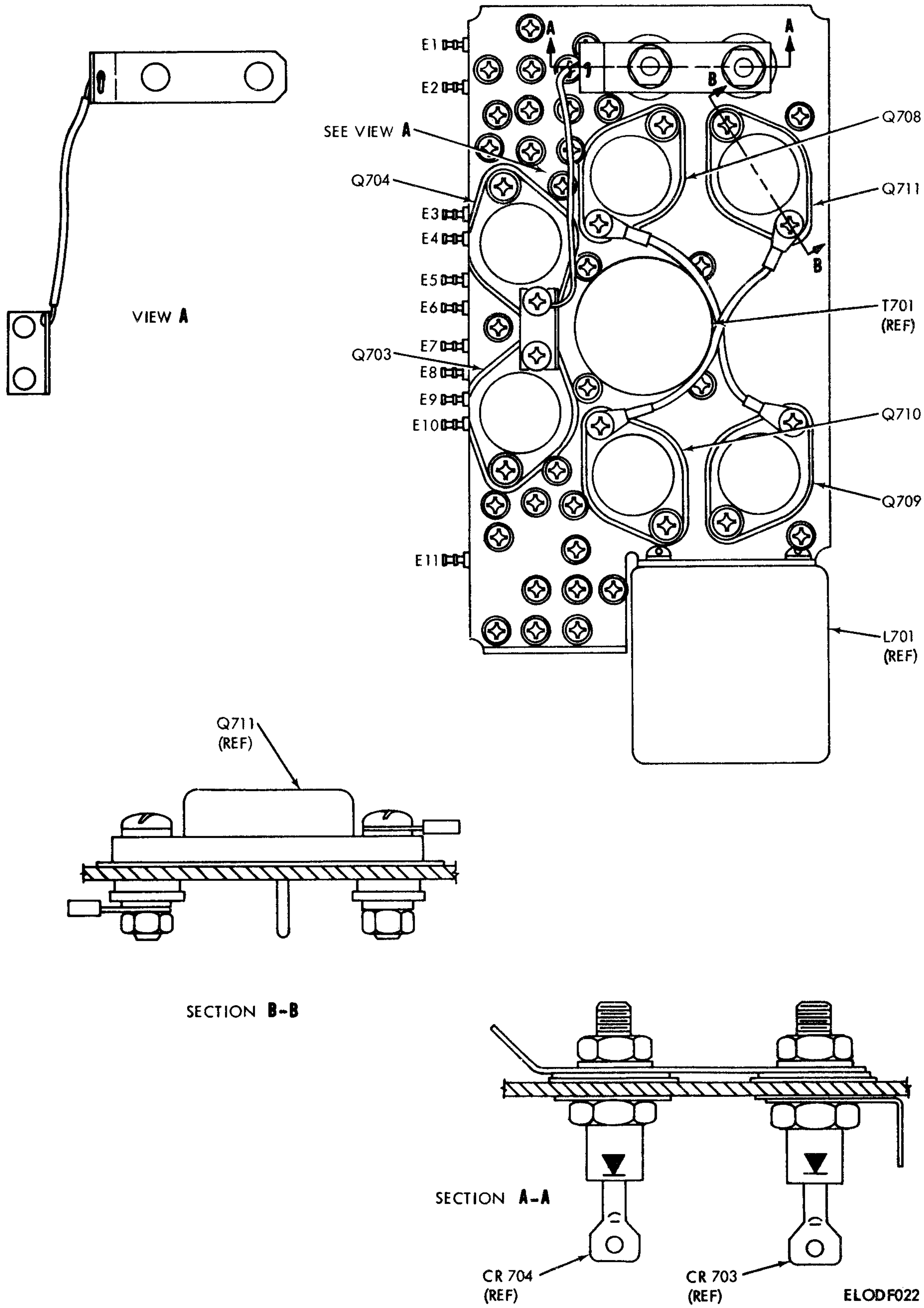

Figure 3-7 ②. Power switch module (A 7) (sheet 2 of 2).

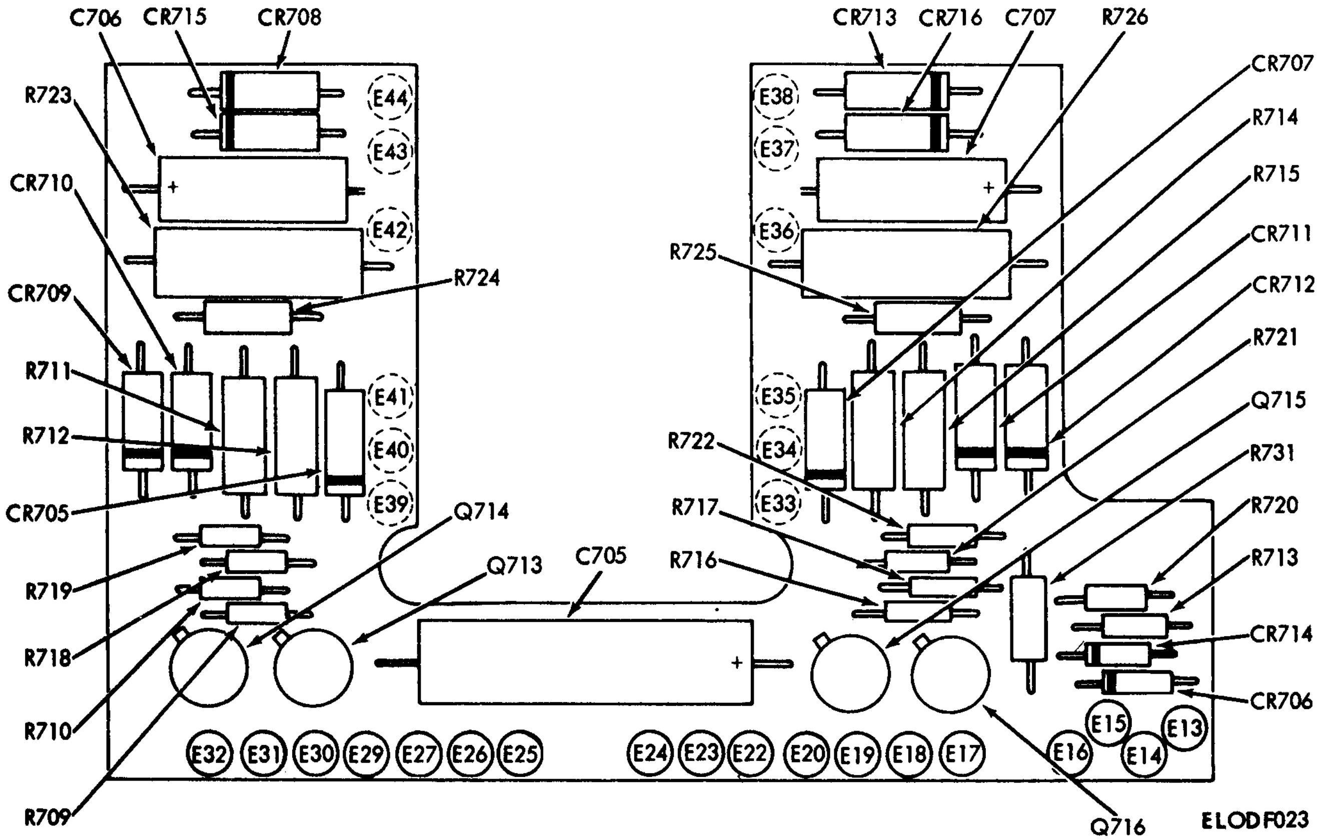

Figure 3-8. Power switch printed circuit board assembly (A7).

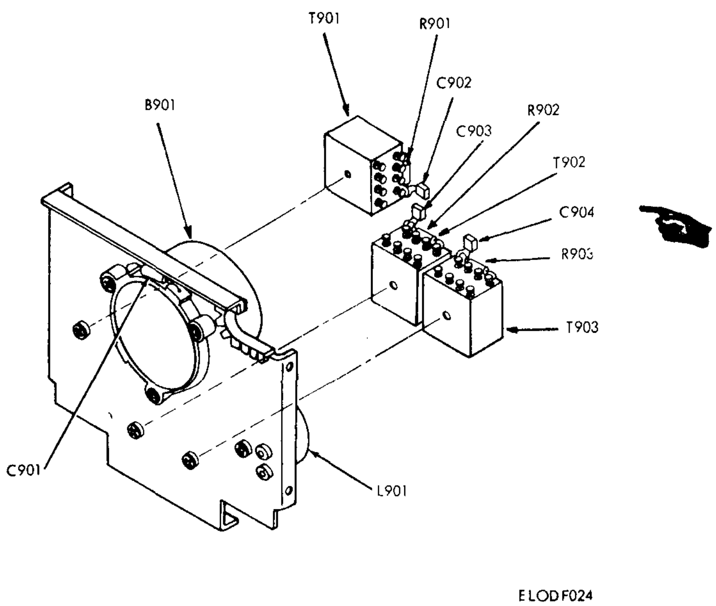

Figure 3-9 Fan bulkhead (A9).

Section IV. MAINTENANCE OF DETAIL NETWORKS

3-22. General

There are no controls or indicators on the static inverter; therefore, performance indications must be measured with the inverter covers removed and the inverter placed on the test bench.

CAUTION

Although voltages in the static inverter are relatively low (e.g., +28 vdc and 115 vac), current levels are high (up to 41 amperes in normal operation, and much higher in short circuit situations). As a result failures are often catastrophic; therefore, unless the symptoms of a failure are known, be extremely careful when troubleshooting the static inverter. No voltages should be applied to the unit until it has been opened and vidually inspected for burned or otherwise damaged components. Where failed components are located, resistance and continuity checks should be performed to isolate the faulty circuits and to identify the cause of the failure. It will be necessary to remove protective coating from leads to take readings.

3-23. Checking Procedure

Check the detailed networks as described in table 3-7. Refer to table 3-7 and figure FO-1 to supplement this data.

Section V. INPUT FILTER AND CAPACITOR BANK

3-24. Input Filter

(fig. 3-10)

Nominal +28 vdc is applied through pin C of connector A5J501 to the encapsulated filter A5. This low pass input filter is capable of receiving a variable input of from +18 to +32 vdc and can supply input load currents of up to 41 amperes at +28 vdc. The encapsulated filter contains a high frequency choke which presents a high impedance to voltage spikes or rf impulse noise that may be induced on the 28 vdc bus. A low frequency, series connected choke within the filter presents a high impedance to 400-Hz signals generated within the inverter.

3-25. Capacitor Bank

(fig. 3-10)

The input capacitor bank acts as a storage cell for the inverter. Nominal +28 vdc is applied from the input filter to capacitors C601 through C610. The capacitor bank provides an additional source of current to supply the output drive circuit when instantaneous demands by the power switch circuits exceed the capacity of the + 28-vdc source. The capacitor bank also aids the input filter in eliminating voltage spikes and rf noise generated by the power switches.

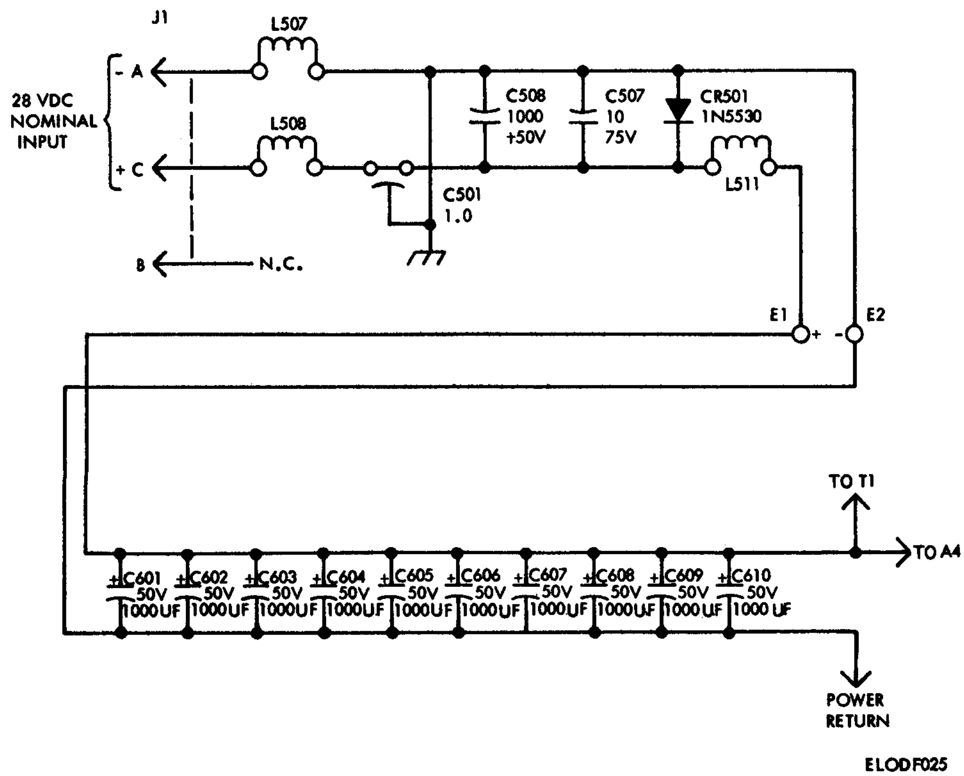

Figure 3-10. Input filter and capacitor bank.

Section VI. OSCILLATOR AND MODULATOR PRINTED CIRCUIT BOARDS

3-26. Oscillator Circuit

(fig. 3-11)

a. The oscillator uses a piezoelectric crystal unit (Y101) to generate a high precision oscillation of 2.4576 MHz when a +5-volt input is applied. The oscillator (Y101, U101) provides the 2.4576 MHz square wave to countdown unit U102 which directs a 38.4-kHz signal to Q101B. This is conducted to a divde-by-6 circuit (U103, U104) to produce three 6.4-kHz high frequency square wave pulses for the three phases to use on the modulator boards (fig. 3-12).

b. The oscillator countdown module (U102) supplies a 2 .4-kHz signal to Q102B, which is routed to another divide-by 6 counter (U104, U105) (fig. 3-14), and which produces three 400-Hz square wave outputs. The three 400-Hz square waves are directed to three tuned transformers (fig. 3-14), which develop a 3-phase, 400-Hz sine wave signal for use on the modulator boards. The three 400-Hz sine wave signals are also routed to the recovery drive circuit (fig. 3-15). These signals are processed in the recovery drive circuit by comparator amplifiers (U106, U107) and drivers (U108) through push-pull transistors, the output of which is a 400-Hz square wave of 14 volts peak to peak.

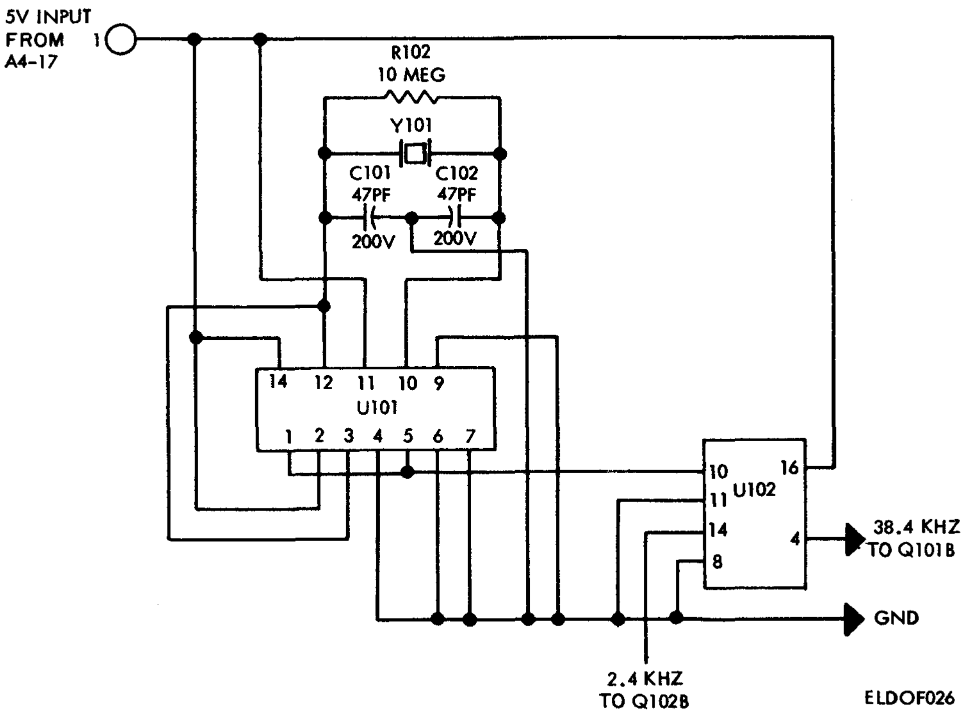

Figure 3-11. Crystal oscillator.

