TM 11-6625-1795-45

TECHNICAL MANUAL

GENERAL SUPPORT AND DEPOT MAINTENANCE MANUAL

TEST SET,
RADAR ALTIMETER MODULE
AN/APM-322

HEADQUARTERS, DEPARTMENT OF THE ARMY
DECEMBER 1971

WARNING

DANGEROUS VOLTAGES exist in this equipment

Be careful when making voltage readings at tip jacks on the module test set panel. When the power supply assembly is removed and disassembled for testing, 115-volt ac and 120-volt dc voltages could be contacted, which may cause severe shock or possible death to the repairman.

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HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, 7 *December 1971*

General Support and Depot Maintenance Manual

TEST SET RADAR, ALTIMETER MODULE AN/APM-322

LIST OF ILLUSTRATIONS

CHAPTER 1

INTRODUCTION

1-1. Scope

a. This manual contains general support and radar maintenance instructions for Test Set, Radar Altimeter Module AN/APM-322 (module test set). It includes instructions appropriate for troubleshooting, testing, and repairing the equipment. It also lists tools, materials, and test equipment required for general support and depot maintenance. Equipment function is covered in chapter 2.

b. The module test set is always used with Test Set, Radar Altimeter System AN/APM-323 (system test set). The technical manuals for both test sets include three other publications: TM 11-6625-1795-12, TM 11-6625-1746-12, and TM 11-6625-1746-45.

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 additions, changes, or additional publications pertaining to the equipment.

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

NOTE

For applicable forms and records, see paragraph l-3, TM 11-6625-1795-12.

1-3. Reporting of Equipment Publications Improvements

The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications) and forwarded direct to Commanding General, US Army Electronics Command, ATTN: AMSEL-ME-NMP-EM, Fort Monmouth, N.J., 07703.

CHAPTER 2

PRINCIPLES OF OPERATION

Section I. BLOCK DIAGRAM ANALYSIS

2-1. General

The module test set consists of a panel assembly, carrying case, and cables required to connect to the modules to be tested. The module test set operates as an extension of Test Set, Radar Altimeter System AN/APM-323 and contains the additional circuits required to permit testing modules of Receiver-Transmitter RT-804A/APN-171 (V) (receiver-transmitter). Only one module may be connected to the module test set at any one time.

2-2. Test Set, Radar Altimeter Module TS-2932/AMP-322

a. Test Set, Radar Altimeter Module TS-2932/APM-322 (module test set panel assembly 2Al) contains power supply assembly 2A1A2, intermediate frequency (i-f) amplifier assembly 2A-1A3, interconnecting circuit card assembly 2A-1A1, and signal simulation and monitor circuits. Figures Z-i and 2-2 illustrate the applications of these components in testing the modules. The power supply assembly is used to energize the module being tested. The i-f amplifier assembly is used only for receiver module tests. The interconnecting circuit card assembly provides mounting positions and interconnect wiring for the four tracker cards comprising the tracker module.

b. The module test set receives power from system test set Panel, Control-Simulation C-8396/APM-323. Video and time-zero signals, where required, are received from system test set Panel, Range-Rate Simulation SM-566/APM-323. The module test set panel is connected to the control-simulation panel by means of Cable Assemblies CX-12206/APM-323, CX-12205/U, and CG-3594/U. Refer to TM 11-6625-1795-12 for interconnecting diagrams.

2-3. Module Test Set Operating Modes

The module test set has five operating modes, differing in its operating characteristics for each module type. The block diagrams, figures 2-1 and 2-2, illustrate the operating modes.

a. Power Supply Module Tests. Figure 2-1, view A, is a block diagram of the operating mode for power supply module tests. The power supply module power input is obtained from the POWER SUPPLY MODULE connector using a system power and signal cable. The 115-volt 400-cps power input from the module test set is turned on by setting the MODULE TEST SELECT switch to POWER SUPPLY MODULE. The input voltage is applied through a variable autotransformer, which has taps selected by VOLTAGE SELECT switch 2A1S4. This switch adjusts the voltage to low, normal, or high values as required in test procedures. The applied voltage is read on a multimeter connected to the 400 CPS HI and LO jacks. The module test set internal power supply is not energized when power supply modules are tested. Power supply outputs are returned through the cable connected to connector J7 to a load resistor circuit and panel tip jacks. This enables test readings of each output voltage under its actual load condition.

b. Transmitter Module Tests. For the transmitter module (fig. 2-1, view B), the MODULE TEST SELECT switch is set to TEST MODULE. This energizes power supply assembly 2A-1A2, providing power input to the transmitter through MODULE POWER connector J14. Transmitter output connector J2 is connected to the system test set attenuator panel with a transmitter rf cable that contains a 20-db fixed attenuator. Transmitter time-zero output is connected to T-ZERO connector J12 to provide an oscilloscope synchronization signal. The PULSE-WIDTH CONTROL switch applies a signal into the transmitter to change its operation mode to a high-altitude wide-pulse output. A second method of synchronizing the oscilloscope is available by connecting the system test set range-rate simulation panel CAL connector to transmitter connector J4, with the shorting cap

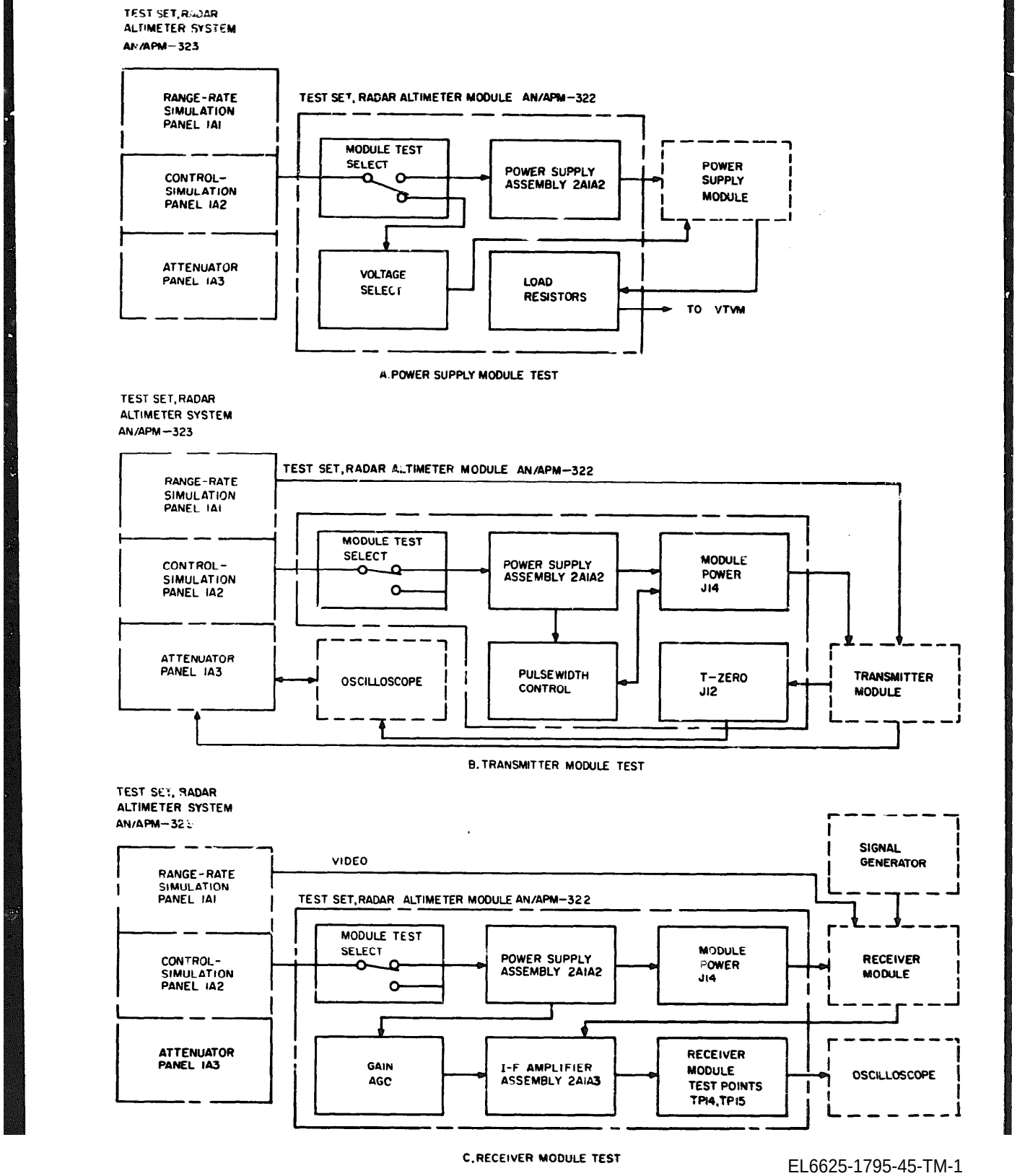

Figure 2-1. Test, Set, Radar Altimeter Module AN APM-322 operating modes-block diagrams.

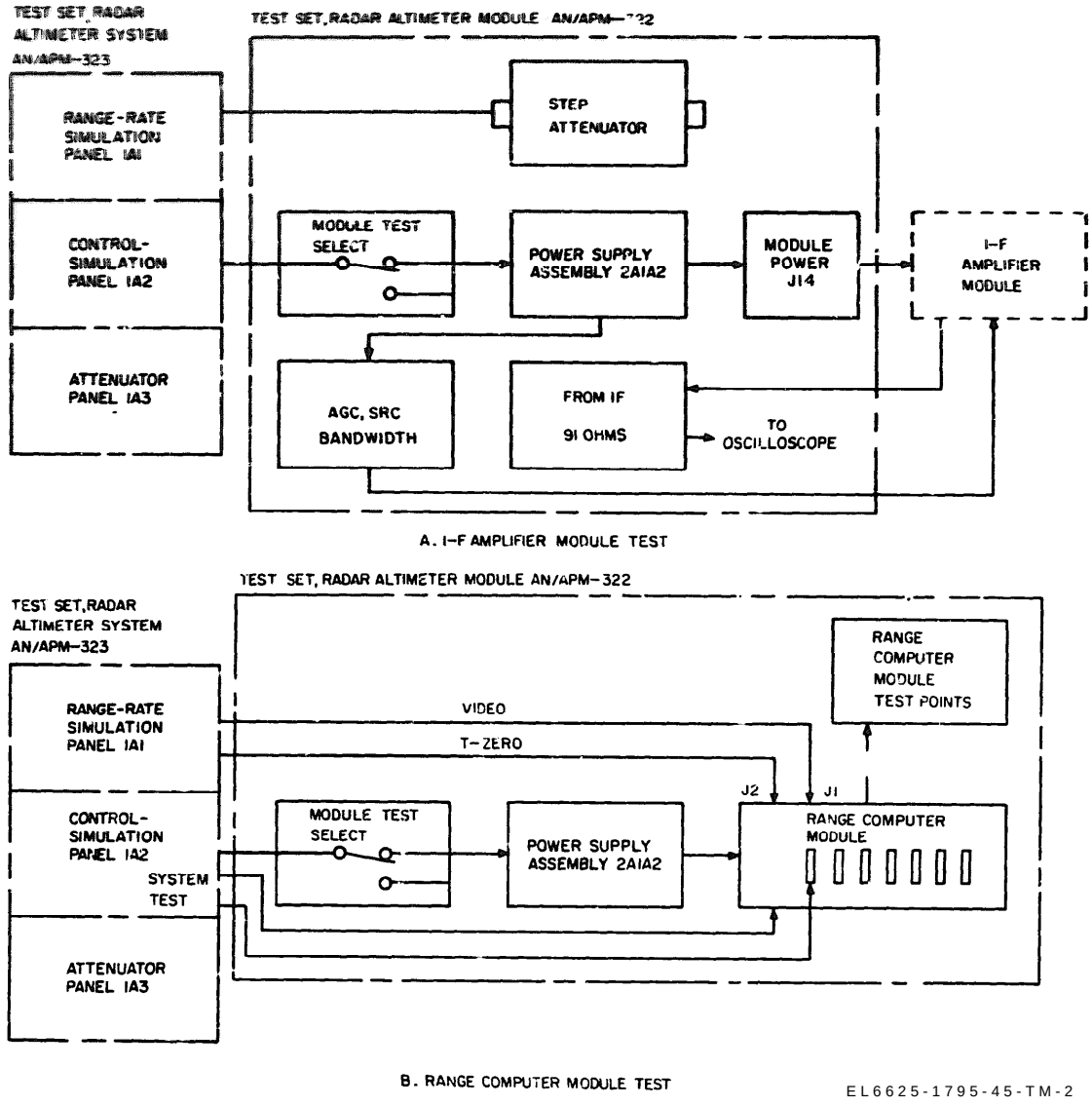

Figure 2-2. Test Set, Radar Altimeter Module AN/APM-322 operating modes-block diagrams.

removed. This deactivates the transmitter prf circuit and the transmitter modulator is triggered from the simulated prf signals. The oscilloscope is then connected to the T-ZERO SYNC connector on the sts range-rate simulation panel.

c. ***Receiver Module*** Tests. The test circuit for receiver module tests is shown in figure 2-1, view C. Signal input to the receiver is applied from a signal generator. Output of the receiver is connected into module test set i-f amplifier assembly 2A1A3. Output of the i-f amplifier assembly is taken from the test points adjacent to FROM RCVR connector J13 and is displayed on Oscilloscope AN USM-281. The GAIN control adjusts the amplifier gain to enable receiver performance checkout.

d. 1-F Amplifier Module Tests. Figure 2-2, view A, illustrates the circuit used in tests of the receiver-transmitter i-f amplifier module. The i-f amplifier module is also energized through MODULE POWER connector J14 and receives variable voltages for its automatic gain control (age), sensitivity range control (WC), and bandwidth control (bwc) circuits. Controls for this

purpose are located in the INTERMEDIATE FREQUENCY AMPLIFIER MODULE section of the panel. To Lest the i-f amplifier module, a calibrated video signal from the system test set is applied into the i-f amplifier module in series with a step attenuator. The required voltages are set in by the AGC and SRC controls, and the i-f amplifier module output is monitored at the FROM IF jacks. Signals from the amplifier module are compared with the video input on the A and B channels of Oscilloscope AN/USM-281.

e. *Range Computer Module Tests.* Figure 2-2, view B, is a simplified signal flow diagram for range computer module tests. The four tracker cards are plugged into the RANGE COMPUTER MODULE card receptacles. The test connector of the system test cable is connected to the TEST connector. Video and T-zero (time-zero) signals are received from the system test set range-rate simulation panel and are applied into the range computer module circuits. The test cable connects the circuit monitor points to the TEST tip jacks on the system test set control-simulation panel. Additional test point tip jacks are located above the card receptacles.

Section II. CIRCUIT ANALYSIS

2-4. General

The module test set circuits consist of interconnecting and power distribution circuits, a power supply assembly, and an i-f amplifier assembly. The power supply and i-f amplifier assemblies are the same as the corresponding modules of Receiver-Transmitter RT-804A/APN-171(v).

a. Power Supply Assembly 2A1A2. The power supply assembly provides regulated dc voltages to energize the modules being tested. The power supply assembly consists of the three subassemblies: subassembly no. 1 2A1A2TB1 (dc amplifier), subassembly no. 2 2AlA2TB2 (rectifier), and subassembly no. 3 2AlA2TB3 (output regulator). The power transformers, filter chokes, and thermal delay relay are mounted separately on the power supply chassis. The dc regulator circuits are conventional, consisting of a sampling stage, series regulator, and zener reference diodes. Figure 2-3 shows the relationship between the output stages and the polarity of interconnections. The +120-volt output is obtained by adding an unregulated +40-volt supply to the regulated +80-volt output and that the -6.3-volt and +80-volt supplies are referenced to the -50-volt supply, which has the closest regulation.

b. Intermediate Frequency Amplifier Assembly 2A1A3. The intermediate frequency amplifier assembly is a high gain video amplifier. It is identical to the i-f amplifier module used in Receiver-Transmitter RT-804A/APN-171(V). The i-f amplifier assembly is used only to check receiver modules. When a receiver module is connected for test, the receiver video output is applied into FROM RCVR jack J13. Tip jacks adjacent to jack J13 provide the i-f amplifier assembly output connection. These jacks have a 91-ohm load resistor connected across them for impedance matching. The GAIN control applies simulated age voltage into the amplifier age circuit.

c. Interconnecting Circuit Card Assembly 2A1A1. This is a printed circuit card providing mounting and circuit interconnections for the tracker cards of the range computer module. Six RANGE COMPUTER MODULE connectors Al through A6 and the TEST connector are mounted card assembly 2A1A1. Refer to figure FO-2 for schematic diagram. Connectors A1 through A4 provide for testing the four tracker cards comprising the range computer module of the Receiver-Transmitter RT-804A/APN-171(V). The TEST connector receives the system test cable from the system test set. When the system test set and module test set are properly interconnected and the tracker cards plugged in, the test input and output readings are connected to the SYSTEM and TEST jacks on the system test set control-simulation panel. Nine additional test jacks are provided above the interconnect panel. These provide direct test point connections with shorter circuit paths for oscilloscope and rf vtvm readouts.

d. Load Resistors. Four load resistors, associated with connectors Al through A4, are connected to points in the printed circuit. Resistor 2A1A1R1 loads the age circuit of tracker card Al. Resistor 2A1A1R2 loads the bandwidth control circuit of tracker card A2. Resister 2A1 Al R3 and diodes 2AlAlCR1 and 2A1A1CR2 load the src circuit of tracker card A3. Resistor 2A1A1R4 loads the src voltage circuit of the test set.

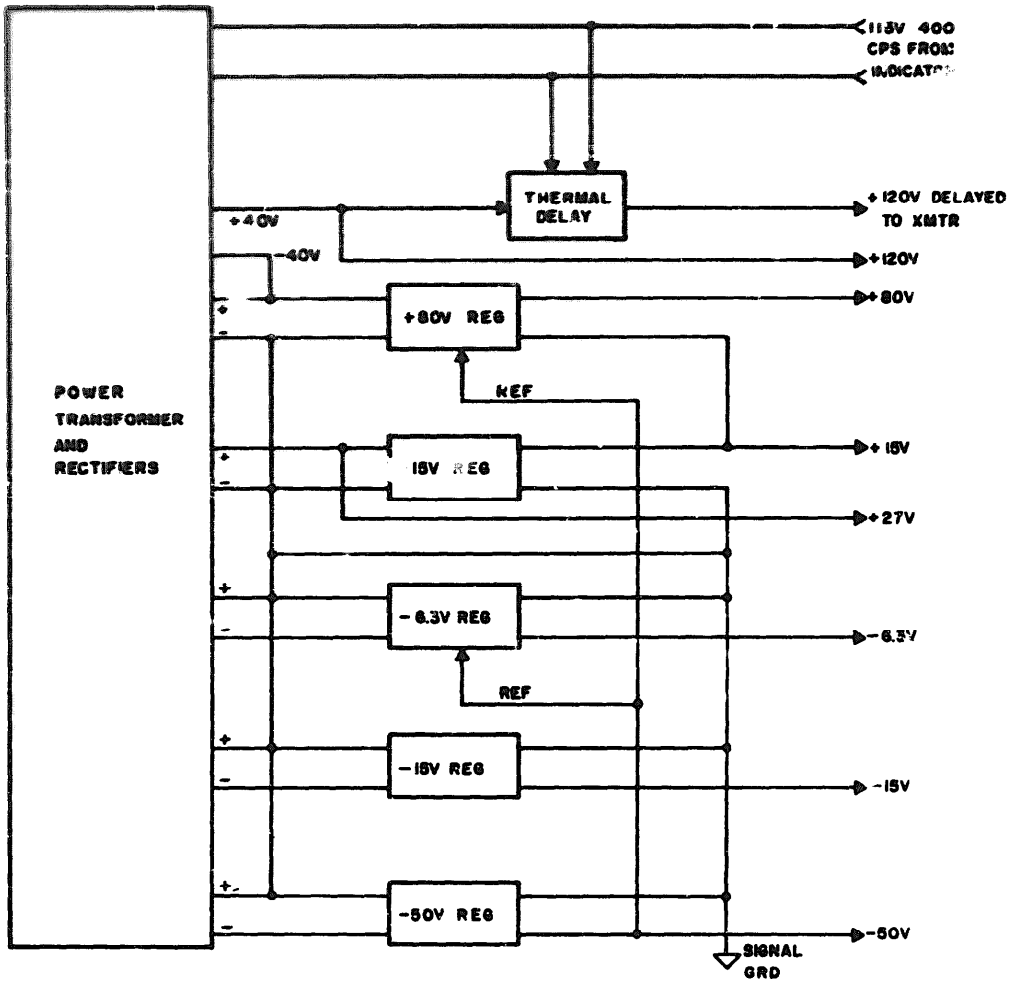

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Figure 2-3. Power supply assembly 2A1A2-block diagram.

e. Step Attenuator 2A1AT1. The INTERMEDIATE FREQUENCY AMPLIFIER MODULE section of the panel contains a step attenuator. This consists of nine fixed attenuators each controlled by a coaxial toggle switch. Setting the switch to the IN position inserts the corresponding value of attenuation in the circuit. Steps of 1 db up to 101 db are provided. The step attenuator is used only for gain checks of i-f amplifier modules. A video signal from the system test set is applied into the i-f amplifier module through the step attenuator, with all switches in the up position (attenuation out). The signal level is displayed on one channel of a dual beam oscilloscope, and the amplifier output is displayed on the other channel. Attenuation is then set in until the output and input signal levels are equal. The total of the attenuator values, to the nearest 1-db step, is used to express the gain of the amplifier.

2-5. Power Distribution for Module Test

Figure 2-4 is a simplified diagram of power distribution in all module tests, except the power supply module test. With the MODULE TEST SELECT switch set to TEST MODULE, power supply assembly A2 is energized. The power supply voltage outputs are connected to MODULE POWER connector J14. Resistors R1 through R7 apply loads to stabilize the voltages. The -15-volt output is applied to the AGC control to supply the variable voltage required. The SRC control connects to the -15-volt supply through 390-ohm resistor R4. I-F amplifier assembly A3

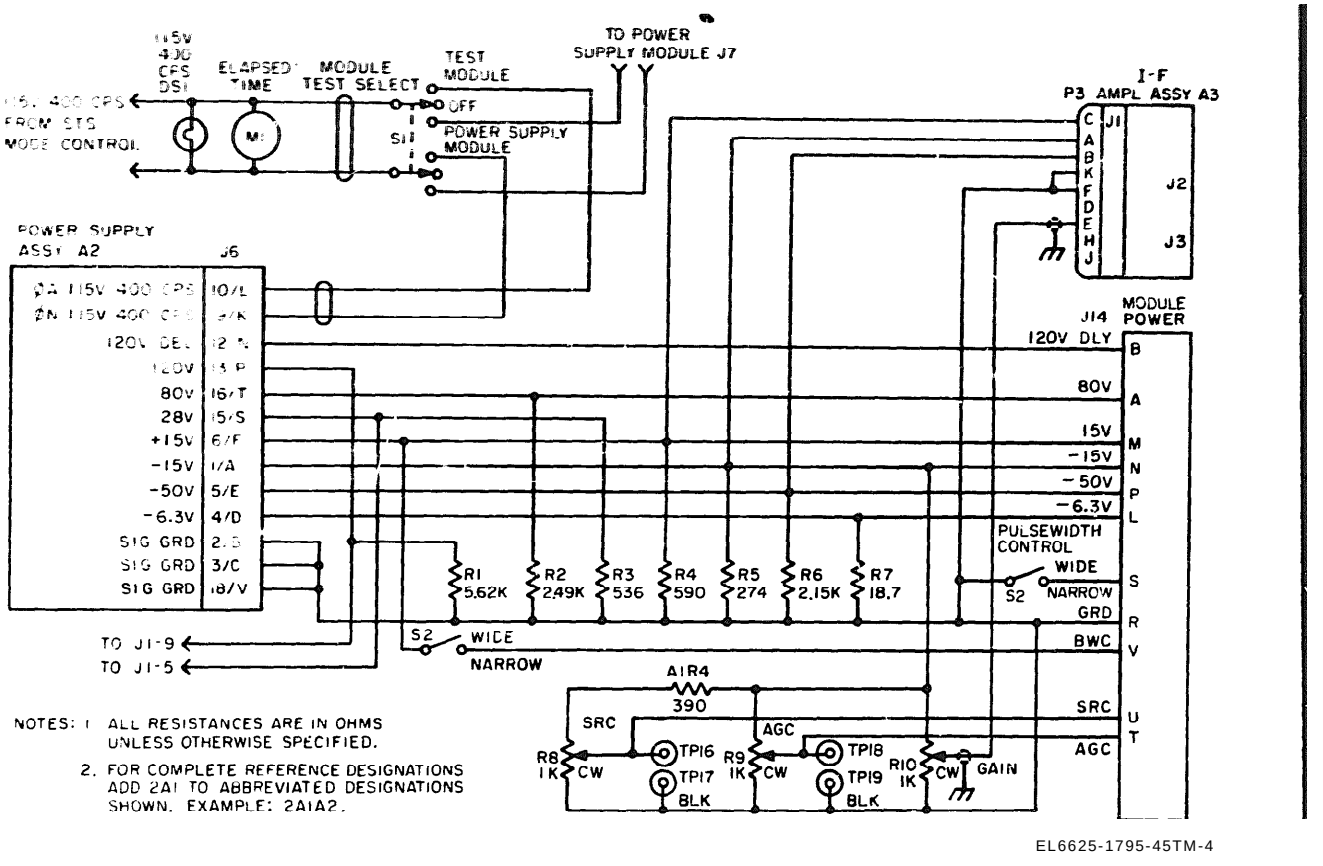

Figure 2-4. Power distribution-functional schema tic diagram.

is supplied +15, −15, and −50 volts at all times when the power supply is energized.

2-6. Power Distribution for Power Supply Module Tests

Figure 2-5 is a simplified circuit of power distribution for power supply module tests. The 115-volt 400-cps input is received from the system test set when the system test set MODE CONTROL switch is set to XCVR/MODULE indicator lamp 2A1DS1 comes on and elapsed time meter Ml starts). When the MODULE TEST SELECT switch is set to POWER SUPPLY MODULE position, the 115-volt input is connected into the voltage select variable autotransformer. VOLTAGE SELECT switch S4 picks off the desired voltage value to energize the power supply module, which is connected to POWER SUPPLY MODULE connector J7. Switch S4 is varied during tests to apply low, normal, and high voltage inputs to the power supply module. Outputs of the power supply module return through connector J7 and are connected to the tip jacks in the POWER SUPPLY MODULE section of the panel. Resistors R11 through R17, connected across these jacks, apply loads equivalent to the normal operating loads of the power supply module. Voltage of each output is read at the corresponding tip jack. Module test set internal power supply assembly 2A1A2 is not energized for this test.

