EMFO LIBRARY

TECHNICAL DATA

TM 11-1036

WAR DEPARTMENT TECHNICAL MANUAL

HANDBOOK OF MAINTENANCE INSTRUCTIONS FOR RADIO FREQUENCY WATTMETER TS-118-AP

EMFO LIBRARY

This is not a revision. This is a reprint of AN 16-35TS118-2 dated 20 March 1945, including revised pages dated 5 July 1945, for stock only. No initial distribution will be made to personnel possessing original publication.

WAR DEPARTMENT • MARCH 1945

TECHNICAL DATA

EO 18 Oct 67
310-4
EMFO LIBRARY

TECHNICAL MANUAL

Operator, Organizational, Field and Depot Maintenance Manual

RADIO FREQUENCY WATTMETER TS–118/AP

TM 11–1036
CHANGE No. 1

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *27 September 1963*

TM 11–1036, 20 March 1945, is changed as follows:

The title of the manual is changed to read as shown above.

Page iii. Delete information in its entirety.

Page 1–1. Add paragraphs 1.1 and 1.2 after paragraph 1.

1.1. Index of 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. DA Pam 310–4 is an index of current technical manuals, technical bulletins, supply bulletins, lubrication orders, and modification work orders available through publications supply channels. The index lists the individual parts (–10, –20, –35P, etc.) and the latest changes to and revisions of each equipment publication.

1.2 Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Use equipment forms and records in accordance with instructions in TM 38–750.

b. Report of Damaged or Improper Shipment. Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment) as prescribed in AR 700–58 (Army), NAVSANDA Publication 378 (Navy), and AFR 71–4 (Air Force).

c. Reporting of Equipment Manual Improvements. The direct reporting by the individual user of errors, omissions, and recommendations for improving this manual is authorized and encouraged. DA Form 2028 (Recommended Changes to DA Technical Manual Parts Lists or Supply Manual 7, 8, or 9) will be used for reporting these improvements. This form will be completed in triplicate using pencil, pen, or typewriter. The original and one copy will be forwarded direct to Commanding Officer, U.S. Army Electronics Materiel Support Agency, ATTN: SELMS–MP, Fort Monmouth, N. J. 07703. One information copy will be furnished to the individual's immediate supervisor (e.g., officer, noncommissioned officer, supervisor, etc).

Page 3–2 – 4–0. Add section III.1 after section III.

SECTION III.1

PREVENTIVE MAINTENANCE INSTRUCTIONS

1. Scope of Maintenance

The maintenance duties assigned to the operator and organizational repairman of the equipment are listed below together with a reference to the paragraphs covering the specific maintenance functions.

a. Daily preventive maintenance checks and services (par. 4).
b. Weekly preventive maintenance checks and services (par. 5).
c. Monthly preventive maintenance checks and services (par. 6).
d. Quarterly preventive maintenance checks and services (par. 7).
e. Cleaning (par. 8).
f. Touchup painting (par. 9).

TAGO 6191A—704416—October 1963

EMFO LIBRARY
TECHNICAL DATA

2. Preventive Maintenance

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble, to reduce downtime, and to assure that the equipment is serviceable.

a. Systematic Care. The procedures given in paragraphs 3 through 9 cover routine systematic care and cleaning essential to proper upkeep and operation of the equipment.

b. Preventive Maintenance Checks and Services. The preventive maintenance checks and services charts (pars. 4 through 7) outline functions to be performed at specific intervals. These checks and services are to maintain Army electronic equipment in a combat serviceable condition; that is, in good general (physical) condition and in good operating condition. To assist operators in maintaining combat serviceability, the charts indicate what to check, how to check, and what the normal conditions are. The references column lists the manuals that contain detailed repair or replacement procedures. If the defect cannot be remedied by performing the corrective actions listed, higher echelon maintenance or repair is required. Records and reports of these checks and services must be made in accordance with the requirements set forth in TM 38–750.

3. Preventive Maintenance Checks and Services Periods

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

a. Paragraph 4 specifies the checks and services that must be accomplished daily (or at least once each week if the equipment is maintained in standby condition).

b. Paragraphs 5, 6, and 7 specify *additional* checks and services that must be performed on a weekly, monthly, and quarterly basis, respectively.

4. Daily Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedures	References
1	Completeness	See that the equipment is complete (TM 11–6625–257–12P).	None.
2	Exterior surfaces	Clean the exterior surfaces, including the panel and meter glass (par. 8). Check the meter glass and indicator lens for cracks.	None.
3	Connectors	Check the tightness of all connectors.	None.
4	Controls and indicators	While making the operating checks (item 5), observe that the mechanical action of each knob, dial, and switch is smooth and free of external or internal binding, and that there is no excessive looseness. Also, check the meter for sticking or bent pointer.	None.
5	Operation	During operation, be alert for any unusual performance or condition.	Section IV, pars. 4, 5, and 6.

5. Weekly Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedures	References
1	Cables	Inspect cords, cables, and wires for chafed, cracked, or frayed insulation. Replace connectors that are broken, arced, stripped, or worn excessively.	None.
2	Handles and latches	Inspect handles, latches, and hinges for looseness. Replace or tighten as necessary.	None.
3	Metal surfaces	Inspect exposed metal surfaces for rust and corrosion. Touchup paint as required (par. 9).	None.

6. Monthly Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedures	References
1	Pluckout items	Inspect seating of pluckout items. Make sure that tube clamps grip tube bases tightly.	None.
2	Jacks	Inspect jacks for snug fit and good contact.	None.
3	Resistors and capacitors	Inspect the resistors and capacitor for cracks, blistering, or other detrimental defects.	None.
4	Interior	Clean interior of chassis and cabinet.	None.
5	Motor	Check brushes on blower motor.	Section IV. Par. 4.

7. Quarterly Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedures	References
1	Publications	See that all publications are complete, serviceable, and current.	DA Pam 310–4.
2	Modifications	Check DA Pam 310–4 to determine if new applicable MWO's have been published. All URGENT MWO's must be applied immediately. All NORMAL MWO's must be scheduled.	TM 38–750 and DA Pam 310–4.
3	Spare parts	Check all spare parts (operator and organizational) for general condition and method of storage. There should be no evidence of overstock, and all shortages must be on valid requisitions.	TM 11–6625–257–12P.

TECHNICAL DATA

8. Cleaning

Inspect the exterior of the equipment. The exterior surfaces should be clean, and free of dust, dirt, grease, and fungus.

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

***Warning:* Cleaning compound is flammable and its fumes are toxic. Provide adequate ventilation. *Do not* use near a flame.**

b. Remove grease, fungus, and ground-in dirt from the cases; use a cloth dampened (not wet) with Cleaning Compound (Federal Stock No. 7930–395–9542). After cleaning, wipe dry with a cloth.

c. Remove dust or dirt from plugs and jacks with a brush.

***Caution:* Do not press on the meter face (glass) when cleaning; the meter may become damaged.**

d. Clean the front panel, meter, and control knobs; use a soft clean cloth. If necessary, dampen the cloth with water; mild soap may be used for more effective cleaning. Wipe dry with a cloth.

9. Touchup Painting Instructions

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 the applicable cleaning and refinishing practices specified in TM 9–213.

Page 7–3 – 7–4. Add appendix after section VII.

APPENDIX

REFERENCES

DA Pam 310–4	Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
TM 9–213	Painting Instructions for Field Use.
TM 11–6625–257–12P	Operator's and Organizational Maintenance Repair Parts and Special Tools List and Maintenance Allocation Chart for Radio Frequency Wattmeters TS–118/AP and TS–118A/AP.
TM 11–6625–257–35P	Field and Depot Maintenance Repair Parts and Special Tools List for Radio Frequency Wattmeters TS–118/AP and TS–118A/AP.
TM 38–750	The Army Equipment Record System and Procedures.

Page 6–1. Delete the introduction in its entirety.

Page 6–3 through 6–11. Delete table of parts.

By Order of the Secretary of the Army:

EARLE G. WHEELER,
General, United States Army,
Chief of Staff.

Official:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

Distribution:

Active Army:

USAMC (5)
Seventh US Army (2)
EUSA (2)
USARJ (2)
USASTC (10)
USA Engr Cen (5)
USAINTC (5)
USAADS (10)
Redstone Arsenal (3)
USA Elct RD Lab (2)
USAEPG (2)
USA Elct Mat Spt Agcy (15)

Units organized under following TOE:
11–7 (2)
11–16 (2)
11–57 (2)
11–98 (2)
11–117 (2)
11–155 (2)
11–157 (2)
11–500 (AA–AE) (2)
11–557 (2)
11–587 (2)
11–592 (2)
11–597 (2)

NG: None.

USAR: None.

For explanation of abbreviations used, see AR 320–50.

☆U. S. GOVERNMENT PRINTING OFFICE: 1963

TECHNICAL DATA

TECHNICAL DATA

TECHNICAL DATA

WAR DEPARTMENT TECHNICAL MANUAL

TM 11-1036

HANDBOOK OF MAINTENANCE INSTRUCTIONS FOR RADIO FREQUENCY WATTMETER TS-118-AP

This is not a revision. This is a reprint of AN 16-35TS118-2 dated 20 March 1945, including revised pages dated 5 July 1945, for stock only. No initial distribution will be made to personnel possessing original publication.

WAR DEPARTMENT • MARCH 1945

United States Government Printing Office
Washington : 1950

TECHNICAL DATA

WAR DEPARTMENT
WASHINGTON 25, D. C., *20 March 1945*

TM 11–1036, Handbook of Maintenance Instructions for Radio Frequency Wattmeter TS–118/AP, is published for the information and guidance of all concerned.

[AG 300.7 (20 Mar 45)]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL
Chief of Staff

OFFICIAL:
J. A. ULIO
Major General
The Adjutant General

DISTRIBUTION:
Stock.