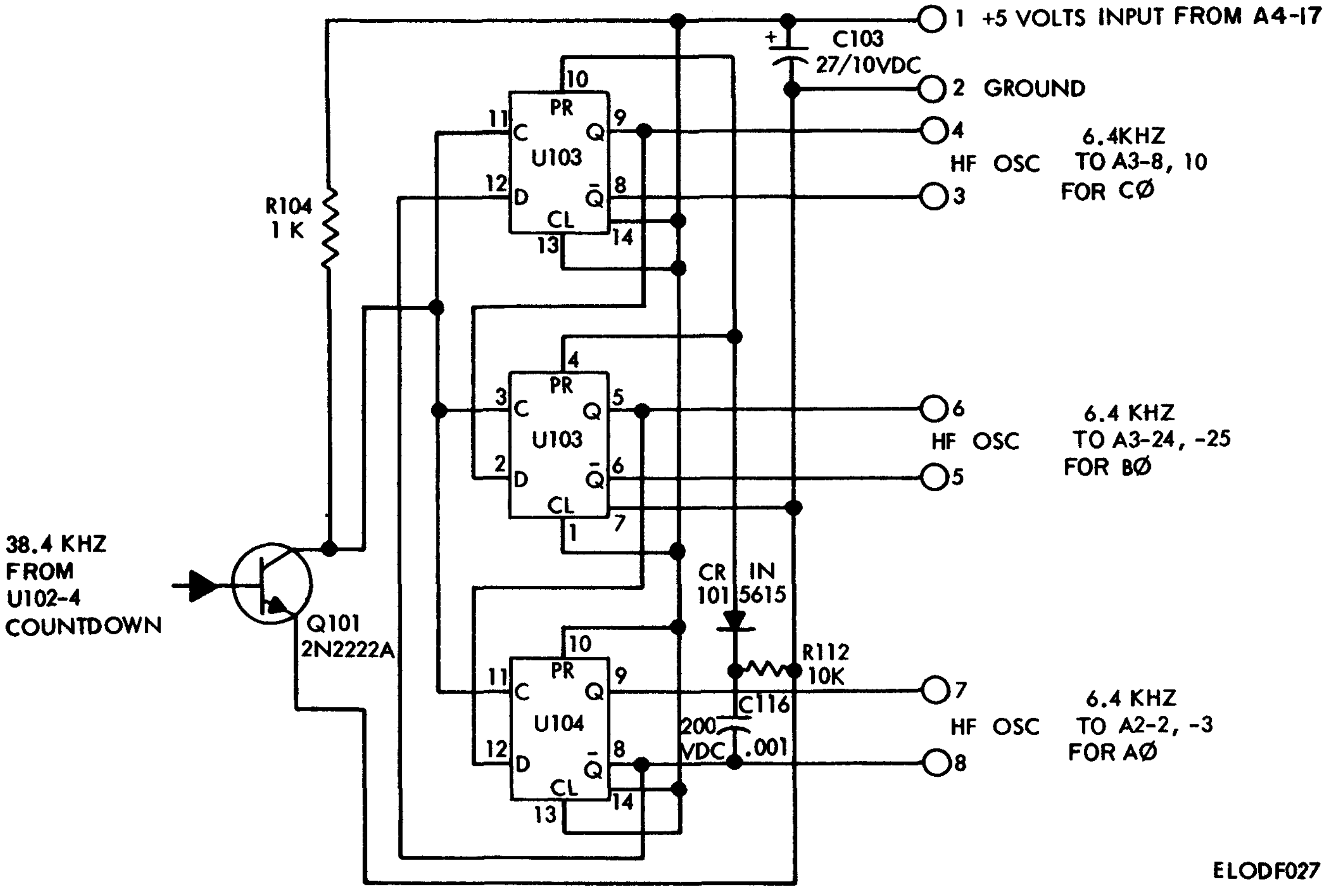

Figure 3-12. Divide-by-6 counter Q101.

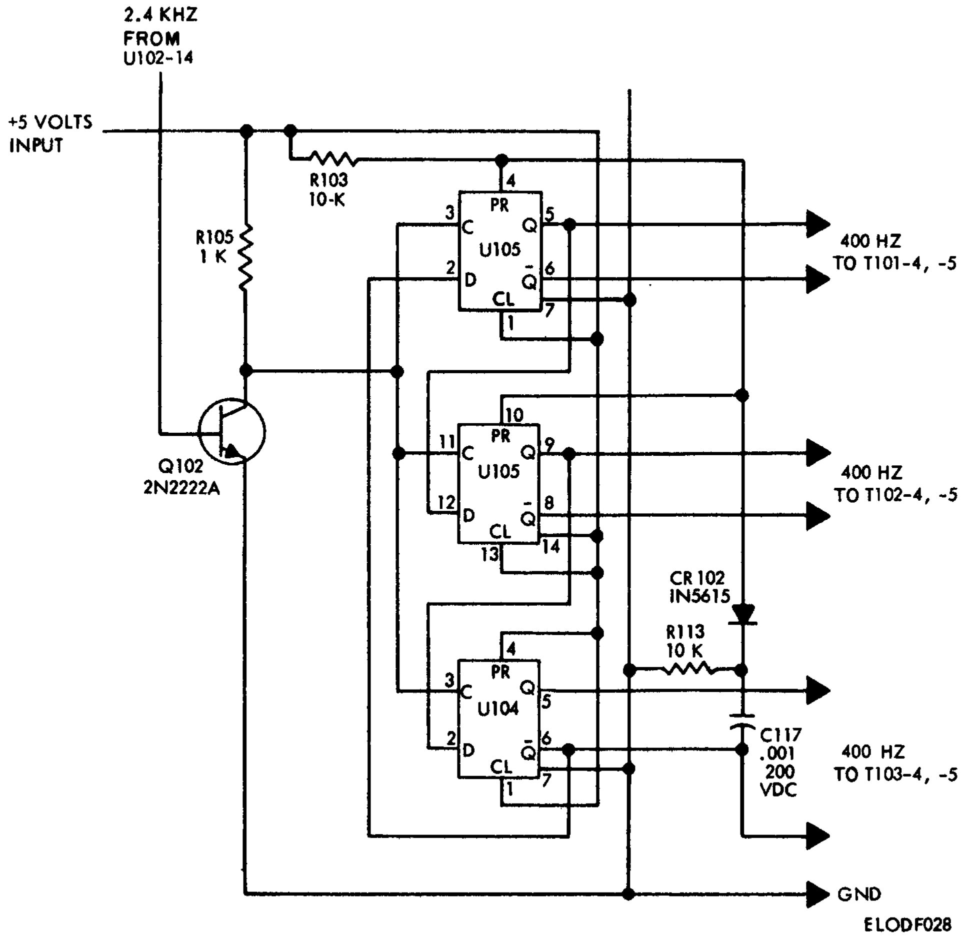

Figure 3-13. Divide-by-6 counter Q102.

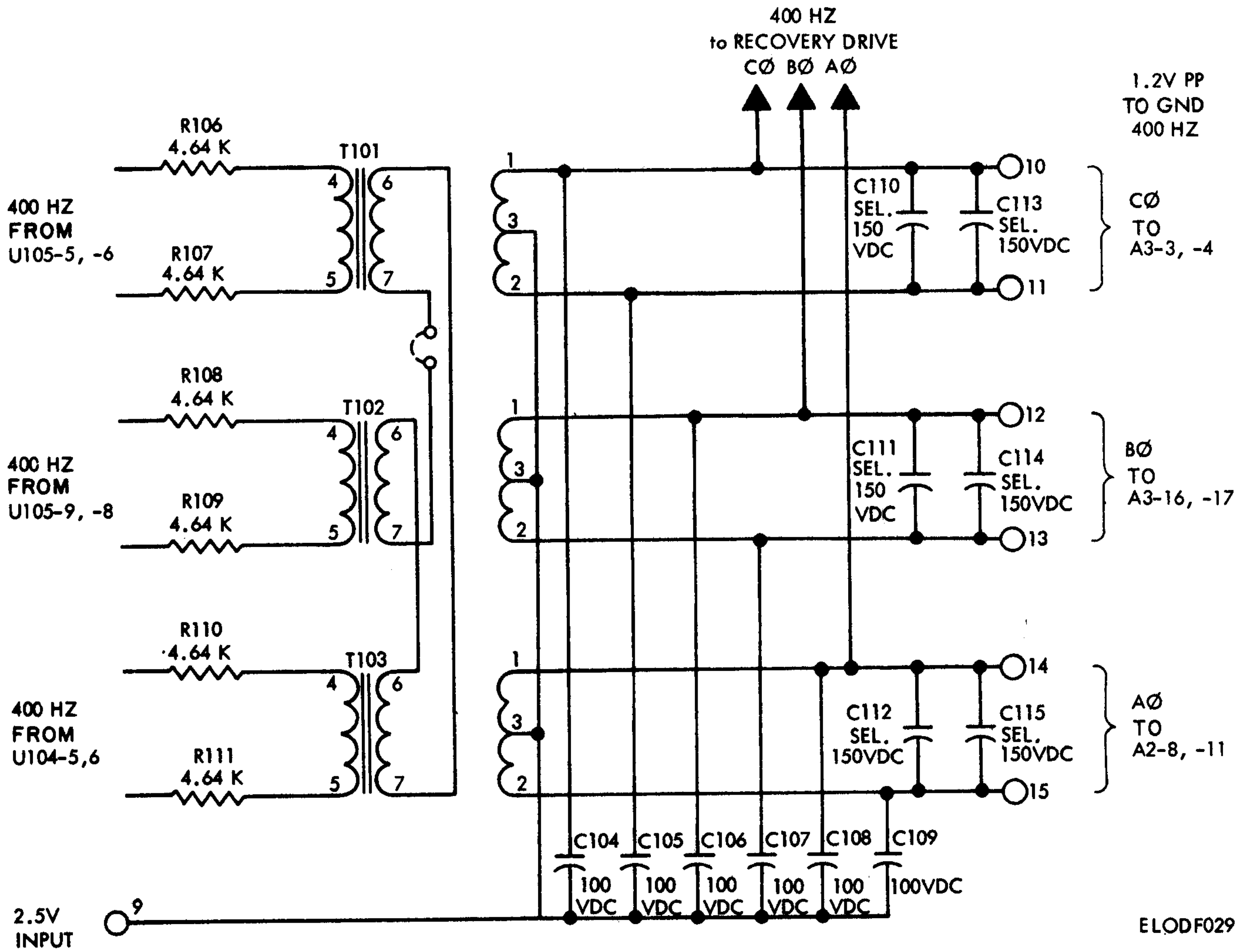

Figure 3-14. Three-phase tuned transformer.

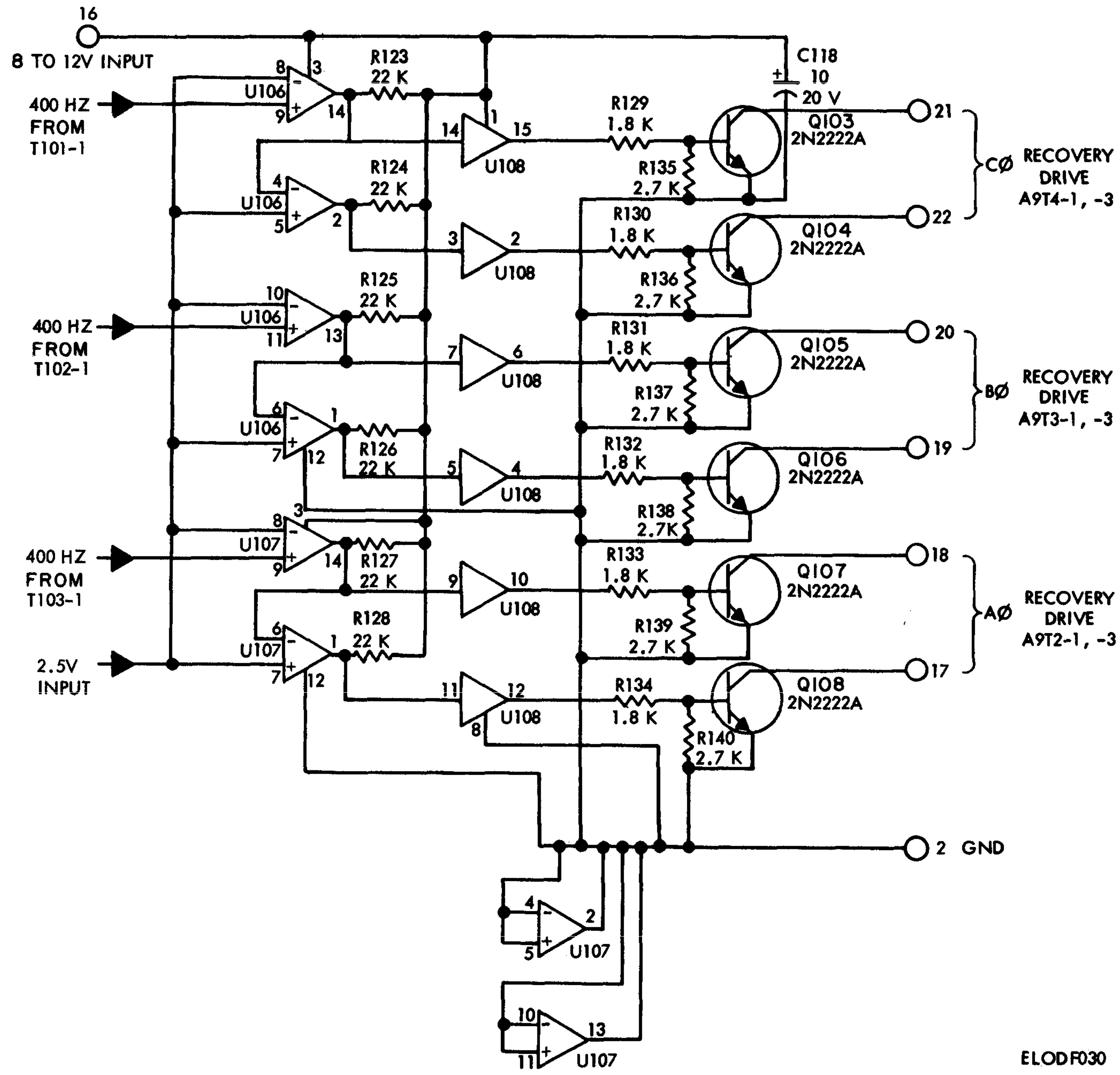

Figure 3-15. Recovery drive

3-27. Modulator Circuit

(fig. 3-16)

a. The high frequency 6.4-kHz square wave signal from the oscillator board enters the modulator board as two square waves 180 degrees out of phase. They are capacitor-coupled to differentiate for the summing diode circuit CR305, CR306. The resultant 12.8-kHz signal is introduced to the ramp generator (U305) and initiates the output data (ramp) to the output drive board. Ramp generator U305 also delivers a ramp reset blanking signal to Q309, Q310.

b. A 400-Hz sine wave feedback signal from the output filter is directed to the output voltage control. The feedback signal is also connected to a turn on sense output (at terminal 20) which is coupled to the overcurrent sense and foldback circuit on the A phase modulator board.

c. The output voltage control circuit (fig. 3-17) receives the feedback signal. Potentiometer R356 and temperature compensator unit U310 develop the signal. The signal is then delivered, with dc input, to comparator U306. Transistor Q304 functions as an integrating amplifier with dc output and is applied to field effect transistor Q306 which controls amplitude of the sine wave input to the modulator and square wave generator circuit. FET Q306 functions as a voltage impedance device. Gate voltage impedance is as follows:

Gate *voltage*	*Impedance*
+2.5v	100 ohms
–3.4v	.2megohms

d. The square wave generator and modulator (fig. 3-18) compare ramp signal with sine wave and modulator output pulse length in accordance with relative amplitude of these signals. Figure 3-18 shows square wave generator and modulator, B phase and C phase (board A3). A similar circuit for A phase modulator (board A2) is shown in figure FO-3.