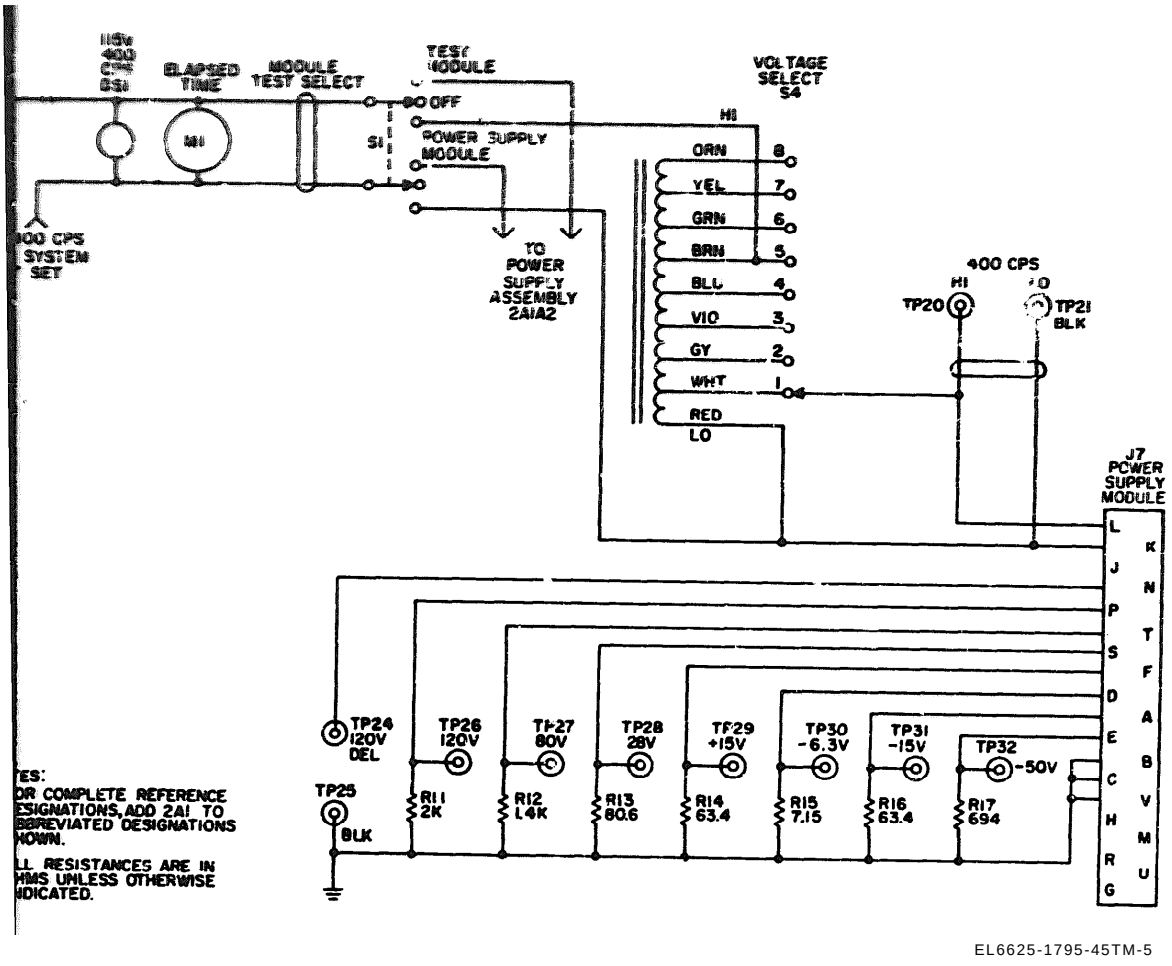

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Figure 2-5. Power supply module tests--functional schematic diagram.

CHAPTER 3

GENERAL SUPPORT MAINTENANCE

Section I. GENERAL

3-1. Scope of General Support Maintenance

General support maintenance consists of testing the module test set panel assembly, troubleshooting any faults, adjusting any out-of-tolerance items, removing and replacing faulty circuit cards, and repairing defective components and controls. Use the test procedures given in section II to find any out-of-tolerance parameters. Refer to the troubleshooting chart in section II to identify the probable cause of the trouble. Additional voltage, resistance, and continuity checks are included in section II to aid in isolating malfunctioning components. Section III includes the recommended adjustment procedures which may be performed at general support maintenance. Disassemble the panel assembly from the module test set case according to the instructions given in section V of this chapter. When instructions are given for removal and replacement of controls, components: or circuit cards, refer to section VI for the detailed procedures. All applicable repair instructions are given in sections IV and VI. Upon completion of the troubleshooting and repair procedures, perform the tests specified in section VII to determine if the unit meets all performance parameters.

3-2. Test Equipment, Tools, and Materials Required

a. Test Equipment. The following test equipment is required for general support maintenance.

test equipment	technical manual
Digital Voltmeter AN/GSM-64	TM 11-6625-444-15
Differential Voltmeter ME-202/U	**TM** 11-6625-537-15
Multimeter AN/USM-223	
Oscilloscope AN/USM-281A	**TM 11-6625-1703-45**
Resistance Bridge ZM-4A/U	**TM 11-2019**
Voltmeter, Electronic AN/URM-145 (vtvm).	**TM** 11-6625-524-44

b. Tools. The only tools required for general support maintenance are hand tools similar to those contained in Tool Kit TK-105/G and common shop equipment such as soldering and painting equipment.

c. Materials. The required materials include the general purpose instrument test leads supplied with the test instruments, the interconnecting cables (step e below) supplied with the module test set, and the items listed below.

Material	*Government specification or vendor stock number*	*Use*
Alcohol, isopropyl	**MIL-F-5566**	**Cleaning printed circuit boards.**
Trichloroethane	**Federal Specification O-T-620, Type I.**	**General cleaning.**
Enamel, black, lusterless	**FSN 8010-687-3636**	**Touchup panels.**
Enamel, light gray	**FSN 8010-285-4868**	**Touchup cases.**
Enamel, white	**FSN 8010-297-2096**	**Repair panel legends.**
Solder, plastic rosin core	**Sn60WRP2, type RMA, per QQ-S-571.**	**Soldering leadwires to circuit boards and connectors.**
Tape, masking	**FSN 7510-266-6712**	**Masking parts and surfaces during retropicalization.**
Tubing, teflon	**AMS3654 (size as required)**	**Insulating leadwires at connector terminals.**
Varnish, epoxy, clear gloss	**Poly-EP no. 810, Valspar, Inc**	**Retropicalizing repaired or otherwise unprotected printed circuit boards.**

d. Special Tools. No special tools are required.

e. Interconnecting Cables. The following interconnecting cables are provided as part of Test Set, Radar Altimeter Module AN/APM-322

Nomenclature	Cable assembly	Cable function
Cable Assembly, Radio Frequency	CG-3594/U (6 ft 6 in.)	Video rf input.
Cable Assembly, Special Purpose, Electrical.	CX-12198/APM-322	Transmitter power input.
Cable Assembly, Radio Frequency	CG-3595/U (3 ft)	T_0 (time-zero signal output.
Cable Assembly, Special Purpose, Electrical.	CX-12199/APM-322	I-F amplifier module power.
Cable Assembly Radio Frequency	CG-3596/APM-322	I-F input (has matching pad).
Cable Assembly, Special Purpose, Electrical, Branched.	CX-12200/APM-322	Receiver module power.
Cable Assembly, Radio Frequency	CG-3597/U (3 ft)	Receiver module rf output.
Cable Assembly, Special Purpose, Electrical.	CX-12201/APM-322	Power supply module test.
Cable Assembly, Special Purpose, Electrical.	CX-12364/APM-322	Power supply module card extender.
Lead, Electrical	CX-12292/APM-322	Ground strap for i-f amplifier module.
Extender, Card Assembly	MX-8531/APM-322	Tracker card tests.

Section II. TROUBLESHOOTING

3-3. General

Connect the module test set to the system test set according to basic test setup (fig. 3–1). Set module test set controls to initial positions shown below. Set system test set **TESTER POWER** switch to ON and **MODE CONTROL** switch to XCVR, MODULE.

Control	Initial position
MODULE TEST SELECT	OFF
PULSEWIDTH CONTROL	WIDE
BANDWIDTH CONTROL	WIDE
Step ATTENUATION (20 DB to 1 DB) switches.	Down (out) position
VOLTAGE SELECT	5

3-4. Voltage Measurements

a. Input Power and Elapsed Time Meter. **With power connected to INPUT POWER connector J3, the INPUT POWER 115V 400 CPS lamp shall be lighted and the ELAPSED TIME meter shall be running.**

b. AGC and SRC Voltages. **Check the agc and src voltages as follows:**

(1) Set the MODULE TEST SELECT switch to TEST MODULE.

(2) Read the agc and src voltage at the AGC and SRC test points on the front of the

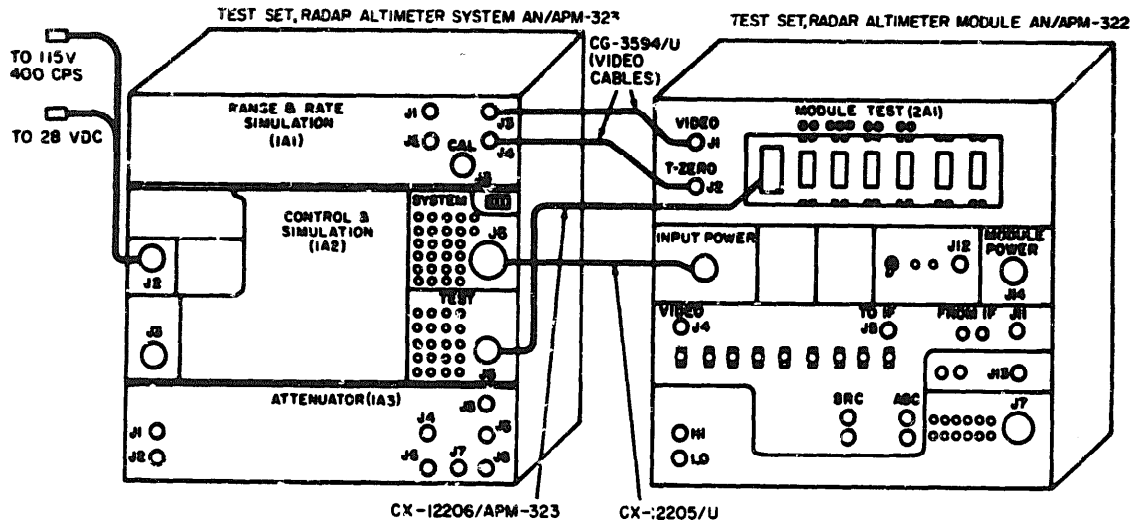

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Figure 3-1. Test Set, Radar Altimeter Module AN/APM-322-basic test setup.

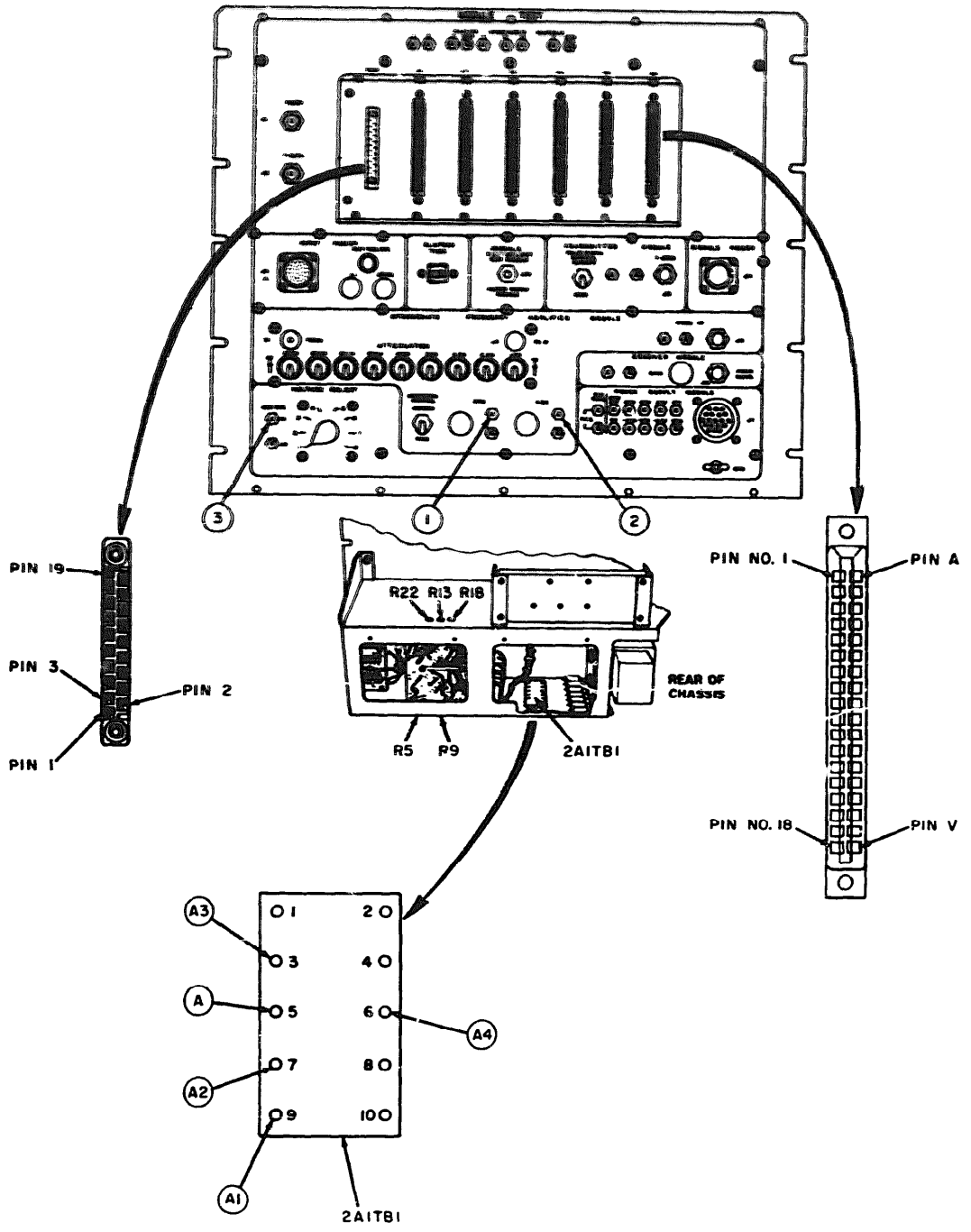


Figure 3-2. Test point locations.

module test set panel (test points 1 and 2, fig. 3-2) using the ME-202/U.

(3) Turn the AGC control knob from one stop to the other. AGC voltage shall vary smoothly from 0.0±0.1 to -14.5±1.0 volts dc.

(4) Turn the SRC control knob from one stop to the other. SRC voltage shall vary smoothly from 0±0.1 to -10.0±1.0 volts dc.

c. Power Supply Module Input. Connect the ME-202/U, set for ac voltmeter operation, to

the 400 CPS HI and LO (ground) jacks (test point 3, fig. 3-2). Set the VOLTAGE SELECT switch to each of its positions. Set the MODULE TEST SELECT switch to POWER SUPPLY MODULE. With input power of 115 ± 1 volt 400 cps, the following voltage outputs of the variable autotransformer shall be indicated.

Position	Voltage (400 cps)
1	92 ± 4
2	97 ± 4
3	103 ± 4
4	109 ± 4
5	115 ± 2
6	121 ± 4
7	126 ± 4
8	132 ± 4

d. Power Supply Assembly 2A1A2. Check power supply voltage outputs as follows:

(1) With module test set INPUT POWER connector J3 connected to the system test set, set the system test set TESTER POWER switch to ON.

(2) Set the MODULE TEST SELECT switch on the module test set to TEST MODULE. Connect Digital Voltmeter AN/GSM-64 to read the dc voltages listed in the chart below at MODULE POWER connector J14. Use the ME-202 U for ripple volt checks.

Pin	Polarity to grd	Dc voltage and tolerance	Maximum ripple
B	−	+120.0 ± 13.5	60 mv
A	−	+80.0 ± 2.4	25 mv
M	−	+15.0 ± 0.5	25 mv
N	+	−15.0 ± 0.5	25 mv
P	+	−50.00 ± 0.15	10 mv
L	+	−6.3 ± 0.2	6 mv

(3) Voltage readings that are not within the tolerances listed in the chart in step (2) above indicate a defective power supply assembly. The module test set shall be removed from the case for power supply assembly adjustment or further troubleshooting checks.

e. Bandwidth Switch. Set the BANDWIDTH CONTROL switch to WIDE. Voltage at MODULE POWER connector J14, pin V to pin R, shall be 0.5 volt or less. Set the switch to NARROW. Voltage shall be +14.0 to +15.5 volts dc.

3-5. Resistance Measurements

a. Set the TESTER POWER and MODE CONTROL switches to OFF. Disconnect the CX-12205/U and CX-12206/U cables while conducting resistance measurements.

b. Check resistance values between pins of the panel connectors listed below. Refer to figure 3-2 for locations of pins on RANGE COMPUTER MODULE connectors A1 through A6 and TEST. Note that two rows of independent pins are contained in A1 through A6. One row is identified by letters and one by numbers. Make sure the test leads are connected to the correct pins. Do not short the pins together.

Check points	Resistor	Resistance
A1 pin 6 to GRD	2A1A1R1	470 ± 47 ohms
A3 pin V to GRD	2A1A1R2	11k ± 1k
TEST pin 19 to J14-U	2A1A1R4 (src clockwise)	140 ± 20 ohms
TEST pin 19 to J14-U	2A1R8+, 2A1A1R4 (src counterclockwise).	300 ± 40 ohms
TEST pin 3 to GRD	2A1R1	5.62k ± 300 ohms
TEST pin 4 to GRD	2A1R2	2.3k ± 230 ohms
TEST pin 5 to GRD	2A1R3	275 ± 100 ohms
TEST pin 18 to GRD	2A1R4	260 to 360 ohms
J14-N to GRD	2A1R5	110 to 135 ohms
J14-P to GRD	2A1R6	1.3k ± 130 ohms
J14-L to GRD	2A1R7	18.3 ± 2.0 ohms
J14-T to GRD	2A1R9 (agc clockwise)	0.0 to 5.0 ohms
J14-T to GRD	2A1R9 (agc counterclockwise)	130 ± 13 ohms
J14-N to J14-S (PULSE WIDTH switch at NARROW).	2A1R10	125 ± 13 ohms
J7-P to J7-B	2A1R11	2k ± 200 ohms
J7-T to J7-B	2A1R12	1.4k ± 140 ohms
J7-S to J7-B	2A1R13	80.6 ± 8.0 ohms
J7-F to GRD	2A1R14	63.4 ± 6.0 ohms
J7-D to GRD	2A1R15	7.15 ± 1.00 ohms
J7-A to GRD	2A1R16	63.4 ± 6.3 ohms
J7-E to GRD	2A1R17	694 ± 70 ohms
I-F amplifier module tip jacks	2A1R18	91 ± 5 ohms
Transmitter module tip jacks	2A1R19	91 ± 5 ohms
Receiver module tip jacks	2A1R20	73 ± 5 ohms

3-6. Continuity Tests

a. Conduct continuity tests with the module test set disconnected from the system test set as explained in paragraph 3–5*a*.

b. Check continuity according to the following chart:

From Connector	Pin	To Connector	Pin
TEST	2	J14	B
TEST	3	A1	1/A
TEST	3	A2	1/A
TEST	3	A4	1/A
TEST	4	A1	2/B
TEST	4	A2	2/B
TEST	4	A3	2/B
TEST	4	A4	2/B
TEST	4	J14	A
TEST	5	A4	3/C
TEST	6	A4	5
TEST	6	A3	E
TEST	7	A3	6
TEST	8	A3	14/R
TEST	10	J3	U
TEST	10	A1	17/U
TEST	10	A2	17/U
TEST	10	A3	17/U
TEST	10	A4	17/U
TEST	10	J6	5/E
TEST	10	J14	P
TEST	11	J14	L
TEST	12	A1	15/S
TEST	12	A2	15/S
TEST	12	A3	15/S
TEST	12	A4	15/S
TEST	13, 14	GRD	----
TEST	15	A2	3/C
TEST	16	A1	F
TEST	17	A4	V
TEST	18	A1	4/D
TEST	18	A2	4/D
TEST	18	A3	4/D
TEST	18	A4	4/D
TEST	18	J14	M
TEST	19	J3	a
TEST	19	A1	16/T
TEST	19	A2	16/T
TEST	19	A2	16/T
TEST	19	J7	16/T
TEST	19	J14	N
J3	C	A4	P
J3	D	GRD	
		A4	14/R
J3	T	GRD	
J3	V	GRD	
J3	W	GRD	
J3	b	A3	J
J3	c	A4	18
J7	A	−15V	
J7	B, C, V	GRD	
J7	D	−6.3V	
J7	E	−50V	
J7	F	+15V	
J7	L	400 CPS HI	
J7	N	120V DLY	
J7	P	120V	
J7	S	28V	
J7	T	80V	
J14	R	GRD	
J14	S	J14	R (PULSE-WIDTH CONTROL switch at NARROW).
J14	S	J14	R (PULSE-WIDTH CONTROL switch at WIDE, no continuity).
J14	T	AGC	
J14	U	SRC	
J14	V	J14	M (BAND-WIDTH CONTROL at NARROW).

3-7. Trouble Analysis

a. If the results of the tests in paragraph 3–4, 3–5, or 3–6 are not correct, the module test set panel assembly shall be removed from the case for further troubleshooting checks. Refer to section V for removal. Connect the module test set panel to the system test set according to paragraph 3–3.

b. Refer to the following troubleshooting chart for symptoms and corrective action.

Para no.	*Symptom*	*Probable trouble*	*Corrective action*
(para 3–4*a*)	115V 400 CPS lamp fails to light.	*a.* Fuse 2A1F1 blown	*a.* Check and replace fuse.
		b. Faulty cable connection.	*b.* Check cable and connector for broken leadwire or bent pin.
		c. No power output from system test set.	*c.* Check system test set power circuit and external power input.
(para 3–4*a*)	ELAPSED TIME meter not operating.	*a.* Faulty wiring	*a.* Check wiring to meter.
		b. Faulty meter unit	*b.* Check for burned out motor or faulty gear train. Replace meter.

Para no.	Symptom	Probable trouble	Corrective action
(para 3-4d)	No voltage	a. Faulty wiring	a. Use a multimeter to check voltages at the following test points (fig. 3-2) on terminal board 2A1TB1: A −50.00 ± 0.15 vdc A1 +120.0 ±13.5 vdc (delayed) A2 −6.3 ± 0.2 vdc A3 −15.0 ± 0.5 vdc A4 +80.0 ± 2.4 vdc
		b. No voltages in step a above.	b. Check MODULE TEST SELECT switch 2A1S1 and wiring to power supply module.
		c. One or more voltages not indicated, or out of limits.	c. Remove and replace power supply assembly. Send to depot for repair.
(para 3-5)	Resistance reading incorrect or open.	a. Faulty resistor	a. Check resistor. Replace if faulty.
		b. Faulty wiring	b. Check wiring and printed circuit paths. Replace or repair as required.
(para 3-6)	No continuity at one or more points.	a. Faulty wiring	a. Check and repair wiring.
		b. Faulty connector pins or terminals.	b. Check for bent or broken pins or faulty terminal connections. Repair or replace connector.
		c. Faulty printed circuit paths in interconnecting circuit card assembly 2A1A1.	c. Inspect and repair paths or replace card assembly 2A1A1.

Section III. ADJUSTMENTS AND ALIGNMENT

3-8. Power Supply Voltage Adjustment

The only adjustment or alignment performed on the module test set is readjustment of output voltages of power supply assembly 2A1A2. This may be done only with the module test set panel assembly removed from the case.

a. When voltage measurements of paragraph 3-4 are not within the tolerances listed, adjusting the power supply variable resistors may clear the trouble. If the voltage output is not present or varies by 2 percent or more, adjustment should not be attempted and the power supply unit should be removed for repair.

b. Remove the 10 oval-head screws and washers holding the panel ends to the case. Remove the 10 filister-head screws at the top and bottom edges of the panel. Remove the panel carefully, making sure that the shielding gaskets do not become damaged or lost.

c. Connect the CG-12205/U and CG-12206/U cables according to *figure* 3-l. Set the TESTER POWER switch to ON and MODE CONTROL switch to XCVR/MODULE. Allow 3 minutes warmup.

d. Connect the digital voltmeter to the system test set TEST jacks listed below. Read the voltages and adjust the variable resistors (see fig. 3-2 for locations) to the actual voltages listed in the table.

TEST jack	*Dc voltage*	*Adjust resistor*
18	+15 ± 0.05	R9
10	−50 ± 0.01	R22
19	−15 ± 0.05	R13
11	−6.3 ± 0.07	R18
4	+80 ± 0.1	R5

Section IV. Repair

3-9. General

Repair of the module test set at general support consists of removing and replacing the defective assemblies of the test set panel assembly and replacing the subassemblies of power supply assembly 2A1A2. Additional repairs consist of resoldering loose leads within the chassis assembly, replacing parts found defective during test procedures, and retropicalizing printed circuit boards after tests or repairs which require penetration of the original coating.

3-10. Solder Technique

Use standard shop practice during the soldering process (TB SIG 222). A pencil soldering iron should be used for all soldering on or to printed circuit board paths. Use a minimum amount of heat that assures a good weld. Remove solder from eyelets using the soldering iron and a solder pick. A stiff brush or solder sucker can be used to remove molten solder from surface printed circuit paths. Use only plastic rosin core solder meeting Federal Specification QQ–S–571, Sn60WRP2, type RMA, to resolder leads and parts to terminal points.

Section V. REMOVAL AND REPLACEMENT

3-11. General

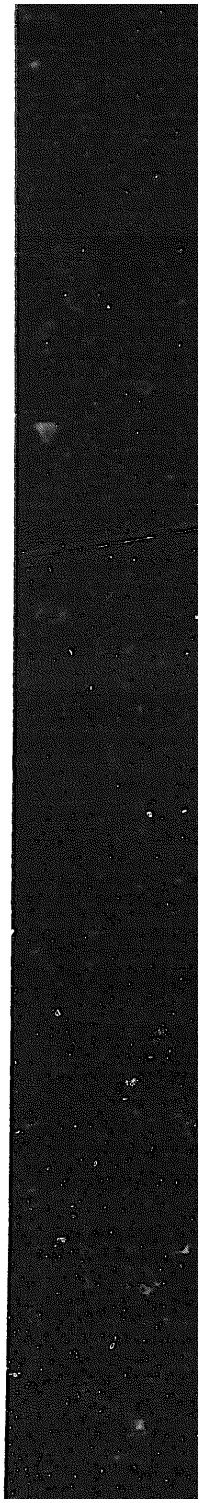
This section contains instructions for the removal of the module test set panel assembly from the model test set case to accomplish the required testing or repairs. Refer to figure 3–3 and the associated key for parts identification information. Use care in handling the panel assembly and cables to avoid damaging any of the components.

3-12. Removing Module Test Set Panel Assemble 2A1

Free the module test set panel assembly (79, fig. 3–3) by removing the 10 oval-head and ten filister-head screws around the edges of the panel Lift the panel assembly free of the module test set case (84) making sure that the gaskets do not become damaged or lost. Support the assembly in a manner that will prevent damage to the exposed components. Refer to section VI fo. removal information on each of the subassemblies.