TABLE OF CONTENTS

Section	*Page*
Destruction of Abandoned Materiel in the Combat Zone	iii
Unsatisfactory Report	iii
I. GENERAL DESCRIPTION	1-1—1-3
1. General	1-1
2. Equipment Supplied	1-1
3. Description	1-1
a. Physical	1-1
b. Electrical	1-3
II. OPERATION AND ADJUSTMENT	2-1—2-2
1. To Start the Equipment	2-1
2. Power Measurement	2-1
3. To Stop the Equipment	2-1
4. Preparation for Use	2-1
5. Meter Zero Adjustment	2-2
III. THEORY OF OPERATION	3-0—3-2
1. Mechanical Characteristics	3-0
2. Electrical Characteristics	3-1
IV. MAINTENANCE	4-0—4-5
1. General	4-0
2. Terminating Resistor	4-0
3. Lossy Line	4-0
4. Blower and Motor	4-1
5. Fuses	4-1
6. Pilot Light	4-1
7. Thermocouples	4-1
8. Meter	4-5
9. Emergency Repair	4-5
V. SUPPLEMENTARY DATA	5-1
1. Tubes	5-1
2. Frequency Range	5-1
3. Impedance	5-1
4. Power Requirements	5-1
VI. PARTS CATALOG	6-1—6-10
VII. DRAWINGS	7-1 to 7-3—7-4

★

LIST OF ILLUSTRATIONS

Figure	*Page*
1-1. Radio Frequency Wattmeter TS-118/AP	iv
1-2. Radio Frequency Wattmeter TS-118/AP (Less Accessories)—Front View	1-2
3-1. Connection of Capacity Coupled Transmitter to Radio Frequency Wattmeter TS-118/AP by means of Tuning Stub TN-87/AP	
4-1. Radio Frequency Wattmeter TS-118/AP —Assembly of Terminating Resistor and Fittings	4-1
4-2. Radio Frequency Wattmeter TS-118/AP (Less Accessories)—Front View, Housing Removed	4-2
4-3. Radio Frequency Wattmeter TS-118/AP (Less Accessories)—Rear View, Housing Removed	4-3
4-4. Thermocouple Element—Dimensions and Construction	4-4
4-5. Radio Frequency Wattmeter TS-118/AP —Circuit and Data for Test of D-C Circuits and Meter	4-5
7-1. Radio Frequency Wattmeter TS-118/AP —Blower Motor Circuit, Schematic Diagram	7-3—7-4
7-2. Radio Frequency Wattmeter TS-118/AP —R-F Power Measuring Circuit, Schematic Diagram	7-3—7-4

Destruction of Abandoned Materiel in the Combat Zone

In case it should become necessary to prevent the capture of this equipment and when ordered to do so, DESTROY IT SO THAT NO PART OF IT CAN BE SALVAGED, RECOGNIZED, OR USED BY THE ENEMY. BURN ALL PAPERS AND BOOKS.

Means:—

1. Explosives, when provided.
2. Hammers, axes, sledges, machetes, or whatever heavy object is readily available.
3. Burning by means of incendiaries such as gasoline, oil, paper, or wood.
4. Grenades and shots from available arms.
5. Burying all debris or disposing of it in streams or other bodies of water, where possible and when time permits.

Procedure:—

1. Obliterate all identifying marks. Destroy nameplates and circuit labels.
2. Demolish all panels, castings, switch- and instrument-boards.
3. Destroy all controls, switches, relays, connections, and meters.
4. Rip out all wiring and cut interconnections of electrical equipment. Smash gas, oil, and water-cooling systems in gas-engine generators, etc.
5. Smash every electrical or mechanical part, whether rotating, moving, or fixed.
6. Break up all operating instruments such as keys, phones, microphones, etc.
7. Destroy all classes of carrying cases, straps, containers, etc.
8. Bury or scatter all debris.

DESTROY EVERYTHING!

★

Unsatisfactory Report

For U. S. Army Air Force Personnel:

In the event of malfunctioning, unsatisfactory design, or unsatisfactory installation of any of the component units of this equipment, or if the material contained in this book is considered inadequate or erroneous, an Unsatisfactory Report, AAF Form No. 54, or a report in similar form, shall be submitted in accordance with the provisions of Army Air Force Regulation No. 15-54, listing:

1. Station and organization.
2. Nameplate data (type number or complete nomenclature if nameplate is not attached to the equipment).
3. Date and nature of failure.
4. Radio model and serial number.
5. Remedy used or proposed to prevent recurrence.
6. Handbook errors or inadequacies, if applicable.

For U. S. Navy Personnel:

Report of failure of any part of this equipment during its guaranteed life shall be made on Form N. Aer. 4112, "Report of Unsatisfactory or Defective Material," or a report in similar form, and forwarded in accordance with the latest instructions of the Bureau of Aeronautics. In addition to other distribution required, one copy shall be furnished to the inspector of Naval Materiel (location to be specified) and the Bureau of Ships. Such reports of failure shall include:

1. Reporting activity.
2. Nameplate data.
3. Date placed in service.
4. Part which failed.
5. Nature and cause of failure.
6. Replacement needed (yes—no).
7. Remedy used or proposed to prevent recurrence.

For British Personnel:

Form 1022 procedure shall be used when reporting failure of radio equipment.

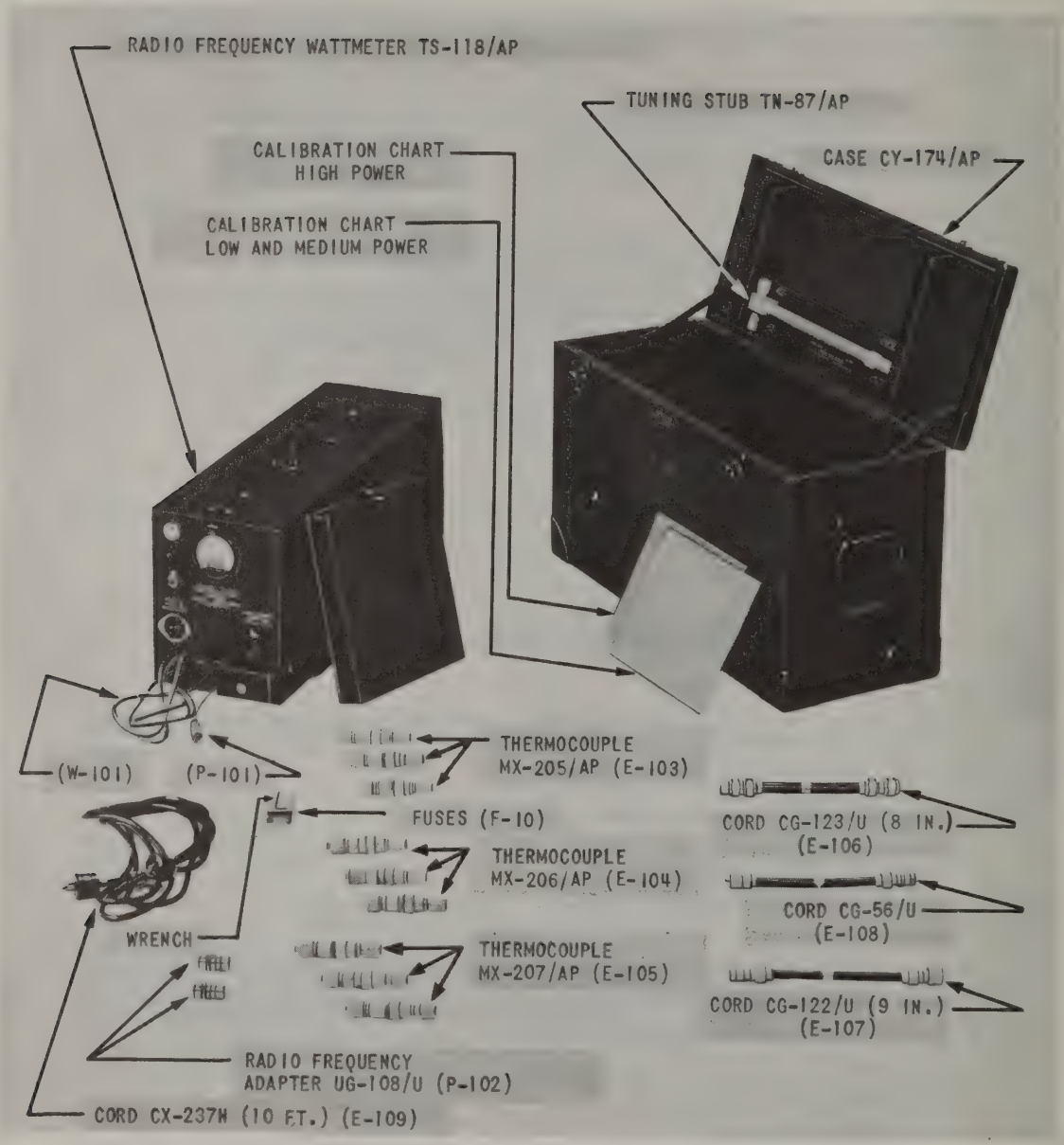


Figure 1-1. Radio Frequency Wattmeter TS-118/AP

SAFETY NOTICE

Dangerous voltages are present at the output connectors of equipments to which Radio Frequency Wattmeter TS-118/AP will be connected. Observe all safety precautions when making or breaking such connections.

SECTION I
GENERAL DESCRIPTION

1. GENERAL.

a. Radio Frequency Wattmeter TS-118/AP is designed to measure r-f power output of raven transmitters.

b. It has an input impedance of 50 ohms at frequencies ranging from 20 to 750 megacycles and will handle inputs ranging from 5 to 500 watts. It may also be used to measure r-f output power of any other transmitter in this frequency and power range, providing that the transmitter measured is equipped with the proper type of output connector.

c. The only power required to operate the equipment is 110 volts, a-c or d-c, for the blower motor. The motor draws about 0.2 amperes at 110 volts.

2. EQUIPMENT SUPPLIED.

The following table lists the equipment supplied with Radio Frequency Wattmeter TS-118/AP:

Quantity per Equipment	*Name of Unit*	*Army-Navy Type Designation*	*Over-all Dimensions (inches)*	*Weight (pounds)*
1	Radio Frequency Wattmeter includes:	TS-118/AP	24½ x 11 x 8½	26
1	Case	CY-174/AP	31 x 14 x 12½	22
3	Thermocouple (low-power)	MX-205/AP		
3	Thermocouple (medium-power)	MX-206/AP		
3	Thermocouple (high-power)	MX-207/AP		
1	Cord (line)	CX-237/U (10 ft.)	120	
1	Cord	CG-123/U (8 in.)	8	
1	Cord	CG-122/U (9 in.)	9	
1	Cord	CG-56/U	9	
2	Radio Frequency Adapter	UG-108/U		
1	Tuning Stub	TN-87/AP		
1	Calibration Chart (low-medium power range)			
1	Calibration Chart (high-power range)			
5	Fuses (2 amperes)			
1	Wrench for #8 Hex-Socket Set Screws			

3. DESCRIPTION.

a. PHYSICAL.

(1) The wattmeter is contained in a rectangular case. At the front end of the case is a control panel containing the milliammeter (M-101), the pilot light (I-101), the blower motor "ON-OFF" switch (S-102), the range switch (S-101), and the power receptacle (J-101).

(2) The thermocouple assemblies, adapters, and some cords are stored in the compartment at the base of the instrument.

(3) Calibration charts are contained in the front cover. Cord CX-237/U (10 ft.) (E-109) and the first six feet of *lossy* line (high-loss coaxial) are stored in the air intake duct at the bottom of Radio Frequency Wattmeter TS-118/AP. Other accessories are contained in a long, narrow drawer at the bottom of the wattmeter.