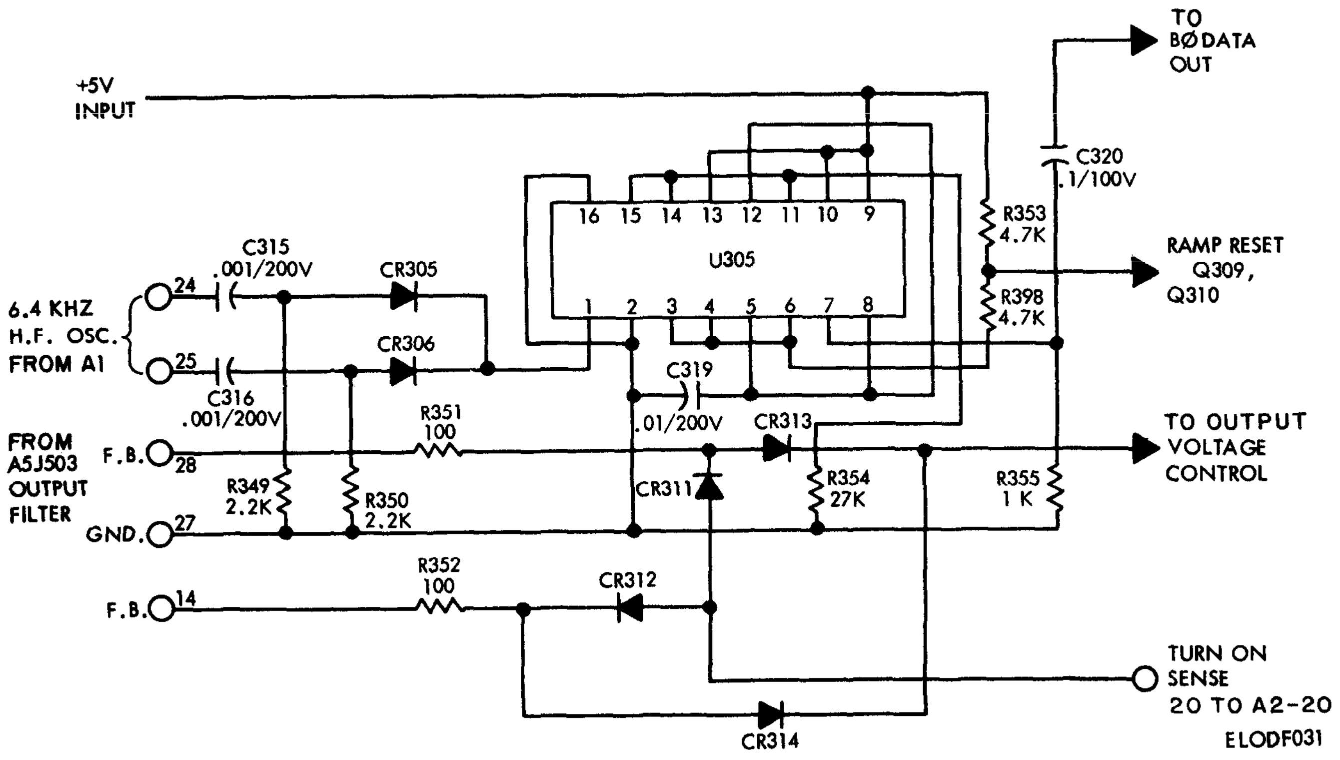

Figure 3-16. Ramp generator–B phase.

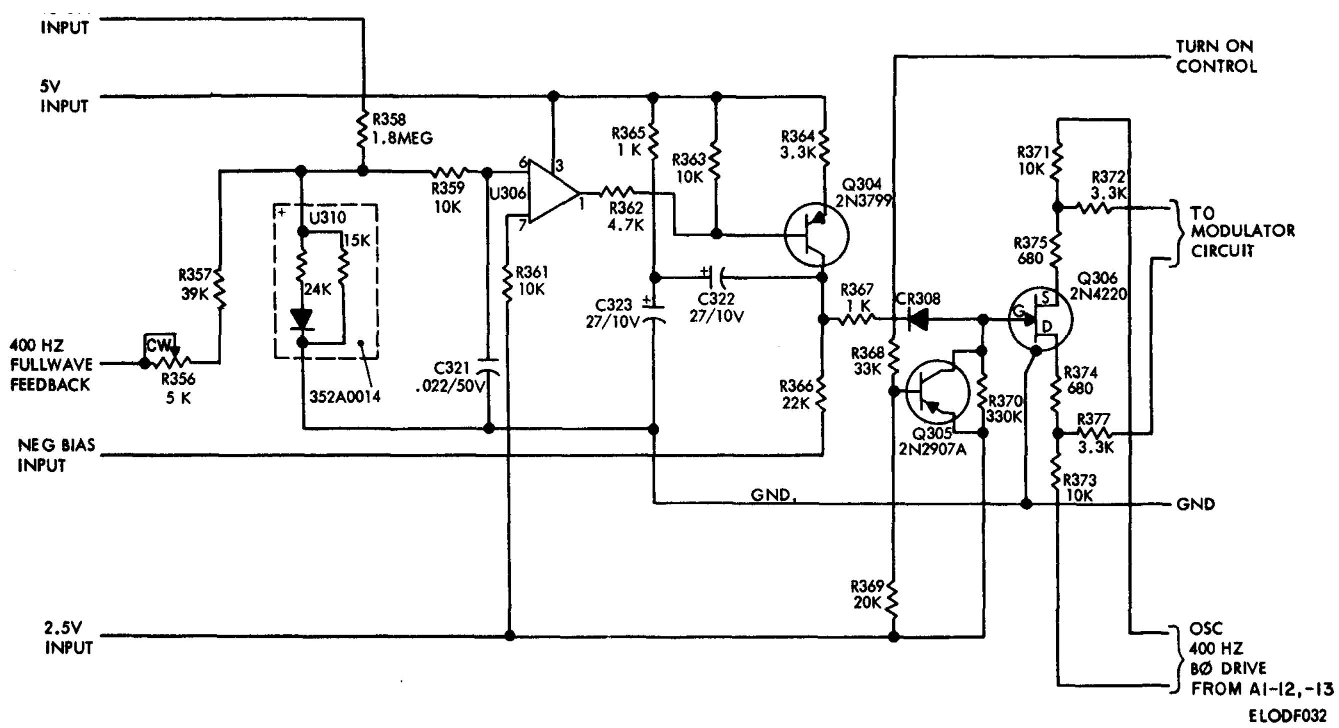

Figure 3-17. Output voltage control - B phase and C phase.

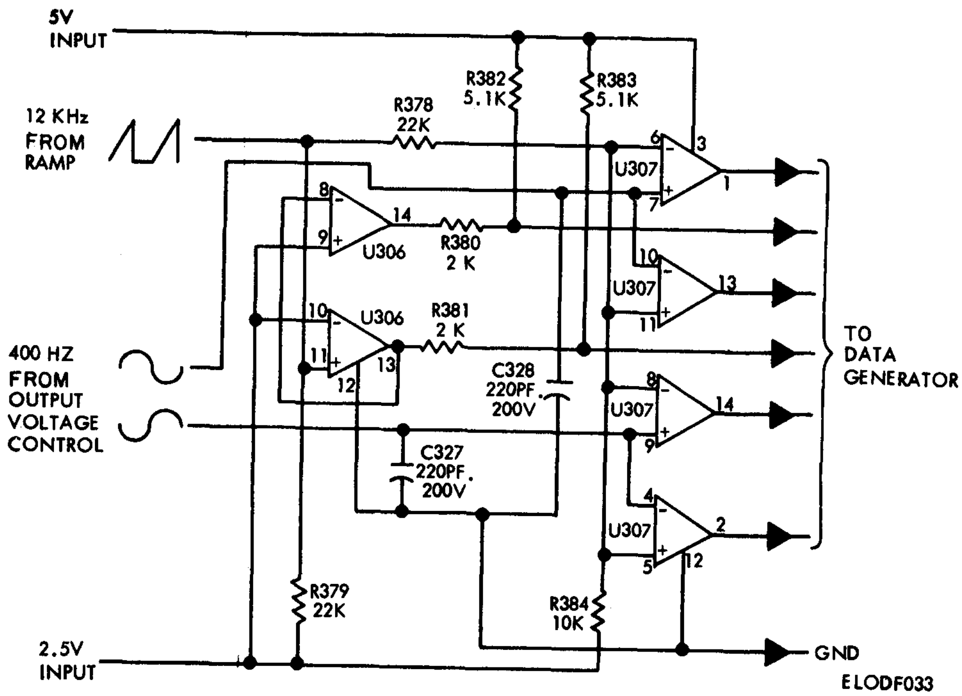

Figure 3-18. Square wave generator and modulator-B phase.

e. The data generator (fig. 3-19) correlates the information for transmittal to the output drive board. Transistors Q309, Q310 disable output data during reset of ramp generator. Figure 3-19 shows data generator–B phase and C phase (Board A3). Refer to figure FO-3 for data generator A phase (board A2).

3-28. Overcurrent Sense and Foldback Circuit

(fig. 3-20)

The overcurrent sense and foldback circuit is located on the A phase modulator board. The current sense signal at pins 7 and 9 is obtained from the power switch board. Comparator amplifier U202-1 functions as a level detector and forwards the signal to an integrating circuit U202-13. Seven-second time circuit U202-2 is monitored by 1-second reset circuit U202- 14. Transistor Q201 functions as the driver for Q202 which, when positive, performs a dump reset action on the 1-second reset circuit. Q206 delays the dump reset circuit to insure engagement. Resistor R215 provides the short circuit current setting, which is adjusted at the factory. The kill line control (pin *4)* transmits overcurrent signals to the dual function, kill control, and high input voltage comparator U401.

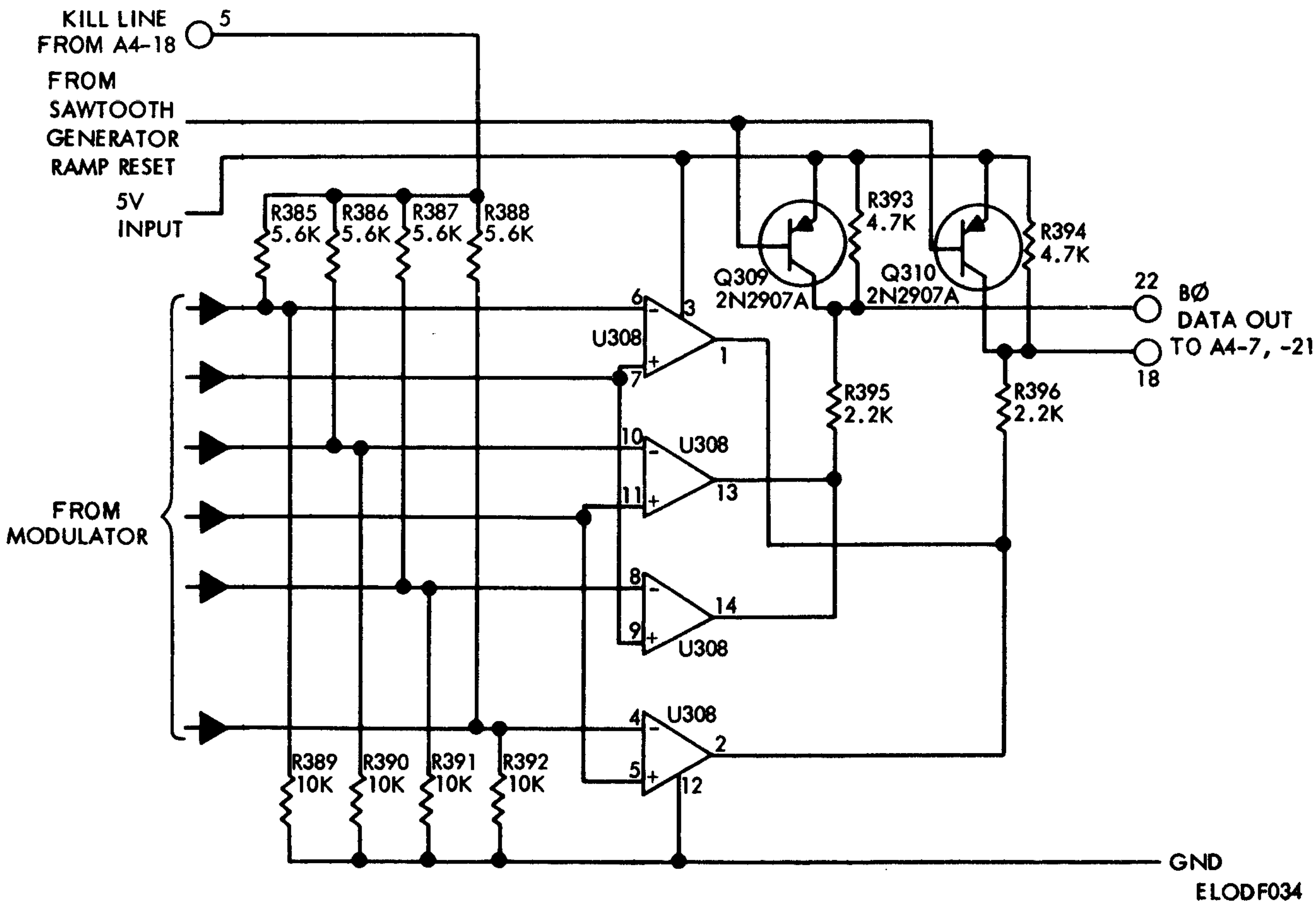

Figure 3-19. Data generator—B phase and C phase.

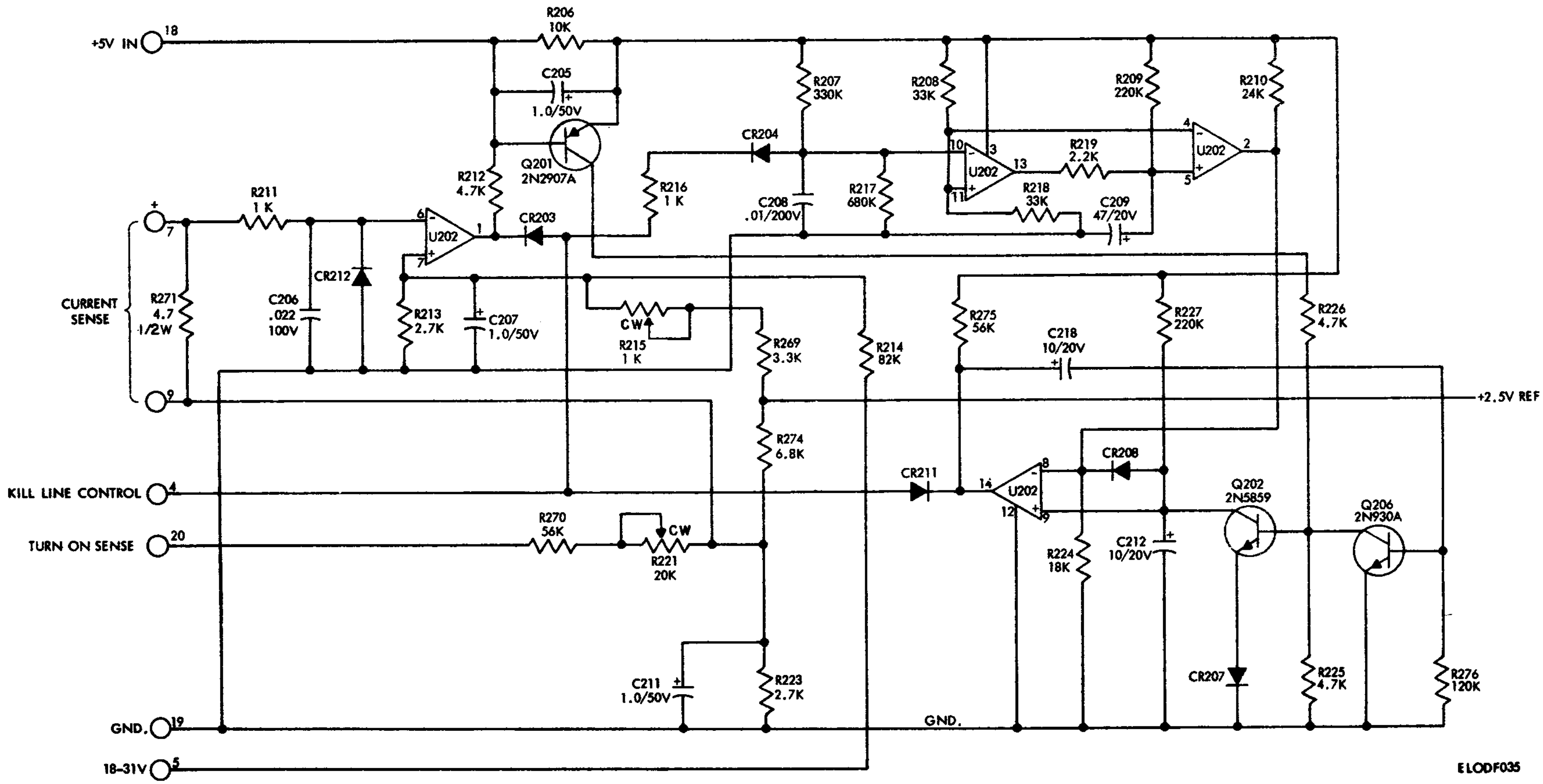

Figure 3-20. Overcurrent sense and foldback.