3-13. Replacement

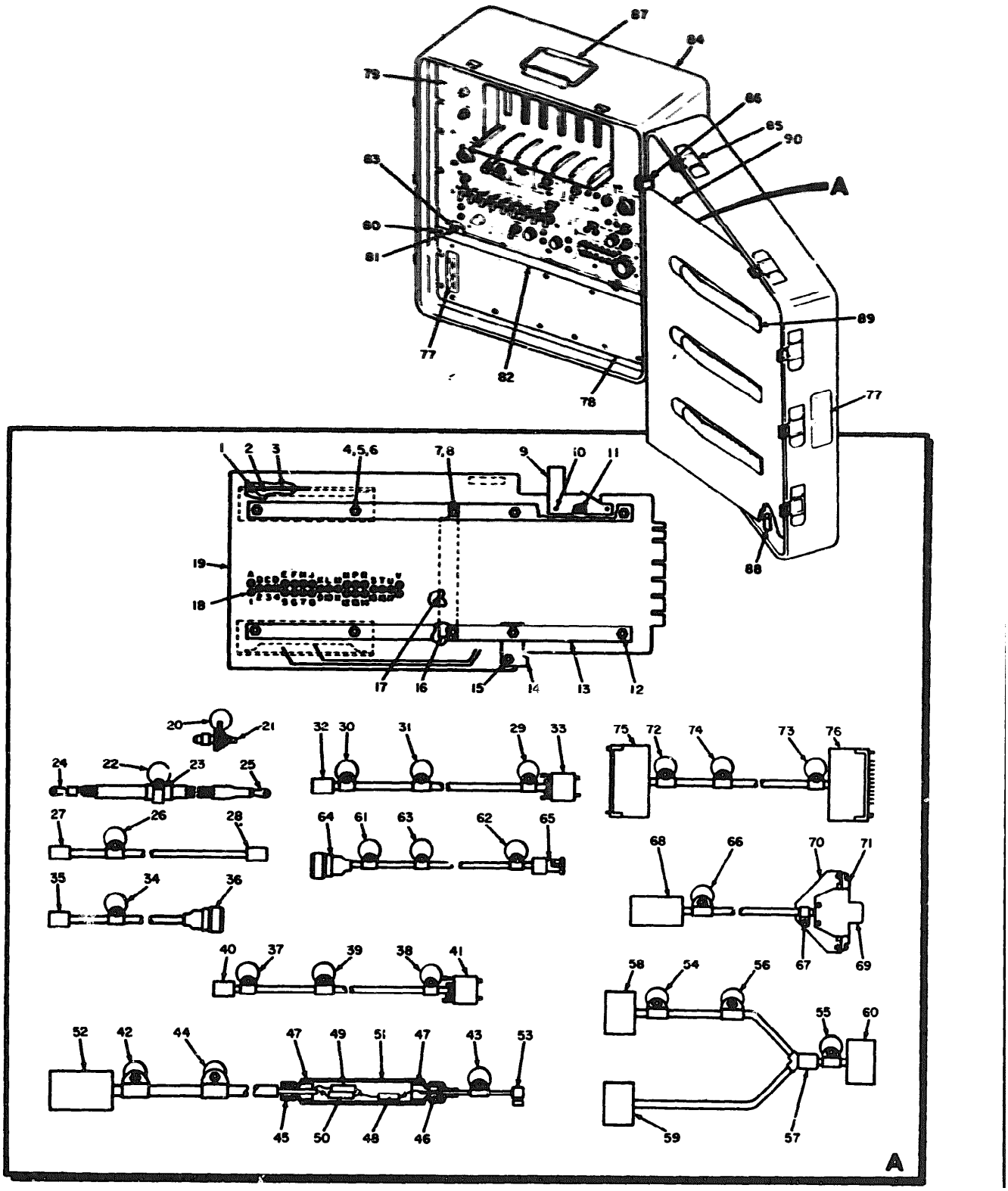
Replacement procedures are the reverse of removal procedures. Refer to section VI for replacement of subassemblies. Then replace the module test set panel assembly according to figure 3–3.



Card assy extender [items 1 through 19]
1 Tubular rivet
2 Printed circuit guide
3 Bracket
4 Machine screw
5 Spacer
6 Hexagon self-locking nut
7 Machine screw
8 Hexagon self-locking nut
9 Latch
10 Spring pin
11 Spring
12 Machine screw
13 Stiffener
14 Bottom guide
15 Machine screw
16 Spacer
17 Electrical receptacle connector, J1
18 Tip jack
19 Printed wiring board
Connector adapter assy [items 20 and 21]
20 Tag
* Nut
* Screw
* Loop clamp
21 Connector adapter
Electrical lead [items 22 through 25]
22 Identification tag
* Nut
* Screw
23 Clamp
24 Lug terminal
25 Lug terminal
Radio frequency cable assy [items 26 through 28] (2)
26 Identification tag
* Nut
* Screw
* Clamp
27 Connector, P1
28 Connector, P2
Electrical special purpose cable assy [items 29 through 33]
29 Identification tag
* Nut
* Screw
* Clamp
30 Identification tag
* Nut
* Screw
* Clamp
31 Identification tag
* Nut
* Screw
* Clamp
32 Connector, P1
33 Connector, P2
Radio frequency cable assy [items 34 through 36]
34 Identification tag
* Nut
* Screw
* Clamp
35 Connector, P1
36 Connector, P2
Electrical special purpose cable assy [items 37 through 41]
37 Identification tag
* Nut
* Screw
* Clamp
38 Identification tag
* Nut
* Screw
* Clamp
39 Identification tag
Nut
* Screw
* Clamp
40 Connector, P1
41 Connector, P2
Radio frequency cable assy [items 42 through 53]
42 Identification tag
* Nut
* Screw
* Clamp
43 Identification tag
* Nut
* Screw
* Clamp
44 Identification tag
* Nut
* Screw
* Clamp
45 Ferrule
46 Ferrule
47 Fitting (2)
48 Resistor, R2
49 Resistor, R3
50 Resistor, R1
51 Tube
52 Connector, P1
53 Connector, P2
Branched electrical special purpose cable assy [items 54 through 60]
54 Identification tag
* Nut
* Screw
* Clamp
55 Identification tag
* Nut
* Screw
* Clamp
56 Identification tag
* Nut
* Screw
* Clamp
57 Transition
58 Connector, P1
59 Connector, J1
60 Connector, P2
Radio frequency cable assy [items 61 through 65]
61 Identification tag
* Nut
* Screw
* Clamp
62 Identification tag
* Nut
* Screw
* Clamp
63 Identification tag
* Nut
* Screw
* Clamp
64 Connector, P1
65 Connector, P2
Electrical special purpose cable assy [items 66 through 71]
66 Identification tag
* Nut
* Screw
* Clamp
67 Clamp
* Nut
* Screw
68 Connector, P1
69 Connector key
* Self-locking cap nut (2)
* Pan head screw (2)
70 Bracket
* Nut (2)
* Screw (2)
71 Connector, P2
Electrical special purpose cable assy [items 72 through 77]
72 Identification tag
* Nut
* Screw
* Clamp
73 Identification tag
* Nut
* Screw
* Clamp
74 Identification tag
* Nut
* Screw
* Clamp
75 Connector, J1
76 Connector, P1
77 Identification plate (2)
78 Blank panel
* Pan head screw (10)
* Pan head screw (5)
79 Module test set panel assy, 2A1
* Pan head screw (5)
* Pan head screw (5)
* Oval head screw (10)
* Finishing washer (10)
80 Pan head screw (2)
81 Clinch self-locking nut (2)
82 Spacer
83 Spacer
84 Test set case
85 Spring latch (7)
86 Butt hinge (3)
87 Handle
88 Valve
89 Clip (3)
90 Lid

( ) Indicates quantity other than one.
* Indicates attaching part for immediately preceding unasterisked item.

Figure 3-3-Continued.



EL6625-1795-45TM-8

Figure 3-3. *Test Set, Radar Altimeter Module AN/APM-322-exploded view.*

Section VI. ASSEMBLY AND DISASSEMBLY

3-14. General

Assembly and disassembly consists of removing assemblies and subassemblies from the module test set, replacing subassemblies no. 1, 2, and 3 (2A1A2TB1, 2A1A2TB2, and 2A1A2TB3) of power supply assembly 2A1A2, and repairing damaged or defective test set cables of the module test set.

a. Use standard shop practices to remove and replace parts such as knobs, lamps, and attaching parts on the module test set panel assembly. Refer to the exposed view, figure 3–4, for part removal and replacement.

NOTE

For complete reference designations, add 2A1 to the abbreviated designations shown in figure 3–4.

1 Electrical receptacle connector, P1
2 Electrical receptacle connector, P2
3 Electrical receptacle connector, J1
4 Electrical receptacle connector, J2
Circuit card assy, A1 [items 8 through 24]
5* Machine screw (14)
6* Hexagon self-locking nut (14)
7* Spacer (2)
8 Composition fixed resistor, A1R1
9 Composition fixed resistor, A1R3
10 Electrical receptacle connector, A1J4
11 Electrical receptacle connector, A1J5
12 Electrical receptacle connector, A1J6
13 Electrical receptacle connector, A1J7
14 Electrical receptacle connector, A1J8
15 Electrical receptacle connector, A1J9
16 Diode semiconductor device, A1CR1
17 Diode semiconductor device, A1CR2
18 Composition fixed resistor, A1R4
19 Composition fixed resistor, A1R2
20 Electrical receptacle connector, A1J2
21 Electrical receptacle connector, A1J3
22 Washer (2)
23 Electrical connector set, A1J1
24 Printed wiring board
25 Electrical equipment chassis
26* Machine screw (12)
27* Hexagon self-locking nut (12)
28 Latch plate
29 Electrical receptacle connector, P3
30 Electrical receptacle connector, P4
31 Electrical receptacle connector, P5
32 Intermediate frequency amplifier assy, A3 [fig. 4–1]
33* Machine screw (4)
34* Lug terminal
35 Angle bracket
36* Machine screw (2)
37* Hexagon self-locking nut (2)
38 Angle bracket
39* Machine screw (2)
40* Hexagon self-locking nut (2)
41 Wire wound fixed resistor, R11
* Machine screw (2)
* Hexagon self-locking nut (2)
42 Wire wound fixed resistor, R13
* Machine screw (2)
* Hexagon self-locking nut (2)
43 Wire wound fixed resistor, R12
* Machine screw (2)
* Hexagon self-locking nut (2)
44 Wire wound fixed resistor, R14
* Machine screw (2)
* Hexagon self-locking nut (2)
45 Wire wound fixed resistor, R16
* Machine screw (2)
* Hexagon self-locking nut (2)
46 Wire wound fixed resistor, R15
* Machine screw (2)
* Hexagon self-locking nut (2)
47 Wire wound fixed resistor, R17
* Machine screw (2)
* Hexagon self-locking nut (2)
48 Power supply assy, A2 [fig. 3–9]
49* Machine screw (2)
50 Terminal board, TB1
* Machine screw (2)
* Spacer (4)
* Hexagon self-locking nut (4)
51 Wire wound fixed resistor, R1
* Machine screw (2)
* Hexagon self-locking nut (2)
52 Wire wound fixed resistor, R7
* Machine screw (2)
* Hexagon self-locking nut (2)
53 Wire wound fixed resistor, R6
* Machine screw (2)
* Hexagon self-locking nut (2)
54 Wire wound fixed resistor, R5
* Machine screw (2)
* Hexagon self-locking nut (2)
55 Wire wound fixed resistor, R4
* Machine screw (2)
* Hexagon self-locking nut (2)
56 Wire wound fixed resistor, R3
* Machine screw (2)
* Hexagon self-locking nut (2)
57 Wire wound fixed resistor, R2
* Machine screw (2)
* Hexagon self-locking nut (2)
58 Electrical receptacle connector, J6
* Machine screw (2)
* Hexagon self-locking nut (2)
59 Grommet
60 Electrical equipment chassis
61* Machine screw (10)
62 Tip jack (23)
63 Tip jack (10)
64 Electrical receptacle connector, J3
* Machine screw (4)
* Hexagon self-locking nut (4)
65 Lug terminal (2)
66 Lamp, DS1
67 Indicator light assy
68 Cartridge fuse, F1
69 Cartridge fuse [spare]
70 Fuseholder (2)
71 Meter, M1
* Machine screw (2)
* Hexagon self-locking nut (2)
72 Switch, S1
73 Switch, S3
74 Electrical receptacle connector, J12
75 Lug terminal
76 Composition fixed resistor, R19
77 Electrical receptacle connector J14
* Machine screw (4)
* Hexagon self-locking nut (4)
78 Solder cup adapter (AR)
79 Lug terminal
80 Variable step attenuator, AT1 [includes J4 and J5]
* Machine screw (4)
81 Switch, S2
82 Electrical receptacle connector, J11
83 Lug terminal
84 Composition fixed resistor, R18
85 Composition fixed resistor, R20
86 Knob (3)
87 Variable resistor, R8
88 Variable resistor, R9
89 Variable resistor, R10
90 Coaxial bulkhead jack, J13
91 Machine screw (4)
92 Transformer, T1
93* Machine screw (4)
94 Angle bracket
95 Knob
96 Rotary switch, S4
97 Electrical receptacle connector, J7
* Machine screw (4)
* Hexagon self-locking nut (4)
98 Wing nut
99 Flat washer
100 Hexagon plain nut
101 Lockwasher
102 Machine screw
103 Machined panel

( ) Indicates quantity other than one.
* Indicates attaching part for immediately preceding unasterisked item.

Figure 3-4-Continued.

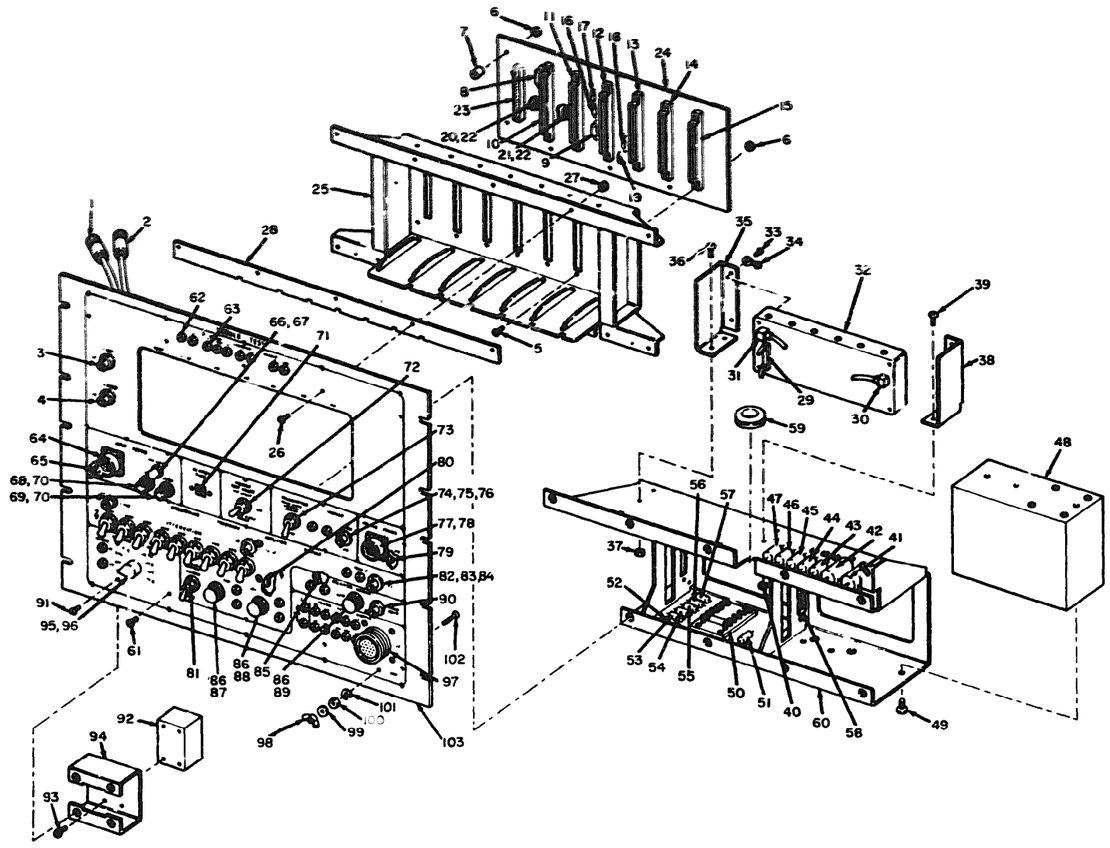


Figure 3-4. Module teat set panel assembly-exploded view.

b. To remove power supply assembly 2A1A2 (48, fig. 3–4) from the electrical equipment chassis (60), take out six screws (49) and slide the power supply assembly out the end of the chassis.

c. To remove i-f amplifier assembly 2A1A3 (32) from the electrical equipment chassis (60), remove attaching parts, items 33 through 40, and disconnect electrical connectors (29, 30, 31).

d. Refer to paragraph 3–16 for assembly and disassembly of the power supply assembly 2A1A2.

e. When replacing or rewiring connectors, use insulating tubing over the leadwires and terminals in the same manner as in the original wiring.

3-15. Testing and Replacing I-F Amplifier Assembly 2A1A3

I-F amplifier assembly 2A1A3, when removed from the module test set, shall be tested in the same manner as the i-f amplifier module of the receiver-transmitter to determine need for replacement. If the module test set being repaired is otherwise operational, use it to test i-f amplifier assembly 2A1A3. If the module test set is not operational, use another module test set to perform the tests.

a. Using the basic test setup of figure 3–1, connect the i-f amplifier assembly for test as shown in figure 3–5. Use Lead, Electrical CX–12202/APM–322 to ground the i-f amplifier assembly

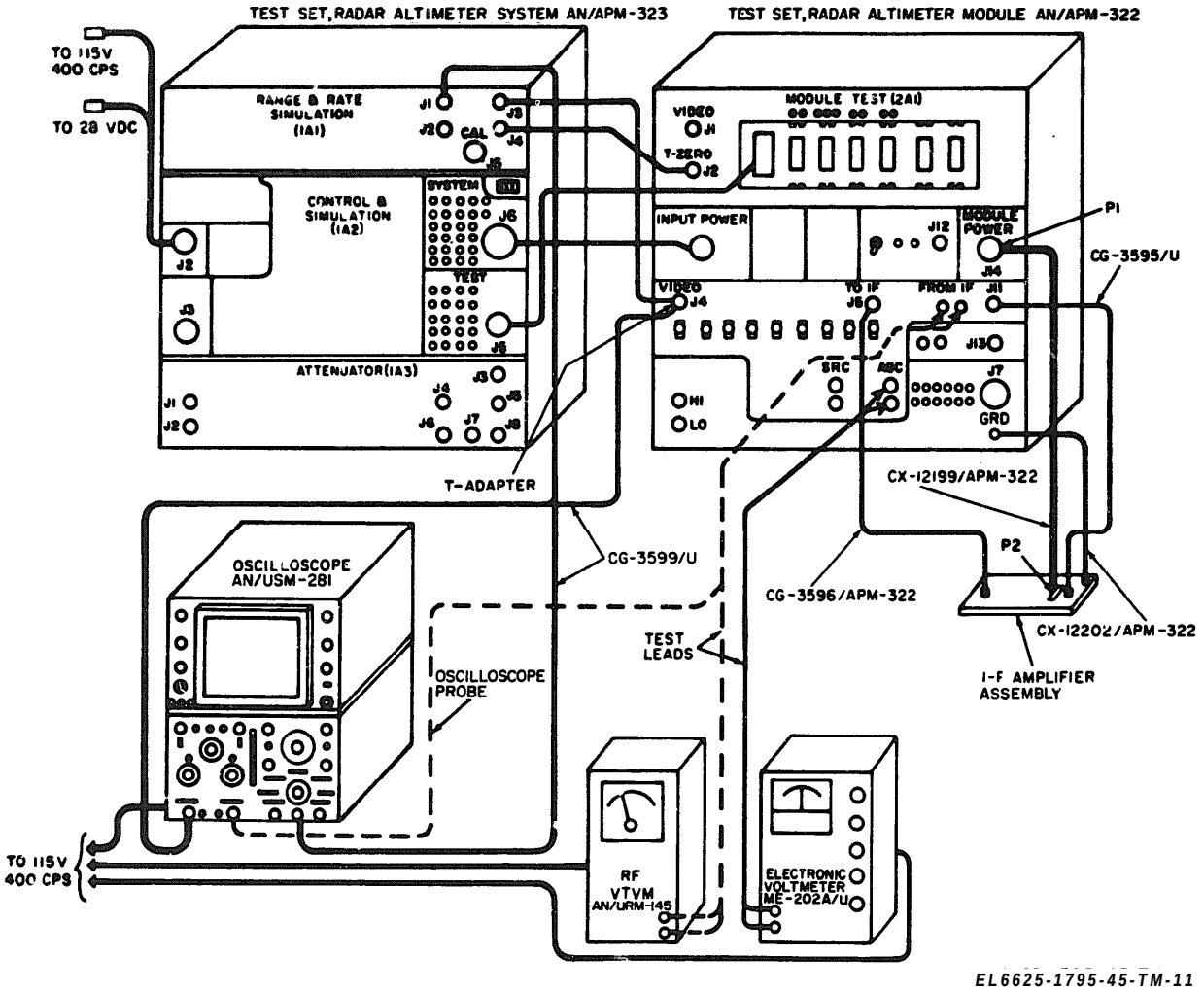


Figure 3-5. I-F amplifier assembly test setup.

can. Connect one end of the lead to the module test set GRD terminal in POWER SUPPLY MODULE section. Secure the other end of the lead to the i-f amplifier assembly can using one of the mounting screws. Failure to do so may cause the i-f amplifier assembly to go into oscillation.

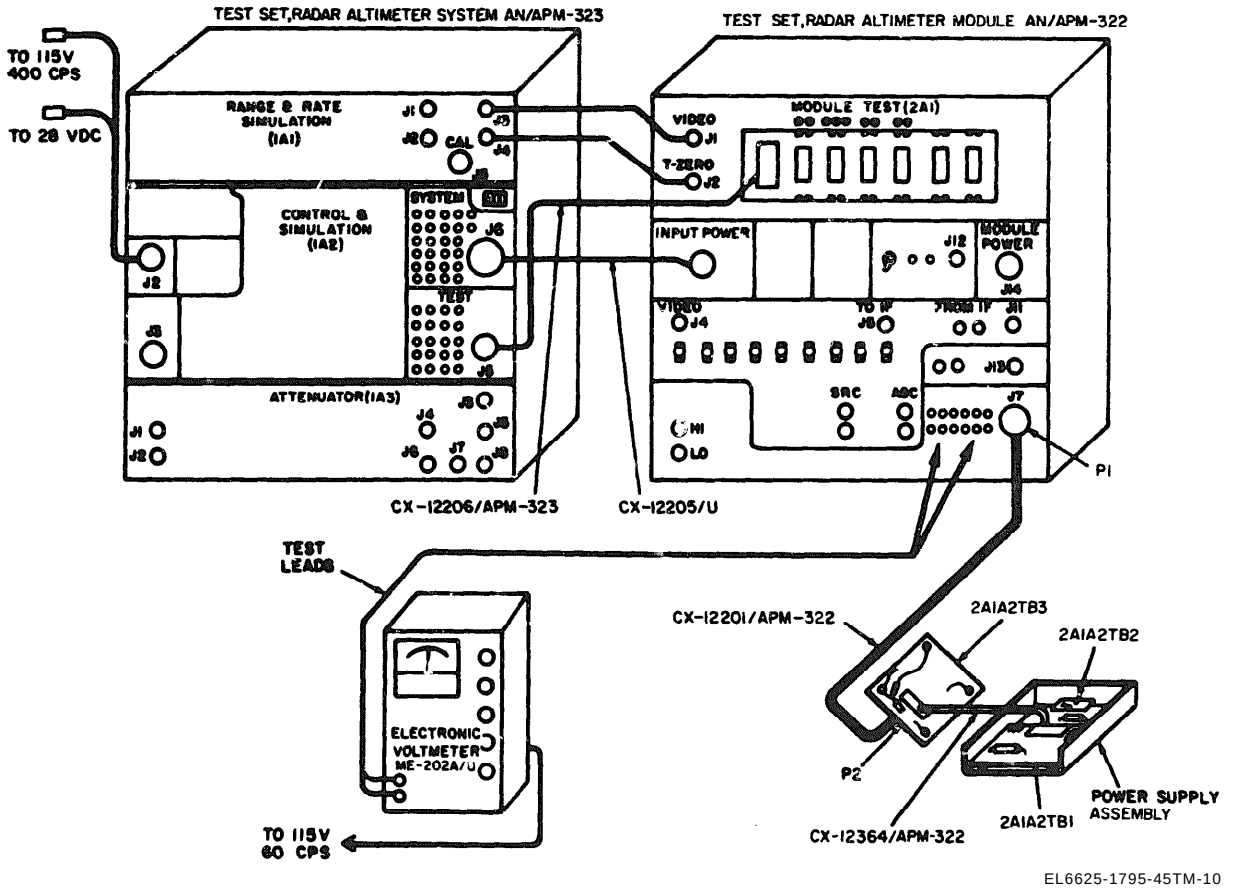
***b.* Connect the oscilloscope channel A to module test set VIDEO connector J4, using a T-adapter and a CG–3599/U cable as shown in figure 3–5. Connect system test set VIDEO TEST jack J3 to the T-adapter. Connect the oscilloscope channel B input to the module test set FROM IF jacks (in place of the vtvm), using a high-impedance probe.**

c. Set the system test set MODE CONTROL switch to XCVR/MODULE. Set the VIDEO POS/NEG switch to POS and BANDWIDTH CONTROL switch to WIDE. Set the module test set MODULE TEST SELECT switch to TEST MODULE. Energize the oscilloscope, the vtvm, and the differential voltmeter. Allow the equipment 5 minutes to stabilize. Adjust the system test set VIDEO AMPLITUDE control for 1.0 ± 0.1 volt peak pulse on the oscilloscope channel A. This shall be the standard test input signal.

d. Check i-f amplifier assembly gain by applying the standard test input of step *c* above and setting in enough attenuation to reduce the output pulse level on channel B to the same level as the input pulse on channel A. The attenuation value is used as the gain figure. This shall be at least 83 db.

