

TECHNICAL MANUAL

**OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT
MAINTENANCE MANUAL**

**SIGNAL GENERATOR
AN/USM-205A**

(NSN 6625-01-007-4796)

This copy is a reprint which includes current
pages from Changes 1 - 2

Change }
No. 2 }

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 4 December 1981

**Operator's, Organizational, Direct Support,
and General Support Maintenance Manual
SIGNAL GENERATOR AN/USM-205A
(NSN 6625-01-007-4796)**

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No. 1 }

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, 5 January 1977

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For
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7-5 through 7-7	7-5 through 7-10

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NG: None.

USAR: None.

For explanation of abbreviations used, see AR 310-50.

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OPERATOR'S ORGANIZATIONAL, DIRECT AND GENERAL SUPPORT MAINTENANCE MANUAL

SIGNAL GENERATOR AN/USM-205A

(NSN 6625-01-007-4796)

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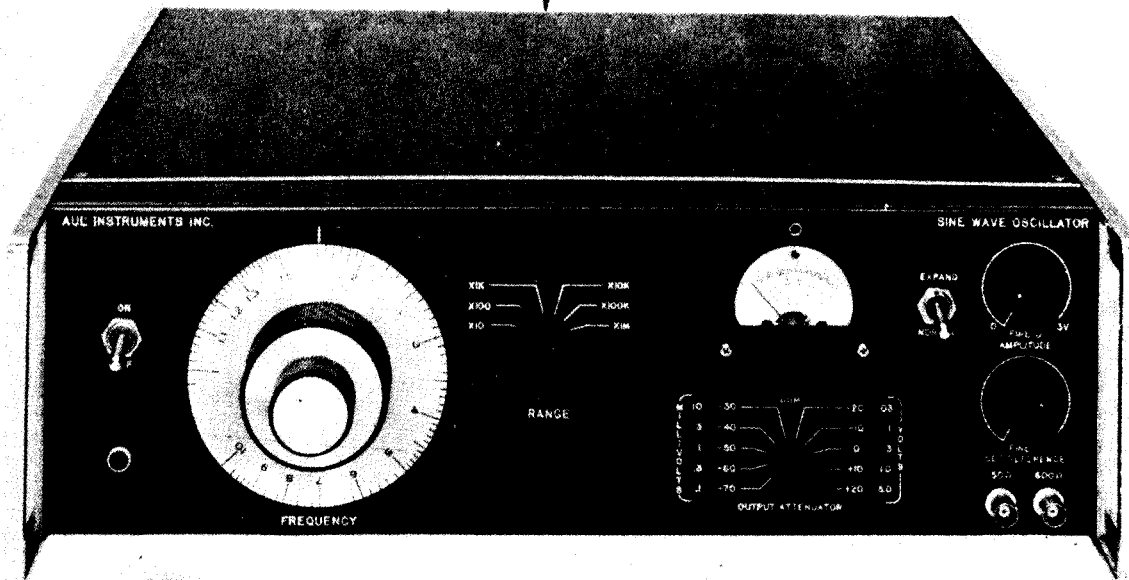
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SIGNAL GENERATOR SG-553A/U



RACK MOUNTING KIT

ELECTRICAL DUMMY LOAD
DA-471/U

EL6625-2644-14-TM-I

Figure 1-1. Signal Generator AN/USM-205A.

CHAPTER I INTRODUCTION

Section I. GENERAL

1-1. Scope

This manual describes Signal Generator AN/USM-205A which is comprised of Signal Generator SG-553A/U and Dummy Load, Electrical DA-471/U (fig. 1-1) and covers the installation, operation, operator's organizational, and general support maintenance instructions for the equipment. Maintenance allocations, test equipment and repair parts and special tools are listed in the appendixes to this manual.

1-2. Index of Technical Publications

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

1-3. Maintenance Forms, Records, and Reports.

a. Reports of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by TM 38-750, The Army Maintenance Management System.

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

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

1-4. Reporting Errors and Recommending Improvements

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) direct to: Commander, US Army Communications-Electronics Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703. In either case, a reply will be furnished direct to you.

1-5. Administrative Storage

Administrative storage of equipment issued to and used by Army activities shall be in accordance with TM 740-90-1.

1-6. Destruction of Army Electronics Materiel

Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

1-6.1. Reporting Equipment Improvement Recommendations (EIR)

If your AN/USM 205A needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Tell us why a procedure is hard to perform. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications Electronics Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703. We'll send you a reply.

Section II. DESCRIPTION AND DATA

1-7. Purpose and Use

Signal Generator SG-533A/U (Signal Generator) part of AN/USM-205A is a general purpose generator used in electronics maintenance shops and laboratories. The unit can be used on a bench or may be rack mounted with the mounting kit provided. The unit is lightweight and may easily be transported if required. The SG-533A/U is used to provide sine wave test signals in the range of 10 hertz (Hz) to 10 megahertz (MHz) with an output level of up to 200 milliwatts into a 50-ohm load or 16 milliwatts into a 600-ohm load.

1-8. Description

The AN/USM-205A is a lightweight, compact unit. The power cord, line voltage selector switch and line

fuse are located on the back panel of the unit. All other operator controls, indicators, and connectors are located on the front panel. The items comprising an operable AN/USM-205A are listed in table 1-1.

1-9. Technical Characteristics

Frequency:

Range 10 Hz to 10MHz, in 6 bands

Dial calibration. 1.10

Dial accuracy. 10 Hz to 100 Hz: $\pm 3\%$

100 Hz to MHz: $\pm 2\%$

1 MHz to 10 MHz: $\pm 3\%$

Distortion 10 Hz to 2 MHz: 1%

2 MHz to 5 MHz: 2%

5 MHz to 10 MHz: 4%

Output:

Power	50 ohms: 200 milliwatts, +23 dbm
	600 ohms: 16 milliwatts
Voltage	50,600 ohms: 3.16 volts
	Open circuit: 6.32 volts
Stability	± 2% per month, + 20°C. to +30°C.
Accuracy amplitude not adjusted	10Hz - 100 Hz: ± 3% 100Hz - 1MHz: ±2% 1 MHz - 10 MHz: ± 4%
Accuracy amplitude readjusted to ref- erence on output modulator	
Range 100 micro volt	10Hz to 20Hz: ± 3% 20Hz to 4MHz: ± 2% 4MHz to 10MHz: ± 3%
Range 300 micro volt to 300 milli- volt	10Hz to 20Hz: ±2.5% 20Hz to 4MHz: ± 1.5% 4MHz to 10MHz: ± 2.5%
Range 1 volt to 3 volts	10Hz to 20Hz: ± 2% 20Hz to 4MHz: ± 1% 4MHz to 10MHz: ±2%
Impedance	50 ohms and 600 ohms with BNC connectors
Hum and noise	Less than 0.05% of max- imum output

Attenuator:

Range	90db in 10 db steps
Accuracy	
-60 dbm to +20 dbm	± 0.075 db
±70dbm to -60 dbm	± 0.2 db

Amplitude control.	20 db, coarse and fine
Meter:	
Normal scale	0 to 1.0 volt rms; 0 to 3.2 volts rms
Calibration	-15 dbm to + 3 dbm
Accuracy	2%
Expanded scale calibra- tion	0, ± 2.5% with 0.1% in- crements
Frequency response:	
100 microvolt range	±1.75%
316 microvolt-316 millivolt range	±0.75%
1.0 volt to 3.16 volt range	±0.25%
Operating temperature	0°C. to 50°C.
Power requirements	115 volts ac ± 10% or 230 volts ac ± 10% 50 – 400 Hz

1-10. Items Comprising an Operable End Item

Refer to table 1-1 for items comprising an operable Signal Generator AN/USM-205A.

Table 1-1. Items Comprising an Operable AN/USM-205A

Qty	NSN	Item	Dimensions(in.)		Weight (lbs)
			Height	Depth	
1		Signal Generator SG-553A/U	57/32	13 1/4	16 3/4 17
1		Dummy Load, Electrical DA-471/U			
1		Rack Mounting Kit			

CHAPTER 2

SERVICE UPON RECEIPT OF EQUIPMENT AND INSTALLATION

2-1. Unpacking
(fig. 2-1)

a. Packing Data. The signal generator is packed for shipment in a corrugated carton. The technical manual and accessories are packed in a separate corrugated carton. An exploded view of the method of packing is shown in figure 2-1.

b. Unpacking Signal Generator.

(1) Open corrugated carton and fold back top flaps.

(2) Remove envelope that contains technical manuals; open envelope and remove technical manuals.

(3) Remove top pad, rear pad, left and right side pads, and front frame.

(4) Remove signal generator from corrugated carton.

c. Unpacking Accessories.

(1) Open corrugated carton and fold back top flaps.

(2) Remove accessories from carton.

2-2. Checking Unpacked Equipment

a. Inspect the equipment for damage. If the

equipment has been damaged, report the damage on DD Form 6, refer to paragraph 1-3.

b. Check the equipment against the packing list. When no packing list accompanies the equipment, use table 1-1. If the equipment is incomplete, refer to procedures given in paragraph 1-3.

2-3. Installation of Equipment

a. Rack Mounting. The signal generator is ready for bench operation. If it is to be rack mounted, the necessary hardware is contained in the rack mounting kit. To convert to rack mounting installation, proceed as follows:

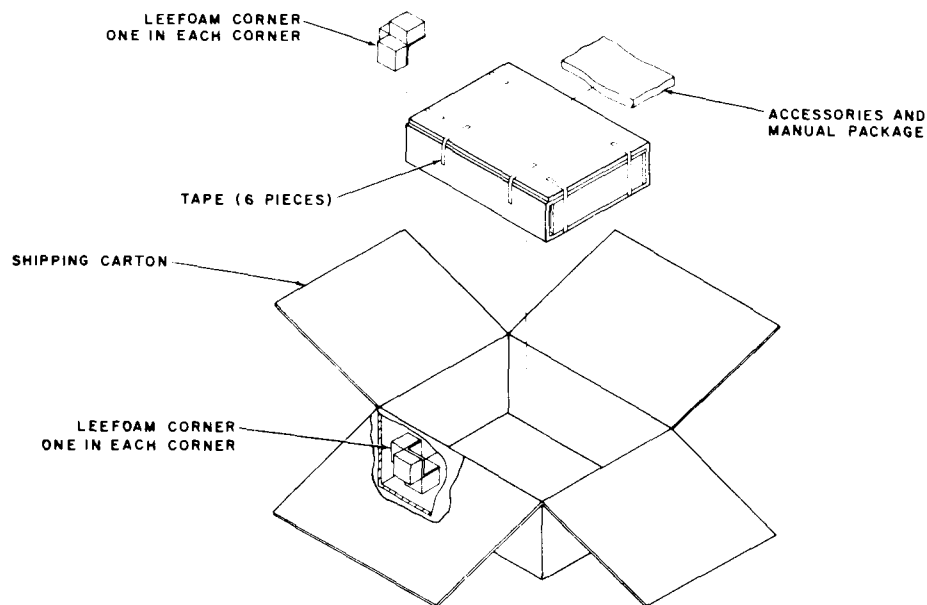
(1) Remove four rubber feet and instrument bail from the signal generator.

(2) Remove filter panels from both sides of signal generator.

(3) Install rack mounting brackets using No. 10 screws provided in rack mounting kit.

(4) Secure the signal generator in a standard 19-inch rack.

b. Power Requirements. The signal generator may be operated from either 115-volt ac power or



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Figure 2-1. Signal Generator AN/USM-205A, packaging diagram.

230-volt ac power. A switch is provided on the rear panel for quick conversion. For 115-volt ac operation, set the switch to the UP position (115 showing). For 230-volt ac operation, set the switch to the DOWN position (230 showing).

CAUTION

For 230-volt ac operation, the line fuse must be changed to a 230-volt 1/8-ampere slow-blow fuse.

CHAPTER 3

OPERATING INSTRUCTIONS

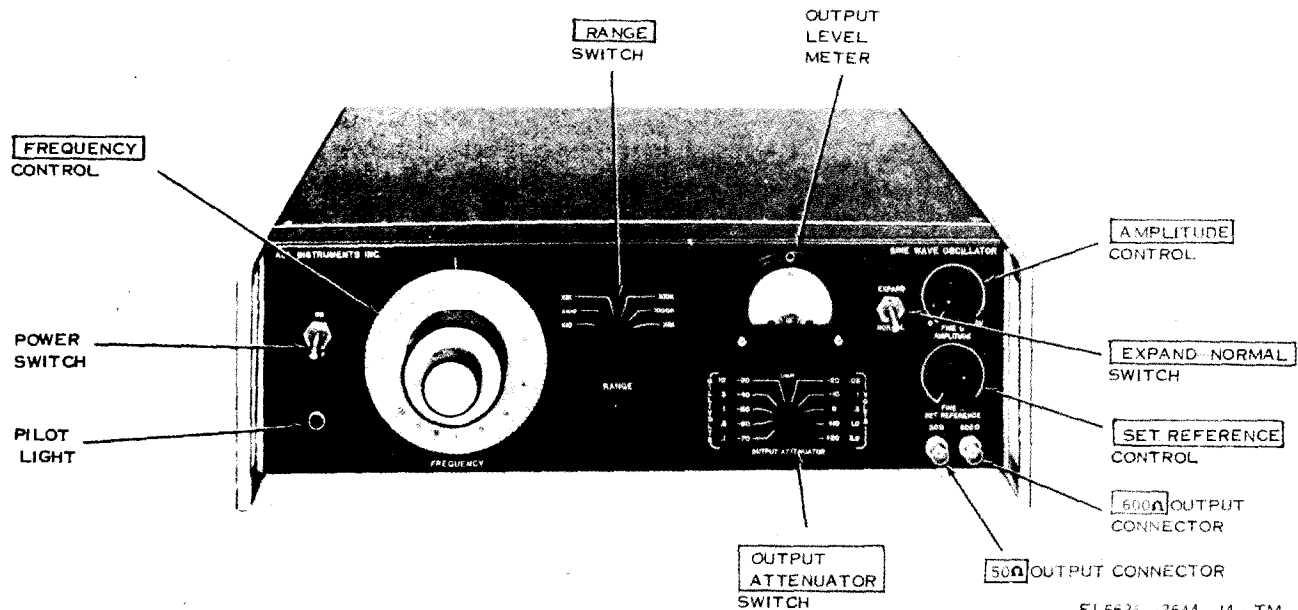
3-1. Operator Controls

Location of operator controls, indicators, and connectors are shown in figure 3-1.

Table 3-1. Operating Controls, Indicator and Connectors

Control or indicator	Function
Power switch	Applied power to signal generator.
FREQUENCY control	Concentric coarse and fine control. Varies frequency of oscillator between steps of RANGE switch.
RANGE switch	Selects one of six frequency ranges from 10 Hz to 1 MHz.
Pilot light	Lights to indicate power applied to signal generator.
Output level meter	Continuously monitors sine-wave output level in terms of full scale, as marked on OUTPUT ATTENUATOR

Control or indicator	Function
EXPAND-NORMAL switch	Toggle switch selects expanded or normal output level meter readings. In EXPAND position, output level meter indicates full-scale deflection with a difference in sine-wave amplitude of 5% from initial setting.
AMPLITUDE control	Controls amplitude of signal generator output.
OUTPUT ATTENUATOR switch	Attenuates sine-wave output in 10 db steps from +20 to -70 db. Marked also in corresponding full-scale voltage levels.



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Figure 3-1. Signal Generator SG-558A/U, operating controls and indicators.

Control or indicator	Function
50 ohms and 600 ohms output connectors	Provides output at impedance levels of 50 and 600 ohms.
SET REFERENCE control	Concentric coarse and fine controls for adjustment of precise output level, when in expanded meter mode (EXPAND-NORMAL switch in EXPAND position).
115/230 switch (not shown)	Enables operator on either 115 volts ac or 230 volts ac from 50-400 Hz. (fig. 4-1).
FUSE (not shown)	Protects signal generator, (fig. 4-1).

3-2. Starting Procedure

To energize the signal generator, set the power switch to ON.

3-3. Operation

a. Set RANGE switch FREQUENCY control, and OUTPUT ATTENUATOR switch to desired settings, AMPLITUDE control to mid-range, and EXPAND-NORMAL switch to NORMAL.

b. Set power switch to ON. The pilot light illuminates.

c. Connect jack to the 50 ohms or the 600 ohms output connector.

d. Adjust the AMPLITUDE control to desired output voltage level from 0 to 3V as indicated of output level meter.

NOTE

The 3V position indicates 3V rms output when working into a matched load. With an unmatched load, the maximum output level is 6V rms. (approximately 10V P-P).

e. If desired, set EXPAND-NORMAL switch to EXPAND. Vary SET REFERENCE control. The output level meter will indicate a level change accordingly.

3-4. Output Level Meter Readings

The output level meter indicates the rms value of the output voltage, and the power level in dbm for resistive loads of 50 ohms. The output voltage level is obtained by multiplying the monitor scale readings by the monitor scale multiplier which appears on the OUTPUT ATTENUATOR switch. Use the following equation and the impedance correction graph of figure 3-2 to obtain the output power level in dbm, for loads other than those marked on the output connectors.

$$\text{Output Voltage} = \frac{R_L}{R_L + R_s} \times 2V_m$$

Where,

R_L = Load Resistance (Terminating Resistance)

R_s = Source Resistance (Output Impedance of Oscillator)

V_m = Output Level Meter Reading

Problem: A 600 ohm load is placed on the 50 ohms output connector. The output level meter indicates an output of 0.9 volt, with the OUTPUT ATTENUATOR set on the 1.0 volt (+10 dbm) range. Find the actual output voltage and power level (in dbm).