Section VII. DC VOLTAGE REGULATOR AND DATA OUTPUT PRINTED CIRCUIT BOARD

3-29. General

The Dc Voltage Regulator and Data Output board also provides a high and low voltage detector circuit, a negative bias source, and a 12-volt booster. Each network is illustrated and detailed in this section.

3-30. 8-Volt and 12-Volt Regulator Circuit

(fig. 3-21)

The 8-volt and 12-volt regulator receives 18-32 vdc from the capacitor bank supply and provides a regulated +8 - to 12-volt nominal output as required by the various other circuits of the unit. Also see figure FO-1.

3-31. Voltage Regulator Circuits, 2.5 and 5.0

(fig. 3-22)

The 2.5- and 5 .0-voltage regulators are emitter follower types composed of transistors (Q405, Q406) and Zener diodes (CR402, CR405) which supply + 5v low power and logic circuitry. The + 2.5v is the basic reference for logic circuit decisions and + 8v regulator.

3-32. High and Low Voltage Detector Circuit

(fig. 3-23)

The high and low voltage detector responds to levels above 33v (at U401-8) and below 8v (at U401-7). High or low input voltage activates the kill control which disables output via logic circuitry.

3-33. Negative Bias Circuit

(fig. 3-24)

The input to the negative bias circuit is fed from the switching modulator. Negative bias is supplied to the modulator circuits on printed circuit boards A2 and A3 by the — 3 .4v regulator.

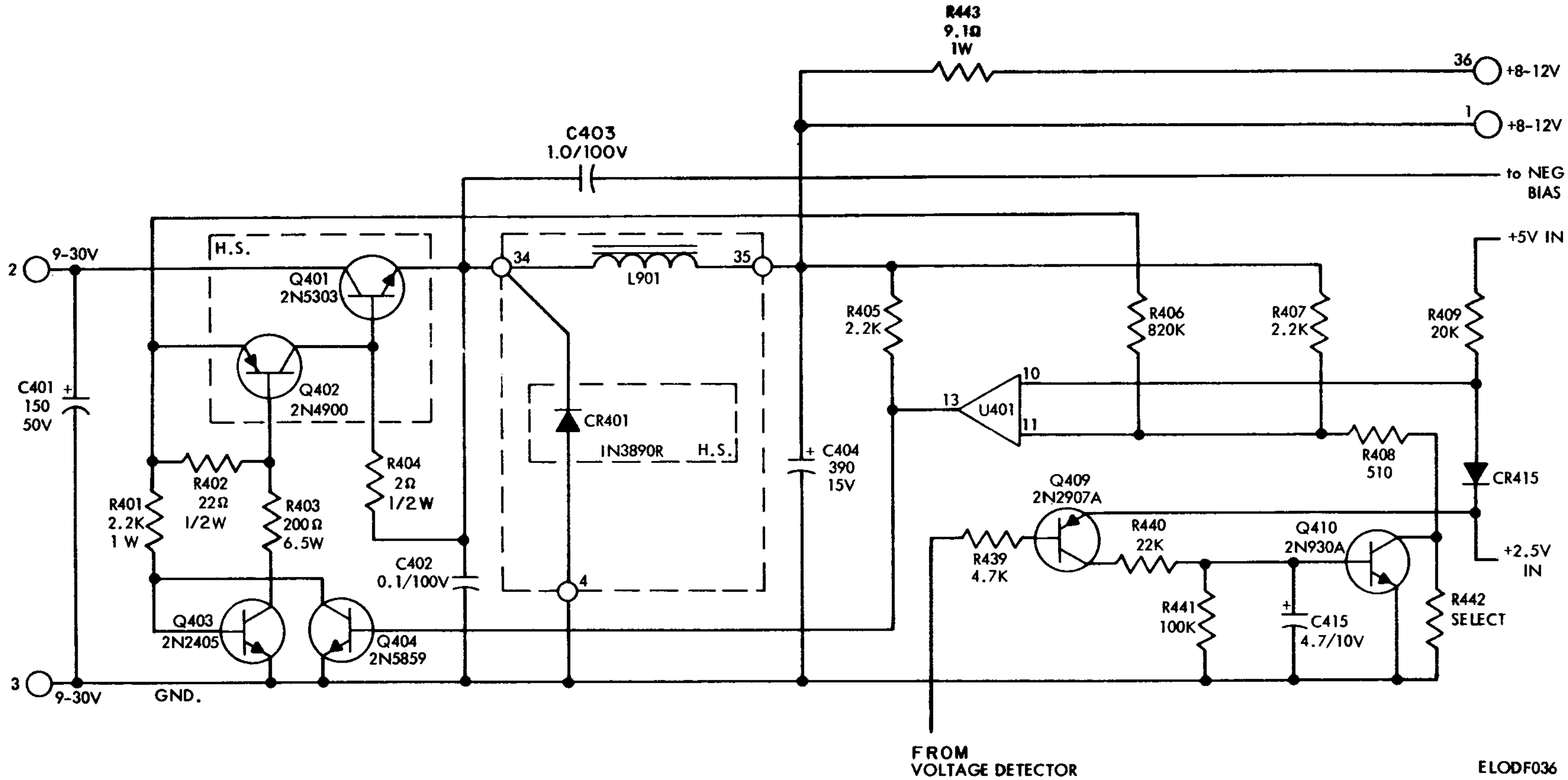

Figure 3-21. 8- and 12-volt booster circuit regulator.

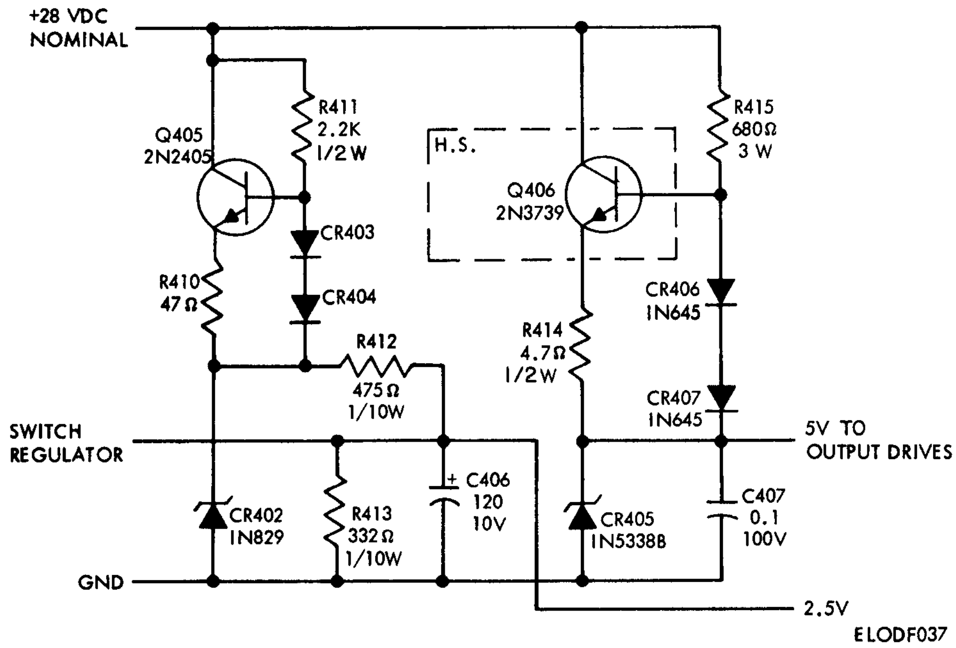

Figure 3-22. 2.5- and 5.O-voltage regulators.

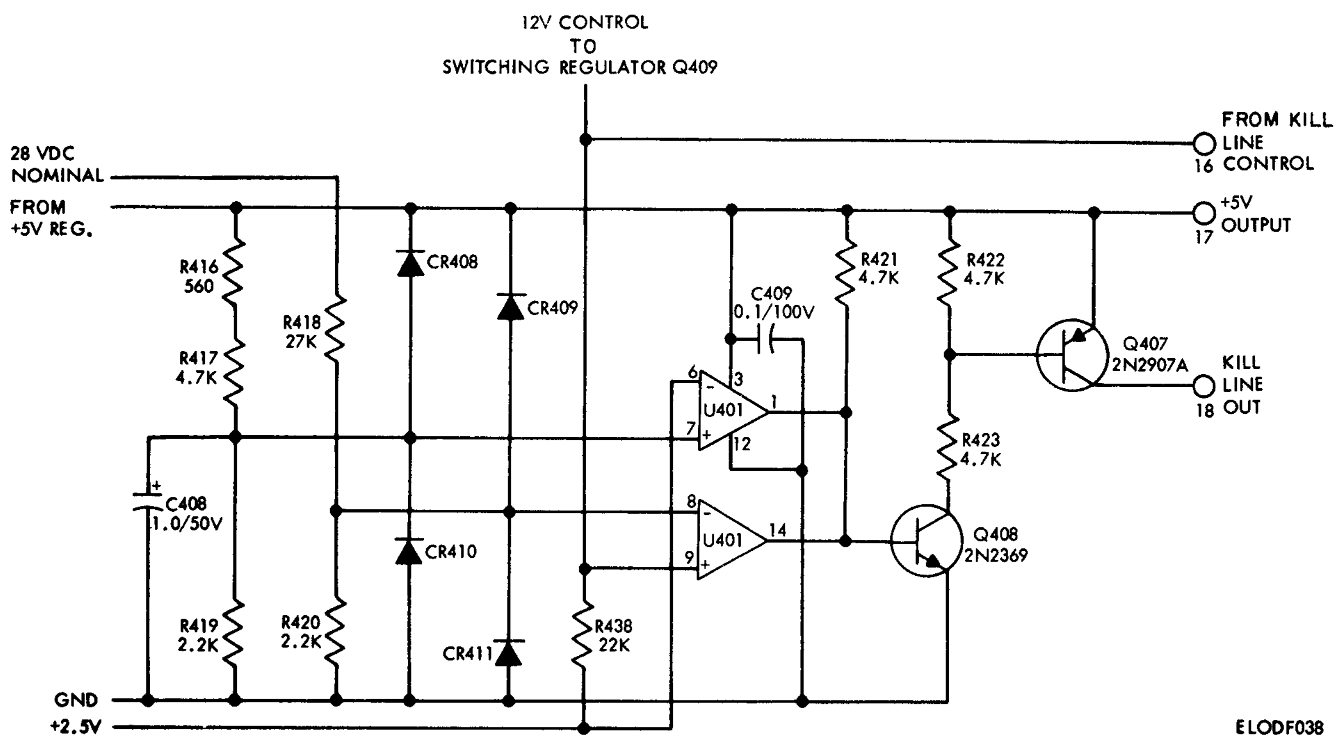

Figure 3-23. High and low voltage detector.

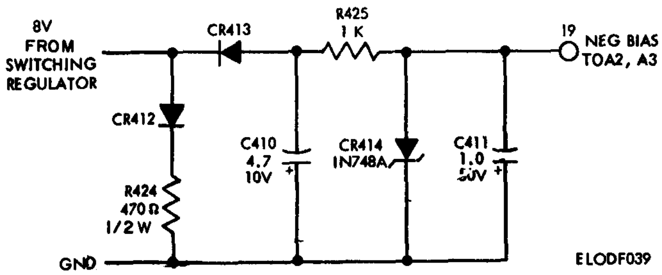

Figure 3-24. –3.4-voltage regulator.

3-34. Data Output Circuit
(fig. 3-25)

The data output drive receives phase data from the modulator circuit and square wave 6.4 kHz input from the oscillator board. The signal is augmented by a + 5v-source from the +5v-regulator circuit and transmitted to the base drive circuit on the power switch board.

3-35. Base Drive Circuit
(fig. FO-9)

The base drive circuit is shown as a typical half circuit for clarity. Darlington pairs (one mounted on the PCB and the other on the A7 chassis) deliver a 7- to 8.5v-push-pull signal to the driving transformer (T701) which produces a 4v peak-to-peak secondary signal (12.8 kHz) for the power switch base input rectifiers.

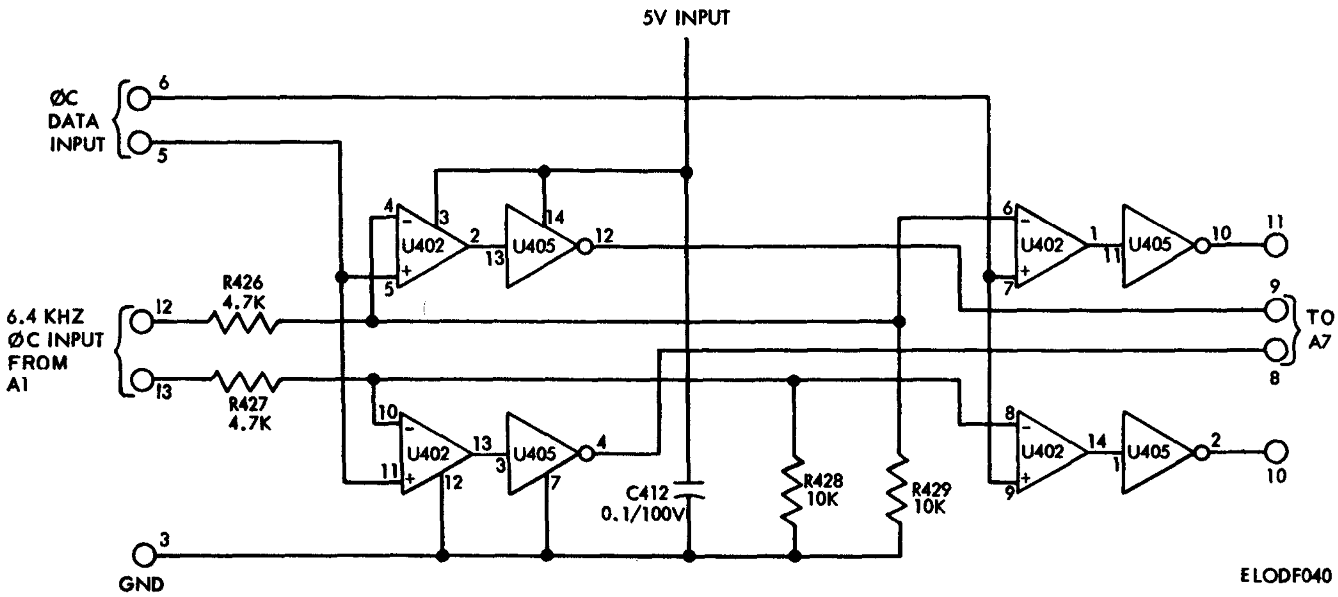

Figure 3-25. Data output drive–C phase.