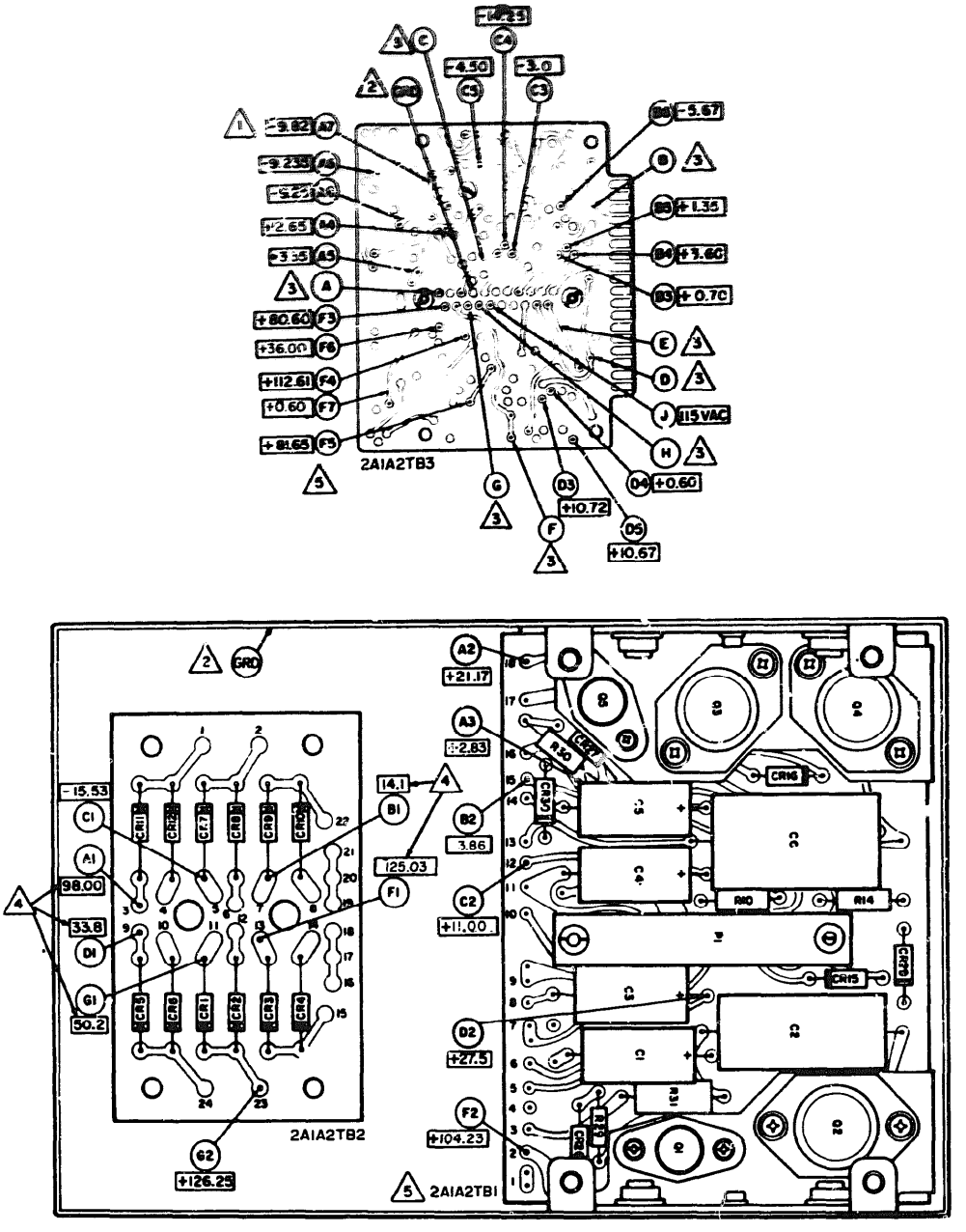
e. Repeat steps *d* through *h* with VIDEO POS/NEG switch set to NEG.

f. Disconnect the oscilloscope and connect the vtvm to the FROM IF jacks. With src voltage at 0.0 volts and age voltage at -1.0 volt, set in 100-db total attenuation. then read the noise level. This shall not exceed 0.8 volt rms. Disconnect the vtvm and connect the oscilloscope channel B to the FROM IF jacks.



EL6625-1795-45TM-10

Figure 3-6. Power supply assembly test setup.



NOTES

1. BOXED NUMBERS ARE VOLTS DC UNLESS OTHERWISE STATED. ALL VOLTAGES ARE REFERENCED TO GROUND AND ARE ± 10% UNLESS OTHERWISE STATED.
2. GROUND REFERENCE (PIN S OF 2AIA2TB3JI OR CHASSIS).
3. VOLTAGES AT THESE TEST POINTS ARE AS FOLLOWS: (A) -50.00 ± O.O1VDC. (B) 6.3 ± 0.07 VDC, (C) 15.00 ± O.O5 VDC. (D) 15.00 ± 0.05 VDC. (E) +28 ± 4 VDC. (F) +80.00 ±O.IO VDC, AND (G) AND (H) +I20 ±6 VDC.
4. VOLTAGES AT THESE TEST POINTS GIVEN IN VOLTS AC RMS.
5. 2AIA2TB3 IS NOT DRAWN TO TN: SAME SCALE AS 2AIA2TBI. 2AIA2TB3 MOUNTS ABOVE 2AIA2TBI IN THE ASSEMBLY AND IS THE SAME SIZE.

EL6625-1795-45-TM-12

Figure 3-7. Power supply assembly-test points.

g. Check minimum detectable signal (sensitivity) as follows:

(1) Set all ATTENUATION switches to IN and the BANDWIDTH CONTROL switch to NARROW.

(2) Adjust the AGC control until the peak noise level on the oscilloscope is −0.50 ± 0.05 volt peak (transients may be larger than 0.5 volt).

(3) Set the ATTENUATION switches as required until the video pulse on channel B can just be detected above the noise level. Attenuation shall be at least 96 db.

h. If the i-f amplifier assembly fails to meet the test requirements, it shall be sent to depot maintenance for repair. Install a replacement i-f amplifier assembly in the module test set.

3-16. Testing and Replacing Parts of Power Supply Assembly 2A1A2

a. General. Perform the tests in the following paragraphs to localize trouble. Figure 3–6 is a diagram of the test setup for power supply assembly troubleshooting checks. Refer to figure 3–7 for a diagram of the test points and test readings. Power supply subassembly no. 3 2A1A2TB3 shall be removed for this test.

b. Inspection. Visually inspect the power supply assembly for burned parts, open leads, or broken parts before energizing. Repair these parts or replace them as required.

WARNING

Do not place subassembly no. 3 on a metal or conductive surface. Insulate it from all potential grounds before applying power. Do not short adjacent pins or connections together during the bench tests. Severe shock to operator or permanent damage to the power supply assembly may result if these warnings are not observed.

c. Test Connections. Connect subassembly no. 3 2A1A2TB3 to subassembly no. 1 2A1A2TB1, using the Cable Assembly CX–12364/APM–322. Connect subassembly no. 3 2A1A2TB3 to module test set POWER SUPPLY MODULE connector J7, using the Cable Assembly CX–12201/APM–322. Make sure that the subassembly will not contact any metal surfaces and will remain in position.

d. Test Procedure. Troubleshoot the power supply assembly as follows:

(1) Set the system test set MODE CONTROL switch to XCVR/MODULE.

(2) Set the module test set MODULE TEST SELECT switch to POWER SUPPLY MODULE. Set the VOLTAGE SELECT control to 5. Allow about 5 minutes for warmup.

(3) Refer to figure 3–7 for power supply test point locations. Refer to the schematic diagram, figure FO–4, for the circuits checked at the test points.

(4) Use Digital Voltmeter AN/USM–64 to read the voltages at each test point. If voltages are incorrect, refer to the following trouble analysis chart for corrective action.

Item no.	*Symptom*	*Probable trouble*	*Corrective action*
1	Any voltage at test ponits A1 through G1 absent or low.	Faulty transformer 2A1A2T1	Return power supply assembly to depot.
2	Any voltage at test points A2 through G2 absent or low.	Faulty subassembly no. 2 2A1A2-TB2 (rectifier).	Check continuity of diodes. Replace subassembly no. 2 2A1A2TB2.
		Faulty capacitors 2A1A2TB1C1 through 2A1A2TB1C6.	Check for short-circuited capacitors. Replace subassembly no. 1 2A1A2TB1.
3	Voltage at test point A3 incorrect	Faulty diode or transistor	Replace subassembly no. 1 2A1A2-TB1.
4	Any voltage at test points A4 through A8, B3 through B6, C3 through C5, D3 through D5, or F3 through F5 incorrect.	Faulty semiconductor or resistor	Replace subassembly no. 1 2A1A2-TB1.

e. Replacing Power Supply Subassemblies. When a specific trouble is located, replace faulty subassembly 2A1A2TB1, 2A1A2TB2, or 2A1A2-TB3. Refer to figure 3–8 for removal of the subassemblies. Refer to the following leadwire list for subassembly terminal connections. Terminal locations are shown in figure 3–7.

Leadwire color	Leadwire size	From Unit	From Terminal	To Unit	To Terminal	Remarks
White-black	NA	T1		TB1	4	Wire part of transformer T1.
Purple	NA	T1		TB1	5	Wire part of transformer T1.
Yellow	NA	T1		TB1	8	Wire part of transformer T1.
White-blue	NA	T1		TB1	11	Wire part of transformer T1.
White-black-brown	NA	T1		TB1	14	Wire part of transformer T1.
White-orange	NA	T1		TB1	13	Wire part of transformer T1.
Brown	26 AWG	TB1	7	K1	2	
Red	26 AWG	TB1	9	K1	3	
White-green	26 AWG	TB1	10	K1	5	
White	26 AWG	TB1	1	K1	7	
Brown	NA	L1		TB1	1	Wire part of reactor L1.
Brown	NA	L2		TB2	2	Wire part of reactor L2.
Brown	NA	L3		TB1	6	Wire part of reactor L3.
Brown	NA	L4		TB1	12	Wire part of reactor L4.
Brown	NA	L5		TB1	15	Wire part of reactor L5.
Brown	NA	L6		TB1	18	Wire part of reatcor L6.
Brown	26 AWG	TB1	4	TB2	16	
Red	26 AWG	TB2	21	K1	3	
Red	NA	L1		TB2	23	Wire part of reactor L1.
Red	NA	L2		TB2	15	Wire part of reactor L2.
Red	NA	L3		TB2	24	Wire part of reactor L3.
Red	NA	L4		TB2	2	Wire part of reactor L4.
Red	NA	L5		TB2	22	Wire part of reactor L5.
Red	NA	L6		TB2	1	Wire part of reactor L6.
White-yellow	NA	T1		TB2	4	Wire part of transformer T1.
White-red	NA	T1		TB2	3	Wire part of transformer T1.
White-purple	NA	T1		TB2	6	Wire part of transformer T1.
White-green	NA	T1		TB2	5	Wire part of transformer T1.
White-black-red	NA	T1		TB2	8	Wire part of transformer T1.
White-grey	NA	T1		TB2	7	Wire part of transformer T1.
Green	NA	T1		TB2	9	Wire part of transformer T1.
Orange	NA	T1		TB2	10	Wire part of transformer T1.
White-brown	NA	T1		TB2	11	Wire part of transformer T1.
White	NA	T1		TB2	12	Wire part of transformer T1.
Grey	NA	T1		TB2	13	Wire part of transformer T1.
Blue	NA	T1		TB2	14	Wire part of transformer T1.
Brown (2)	NA	T1		TB2	17, 18	Wires part of transformer T1, may be attached in any order.
Red (2)	NA	T1		TB2	19, 20	Wires part of transformer T1, may be attached in any order.
	22 AWG	TB1	3	TB1	17	Solid bare leadwire per QQ-W-343, type S.
	22 AWG	TB1	7	TB1	16	Solid bare leadwire per QQ-W-343, type S.
	22 AWG	TB1	19	E1		Solid bare leadwire per QQ-W-343, type S.

NOTES

1. All leadwires are teflon covered per MIL-W-16878, type E, unless otherwise specified.
2. For complete reference designations, add 2A1A2 to the abbreviated designations listed.

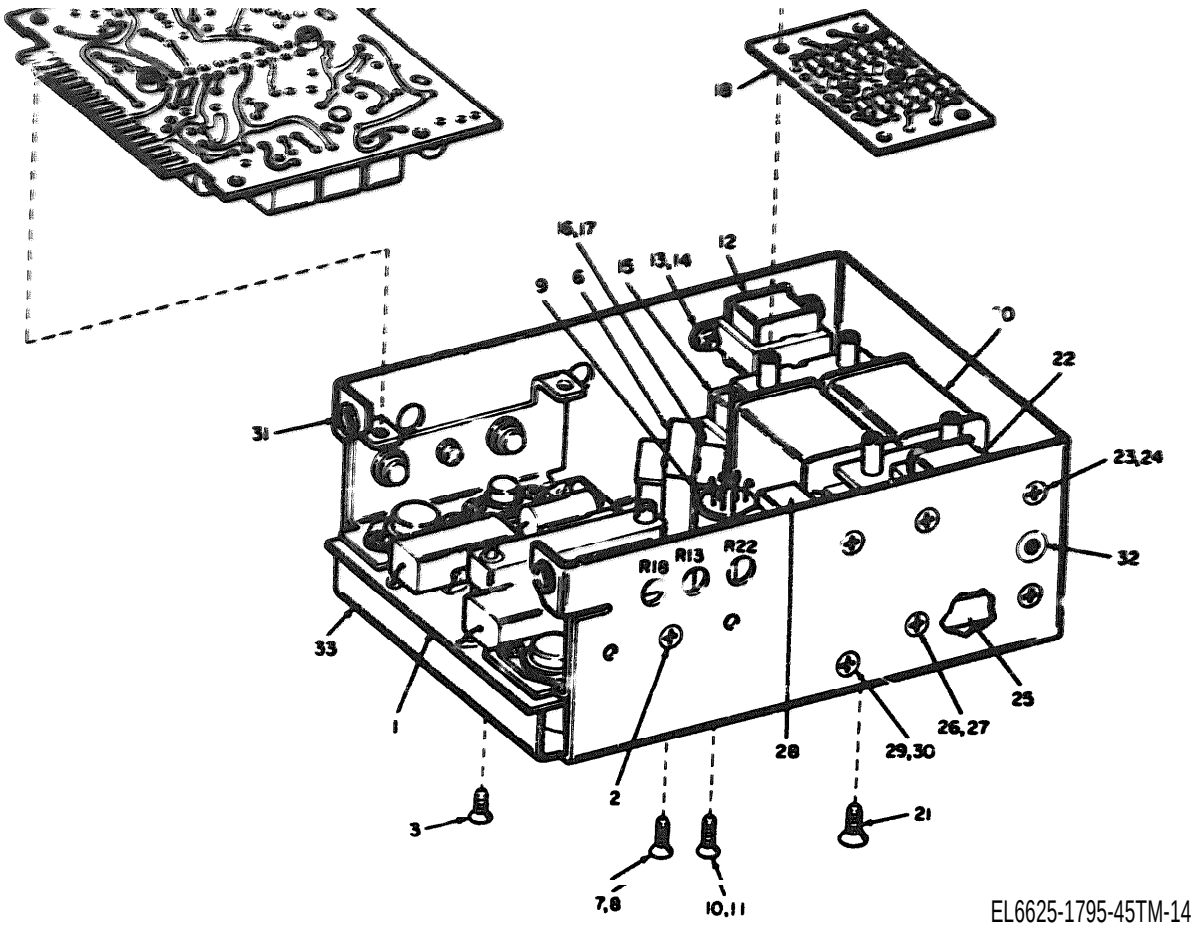
f. Retropicatization. After testing the power supply subassemblies, the original coating shall be restored wherever penetration was made for the test connection. Use the following procedure.

WARNING

Use cleaning agents in a well-ventilated area. Do not inhale the vapors or allow agent to contact the skin. Do not use near an open flame.

(1) Clean the printed circuit board area with isopropyl alcohol (para 3-2c). Allow the area to air dry.

(2) Varnish the area using the epoxy varnish (para 3-2c) and an artist's brush. Use masking tape to protect connector contacts or other areas which are not to be varnished. Apply a thin even coat and allow the varnish to air dry for 24 hours or oven cure the board at 180° F. for 8 hours.



NOTE

For complete reference designations, add 2A1A2 to abbreviated designations shown in figure 3-8.

1 Power supply subassy no. 1, TB1 [fig. 4–4]
2* Machine screw (2)
3* Machine screw (2)
4 Power supply subassy no. 3, TB3 [fig. 4–6]
5* Machine screw (4)
6 Reactor, L2
7* Machine screw (2)
8* Self-locking nut (2)
9 Relay, K1
10* Machine screw (2)
11* Self-locking nut (2)
12 Reactor, L1
13* Machine screw (2)
14* Self-locking nut (2)
15 Reactor, L3
16* Machine screw (2)
17* Self-locking nut (2)
18 Power supply subassy no. 2, TB2 [fig. 4–5]
19* Machine screw (4)
20 Power transformer, T1
21* Machine screw (4)
22 Reactor, L4
23* Machine screw (2)
24* Self-locking nut (2)
25 Reactor, L6
26* Machine screw (2)
27* Self-locking nut (2)
28 Reactor, L5
29* Machine screw (2)
30* Self-locking nut (2) Chassis assy [items 31 through 33]
31 Eyelet (2)
32 Self-locking clinch nut (4)
33 Chassis

( ) Indicates quantity other than one.
* Indicates attaching part for immediately preceding unasterisked item.

Figure 3-8. Power supply assembly-exploded view.

(3) Check the area after curing to make sure that the area is completely coated with the varnish. If it is not, apply a second thin coat to the area and repeat the curing procedure.

g. Readjusting Power Supply Voltages. After replacing a power supply subassembly, check the power supply output voltages and readjust the voltages as follows.

(1) Connect the power supply assembly to module test set connector J7. Set the system test set MODE CONTROL switch to XCVR/MODULE.

(2) Set the module test set MODULE TEST SELECT switch to POWER SUPPLY MODULE. Set the VOLTAGE SELECT control to 5. Allow about 5 minutes for warmup.

(3) Use Digital Voltmeter AN/GSM-64 to read voltages at the POWER SUPPLY MODULE jacks listed in the chart below. Observe the proper polarities as shown.

Tip jack	*Signal volts*	*Adjust resistor*
−50V	−50.00 ± 0.01 vdc	R22.
−6.3V	−6.30 ± 0.07 vdc	R18.
80V	+80.0 ± 0.1 vdc	R5.
15V	+15.00 ± 0.05 vdc	R9.
−15V	−15.00 ± 0.05 vdc	R13.
28V	+28 ± 4 vdc	None.
120V	+120 ± 6 vdc	None.
120V DLY	+120 ± 6 vdc, 2.5 ± 0.5 minutes after power applied.	None.

(4) If any voltage is not within limits, adjust the corresponding variable resistor listed in the above chart. Refer to figure 3-9 for locations of the variable resistors.

(5) After adjusting, repeat the test readings and readjust as necessary until all adjustable voltages are within limits.

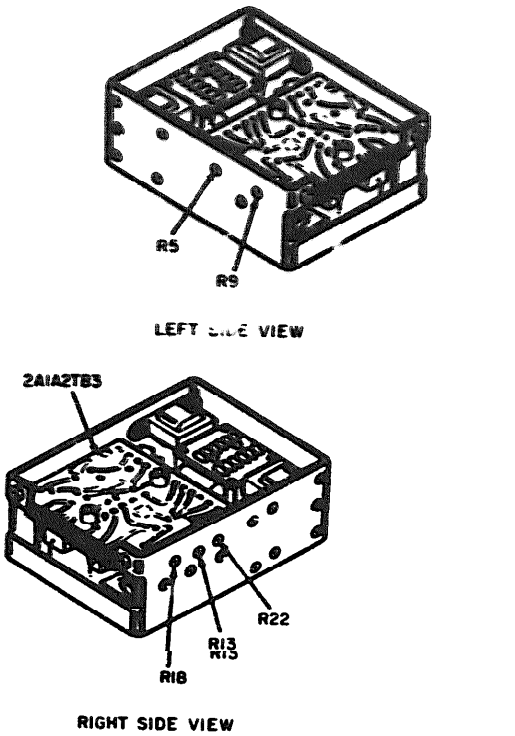


Figure 3-9. *Power supply assembly-adjustments.*

Section VII. TESTING PROCEDURES

3-17. General

a. The testing procedures in this section are for use by electronic maintenance shops and service organizations responsible for general support maintenance of electronic equipment to determine the acceptability of repaired equipment. These procedures set forth specific requirements that repaired equipment shall meet before it is returned to the using organization.

b. Comply with the instructions preceding each chart before proceeding to the chart. Perform each step *in* sequence. Do not vary the sequence. Perform each specified test procedure and verify it against its minimum performance standard.

3-18. Special Requirements

There are no special test requirements for Test Set, Radar Altimeter Module AN/APM-322. All alignments and adjustments are performed during repair and troubleshooting procedures. No other calibration adjustments are provided in the module test set. Tests of step attenuator 2A1AT1 require depot or calibration facility test equipment and cannot be performed at genera! support maintenance.

3-19. Physical Test and Inspection

a. ***General.*** Inspect the module test set case, panel, and cables according to the following chart. When any fault is observed, return the unit for repair. If the unit passes inspection, proceed to the functional tests.

b. Procedure.

Step no.	Item	Inspect for	Corrective action
1	Test set case	a. Dents, cracks, or scratches	a. Repair dents and weld cracks. Clean surfaces with trichloroethane. Cover scratches with gray enamel (TB 746–10).
		b. Bent or twisted hinges, fasteners, or supports.	b. Straighten or replace.
2	Panel	a. Loose switches or knobs	a. Tighten nuts or setscrews.
		b. Free movement of variable controls and positive switch action.	b. Return unit for parts replacement.
		c. Bent or broken connector pins or damaged shell.	c. Return unit for parts replacement.
		d. Chipped or scratched finish	d. Repair with lusterless black enamel.
		e. Damaged or obliterated lettering	e. Repair with fine-pointed brush and white enamel.
		f. Deposits of dirt, grease, or corrosion	f. Clean panel and components with trichloroethane.
3	Cables	a. Damaged insulation, bent or broken contact pins, damaged connector shells, loose or missing clamps.	a. Return cable for repair.
		b. All cables present	b. Obtain any missing cables. Coil cables and stow in lid of case.

3-20. Functional Tests

a. Test Equipment and Materials Required. Functional tests are made using the test equipment listed in paragraph 3–2*a*.

Location
System test set (control-simulation panel)
Module test set

b. Test Connections and Conditions. Connect the module test set and system test set as shown in figure 3–1. Set the controls as follows.

Control	Initial position
MODE CONTROL	XCVR/MODULE
TESTER POWER	ON
MODULE TEST SELECT	TEST MODULE
VOLTAGE SELECT	5

c. Procedure. Perform the following tests according to the paragraph referenced in the chart. If minimum standards are not met, return the unit for further troubleshooting and repair.

Step no.	Test	Reference paragraph	Minimum standard
1	AGC and src voltage	3–4*a*	Vary smoothly, −0.05 vdc to −14.5 vdc (agc), 0.04 vdc to −10 vdc (src).
2	Power supply inputs	3–4*c*	Maximum error ±4 vac.
3	Power supply outputs	3–4*d*	Within limits of paragraph 3–4*d* (2).
4	BANDWIDTH CONTROL switch	3–4*e*	Within limits of paragraph 3–4*e*.
5	Resistance checks	3–5	Within tolerances of paragraph 3–5*b*.
6	Continuity checks	3–6	No discontinuity.
7	PULSEWIDTH CONTROL switch	3–6	No continuity 2A1J14S to R, at WIDE. Continuity 2A1J14S to R, at NARROW.

3-21. Cable Assembly and Card Assembly Extender

a. Test Equipment and Materials Required. Use Multimeter AN/USM–223.

b. Test Connections and Conditions. Use test leads or probes that will make contact with pins in the connector inserts.

c. Procedure. Refer to figure 3–10 for card assembly extender and cable schematic diagrams. Check continuity between cable connector pins according to the following steps. When no continuity is indicated, repair or replace the affected cable.

(1) *Cable Assembly CX–12201/APM–322.*

From	To
P1–L	P2–10/L
P1–K	P2–9/K
P1–J	P2–8/J
P1–N	P2–12/N

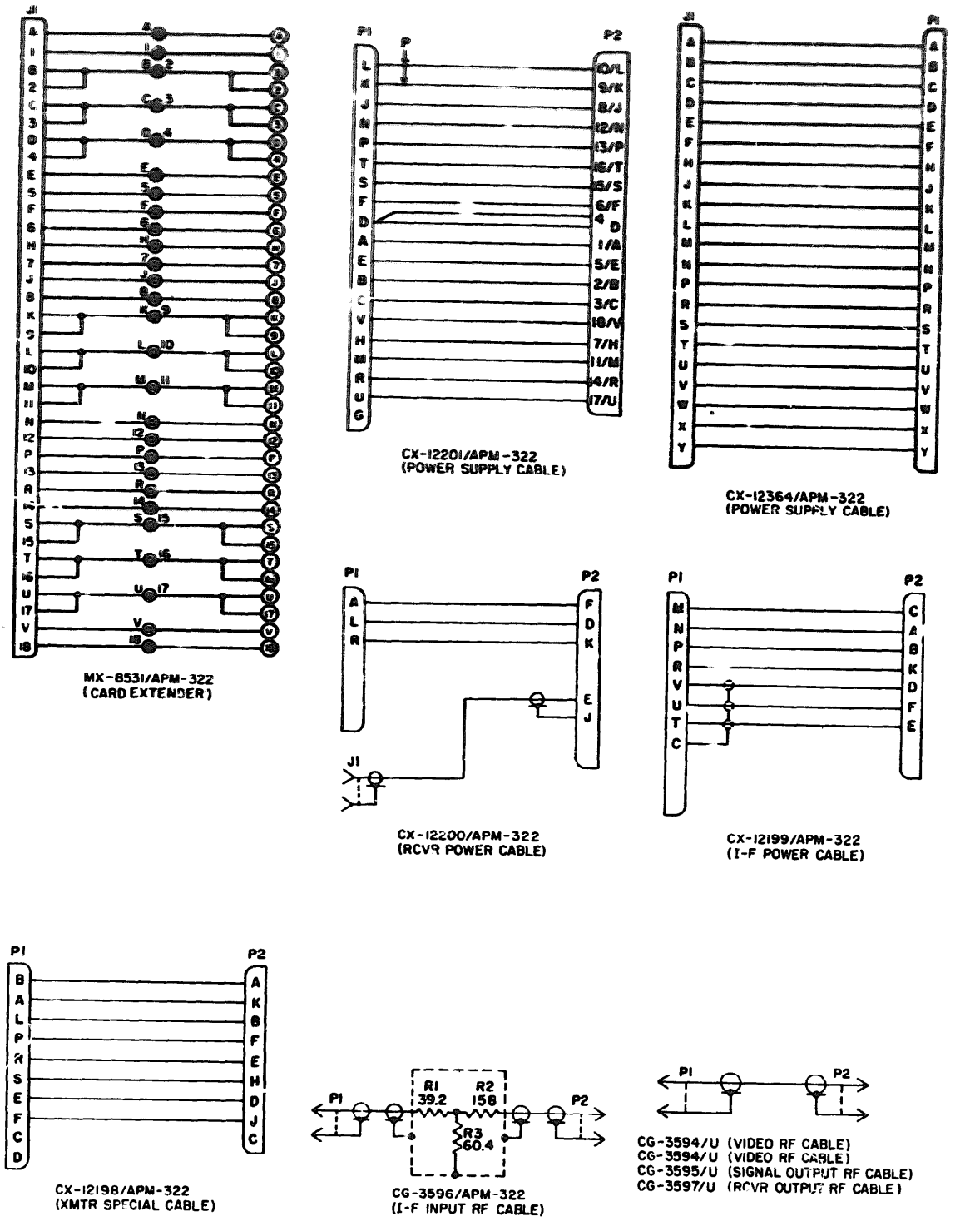


Figure 3-10. Test Set, Radar Altimeter Module AN/APM-322-card assembly extender and cable schematic *diagrams.*

From	To
P1-P	P2-13/P
P1-T	P2-16/T
P1-S	P2-15/S
P1-F	P2-6/F
P1-D	P2-4/D
P1-A	P2-1/A
P1-E	P2-5/E
P1-B	P2-2/B
P1-C	P2-3/C
P1-V	P2-18/V
P1-H	P2-7/H
P1-M	P2-11/M
P1-R	P2-14/R
P1-U	P2-17/U

(2) ***Cable Assembly CX-12364/APM-322.***

From	To
J1-A	P1-A
J1-B	P1-B
J1-C	P1-C
J1-D	P1-D
J1-E	P1-E
J1-F	P1-F
J1-H	P1-H
J1-J	P1-J
J1-K	P1-K
J1-L	P1-L
J1-M	P1-M
J1-N	P1-N
J1-P	P1-P
J1-R	P1-R
J1-S	P1-S
J1-T	P1-T
J1-U	P1-U
J1-V	P1-V
J1-W	P1-W
J1-X	P1-X
J1-Y	P1-Y

(3) ***Cable Assembly CX-12200/APM-322.***

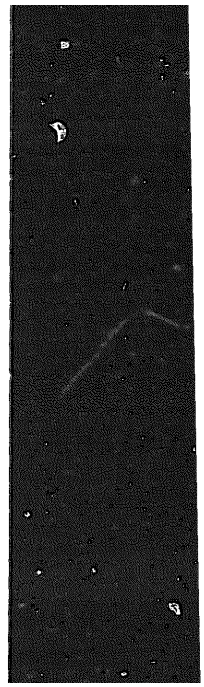
From	To
P1-A	P2-F
P1-L	P2-D
P1-R	P2-K
J-1	P2-E, J

(4) ***Cable Assembly CX-12199/APM-322.***

From	To
P1-M	P2-C
P1-N	P2-A
P1-P	P2-B
P1-R	P2-K
P1-V	P2-D
P1-U	P2-F
P1-T	P2-E
P1-C	Shield grd

(5) ***Cable Assembly CX-12198/APM-322.***

From	To
P1-B	P2-A
P1-A	P2-K
P1-L	P2-B
P1-P	P2-F
P1-R	P2-E
P1-S	P2-H
P1-E	P2-D
P1-F	P2-J



(6) ***Cable Assembly*** *CG-3596/APM-322.* Check for 197.2 ± 10.0 ohms between center pins of connectors P1 and P2. Check for 100 ± 10 ohms between center and outer conductor of connector PI. Check for 218.4 ± 12.0 ohms between center and outer conductor of connector P2.