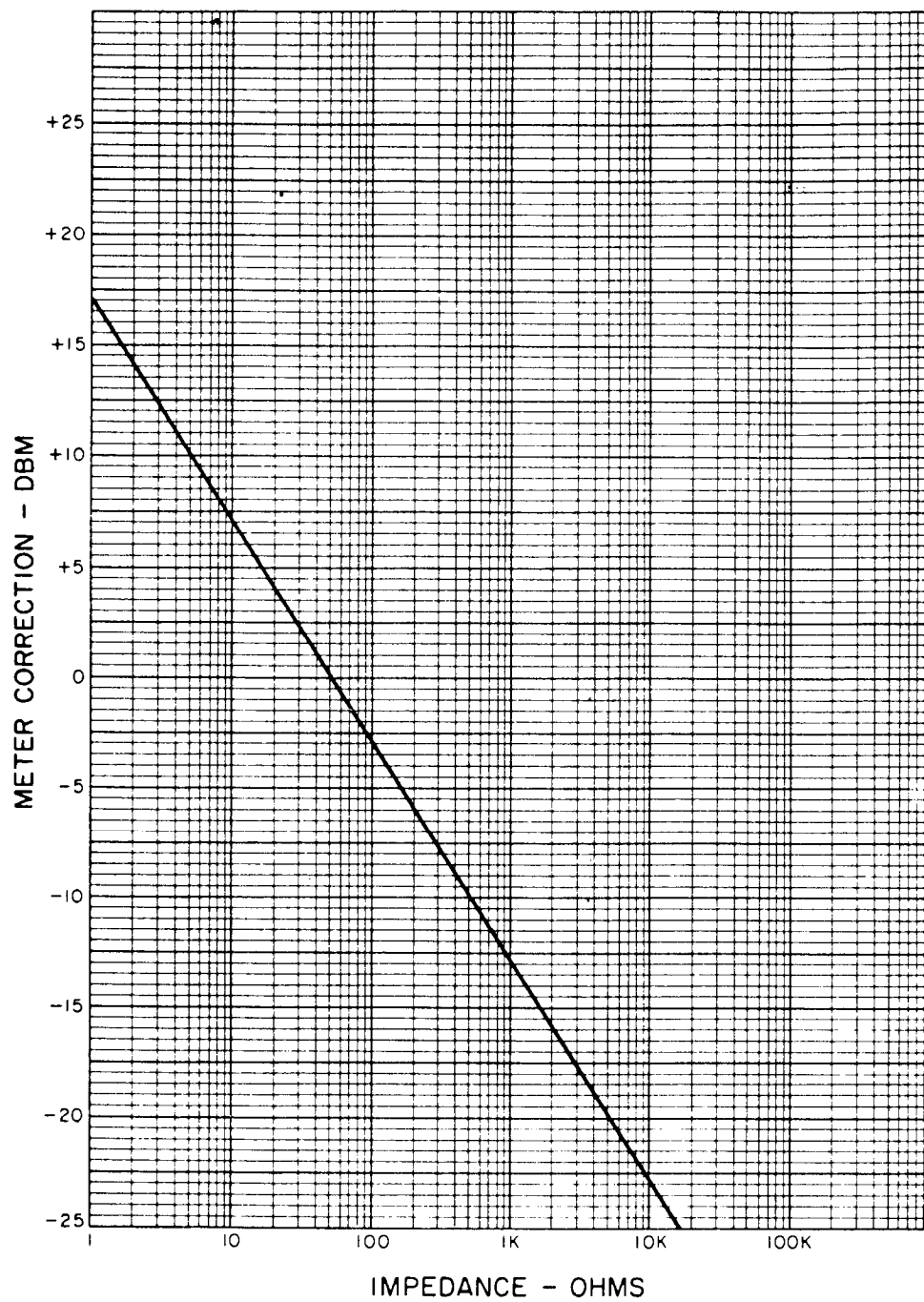
Solution: The actual output voltage is calculated as follows:

$$\text{Output Voltage} = \frac{600}{600 + 50} \times 2 (0.9) = 1.66 \text{ volts}$$

The indicated power level would be 17.3 dbm for an output voltage of 1.66 volts on the 3.0 volts (+20 dbm) range. The actual power level is the algebraic sum of the indicated power level and the correction factor obtained from the impedance graph of figure 3-2. For this example a correction of - 10.8 dbm is obtained for a 600 ohms load. The actual power level is + 6.5 dbm (17.3 dbm + (-10.8 dbm)).

3-5. Stopping Procedure

To deenergize the signal generator, set the Power switch to OFF.



EL6625-2644-14-TM-23

Figure 3-2. Impedance correction graph.

CHAPTER 4

OPERATOR/CREW AND ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. OPERATOR AND ORGANIZATIONAL TOOLS AND EQUIPMENT

4-1. Common Tools and Equipment

Tools and test equipment used by the operator and organizational repairman for the signal generator are listed in appendix B.

4-2. Special Tools and Equipment

No special tools are required for maintenance.

4-3. Lubrication Instructions

No lubrication instructions are required.

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

4-4. General

Preventive maintenance is the systematic rare, servicing, and inspection of equipment to prevent the occurrence of trouble, to reduce downtime, and to assure that the equipment is serviceable. The necessary preventive maintenance checks and services to be performed are listed and described in tables 4-1, 4-2, and 4-3. Item numbers indicate the sequence of minimum inspection requirements. Defects discovered during operation of the unit will be noted for future correction, to be made as soon as operation has ceased. Operation shall be stopped immediately if a deficiency is noted which would damage the equipment. Record all deficiencies together with corrective action taken as prescribed in TM 38-750.

4-5. Scope of Operator's Maintenance

The maintenance duties assigned to the operator of the signal generator are listed below.

a. Daily preventive maintenance checks and services (table 4-1).

b. Weekly preventive maintenance checks and services (table 4-1).

c. Cleaning (para 4-8).

d. Troubleshooting (table 4-4).

e. Repairs.

(1) Replacement of pilot light (para 4-11).

(2) Replacement of fuse (para 4-12).

4-6. Systematic Care

The procedures given in tables 4-1 through 4-3, along with paragraphs 4-8 and 4-9, cover routine systematic care and cleaning essential to proper upkeep of this equipment when it is used separately. When this equipment is used as part of a set or system, follow the procedures established in the set or system manual.

4-7. Preventive Maintenance Checks and Services Periods

Preventive maintenance checks and services of the signal generator are required daily, weekly, monthly, and quarterly.

a. Table 4-1 specifies checks and services that must be accomplished daily and under the special conditions listed below:

(1) At least once each week if the equipment is maintained in standby condition,

(2) When the equipment is initially installed.

(3) When the equipment is reinstalled after removal for any reason.

b. Tables 4-1 through 4-3 specify additional checks and services that must be performed on a weekly, monthly, and quarterly basis, respectively.

c. To assist in maintaining combat serviceability, the tables indicate what to check, how to check, and what normal conditions are. References included are to illustrations, paragraphs, or manuals that contain detailed repair or replacement procedures. If the defect cannot be remedied by performing the corrective actions indicated, higher maintenance category repair is required.

Table 4-1. Operator/Crew Preventive Maintenance Checks and Services
D-Daily
Time Required: 0.4
W-Weekly
Time Required:

<i>Interval and sequence No. D W</i>	<i>Item to be inspected Procedure</i>	<i>Work time (M/H)</i>
1	EXPOSED ITEMS Clean exposed surfaces of case and control panel (para 4-8).	0.1
2	CONTROLS Check that mechanical action of each knob, switch, and control is smooth and free of binding and no excessive looseness is apparent.	0.1
3	OPERATION Perform operating procedures given in paragraph 3-3.	0.2
1	POWER CORD Inspect cord for chafed, cracked, or frayed insulation. Replace cord that is stripped or worn excessively.	0.05
2	HARDWARE Inspect all exterior hardware for looseness and damage. All screws must be tight and not damaged.	0.5
3	METAL SURFACES Inspect exposed metal surfaces for rust and corrosion. Clean and touch up paint as required (para 4-10).	0.5

Table 4-2. Organizational Preventive Maintenance Checks and Services
M-Monthly
Total man-hours required: 0.4

<i>Sequence number</i>	<i>Item to be inspected Procedure</i>	<i>Work time (M/H)</i>
1	PLUCKOUT ITEMS Inspect seating of pluckout items. Do not remove, rock, or twist to inspect; use only direct pressure to ensure item is fully seated (table 4-4),	0.2
2	CONNECTORS Inspect connectors for snug fit and good contact.	0.1
3	TRANSFORMER Inspect terminals on power transformer. No dirt or corrosion should be evident (para 4-8).	0.1
4	TERMINAL BLOCKS AND COMPONENTS BOARDS Inspect for loose connections and cracked or broken insulation.	0.1

Table 4-3. Organizational Preventive Maintenance Checks and Services
Q—Quarterly
Total man-hours required: 0.5

<i>Sequence number</i>	<i>Item to be inspected Procedure</i>	<i>Work time (M/H)</i>
1	PUBLICATIONS See that all publications are complete, serviceable, and current (DA Pam 310-4).	0.5
2	MODIFICATIONS Check DA Pam 310-7 to determine if new applicable MWOs have been published. All urgent MWOs must be applied immediately. All normal MWOs must be scheduled (TM 38-750 and DA Pam 310-7).	
3	SPARE PARTS Check all spare parts (operator/crew and organizational) for general condition and method of storage. No overstock should be evident and all shortages must be on valid requisitions.	

4-8. Cleaning

Inspect the exterior surfaces of the signal generator; exterior surfaces should be clean, free of dust, dirt, grease and fungus.

a. Remove dust and loose dirt with a clean, soft cloth.

WARNING

The fumes of trichloroethane are toxic. Provide thorough ventilation whenever used. **DO NOT USE NEAR AN OPEN FLAME.** Trichloroethane is not flammable, but exposure of the fumes to an open flame or hot metal forms highly toxic phosgene gas.

b. Remove grease, fungus, and ground-in dirt

from the case; use a cloth dampened (not wet) with trichloroethane (NSN 6810-00-292-9625).

c. Remove dust or dirt from connectors with a brush,

d. Clean the front panel and control knobs; use a soft, clean cloth. If dirt is difficult to remove, dampen the cloth with water; use mild soap if necessary.

4-9. Touchup Painting

Remove rust and corrosion from metal surfaces by lightly sanding them with fine sandpaper. Brush two thin coats of paint on the bare metal to protect it from further corrosion. Refer to applicable cleaning and refinishing practices specified in TB 746-10.

Section III. TROUBLESHOOTING

4-10. General Troubleshooting Information

Troubleshooting this equipment is based upon the operational check contained in the daily preventive maintenance checks and services table. To troubleshoot the equipment, perform all functions in table 4-1 and proceed through the items until an abnormal condition or result is observed. When an abnormal condition or result is observed, note the trouble and sequence number and go directly to the corresponding trouble in the troubleshooting table 4-4. Perform the checks and corrective actions indicated in the troubleshooting table. If the corrective measures indicated do not result in correction of the trouble, higher maintenance category repair is required. Paragraphs 4-12 and 4-13 (referenced in table 4-4) contain additional information and step-by-step instructions for performing equipment tests and repairs to be used during the troubleshooting procedures.

4-11. Replacement of Pilot Light

When the signal generator operates normally but the pilot lamp does not illuminate, the pilot lamp is probably defective. Replace the pilot lamp with one known to be good. If the pilot lamp still does not illuminate, higher maintenance category re-

pair is required. Replace the pilot lamp as follows:

- a.* Remove top cover.
- b.* Unsolder two leads on rear of pilot light.
- c.* Remove speed nut from rear of pilot light.
- d.* Remove pilot light and replace it with a new one.
- e.* Replace speed nut and solder leads to terminal posts.

4-12. Replacement of Fuse (fig. 4-1)

If the signal general is completely inoperative (pilot lamp does not illuminate and output level meter pointer does not deflect), the fuse is probably defective. Replace the defective fuse with a new one. If the new fuse blows when the power is applied, higher maintenance category repair is required.

- a.* At the rear of the signal generator, turn the fuseholder cap counterclockwise to unlock.
- b.* Pull out the fuseholder cap with the defective fuse. Remove the defective fuse and replace it with a new one.
- c.* Insert the fuseholder cap, with the new fuse into the fuseholder. Press in on the fuseholder cap and turn in clockwise to lock.

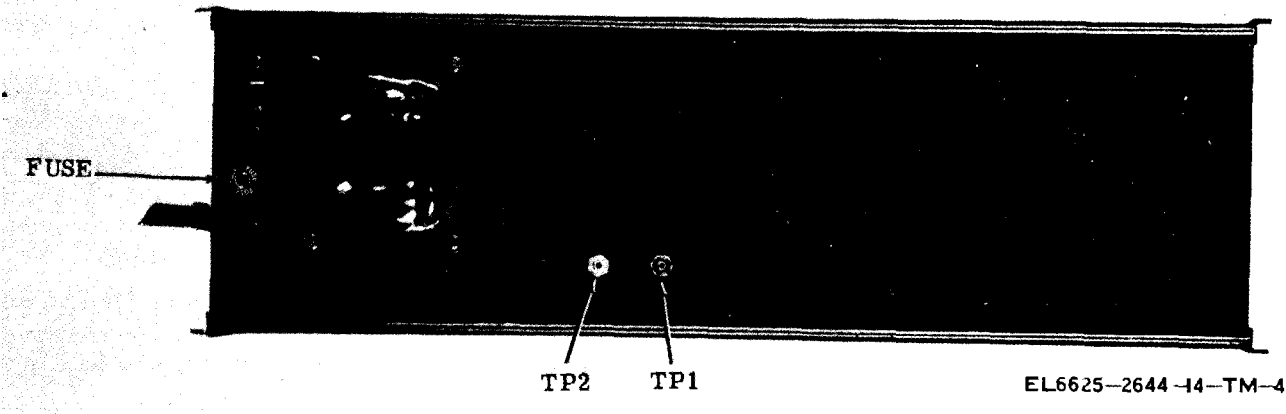


Figure 4-1. AN/USM-205A, rear view, location of fuse.

Table 4-4. Organizational Troubleshooting

<i>Malfunction</i>	<i>Probable cause</i>	<i>Corrective action</i>
a. Power pilot lamp does not light.	a. Defective lamp DSI or blown fuse F1.	a. Replace lamp DSI or fuse F1 (para 4-11 and 4-12).
b. No output signal (power pilot lamp lights).	b. Defective signal generator.	b. Higher maintenance category.
c. With amplitude control fully clockwise, output signal amplitude low (less than 30 volts).	c. Defective signal generator.	c. Higher maintenance category.

CHAPTER 5

FUNCTIONING

5-1. Block Diagram Description (fig. 5-1)

a. The signal generator contains a Wein bridge type oscillator whose output frequently is controlled by the front panel FREQUENCY and RANGE switches. The resultant selected output is applied to an output amplifier circuit which develops the required drive. The amplifier output is applied to the front panel 50 ohms and 600 ohms connectors via an output attenuator circuit whose value of inserted resistance in the signal path is controlled by the front panel OUTPUT ATTENUATOR switch.

b. An indication of the output level is indicated on the front panel output level meter. The meter receives an input from the output amplifier via an expanded meter circuit. The expanded meter circuit is controlled by the front panel EXPAND-NORMAL switch. In the EXPAND position, the output level meter indicates full scale deflection with a difference in sine wave amplitude of 5% from initial setting.

5-2. Oscillator Amplifier Circuit Analysis (figs. 5-2 and FO-2)

a. The base of Q2 is the non-inverting (+)

input of a differential amplifier, and the base of Q3 is the inverting (-) input. The FET drain resistance is the effective sum of resistors R6, R7, and R8 and is controlled by control amplifier AR2 input to FET Q8.

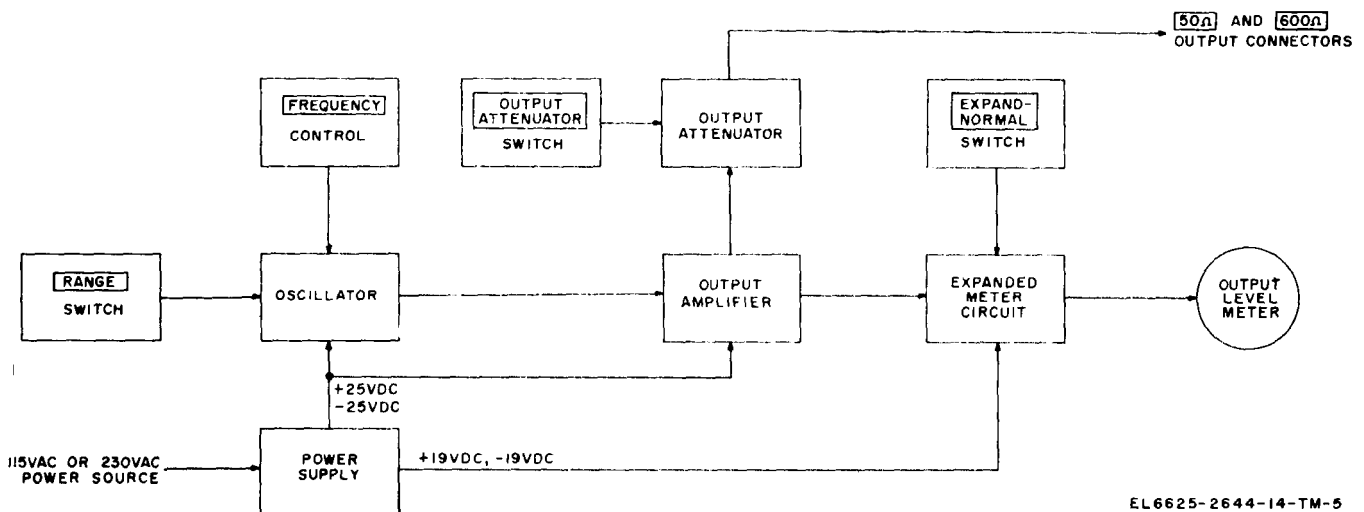
b. The output level of AR2 is established by the setting of the amplitude control potentiometer R39, at the noninverting (+) input.

c. The inverting (-) input is driven by the peak detector, CR5. The dc level at the (-) input is determined by the amplitude of the oscillator amplifier output. If the output of the oscillator increases, C13 charges through CR5, to a proportionally higher positive voltage. This positive going voltage is applied to the (-) input, causing a negative going level at the output which reduces the conductivity of FET Q8.

d. CR8 and CR9 (fig. FO-2) serves as temperature compensation for CR4 and CR5 in the (-) input side of ARI.

e. FET Q1 is inserted into the circuit on the X10, X100, X1K, and X10K ranges, in order to isolate the high resistance values in the tuned circuit from the relatively low input impedance of the oscillator amplifier.

f. FB1 and FB2 are ferrite beads, which serve to decouple the power supply by suppressing any



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Figure 5-1. AN/USM-205A, overall block diagram.

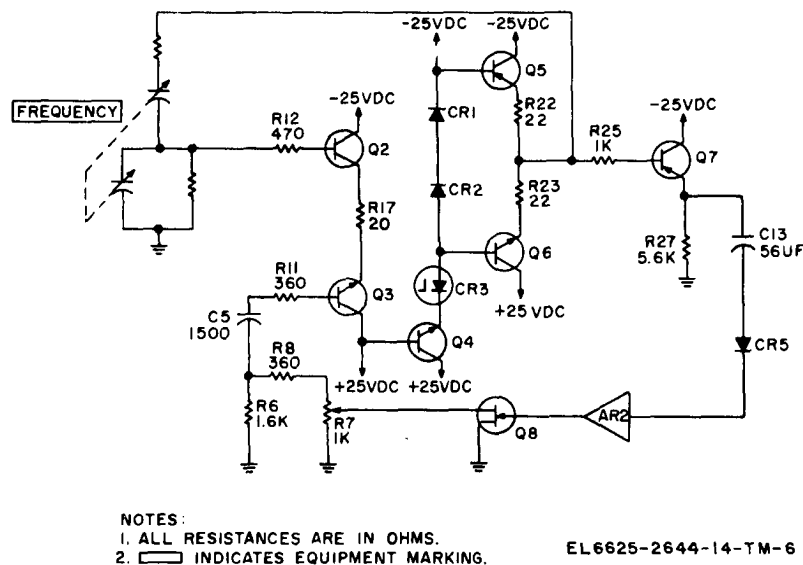


Figure 5-2. Modified Wein bridge oscillator simplified schematic diagram.

parasitic oscillations, which might be present in the circuit.

g. The output of the oscillator amplifier is applied across the amplitude control potentiometer, the arm of which is connected to the input of the output amplifier.