Section VIII. POWER SWITCH PRINTED CIRCUIT BOARD

3-36. Base and Current Sense Circuits
(fig. 3-26)

The base and current sense circuits are located on the chassis part of the A7 module. The driving transformer (T701) output is received by the summing diodes (CR708, CR715) in the base circuit and delivered to the power switch circuit. The current sense circuit applies the inductor L701 signal through terminal E 1 to the overcurrent circuit on PCB A2.

3-37. Power Switch Circuit
(fig. 3-27)

The power switch circuit also includes the recovery circuit and pulser inductor L701. The phase data from the summing diodes is applied to the power switches (Q708, Q709) and then to the pulser-inductor (L701). The recovery circuit receives 400-Hz phase input from its driving transformer (T901) on the A9 module. Output is directed to power transformer T1 from pulser-inductor L701-7.

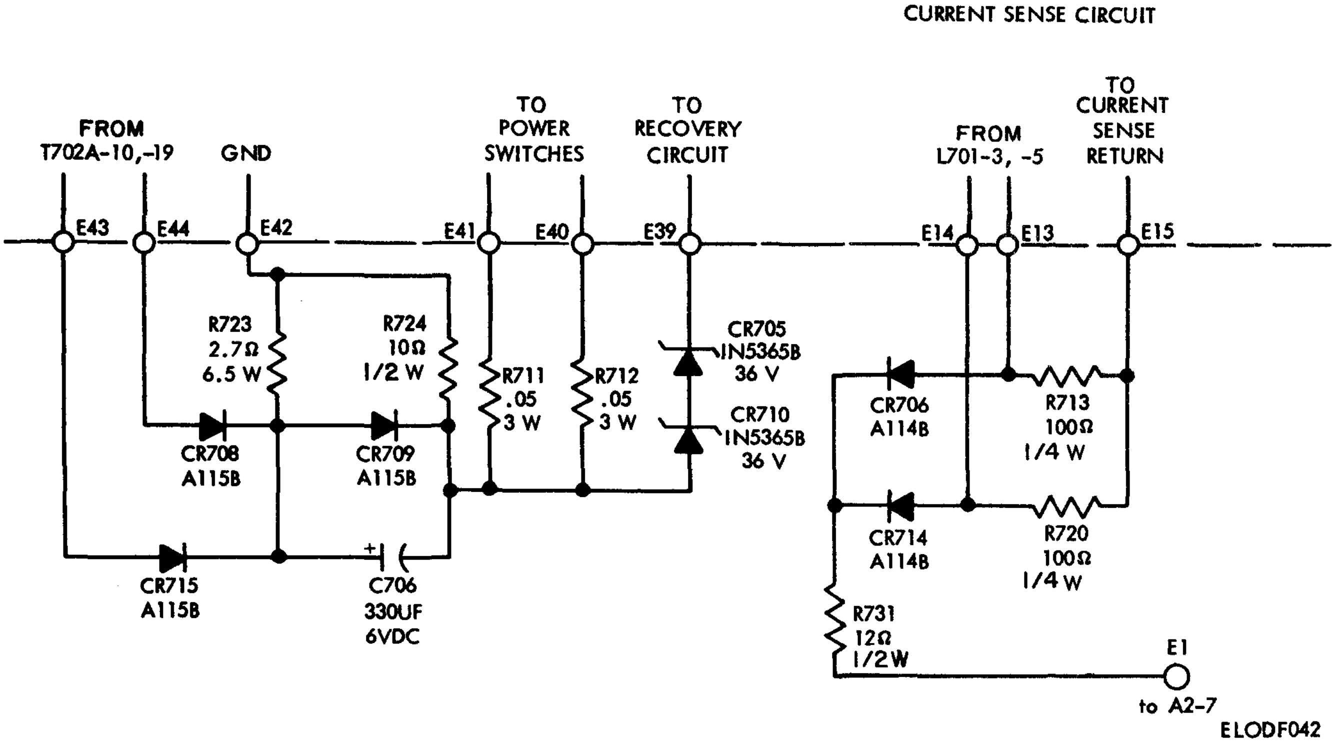

Figure 3-26. Base and current sense.

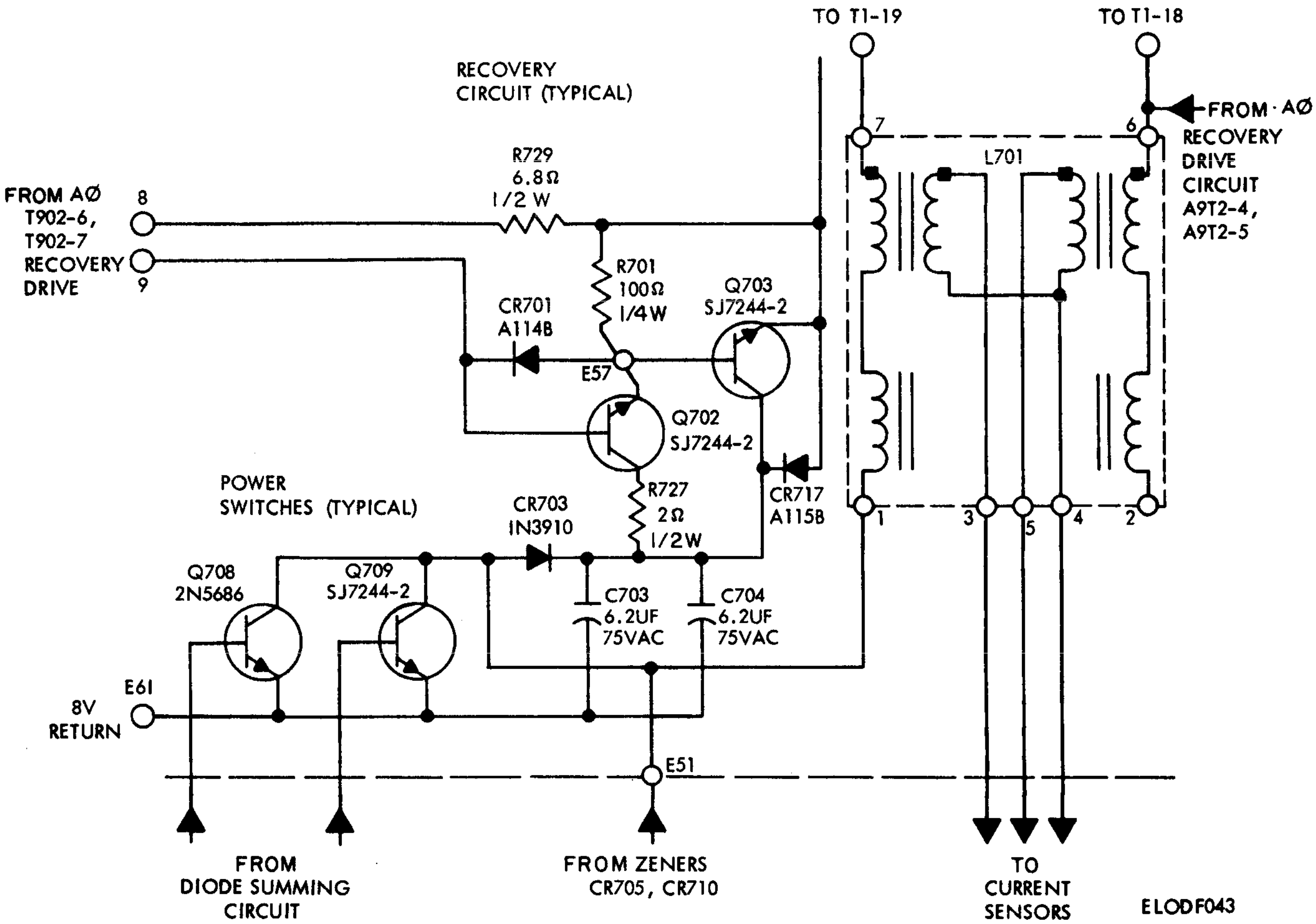

Figure 3-27. Power switch.

Section IX. RECOVERY DRIVE AND POWER TRANSFORMERS

3-38. Recovery Drive Circuit
(fig. 3-28)

The recovery drive transformers are located on Module A9. Input from the recovery drive circuit on the oscillator board (A1) is applied and transferred as 2v signals to the recovery drive circuit on module A7 chassis.

3-39. Power Transformer Circuit
(fig. 3-29)

The power transformer (T1) and capacitors (C611 through C619) provide a step-up of 30 vac to 115 vac at 400 Hz, 3 phase, to the output filter. Capacitors C617, C618, and C619 are selected tuning components and are not used unless required. Capacitors C601 through C610 act as a storage cell for the dc input to the unit and provide an additional source of current to supply the circuits when instantaneous demands exceed the 28-vdc source.

3-40. Output Filter
(fig. 3-30)

The output filter is an encapsulated unit and is illustrated for circuit continuity purposes only. Do not make any repairs to this unit.

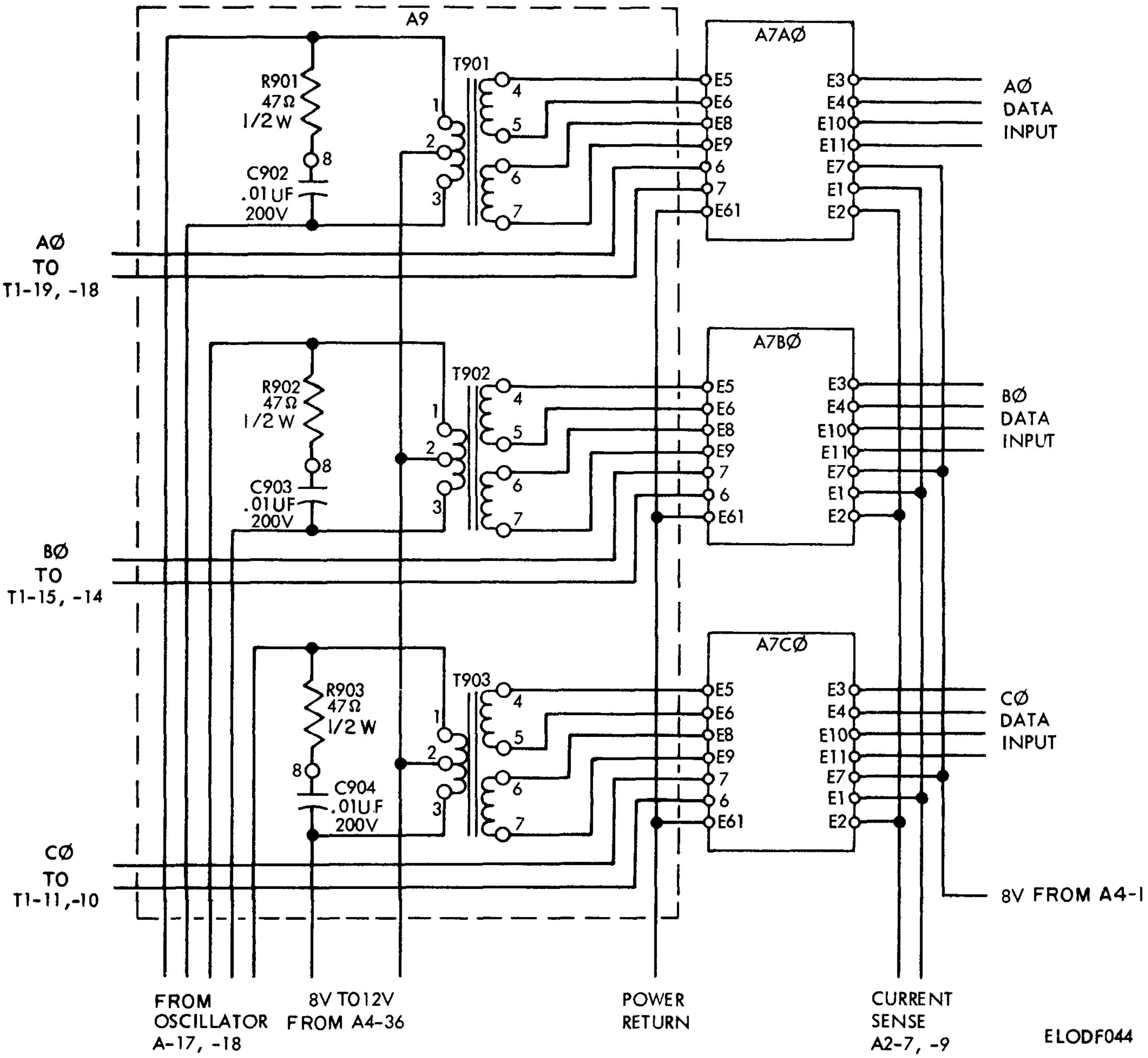

Figure 3-28. Recovery drive transformers.

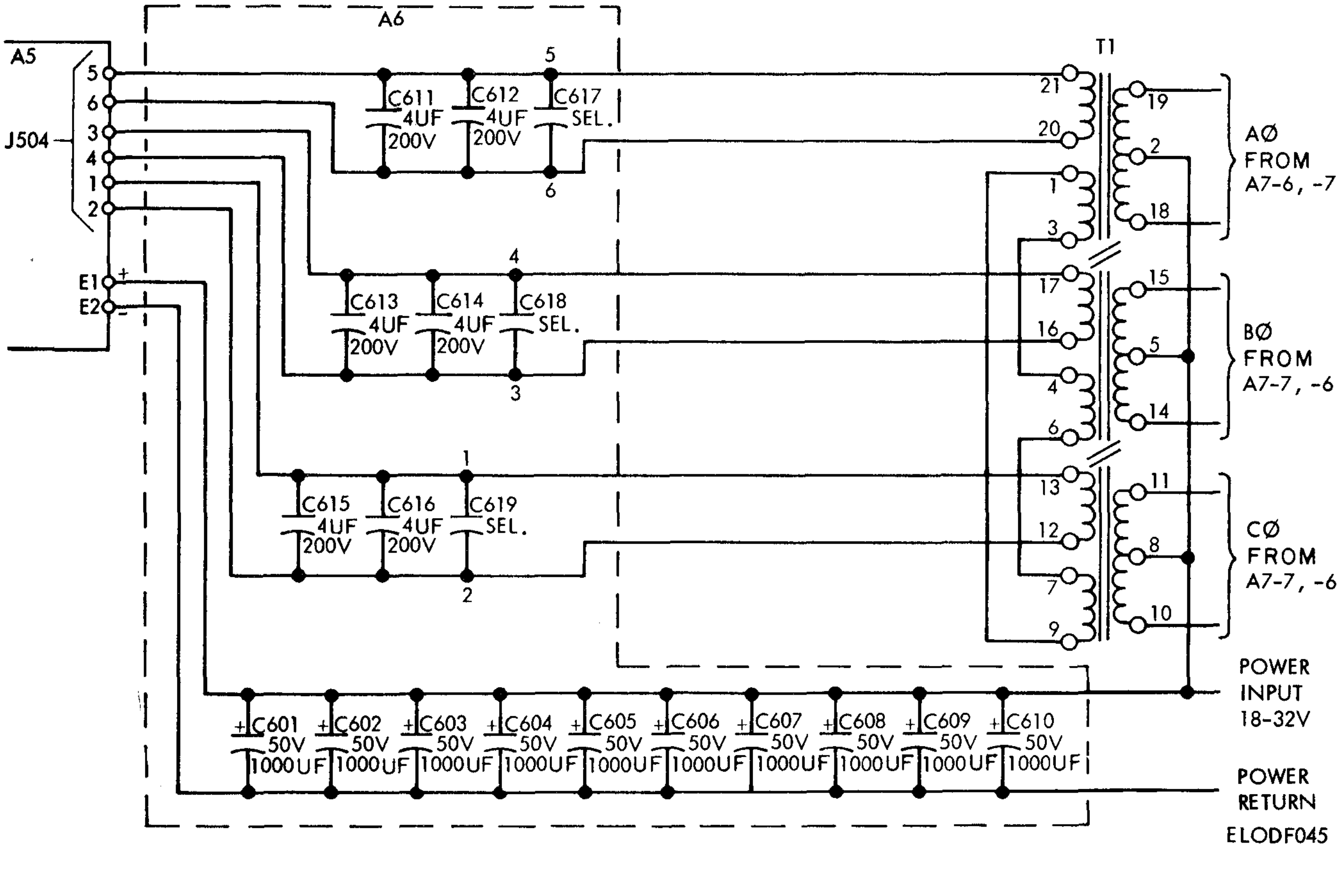

Figure 3-29. Power transformer and capacitors.