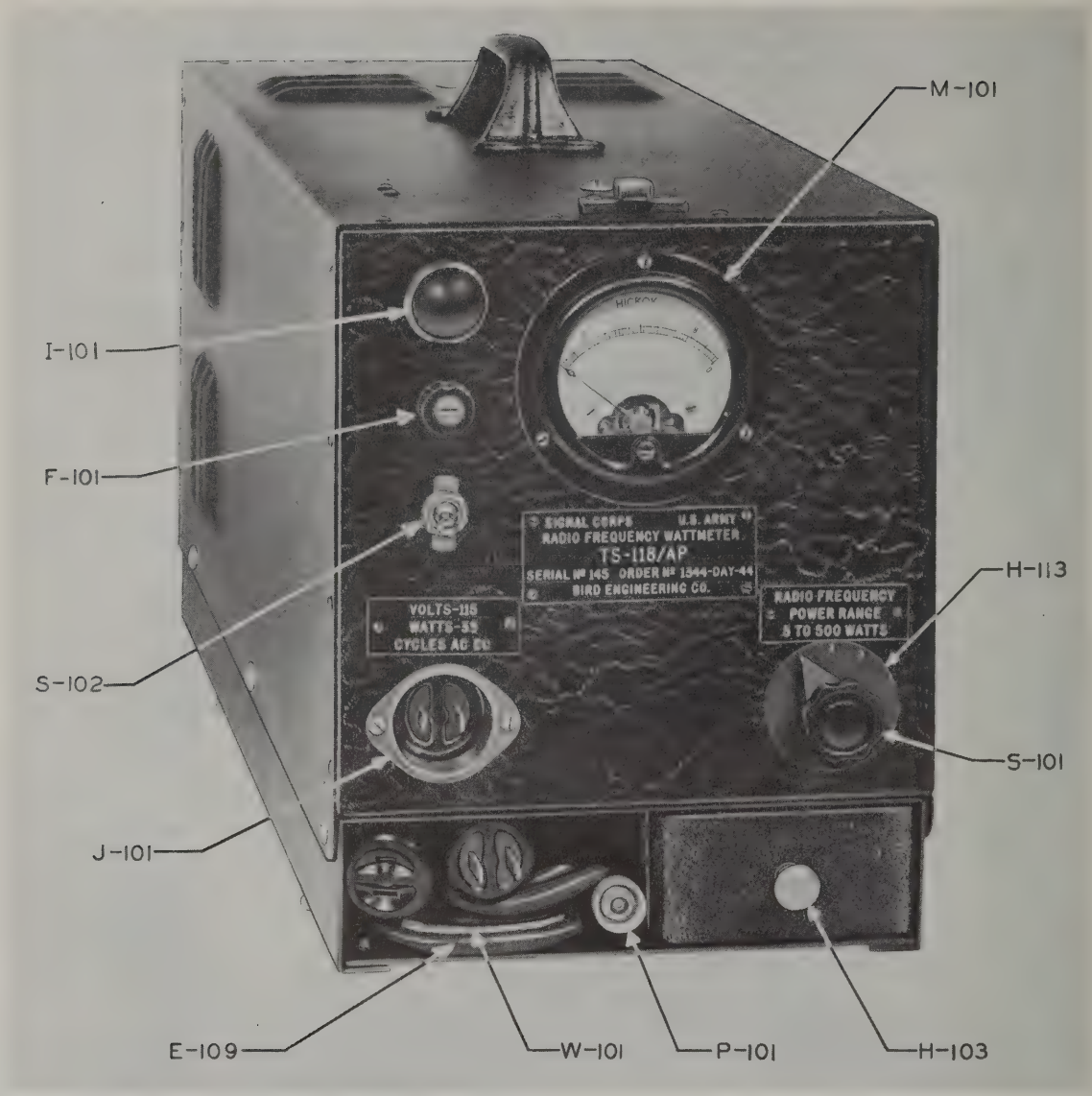


Figure 1-2. Radio Frequency Wattmeter TS-118/AP (Less Accessories)—Front View

(4) A carrying case is provided for storage and transportation.

b. ELECTRICAL.—The wattmeter consists of the following:

(1) A 50-ohm load (dummy antenna) composed of 100 feet of 50-ohm high-loss coaxial line (W-101), a 50-ohm terminating resistor (R-101), and Radio Frequency Plug UG-15/U (P-101).

(2) A series type thermocouple, inserted between the transmitter and load. The thermocouple generates d-c voltages proportional to the input power to the 50-ohm load. Thermocouples are furnished in three power ranges.

(3) A d-c meter (0 to 1 milliampere scale) and switching circuit, connected across the line terminating resistor, indicates the value of current developed by the thermocouple and transmitted along the line. Readings increase directly with increase in r-f power and are translated into r-f power values by reference to the calibration charts furnished.

(4) A blower system, motor operating on 115 volts, a-c (25 to 60 cycles) or d-c for cooling the load.

SECTION II

OPERATION AND ADJUSTMENT

1. TO START THE EQUIPMENT.

a. Turn the "ON-OFF" switch (S-102) on the wattmeter to "ON." The pilot lamp should light indicating that the blower motor is operating.

CAUTION

Do not apply r-f voltage to the wattmeter unless the fan motor is operating. Leave the fan motor in operation until tests are completed.

b. Turn the plate voltage switch of the transmitter to the "ON" position.

2. POWER MEASUREMENT.

a. By means of suitable equipment, make certain that the transmitter is on proper frequency, or determine the approximate frequency channel as accurately as possible.

b. Turn selector switch S-101 to position "2." Positions of the selector switch are as follows:

(1) Position "1" turns the meter off.

(2) Position "2" is used for normal operation. This position is used with all three thermocouple types to read power as given on curves marked position "2."

(3) Position "3" gives extended power range for use with high-power Thermocouple MX-207/AP *only*, to read power as given on curve marked position "3."

CAUTION

Use position "2" for all normal power measurements. Use position "3" *only* when transmitter exceeds the range of the high-power Thermocouple MX-207/AP when the switch is set on position "2."

c. If measuring the output of a capacitively coupled transmitter, set the slider on Tuning Stub TN-87/AP to give maximum output as indicated on the milliammeter of Radio Frequency Wattmeter TS-118/AP. Approximate settings are indicated by the calibration of the tuning stub.

Note

Calibration charts supplied with later models of Radio Frequency Wattmeter TS-118/AP have an extended frequency range. The new high frequency limit is 1400 megacycles. Differences found between the old and the new charts are not due to any differences in the wattmeter, but entirely to more accurate calibration data. Use the new chart whenever available.

d. Note the wattmeter's milliammeter reading. Using the number of milliamperes indicated, and having the frequency of the signal in megacycles, find the power in watts on the calibration chart for the thermocouple used.

e. Never use thermocouples with the cover removed as this will affect the calibration. Thermocouples are calibrated, and should be used when possible with the axis horizontal and the cover on the upper side since it has been found that the location of the thermocouple junction relative to the heater wires will influence the output of the thermocouple.

3. TO STOP THE EQUIPMENT.

Turn the r-f source to the "OFF" position. If tests have been completed, turn the wattmeter "ON-OFF" motor switch to the "OFF" position.

Note

If high values of r-f power have been measured, run the blower for a while to cool the load. In case of very high frequencies and powers, the external part of the *lossy* line may be placed in the air duct for cooling.

4. PREPARATION FOR USE.

a. Place Radio Frequency Wattmeter TS-118/AP near the transmitter under test.

b. Make certain that the transmitter "ON-OFF" switch is in the "OFF" position, or that the r-f source is not in operation.

c. Attach one end of Cord CX-237/U (10 ft.) (E-109) to the power supply, and plug the other end of the power cord into the recessed receptacle of the wattmeter.

d. The following procedures are used for inductively and capacitively coupled transmitters:

(1) When transmitters are inductively coupled, plug one end of either Cord CG-56/U (E-108) or Cord CG-122/U (9 in.) (E-107), or Radio Frequency Adapter UG-108/U (P-102) and Cord CG-123/U (8 in.) (E-106), into the transmitter output jack. Connect the other end to the proper size thermocouple as determined by following paragraph *e.* Connect the thermocouple to the *lossy* line.

(2) When transmitters are capacitively coupled, plug one end of either Cord CG-56/U (E-108) or Cord CG-122/U (E-107) or Radio Frequency Adapter UG-108/U (P-102) and Cord CG-123/U (E-106) into the transmitter output jack. Connect the other end to Tuning Stub TN-87/AP and connect the tuning stub to the proper size thermocouple as determined by the following paragraph *e.* Connect the thermocouple to the *lossy* line.

e. Selection of thermocouple is to be made as follows:

Power Range	*Thermocouples*	*Reference Symbol*	*Color Identification*
5-45 watts	MX-205/AP (low)	(E-103)	Red
20-200 watts	MX-206/AP (medium)	(E-104)	Yellow
100-500 watts	MX-207/AP (high)	(E-105)	Green

(1) When Radio Frequency Jack UG-101/U is used for power output connection of the transmitter, use Cord CG-123/U (8 in.) (E-106) and Radio Frequency Adapter UG-108/U (P-102) between the thermocouple and the transmitter.

(2) When Radio Frequency Jack UG-22/U is used for power output connection of the transmitter, use Cord CG-122/U (9 in.) (E-107) between the transmitter and the thermocouple.

(3) When Socket SO-239 is used for power output connection of the transmitter, use Cord CG-56/U (E-108) between the transmitter and the thermocouple and *lossy* line.

f. Avoid sharp bends in the *lossy* line between the thermocouple and the wattmeter.

Note

Make certain that air outlets on the side and top of the radio frequency wattmeter are clear of obstacles which might impede the flow of the cooling air blast. Since the air inlet is through the bottom compartment at the left of the thermocouple tray, it is important that this channel be left free and open during operation of the wattmeter.

5. METER ZERO ADJUSTMENT.

a. Turn selector switch S-101 to position "2".

b. With no radio frequency applied to the wattmeter, the d-c milliammeter (M-101) should read zero. If it does not, adjust screw-driver control until a zero reading is obtained.

SECTION III

THEORY OF OPERATION

1. MECHANICAL CHARACTERISTICS.

a. The wattmeter proper consists essentially of 100 feet of coaxial high-loss (herein referred to as *lossy)* line (W-101) terminated by a 50-ohm resistor R-101, a meter M-101, and a thermocouple E-103, E-104, or E-105.

(1) The *lossy* line is wound partly on a bakelite tube (H-108) and partly on a reel consisting of six rods supported between plates which also support the tube. The resistor R-101 is centrally located in the tube by means of spokes on the fittings H-114 and is held in place by the clamp H-109 on the tube (which also serves as a mounting bracket). About 22 inches of line, on the resistor end, is left free from the tube to enable the resistor to be withdrawn from the tube for inspection or repair. On the rear-end plate is mounted a motor B-101 and blower O-101 which directs air into the tube. The air stream passes over the resistor and by keeping it cool enables it to dissipate considerably more than its rated wattage. On the front end plate is a deflector H-112 which reverses the direction of the air stream sending it back over the outside of the tube where it cools the *lossy* line wound on the tube and reel.

(2) The assembly just described is mounted on a base which serves as a base for the instrument. The base contains a drawer for the accessories and an air duct which connects the compartment (formed with the housing on) containing the motor and blower to the outside air.

(3) A housing is fastened on the base and encloses the reel assembly, blower, motor, etc. The housing is attached by means of screws, and is provided with vents for the outlet of cooling air and a handle for carrying the instrument. The front end of the housing serves as a panel for mounting the meter, controls, nameplates, etc.