5-3. Output Amplifier Circuit Analysis (figs. 5-3 and FO-2)

a. Basically, the output amplifier consists of a complementary-pair output stage, each side of which is driven by a differential amplifier.

b. The emitters of Q20 and Q21 are essentially at 0 volt dc and are wired so that Q20 will conduct on a positive drive signal, and Q21 will conduct on a negative drive signal.

c. Considering the positive portion of the amplifier, and assume a positive going signal at the input to Q13, and the base of Q12 as being grounded. Because the signal is inverted through Q13, but not through Q12, the result is that Q16 and Q17 are driven out of phase, but in a direction to cause them both to conduct. This results in a high impedance source for Q20, which in turn improves the linearity of Q20 and greatly reduces cross-over distortion.

d. The signal at the emitter of Q20 is in phase with the input signal, and is fed back to the base of Q13. Q13, therefore, is driven in two directions at once; i.e., driving the base positive tends to drive it harder, and driving the emitter positive at the same time tends to cut it off. Thus, the output from the collector of Q13 is a

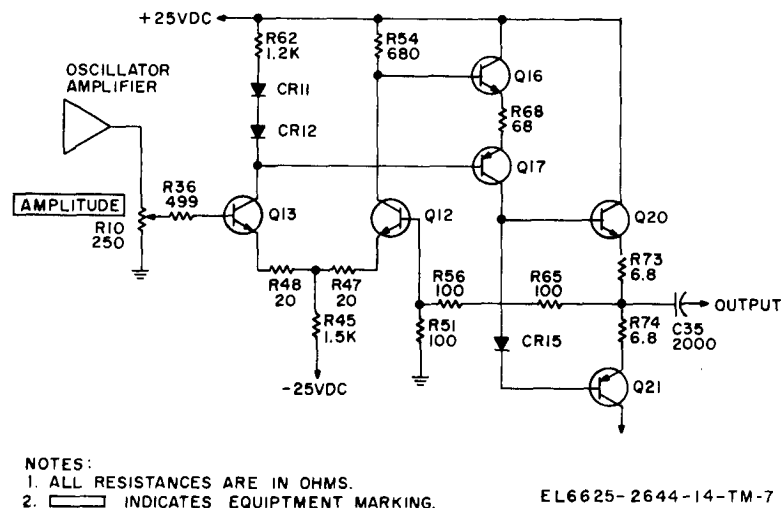


Figure 5-3. Output amplifier, simplified schematic diagram.

function of the difference between the two driving signals. The negative portion of the output amplifier is identical to the positive portion.

e. Under a no-signal condition, Q16 and Q17 conduct slightly. CR15 is a stabistor which equals three diodes in series, all of which are matched, so their voltage drops at any given amount of current are equal and constant over a wide range of current. The drop across CR15 is sufficient to forward-bias output transistors, Q20 and Q21. This assures conduction in Q20 immediately as Q21 becomes cut-off, thus eliminating any cross-over distortion.

f. The output signal is coupled through C35 to the attenuator, and at the same time applied to a feedback divider, R56, R65, and R51. The portion of the signal developed across R51 is applied to the base of Q12 as negative feedback, as discussed above.

5-4. Power Supplies Circuit Analysis (fig. FO-2)

a. All the power supplies are located on the same circuit board as the output amplifier. Four different supplies are used; +25 and -25 volts, +19 and -19 volts.

b. All power supplies are regulated, and all are slaved to the +25 volt supply. The positive and the negative supplies are identical in operation; therefore only the positive power supplies will be discussed.

c. Regulation of the +25 volt supply is accomplished by the passing transistor, Q2. The output voltage is divided down through R23, R24 and R25 to provide a variable input to the inverting (-) input of differential amplifier AR1.

d. The output voltage is also the source for Q7, which is connected as a Zener diode. Q7 breaks down at 6.7 volts and thus keeps a constant voltage at the non-inverting (+) input to AR1.

e. A drop in output voltage causes a less positive voltage at the (-) input to AR1, which results in a more positive voltage at the output (pin 6) of AR1. This voltage is applied to the gate of FET Q3, causing it to conduct more, which pulls the base of Q3 negative. This results in increased conduction through Q2, which raises the output. CR5 and CR6 establish the necessary positive and negative supplies for the integrated circuits, AR1 and AR2.

f. The +25 volts supply is used as the supply for the +19 volts supply. CR9 is a 20 volt Zener, which holds the base of Q9 at a constant voltage. Q9 acts as an emitter follower to supply base current to Q8, which also acts as an emitter

follower, capable of supplying the current for the circuits driven by the 19 volts supply.

5-5. Output Level Meter Circuit **Analysis** (fig. FO-2)

a. The meter circuit is essentially a linear, wide-band ac amplifier, the output of which is rectified and applied to a voltmeter.

b. The sine wave from the output amplifier is fed into the base of Q3, which is an emitter follower. Q3 in turn drives Q2, which can be considered as a common-base amplifier for the input signal.

c. Q2 is a current source for Q2 and Q3, therefore, the input to the rectifier is a very high impedance source, greatly improving the linearity of the meter. Q4 provides a high impedance feedback path for stabilization of the amplifier.

d. CR1 and CR2 act as temperature compensation diodes for the emitter-base junctions of Q2 and Q3. CR3, likewise, compensates for the emitter-base junction of Q1.

5-6. Expanded Meter Circuit Analysis (figs. 5-4 and FO-2)

a. The expanded meter circuit consists of two separate circuits, a reference voltage supply and a comparator-amplifier to drive the meter, when the EXPAND mode is selected.

b. The reference supply is a standard three-stage series voltage regulator, the output of which is determined by the setting of the REFERENCE SET adjustments (FO-2). The output is adjustable from approximately +12.7 volts to +15.3 volts.

c. The comparator-amplifier continuously compares the set reference voltage to the average value of the output from the output amplifier.

d. The incoming ac signal is coupled through a peaking network, L1, R19, and C19 (fig. 5-4). This network is only effective at the higher frequencies. CR7 rectifies this signal charging C18 and C21 to some average value. The voltage from C18 and C21 is applied to the noninverting (+) input of the differential amplifier, AR1. The inverting (-) input is driven by the set reference voltage (E ref). The two signals are compared, and any difference between the two is amplified by a factor determined by the ratio of resistors R27 and R28.

e. In this case, the gain of the amplifier is 2. Because the reference supply can be varied from 12 to 15 volts, the noninverting input signal range cannot be any more than from 6 to 7.5 volts. If

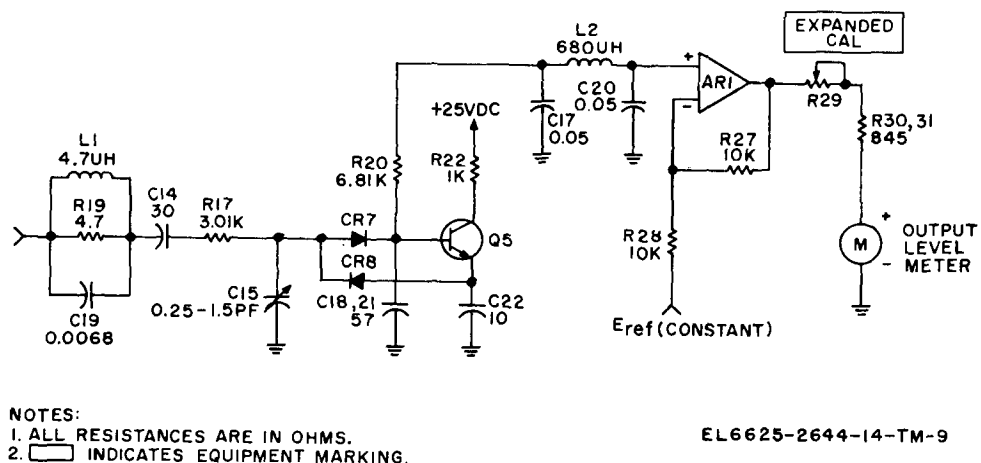


Figure 5-4. Expanded meter circuit, simplified schematic diagram.

the range is more than that, the amplifier cannot balance itself. This range is the average value corresponding to an ac output of approximately 2.8 to 3.2 volts. Therefore, the SET REFERENCE controls on the front panel can be adjusted for a 0% indication on the EXPAND scale of the output level meter, as long as the output is within this range. This then enables any changes in output level to be read directly in terms of % of reference setting. Maximum range is $\pm 2.5\%$ of setting.

5-7. Output Attenuator Circuit Analysis (fig. FO-2)

a. The OUTPUT ATTENUATOR switch selects a combination of resistive delta networks to produce a given amount of attenuation. The total -90 db attenuation is switched in a 10-20-30-30 configuration.

b. The resistor values are selected in such a manner that the impedance of any combination of delta networks equals 50 ohms at both the input and the output, and at the same time provides the desired amount of attenuation.

CHAPTER 6

GENERAL SUPPORT MAINTENANCE

Section I. GENERAL

6-1. Scope

The procedures for troubleshooting and general support maintenance of the signal generator are outlined in subsequent sections of this chapter. Where applicable, the procedures include instructions for making voltage and resistance measurements and instructions for replacing components when the procedure is not obvious. When making voltage and resistance measurements, observe the instructions in paragraph 6-2. Figures 6-1 and 6-2 illustrate component locations.

6-2. Voltage and Resistance Measurements

WARNING

Be very careful when handling or testing

any part of the signal generator while it is connected to the power source. Certain points throughout the chassis operate at voltages to 230 volts. Do not touch these points while power is being applied to the signal generator.

Make all voltage and resistance measurements using Multimeter TS-352/U, or equivalent, at the points specified in the troubleshooting table. To make measurements that are not specified in figures 6-3 and 6-4, refer to the appropriate schematics and wiring diagrams to determine the test point desired.

Section II. GENERAL SUPPORT TOOLS AND TEST EQUIPMENT

6-3. Tools and Test Equipment

Tools and test equipment required for troubleshooting the signal generator are listed in table 6-1, below.

6-4. Special Tools and Equipment

No special tools or equipment are required.

Table 6-1. General Support Tools and Test Equipment

<i>Item</i>	<i>Common name</i>
Counter, Electronic, Digital Readout AN/USM-207	Frequency counter
Voltmeter, Electronic ME-202/U	Voltmeter
Oscilloscope, AN/USM-281	Oscilloscope

Section III. TROUBLESHOOTING

6-5. Organization of Troubleshooting Procedures

a. General. The first step in servicing a defective signal generator is to sectionalize the fault. Sectionalization means tracing the fault to one of the major circuits responsible for the abnormal operation. The second step is to localize the fault. Localization means tracing the fault to a particular stage or network within one of the major circuits. The third step is to isolate the fault. Isolation means tracing the fault to the defective

part responsible for the abnormal condition. Some faults, such as burned-out resistors, arcing, and shorted transformers often can be located by sight, smell, and hearing. The majority of faults, however, must be isolated by checking voltages and resistances.

b. Component Sectionalization, Localization, and Isolation. Listed below is a group of tests arranged to simplify and to reduce unnecessary work and to aid in tracing a trouble to a specific component. Follow the procedure in the sequence

given. A serviceman must be careful not to cause further damage to the signal while it is being serviced.

(1) *Visual inspection.* The purpose of visual inspection is to locate faults without testing or measuring circuits. All visual signs should be observed and an attempt made to sectionalize the fault to a particular function.

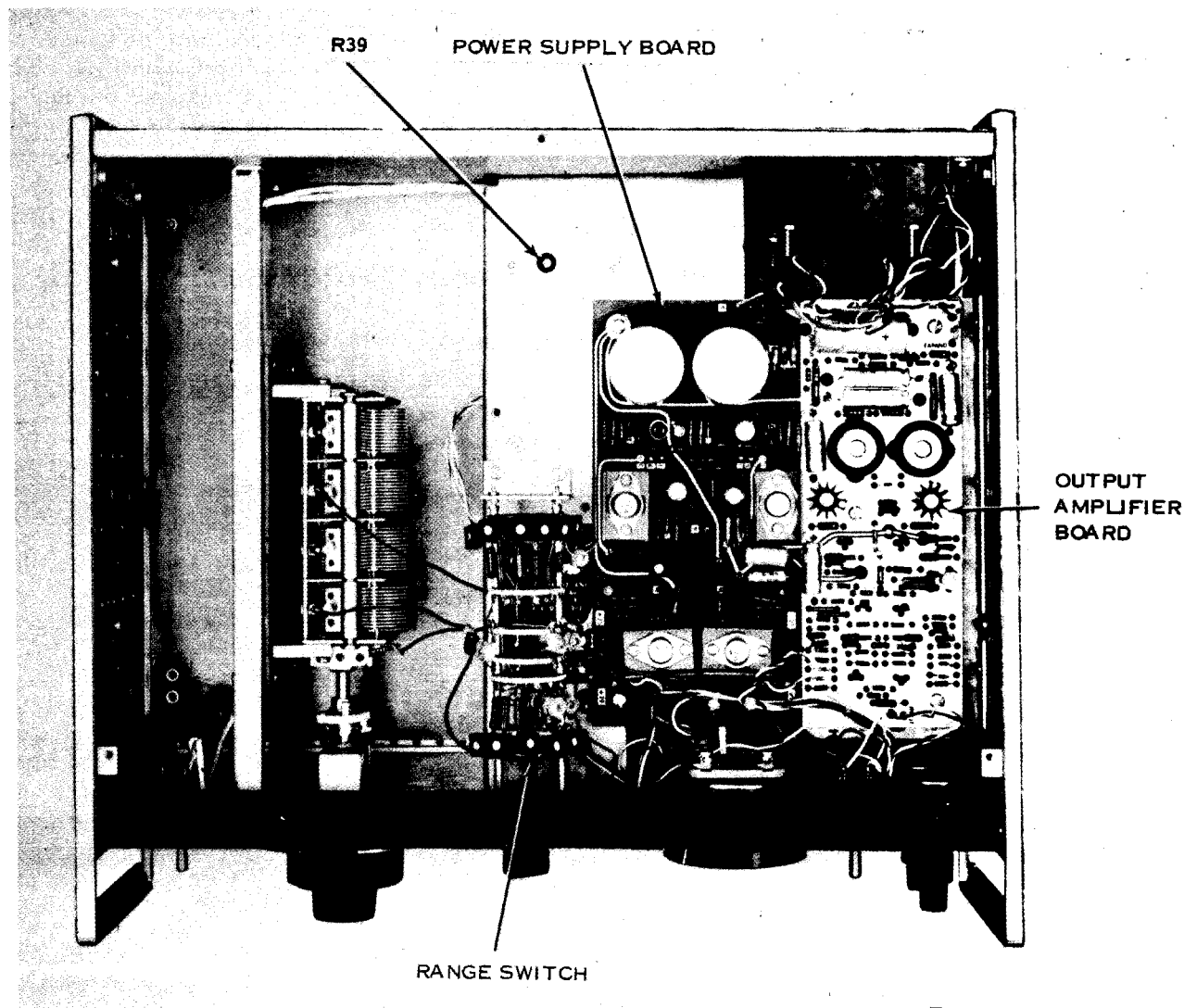
(2) *Operational tests.* Operational tests frequently indicate the general location of trouble. In many instances, the tests will help in determining the exact nature of the fault. The daily maintenance service and inspection table (4-1) contains a good operational test.

(3) *Troubleshooting table.* The troubleshooting table (6-2) lists symptoms of common troubles and gives (or references) corrective mea-

asures. Such a table obviously cannot include all trouble symptoms that may occur. The repairman should use this chart as a guide in analyzing symptoms that may not be listed.

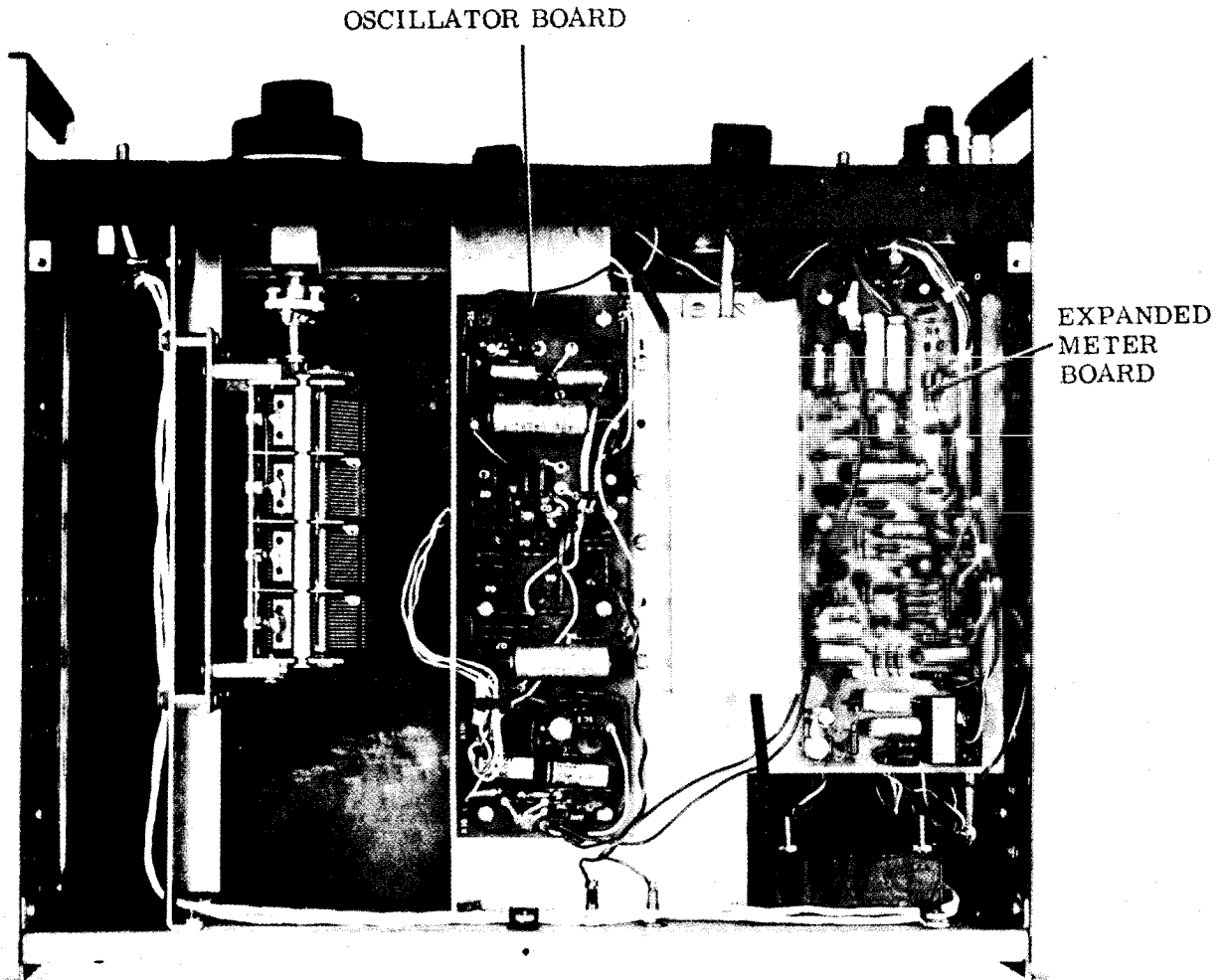
(4) *Voltage and resistance measurements.* Take voltage measurements related to the stage or board in question (fig. 6-2 or 6-3). Where abnormal voltage reading is obtained, take resistance measurements.

(5) *Intermittent troubles.* In all the tests, the possibility of intermittent troubles should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the equipment. It is possible that some external connections may cause trouble. Test wiring for loose connections; move wires and components with an insulated tool, such as a pencil or



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Figure 6-1. AN/USM-205A, top view, location of components.



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Figure 6-2. AN/USM-205A, bottom view, location of components.

fiber rod. This may show where a faulty connection or component is located. Minute cracks in printed circuit boards can cause intermittent operation. A magnifying glass is often helpful in locating defects in printed boards. Make continuity measurements of printed conductors.