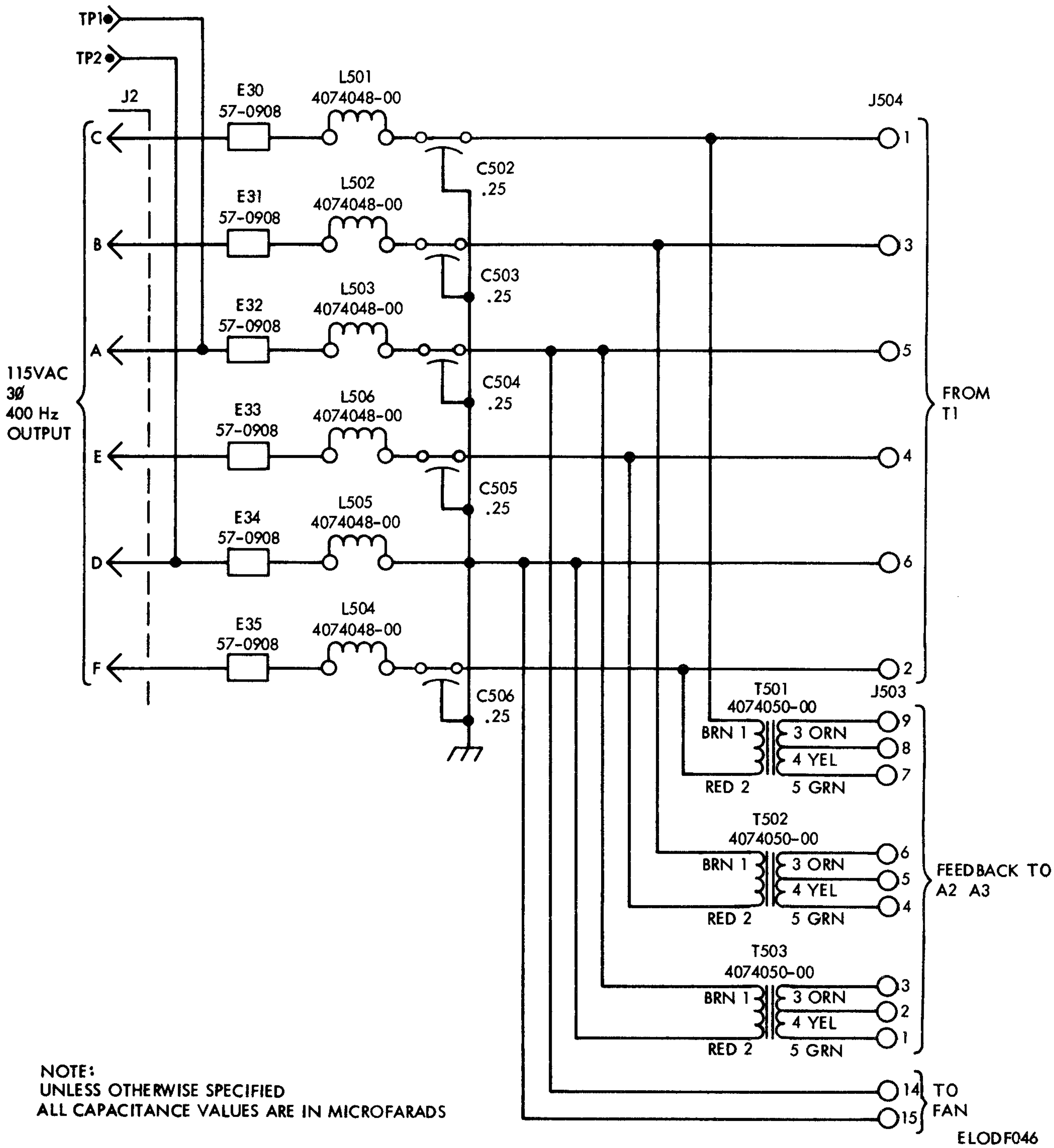

Figure 3-30. Output filter.

Section X. UNIT TESTING PROCEDURES

3-41. General

CAUTION

The procedures in this section are to be performed only after preceding sections of this chapter have been performed. This will prevent further damage to other faulty circuits that may be present in a unit not processed through troubleshooting procedures.

This section covers testing procedures for use by direct support maintenance personnel to determine whether the performance of repaired equipment is satisfactory for return to users. See table 3-5 and figure FO-8 for test setup. Use figure 3-31 for distortion testing. Testing shall be in the order given in this section to insure a logical, sequential method of testing. Table 3-8 sets forth the order of procedure to insure conformance with the specified parameters. Data may be reocrded on form as shown in table 3-9.

3-42. Test Equipment Setup

a. Preliminary Setup.

(1) Connect dc power supply to unit under test.

(2) Apply power to all test equipment.

(3) Adjust each phase load to zero.

(4) Insure that the load is Y-connected.

b. Setup Limits and Recording Accuracy.

(1) Ac and dc volts.	±.1 v.
(2) Ac power	±3.75 w.
(3) Dc	±.1 A.
(4) Frequency	± Hz.
(5) Power factor	Preset.
(6) Distortion	Nearest .1%.
(7) Efficiency	Nearest .1%.

c. Performance Tests. Record required readings as shown on table 3-9. This form, if used, must be prepared by the maintenance technician.

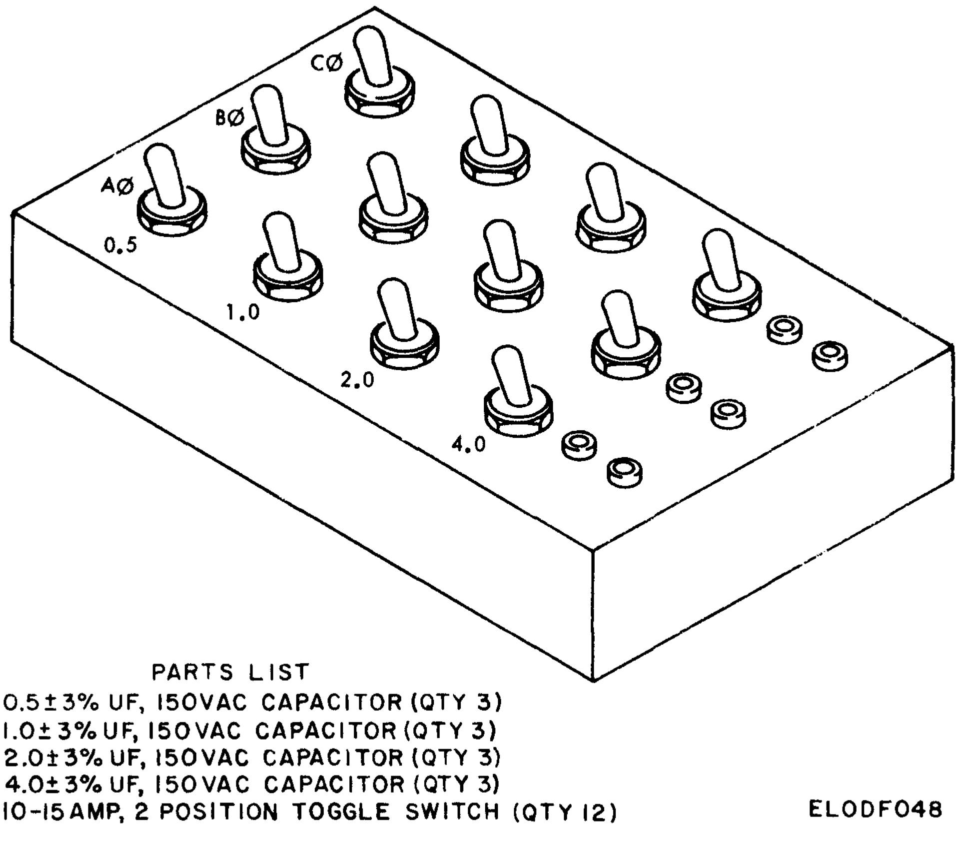

Figure 3-31. Trimmer fixture

3-43. No-Load Test Procedure

a. Set equipment as follows:

(1) Load settings	0.
(2) Load function	No load.
(3) Wattmeter selector	AØ

NOTE

The wattmeter and monitor selectors are changed as required to monitor or adjust the particular parameter being tested.

b. Observing the direct current, turn the dc power on and raise the input voltage to 24 vdc. If direct current exceeds 6 amperes, proceed to troubleshooting section of this manual. Observe and record voltage output, distortion, and frequency as required by table 3-9. If the parameters are outside the established limits as shown on table 3-8, proceed to troubleshooting section.

c. Repeat *b* above at 27 and 30 vdc and record.

3-44. Load Test Procedure

a. Equipment Setup.

(1) Load	On.
(2) Load function	Unity PF.
(3) Wattmeter selector	AØ .
(4) Monitor selector	Vdc.

b. Testing Procedure Sequence.

(1) Begin with all loads at zero.

(2) Raise input voltage to required value.

(3) Select wattmeter AØ and monitor selector as required.

(4) Adjust AØ for watts required by the particular setup on table 3-9.

(5) Readjust input voltage as required.

(6) Repeat (3), (4), and (5) above for BØ .

(7) Repeat (3), (4), and (5) above for CØ .

c. Special Loads. Repeat *b* above as required for a particular load.

3-45. Unity Power Factor Load Test Procedure

a. 30- Vdc---l25-Watt *Test.* With the input voltage and output power set to 30 vdc and 125 watts, respectively, record the direct current, output voltage, distortion, and frequency as required on table 3-9. Repeat this procedure as required for a particular load.

b. 27- *Vdc –125- Watt Test.* Proceed as in *a* above and record.

c. 24- *Vdc —125- Watt Test.* Proceed as in *a* above and record.

d. 24- *Vdc* –2.50- *Watt Test.* Proceed as in *a* above and record.

e. 27- *Vdc--250- Watt Test.* Proceed as in *a* above and record.

f. 30- *Vdc–250- Watt Test.* Proceed as in *a* above and record.

***3-46.* Capacitive Power Factor Tests**

a. Equipment Settings.

(1) Load	On.
(2) Load function	Capacitive P. F. (–.95).
(3) Wattmeter selector	AØ .
(4) Monitor selector	Vdc.

b. Capacitive PF (–.95) Tests.

(1) 30-vdc–237.5-watt test. With the input voltage at 30 vdc and output power at 237.5 watts, record direct current, output voltage, and distortion as required on table 3-9. Repeat this procedure as required for a particular load.

(2) 27-vdc-237.5-watt test. Proceed as in (1) above and record.

(3) *24-vdc–237.5-watt test.* Proceed as in (1) above and record.

(4) *24-vdc–118.5-watt test.* Proceed as in (1) above and record.

(5) *27-vdc–118.5-watt test.* Proceed as in (1) above and record.

(6) *30-vdc-118.5-watt test.* Proceed as in (1) above and record.

3-47. Inductive Power Factor Test

a. Equipment Setup.

(1) Load	On.
(2) Load function	Inductive P. F. (+.85).
(3) Wattmeter selector	AØ .
(4) Monitor selector	Vdc.

b. Inductive P. F./ (+ .85) Tests.

(1) 30- vdc – *106.3-watt test.* With input voltage at 30 vdc and output power at 106.3 watts, record direct current, output voltage, and distortion as required per table 3-9. Repeat this procedure as required for a particular load.

(2) *27-vdc–106.3-watt test.* Proceed as in (1) above and record.

(3) *24-vdc–106.3-watt test.* Proceed as in (1) above and record.

(4) *24-vdc–212.5-watt test.* Proceed as in (1) above and record.

(5) *27-vdc–212.5-watt test.* Proceed as in (1) above and record.

(6) *30-vdc-–212.5-watt test.* Proceed as in (1) above and record.

3-48. Overload and Efficiency Tests

a. Preliminary Test Settings.

(1) Load	On.
(2) Load function	Overload.
(3) Wattmeter selector	AØ .
(4) Monitor selector	Vdc.

b. Test Procedure. Set the input voltage to 18 vdc and output power to 218 watts. Repeat this procedure as required for a particular load. Record direct current, output voltage, and frequency on table 3-9.

3-49. Overload Test

a. Equipment Setup.

(1) Load	On and off.
(2) Load function	Overload.
(3) Wattmeter selector	AØ .
(4) Monitor selector	Vdc.

b. Test Procedure.

(1) With the load off, adjust the input voltage to 26 vdc. Adjust each load to 4.36 amperes. With load on, allow the unit to be overloaded 5 seconds. Record the direct current and output voltage on table 3-9.

(2) Turn the load to on and adjust load for 250

watts. Repeat this procedure as required for a particular load. Record direct current and output voltage after circuit stabilization for 15 minutes.

3-50. Short Circuit Test

a. Equipment Setup.

(1) Load ... On.

(2) Load function ... Load, unity P. F.

(3) Wattmeter selector ... AØ .

(4) Monitor selector ... Vdc.

b. Test Procedure.

(1) Set input voltage to 26 vdc and output power to 250 watts. Repeat this procedure as required for a particular load.

(2) Depress short switch and record dc and output currents; then allow unit to foldback, which should be between 5 and 10 seconds.

(3) Release the short switch and record time required to recover to full output voltage.

(4) Allow unit to stabilize for 1 minute and record dc, output voltages, and frequencies as required table 3-9.

3-51. Efficiency Test

a. Equipment Setup.

(1) Load ... On.

(2) Load function ... Load, unity P. F.

(3) Wattmeter selector ... AØ .

(4) Monitor selector ... VDC.

b. Test Procedure.

(1) Set input voltage to 28 vdc and adjust power for 250 w. Repeat this procedure as required on table 3-8.

(2) Record dc, output voltages, and frequencies as required.

(3) Compute efficiency by using the following formulas and record in the appropriate block.

INPUT POWER=E IN X IIN

TOTAL OUTPUT POWER =3 X 250.0

$$\text{EFFICIENCY} = \frac{\text{TOTAL OUTPUT POWER}}{\text{INPUT POWER}}$$

Table 3-8. Parameter Limits

Para	DCV	P.F.	Pout Watts	DCI	AØV	Dist ØA	BØV	Dist ØB	CØV	Dist ØC	Freq
3-43b	24	-	0								
3-43c	27	-	0								
3-43c	30	-	0								
3-45a	30	1	125.0								
3-45b	27	1	125.0								
3-45c	24	1	125.0								
3-45d	24	1	250.0								
3-45e	27	1	250.0								
3-45f	30	1	250.0								
3-46b(1)	30	-.95	237.5								
3-46b(2)	27	-.95	237.5								
3-46b(3)	24	-.95	237.5								
3-46b(4)	24	-.95	118.5								
3-46b(5)	27	-.95	118.5								
3-46b(6)	30	-.95	118.5								
3-47b(1)	30	+.85	106.3								
3-47b(2)	27	+.85	106.3								
3-47b(3)	24	+.85	106.3								
3-47b(4)	24	+.85	212.5								
3-47b(5)	27	+.85	212.5								
3-47b(6)	30	+.85	212.5								

With an input voltage of 24 vdc, each phase output voltage must be within 107.5 to 117.3 volts ac.

With an input voltage of 27 and 30 vdc, each phase output voltage must be within 112.7 to 117.3 volts ac.

Distortion must be 5% or less in all cases.

No specification for DCI at these specified input dc voltages.

Frequency Limits 393 Hz to 407 Hz.