(4) A cover is provided for the front of the instrument. This serves to protect the meter and controls and provides a space for stowing the calibration charts.

b. The short cords and adapters furnished allow connection of the thermocouples to transmitters having the following types of output connectors: Radio Frequency Jacks UG-22/U and UG-101/U, and Socket SO-239.

c. The thermocouple elements consist of ½-inch lengths of Nichrome and Advance wire with twisted silver-soldered junctions. These wires are mounted as the central conductor of the thermocouple. The thermocouple is provided with Radio Frequency Plug UG-21/U (in part) and Radio Frequency Jack UG-23/U (in part). The end having Radio Frequency Jack UG-23/U should always be connected directly to the *lossy* line.

2. ELECTRICAL CHARACTERISTICS.

a. Radio Frequency Wattmeter TS-118/AP is primarily designed for use with transmitters having 50-ohm output circuits and concentric output connectors. Matching sections are not required between transmitter and wattmeter. However, a 9-inch cord should always be used between the thermocouple and the transmitter.

The output terminals of certain transmitters, such as Radio Set AN/APT-5, present an open circuit to the voltage developed by the thermocouple. The meter in Radio Frequency Wattmeter TS-118/AP will show no reading unless a d-c path is provided from the center to the outer conductor of the transmission line between the transmitter and the thermocouple. Tuning Stub TN-87/AP provides this d-c path and still presents a high impedance path to the radio frequency current in the cable. In operation, the tuning stub is connected between the transmitter and the thermocouple. (See figure 3-1.) The slider should be set at a figure corresponding to 7500 divided by the mean frequency (of the transmitter) in megacycles. At this setting, the tuning stub will present an extremely high non-reactive impedance to the radio frequency current in the transmission line. Any necessary adjustments on the transmitter or radiating system should be made with the slider in this position. Adjustment of the slider may now give some increase in meter reading. This reading, when referred to the proper calibration chart, will show the maximum power obtainable from the transmitter.

b. The thermocouple (E-103, E-104 or E-105) is connected through Radio Frequency Plug UG-15/U (P-101) to the end of a *lossy* line (W-101) 100 feet in length which has a characteristic impedance of 50 ohms. The line is terminated on the other end by a 50-ohm resistor R-101. This results in a condition where the input impedance of the line appears as a pure resistance of 50 ohms regardless of its length and the frequency of the input power. No standing waves will develop on such a line when the termination is correct. Improper termination may result at extremely high frequencies because reactance, skin effect, etc., cause the resistor to depart from its low-frequency value of 50 ohms.

(1) Radio-frequency current generates heat due to the resistance of the wire in the thermocouple element. This raises the temperature of the junction above that of the line. The d-c voltage developed in the junction as a result of thermoelectric action causes direct current to flow through the line and resistor. This direct current will be proportional to the square of the r-f current producing it. Since the r-f current flows through a constant resistance of 50 ohms, the direct current produced by the thermocouple will be proportionate to the power produced by the transmitter.

(2) A d-c meter (M-101) is connected across the terminating resistor. The deflection of the meter is proportional to the voltage produced by the thermocouple and when referred to the proper calibration chart indicates the amount of r-f power being produced by the transmitter.

(3) Skin effect and other physical conditions cause the resistance of the thermocouple wires to increase with an increase in frequency. Therefore, for a given current (since the heating of the thermocouple is pro-

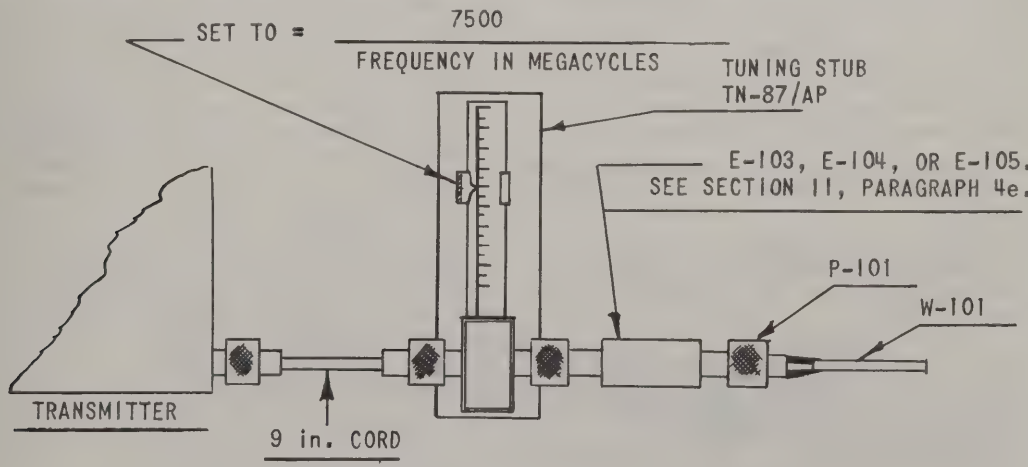


Figure 3-1. Connection of Capacity Coupled Transmitter to Radio Frequency Wattmeter TS-118/AP by means of Tuning Stub TN-87/AP

portional to the product of the r-f current (rms) squared times the thermocouple resistance) there will be an increase in heating with an increase in frequency. Hence, the frequency of the transmitter must be known within approximately 2 percent in order to read the power from the charts correctly.

c. Radio Frequency Wattmeter TS-118/AP not only measures but absorbs and dissipates as heat the power output of the transmitter. This power is dissipated partly in the *lossy* line and partly in the terminating resistor. At a frequency of 160 megacycles, about 90 percent of the power is dissipated in the line and 10 percent in the resistor. At higher frequencies, more power is dissipated in the line and less in the resistor; while at the lower frequencies, the reverse is true. Because of its high attenuation (approximately 9½ db. at 160 mc.) the long line has the further effect of reducing the magnitude of erroneous indications caused by any standing waves that may be present.

d. The power for the blower motor (B-101) comes from a 110-volt a-c or d-c line and enters the blower circuit at receptacle (J-101). (See fig. 7-1.) The current passes through switch (S-102) and a 2-ampere fuse (F-101). Resistor (R-102), in series with the pilot light and connected across the motor, reduces the voltage across lamp (I-101). A filter circuit consisting of two (2) Ohmite Z1 r-f chokes and two (2) 0.1-microfarad capacitors is used to remove r-f interference from the blower motor circuit. The blower motor draws about 0.2 amperes at 115 volts, alternating or direct current.

SECTION IV
MAINTENANCE

1. GENERAL.

a. When subjected to ordinary use Radio Frequency Wattmeter TS-118/AP should require very little maintenance. An occasional visual inspection of parts and cleaning is all that should be necessary. However, due to overloading, mishandling or accident, components may be damaged to such an extent as to need replacing.

2. TERMINATING RESISTOR.

(See figure 4-1.)

a. To test the resistor R-101 without removing it from the instrument, place the selector switch S-101 on position "1." With any ohmmeter or resistance bridge having a suitable range, measure the resistance between the center conductor of Radio Frequency Plug UG-15/U (P-101) and the shield of the *lossy* line; the nominal resistance is 50 ohms and the measured resistance should be within 10 percent of this value.

CAUTION

If the selector switch is left on position "2" or "3," the meter may be damaged by the overload from the battery in the measuring instrument.

If the line checks open, the resistor may be burned out or broken, or the center conductor of the line W-101 may be open.

b. To examine resistor R-101, remove the housing, remove deflector H-112 from the front plate, loosen clamp H-109 around bakelite tube, and withdraw resistor assembly.

Note

Earlier models of Radio Frequency Wattmeter TS-118/AP were not modified to permit the housing to be completely disconnected from the base except by unsoldering the cable connecting the two units.

c. To replace defective resistor R-101, remove screws connecting the cap H-110 to end fitting H-114, and this will disconnect one of the chokes L-101. Loosen clamps H-102, remove end fittings and center conductor from defective resistor, and substitute new resistor. To reassemble, reverse the order just described.

3. LOSSY LINE.

a. The *lossy* line W-101 may be tested for short or open circuit by testing between the center conductor of Radio Frequency Plug UG-15/U (P-101) and the sheath of the line; this should measure approximately 50 ohms. If the line checks open, its center conductor may be broken or the resistor may be burned out or broken. Replacement of the resistor has been described under paragraph 2*b*, this section. If the line checks shorted, the defect is probably in the line. In either case, examine the line near the connector. If the line is frayed and badly worn or excessively flexible, the difficulty may be at this point. If so, an emergency repair may be made. A short section may be cut off, and the plug P-101 removed from this section and replaced on the fresh end of cable provided by cutting off the defective end. This should in no way impair the operation of the instrument.

b. If the *lossy* line (W-101) is so badly damaged that it requires replacement, proceed as follows: Remove the housing; remove resistor R-101 as in paragraph 2*b*, this section; remove screws holding fitting H-104 to flange H-105; unsolder center conductor of resistor from center conductor of line; remove from base; unwind line from reel; remove bakelite tube H-108 from reel; and unwind remainder of line from tube.

(2) Procure or make up a new line assembly (W-102) consisting of 100 feet of Radio Frequency Cable RG-38/U (W-101), a flange H-105, and a Radio Frequency Plug UG-15/U (P-101).

(3) Starting about 20 to 24 inches from the end of the line having the flange, fasten the line to the tube with a piece of bare copper wire passed through the holes in the tube and around the line. Wind the line closely on the tube until the holes are reached for fastening on the other end. Fasten the line as before.

(4) Reassemble the tube in the reel and continue to wind the line on the outside of the reel, leaving a space between turns for air circulation, also leaving about six feet free on the connector end to pass through the airduct and to the transmitter.

(5) Reassemble the reel to the base, replace motor and blower, the resistor assembly, the deflector, all electrical connections, and the housing.

4. BLOWER AND MOTOR.

Motor B-101 has ball bearings and requires no lubrication. It is conservatively rated and should run continuously for long periods without attention. The brushes are the only parts subjected to appreciable wear. These may be removed for inspection or replacement by removing the bakelite caps over the brush holders on either side of the motor. The brushes E-101 may then be withdrawn for inspection.

5. FUSES.

If the motor fails to operate and the pilot light does not light, fuse F-101 is probably blown. This may be removed for inspection or replacement by removing with a screw driver the red plug marked fuse on the front of the instrument. Extra fuses are supplied with the instruments. These will be found in the accessories drawer.

6. PILOT LIGHT.

The pilot light, if burned out, may be easily replaced from inside the housing. The lamp I-101 is a 120-volt, 6-watt type with a candelabra screw base and S6 bulb.

7. THERMOCOUPLES.

a. The life of a thermocouple element is limited, particularly when used beyond its recommended range. To inspect the thermocouple, remove the free half of the thermocouple barrel. If the thermocouple element appears intact, replace the cover of the barrel and check the condition of the short cable between the transmitter and the thermocouple. Do not tamper with thermocouple element after use, since the wires become brittle.

(1) If the thermocouple element has burned out, or is broken, replace the cover of the thermocouple barrel and substitute another thermocouple of the same range. Return faulty thermocouples to the repair depot and secure a replacement unit.

CAUTION

Do not operate a wattmeter with the thermocouple cover open as the meter reading will be lower than the calibrated value. Do not operate the transmitter with the thermocouple free from the high-loss line, since the thermocouple will burn out for even moderate powers when used on no-load condition.

b. Thermocouple elements E-111, E-112, and E-113 are supplied as spare parts. If not available they may be made up as follows.