(7) ***Extender, Card Assembly*** *MX-8531/APM-322.* For the card assembly extender, check between the pins of connector J1 to the corresponding contacts on the card plug-in end.

(8) ***Insulation resistance.*** Check insulation resistance between each conductor, except Cable Assembly CC-3596/APM-322. Insulation resistance shall be 10 megohms minimum.

CHAPTER 4

DEPOT MAINTENANCE

Section I. OVERHAUL INSTRUCTIONS

4-1. Scope of Depot Maintenance

Complete rebuild of the module test set or its individual components may be accomplished by depot maintenance facilities when authorized. Rebuild action will include all repairs, rebuild, and replacement operations necessary to make the equipment suitable for return to DA supply system stocks for reissue to using organizations as equipment equivalent to new material. Detailed procedures for accomplishing the repairs and adjustments established in the preceding portions of this manual and such additional repair and rebuild operations as deemed necessary, will be established by the facility performing the work. Section II (to be supplied) establishes the requirements that shall be met by rebuilt or repaired equipment before it is returned to DA supply system stocks.

4-2. Tools, Test Equipment, and Materials Required

a. Tools. No special tools are required.

b. Test Equipment. The following test equipment is required for depot maintenance.

Test equipment	*Technical manual*
Differential Voltmeter ME-202/U	TM 11-6625-537-15
Oscilloscope AN/USM-281A	TM 11-6625-1703-15
Resistance Bridge ZM-4A/U	TM 11-2019
Voltmeter, Electronic AN/URM-145 (vtvm).	TM 11-6625-524-14
X-1 Digital Voltmeter (with ohms converter), Non-Linear Systems, Inc, Del Mar, Calif. 92014 (for depot card testing).	

c. Materials. The following materials are required for depot maintenance.

Material	*Government specification or vendor stock number*	*Use*
Adhesive, epoxy	A-2E, manufactured by Armstrong Resins, Inc, Warsaw, Ind.	Attaching connector 2A1A3J2 to circuit board in i-f amplifier assembly. Bonding parts to circuit board in i-f amplifier assembly.
Alcohol, isopropyl	MIL-F-5566	Cleaning.
Solder, plastic rosin core	Sn60WRP2, type RMA, per QQ-S-571.	Soldering leadwires to circuit boards and connectors.
Tape, masking	FSN 7510-266-6712	Masking parts and surfaces which are not to be coated during tropicalization.
Varnish, epoxy, clear gloss	Poly-EP no. 810 Valspar, Inc	Retropicalizing repaired or otherwise unprotected printed circuit boards.

4-3. Troubleshooting

a. Perform the general support troubleshooting checks in paragraph: 3-3 through 3-6. Refer to the trouble analysis procedure in paragraph 3-7 to determine the required disassembly and repair.

b. When incorrect readings are obtained, the module test set panel assembly shall be removed from the case (para 3-12). Then check the i-f amplifier assembly and power supply assembly according to paragraphs 3-15 and 3-16.

4-4. Removal

a. Remove module test set panel assembly 2A1 from the module test set case according to the instructions in general support maintenance, paragraph 3-12, and the associated exploded view, figure 3-3.

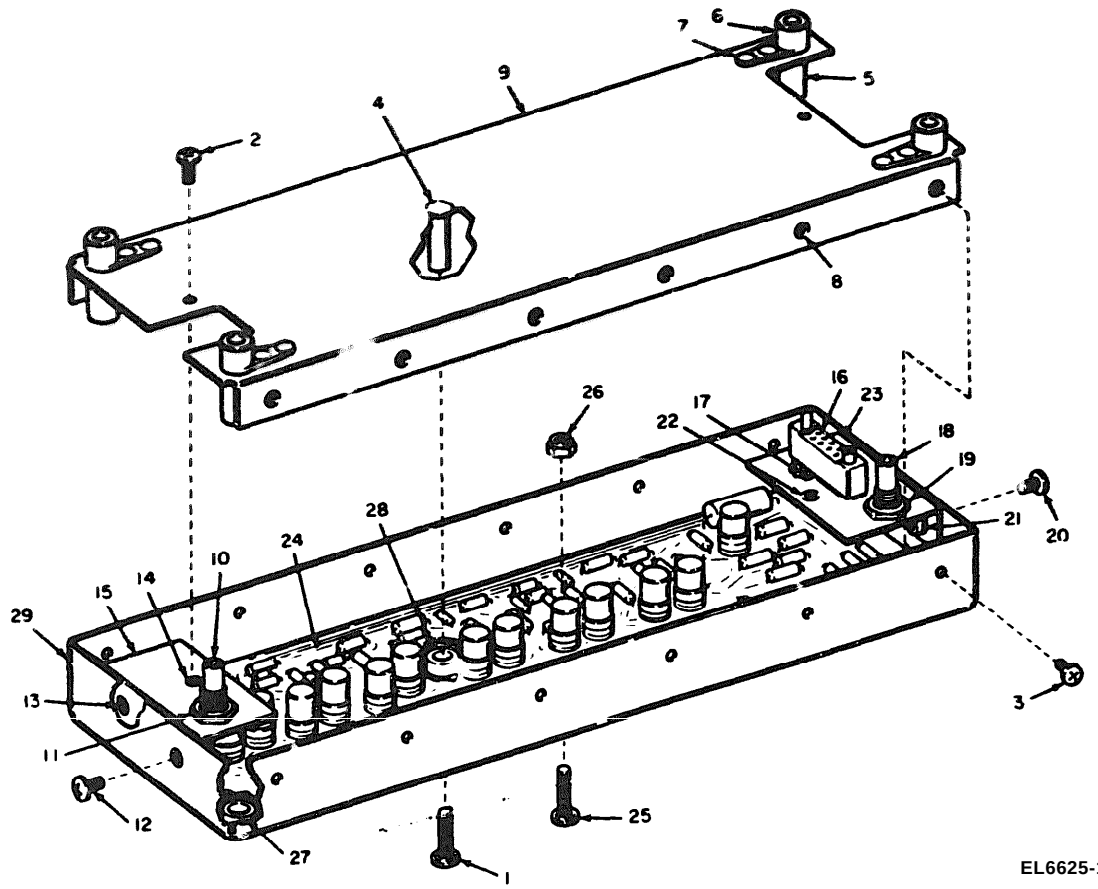
b. Remove power supply assembly 2A1A2 and i-f amplifier assembly 2A1A3 from module test set panel assembly 2A1 according to instructions in general support maintenance, paragraph 3-14, and the associated exploded view, figure *3-4.*

c. To remove subassemblies no. 1, no. 2, and no. 3 (2A1A2TB1 through 2A1A2TB3) from power supply assembly 2A1A2 refer to general support maintenance, paragraph 3–16*e*, and associated exploded view, figure 3–8.

4-5. Disassembly

a. General. Disassemble the test set only as necessary to isolate and replace parts found defective in troubleshooting. The exploded or parts location views, figures 3–3, 3–4, 3–8, 4–1, and 4–3 through 4–6, are indexed in the general order of disassembly, except attaching parts are indexed immediately following the parts they attach.

b. I-F Amplifier Assembly. Disassemble i-f amplifier assembly 2A1A3 (fig. 4–1) as follows:



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NOTE

For complete reference designations, add 2A1A3 to abbreviated designations shown in figure 4–1.

Cover assy [items 4 through 9]
1* Machine screw
2* Machine screw (2)
3* Machine screw (12)
4 Sleeve nut
5 Sleeve spacer (4)
6 Nut plate (4)
7* Rivet (4)
8 Self-locking clinch nut (12)
9 Cover
10 Electrical connector, J3
11 Hexagon plain nut
Bracket assy [items 13 through 15]
12* Machine screw (2)
13 Self-locking clinch nut (2)
14 Self-locking clinch nut
15 Angle bracket
16 Electrical connector, J1
17* Hexagon plain nut (2)
18 Electrical connector, J2
19 Hexagon plain nut
Bracket assy [items 21 through 23]
20* Machine screw (2)
21 Self-locking clinch nut (2)
22 Self-locking clinch nut
23 Angle bracket
24 I-F amplifier and detector assy, TB1 [fig. 4–3]
25* Binding head screw (4)
26* Self-locking hexagon nut (4)
Can assy [items 27 through 29]
27 Sleeve spacer (4)
28 Spacer (5)
29 Can

( ) Indicates quantity other than one.
* Indicates attaching part for immediately preceding unasterisked item.

Figure 4-1. I-F amplifier assembly-exploded view.

(1) To remove the cover for testing, remove attaching parts, items 1 through 3. Remove screws (12, 20). Then remove the cover (9). Replace screws (12, 20) to secure the connector brackets. Use one of these screws to secure the CX-12202/APM-323 ground strap (fig. 3-5).

(2) To remove the amplifier and detector assembly for repairs, remove screws (12, 20) to free the angle brackets (15, 23) from the can (29). Remove screws (25) and nuts (26) to free i-f amplifier and detector assembly from the can (29). Lift the assembly out of the can.

4-6. Repair

Repair of the module test set at depot maintenance consists of the tasks listed in sections IV through VI of general support maintenance. Additional repairs consist of testing i-f amplifier assembly 2A1A3 and power supply assembly 2A1A2 to determine defective components that require repair or replacement, resoldering loose leads within the test set chassis and within the modules, and retropicalizing printed circuit board assemblies.

4-7. I-F Amplifier Assembly Repair

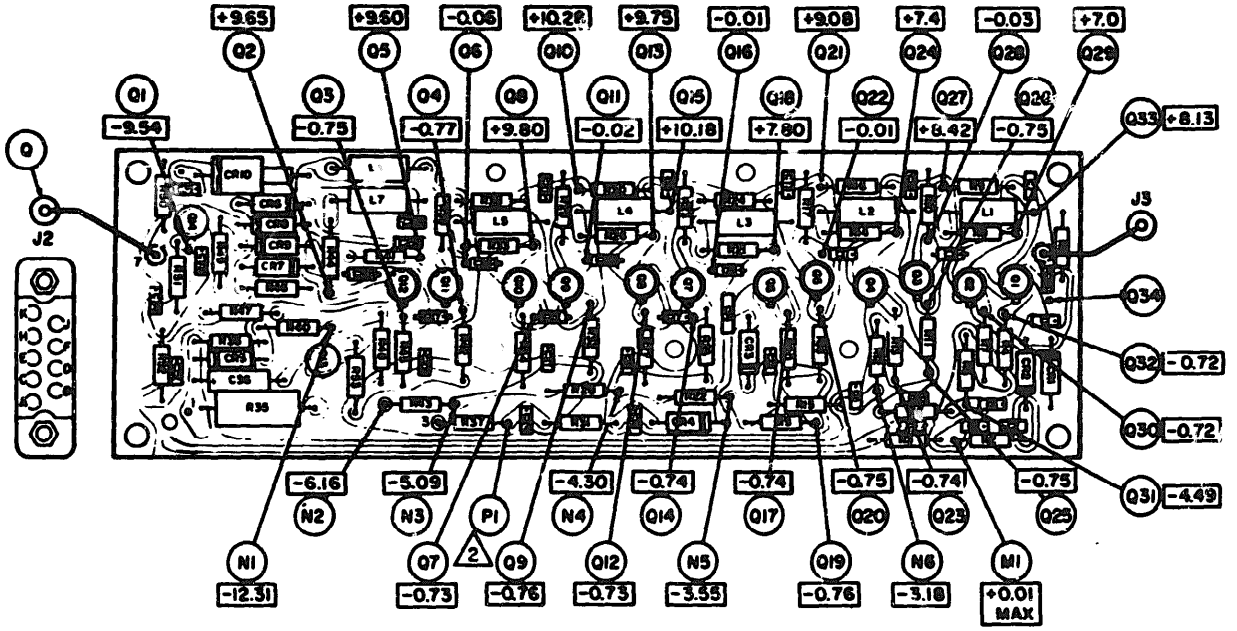
When the troubleshooting checks (para 4-3 and 3-15) indicate faults in the i-f amplifier assembly, perform the following circuit checks with the cc removed (para 4-5*b*).

a. Preliminary Steps. Perform the following preliminary steps.

(1) Set the system test set MODE CONTROL switch to XCVR/MODULE.

(2) Connect the amplifier and test equipment according to figure 3-5. Be sure to connect Electrical Lead CX-12202/APM-322 between the module test set POWER SUPPLY MODULE GRD terminal and the i-f amplifier assembly chassis. This is necessary to prevent oscillation.

(3) Set the module test set MODULE TEST SELECT switch to TEST MODULE.



NOTES:
1. ALL VOLTAGES ARE GIVEN IN DC, NOMINAL VALUE, UNLESS OTHERWISE STATED. ALL VOLTAGES HAVE TOLERANCE OF ± 10% UNLESS OTHERWISE STATED.
2. VOLTAGE AT P1 IS +0.09 VDC WHEN MTS BANDWIDTH CONTROL SWITCH IS SET TO NARROW AND IS +4.10 VDC WHEN SWITCH IS SET TO WIDE.
3. ALL VOLTAGES MEASURED WITH SIGNAL PIN OF CONNECTOR J3 GROUNDED.
4. FOR COMPLETE REFERENCE DESIGNATIONS, ADD 2A1A3 TO ABBREVIATED DESIGNATIONS SHOWN.

EL6625-1795-45TM-21

Figure 4-2. I-F amplifier assembly-test points.

(4) Energize Oscilloscope AN/USM-281, Electronic Voltmeter AN/URM-145, and the differential voltmeter.

(5) Turn on the X-1 Digital Voltmeter. This shall be used for voltage readings in the amplifier circuit.

b. I-F Amplifier Assembly Trouble Analysis.

(1) *General.* Perform the troubleshooting procedures of the table in the following step. Refer to the schematic diagram, figure FO-3, and the test point location diagram, figure 4-2, during troubleshooting. Faulty parts shall be repaired or replaced according to the instructions in paragraph 4-7*d*. Do not retropicalize the circuit board parts until all tests are complete and the i-f amplifier assembly is operational. Measure the voltages shown in the boxes in figure 4-2 with reference to ground (chassis) with no signal input at connector 2A1A3J3, src input voltage at 0 volts dc, and agc input at −4.0 volts dc.

(2) *Troubleshooting table.* The *Reference* column lists the test during which the abnormal indication occurs. The troubleshooting steps which help to isolate the failure to a specific part are listed in the *Procedure* column. All test points noted in the table refer to figure 4-2 unless otherwise stated. The test points shall be tested for the nominal voltage to ground specified in figure 4-2 using the X-1 Digital Voltmeter. Perform the stage gain checks of paragraph 4-7*c*, as required by reference in the *Procedure* column.

Reference	*Abnormal indication*	*Procedure*
Amplifier gain	*a.* Noise level greater than 0.8 volt peak with 100-db attenuation.	*a.* (1) Check agc circuits (fig. FO-3) for proper value and operation. Check test points N1 through N6 for proper voltages, using the X-1 Digital Voltmeter. (2) If agc circuit components are good, check gain from stage to stage (para 4-7*c*). (3) Repair or replace faulty parts.
	b. Gain less than 83 db for 1-volt peak output with agc at −1.0 volt, src at 0 volt.	*b.* (1) Check gain from stage to stage (para 4-7*c*). (2) Repair or replace faulty parts.
	c. Gain less than 78 db with agc at −7 volts dc, src at 0 volt.	*c.* Repeat steps *a*(1), (2), and (3) above for abnormal indication.
	d. Gain greater than 56 to 72 db with src at −7.0 volts, agc at −1.0 volt.	*d.* (1) Check test point M1 for proper voltage. Check parts of src circuit for proper value. (2) Check test points Q32 and Q33 for proper voltages. (3) Check individual parts for resistance and continuity (para 4-7*d*). (4) Repair or replace faulty part.

c. Stage Gain Troubleshooting Steps. With the equipment connected as in paragraph 4-7a and figure 3-5, perform the following steps :

(1) Set the system test set VIDEO POS/NEG switch to NEG.

(2) Adjust the system test set VIDEO AMPLITUDE control for -1.0-volt peak pulse on oscilloscope channel A.

(3) Disconnect Cable Assembly CG-3596/APM-322 from module test set TO IF connector J5. Connect the oscilloscope channel B input to the connector.

(4) Set the module test set ATTENUATION switches to IN or out as required to obtain -0.100-volt pulse on the oscilloscope.

(5) Disconnect the oscilloscope channel B from TO IF connector J5 and reconnect Cable Assembly CG-3596/APM-322 to connector J5.

(6) Use the oscilloscope channel B input to measure the pulse amplitude at test point Q29 (fig. 4-2). The pulse amplitude shall be -0.100 volt.

(7) Repeat step (6) above for each of the following test points: Q24, Q18, Q13, and Q8. Add 10 db for each test point and note a pulse amplitude of -0.100 volt at each point. Check them in the order listed.

(8) If gain through test point Q8 is proper, check test points Q1 through Q6 for proper voltages (fig. 4-2).

(9) When the gain or voltage at an individual test point is incorrect, deenergize the module and

check circuit part values. See the schematic diagram (fig. FO–3) for wiring connections.

(10) Repair or replace parts as required.

d. Repairing I-F Amplifier and Detector Assembly.

(1) The preceding troubleshooting checks should isolate the fault to a portion of a circuit. The faulty part can then be determined by in-circuit resistance checking. Use the ohms converter with the X–1 Digital Voltmeter for these checks. Observe the following general procedures.

Caution

If the X–1 Digital Voltmeter with ohms converter or equivalent is not available, do not use ohmmeters which pass a current of more than 1 milliampere through the circuit being tested. Most multimeters and many electronic voltohmmeters do not meet this requirement, except on the X100 or higher ranges. Check ohmmeter circuit current before using it for solid-state circuit testing.

(a) All transistors in the i-f amplifier assembly are NPN type. The transistors can be checked roughly by checking forward and reverse resistance from base to emitter and collector. With the negative ohmmeter lead connected to the base, a high resistance (50,000 ohms or more) will be indicated to the emitter and collector. With the positive ohmmeter lead connected to the base, a low reading (500 ohms or less) will be indicated. Actual resistance readings vary greatly, depending on the type of instrument, test voltage, and circuit conditions. For this reason no resistance readings are given. If open or short-circuit readings are obtained, the transistor shall be replaced. Be sure the insulating varnish is penetrated when testing.

(b) When readings are marginal, an in-circuit transistor tester would aid in determining transistor condition. Otherwise, testing by substitution is necessary. In-circuit checks of diodes and resistors require careful attention to shunting circuit paths and polarity of ohmmeter leads. In-circuit capacitor checks require an instrument applying very low voltage (10 volts or less).

(c) Remove the insulating varnish from a soldered connection before unsoldering it. Use soldering aids as required to remove solder and component leadwires. Refer to figure 4-3 for location and identification of the i-f amplifier and detector assembly parts. Refer to the schematic diagram, figure FO-3, for circuit connections.

(d) Parts removed from the board shall be discarded since they are heat-sensitive and would have poor reliability if returned to use. Use extreme care in unsoldering and removing parts to avoid damaging other parts or the printed circuit paths and eyelets.

(e) Cement the replacement part to the printed circuit board using the adhesive listed in paragraph 4–2c. Make sure the part leads are inserted into the eyelet and the part is properly oriented. Press and hold the part to the printed circuit board until the leads have been soldered according to paragraph 3–10. Use a heat sink between the soldering iron and the part body during the soldering operation. Use a 6-watt soldering iron and use care to avoid overheating components or damage the board. Use the isopropyl alcohol to remove solder flux residues from the printed circuit board. Allow the adhesive to cure for 24 hours.

(f) Observe the same care as above when resoldering or reconnecting leadwires. Replace damaged lead wires with size, length, and color the same as the original lead wire.

(2) After repairing the board, the insulating varnish shall be restored on all areas that were penetrated during testing or repair procedures. Solder flux and other contamination shall be cleaned from the board and components before applying the varnish.

WARNING

Use cleaning agents in a well-ventilated area. Do not inhale the vapors or allow agent to contact the skin. Do not use near an open flame.

(a) Clean the printed circuit board area with isopropyl alcohol (para 4-2c). Allow the area to air dry. Use masking tape to protect areas such as connectors which are not to be varnished.

(b) Varnish the area using the epoxy varnish (para 4-2c) and an artist's brush. Avoid connector contacts or other areas which are not to be varnished. Coat the surfaces and leadwires of all new parts. Apply a thin even coat and allow the varnish to air dry for 24 hours, or oven cure the board at 180°F. for 8 hours.

(c) Check the area after curing to make sure that the varnish coat is completely even with no voids or bubbles. If it is not, apply a second thin coat to the area and repeat the curing procedure.

4-8. Power Supply Assembly Repair

A power supply assembly that fails the tests of paragraph 3-4d or the adjustment and aline-

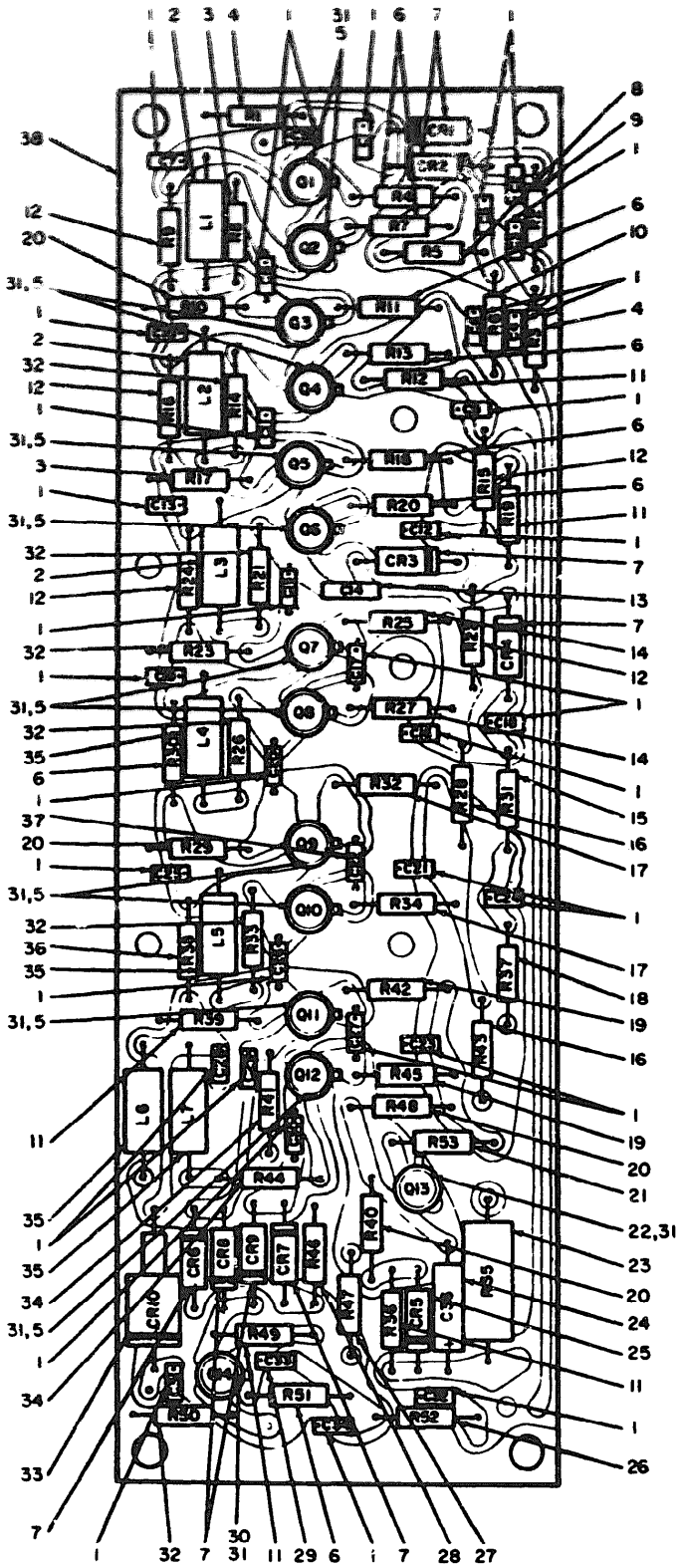


Figure 4-3. I-F amplifier and detector assembly-parts location view.

NOTE

For complete reference designations, add 2A1A3TB1 to abbreviated designations shown in figure 4-3.