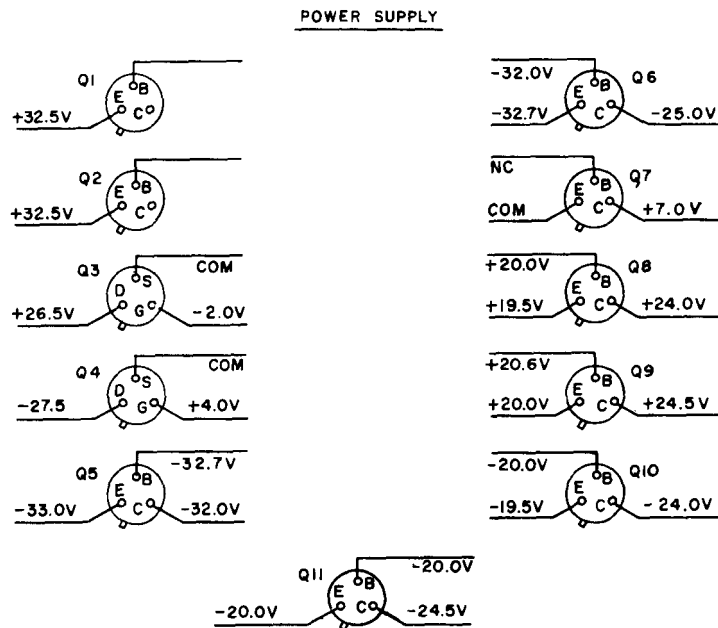
c. Visual Inspection. Failure of the signal generator to operate properly can often be traced to one or more of the following faults:

- (1) Improperly connected power cable, or no voltage at the outlet into which the power cable is connected.
- (2) Burned-out fuse.
- (3) Broken wires.
- (4) Improperly connected output or input cables.
- (5) Worn, broken, or disconnected cords or connectors.

6-6. Troubleshooting Chart

a. General. In the troubleshooting table 6-2, procedures are given for localizing and isolating troubles to a stage or part. Parts locations are indicated in figures 6-1 and 6-2. Voltage measurements are contained in figure 6-3 and the overall schematic diagram is shown in figure FO-2. When trouble has been localized to a particular stage, use voltage and resistance measurements to isolate trouble to a particular part.

b. Procedure. The chart below is given as an aid in locating trouble in the signal generator. The chart lists the symptoms, the probable troubles, and the corrective measures to be taken. If the trouble symptom is known, go directly to the appropriate item. If no symptoms are known, start with the first item and proceed until the trouble is found.



NOTES:

1. ALL VOLTAGE MEASUREMENTS ARE FROM DESIGNATED TERMINAL TO CHASSIS USING MULTIMETER ME-26/U, NO SIGNAL CONDITIONS.
2. IN THE METER CIRCUIT THE GATE OF Q4 IS +10V. ALL OTHER VOLTAGES TRACK THE AMPLITUDE AND/OR SET REFERENCE CONTROLS.

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Figure 6-3. Power supply, voltage measurements.

Table 6-2. General Support Troubleshooting

<i>Malfunction</i>	<i>Probable cause</i>	<i>Corrective action</i>
1. Pilot light does not illuminate	a. Power switch S1 defective	a. Replace defective switch.
	b. Fuse F1 open	b. Replace fuse F1.
2. +25 volt power supply incorrect or noisy.	a. Transistor A1Q1, A1Q2, A1Q3, or A1Q7 or diode A1CR5 defective.	a. Replace defective transistor (s) or diode.
	b. Potentiometer A1R24 out of adjustment.	b. Adjust potentiometer A1R24 (para 7-3) .
	c. Amplifier A1AR1 defective	c. Replace defective amplifier.
3. Meter indications erratic or incorrect with EXPAND-NORMAL switch in NORMAL position.	a. Transistors A4Q1, A4Q2, A4Q3, or A4Q4 or diode A4CR4 or A4CR5 defective.	a. Replace defective transistor(s) or diode(s).
	b. Potentiometer A4R15 out of adjustment.	b. Adjust potentiometer A4R15 (para 7-3) .
	c. Meter M1 defective	c. Replace defective meter.
4. Meter indications erratic or incorrect with EXPAND-NORMAL switch in EXPAND position.	a. Transistor A4Q5, A4Q6, A4Q7, or A4CR8, or amplifier A4AR1 defective.	a. Replace defective transistor(s), diode (s), or amplifier.
	b. Potentiometer A4R29 out of adjustment.	b. Adjust potentiometer A4R29 (para 7-3).
5. Output signal has positive sine-wave only.	Transistor A1Q12, A1Q16, A1Q17, or A1Q20 or resistor A1R13 defective.	Replace defective transistor (s) or resistor.
6. Output signal has negative sine-wave only.	Transistor A1Q14, A1Q15, A1Q18, A1Q19, or A1Q21 defective.	Replace defective transistor(s).
7. Frequency calibration is out of tolerance on all ranges.	Range switch subassembly out of adjustment.	Check frequency calibration (para 7-3).
8. No output	Transistor A3Q1, A3Q2, A3Q3, A3Q4, A3Q5, A3Q6, A3Q7, or A3Q8 or amplifier A3AR1.	Replace defective transistor (s) or amplifier.

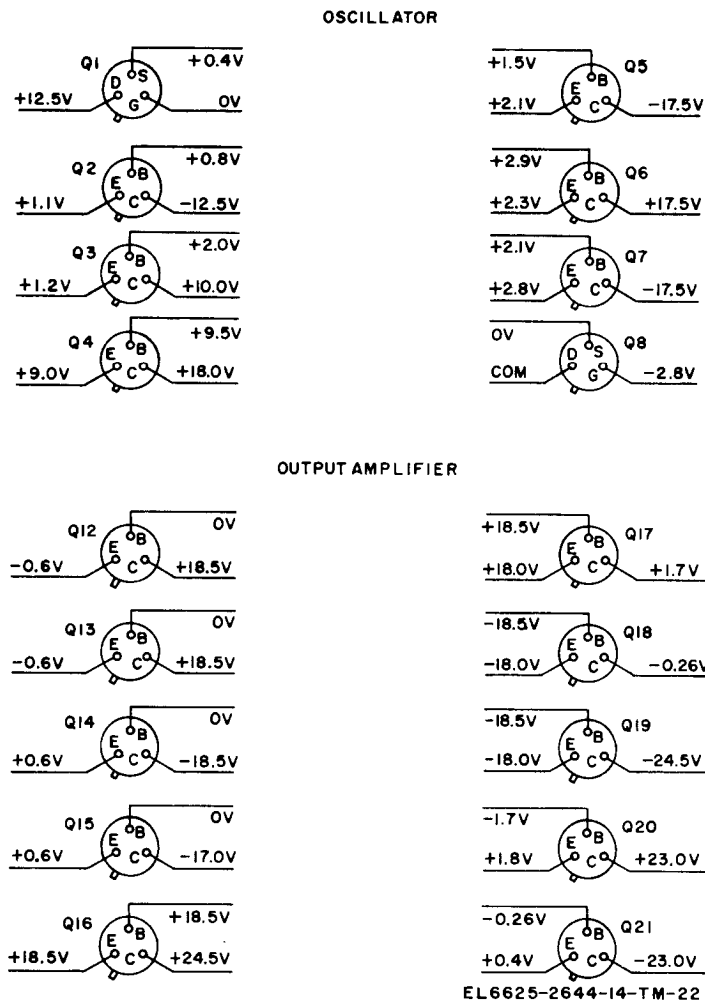


Figure 6-4. Oscillator and output amplifier voltage measurements.

Section IV. MAINTENANCE OF SIGNAL GENERATOR

6-7. General Parts Replacement Techniques

Most of the signal generator parts can be reached without special procedures. The following precautions apply

a. Precision-type resistors are contained on the RANGE switch assembly, expanded meter board, and attenuator. When soldering these resistors, keep the tip of a long-nosed pliers between the end of the resistor and the point being soldered. This procedure will prevent excessive heat from entering the resistor and changing its value.

b. When removing a switch or control, make a note of the connections before unsoldering them.

c. Check all connections against the wiring diagram (fig. FO-3) before disconnecting and after reconnecting to a component.

6-8. Alignment Procedures

a. Test Equipment. The test equipment required for alignment are the Thermal Converter HP-11049 and

those listed in paragraph 6-3.

b. Conditions for Alignment Tests. To prepare the signal generator for alignment, proceed as follows:

(1) Remove the instrument from the cabinet.

(2) Connect the power cable to the power source. Be sure that the ac voltage is the same as that used for normal operation of the signal generator.

(3) Set the Power switch to on; the pilot light should illuminate.

(4) Allow the signal generator to warm up for at least 30 minutes before proceeding with the alignment.

6-9. Operational Adjustments

(fig. 6-1 and 6-2)

a. Set the Power switch to on, FREQUENCY control to 5, RANGE switch to XIX, OUTPUT ATTENUATOR switch to +20db, AMPLITUDE control fully clockwise, and EXPAND-NORMAL switch to NORMAL.

b. Connect voltmeter to TP3 (+25) on power supply

board A1 (fig. 6-5).

c. Adjust R24 on power supply for a reading of 25.00 volts.

d. Measure voltage at TP2(-25) on power supply. Reading should be -25.00 volts ± 0.2 volt.

e. Measure voltage at TP4(+19) and TP5(-19) on power supply. Readings should be +19 and -19 volts, ± 1 volt, respectively.

f. Connect voltmeter to TP1 (fig. 4-1). (Blue test point on the rear panel.)

g. Set FREQUENCY control to 1.

h. Adjust R7 and R18 on RANGE switch (fig. 6-6) to their center range position (6-6).

i. Adjust R7 on oscillator board (fig. 6-7) for a reading of -2.500 volts.

j. Connect voltmeter to the 50 ohms output connector. Using DA-471/U terminate output in 50 ohms at input to voltmeter.

k. Adjust R39 on oscillator board (fig. 6-1) for a reading of 3.200 volts rms.

l. Adjust METER CAL R15 on expanded meter board (fig. 6-8) for a reading of 3.200 volts on the output level meter.

m. Set RANGE switch to XIM.

n. Adjust C3 on expanded meter board for a reading of 3.200 volts on the output level meter.

6-10. Expanded Meter Adjustments

a. Position controls as in paragraph 6-9a.

b. Connect voltmeter to 50 ohms output connector. Using DA-471/U terminate output in 50 ohms at input to voltmeter.

c. Adjust front panel AMPLITUDE control for a reading of 3,000 volts on voltmeter.

d. Position SET REFERENCE controls (coarse and fine) to center of their range.

e. Set EXPAND-NOW switch to EXPAND. Output level meter should read near 0 (zero).

f. Position SET REFERENCE control for a reading of 0% on output level meter expand scale.

g. Adjust front panel AMPLITUDE control for a reading of 3.075 volts on voltmeter (+ 2.5% increase).

h. Adjust EXPAND CAL R29 on expanded meter board (fig. 6-8) for a reading of +2.5% on output level meter expanded scale.

i. Repeat steps c through h until no further adjustment of R29 is required.

6-11. Frequency Calibration

(fig. 6-1 and 6-2)

a. Position controls as in paragraph 6-9a, except FREQUENCY control to 1.

b. Connect voltmeter to TP1 (blue) on rear panel (fig. 4-1).

c. Connect frequency counter to the 50 ohms output connector.

NOTE

The voltage of TP1 shall be maintained at -2.500 volts ± 0.5 volts for all calibration adjustment (except 10 MHz). Adjust R7 on oscillator board to maintain -2.500 voltage reading.

d. Alternating between R7 and R18 on RANGE switch (fig. 6-6) adjust for a reading of 1.000 kHz while maintaining the voltage at TP1.

e. Set FREQUENCY control to 10.

f. Alternating between C4 on oscillator board (fig. 6-6) and C5 on RANGE switch, adjust for a frequency of 10.00 kHz, while maintaining the voltage at TP1.

g. Set RANGE switch to X10.

h. Alternating between R11 and R14 on RANGE switch, adjust for a frequency of 10.0 Hz maintaining the voltage at TP1.

i. Set RANGE switch to X100.

j. Alternating between R9 and R16 on the RANGE switch, adjust for a frequency of 100.00 Hz, maintaining the voltage at TP1.

k. Set RANGE switch to X10K and FREQUENCY control to 1.

l. Alternating between R5 and R20 on RANGE switch, adjust for a frequency of 10.00 kHz, maintaining the voltage at TP1.

m. Set RANGE switch to X100K.

n. Alternating between R3 and R22 on RANGE switch, adjust for a frequency of 100.00 kHz, maintaining the voltage at TP1.

o. Set FREQUENCY control to 10.

p. Alternating between C3 and C10 on RANGE switch, adjust for a frequency of 1000 kHz, maintaining the voltage at TP1.

q. Set RANGE switch to X1M, and the FREQUENCY control to 1.

r. Alternating between R1 and R24 on RANGE switch, adjust for a frequency of 1.000 MHz, maintaining the voltage at TP1.

s. Set FREQUENCY control to 10.

t. Alternating between C1 and C8 on RANGE switch, adjust for a frequency of 10.15 MHz (1.5% high), and maintain a voltage of -2.7 ± 0.1 volts at TP1. AMPLITUDE control must be fully clockwise.

u. Repeat steps m through t until voltage and frequency conditions are satisfied.

6-12. Amplitude Adjustment

CAUTION

During the following adjustments do not apply more than rated voltage of 3 vac to thermal converter (HP-11049) while adjusting AMPLITUDE control.

a. Set AMPLITUDE control fully counter clockwise.

b. Connect thermal converter to 50 ohms output connector.

c. Connect voltmeter to output of thermal converter.

d. Adjust AMPLITUDE control on the front panel clockwise for 3 vac input to thermal converter.

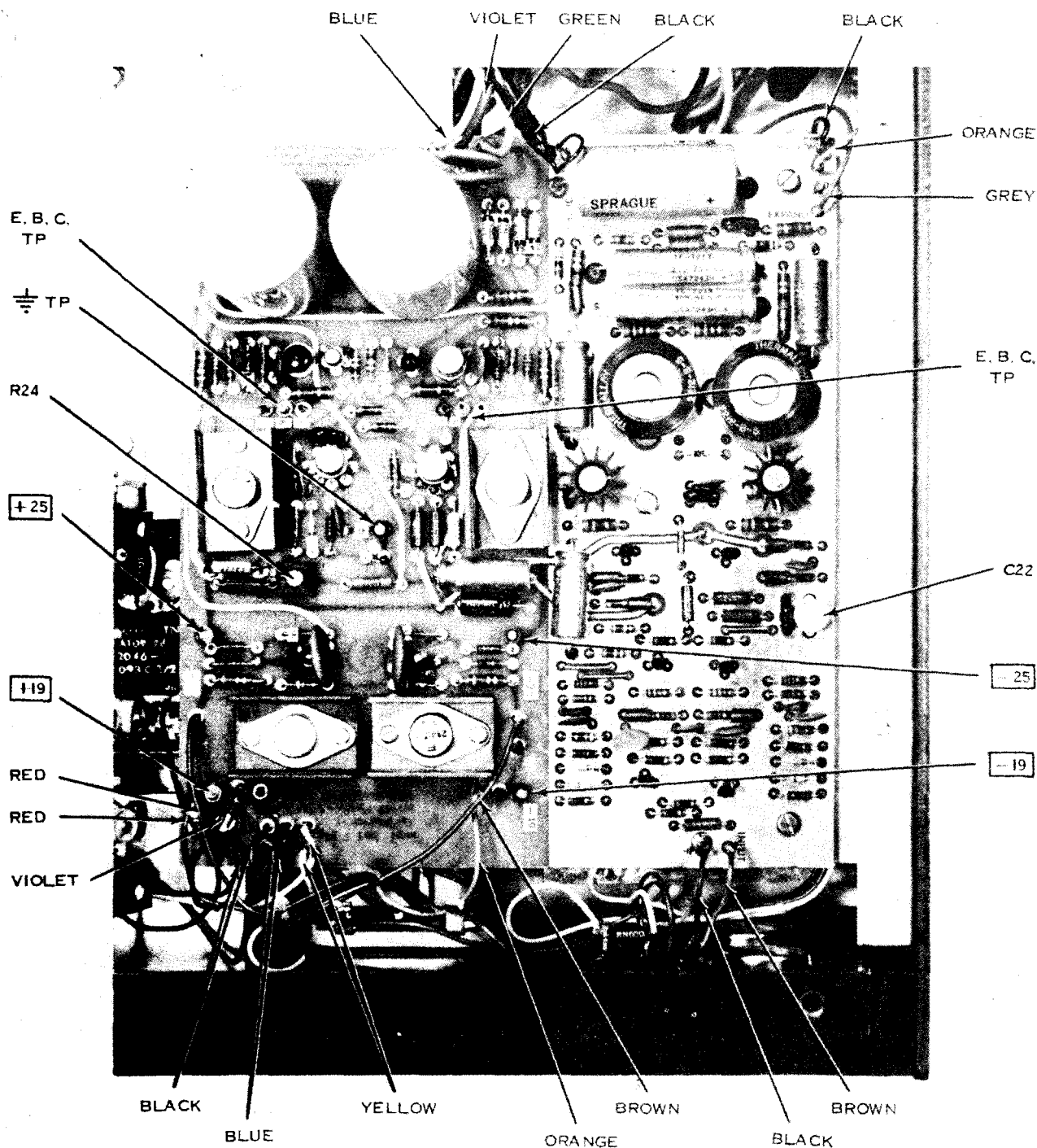
e. Set RANGE switch to X1K, and FREQUENCY same reading on voltmeter.

control to 10.

f. Observe and record reading on voltmeter.