(1) Obtain two lengths of wire, one which is Nichrome or Chromel and the other Advance or Copel. The Nichrome wire should be cut at least 1-inch long and the Advance somewhat longer to be readily identified from the Nichrome. Twist one end of Nichrome together with one end of Advance; make certain there is a neat and tight twist about 1/4-inch long. Select wire sizes according to the following table:

THERMOCOUPLE DATA

Nomenclature	*Color Code*	*Wire Sizes*		*Ref. Symbol for Element*
		Nichrome or Chromel	*Advance or Copel*	
Thermocouple MX-205/AP (Low-Power)	Red	No. 34 B & S (.0063)	No. 34 B & S (.0063)	E-111
Thermocouple MX-206/AP (Medium-Power)	Yellow	No. 28 B & S (.0126)	No. 28 B & S (.0126)	E-112
Thermocouple MX-207/AP (High-Power)	Green	No. 26 B & S (.0159)	No. 24 B & S (.0201)	E-113

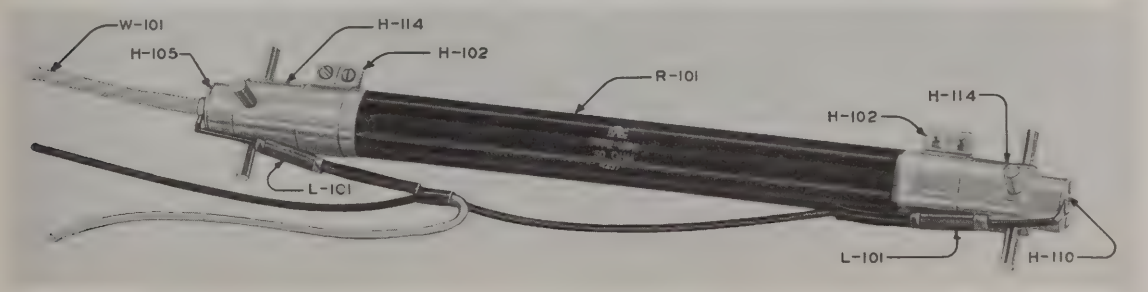


Figure 4-1. Radio Frequency Wattmeter TS-118/AP—Assembly of Terminating Resistor and Fittings

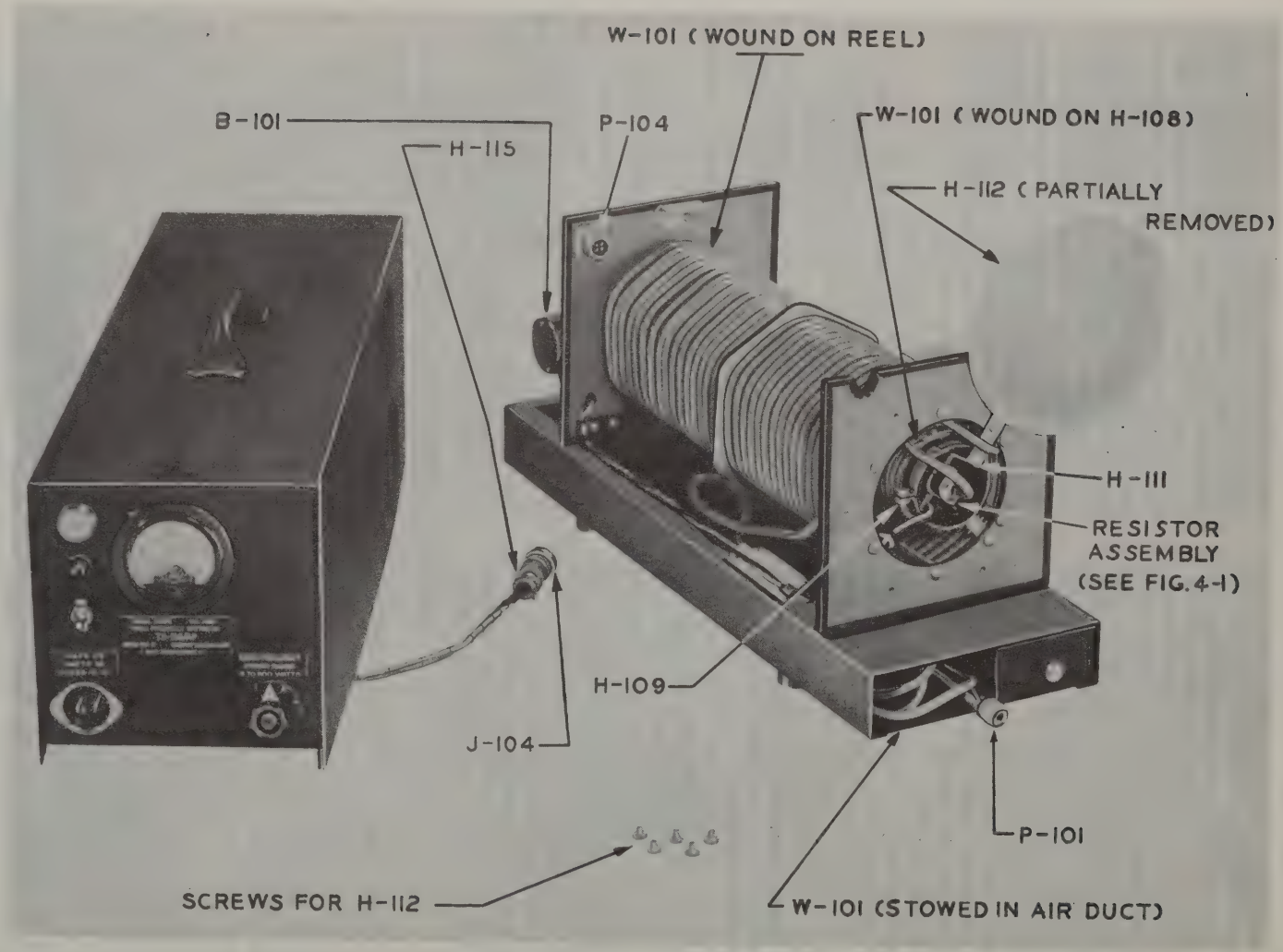


Figure 4-2. Radio Frequency Wattmeter TS-118/AP (Less Accessories)—Front View, Housing Removed

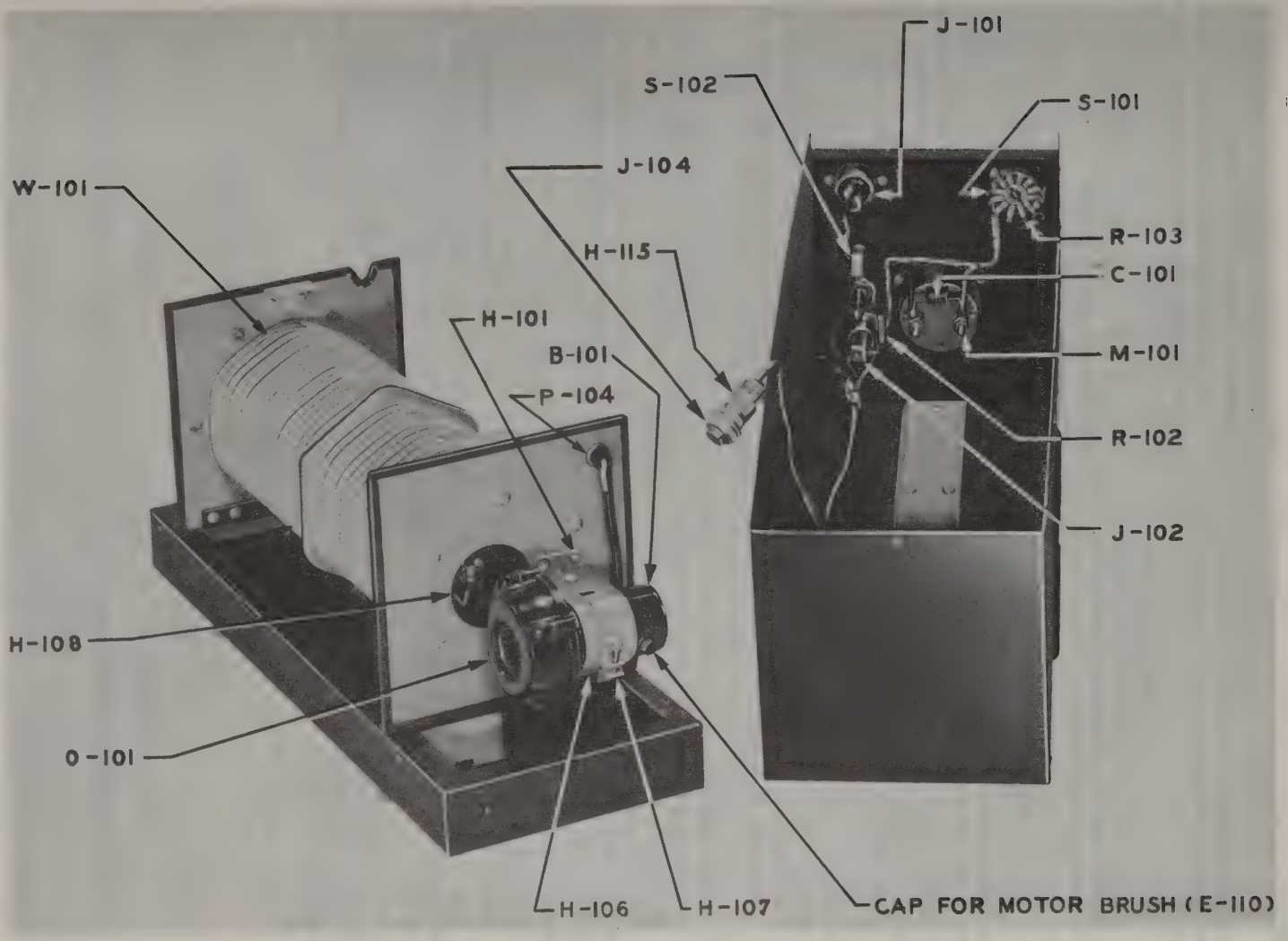


Figure 4-3. Radio Frequency Wattmeter TS-118/AP (Less Accessories)—Rear View, Housing Removed

Note

For identification, always leave the Advance wire longer than necessary until ready to solder in place.

(2) Melt some silver solder in a small porcelain pot or crucible. Apply silver solder flux to the twist and dip the twist into the pot until the twist is covered with silver solder to the point where the twist begins to part.

CAUTION

Only dip once and do not leave twist in melted solder until wire melts.