1 Electrolytic fixed capacitor, C1 through C13, C15 through C21, C23 through C32, C34, C35 (32)
2 Radio frequency coil, L1 through L3 (3)
3 Film fixed resister, R8, R17 (2)
4 Film fixed resistor, R1, R3 (2)
5 Transistor, Q1 through Q12 (12)
6 Composition fixed resistor, R4, R7, R11, R13, R18, R20, R30, R51 (8)
7 Diode semiconductor device, CR1 through CR4, CR6 through CR9 (8)
8 Film fixed resistor, R5
9 Film fixed resistor, R2
10 Film fixed resistor, R6
11 Film fixed resistor, R12, R19, R36, R39, R49 (5)
12 Film fixed resistor, R9, R15, R16, R22, R24 (5)
13 Ceramic dielectric fixed capacitor, C14
14 Film fixed resistor, R25, R27 (2)
15 Film fixed resistor, R31
16 Film fixed resistor, R28, R43 (2)
17 Film fixed resistor, R32, R34 (2)
18 Film fixed resistor, R37
19 Film fixed resistor, R42, R45 (2)
20 Film fixed resistor, R10, R29, R40, R48 (4)
21 Film fixed resistor, R53
22 Transistor, Q13
23 Film fixed resistor, R35
24 Electrolytic fixed capacitor, C36
25 Diode semiconductor device, CR5
26 Film fixed resistor, R52
27 Film fixed resistor, R47
28 Film fixed resistor, R46
29 Ceramic dielectric fixed capacitor, C33
30 Transistor, Q14
31 Transistor pad (14) [used with items 5, 22, and 30]
32 Film fixed resistor, R14, R21, R23, R26, R33, R50 (6)
33 Diode semiconductor device, CR10
34 Film fixed resistor, R41, R44 (2)
35 Radio frequency coil, L4 through L7 (4)
36 Film fixed resistor, R38
37 Mica dielectric fixed capacitor, C22
38 Printed circuit board

( ) Indicates quantity other than one.

Figure 4-3-Continued.

ment of paragraph 3-8 shall be repaired according to the following procedures. Power supply subassemblies replaced at general support maintenance shall also be repaired at depot maintenance.

a. Power Supply Assembly Repair. Perform the troubleshooting procedures of paragraph 3-16 to localize trouble. Then perform the troubleshooting checks of paragraph ***4-8b.*** Use the test setup of figure 3-6. Use the X-l Digital Voltmeter to make the voltage readings in figure 3-7. Refer to the schematic diagram, figure FO-4, for circuit checked at each test point.

(1) ***Subassembly* No. 3 2A1A2TB3.** A subassembly no. 3 2A1A2TB3 that has failed shall be checked by installing it in a power supply unit and performing the troubleshooting checks of paragraph ***4-8b.*** Isolate faults with the board removed, using the X-l Digital Voltmeter with ohms converter.

(2) Subassembly No. 2 2A1A2TB2. A faulty subassembly no. 2 2A1A2TB2 shall be checked for faulty diodes or capacitors using the X-l Digital Voltmeter with ohms converter.

(3) Subassembly No. 1 2A1A2TB1. A faulty subassembly no. 1 2A1A2TB1 shall be assembled with subassemblies 2A1A2TB2 and 2A1A2TB3 that are known to be good. Perform the troubleshooting checks of paragraph ***4-8b*** to localize trouble. Check components of the board using the X-l Digital Voltmeter with ohms converter.

b. Power Supply* 2A1A2 *Trouble Analysis. If the power supply output voltages are incorrect, perform the analysis and corrective steps listed below. Refer to schematic diagram, figure FO-4, and test point location diagram, figure 3-7, to locate parts, connections, and test points, Connections to the test equipment and intramodule connections are the same as specified in paragraph 3-16 and figure 3-6. Faulty parts shall be repaired or replaced using the same printed circuit card repair procedures given in paragraph ***4-7d.*** Do not retropicalize a circuit until all tests of the module are complete and the power supply is operationally ready for installation. The ***Reference*** column below lists the power supply output circuit under test. The Abnormal ***result*** column lists typical failure indications. The troubleshooting steps which help isolate to the faulty part or lead are listed in the ***Procedure*** column.

Reference	Abnormal result	Procedure
−50 vdc	a. Voltage present but cannot be adjusted to −50.00 ± 0.05 vdc.	a. (1) Check the test points (fig. 3-7) listed below for proper voltage: A1 98.00 ± 10.00 v rms A2 +21.17 ± 4.20 vdc A3 +2.83 ± 0.28 vdc A4 +12.65 ± 2.0 vdc A5 + 3.35 ± 0.33 vdc A6 −9.235 ± 0.92 vdc A7 −9.82 ± 0.92 vdc A8 −9.25 ± 0.92 vdc (2) When a voltage is found to be wrong and the preceding voltage is correct, deenergize the module, remove the faulty subassembly (para 3–16) and check individual part values. Replace the subassembly part and repeat the test.
	b. No −50 vdc	b. (1) Check for 98.00 ± 10.00 v rms at test point A1 and at the white-yellow lead of transformer 2A1A2T1. If voltage is present at one, but not both points, check diodes 2A1A2TB2-CR11 and 2A1A2TB2CR12. Replace faulty diode. (2) If voltage is missing at both points, check continuity from white-orange lead of transformer 2A1A2T1 to subassembly no. 3 pin 5. If no continuity exists, repair faulty connection on subassembly. If continuity exists, replace transformer 2A1A2T1. (3) If steps (1) and (2) yield proper results, check test points A2 through A8 for proper voltages. Determine faulty subassembly as in step a (2) above.
−6.3 vdc	a. Voltage present but cannot be adjusted to −6.30 ±0.07 vdc.	a. (1) Check the test points (fig. 3–7) listed below for proper voltage: B1 14.10 ± 1.41 v rms B2 +3.86 ± 0.40 vdc B3 +0.70 ± 0.12 vdc B4 +3.60 ± 0.20 vdc B5 +1.35 ± 0.15 vdc B6 −5.67 ± 0.20 vdc (2) When a voltage is found to be wrong and the preceding voltage is correct, deenergize the module, remove the faulty subassembly (para 3–16) and check individual part values. Replace the faulty part and repeat the test until the power supply operates properly.
	b. No −6.3 vdc	b. (1) Check for 13.00 ± 2.60 v rms at test point B1, and at the white-black-red lead of transformer T1. If the voltage is present at one, but not both points, check diodes CR9 and CR10. Replace faulty diode. (2) If the voltage is missing at both points, check continuity from white-black-brown lead of transformer T1 and subassembly no. 3 pin D. If no

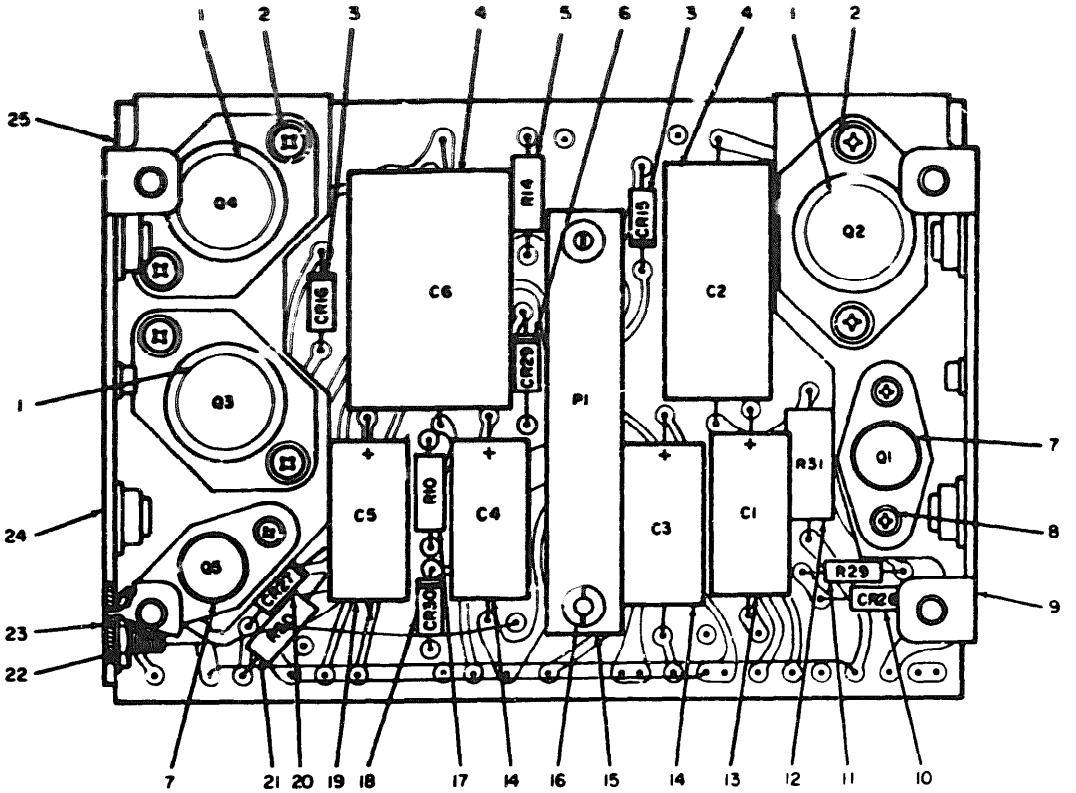
Reference	Abnormal result	Procedure
		continuity exists, repair faulty connection on subassembly. If continuity exists, replace transformer T1.
		(3) If steps (1) and (2) yield proper results, check test points B2 through B6 for proper voltages. Determine faulty subassembly as in step *a* (2) above.
+80 vdc	*a.* Voltage present but cannot be adjusted to +80.0 ± 0.1 vdc.	a. (1) Check the test points (fig. 3-7) listed below for proper voltage: F1 125.0 ± 15.0 v rms F2 +104.23 ± 10.00 vdc F3 +80.60 ± 1.00 vdc F4 +112.00 ± 12.00 vdc F5 +81.65 ± 1.00 vdc F6 +36.00 ± 3.60 vdc F7 +0.60 ± 0.20 vdc
		(2) When a voltage is found to be wrong and the preceding voltage is correct, deenergize the module, remove the faulty subassembly (para 3-16) and check individual part values. Replace the faulty part and repeat the test until the power supply operates properly.
	b. No +80 vdc	*b.* (1) Check for 125 ± 15 v rms at test point F1 and at the blue lead of transformer 2A1A2T1. If voltage is present at one, but not both points, check diodes 2A1A2TB2CR3 and 2A1A2TB2CR4. Replace faulty diode.
		(2) If the voltage is missing at both points, check continuity from violet lead of transformer 2A1A2T1 to chassis ground. If no continuity exists, repair faulty subassembly lead. If continuity exists, replace transformer 2A1A2T1.
		(3) If steps (1) and (2) yield proper results, check test points F2 through F7 for proper voltages. Determine faulty subassembly as in step *a* (2) above.
+15 vdc	*a.* Voltage present but cannot be adjusted to +15.00 ± 0.05 vdc.	a. (1) Check the test points (fig. 3-7) listed below for proper voltage: D1 33.8 ± 6.0 v rms D2 +27.5 ± 5.0 vdc D3 +10.72 ± 0.10 vdc D4 +0.60 ± 0.20 vdc D5 +10.67 ± 1.06 vdc
		(2) When a voltage is found to be wrong and the preceding voltage is correct, deenergize the module, remove the faulty subassembly (para 3-16), and check individual part values. Replace the faulty part and repeat the test until the power supply operates properly.
	b. No +15 vdc	*b.* (1) Check for 33.8 ± 6 v rms at test point D1 and at orange lead transformer 2A1A2T1. If voltage is present at

Reference	Abnormal result	Procedure
		one, but not both points, check diodes 2A1A2TB2CR5 and 2A1A2TB2CR6. Replace faulty diode.
		(2) If the voltage is missing at both points, check continuity from yellow lead of transformer 2A1A2T1 to ground. If no continuity exists, repair faulty subassembly lead. If continuity exists, replace transformer 2A1A2T1.
		(3) If steps (1) and (2) yield proper results, check test points D2 through D5 for proper voltages. Determine faulty subassembly as in step a (2) above.
−15 vdc	a. Voltage present but cannot be adjusted to −15.00 ± 0.05 vdc.	a. (1) Check the test points (fig. 3-7) listed below for proper voltage: C1 −15.53 ± 3.00 v rms C2 +11.00 ± 3.00 vdc C3 −3.00 ± 1.00 vdc C4 −14.25 ± 0.30 vdc C5 −4.50 ± 0.50 vdc
		(2) When a voltage is found to be wrong and the preceding voltage is correct, deenergize the module, remove the faulty subassembly (para 3-16), and check individual part values. Replace the faulty part and repeat the test until the power supply operates properly.
	b. No −15 vdc	b. (1) Check for 33.3 ± 6.0 v rms at test point C to test point C1. Check for 33.3 ± 6 v rms from test point C (−15V jack) to the anode of diode A8CR8. If voltage is present at one, but not both points, check diodes TB2CR3 and TB2CR4. Replace faulty diode.
		(2) If the voltage is missing at both points, check continuity from white-blue lead of transformer 2A1A2T1 to ground. If no continuity exists, repair faulty subassembly lead. If continuity exists, replace transformer 2A1A2T1.
		(3) If steps (1) and (2) yield proper results, check test points C2 through C5 for proper voltages. Determine faulty subassembly as in step a (2) above.
+28 vdc	Voltage missing, too high, or too low	Check continuity from test point D2 to subassembly no. 1 pin 15. Repair fault. If voltage too high or too low, check rectifier circuit of +15 vdc supply and replace faulty part.
+120 vdc	Voltage not 120 ± 6 vdc, +80 vdc correct.	Check for 50.2 ± 5.0 vrms at test point G1 (fig. 3-7) and at white lead of transformer 2A1A2T1. If voltage present at one, but not both points, check diodes 2A1A2TB2CR1 and 2A1A2TB2CR2. Replace faulty diode.

Reference	Abnormal result	Procedure
Ripple voltage	Ripple exceeds limits	Check capacitors 2A1A2TB2C17 through 2A1A2TB2C22, 2A1A2TB1C1 through 2A1A2TB1C6, and 2A1A2TB3C7 through 2A1A2TB3C16.

c. Power Supply Subassembly No. 1 2A1A2TB1.

(1) When faults are localized to circuits in power supply subassembly no. 1 2A1A2TB1 refer to Figure 4-4 for parts location view



EL6625-1795-45TM-18

NOTE

For complete reference designations, add **2A1A2TB1 to** abbreviated designations shown in figure 4-4.

1 Transistor, Q2, Q3, Q4 (3)
2* Machine screw (6)
* Clamp (3) [supplied with item 1]
* Mica washer (6) [supplied with item 1]
* Flat washer (6)
* Insulating washer (6) [supplied with item 1]
* Self-locking clinch nut (6)
3 Diode semiconductor device, CR15, CR16 (2)
4 Paper dielectric fixed capacitor, C2, C6 (2)
5 Composition fixed resistor, R14
6 Diode semiconductor device, CR29
7 Transistor, Q1, Q5 (2)
8* Machine screw (4)
* Insulated washer (4) [supplied with item 7]
* Lock washer (4) [supplied with item 7]
* Self-locking clinch nut (4)
* Insulated washer (2) [supplied with item 7]
9 Transistor mounting bracket
10 Diode semiconductor device, CR26
11 Composition fixed resistor, R29
12 Wire wound fixed resistor, R31
13 Electrolytic fixed capacitor, C1
14 Electrolytic fixed capacitor, C3, C4 (2)
15 Electrical connector, P1
16 Connector mounting spacer (2) [used with item 15]
* Connector mounting nut (2)
17 Composition fixed resistor, R10
18 Diode semiconductor device, CR30
19 Electrolytic fixed capacitor, C5
20 Diode semiconductor device, CR27
21 Composition fixed resistor, R30
22 Self-locking clinch nut
23 Lug terminal
24 Transistor mounting bracket
25 Printed circuit board

( ) Indicates quantity other than one.
* Indicates attaching part for immediately preceding unasterisked item.

Figure 4-4. Power supply subassembly no. 1-parts location view.

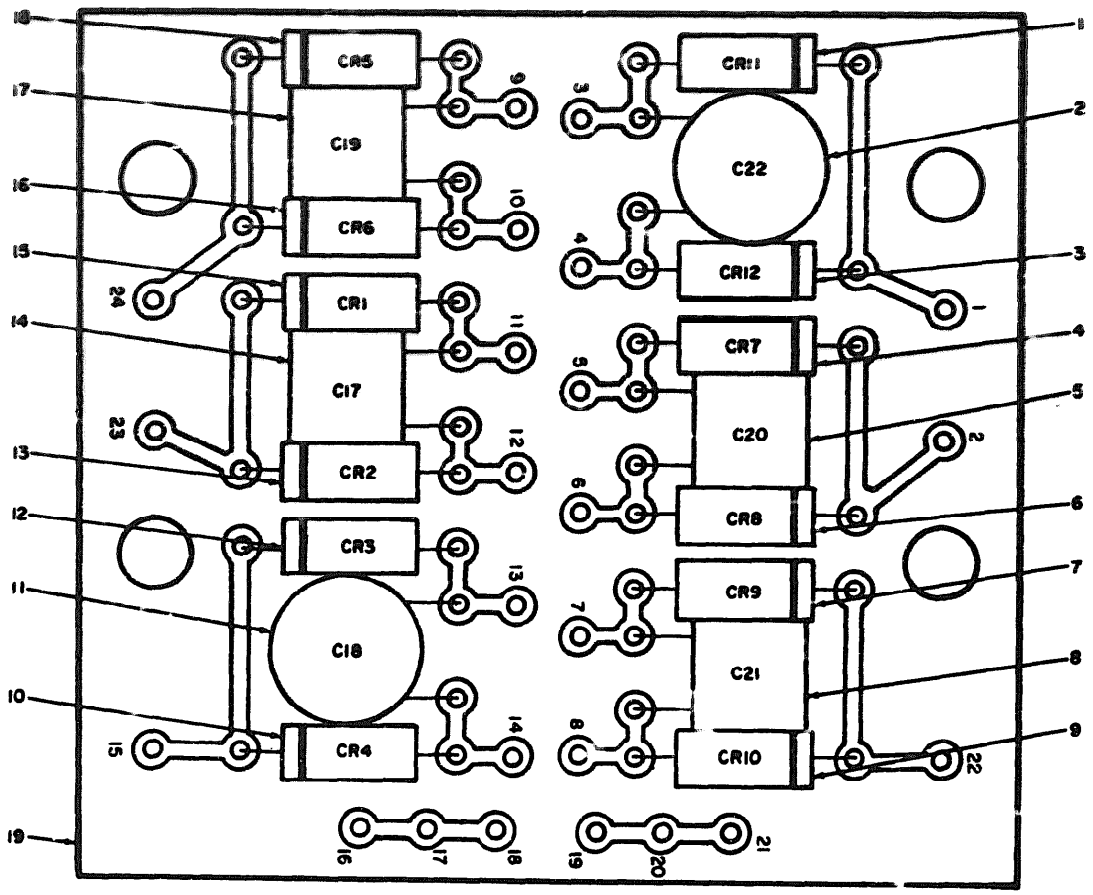
(2) Perform component checks using the X-1 Digital Voltmeter with ohms converter. Follow the general procedures given for the i-f amplifier and detector assembly in paragraph 4-7*d*. Transistors in the power supply are also NPN types, so polarities of readings will be the same.

(3) Use extreme care in removing and replacing printed circuit board components (para 4-7*d*(1), steps (*a*) through (*e*)). Observe best shop practices for repair of printed circuit assemblies.

(4) After repairs and bench check tests are completed, the board shall be retropicalized (para 4-7*d*(3)).

d. Power Supply Subassembly No. 2 2A1A2-TB2.

(1) When faults are localized to circuits in power supply subassembly no. 2 2A1A2TB2 refer to figure 4-5 for parts location view.

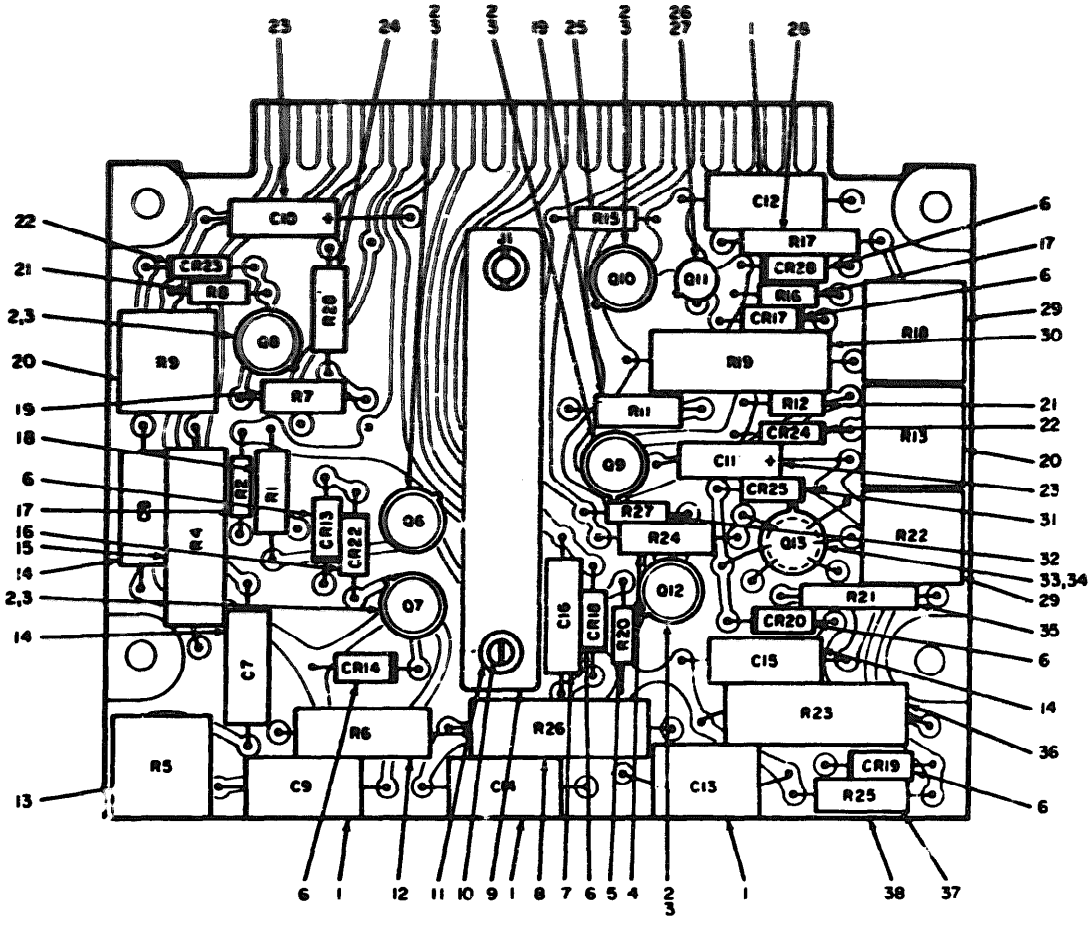


EL6625-1795-45TM-19

NOTE
For complete reference designations, add 2A1A2TB2 to abbreviated designations shown in figure 4-5.

1 Diode semiconductor device,
2 Ceramic dielectric fixed capaci-
3 Diode semiconductor device,
4 Diode semiconductor device, CR7
5 Ceramic dielectric fixed capacitor, C20
6 Diode semiconductor device, CR8
7 Diode semiconductor device, CR9
8 Ceramic dielectric fixed capacitor, C21
9 Diode semiconductor device, CR10
10) Diode semiconductor device, CR4
11 Ceramic dielectric fixed capacitor, Cl8
12 Diode semiconductor device, CR3
13 Diode, semiconductor device, CR2
14 Ceramic dielectric fixed capacitor, C17
15 Diode semiconductor device, CR1
16 Diode semiconductor device, CR6
17 Ceramic dielectric fixed capacitor, Cl9
18 Diode semiconductor device, CR5
19 Printed wiring board

Figure 4-5. *Power supply subassembly no. 2-parts location view.*



EL6625-1795-45TM-20

NOTE
For complete reference designations, add 2A1A2TB3 to abbreviated designations shown in figure 4-6.

1 Paper dielectric fixed capacitor, C9, C12 through C14 (4)
2 Transistor Q6 through Q10, Q12 (6)
3 Transistor pad (6) [used with item 2]
4 Film fixed resistor, R24
5 Composition fixed resistor, R20
6 Diode semiconductor device, CR13, CR14, CR17 through CR20, CR28 (7)
7 Paper dielectric fixed capacitor C16
8 Film fixed resistor, R26
9 Electrical connector, J1
10* Connector mounting nut (2)
11 Connector mounting spacer (2)
12 Film fixed resistor, R6
13 Wire wound variable resistor, R5
14 Paper dielectric fixed capacitor, C7, C8, C15 (3)
15 Film fixed resistor, R4
16 Diode semiconductor device, CR22
17 Composition fixed resistor, R2, R16 (2)
18 Composition fixed resistor, R1
19 Composition fixed resistor, R7, R11 (2)
20 Wire wound fixed resistor, R9, R13 (2)
21 Composition fixed resistor, R8, R12 (2)
22 Diode semiconductor device, CR23, CR24 (2)
23 Electrolytic fixed capacitor, C10, C11 (2)
24 Composition fixed resistor, R28
25 Composition fixed resistor, R15
26 Transistor, Q11
27 Transistor pad [used with item 26]
28 Wire wound fixed resistor, R17
29 Wire wound variable resistor, R18, R22 (2)
30 Film fixed resistor, R19
31 Diode semiconductor device, CR25
32 Composition fixed resistor R27
33 Electrical clip [holds item 34 in position]
34 Transistor, Q13
35 Wire wound fixed resistor, R21
36 Film fixed resistor, R23
37 Film fixed resistor, R25
38 Printed circuit board

( ) Indicates quantity other than one.
* Indicates attaching part for immediately preceding unasterisked item.

Figure 4-6. Power supply subassembly no. S-parts location view.

(2) Perform component checks using the X-1 Digital Voltmeter with ohms converter. Follow the general procedures given for the i-f amplifier and detector assembly in paragraph 4-7d. Transistors in the power supply are also NPN types so polarities of readings will be the same.

(3) Use extreme care in removing and replacing printed circuit board components (para 4-7d(1), steps (a) through (e)). Observe best shop practices for repair of printed circuit assemblies.

(4) After repairs and bench check tests are completed, the board shall be retropicalized (para 4-7d).

e. Power Supply Subassembly No. 3 2A1A2TB3.

(1) When faults are localized to circuits in power supply subassembly no. 3 2A1A2TB3 refer to figure 4-6 for parts location view.

(2) Perform component checks using the X-1 Digital Voltmeter with ohms converter. Follow the general procedures given for the if amplifier and detector assembly in paragraph 4-7d. Transistorsin the power supply are also NPN types, so polarities of readings will be the Same.

(3) Use extreme care in removing and replacing printed circuit board components (para 4-7d(1), steps (a) through (e)). Observe best shop practices for repair of printed circuit assemblies.

(4) After repairs and bench check tests are completed, the board shall be retropicalized (para 4-7d).

4-9. Reassembly

a. Reassemble the i-f amplifier and detector assembly using figure 4-3 for reference. Reassembly 1-1 amplifier assembly 2A1A3 using figure 4-1 for reference. Connect any removed lead wires in accordance with the schematic diagram, figure FO-3

b. Reassembly the power supply sub assemblies into power supply assembly 2A1A2 using figure 3-8 for reference. Connect the lead wires according to the lead wire list and procedures in paragraph 3-16e

4-10. Replacement

Rplace repair and overhauled assemblies and subassemblies into the module test set as follows:

a. For installation of the power supply assembly and the i-f amplifier assembly, follows the reverse order of disassembly described in paragraph 3-14 and illustrated in figure 3-4.

b. Replace the module test set panel assembly into the module test set case following the reverse order of disassembly described in paragraph 3-12 and illustrated in figure 3-3.

4-11. Adjustments and Alignment

The only adjustments required in the module test set are voltage adjustments to power supply assembly 2A1A2. Adjustments during repair are covered in paragraph 3-16g and figure 3-9 Adjustments to the power supply in its installed position in the module test sets are covered in paragraph 3-8 and figure 3-2.