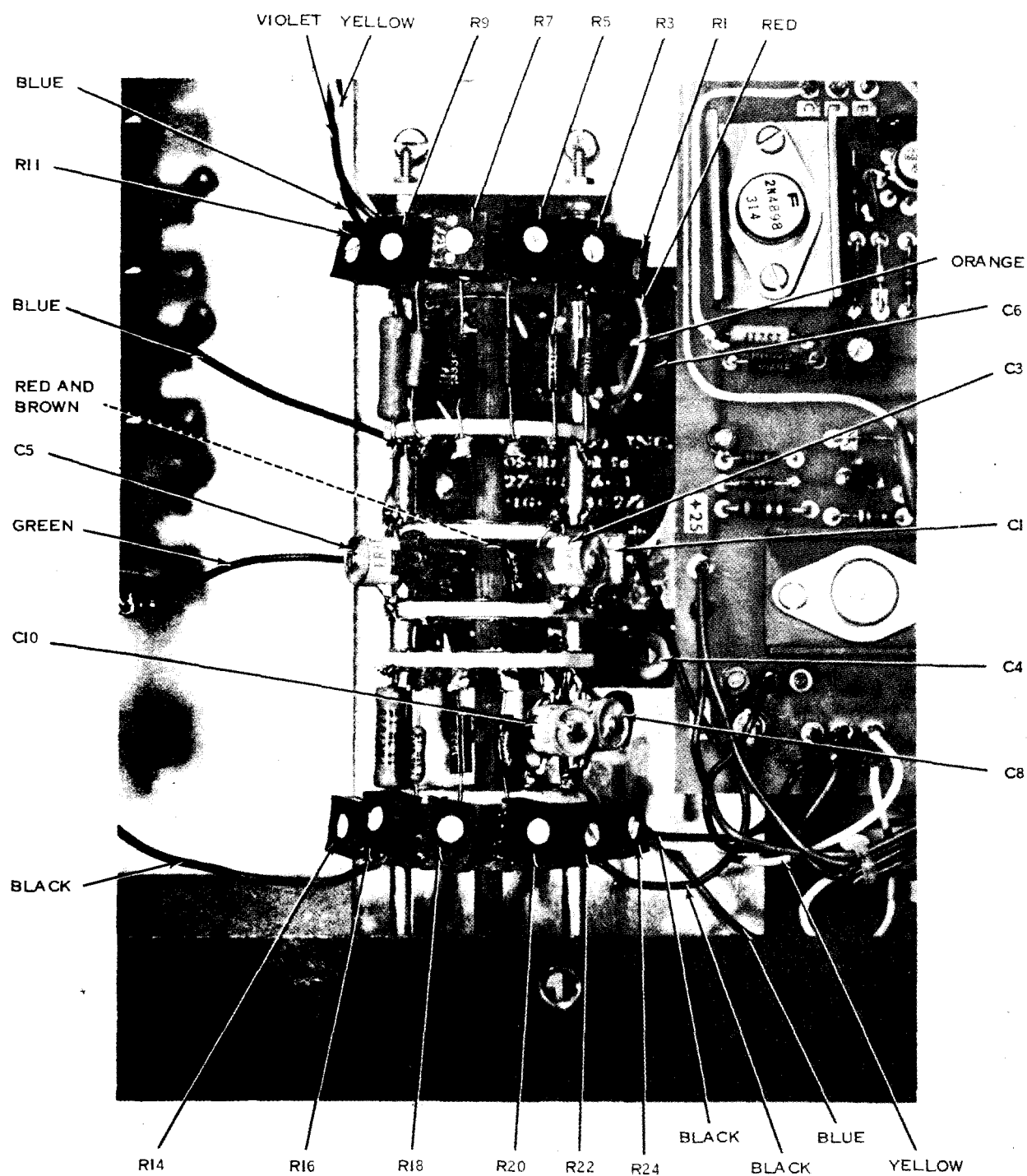
g. Set RANGE switch to X1M.

h. Adjust C22 on the amplifier board (fig. 6-5) for



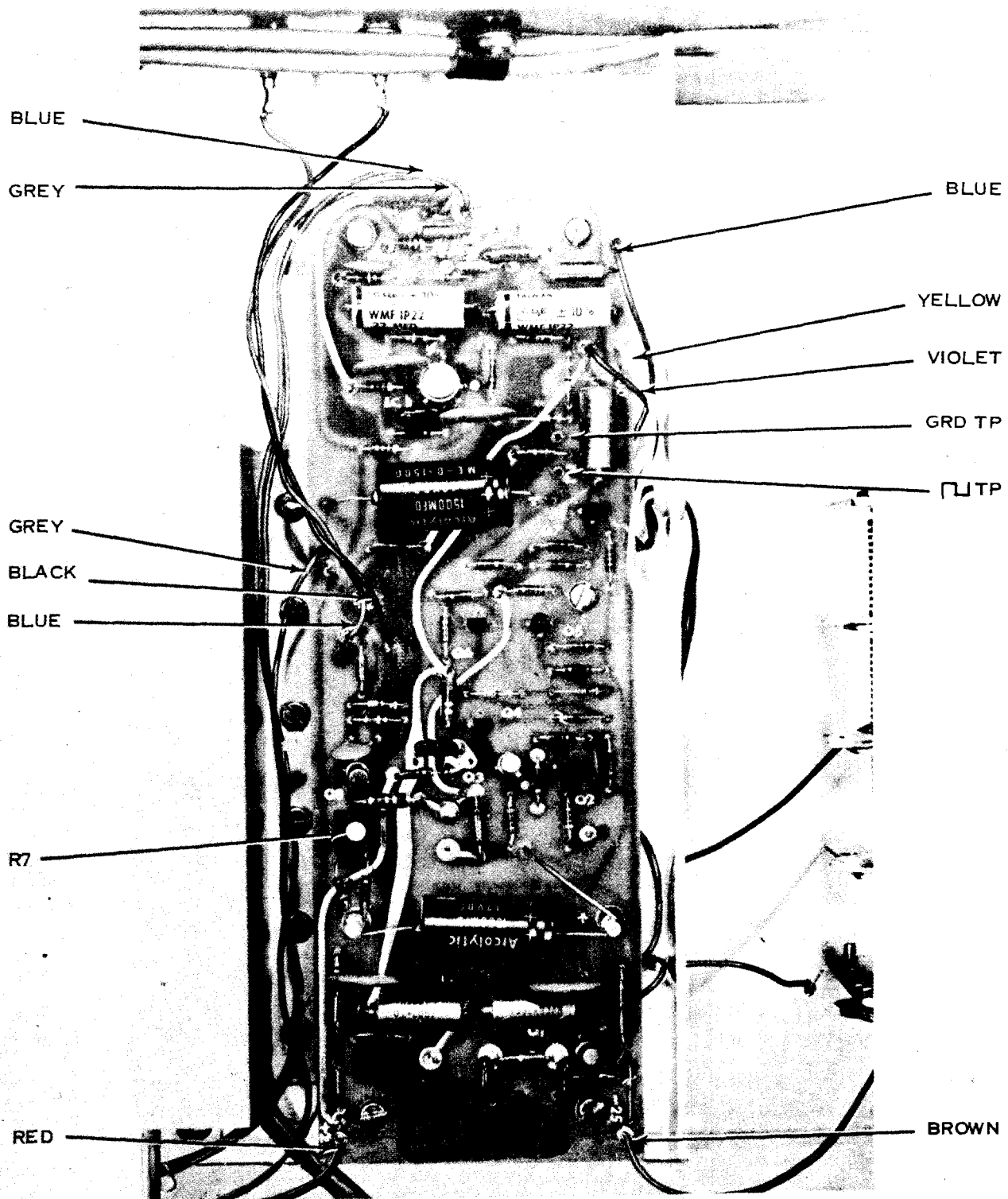
EL6625-2644-14-TM-24

Figure 6-5. Power supply and output amplifier circuit board, adjustment controls.



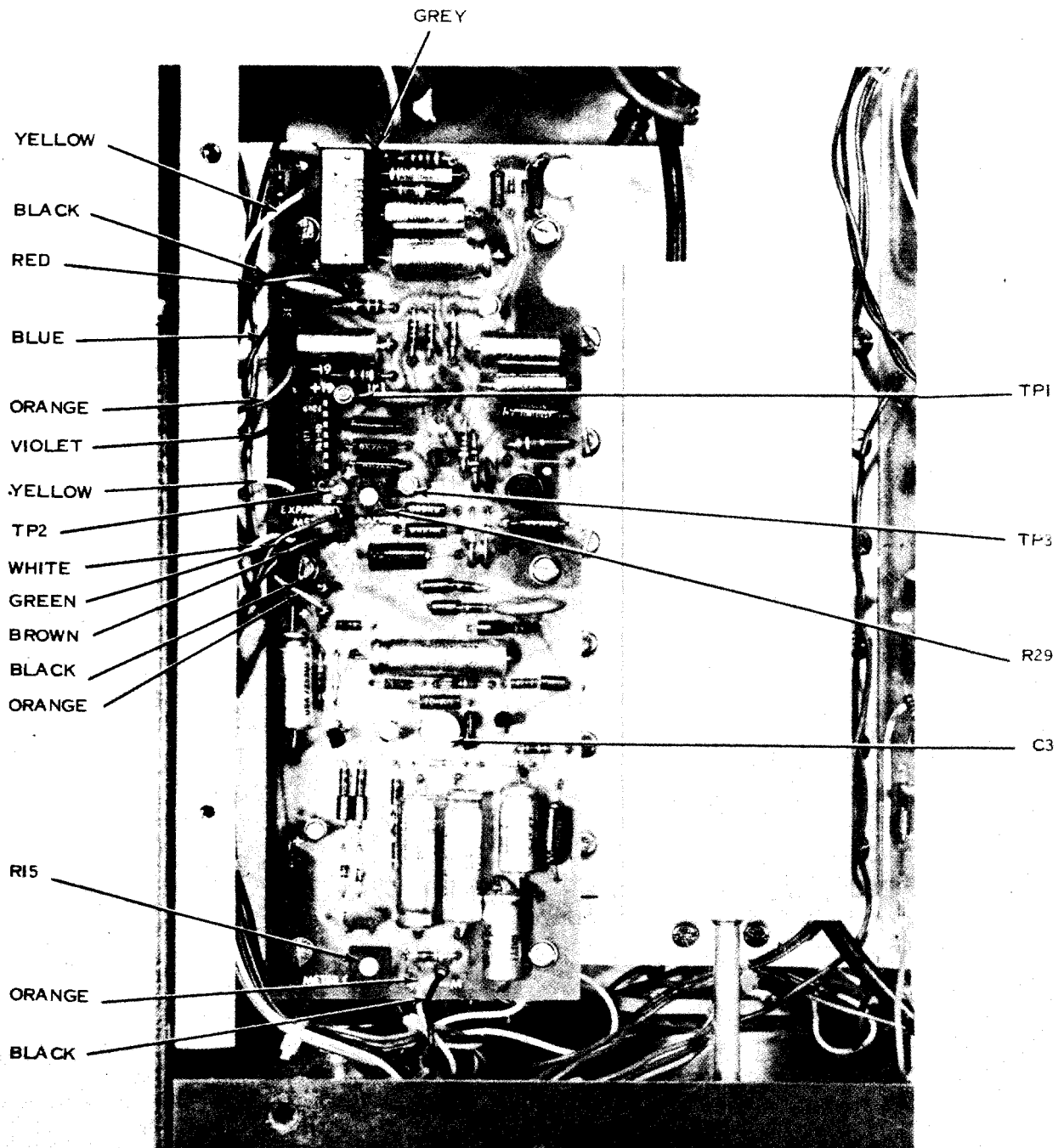
EL6625-2644-14-TM-25

Figure 6-6. Range switch assembly, adjustment controls.



EL6625 - 2644 - 14 - TM - 26

Figure 6-7. Oscillator circuit board, adjustment controls.



EL6625-2644-14-TM-8

Figure 6-8. Expanded meter board, adjustment controls.

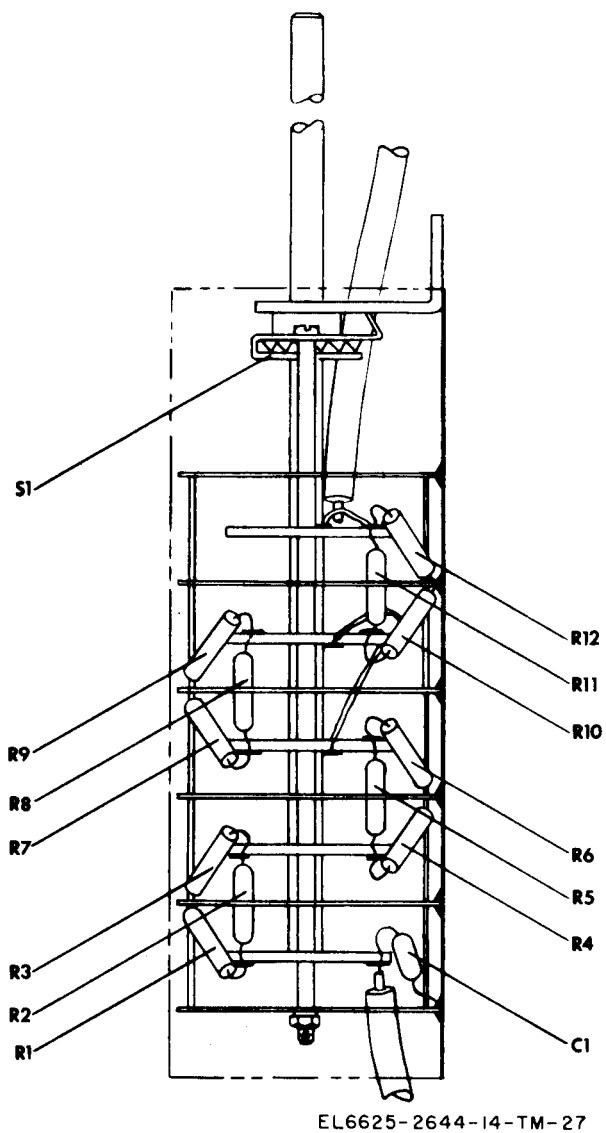


Figure 6-9. Attenuator assembly, parts location.

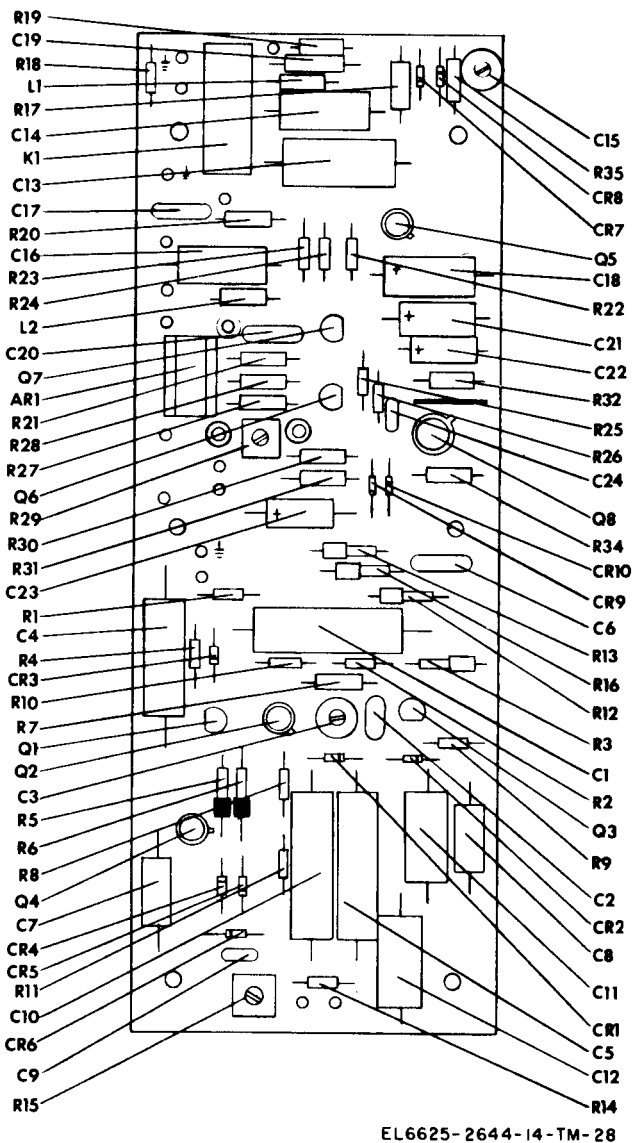


Figure 6-10. Expanded meter board, parts location.

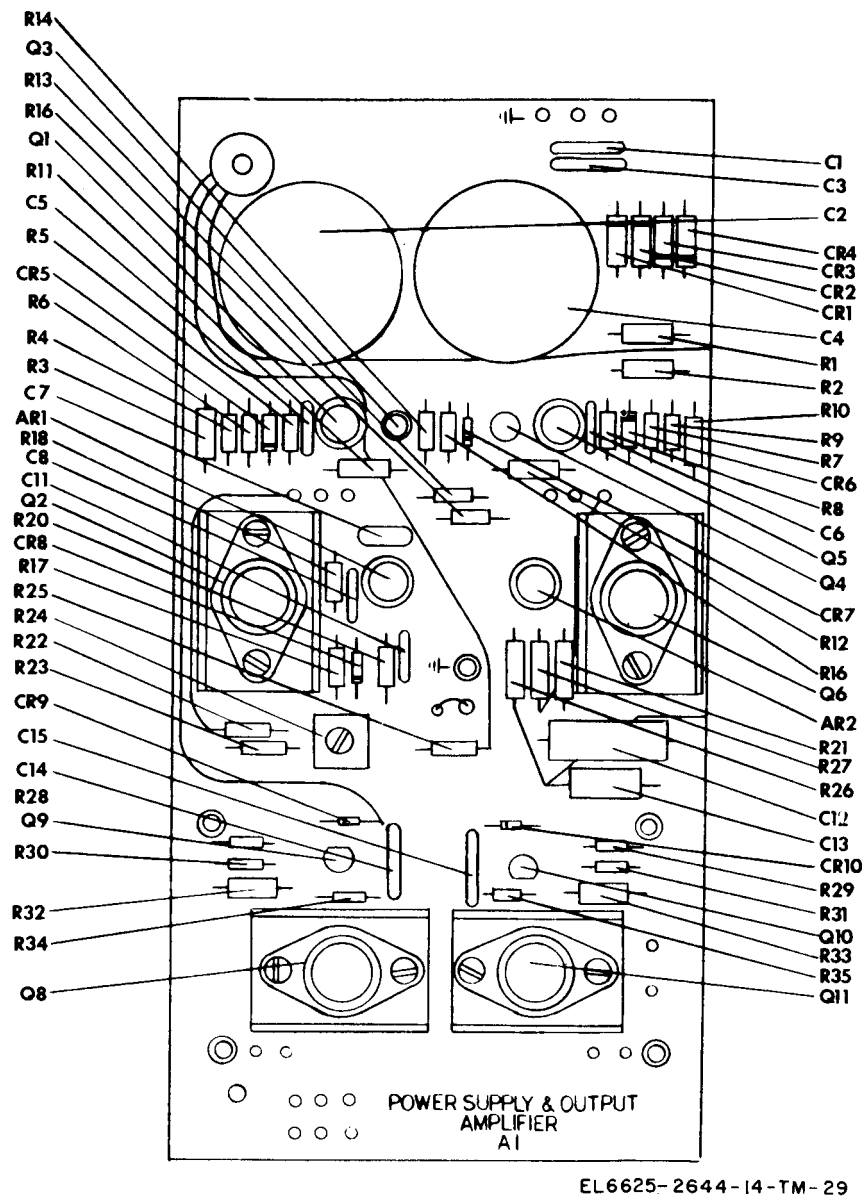


Figure 6-11. Power supply and output amplifier A1 circuit board, parts location.

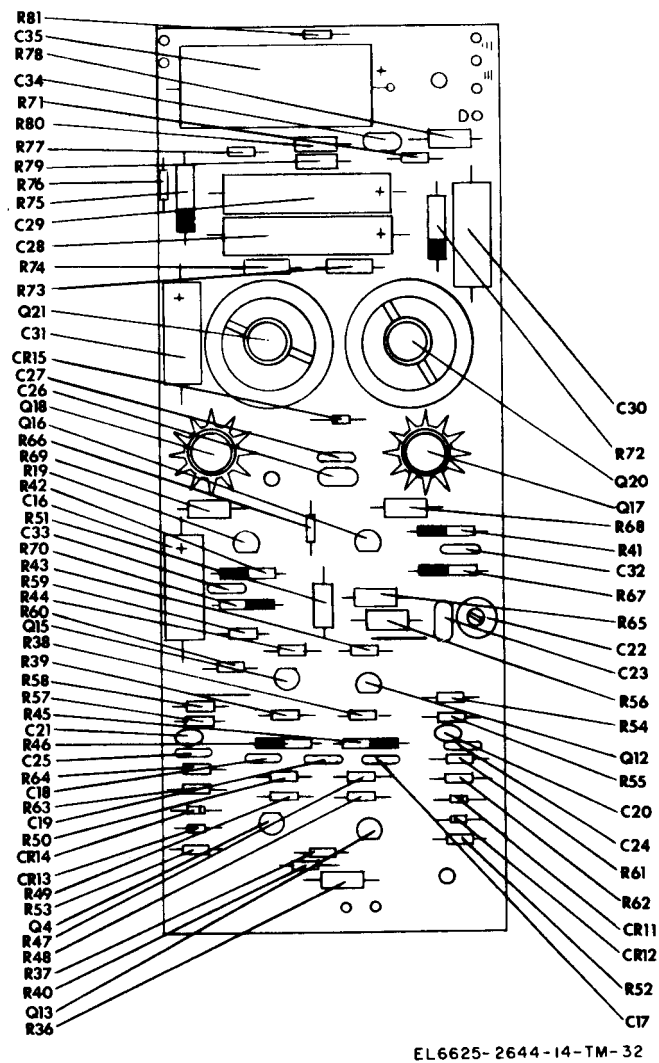


Figure 6-12. Power supply and output amplifier A2 circuit board, parts location.