(3) Next cut the Nichrome wire ½-inch long (measured from the junction point) and the Advance wire $1\frac{1}{16}$-inch long. Silver dip ⅛-inch to $\frac{3}{16}$-inch of the free end of the Nichrome lead as was done with the twist, do the same with $\frac{5}{16}$-inch to ⅜-inch of the Advance lead. This is to facilitate soldering the element in place in the housing as solder does not readily adhere directly to Nichrome or Advance wire. Make certain that at least $\frac{5}{16}$-inch of both the Nichrome and Advance wire is free from silver solder immediately adjacent to the twist or junction, since this part serves as the heater to raise the temperature of the junction and anything done to lower its resistance will impair the efficiency of the thermocouple.

c. Insertion of thermocouple elements in housings is accomplished in following manner:

(1) Place the thermocouple with the male end of Radio Frequency Plug UG-21/U in vise.

(2) Place a small bit of rosin flux in the slot or .042-inch hole drilled in the end of the threaded stud inside the shell.

(3) Place the Nichrome end of the thermocouple element (E-111, E-112 or E-113 as required) in the slot or hole. If the identity has been lost, Nichrome can be differentiated from Advance in the following two ways:

(a) Test each wire by bending. Nichrome will be found to be much stiffer than Advance.

(b) Connect the thermocouple element to a d-c millivoltmeter or milliammeter of low range. Heat the junction by means of a soldering iron until a deflection is obtained on the meter. If the meter deflection is upscale, the Nichrome wire will be the one connected to the positive terminal of the meter.

(4) Apply a small soldering iron to the stud. Care must be taken not to get the stud too hot or apply too much pressure as the polysteyrene bushing will soften when hot and the pressure will force the stud away from the center of the thermocouple housing; and upon cooling the center conductor of the thermocouple, of which the stud is a part, will be permanently misaligned.

(5) Apply a very small amount of solder until the hole is filled.

(6) Pull gently on the thermocouple element to see whether or not a tight solder joint has been made.

(7) Reverse the thermocouple housing and place the female end of Radio Frequency Jack UG-23/U in the vise.

(8) Place a small bit of rosin flux in the slot or 0.042-inch hole drilled in the stud.

(9) Cut lead on the Advance end of thermocouple element to proper length, and place the lead in the slot or hole.

(10) Apply a small soldering iron to the stud and solder as before.

(11) Pull gently on the thermocouple element to see whether or not a tight solder joint has been made.

(12) Check the polarity as described in paragraph 7*c*(3)*(b)*, this section.

d. Perform the following to adjust thermocouples:

(1) Select an average thermocouple and use it only for a standard.

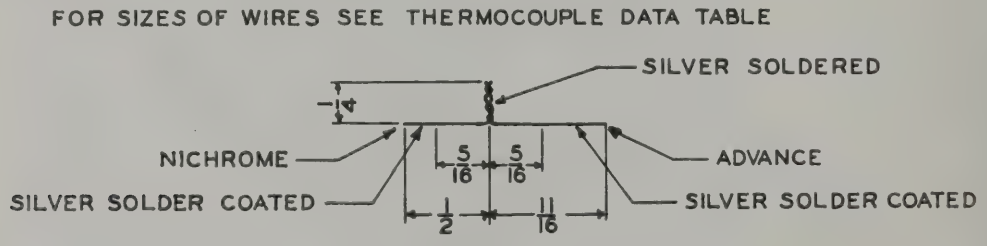


Figure 4-4. Thermocouple Element—Dimensions and Construction

(2) Select a transmitter with a fairly constant output.

(3) Place the standard thermocouple in series with the transmitter and *lossy* line of Radio Frequency Wattmeter TS-118/AP as for normal operation.

(4) Obtain a reading at about midscale.

(5) Replace the standard thermocouple assembly with the thermocouple assembly to be adjusted.

(6) Carefully clip the twist on the new thermocouple element in assembly until the same reading is obtained on the meter as when the standard thermocouple was in the circuit. Make certain the cover is on the thermocouple being adjusted when making the meter reading.

(7) If the meter reading with the thermocouple to be adjusted is too high, or becomes too high, nothing further can be done to remedy the situation. Discard such a thermocouple assembly, for reworking, and replace with a satisfactory one.

8. METER.

a. Meter M-101 on Radio Frequency Wattmeter TS-118/AP is actually a millivoltmeter having a full scale range of 25 millivolts. If the meter is badly damaged or burned out, little can be done but replace the meter, unless adequate facilities are available for repairing meters. The external resistor on the back of the meter, if there is one, is part of the meter and is supplied with it.

b. In an emergency, any d-c millivoltmeter, with a range of 25 millivolts or more, can be used. Keep in mind that 25 millivolts represents a full scale or a 1-milliampere reading on the meter and calibration charts of the radio frequency wattmeter. All other readings will be directly proportional.

c. A circuit for testing the meter and d-c circuits is shown in figure 4-5. The data given allows for drop in the line due to the load of the resistor. When the meter of the radio frequency wattmeter is applied directly across the terminals of such a tester, it should read full scale at 25 millivolts.

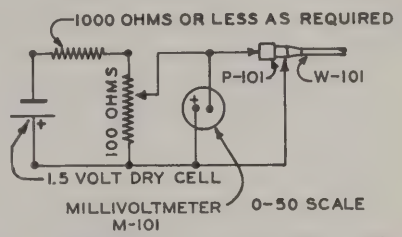
9. EMERGENCY REPAIR.

a. The following are causes of erratic meter indication when r-f power is applied:

(1) This may be due to poor connections between the transmitter and cord or the adapter or thermocouple and the *lossy* line. Check to make certain that these connections are firm.

(2) Resistance elements in thermocouples may be making erratic connection with thermocouple holders. Substitute a replacement thermocouple of the same range. If the meter deflection now becomes steady, the erratic thermocouple element may have been broken or is making poor contact. Send the faulty thermocouple to the repair depot and replace with one which is in satisfactory condition.

b. If meter fails to indicate when r-f power is applied, check the connections, thermocouple, *lossy* line, resistor, meter, and r-f chokes for open circuits.



RADIO FREQUENCY WATTMETER TS-118/AP		MILLIVOLTMETER	
SWITCH POSITION	METER READING	LIMITS	NOMINAL
1	NONE	ANY INPUT	0.00
2	1.0	25.2 - 27.3	26.25
3	1.0	34. - 39.	36.5
METER ONLY	1.0	24. - 26.	25.

Figure 4-5. Radio Frequency Wattmeter TS-118/AP —Circuit and Data for Test of D-C Circuits and Meter

SECTION V

SUPPLEMENTARY DATA

1. TUBES.

Radio Frequency Wattmeter TS-118/AP contains no vacuum tubes.

2. FREQUENCY RANGE.

It will operate on frequencies from as low as 20 megacycles to above 1000 megacycles without the necessity of tuning adjustments.

3. IMPEDANCE.

It has an input impedance of 50 ohms at any frequency within its usable range, and will handle power inputs up to 500 watts.

4. POWER REQUIREMENTS.

The only power connections necessary are a 110-volt, a-c or d-c line for the blower motor and connection to the transmitter to be measured. The blower motor draws about 0.2 amperes at 115 volts, a-c or d-c.

430618 O - 57 - 3

SECTION VI
PARTS CATALOG

Introduction

Table of Parts

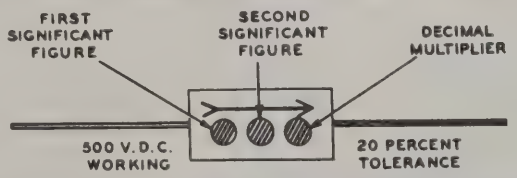
The parts listed in this table do not constitute a complete electrical and mechanical breakdown of the equipment. The table lists all electrical parts together with such operative mechanical parts as are subject to loss or failure, with the exception of structural and minor parts such as standard bolts, screws, nuts, and the like. In some instances individual detail parts of a sub-assembly may not be listed as separate items, since replacement of such items is impractical.

Ordering of Spare Parts

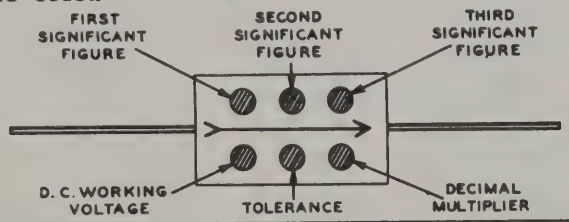
Each Service using this list has established certain depots and service groups for the storage and issue of spare parts to its organizations requiring them. The regulations of each Service should be studied to determine the method and source for requisitioning spare parts. The information in this list, as to manufacturer's or contractor's name, type, model, or drawing number, is not to be interpreted as authorization to field agencies to attempt to purchase identical or comparable spare parts directly from the manufacturer or a wholesale or retail store except under emergency conditions as covered by existing regulations of the Service concerned.

U. S. Army Personnel: This table is for information *only* and is not to be used as a basis for requisitioning parts. Authorities for obtaining maintenance items are as follows: 1. For using organizations: applicable Service publications of the 00-30 series of AAF Technical Orders. 2. For higher maintenance and supply echelons: applicable Service publications of the 08-55 series of AAF Technical Orders.

RMA COLOR CODES FOR CAPACITORS (MMFD)



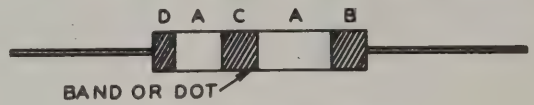
COLOR	NUMERAL	VOLTS	MULTIPLIER	TOLERANCE
BLACK	0		1	
BROWN	1	100	10	1%
RED	2	200	100	2%
ORANGE	3	300	1,000	3%
YELLOW	4	400	10,000	4%
GREEN	5	500	100,000	5%
BLUE	6	600	1,000,000	6%
VIOLET	7	700	10,000,000	7%
GRAY	8	800	100,000,000	8%
WHITE	9	900	1,000,000,000	9%
GOLD		1000	0.1	5%
SILVER		2000	0.01	10%
NO COLOR		500		20%



RMA COLOR CODE FOR RESISTORS (OHMS)

COLOR	A 1st DIGIT	B 2nd DIGIT	C MULTIPLIER
SILVER			0.01
GOLD			0.1
BLACK		0	1.0
BROWN	1	1	10
RED	2	2	100
ORANGE	3	3	1,000
YELLOW	4	4	10,000
GREEN	5	5	100,000
BLUE	6	6	1,000,000
PURPLE	7	7	10,000,000
GRAY	8	8	100,000,000
WHITE	9	9	

D — TOLERANCE CODE:
GOLD = 5% SILVER = 10% NO COLOR = 20%



OLD COLOR ARRANGEMENT



NEW COLOR ARRANGEMENT

BODY COLOR (NEW COLOR ARRANGEMENT ONLY) INDICATES TYPE OF RESISTOR, AS FOLLOWS:—
BLACK — COMPOSITION, NON-INSULATED
TAN, OLIVE OR WHITE — COMPOSITION, INSULATED
DARK BROWN — WIRE-WOUND, INSULATED