4-12. Bench Checkout

Bench checkout consists of performing the general support maintenance troubleshooting tests, paragraphs 3-3 through 3-5, and the physical tests and inspections of paragraph 3-19.

Section II. OVERHAUL STANDARDS

4-13. Applicability of Depot Overhaul Standard

The tests and adjustments outlined in this section are designed to measure the performance capability of repaired equipment. All equipment that is to be returned to stock shall meet the standards given in these tests.

4-14. Applicable References

a. *Repair Standards.* Applicable procedures of the depot performing these tests and the general standards for repaired electronic equipment given in TB SIG 355-1, TB SIG 355-2, and TB SIG 355-3 form a part of the requirements for testing this equipment.

b. Technical Publication TM 11-6625-1795-12 is the only other technical publication applicable to this equipment.

c. *Modification Work Orders.* Perform all ap-

plicable modification work orders pertaining to this equipment before making the tests specified. DA Pam 310–7 lists all current MWO's.

4-15 Test Facilities Required

a. The test facilities required for general support maintenance are required also for depot overhaul standards tests. For identification of this equipment refer to paragraph 3-2.

b. Additional equipment required for depot overhaul standards tests is listed below. (Equivalent items may be used.)

Test equipment	Technical manual
Adapter, 874–QNP, General Radio Co, 22 Baker Ave, West Concord, Mass. 01781	
Adapter, 50–074–6800, Sealectro Corp, 225 Hoyt, Mamaroneck, N.Y. 10544	
I–F amplifier and detector, 1216A, General Radio Co, 22 Baker Ave, West Concord, Mass. 01781.	
I–F attenuation calibrator, PA–2, Wienschel Engineering Co, Clopper Road, Gaithersburg, Md. 20760.	
Matching pad adapter, 90 ohms to 50 ohms, 011–0058–00 (two required), Tektronix, Inc, PO Box 500, Beaverton, Ore. 97005.	
RF cable, 1366–C36 (two required), Pomona Electronics Co, Inc, 1500 E 9th, Pomona, Calif. 91766.	
Signal Generator AN/USM–44	TM 11-6625-508-10
T-adapter, 21900, Amphenol Corp, Amphenol RF Div, 33 E Franklin St, Danb Conn. 06810.	

4-16. Test Procedures

a. Voltage Measurements. After observing the preliminary instructions of paragraph 3-3, perform the tests of paragraph 3-4. Voltages shall be within the tolerances shown.

b. Resistance Measurements. Check resistance values according to paragraph 3-5. Values shall be within the limits shown.

c. Cable Assemblies. Refer to figure 3-10 for circuit schematic diagram of the cable assemblies. Check cable continuity according to paragraph 3-21c.

d. I-F Amplifier Assembly 2AlA3. An overhauled or repaired i-f amplifier assembly shall pass the tests of paragraph 3-15. These tests are made with the i-f amplifier assembly removed from the module test set. An i-f amplifier assembly that has not been removed for repair can be tested in its installed position, with the module test set panel removed from the case, as follows :

(1) Using the basic test setup of figure 3-1, connect an adapter (5O-074-6800) to module test set FROM RCVR jack J13. Connect the i-f input cable (cable assembly CG-3596/APM-322) to TO IF jack J5 and the adapter, with connector Pl connecting to jack J5 and connector P2 connecting to the adapter.

(2) Use an X10 oscilloscope probe to connect the oscillocone B input to the tip jacks in the RECEIVER MODULE section of the module test set panel. Connect the oscilloscope external sync input to system test set VIDEO SYNC jack Jl.

(3) Use a CG-3599/U cable (part of the system test set) to connect VIDEO TEST jack J3 to module test set VIDEO jack J4, using a T-adapter (21900) at jack J4. Connect the oscilloscope A input to the T-adapter, using a CG-3694/U cable.

(4) Set the TESTER POWER switch to ON and MODE CONTROL switch to XCVR MODULE. Set MODULE TEST SELECT switch to TEST MODULE. Connect Differential Voltmeter ME-202/U to terminal 10 of terminal board 2AlAlTBl and ground. Adjust the RECEIVER MODULE GAIN control for -1.0 volt dc.

(5) Set the RANGE/RATE select switch to RANGE. Set system test set VIDEO POS/NEG switch to NEG. Adjust the VIDEO AMPLITUDE control for a pulse peak value of -1.0 volt on oscilloscope channel A. Set the ATTENUATION step switches until the output pulse peak on channel B equals the input signal pulse peak on channel A. Attenuation value shall be 80 db or greater.

(6) Set system test set VIDEO POS/'NEG switch to POS. Repeat step (5) with + 1.0 ± 0.l-volt pulse peak value. Result shall be the same.

e. Step Attenuator 2A1AT1. Check the attenuation of each step of step attenuator 2AlATl as follows (fig. 4-7). This test is made with the system test set and module test set not energized

(system test set MODE CONTROL switch at OFF), or with the system test set completely disconnected from the module test set.

(1) Connect the 90- to 50-ohm matching pad adapters to module test set VIDEO jack J4 and to TO IF jack J5.

(2) Connect the signal generator output to the pad at jack J4, using an rf cable.

(3) Connect the input of the i-f attenuation calibrator to the pad at jack J5, using an rf cable.

(4) Connect the i-f amplifier and detector to the i-f attenuation calibrator using an 874-QNP Adapter. Set the system test set MODE CONTROL switch to OFF

(5) Refer to the manuals provided with the test equipment to insure correct operation and accurate readings of attenuation and vswr.

(6) Adjust the signal generator for 30 mc and 0 dbm. Set the i-f attenuation calibrator for 0 db. Apply power to the signal generator, i-f attenuation calibrator, and i-f amplifier and detector. Allow about 5 minutes for warmup.

(7) Set all module test set ATTENUATION switches to the down position. Adjust the signal generator and i-f attenuation calibrator to obtain about 8 db on the i-f amplifier and detector. Use this value as the reference point.

(8) Check the insertion loss. Disconnect the two cables and adapter plugs from connectors J4 and J5. Connect the adapters together using a UG914/U double female adapter and read the attenuation difference. It shall not exceed 0.3 db.

(9) Set the i-f attenuation calibrator for −60 db. Increase the signal generator output as required. Adjust the i-f attenuation calibrator and signal generator output to return to the reference reading on the i-f amplifier and detector.

(10) Set the module test set 1 DB ATTENUATION switch to IN. Adjust the i-f attenuation calibrator to obtain nuil and read the attenuation indicator. This shall be 1.00 ± 0.25 db.

(11) Consecutively set the module test set 2 DB, 3 DB, 5 DB, and 10 DB switches to IN, readjusting the i-f attenuation calibrator for each and reading the added attenuation. This shall be within ± 0.25 db for each step.

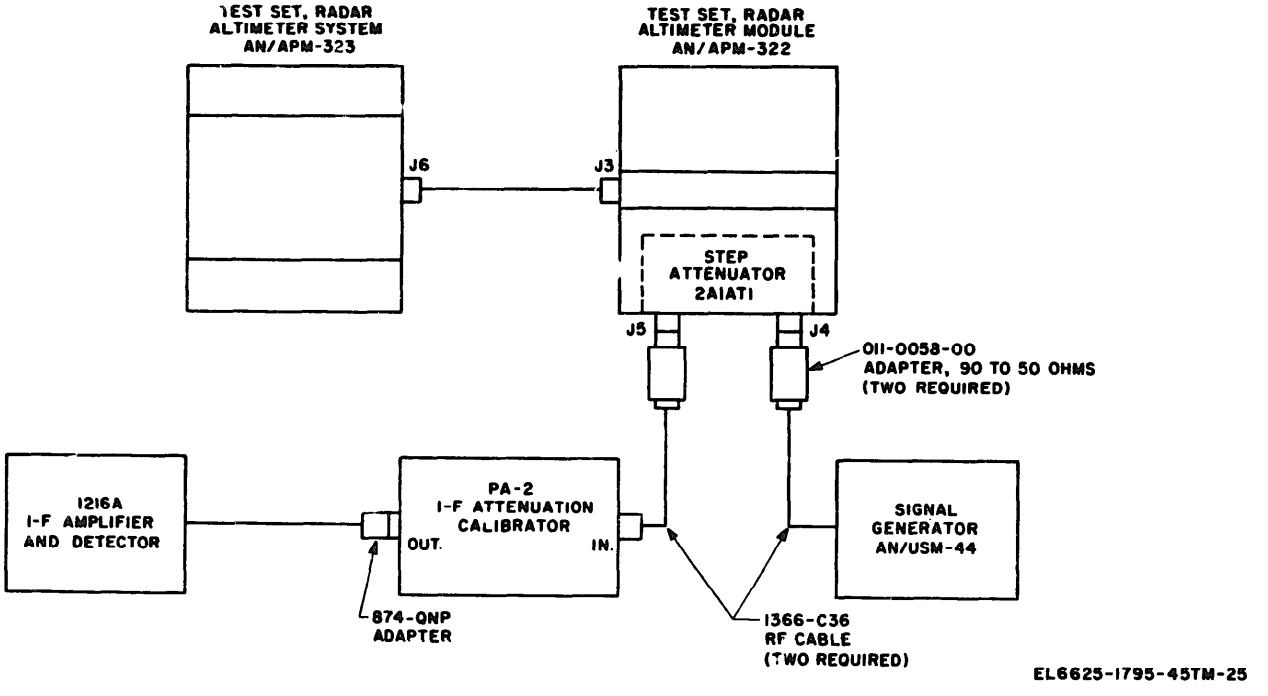


Figure 4-7. *Step attenuator test setup.*

(12) With the 1 DB, 2 DB, 3 DB, 5 DB, and 10 DB switches at IN, set the 20 DB switch (adjacent to the 10 DB switch) to IN and read the added attenuation. This shall be 20 ± 0.5 db.

(13) Return all mts ATTENUATION switches to the down position. Return the i-f attenuation calibrator to −62 db and adjust to 8-db reference.

(14) Repeat the above procedure, step (12), for the remaining three 20 db switches. Attenuation value for each shall be within ±0.5 db of its nominal 20-db value.

APPENDIX A

REFERENCES

The following publications contain information applicable to the maintenance of Test **Set, Radar Altimeter Module AN/APM–322.**

DA Pam 310-4	**Index of Technical M**anuals, Technical Bulletins, Supply **Manuals (types** 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	US Army Equipment Index of Modification Work Orders.
TB SIG 222	Solder and Soldering.
TB SIG 355-1	Depot Inspection Standard for Repaired Signal Equipment.
TB SIG 355-2	Depot Inspection Standard for Refinishing Repaired Signal Equipment.
TB SIG 355-3	Depot Inspection Standard for Moisture and Fungus Resistant Treatment.
TB 746-10	Field Instructions for Painting and Preserving Electronics Command **Equipment.**
TM 11-2019	Test Sets I-49, I-49-A, and I-49-B and Resistance Bridges ZM-4A/U and ZM-4B/U.
TM 11-5841-272-35	Direct Support, General Support, and Depot Maintenance Manual: Altimeter Set, Electronic AN/APN-171A (V) 1.
TM11-6625-444-15	Operator's Organizational, DS, GS, and Depot Maintenance Manual: Digital Voltmeter AN/GSM-64.
TM 11-6625-508-10	Operator’s Manual : Signal Generators AN/USM44 and AN/USM44A.
TM 11-6625-524-14	Operator, Organizational, and Field Maintenance Manual : Voltmeter, Electronic AN,/URM-145.
TM 11-6625-537-15	Operator, Organizational, Field, and Depot Maintenance Manual : Voltmeter, Electronic ME-202/U.
TM 11-6625-1746-12	Operator’s and Organizational Maintenance Manual for Test Set, Radar Altimeter System AN/APM-323.
TM 11-6625-1746-45	General Support and Depot Maintenance Manual for Test Set, Radar Altimeter System AN/APM-323.
TM 11-6625-1795-12	Operator’s and Organizational Maintenance Manual for Test Set, Radar A1timeter Module AN/APM-322.
TM 38-750	The Army Maintenance Management System (TAMMS).

By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, United States Army,
Chief of Staff.

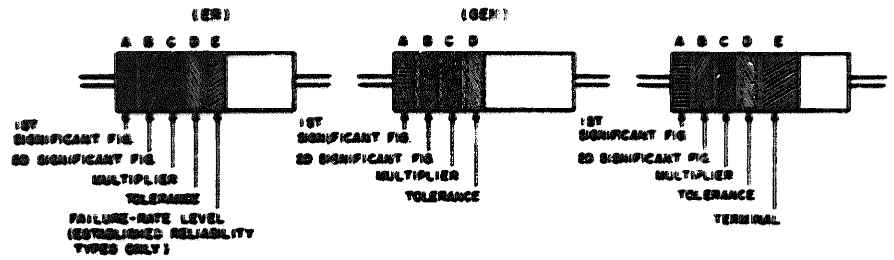
Official:

VERNE L. BOWERS,
Major General, United States Army,
The Adjutant General.

Distribution:

To be distributed in accordance with DA Form 12-36, Direct/General Support **requirements for OV-lA, OV-lB, and OV-1C aircrafts.**

*US, GOVERNMENT PRINTING OFFICE. 1979--296-196 237



COLOR CODE MARKING FOR COMPOSITION TYPE RESISTORS.

COLOR-CODE MARKING FOR FILM-TYPE RESISTORS.

TABLE 1
COLOR CODE FOR COMPOSITION TYPE AND FILM TYPE RESISTORS.

BAND A		BAND B		BAND C		BAND D		BAND E		
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)	COLOR	FAILURE RATE LEVEL	TERM.
BLACK	0	BLACK	0	BLACK	1			BROWN	M	
BROWN	1	BROWN	1	BROWN	10			RED	P	
RED	2	RED	2	RED	100			ORANGE	R	
ORANGE	3	ORANGE	3	ORANGE	1,000			YELLOW	S	
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER	±10 (COMP. TYPE ONLY)	WHITE		SOLD-ERABLE
GREEN	5	GREEN	5	GREEN	100,000	GOLD	±5			
BLUE	6	BLUE	6	BLUE	1,000,000	RED	±2 (NOT APPLICABLE TO ESTABLISHED RELIABILITY).			
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7							
GRAY	8	GRAY	8	SILVER	1 01					
WHITE	9	WHITE	9	GOLD	0.1					

BAND A — THE FIRST SIGNIFICANT FIGURE OF THE RESISTANCE VALUE (BANDS A THRU D SHALL BE OF EQUAL WIDTH)

BAND B — THE SECOND SIGNIFICANT FIGURE OF THE RESISTANCE VALUE

BAND C — THE MULTIPLIER (THE MULTIPLIER IS THE FACTOR BY WHICH THE TWO SIGNIFICANT FIGURES ARE MULTIPLIED TO YIELD THE NOMINAL RESISTANCE VALUE.)

BAND D — THE RESISTANCE TOLERANCE

BAND E — WHEN USED ON COMPOSITION RESISTORS, BAND E INDICATES ESTABLISHED RELIABILITY FAILURE-RATE LEVEL. ON FILM RESISTORS, THIS BAND SHALL BE APPROXIMATELY 1-1/2 TIMES THE WIDTH OF OTHER BANDS, AND INDICATES TYPE OF TERMINAL

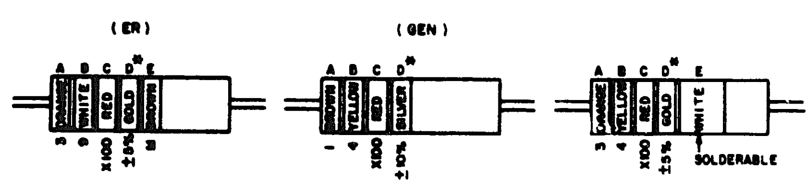
RESISTANCES IDENTIFIED BY NUMBERS AND LETTERS
(THESE ARE NOT COLOR CODED)

SOME RESISTORS ARE IDENTIFIED BY THREE OR FOUR DIGIT ALPHA NUMERIC DESIGNATORS. THE LETTER R IS USED IN PLACE OF A DECIMAL POINT WHEN FRACTIONAL VALUES OF AN OHM ARE EXPRESSED. FOR EXAMPLE

2R7 = 2.7 OHMS   10R0 = 10.0 OHMS

FOR WIRE-WOUND-TYPE RESISTORS COLOR CODING IS NOT USED. IDENTIFICATION MARKING IS SPECIFIED IN EACH OF THE APPLICABLE SPECIFICATIONS

EXAMPLES OF COLOR CODING



NOMINAL RESISTANCE 3,900 OHMS
RESISTANCE TOLERANCE ±5%
FAILURE RATE LEVEL M

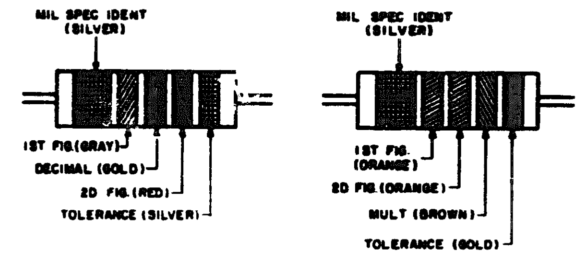
NOMINAL RESISTANCE 1,400 OHMS
RESISTANCE TOLERANCE ±10%

NOMINAL RESISTANCE 3,400 OHMS
RESISTANCE TOLERANCE ±5%
TERMINAL SOLDERABLE

COMPOSITION-TYPE RESISTORS

FILM-TYPE RESISTORS

A. COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS



(A) 8.2UH ± 10%

(B) 330UH ± 5%

COLOR CODING FOR TUBULAR ENCAPSULATED R.F CHOKES. AT A, AN EXAMPLE OF OF THE CODING FOR AN 8.2UH CHOKE IS GIVEN. AT B, THE COLOR BANDS FOR A 330 UH INDUCTOR ARE ILLUSTRATED

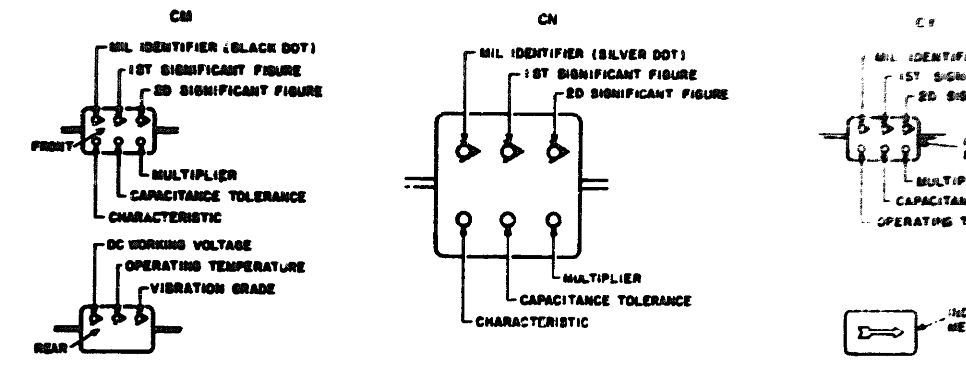
TABLE 2
COLOR CODING FOR TUBULAR ENCAPSULATED R.F CHOKES.

COLOR	SIGNIFICANT FIGURE	MULTIPLIER	INDUCTANCE TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	1
RED	2	100	2
ORANGE	3	1,000	3
YELLOW	4		
GREEN	5		
[illegible]	6		
[illegible]	[illegible]		
[illegible]	8		
[illegible]	[illegible]	[illegible]	
[illegible]			
[illegible]			20
[illegible]			[illegible]
[illegible]			5

MULTIPLIER IS THE FACTOR BY WHICH THE TWO COLOR FIGURES ARE MULTIPLIED TO OBTAIN THE INDUCTANCE VALUE OF THE CHOKE COIL.

B. COLOR CODE MARKING FOR MILITARY STANDARD INDUCTORS.

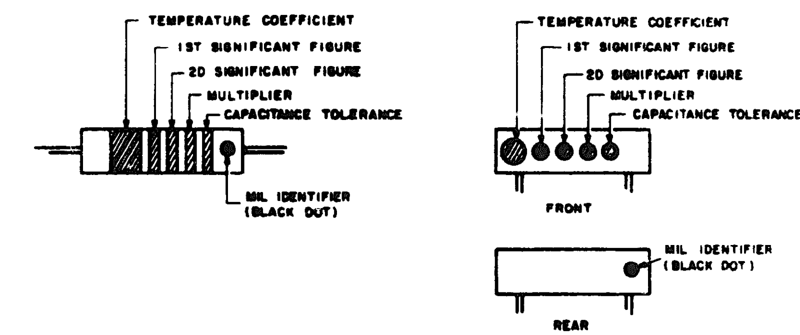
CAPACITORS, FIXED, VARIOUS-DIELECTRICS, STYLES CM, CN, CY, AND CB



MICA-DIELECTRIC

PAPER-DIELECTRIC

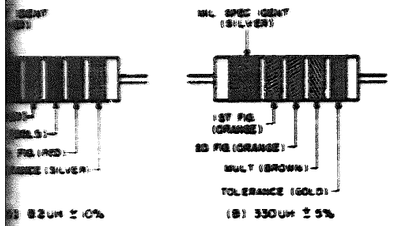
GLASS-DIELECTRIC,



AXIAL LEAD

RADIAL LEAD

Figure FO-1. Color code marking for MIL-STD resistors, inductors and capacitors.



BANDS FOR TUBULAR ENCAPSULATED R F CHOKES. AT A, AN EXAMPLE OF CODING FOR AN 82UH CHOKE IS GIVEN. AT B, THE COLOR BANDS FOR INDUCTOR ARE ILLUSTRATED

TABLE 2
COLOR CODING FOR TUBULAR ENCAPSULATED R F CHOKES

COLOR	SIGNIFICANT FIGURE	MULTIPLIER	INDUCTANCE TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	1
RED	2	100	2
ORANGE	3	1,000	3
YELLOW	4		
GREEN	5		
BLUE	6		
PURPLE (VIOLET)	7		
GREY	8		
WHITE	9		
GOLD			5
SILVER			10

MULTIPLIER IS THE FACTOR BY WHICH THE TWO COLOR FIGURES ARE MULTIPLIED TO OBTAIN THE INDUCTANCE VALUE OF THE CHOKE COIL

A. COLOR CODING FOR TUBULAR ENCAPSULATED R F CHOKES.

CAPACITORS, FIXED, VARIOUS-DIELECTRICS, STYLES CM, CN, CY, AND CB

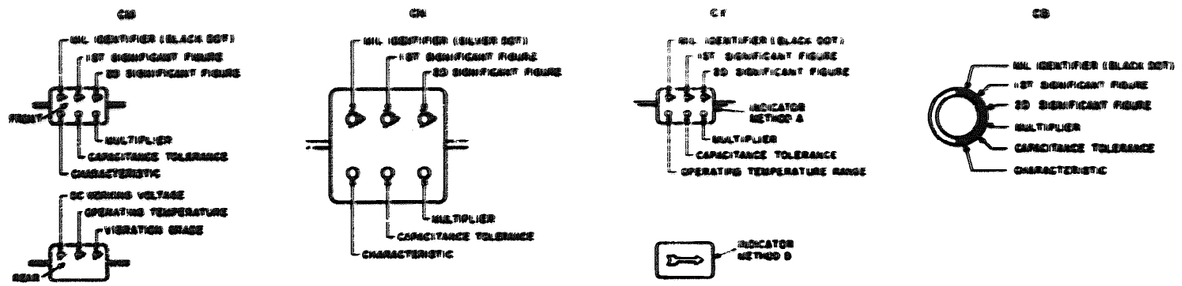


TABLE 3 — FOR USE WITH STYLES CM, CN, CY AND CB.

COLOR	MIL ID	1ST SIG FIG	2D SIG FIG	MULTIPLIER	CAPACITANCE TOLERANCE				CHARACTERISTIC			DC WORKING VOLTAGE	OPERATING TEMPERATURE RANGE	VIBRATION GRADE
					CM	CN	CY	CB	CM	CN	CB	CM, CB	CY, CB	CM
BLACK	BLACK DOT	0	0	1			±20%	±20%		A				
BROWN		1	1	10					B	E	B			
RED		2	2	100	±2%		±2%	±2%	C					
ORANGE		3	3	1,000		±30%			D		D	300		
YELLOW		4	4	10,000					E					
GREEN		5	5		±5%				F			500		
BLUE		6	6											
PURPLE (VIOLET)		7	7											
GREY		8	8											
WHITE		9	9											
GOLD				0.1			±5%	±5%						
SILVER	CN				±10%	±10%	±10%	±10%						

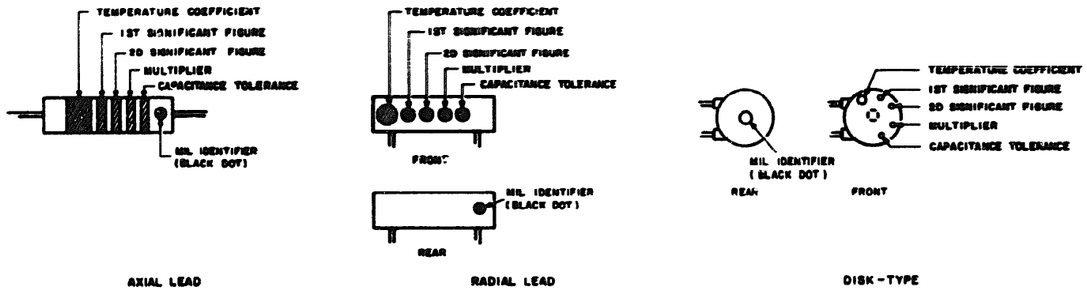


TABLE 4 — TEMPERATURE COMPENSATING, STYLE CC.

COLOR	TEMPERATURE COEFFICIENT[4]	1ST SIG FIG	2D SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE		MIL ID
					CAPACITANCES OVER 10 UUF	CAPACITANCES 10 UUF OR LESS	
BLACK	0	0	0	1		±2.0 UUF	CC
BROWN	−30	1	1	10	±1%		
RED	−80	2	2	100	±2%	±0.25 UUF	
ORANGE	−150	3	3	1,000			
YELLOW	−220	4	4		±5%	±0.5 UUF	
GREEN	−330	5	5				
BLUE	−470	6	6				
PURPLE (VIOLET)	−750	7	7				
GREY		8	8	0.01			
WHITE		9	9	0.1	±10%		
GOLD	+100					±1.0 UUF	
SILVER							

1. THE MULTIPLIER IS THE NUMBER BY WHICH THE TWO SIGNIFICANT (SIG) FIGURES ARE MULTIPLIED TO OBTAIN THE CAPACITANCE IN UUF.
2. LETTERS INDICATE THE CHARACTERISTICS DESIGNATED IN APPLICABLE SPECIFICATIONS: MIL-C-5, MIL-C-250, MIL-C-11272B, AND MIL-C-10950C RESPECTIVELY
3. LETTERS INDICATE THE TEMPERATURE RANGE AND VOLTAGE-TEMPERATURE LIMITS DESIGNATED IN MIL-C-11015D.
4. TEMPERATURE COEFFICIENT IN PARTS PER MILLION PER DEGREE CENTIGRADE.

B. COLOR CODE MARKING FOR MILITARY STANDARD INDUCTORS.

C. COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS.

Figure FO-1. Color code marking for MIL-STD resistors, inductors and capacitors.