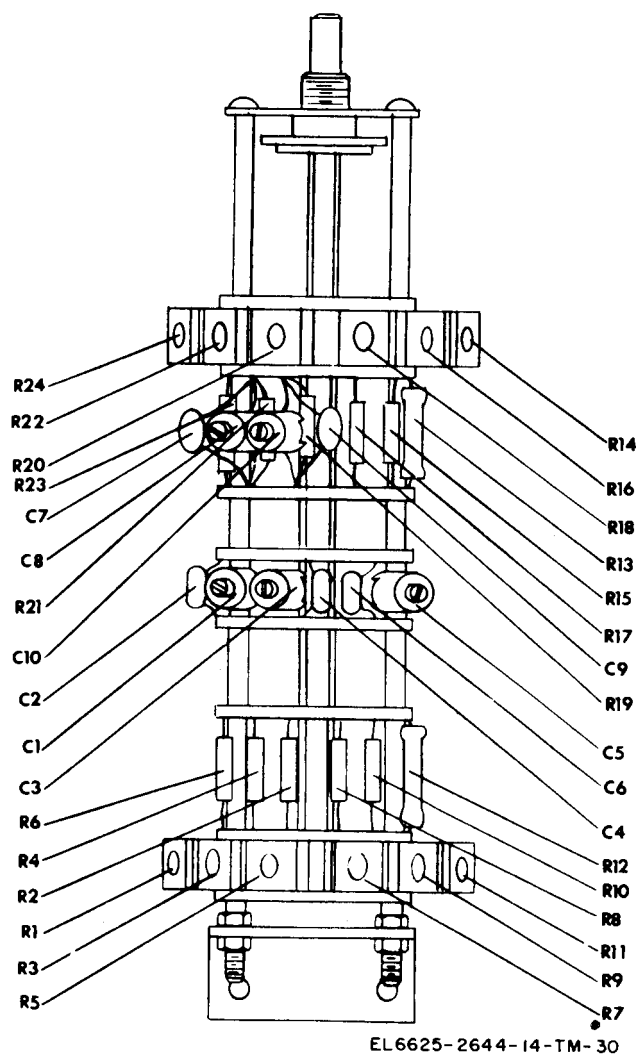


Figure 6-13. Range switch assembly, parts location.

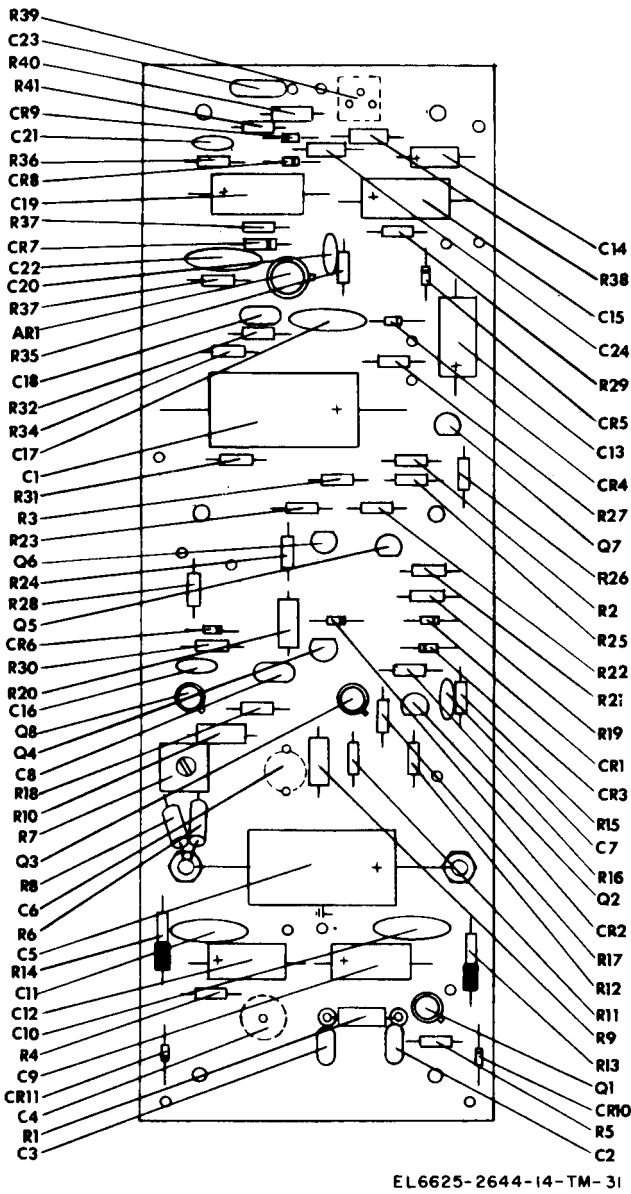


Figure 6-14. Oscillator circuit board, parts location.

CHAPTER 7
GENERAL SUPPORT TESTING PROCEDURES

7-1. General

a. Testing procedures are prepared for use by Electronics Field Maintenance Shops and Electronics 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 must meet before it is returned to the using organization. These procedures may also be used as a guide for testing equipment that has been repaired at direct support maintenance if the proper tools and test equipments are available.

b. Comply with the instructions preceding each procedure. Perform each step in sequence; do not vary the sequence. For each step, perform all the actions required and verify it against its performance standard.

7-2. Test Equipment Required

All the test equipment required to perform the testing procedures given in this chapter are listed in the following table 7-1.

Table 7-1. General Support Test Procedure
Tools and Test Equipment

Nomenclature	Common name
Analyzer, Spectrum TS-723/U	Analyzer
Attenuator, Variable CN-796/U	Attenuator

Nomenclature	Common name
Counter, Electronic, Digital Read-out AN/USM-207	Counter
Indicator, Standing Wave Ratio IM-175/U	Indicator
Multimeter TS-352/U	Multi meter
Oscilloscope AN/USM-281	Oscilloscope
Voltmeter, Electronic ME-202/U	Voltmeter
Test Set, Transistor TS-1836/U	Transistor test set
Thermal Converter (HP 11049)	Thermal converter
Tool Kit TK-100/G	
Tools and Test Equipment available to the general support repairman because of his assigned mission	

7-3. Modification Work Orders

The performance standards listed in the tests (para 7-4 through 7-11) assume that all modification work orders on this equipment have been performed. A listing of current modification work orders will be found in DA Pam 310-7.

7-4. Physical Tests and Inspections

- a. *Test Equipment and Materials.* No test equipment or materials are required.
- b. *Test Connection and Conditions.*
 - (1) No connections necessary.
 - (2) Remove signal generator chassis from its case.
- c. *Procedure.* Refer to table 7-2 for correct procedures.

Table 7-2 Physical Tests and Inspections

Step No.	Test equipment	Control settings	Equipment under test	Test procedure	Performance standard
1	None	Controls may be in any position.		a. Inspect case and chassis for damage, missing parts, and condition of paint. NOTE Touch-up painting is recommended instead of refinishing whenever practical; screw heads, binding post, receptacles, and other plated parts should not be painted <i>or</i> polished with abrasives.	a. No damage evident or parts missing. External surfaces intended to be painted must not show bare metal. Panel lettering must be legible.

Table 7-2. Physical Tests and Inspections-Continued

Control settings				
Step No.	Test equipment	Equipment under test	Test procedure	Performance standard
			b. Inspect all controls and mechanical assemblies for loose or missing screws, bolts, and nuts.	b. Screws, bolts, and nuts must be tight. None missing.
			c. Inspect all connectors, sockets, and receptacles, fuseholders, and dials for looseness, damage, or missing parts.	c. No loose parts or damage. No missing parts.
2	None	Controls may be in any position.	a. Rotate all panel controls throughout their limits of travel.	a. Controls must rotate freely without binding or excessive looseness.
			b. Inspect dial stops for damage or bending and for proper operation.	b. Stops operate properly without evidence of damage.
			c. Operate all switches.....	c. Switches must operate
3	Replace signal generator in its case.	

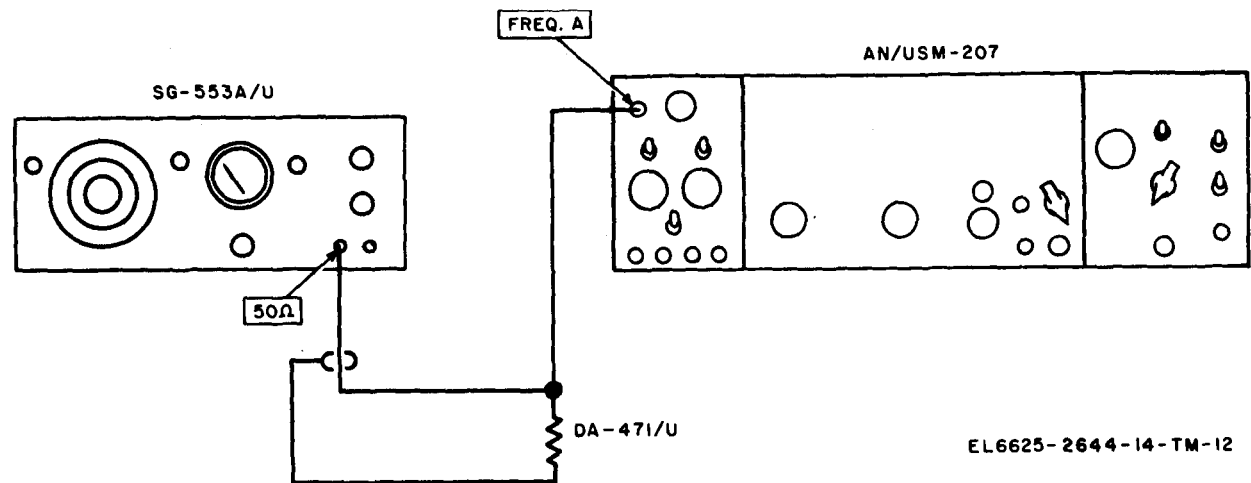


Figure 7-1. Frequency range and dial accuracy, test setup.

7-5. Frequency Range and Dial Accuracy Test

- a. **Test Equipment and Materials.** Counter, Electronic. Digital Readout AN/USM-207 and Dummy Load, Electrical DA-471/U.
- b. **Test Connections and Conditions.** Terminate the 50 ohms output using DA-471/U and interconnect the equipment as shown in figure 7-1.
- c. **Procedure.** Perform procedures in table 7-3. Permit appropriate warmup time.

7-6. Output Power Chock

- a. **Test Equipment and Materials.** Voltmeter, Electronic ME-202/U; Dummy Load, Electrical DA-471/U; and Adapter; Connector NSN 5935-00-454-9945 (600 ohms termination).
- b. **Test Connections and Conditions.** Terminate the 50 ohms output using Da-471/U and interconnect the equipment as shown in figure 7-2.
- c. **Procedure.** Perform procedures in table 7-4. Permit appropriate warmup time.

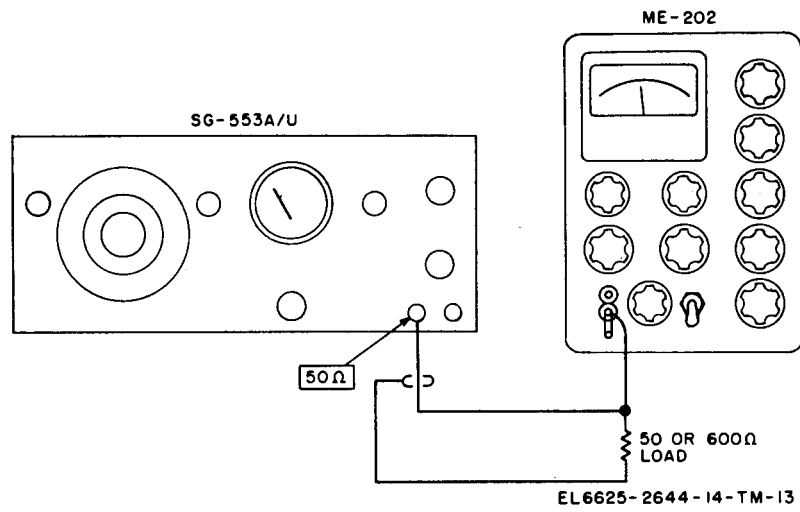


Figure 7-2. Output power, test setup.

Table 7-3. Frequency Range and Dial Accuracy Test

Step	Test equipment	Control settings	Equipment under test	Test procedure	Performance standard
1	1 N/USM-207 Frequency Counter: Switches: SENSITIVITY: 100V Time Base: GATE TIME: (SEC ⁻¹) -10 ⁴ FUNCTION: FREQ	SG-553A/U FREQUENCY: 1 AMPLITUDE: mid-range OUTPUT ATTENUATOR: +20 dbm. Power: ON.	SG-553A/U	RANGE: X10	AN/USM-207 10.0 Hz $\pm 3\%$ indication.
2	Same as step 1	Same as step 1		RANGE: X100	100 Hz $\pm 2\%$ indication.
3	Same as step 1	Same as step 1		RANGE: X1K	1.00 kHz $\pm 2\%$ indication.
4	Same as step 1	Same as step 1		RANGE: X10K	10.0 kHz $\pm 2\%$ indication.
5	Same as step 1	Same as step 1		RANGE: X100K	100 kHz $\pm 2\%$ indication.
6	Same as step 1 except Time Base switch: GATE TIME (SEC ⁻¹) -10 ⁴ .	Same as step 1		a. RANGE: X1M b. FREQUENCY: 5	a. 1.00 mHz $\pm 3\%$ indication. b. 5.00 mHz $\pm 3\%$ indication.
7	Same as step 1	Same as step 1 except FREQUENCY dial to 5.		RANGE: X100K	500 kHz $\pm 2\%$ indication.
8	Same as step 1	Same as step 7		RANGE: X1K	50 kHz $\pm 2\%$ indication.
9	Same as step 1	Same as step 7		RANGE: X1K	5 kHz $\pm 2\%$ indication.
10	Same as step 1	Same as step 7		RANGE: X100	500 Hz $\pm 2\%$ indication.
11	Same as step 1	Same as step 7		a. RANGE: X10 b. FREQUENCY: 10	a. 50.0 Hz $\pm 3\%$ indication. b. 100 Hz $\pm 3\%$ indication.
12	Same as step 1	Same as step 1 except FREQUENCY dial to 10.		RANGE: X100	1 kHz $\pm 2\%$ indication.
13	Same as step 1	Same as step 12		RANGE: X1K	10 kHz $\pm 2\%$ indication.
14	Same as step 1	Same as step 12		RANGE: X10K	100 kHz $\pm 2\%$ indication.
15	Same as step 6	Same as step 12		RANGE: X100K	1000 kHz $\pm 3\%$ indication.
16	Same as step 6	Same as step 12		RANGE: X1M	10.00 mHz $\pm 3\%$ indication.
17		Power: OFF		Disconnect equipment.	

Table 7-4. Output Power Check

Step	Test equipment	Control settings	Equipment under test	Test procedure	Performance standard
1	ME-202/U RANGE: 5 AC-DC polarity: AC	SG-553A/U FREQUENCY: 10 AMPLITUDE: clockwise. OUTPUT ATTENUATOR: +20 dbm. Power: ON.	SG-553A/U	RANGE switch: X10	ME-202/U At least 3.1600 volts ac. NOTE 3.16 volts into 50 ohms = 200 mw.
2	Same as step 1	Same as step 1		Same as step 1 except remove 50 ohms termination (DA-471/U) and insert 600 ohms termination as shown in figure 7-2.	At least 3.1600 volts ac. NOTE 3.16 volts into 600 ohms = 16 mw.
3	Same as step 1 except RANGE: 50.	Same as step 1		Remove termination and reconnect AN/USM-205A to ME-202/U.	6.23 volts ac (open circuit).
4		Power: OFF		Disconnect equipment.	

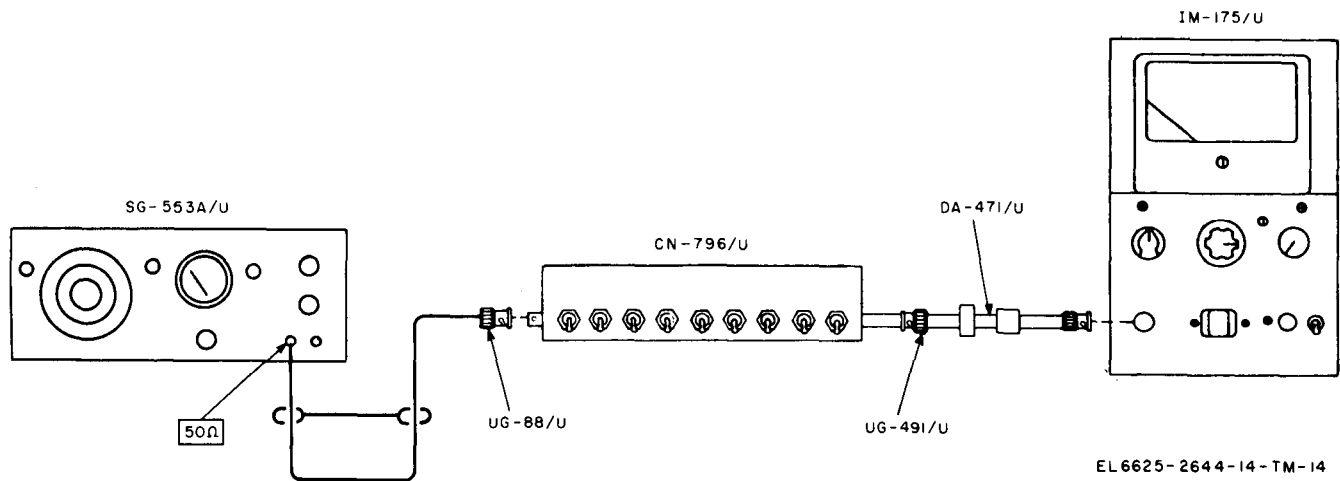


Figure 7-3. Attenuator, test setup.

7-7. Attenuator Check

a. *Test Equipment and Materials.* Attenuator, Variable CN-796/U; Dummy Load, Electrical DA-471/U; and Indicator, Standing Wave Ratio IM-175/U.

b. *Test Connections and Conditions.* Interconnect the equipment as shown in figure 7-3.

c. *Procedure.* Perform procedures in table 7-5. Permit appropriate warmup time.

Table 7-5. Attenuator Check

Step No.	Test equipment	Control settings	Equipment under test	Test procedure	Performance standard
1	CN-796/U Set controls for -90 db. IM-175/U Meter scale: EXPAND RANGE: 50	SG-553A/U RANGE: X1K FREQUENCY: 1. AMPLITUDE: clockwise. OUTPUT ATTENUATOR: +20 dbm. Power: ON.		SG-553A/U Adjust AMPLITUDE	IM-175/U 1 db reading.
2	Same as step 1	Same as step 1	Same as step 1	Sequentially positive OUTPUT ATTENUATOR switch from +20 to -60, while positioning CN-796/U from -90 db to -10 db.	-10 ± .075 db reading at each step.
3	Same as step 1	Same as step 1	Same as step 1	Position OUTPUT ATTENUATOR switch to -70 and CN-796/U to 0 db.	-10 ± 0.2 db reading.
4				Power: OFF.	

7-8. Output Level Meter, Normal Scale Accuracy Check

a. *Test Equipment and Materials.* Voltmeter Electronic ME-202/U and Dummy Load DA-471/u.

b. *Test Connections and Conditions.* Terminate the 50 ohms output using DA-471/U and interconnect equipment as shown in figure 7-4.

c. *Procedure.* Perform procedures in table 7-6. Permit appropriate warmup time.

7-9. Output Level Meter Expanded Scale Accuracy Check

a. *Test Equipment and Materials.* Voltmeter, Electronic ME-202/U and Thermal Converter HP-11049A.

b. *Test Connections and Conditions.* Interconnect equipment as shown in figure 7-5.

c. *Procedure.* Perform procedures in table 7-7. Permit appropriate warmup time.