TABLE OF PARTS

MODEL: RADIO FREQUENCY WATTMETER TS-118/AP

Reference Symbol	*Army Stock Number Navy Stock Number British Ref. Number*	*Name of Part and Description*	*Function*	*Mfr. and Desig. or Standard Type*	*Cont. or Govt. Dwg. or Spec. No.*
A-101	*	FOOT, supporting: 3/4 inch diameter round brass rod, 1/2 inch long one end rounded off 5/32 inch radius, other end flat. Concentrically drilled No. 7 drill thru and counterbored 7/32 inch deep from rounded off end, 3/8 inch diameter. Finish white nickel.	Supports base of instrument	Bird Engineering Co. Part No. 2028	Bird Dwg. No. 2028
B-101	3H3000-85 —— ——	MOTOR, blower: series; 1/75 H.P.; 115 V., AC-DC; 6000 R.P.M.; 2 inches diameter x 3 1/4 inches long; 1/4 inch diameter shaft of stainless steel projects 13/16 inch; bell at shaft end is tapped to match holes in motor plate of part O-101.	Drives impeller of blower	Radex Corp. Type SM-3 Motor, Ball Bearing Counterclockwise rotation, to mount on type E, L-R No. 2 blower, motorplate.	Bird Dwg. No. 2054
C-101	3D9500-18 —— ——	CAPACITOR, fixed: mica; .0005 microfarad ±10%; 500 volts DCW; low-loss phenolic case; 29/64 x 3/16 x 1 1/4 case; No. 20 B & S (.032) solid tinned copper wire leads approximately 1 1/4 inches long.	R-F bypass for meter	Aerovox type 1468	Bird Dwg. No. 1868
E-101	*3Z3275 —— ——	HOLDER, fuse: Molded phenolic case 7/16 inch diameter, 1 3/4 inches long shouldered up to 3/4 inch diameter, 3/8 inch long. Case is hollow and has removable plug and sleeve assembly to accept one end of fuse. Mounts thru 1/2 inch diameter hole and fastens by nut and lock washer furnished with post.	Holds fuse for blower motor circuit	Littelfuse Inc. No. 1075 Extractor Fuse Post	Bird Dwg. No. 2060
E-102	2Z5822-93 —— ——	KNOB, meter selector switch: Round; moulded black phenolic; pointer; hole for 1/4 inch diameter shaft, 15/32 inch deep in brass insert; attaches by set screws; No. 8-32 headless hexagon socket cup point, 2 used; over-all height 21/32 inch, hub 13/16 inch diameter, 11/32 inch long, flange is 9/32 long, 1 1/8 inches diameter, pointer projects 7/8 inch from shaft hole center.	Rotates meter selector switch shaft and indicates switch position by means of pointer.	Kurz-Kasch Inc. No. S-308-64 BB-40269 Knob with two No. 8-32 Allen headless set screws.	Bird Dwg. No. 2228
E-103	3F3989-205 —— ——	THERMOCOUPLE MX-205/AP (low-power): Thermocouple unit 4 inches long with Radio Frequency Plug UG-21/U on end and Radio Frequency Jack UG-23/U on the other end; split barrel 1 1/2 inches long enclosing thermocouple 0 to 50 watts, low-power.	Generates d-c current proportional to r-f power output of transmitter.	Bird Engineering Co. Part No. 2090	Bird Dwg. No. 2090
E-104	3F3989-206 —— ——	THERMOCOUPLE MX-206/AP (medium-power): Thermocouple unit 4 inches long with Radio Frequency Plug UG-21/U on one end and Radio Frequency Jack UG-23/U on other end; split barrel 1 1/2 inches long enclosing medium-power thermocouple 25 to 150 watts.	Generates d-c current proportional to r-f power output of transmitter.	Bird Engineering Co. Part No. 2091	Bird Dwg. No. 2091

*Not available as a spare part, listed for reference only.

TABLE OF PARTS (Continued)

MODEL: RADIO FREQUENCY WATTMETER TS-118/AP

Reference Symbol	*Army Stock Number Navy Stock Number British Ref. Number*	*Name of Part and Description*	*Function*	*Mfr. and Desig. or Standard Type*	*Cont. or Govt. Dwg. or Spec. No.*
E-105	3F3989-207	THERMOCOUPLE MX-207/AP (high-power): Thermocouple unit 4 inches long with Radio Frequency Plug UG-21/U on one end and Radio Frequency Jack UG-23/U on the other end; split barrel 1½ inches long enclosing thermometer 100 to 500 watts high-power.	Generates d-c current proportional to r-f power output of transmitter.	Bird Engineering Co. Part No. 2092	Bird Dwg. No. 2092
E-106	1F430-123.8	CORD CG-123/U (8 in.): R-F power connecting cord; length 8 inches; consist of approximately 8 inches of Radio Frequency Cable RG-14/U terminating at each end in Radio Frequency Plug UG-100/U connector; a zinc marker ½ inch wide encircles the cable at approximately middle of its length and bears the following stamped marking: Cord CG-123/U (8 in.).	Connect transmitter to Radio Frequency Adapter UG-108/U.	Bird Engineering Co. Part No. 2096	Bird Dwg. No. 2096
E-107	1F430-122.9	CORD CG-122/U (9 in.): R-F power connecting cord; length 9 inches; consists of approximately 9 inches of Radio Frequency Cable RG-8/U terminating at one end in Radio Frequency Jack UG-23/U and at the other end in Radio Frequency Plug UG-21/U; a zinc marker ½ inch wide encircles the cable at approximately middle of its length and bears the following stamped marking: Cord CG-122/U (9 in.).	Connects transmitter to to thermocouple.	Bird Engineering Co. Part No. 2095	Bird Dwg. No. 2095
E-108	1F430-56.9	CORD CG-56/U: R-F power connecting cord; length 9 inches; consists of approximately 9 inches of Radio Frequency Cable RG-8/U, terminating at one end in Radio Frequency Jack UG-23/U and at the other end in Plug PL-259; a zinc marker ½ inch wide encircles the cable at approximately middle of its length and bears the following stamped marking: Cord CG-56/U (9 in.).	Connects transmitter to thermocouple.	Bird Engineering Co. Part No. 2094	Bird Dwg. No. 2094
E-109	3E6000-237-120	CORD CX-237/U (10 ft.): 10 feet long; 2 conductors No. 18 B & S Gauge; conductors are stranded (16 strands No. 30) bare copper wire; rubber insulation over conductors, rubber sheath over-all; one end terminates in a shielded connector with male blades, the other end in a shielded connector with female contacts; the connector with male blades is an American Phenolic Corporation No. 61-M1, 2 pole standard plug, the other connector is an American Phenolic Corporation No. 61-F11, 2 pole receptacle; a zinc marker ½ inch wide encircles the cord 5½ inches from male connector and bears the following stamped marking: Cord CX-237/U (10 ft.).	Connects blower motor circuit to power source.	Bird Engineering Co. Part No. 2225	Bird Dwg. No. 2225
E-110	3H525-13	BRUSH, motor: Carbon contact 3/16 inch square, 5/16 inch long, with flexible stranded copper wire lead, light compression spring and copper washer which retains spring and to which the copper lead is soldered. Washer is ¼ inch diameter, 1/64 inch thick.	Electrical contact supplying current to armature.	Radex Corp. Part No. 908	Bird Dwg. No. 2229

E-111		THERMOCOUPLE ELEMENT: A length of No. 34 B & S (.0063) Nichrome wire and a length of No. 34 B & S (.0063) Advance wire, having an end of one twisted with an end of the other to form a tight twist approximately 1/4 inch long. The free ends are stretched in opposite directions from the twist to form an approximate straight line at right angles to the twist. The Advance wire has a length of approximately 1 1/16 inch from the twist, the Nichrome of approximately 1/2 inch from the twist, to identify the two types of wire. The entire twist is silver soldered and each free end is coated with silver solder from its end to a point 5/16 inch from the twist.	Connects studs in thermocouple, generates d-c current when twist is heated by r-f power from transmitter.	Bird Engineering Co. Part No. 2269	Bird Dwg. No. 2269
E-112		THERMOCOUPLE ELEMENT: This item is same as E-111 except as follows, the Nichrome wire is #28 B & S (.0126) and the Advance wire is #28 B & S (.0126).	Same as E-111	Bird Engineering Co. Part No. 2270	Bird Dwg. No. 2270
E-113		THERMOCOUPLE ELEMENT: This item is same as E-111 except as follows, the Nichrome wire is #26 B & S (.0159) and the Advance wire is #24 B & S (.0201).	Same as E-111	Bird Engineering Co. Part No. 2271	Bird Dwg. No. 2271
E-114	*	CENTER CONDUCTOR: This consists of three brass parts which are assembled by silver soldering and finished in white nickel; the main portion is a brass tube 10 9/16 inch long, 7/16 inch OD, 23/64 inch ID, each end counterbored 3/8 inch diameter 3/8 inch deep; the fittings for ends are alike in the following details; they are made from brass rod 1/2 inch diameter x 2 1/2 inch long shouldered 3/8 inch diameter for a length of 1/2 inch, the portion beyond the shoulder is turned .450 inch diameter and then formed to a 9 1/2° included angle frustum of a cone the upper base of which is .150 inch diameter; in one fitting a 3/16 inch diameter hole 1/4 inch deep is concentrically drilled into the small end; in the other fitting a concentric 4-40 NC-2 tapping 1/4 inch deep is made in the small end; one fitting is silver soldered into the counterbore at one end of the tube and the other fitting is silver soldered into the counterbore at the other end of the tube.	Forms center conductor of a coaxial line within R-101 which corresponds to outer conductor.	Bird Engineering Co. Part No. 2003	Bird Dwg. No. 2003
F-101	3Z1927 —— ——	FUSE, motor circuit: Extractor type; rating, 2 amperes at 250 volts; glass insulation; ferrule type contacts; not renewable; Underwriter's standard type; 1/4 inch diameter, 1 1/4 inches long.	Protects blower motor circuit	Littelfuse No. 1042 fuse	Bird Dwg. No. 2097
H-101	6Z4856-34 —— ——	GROMMET, rubber: Fits 7/16 inch diameter hole; 7/16 inch outside diameter, 3/16 inch inside diameter, 3/16 inch thick.	Cushions blower motor bracket	American Radio Hardware Co. No. 1118G	Bird Dwg. No. 2056
H-102		CLAMP, resistor: Circular type, clamps end fitting and resistor; phosphor bronze band and brass stiffening strips, finish white nickel; 3/4 inch wide band, 1/64 thick formed into 1 1/8 inch inside diameter cylinder with strips 1/16 inch thick, 3/8 inch wide sweated to band and extending outward radially from cylinder. Two 6-32 screws pass through one strip and screw into tapped holes in the other. Suitable lock washers are used under screw heads.	Provides electro-mechanical connection between resistor and end fitting.	Bird Engineering Co. Part No. 2007	Bird Dwg. No. 2007

*Not available as a spare part, listed for reference only.