Table 3-8. Parameter Limits—Continued

Para	DCV	P.F.	Pout Watts	DCI	AØV	Dist AØ	BØV	Dist BØ	CØV	Dist CØ	Freq	
3-48b	18	1	218.0		100-117.5		100-117.5		100-117.5		380-407	
3-49b(1)	26	1	4.36A		50 MIN		50 MIN		50 MIN			5 Sec
3-49b(2)	26	1	250.0		107-117.5	5% Max	107-117.5	5% Max	107-117.5	5% Max	380-407	15 Min
Short Circuit					AØ Current		BØ Current		CØ Current			Recovery
3-50b(2)	26	1			5.44 Min		5.44 Min		5.44 Min			2 Sec Max
3-50b(4)	26	1	250.0		107-117.5		107-117.5		107-117.5		380-407	5 Min
Efficiency				DCI	AØV	Dist AØ	BØV	Dist BØ	CØV	Dist CØ	Freq	%
3-51b(2)	28	1	250.0		112.7 117.3	5% Max	112.7 117.3	5% Max	112.7 117.3	5% Max	380 407	65% Min
3-51b(3)	28	1	250.0		112.7 117.3	5% Max	112.7 117.3	5% Max	112.7 117.3	5% Max	380 407	65% Min

Table 3-9. Data Record Sheet

Para	DCV	P.F.	Pout Watts	DCI	AØV	Dist ØA	BØV	Dist ØB	CØV	Dist ØC	Freq
3-43b	24	-	0								
3-43c	27	-	0								
3-43c	30	-	0								
3-45a	30	1	125.0								
3-45b	27	1	125.0								
3-45c	24	1	125.0								
3-45d	24	1	250.0								
3-45e	27	1	250.0								
3-45f	30	1	250.0								
3-46b(1)	30	-.95	237.5								
3-46b(2)	27	-.95	237.5								
3-46b(3)	24	-.95	237.5								
3-46b(4)	24	-.95	118.5								
3-46b(5)	27	-.95	118.5								
3-46b(6)	30	-.95	118.5								
3-47b(1)	30	+.85	106.3								
3-47b(2)	27	+.85	106.3								
3-47b(3)	24	+.85	106.3								
3-47b(4)	24	+.85	212.5								
3-47b(5)	27	+.85	212.5								
3-47b(6)	30	+.85	212.5								

Table 3-9. Data Record Sheet—Continued

Para	DCV	P.F.	Pout Watts	DCI	AØV	Dist AØ	BØV	Dist BØ	CØV	Dist CØ	Freq	
3-48b	18	1	218.0									
3-49b(1)	26	1	4.36A									5 Sec
3-49b(2)	26	1	250.0									15 Min
Short Circuit					AØ Current		BØ Current		CØ Current			Recovery
3-50b(2)	26	1										
3-50b(3)	26	1	250.0									5 Min
Efficiency				DCI	AØV	Dist AØ	BØV	Dist BØ	CØV	Dist CØ	Freq	%
3-51b(2)	28	1	250.0									
3-51b(3)	28	1	250.0									

APPENDIX A

REFERENCES

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals, Supply Bulletins, and Lubrication orders.
DA Pam 310-7	US Army Equipment Index of Modification Work Orders.
TM 11-6625-700-10	Operator's Manual: Digital Readout, Electronic Counter AN/USM-207.
TM 11-6625-700-25	Organizational, DS, GS, and Depot Maintenance Manual: Digital Readout, Electronic Counter AN/USM-207 (NSN 6625-00-911-6368).
TM 11-6625-1703-15	Operator, Organizational, DS, GS, and Depot Maintenance Manual Oscilloscope AN/USM-281A (NSN 6625-00-228-2201).
TM 11-6625-2616-14	Operator's, Organizational, Direct Support, and General Support Maintenance Manual: Digital Voltmeter AN/GSM-64A.
TM 38-750	The Army Maintenance Management System (TAMMS).
TM 740-90-1	Administrative Storage of Equipment.
TM 750-244-2	Procedure for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).
TM 11-1520-221-20	Organizational Maintenance Manual: Electronic Equipment Configurations, Army Models AH-1G, AH-1Q, and AH-1S(MOD) Helicopters.
TM 11-1520-236-20	Organizational Maintenance Manual: Electronic Equipment Configurations, Army Model AH-1S Helicopters (NSN 1520-00-504-9112).

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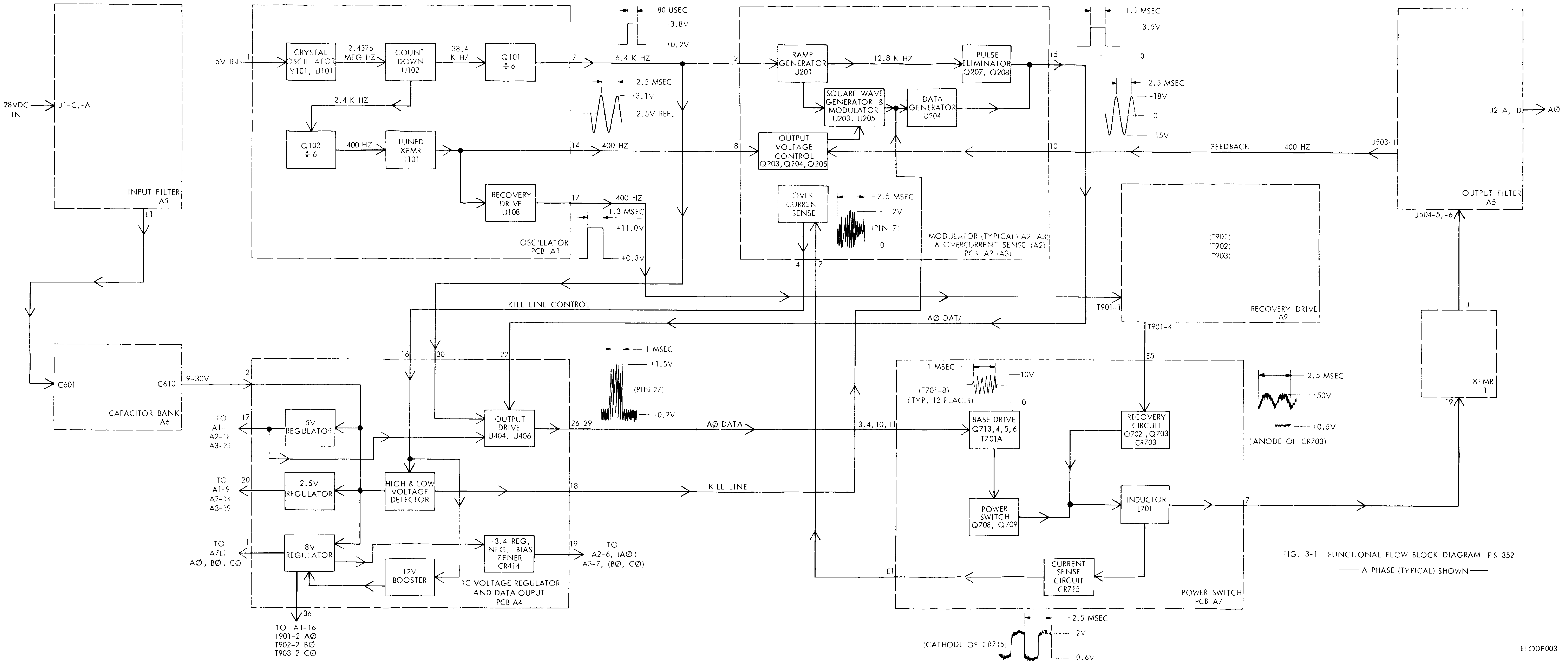
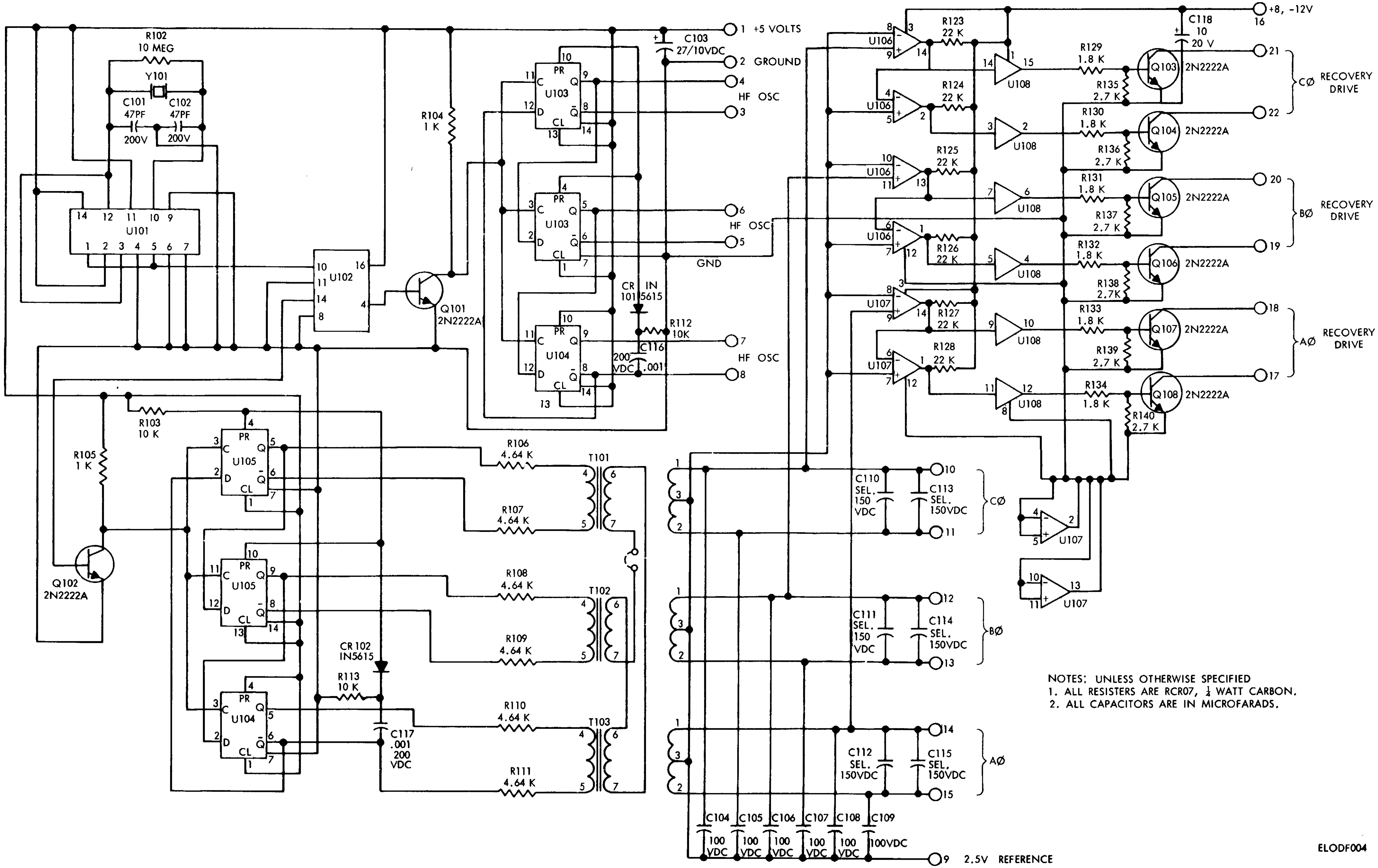


Figure FO-1. Functional flow block diagram.



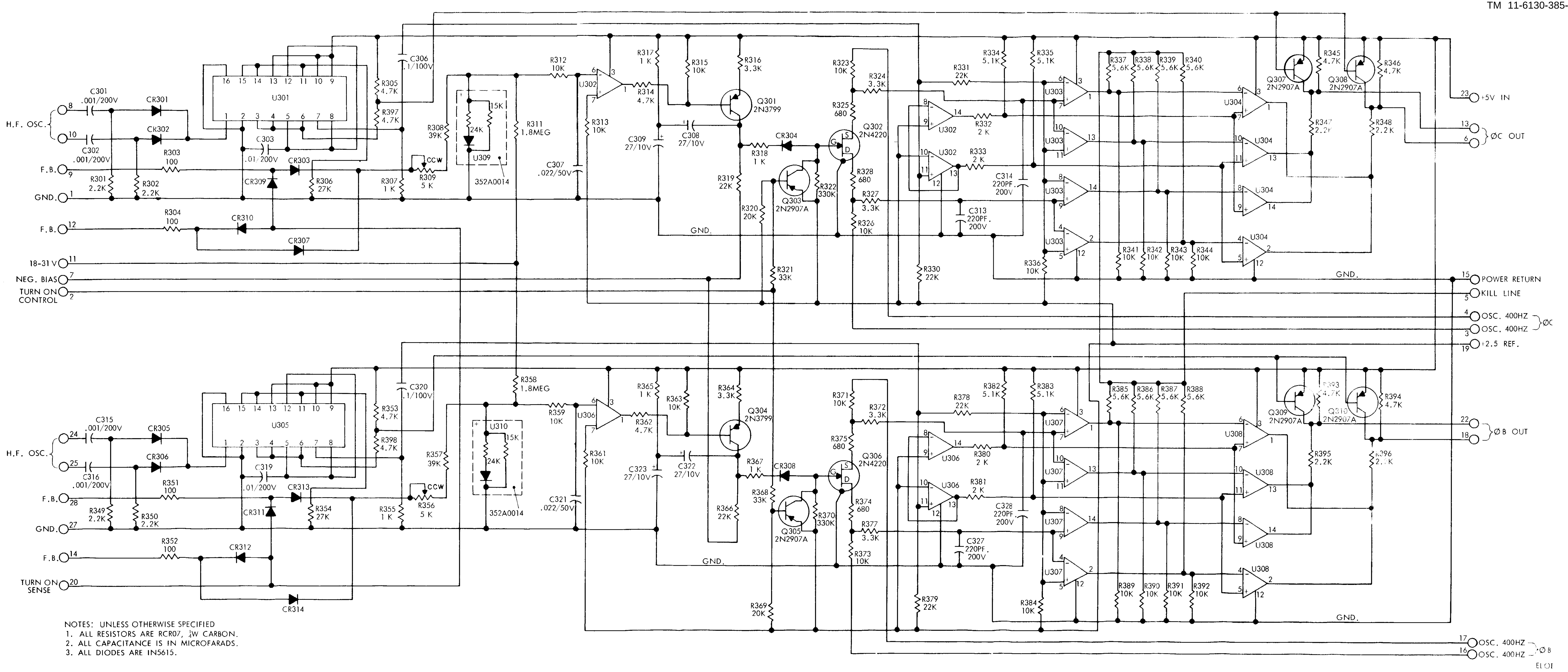
NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTERS ARE RCR07, ¼ WATT CARBON.
2. ALL CAPACITORS ARE IN MICROFARADS.

Figure FO-2. Oscillator printed circuit board schematic diagram (A1).

NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTOR VALUES ARE IN OHMS; RCR07 (¼WATT).
2. ALL CAPACITOR VALUES ARE IN MICROFARADS.
3. ALL DIODES ARE IN5615.

Figure FO-3. AØ modulator and current sense printed circuit board schematic diagram (A2).



NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE RCR07, ¼W CARBON.
2. ALL CAPACITANCE IS IN MICROFARADS.
3. ALL DIODES ARE IN5615.

Figure FO-4. BØ, CØ modulator printed circuit board schematic diagram (A3).