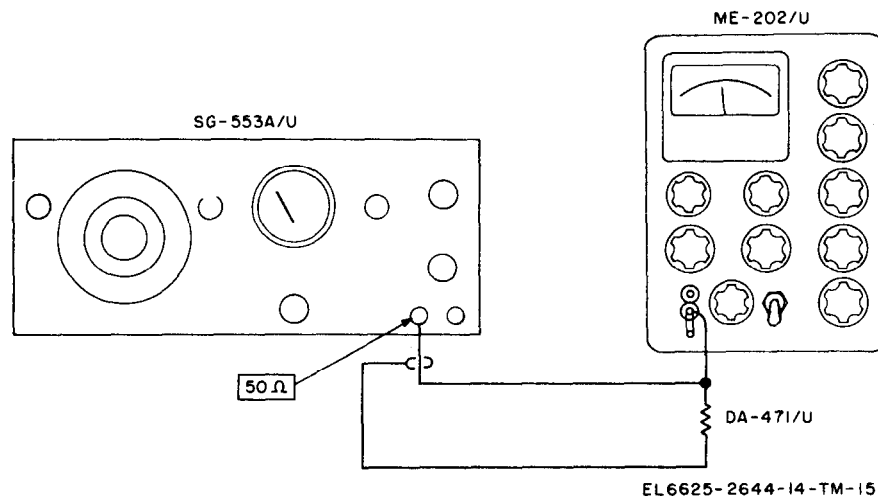


Figure 7-4. Output level meter, normal scale accuracy, test setup.

Table 7-6. Output Level Meter, Normal Scale, Accuracy Check

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	ME-202/U: RANGE: 5 NULL: VTVM Function: AC Voltage Readout Dials: 3.0000	SG-553A/U: RANGE: X1K FREQUENCY: 5 AMPLITUDE coarse: ccw AMPLITUDE FINE: midposition SET REFERENCE coarse: midposition SET REFERENCE FINE: midposition OUTPUT ATTENUATOR: +20 DBM EXPAND-NORMAL: NORMAL Power: ON	<p>a. Adjust SG-553A/U AMPLITUDE coarse control to obtain a 3.0 volt indication on SG-553A/U output level meter.</p> <p>b. Set ME-202/U NULL switch to 0.1 position.</p> <p>c. Adjust SG-553A/U AMPLITUDE FINE control for a 0 (center scale) indication on ME-202/U meter.</p> <p>d. Set SG-553A/U EXPAND-NORMAL switch to EXPAND and adjust SET REFERENCE coarse and/or SET REFERENCE FINE controls for a 0 (center scale) indication on top scale of SG-553A/U output level meter.</p> <p>e. Adjust SG-553A/U AMPLITUDE FINE control ccw to obtain a -2.5 percent indication on top scale of SG-553A/U output level meter.</p> <p>f. Adjust SG-553A/U AMPLITUDE FINE control cw to obtain a +2.5 percent indication on top scale of SG-553A/U output level meter.</p> <p>g. Set SG-553A/U EXPAND-NORMAL switch to NORMAL.</p> <p>h. Set ME-202/U NULL switch to VTVM.</p>	<p>a. None.</p> <p>b. ME-202/U meter shall indicate 0 ± 0.06 volt (0.6 on lower scale equals 0.06 volt).</p> <p>c. None.</p> <p>d. None.</p> <p>e. ME-202/U meter shall indicate between -0.072 and -0.078 volt.</p> <p>f. ME-202/U meter shall indicate between +0.072 and +0.078 volt.</p> <p>g. None.</p> <p>h. None.</p>
	Same as step 1 except Voltage Readout Dials: 2.0000	Same as step 1	<p>a. Adjust SG-553A/U AMPLITUDE coarse and/or AMPLITUDE FINE controls to obtain a 2.0-volt indication on SG-553A/U output level meter.</p> <p>b. Set ME-202/U NULL switch to 0.1 position.</p> <p>c. Set ME-202/U NULL switch to VTVM.</p>	<p>a. None.</p> <p>b. ME-202/U meter shall indicate 0 ± 0.04 volt.</p> <p>c. None.</p>
3	Same as step 1 except Voltage Readout Dials: 1.0000	Same as step 1	<p>a. Adjust SG-553A/U AMPLITUDE coarse and/or AMPLITUDE FINE controls to obtain a 1.0-volt indication on SG-553A/U output level meter.</p> <p>b. Set ME-202/U NULL switch to 0.1 position.</p> <p>c. Set ME-202/U NULL switch to VTVM.</p>	<p>a. None</p> <p>b. ME-202/U meter shall indicate 0 ± 0.02 volt.</p> <p>c. None.</p>

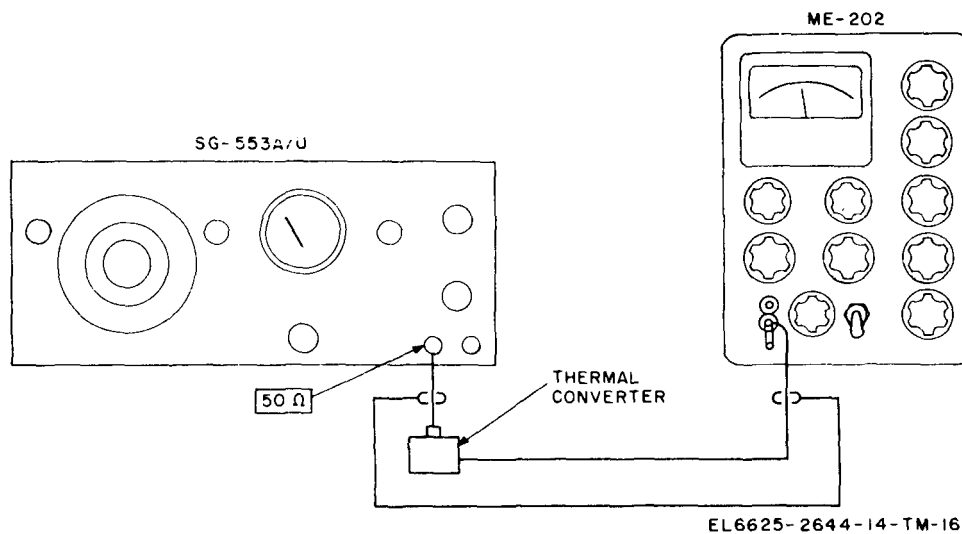


Figure 7-5. Output level meter, expanded scale accuracy, test setup.

Table 7-7. Output Level Meter, Expanded Scale, Accuracy Check

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
4			Power: OFF	
1	ME-202/U: RANGE: .5 NULL: .01 Function: + Voltage Readout Dials: 0.0000	SG-553A/U: RANGE: X1K FREQUENCY: 5 AMPLITUDE coarse: ccw AMPLITUDE FINE: midposition SET REFERENCE coarse: midposition SET REFERENCE FINE: midposition OUTPUT ATTENUATOR: +20 DBM EXPAND-NORMAL: NORMAL Power: ON	<p>a. Adjust SG-553A/U AMPLITUDE coarse control to obtain a 3.0 volt indication on SG-553A/U output level meter.</p> <p>b. Adjust ME-202/U Voltage Readout Dials to obtain a 0 (center scale) indication on ME-202/U meter.</p> <p>c. Set SG-553A/U EXPAND-NORMAL switch to EXPAND and adjust SET REFERENCE coarse and/or SET REFERENCE FINE controls to obtain a 0 (center scale) indication on top scale of SG-553A-U output level meter.</p> <p>d. Set SG-553A/U FREQUENCY dial to 1, RANGE switch to X10, and adjust AMPLITUDE FINE control to obtain a 0 (center scale) indication on ME-202/U meter.</p> <p>e. Set SG-553A/U RANGE switch to X1 00, X1K, X10K, X100K, and X1M positions in sequence.</p> <p>NOTE Adjust AMPLITUDE FINE control to obtain a 0 (center scale) indication on ME-202/U meter after each RANGE switch change.</p> <p>f. Set SG-553A/U FREQUENCY dial to 10 and</p>	<p>a. None.</p> <p>b. None.</p> <p>c. None</p> <p>d. SG-553A/U output level meter shall indicate 0 (center scale) ± 14 top scale divisions.</p> <p>e. Same as d above for each RANGE switch position.</p> <p>f. Same as above.</p>

Table 7-7. Output Level Meter, Expanded Scale, Accuracy Check-Continued

Step No	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1			adjust AMPLITUDE FINE control to obtain a 0 (center scale) indication on ME-202/U meter.	
2	Power: OFF	

7-10. Frequency Response Check

a. Test Equipment and Materials. Voltmeter, Electronic ME-202/U and Dummy Load DA-471/U.

b. Test Connections and Conditions. Do not interconnect equipment until directed to in table 7-8 following.

lowing.

c. Procedure. SG-553A/U must have passed checks outlined in paragraphs 7-8 and 7-9 prior to performing the procedures in table 7-8. Permit appropriate warmup time.

Table 7-8. Output Amplitude and Frequency Response Check

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
1	N/A Terminate output using DA-471/U.	SG-553A/U: RANGE: X10 FREQUENCY: 10 AMPLITUDE coarse: ccw AMPLITUDE FINE: midposition SET REFERENCE coarse: midposition SET REFERENCE FINE: midposition OUTPUT ATTENUATOR: +20 DBM EXPAND-NORMAL: NORMAL Power: ON	a. Adjust SG-553A/U AMPLITUDE coarse control to obtain a 3.0 volt indication on SG-553A/U output level meter. b. Set SG-553A/U EXPAND-NORMAL switch to EXPAND and adjust SET REFERENCE coarse and/or SET REFERENCE FINE controls for a 0 (center scale) indication on top scale of SG-553A/U output level meter. c. Set SG-553A/U RANGE switch to X1 00, X1K, X1 0K, X100K, and X1M positions in sequence.	a. None. b. None. c. SG-553A/U output level meter shall indicate 0 (center scale) ± 2.0 percent (± 20 top scale divisions) for each RANGE switch position.
2	Connect equipment as shown in figure 7-4. ME-202/U: RANGE: 5 NULL: VTVM Function: AC Voltage Readout Dials: 3.0000	Same as step 1 except SG-553A/U: RANGE: X1K FREQUENCY: 5 EXPAND-NORMAL: EXPAND	a. Adjust SG-553A/U AMPLITUDE coarse control to obtain a +3.0 volt indication on ME-202/U meter. b. Set ME-202/U NULL switch to 0.1 position and adjust SG-553A/U AMPLITUDE FINE control to obtain a 0 (center scale) indication on ME-202/U meter. c. Set ME-202/U NULL switch to VTVM and adjust SG-553A/U SET REFERENCE coarse and/or SET REFERENCE FINE controls to obtain a 0 (center scale) indication on top scale of SG-553A/U output level meter. d. Set SG-553A/U RANGE switch to X10, FREQUENCY to 1, EX-	a. None. b. None. c. None. d. None.

Table 7-8. Output Amplitude and Frequency Response Check-Continued

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
			PAND-NORMAL switch to NORMAL, and adjust AMPLITUDE FINE control to obtain a 3.0 volt indication on SG-553A/U output level meter.	
			e. Set SG-553A/U EXPAND-NORMAL switch to EXPAND.	e. SG-553A/U output level meter shall indicate 0 (center scale) \pm 2.0 percent (\pm 20 top scale divisions).
			f. Set SG-553A/U FREQUENCY dial to 4 EXPAND-NORMAL switch to NORMAL, and adjust AMPLITUDE FINE control to obtain a 3.0 volt indication on SG-553A/U output level meter.	f. None.
			g. Set SG-553A/U EXPAND-NORMAL switch to EXPAND.	g. SG-553A/U output level meter shall indicate 0 (center scale) \pm 1.0 percent (\pm 10 top scale divisions).
			h. Set SG-553A/U RANGE switch to X1 00, EXPAND-NORMAL switch to NORMAL, and adjust AMPLITUDE FINE control to obtain a 3.0 volt indication on SG-553A/U output level meter.	h. None
			i. Set SG-553A/U EXPAND-NORMAL switch to EXPAND.	i. Same as g above.
			j. Repeat steps h and i above with SG-553A/U RANGE switch set to X1K, X10K, X100K, and X1M positions in sequence.	j. Same as g above for each RANGE switch position.
			k. Set SG-553A/U FREQUENCY dial to 10, EXPAND-NORMAL switch to NORMAL, and adjust AMPLITUDE FINE control to obtain a 3.0 volt indication on SG-553A/U output level meter.	k. None
			l. Set SG-553A/U EXPAND-NORMAL switch to EXPAND.	l. Same as e above
3	Power: OFF	

7-11. Distortion Check

a. *Test Equipment and Materials.* Analyzer, Spectrum TS-723/U.

b. *Test Connections and Conditions.* Interconnect

equipment as shown in figure 7-6,

c. *Procedure.* Perform procedures in table 7-9, Permit appropriate warmup time.

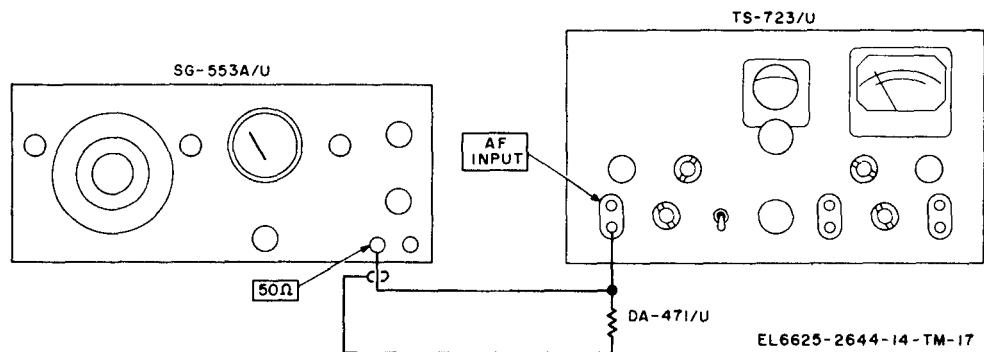


Figure 7-6. Distortion test setup.

Table 7-9. Distortion Check

Step No.	Test equipment control settings	Equipment under test control settings	Test procedure	Performance standard
	TS-723/U: AF-RF Selector SW: AF Meter Range SW; 100 percent Function SW: SET LEVEL RANGE switch: X1 Signal INPUT Control: ccw	SG-553A/U: Power: OFF RANGE: X10 FREQUENCY dial: 10 AMPLITUDE: clockwise OUTPUT ATTENU- ATOR: + 20 Power: ON	TS-723/U: a. Adjust the signal INPUT control clockwise to obtain full scale meter reading (1.0). b. Set the function switch to DISTORTION. c. Adjust the coarse FREQUENCY tuning control until the meter pointer drops sharply. d. Switch the meter range switch counterclockwise as necessary to obtain a reading while adjusting the coarse and fine FREQUENCY and BALANCE controls for maximum meter dip or null. e. Read the percent distortion on the meter scale selected by the meter range switch.	TS-723/U: Distortion less than 1 percent.

APPENDIX A REFERENCES

DA Pam 310-4 SB 38-100	Index of Technical Publications. Preservation, Packaging, Packing, and Marking Materials, Supplies and Equipment Used by the Army.	TM 11-6625-537-15	Operator, Organizational, Field, and Depot Maintenance Manual: Voltmeter Electronic ME-202/U.
TB 43-0118	Field Instructions for Painting and Preserving Electronics Command Equipment Including Camouflage Pattern Painting of Electrical Equipment Shelters.	TM 11-6625-539-15-1	Organizational, Direct Support, General Support, and Depot Maintenance Manual: Test Set, Transistor TS-1836A/U.
TM 11-6625-255-14	Operator's, Organizational, Direct Support and General Support Maintenance Manual: Spectrum Analyzer TS-723A/U, TS-723B/U, TS-723C/U and TS-723D/U (NSN 6625-00-668-9418),	TM 11-6625-545-15	Operator's, Organizational, Direct Support, General Support, and Depot Maintenance Manual: Indicators, Standing Wave Ratio IM-175/U (NSN 6625-00-892-5670) and IM-175B/U (NSN 6625-00-862-3480).
TM 11-6625-366-15	Operator's, Organizational, Direct Support, General Support, and Depot Maintenance Manual: Multimeter TS-352B/U (NSN 6625-00-553-0142).	TM 11-6625-700-10	Operator's Manual, Digital Readout, Electronic Counter AN/USM-207 (NSN 6625-00-911-6368).
		TM 38-750	The Army Maintenance Management Systems (TAMMS).

APPENDIX C

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

C-1. General

This appendix provides a summary of the maintenance operations for AN/USM-205A. It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

C-2. Maintenance Function

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean, preserve, drain, paint, or to replenish fuel/lubricants/hydraulic fluids or compressed air supplies.

d. Adjust. Maintain within prescribed limits by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. Align. To adjust specified variable elements of an item to about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipment used in precision measurement. Consists of the comparison of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. In-stall. The act of emplacing, seating, or fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment/system.

h. Replace. The act of substituting a serviceable like-type part, subassembly, model (component or assembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module/component/assembly, end item or system.

j. Overhaul. That periodic maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (e.g., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like-new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like-new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipment/components.

C-3. Column Entries

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Functions. Column 3 lists the functions to be performed on the item listed in column 2.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a “worktime” figure in the appropriate subcolumn (s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number of complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate “worktime” figures will be shown for each category. The number of man-hours specified by the “worktime” figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. Subcolumns of column 4 as follows:

C-Operator/Crew
O-Organizational
F-Direct Support
H-General Support
D-Depot

e. Column 5, Tools and Equipment. Column 5 specifies by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

C-4. Tool and Test Equipment Requirements (Table 1)

a. Tool or Test Equipment Reference Code. The numbers in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool or test equipment for the maintenance functions.

b. Maintenance Category. The codes in this column indicate the maintenance category allocated the tool or test equipment.

c. Nomenclature. This column lists the noun name and nomenclature of the tools and test equipment required to perform the maintenance functions.

d. National/NATO Stock Number. This column lists the National/NATO stock number of the specific tool or test equipment.

e. Tool Number. This column lists the manufacturer’s part number of the tool followed by the Federal Supply Code for manufacturers (5-digit) in parentheses.