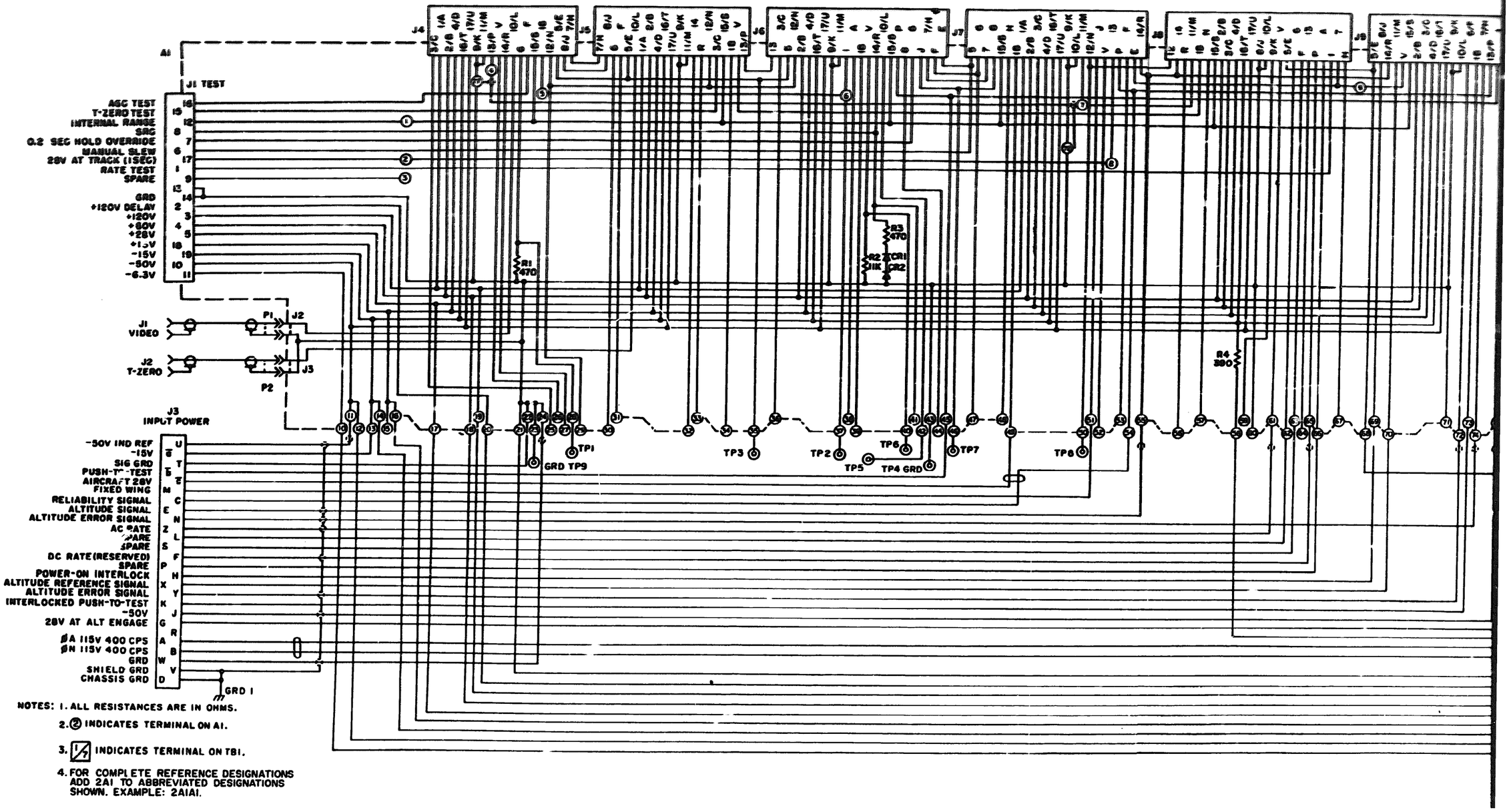
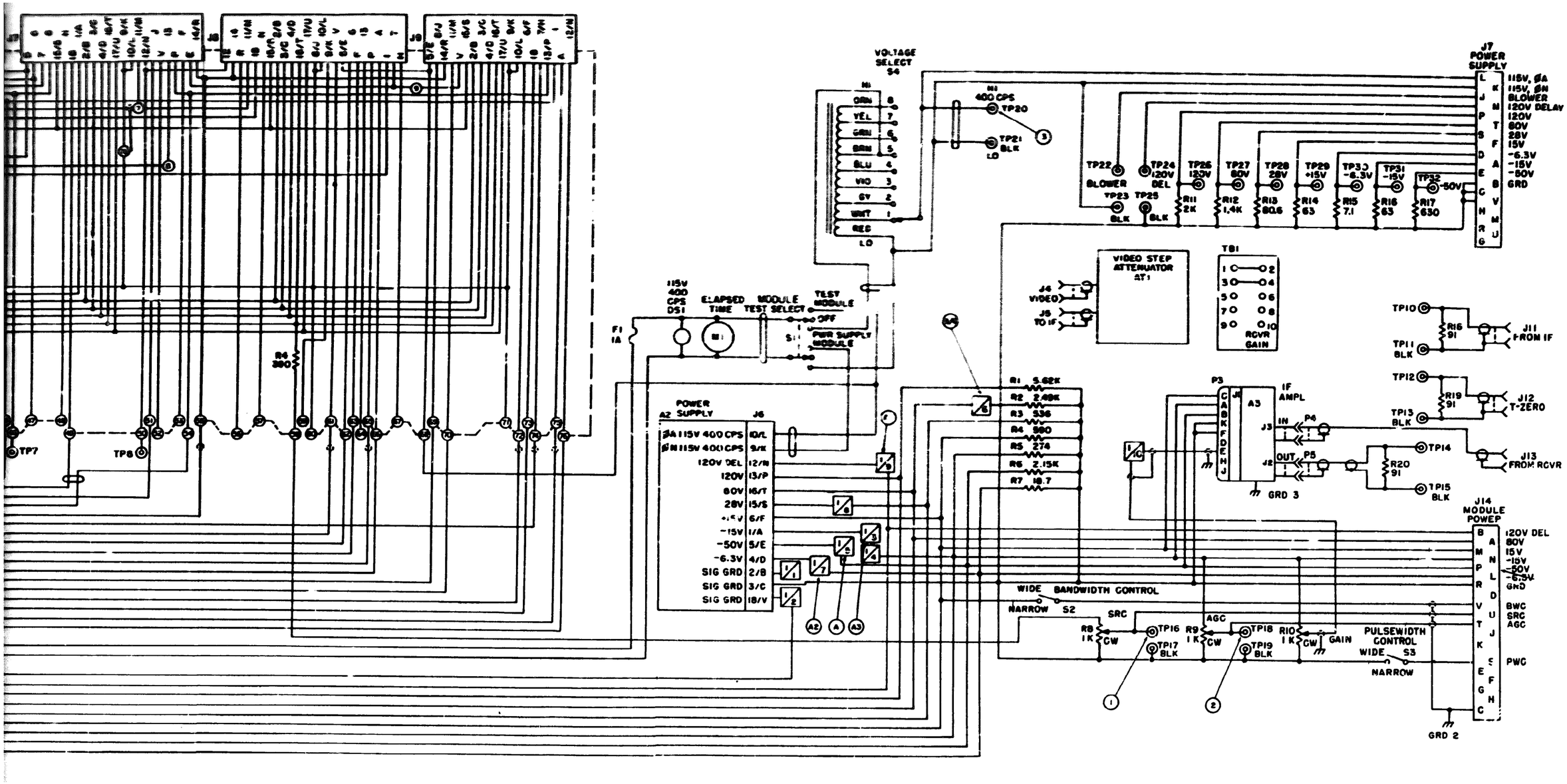
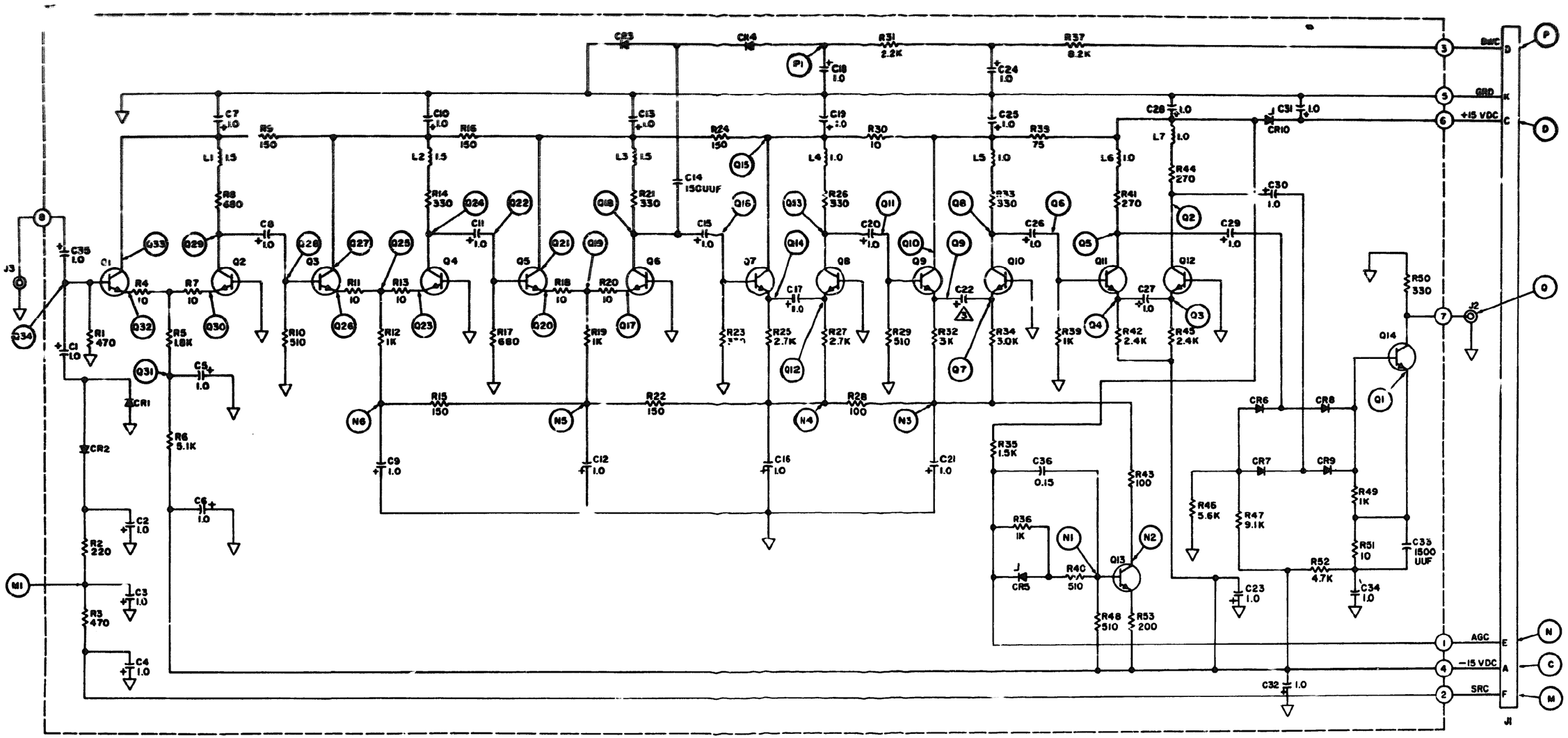


***Figure FO-2. Test** Set, **Radar** Altimeter Module AN/APM422-schematic diagram.*



EL6625-1795-45-TM-22

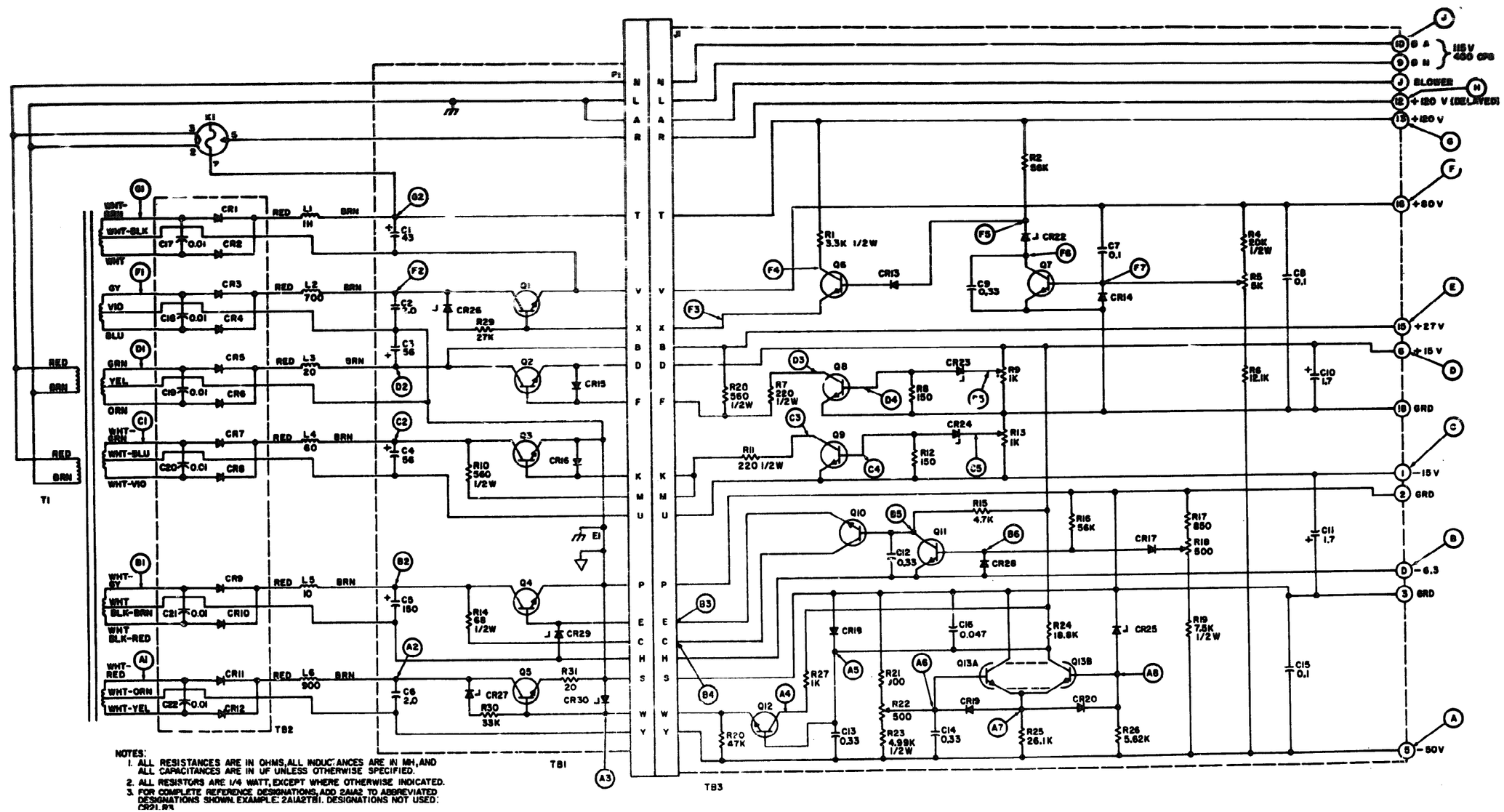
Figure *FO-2. Teat Set, Radar Altimeter Module AN/APM-222-schematic diagram.*



NOTES: 1. ALL RESISTANCES ARE IN OHMS, ALL INDUCTANCES ARE IN MH, AND ALL CAPACITANCES ARE IN UF UNLESS OTHERWISE SPECIFIED.
2. FOR COMPLETE REFERENCE DESIGNATIONS, ADD 2A1A3 TO THE ABBREVIATED DESIGNATIONS SHOWN. EXAMPLE: 2A1A3J2.
3. C22 IS 2200 UUF OR 2400 UUF.

Figure FO-3. I-F amplified assembly--schematic diagram.

EL6625-1795-45TM-24



NOTES:
1. ALL RESISTANCES ARE IN OHMS, ALL INDUCTANCES ARE IN MH, AND ALL CAPACITANCES ARE IN UF UNLESS OTHERWISE SPECIFIED.
2. ALL RESISTORS ARE 1/4 WATT, EXCEPT WHERE OTHERWISE INDICATED.
3. FOR COMPLETE REFERENCE DESIGNATIONS, ADD 2A1A2 TO ABBREVIATED DESIGNATIONS SHOWN. EXAMPLE: 2A1A2TB1. DESIGNATIONS NOT USED: CR21, R9

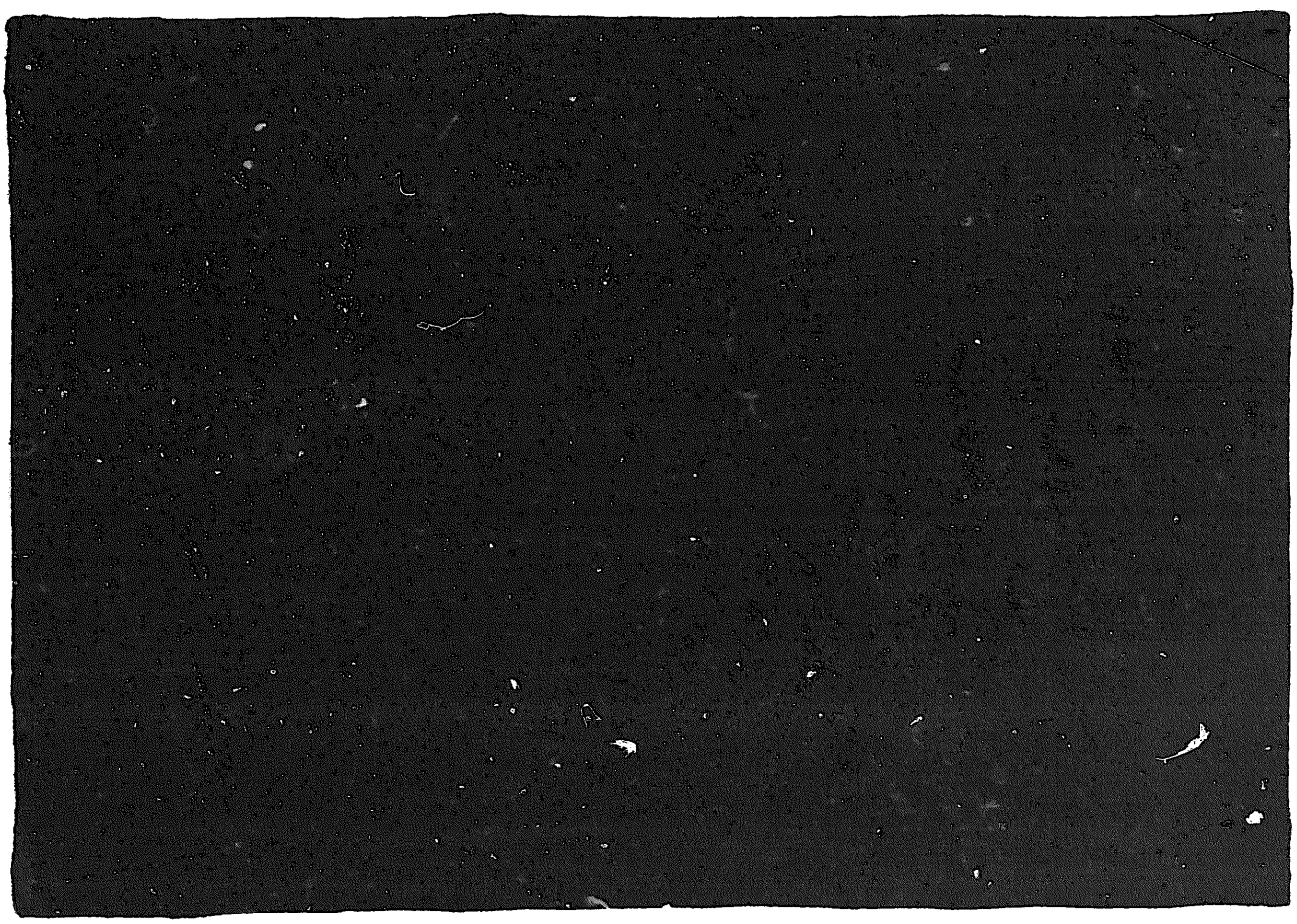
Figure FO-4. Power supply assembly-schematic diagram.

EL 6625-1795-45TM-23

END

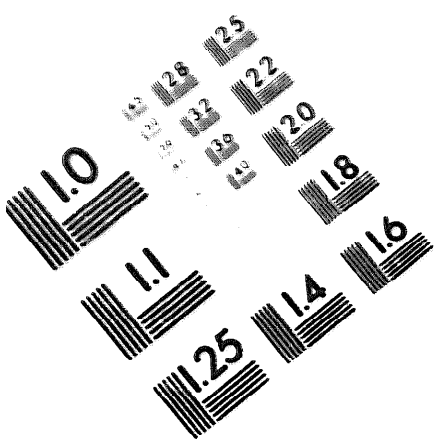
12-25-82

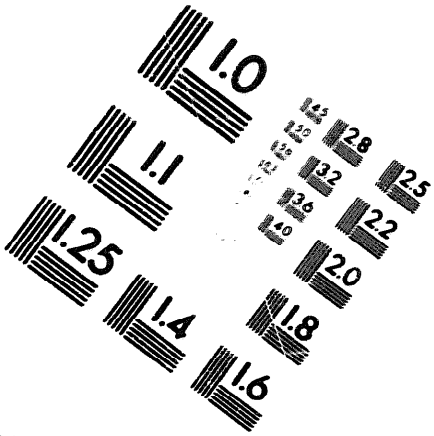
DATE



DEPARTMENT OF THE ARMY

MICROFORM
TEST TARGET





150 MM

1.5 mm (e= 1.09 mm)

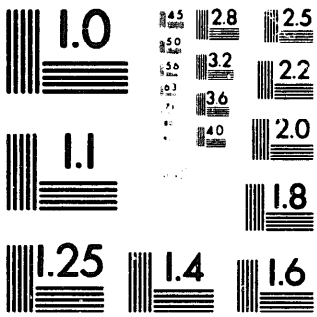
ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
abcdefghijklmnopqrstuvwxyz$¢£/%#½¼¾—=+×&@*

2.0 mm (e= 1.37 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*

2.5 mm (e= 1.77 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*



1.5 mm (e= 1.09 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
abcdefghijklmnopqrstuvwxyz$¢£/%#½¼¾—=+×&@*

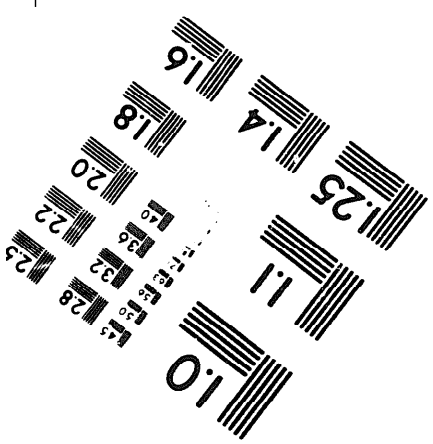
2.0 mm (e= 1.37 mm)

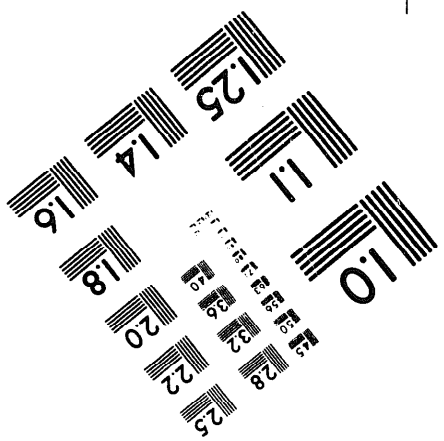
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*

2.5 mm (e= 1.77 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*

200 MM

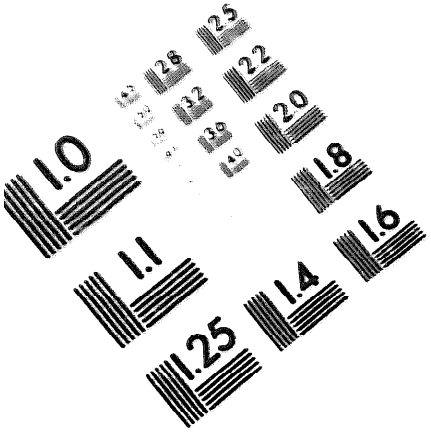


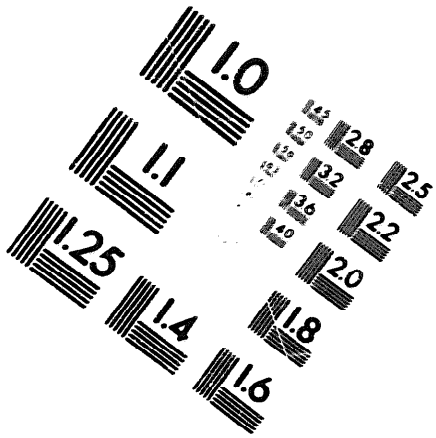


250 MM

DEPARTMENT OF THE ARMY

MICROFORM
TEST TARGET





150 MM

1.5 mm (e= 1.09 mm)

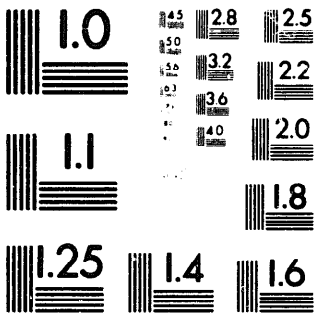
ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
abcdefghijklmnopqrstuvwxyz$¢£/%#½¼¾—=+×&@*

2.0 mm (e= 1.37 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*

2.5 mm (e= 1.77 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*



1.5 mm (e= 1.09 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
abcdefghijklmnopqrstuvwxyz$¢£/%#½¼¾—=+×&@*

2.0 mm (e= 1.37 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*

2.5 mm (e= 1.77 mm)

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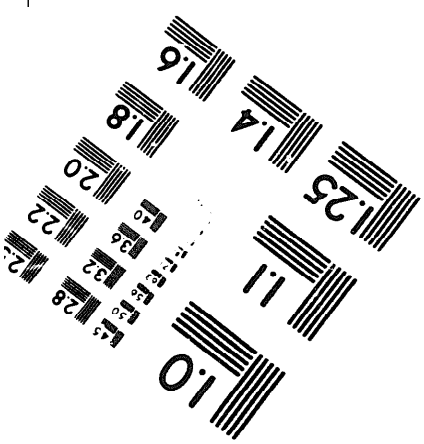
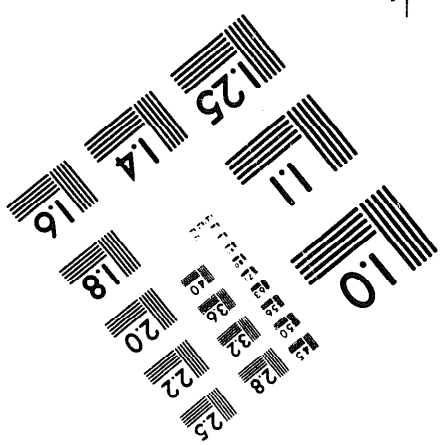
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*

200 MM





250 MM