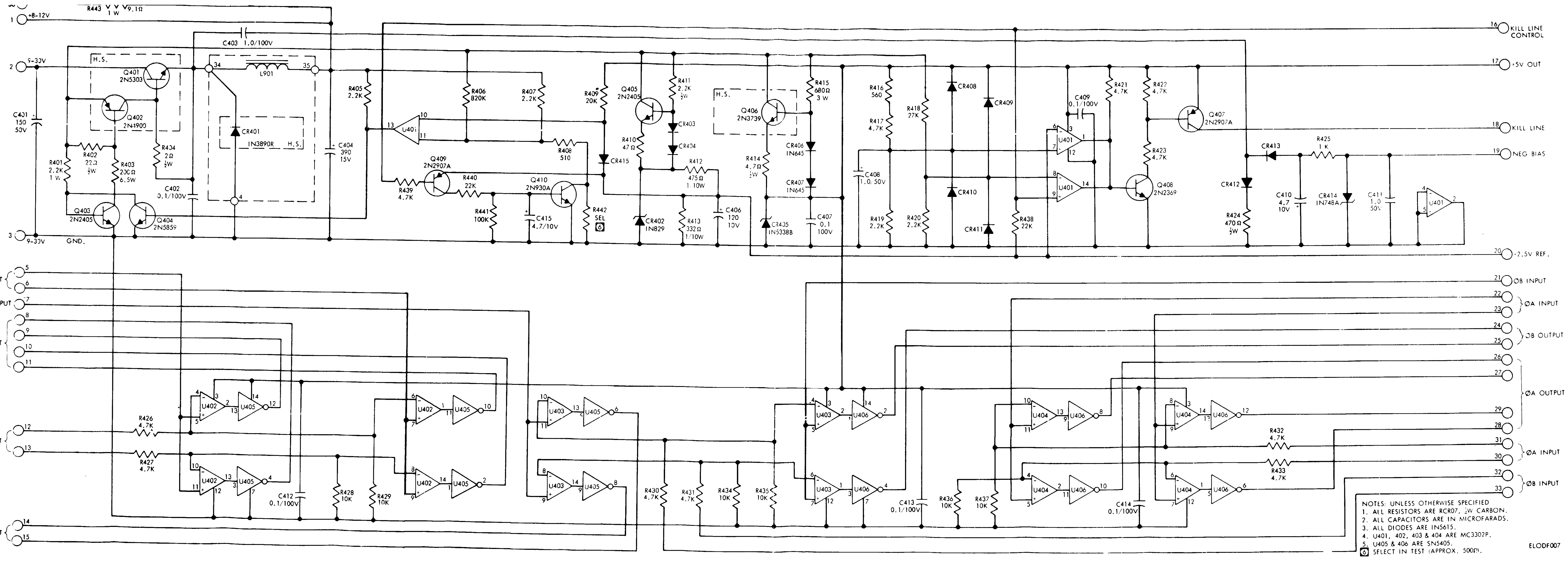


Figure FO-5. Dc voltage regulator and data drive printed circuit board schematic diagram (A4).

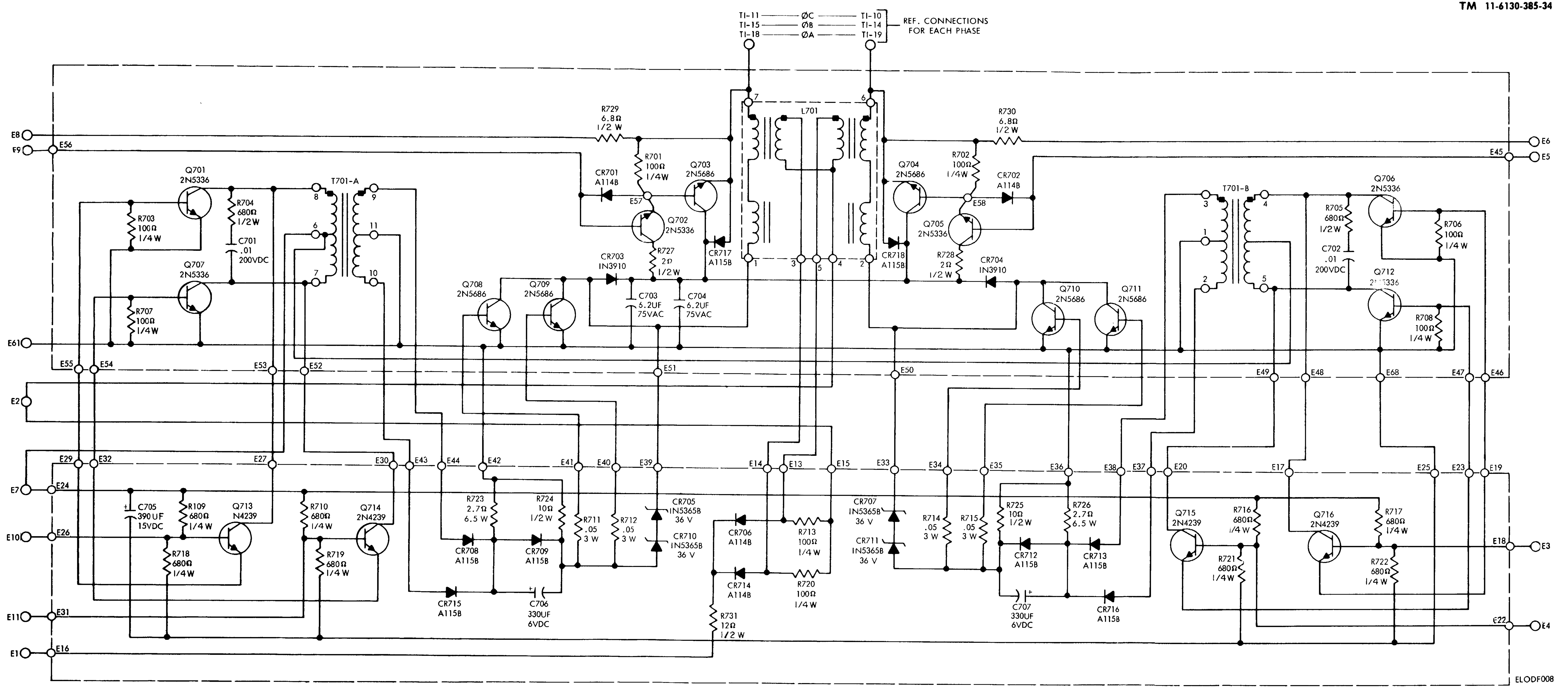
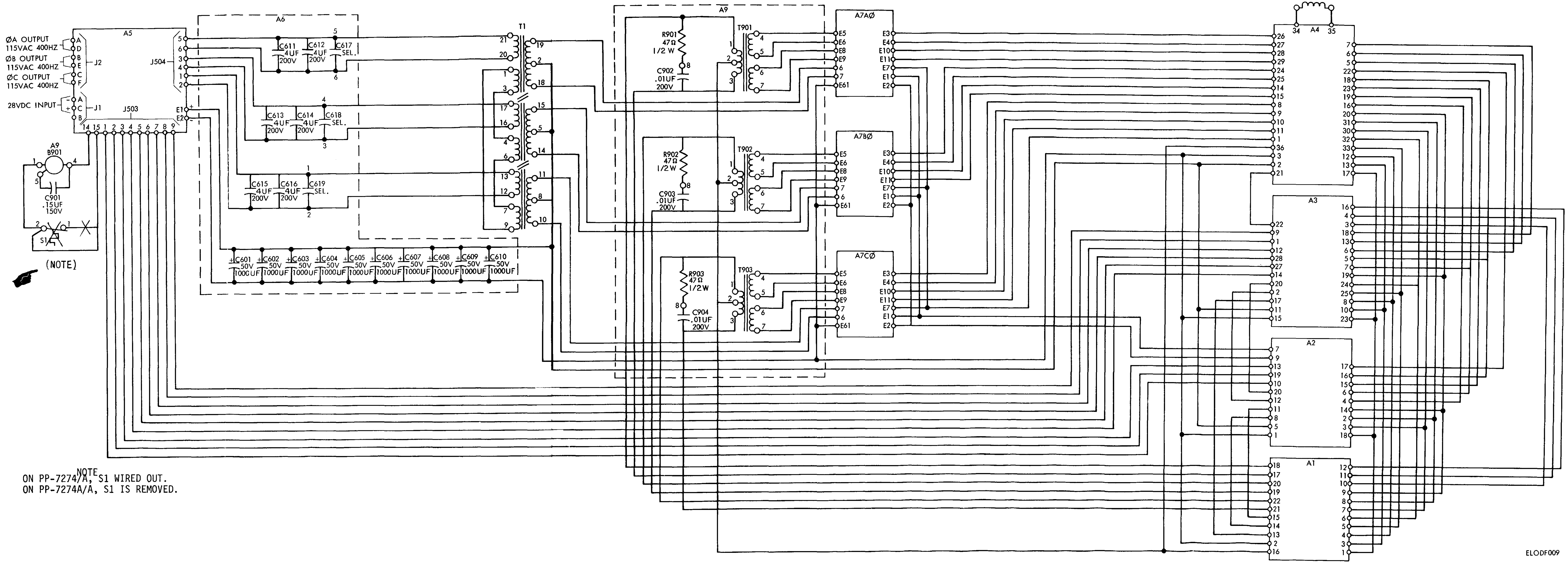


Figure FO-6. Power switch module and printed circuit board schematic diagram (A7).



NOTE
ON PP-7274/A, S1 WIRED OUT.
ON PP-7274A/A, S1 IS REMOVED.

Figure FO-7. Interconnection diagram.

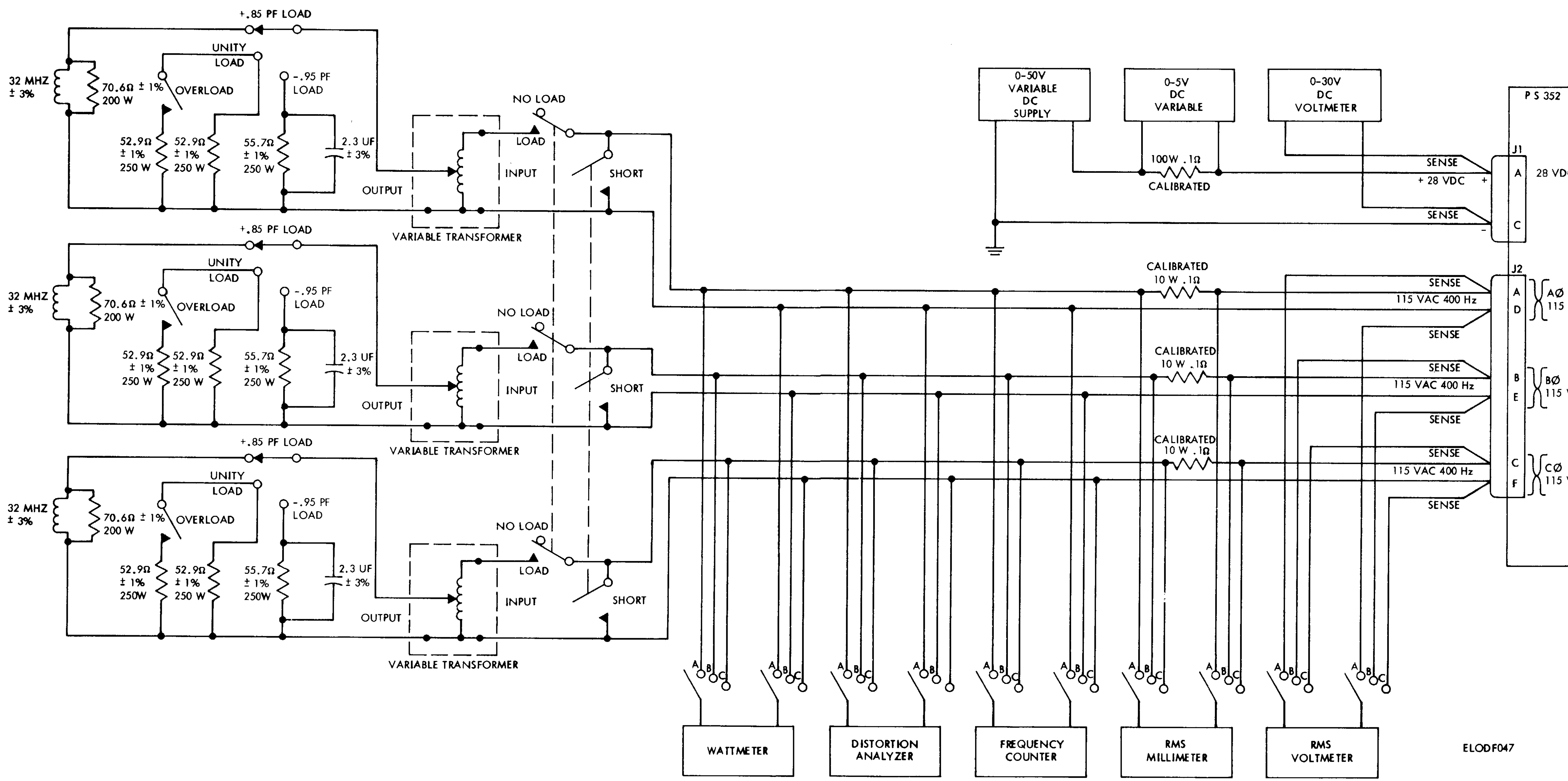


Figure FO-8. Test connection block diagram.

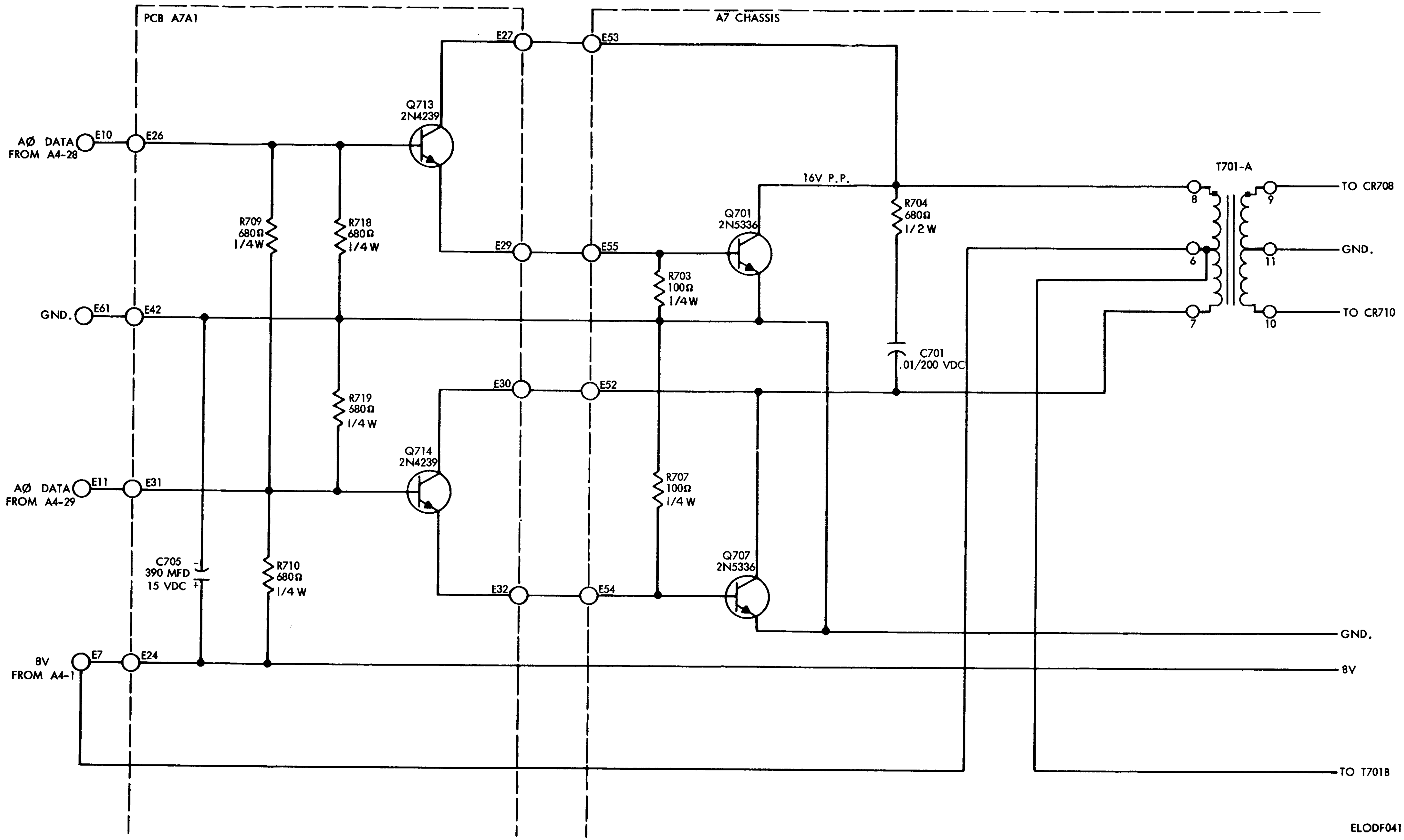


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Figure FO 9. Base drive circuit.

By Order of the Secretary of the Army:

FRED C. WEYAND
General, United States Army
Chief of Staff

Official:

PAUL T. SMITH
Major General, United States Army
The Adjutant General

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