SECTION II MAINTENANCE ALLOCATION CHART
FOR

AN/USM-205A

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIPMENT
			C	O	F	H	D	
01	GENERATOR, SIGNAL AN/USM-205A	Inspect ¹ Test ⁴ Service ² Adjust ⁵ Repair ³ Repair ⁶ Overhaul Rebuild		0.2 0.5 0.3		0.8 0.4 0.7 1.5		1 to 9 11 1 to 10,12 11 10 1 to 10 1 to 10
02	DUMMY LOAD, DA-471/U	Inspect ⁷ Repair		0.1 0.2			2.0	

- (1) VISUAL, EXTERNAL.
 (2) CLEAN, TOUCH-UP EXTERNALLY.
 (3) REPLACE KNOBS, FUSES.
 (4) OPERATIONAL CHECKS, VOLTAGE, RESISTANCE CHECKS.
 (5) VOLTAGE, FREQUENCY ADJUSTMENTS
 (6) REPLACE DEFECTIVE PC BOARDS AND PARTS
 (7) INSPECT FOR OBVIOUS DAMAGE ONLY

TABLE I. TOOL AND TEST EQUIPMENT REQUIREMENTS
FOR

AN/USM-205A

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
1	H,D	ANALYZER, SPECTRUM TS-723/U	6625-00-668-9418	
2	H,D	ATTENUATOR, VARIABLE CN-796/U	5985-00-087-2547	
3	H,D	COUNTER, ELECTRONIC, DIGITAL READOUT AN/USM-207	6625-00-911-6368	
4	H,D	INDICATOR, STANDING WAVE RATIO IM-175/U	6625-00-892-5670	
5	H,D	MULTIMETER TS-352/U	6625-00-553-0142	
6	H,D	OSCILLOSCOPE AN/USM-281	6625-00-228-2201	
7	H,D	VOLTMETER, ELECTRONIC ME-202/U	6625-00-050-8686	
8	H,D	TEST SET, TRANSISTOR TS-1836/U	6625-00-893-2628	
9	H,D	THERMAL CONVERTER (HP 11049)	4931-00-130-5379	
10	H,D	TOOL KIT, ELECTRONIC EQUIPMENT TK-100/G	5180-00-605-0079	
11	O	TOOLS AND TEST EQUIPMENT AVAILABLE TO THE ORGANIZATIONAL REPAIRMAN BECAUSE OF HIS ASSIGNED MISSION		
12	H,D	ADAPTER, CONNECTOR (600 OHM)	5935-00-454-9945	

By Order of the Secretary of the Army:

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

Official:

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

Distribution:

Active Army:

USASA (2)
 Dir of Trans (1)
 COE (1)
 TSG (1)
 USAARENBD (1)
 AMC (1)
 MICOM (2)
 TECOM (2)
 TRADOC (2)
 ARADCOM (2)
 ARADCOM Rgn (2)
 OS Maj Cored (4)
 LOGCOMD (3)
 USACC (4)
 MDW (1)
 Armies (2)
 Corps (2)
 HISA (Ft Monmouth) (43)
 Ft Gillem (10)
 Ft Gordon (10)
 Ft Huachuca (10)
 Ft Carson (5)
 Ft Richardson (ECOM Oft) (2)
 WSMR (1)
 Svc Colleges (1)
 USASESS (5)

USAINTC (3)
 USAADS (2)
 USAFAS (2)
 USAARMS (2)
 USAIS (2)
 USAES (2)
 AD (1) except
 SAAD (30)
 LBAD (14)
 TOAD (14)
 SHAD (3)
 USA Dep (2)
 Sig Sec USA Dep (2)
 Sig Dep (2)
 ATS (1)
 MAAG (1)
 WRAMC (1)
 USARMIS (1)
 USAERDAA (1)
 USAERDAW (1)
 Sig FLDMS (1)
 Units org under fol TOE:
 11-500 (AA-AC) (1)
 29-134 (1)
 29-136 (1)

ARNG & USAR: None.

For explanation of abbreviations used, see AR 310-50.

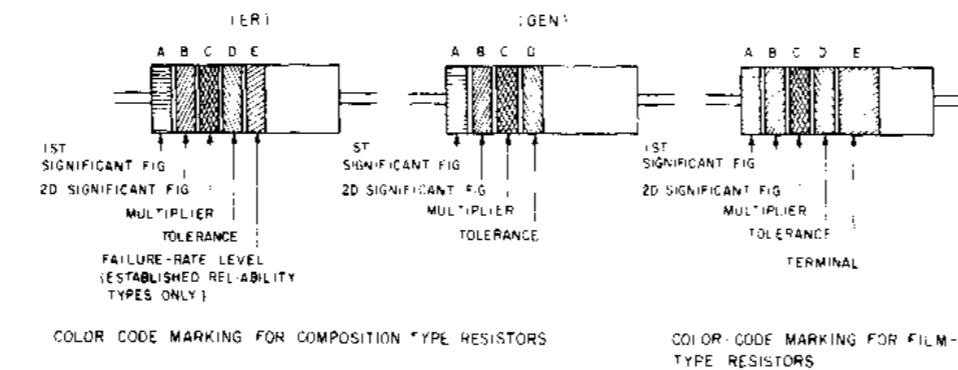


TABLE 1
COLOR CODE MARKING FOR COMPOSITION TYPE AND FILM TYPE RESISTORS

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
BLACK	0	BLACK	0	BLACK	1	BROWN	±10 (COMP TYPE ONLY)	BROWN	M10
BROWN	1	BROWN	1	BROWN	10	RED	±1	RED	P100
RED	2	RED	2	RED	100	ORANGE	±0.1	ORANGE	P1000
ORANGE	3	ORANGE	3	ORANGE	1,000	YELLOW	±5	YELLOW	S1000
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER	±0.01	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	0.01				
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.

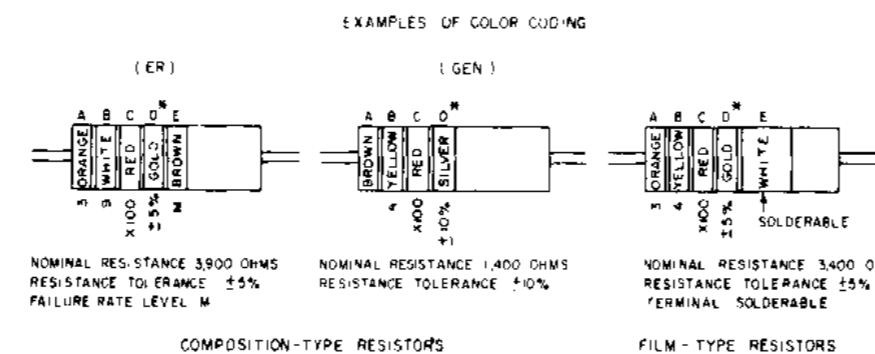
BAND E — WHEN USED ON COMPOSITION RESISTORS, BAND E INDICATES ESTABLISHED RELIABILITY FAILURE RATE LEVEL PERCENT FAILURE PER 1,000 HOURS (ON FILM RESISTORS, THIS BAND SHALL BE APPROXIMATELY 1/12 TIMES THE WIDTH OF OTHER BANDS AND INDICATES TYPE OF TERMINAL).

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.

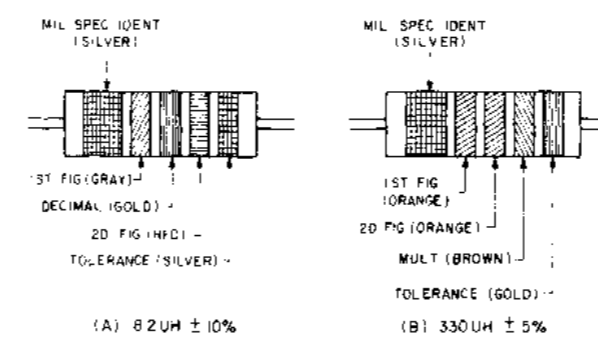


COMPOSITION-TYPE RESISTORS

IF BAND D IS OMITTED, THE RESISTOR TOLERANCE IS ±20% AND THE RESISTOR IS NOT MIL-STD

A. COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS

FILM-TYPE RESISTORS



COLOR CODING FOR TUBULAR ENCAPSULATED RF CHOKES. AT A, AN EXAMPLE OF THE CODING FOR AN 82UH CHOKES IS GIVEN. AT B, THE COLOR BANDS FOR A 330UH INDUCTOR ARE ILLUSTRATED.

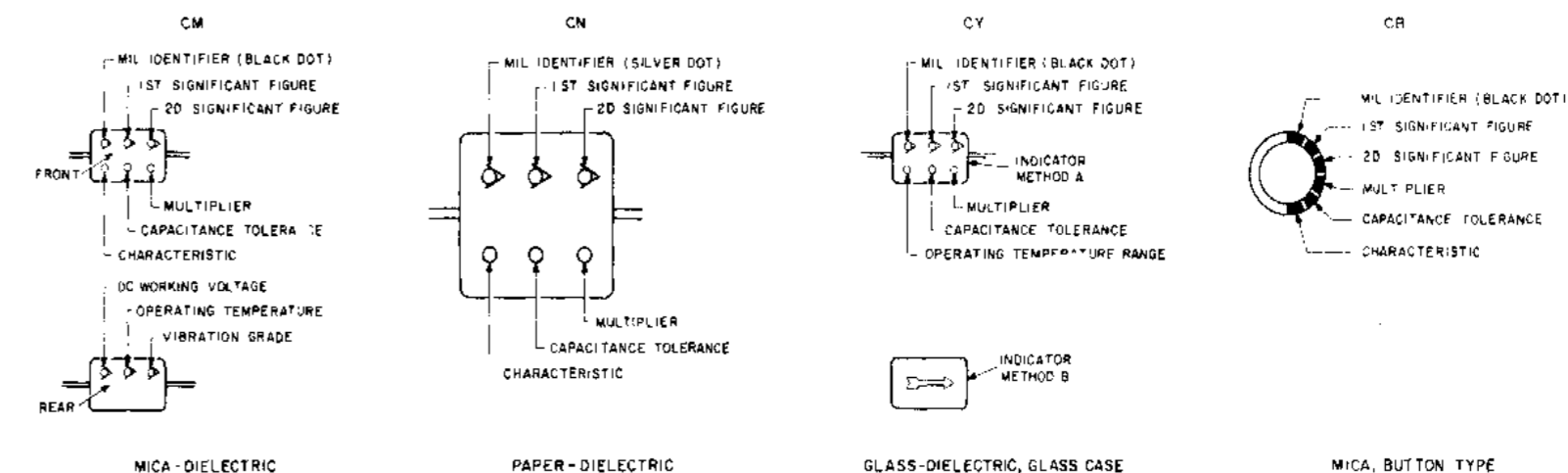
TABLE 2
COLOR CODING FOR TUBULAR ENCAPSULATED RF CHOKES

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		
VIOLET	7		
GRAY	8		
WHITE	9		
NONE			20
SILVER			10
GOLD			5

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

B. COLOR CODE MARKING FOR MILITARY STANDARD INDUCTORS

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

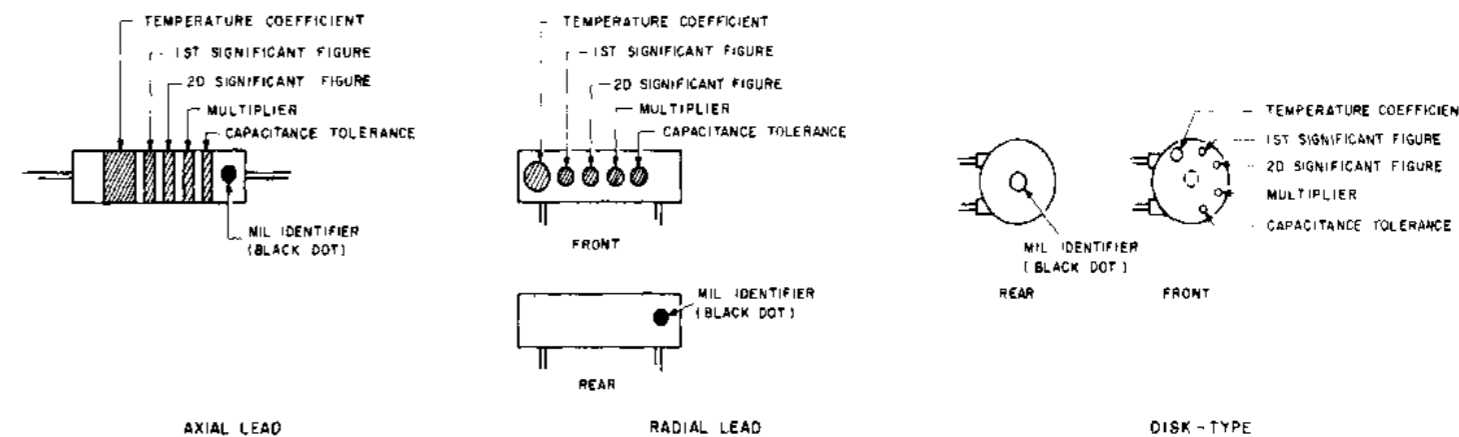


MICA-DIELECTRIC

PAPER-DIELECTRIC

GLASS-DIELECTRIC, GLASS CASE

MICA, BUTTON TYPE



AXIAL LEAD

RADIAL LEAD

DISK-TYPE

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

COLOR	MIL ID	1ST SIG FIG	2ND SIG FIG	MULTIPLIER	CAPACITANCE TOLERANCE	CHARACTERISTIC	DC WORKING VOLTAGE	OPERATING TEMP RANGE	VIBRATION GRADE
BLACK	CM, CY	0	0	1	±20%	A	50V	-55°C to +100°C	10-55 Hz
BROWN		1	1	10	±20%	B	50V	-55°C to +100°C	
RED		2	2	100	±2%	C	50V	-55°C to +100°C	
ORANGE		3	3	1,000	±30%	D	50V	-55°C to +100°C	
YELLOW		4	4	10,000	±10%	E	50V	-55°C to +100°C	10-2,000 Hz
GREEN		5	5		±5%	F	50V	-55°C to +100°C	
BLUE		6	6				50V	-55°C to +100°C	
PURPLE (VIOLET)		7	7				50V	-55°C to +100°C	
GRAY		8	8				50V	-55°C to +100°C	
WHITE		9	9				50V	-55°C to +100°C	
GOLD				0.1	±5%		50V	-55°C to +100°C	
SILVER	CN			0.01	±10%		50V	-55°C to +100°C	

TABLE 4 — TEMPERATURE COMPENSATING, STYLE CC

COLOR	TEMPERATURE COEFFICIENT	1ST SIG FIG	2ND SIG FIG	MULTIPLIER	CAPACITANCE TOLERANCE	MIL ID
BLACK	0	0	0	1	±2.0 uF	CC
BROWN	-30	1	1	10	±1%	
RED	-80	2	2	100	±2%	
ORANGE	-150	3	3	1,000	±1%	
YELLOW	-220	4	4		±5%	
GREEN	-350	5	5		±10%	
BLUE	-470	6	6			
PURPLE (VIOLET)	-750	7	7			
GRAY		8	8	0.01	±10%	
WHITE		9	9	0.1	±10%	
GOLD	+100			0.1	±10%	
SILVER				0.01	±10%	

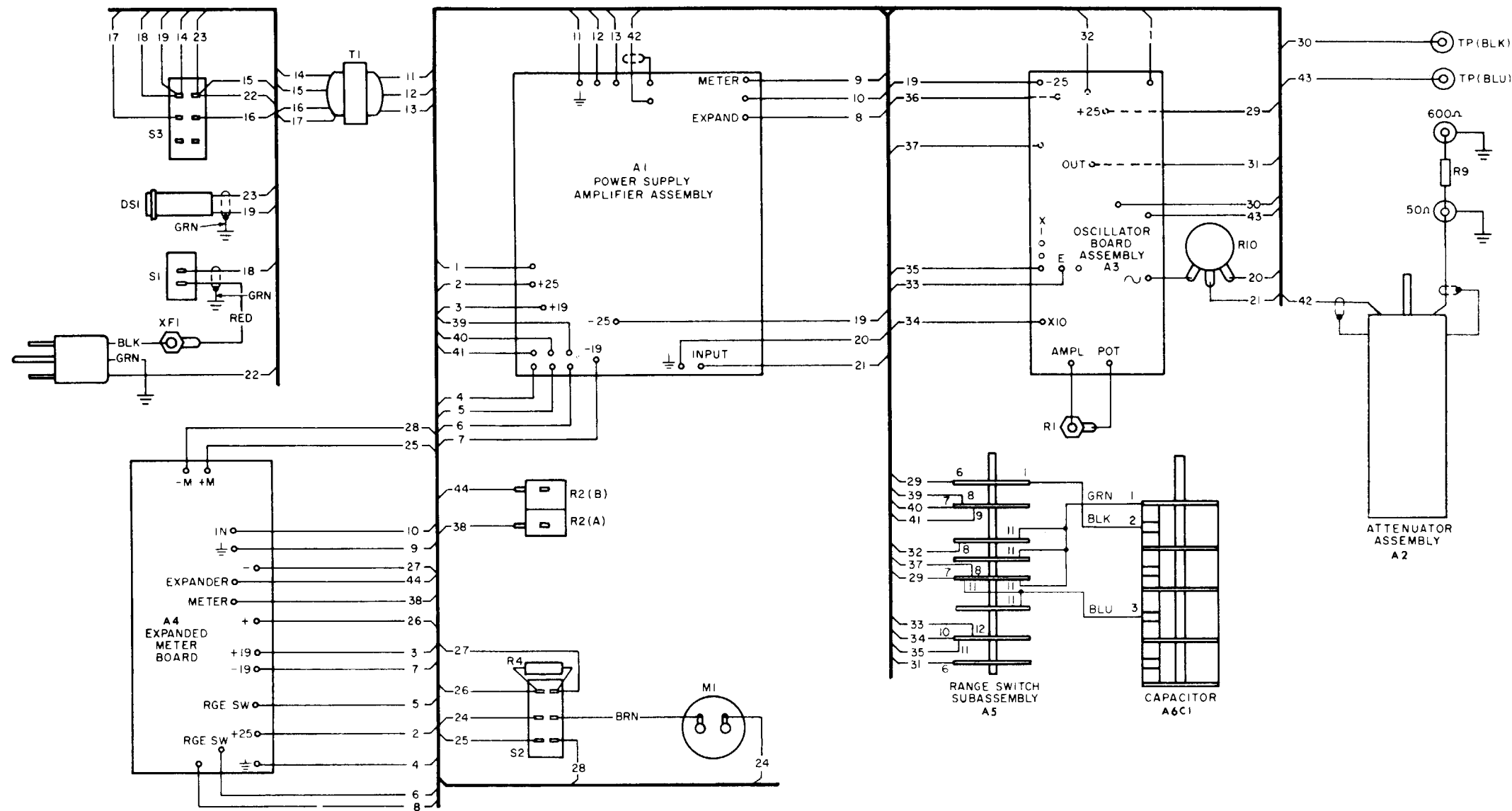
- THE MULTIPLIER IS THE NUMBER BY WHICH THE TWO SIGNIFICANT (SIG) FIGURES ARE MULTIPLIED TO OBTAIN THE CAPACITANCE IN UUF.
- LETTERS INDICATE THE CHARACTERISTICS DESIGNATED IN APPLICABLE SPECIFICATIONS: MIL-C-5, MIL-C-250, MIL-C-1272B, AND MIL-C-10350C RESPECTIVELY.
- LETTERS INDICATE THE TEMPERATURE RANGE AND VOLTAGE-TEMPERATURE LIMITS DESIGNATED IN MIL-C-10150.
- TEMPERATURE COEFFICIENT IN PARTS PER MILLION PER DEGREE CENTIGRADE.
- OPTIONAL CODING WHERE METALLIC PIGMENTS ARE UNDESIRABLE.

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

C. COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS

ESC-FM 913.23

Figure FO-2. Signal Generator AN/USM-205A, schematic diagram.



COLOR CODE			
WIRE NO	COLOR	WIRE NO	COLOR
1	RED	23	RED
2	RED	24	RED
3	VIOLET	25	ORANGE
4	BLACK	26	YELLOW
5	BLUE	27	WHITE
6	YELLOW	28	BLACK
7	ORANGE	29	BROWN
8	GRAY	30	BLACK
9	BLACK	31	ORANGE
10	ORANGE	32	GREEN
11	BLUE	33	VIOLET
12	VIOLET	34	BLUE
13	GREEN	35	YELLOW
14	YELLOW	36	RED
15	BROWN	37	BROWN
16	ORANGE	38	GREEN
17	RED	39	YELLOW
18	BLACK	40	BLUE
19	BROWN	41	BLACK
20	BLACK	42	BLACK
21	BROWN	43	BLUE
22	WHITE	44	BROWN

EL 6625-2644-14-TM-20

Figure FO-3. Signal Generator AN/USM-205A, wiring diagram.

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