TABLE OF PARTS (Continued)

MODEL: RADIO FREQUENCY WATTMETER TS-118/AP

Reference Symbol	*Army Stock Number Navy Stock Number British Ref. Number*	*Name of Part and Description*	*Function*	*Mfr. and Desig. or Standard Type*	*Cont. or Govt. Dwg. or Spec. No.*
H-103	*	KNOB, drawer: Material is 5/8 inch diameter round brass rod, 5/8 inch long, finish is white nickel. One end is flat, the other convex on a 5/8 inch radius. The outside diameter is turned to form a suitable grasping surface for the fingers. The flat end is tapped 10-32, 1/4 inch deep for mounting screw.	Provides for manual operation of drawer.	Bird Engineering Co. Part No. 2029	Bird Dwg. No. 2029
H-104	*	BUSHING, motor mounting screw: Made from 7/32 inch diameter round brass rod, 3/16 inch long. A No. 25 drill hole is drilled through piece concentric with stock diameter.	Prevents compression of grommet.	Bird Engineering Co. Part No. 2035	Bird Dwg. No. 2035
H-105	*	FLANGE, soldering: Made from 7/8 inch diameter round brass rod 9/32 inch long. A 9/32 inch diameter hole is drilled concentrically through the rod and the outside diameter turned down so as to form a disc 1/32 inch thick with an extended cylindrical part 19/64 inch diameter concentric with the hole. 3 holes 1/8 inch diameter are drilled through the disc equally spaced on a 5/8 inch circle concentric with the center hole. Finish is white nickel.	Connects shield of lossy line to resistor end fitting.	Bird Engineering Co. Part No. 2212	Bird Dwg. No. 2212
H-106	*	BRACKET, motor mounting: "U" shape with flanges at ends of limbs; 2S or 3S, 1/2 H aluminum anodyzed; 1 1/16 inches wide, 3 5/8 inches long, 2 1/16 inches between limbs, 3 1/4 inches over flanges; 2 mounting holes, 1 1/16 inches center to center in each flange, center to center from flange to flange, 2 3/4 inches; rectangular holes on center line of each limb to admit strap of motor mounting clamp.	Supports blower motor.	Bird Engineering Co. Part No. 2036	Bird Dwg. No. 2036
H-107	*	CLAMP, motor mounting: 1/2 inch wide, 1/64 inch thick, 11 inches long, cadmium plated steel strap, fitted with screw type buckle; one 1/4-24 screw; clamps hose from one inch diameter to 3 inches diameter.	Fastens motor to mounting bracket.	Actus Products Co. Wrap-Lock all purpose hose clamp. No catalog or part number.	Bird Dwg. No. 2057
H-108	3G1837-518 —— ——	TUBE, cable coiling: Grade XX Bakelite tubing 2 3/8 inches inside diameter, 2 1/2 inches outside diameter, 16 7/16 inches long; four No. 50 drill size holes are drilled through one wall of tube at each end, 5/8 inch from end for two holes and 1 inch from end for other two, spaced 7/16 inch center to center measured around center circumference of tube.	Supports inner coils of lossy line.	Bird Engineering Co. Part No. 2023	Bird Dwg. No. 2023

*Not available as a spare part, listed for reference only.

H-109	*	CLAMP, cable tube: Material is 1/16 inch thick x 7/16 inch wide, steel flat wire, white nickel finish; formed into a circular band 2 1/2 inches inside diameter with outward extended radial ears having a hole in each through which a 10-32 round head machine screw 1/2 inch long is passed. The screw is retained by a hex nut and lock washer. Two outward extending arms of same material as band are spot welded to it. Each arm has a 10-32 tap hole in it 59/64 inch from outside diameter of band. Arms are 1 3/32 inch long. The arms and ears divide circumference of band into approximately 3 equal parts.	Supports front end of cable coiling tube.	Bird Engineering Co. Part No. 2040	Bird Ddw. No. 2040
H-110	*	CAP, resistor: Material is yellow 1/2 hard brass sheet 1/32 inch thick in the form of a disc 7/8 inch diameter, white nickel finish. Has a centered hole 1/8 inch diameter and 3 holes 1/8 inch diameter equally spaced on a 5/8 inch diameter circle concentric with the center hole.	Electro-mechanical connection between end of center conductor and resistor fitting.	Bird Engineering Co. Part No. 2213	Bird Dwg. No. 2214
H-111	*	BRACKET, resistor locating: "L" shape; 3S or 2S, 1/2 hard, anodyzed aluminum, 1/16 inch thick, 9/16 inch wide; legs of "L" are 1 3/8 inches and 1 9/16 inches; a 1/4 inch diameter hole is punched in each leg on center-line of width spaced 1 1/16 inches in the short leg and 1 1/4 inches in the long leg.	Locates resistor assembly axially in the cable coiling tube.	Bird Engineering Co. Part No. 2214	Bird Dwg. No. 2213
H-112	*	DEFLECTOR, air stream: Material is 2S-0 aluminum, 1/32 inch thick anodyzed finish; formed into a dished disk with outside diameter of 6 7/8 inches, depth of dish 1 inch, diameter of base 2 3/8 inches, diameter at junction of flange and sloping sides 5 7/8 inches; 6 holes equally spaced on 6 3/8 inches diameter circle are punched through flange; diameter of holes 7/32 inch.	Deflects air stream thru cable coiling tube back over outside of tube and out thru outer coils of lossy line.	Bird Engineering Co. Part No. 2013	Bird Dwg. No. 2013
H-113	*	DIAL PLATE, switch. 1/64 inch thick aluminum disc, 1 13/16 inches diameter, with 7/16 inch diameter center hole; numerals 1, 2 and 3 are etched into a black background on 30 degree centers, centered on a 1 3/16 radius circle.	Indicates switch position.	Bird Engineering Co. Part No. 1839	Bird Dwg. No. 1839
H-114	*	FITTING, resistor: An assembly of brass parts which are finished in white nickel. Body of assembly is of 1 1/8 inches diameter round brass rod 2 inches long, bored concentrically with a 21 degree included angle taper hole, .300 inch diameter at small end. Outside diameter at same end as small diameter of hole is turned to 7/8 inch diameter for a length of 1/2 inch. Four flats are milled across body at shouldered end, equally spaced, 1 inch between flat surfaces, 1/2 inch wide, located 3/4 inch from shouldered end to center line of flat. A 6-32 tapping is made in center of each flat, a stud is screwed into each tapping and a 1/4 inch diameter rod, 1 1/16 inch long which is concentrically tapped is screwed over the end of each stud with end of rod tight against flat.	Connects lossy line to resistor and center conductor. Supports resistor assembly in cable coiling tube.	Bird Engineering Co. Part No. 2231	Bird Dwg. No. 2231
H-115	2Z2636-12	CLAMP, cable: AN3057-6, 1 3/16 inch O.D. 1 5/64 inch long, aluminum die cast, 3/4 inch-20 female threads.	Secures connector, AN-3106-14S-2S to cable connecting housing to base electrically.	American Phenolic Corp. AN3057-6	Bird Eng'g. Co. Dwg. No. A2337

*Not available as a spare part; listed for reference only.

TABLE OF PARTS (Continued)

MODEL: RADIO FREQUENCY WATTMETER TS-118/AP

Reference Symbol	*Army Stock Number Navy Stock Number British Ref. Number*	*Name of Part and Description*	*Function*	*Mfr. and Desig. or Standard Type*	*Cont. or Govt. Dwg. or Spec. No.*
I-101	6Z6815-22 —— ——	LAMP: Incandescent G-E Mazda No. 56; 120 volts, 6 watts; candelabra size, screw type base, 3/4 inch diameter x 1 1/4 inch long clear bulb.	Illuminates pilot light.	General Electric Co. Mazda 6 watt S 6, 120 volt.	Bird Dwg. No. 2207
J-101	2Z7138.1 —— ——	RECEPTACLE: Flush mounting; 2 contacts, 110 volts—15 amperes; brass blades; molded phenolic insulation; housing burnished nickel plated steel; mounts by passing body into a 1 7/16 inch diameter hole and fastening with two No. 6 machine screws, 1 3/4 inches center to center.	Connects blower motor circuit to power cord.	American Phenolic Corp. No. 61-MIO 2 pole standard plug.	Bird Dwg. No. 2081
J-102		LAMP HOLDER: Candelabra screw base on U shaped steel bracket, snapping into brass panel mounting shell, which holds a jewel and bezel assembly; 2 3/4 inches long, 1 1/4 inches diameter; Drake Mfg. Co. Type 75 Panel Lamp Holder with red jewel.	Holds pilot light.	Drake Mfg. Co., type 75 panel lamp holder with red jewel.	Bird Dwg. No. 2059
J-103	2Z3062-100	CONNECTOR, female contact: Standard Radio Frequency Jack UG-23/U connector body, with silver plated brass collar, 5/16 inch I.D., pressed into end of body which normally fits on cable, 1 round female contact, 5/8 inch O.D., 1 1/2 inches long, silver plated brass shell, 5/8 inch-24 male threads on both ends.	Connects Tuning Stub TN-87/AP to thermocouple and Radio Frequency Wattmeter TS-118/AP.	Bird Engineering Co. Part No. 2435.	Bird Dwg. No. A2435
J-104	2Z7254-1	CONNECTOR, female contact: AN3106-14S-2S, 4 round female contacts, 1 1/16 inches O.D., 1 11/32 inches long, die cast aluminum shell, 3/4 inch-20 male thread on one end, 7/8 inch-20 female on other.	Provides electrical disconnect between housing and base assemblies of Radio Frequency Wattmeter TS-118/AP.	American Phenolic Corp. AN3106-14S-2S.	Bird Dwg. No. A2449
L-101	3C323-88A —— ——	COIL, r-f choke: 80 turns close wound, No. 30 B & S (.010) enameled copper wire; d-c resistance .8 ohm; single layer wound, coil form an IRC 1. megohm, BTI resistor; mounts by soldering terminals direct; terminals are tinned copper wire, normally used for resistor connection; over-all dimensions, 3/16 diameter, 2 inches long.	Series inductance of filter eliminating r-f from meter circuit.	Bird part No. 1658	Bird Dwg. No. 1658
M-101	3F7425 —— ——	METER: D-C millivoltmeter D'Arsonval type movement; scale calibrated on non-magnetic panel, 0 to 1.0 milliamperes, 50 scale divisions, accuracy 2 percent sensitivity 25 millivolts; housed in 3 1/2 inch American War Standard Case; humidity proof molded phenolic case; stud and nut type terminals, material brass, threaded 1-4-28 NF-2 and fitted with 3/8 hexagon, 1/8 thick nuts; mounts by passing case body through a 2 13/16 inches diameter hole and fastening with three No. 4 machine screws passed through holes in flange of instrument and matching holes in mounting panel, using suitable nuts and lock washers behind panel.	Indicates amount of current in thermocouple circuit.	Hickok Electrical Instrument Co. Model 46	Bird Dwg. No. 2058
O-101	3H402-2 ——	BLOWER ASSEMBLY: Consists of plastic housing, over-all dimensions 1 3/8 inches x 3 17/32 inches x 3 9/16 inches having	Cools resistor R-101, and cable W-101.	L-R Manufacturing Co. No. 2 Blower,	Bird Dwg. No. 2055

	——	1 3/16 inches diameter blower opening projecting from side; equipped with 24 blade blower wheel 1 inch d, 2 1/32 inches diameter, arranged for clockwise rotation on 250 inch diameter shaft, and having two #8 Allen set screws 90 degrees apart.		clockwise rotation, type E motor plate.	
P-101	2Z7390-15 ——	RADIO FREQUENCY PLUG UG-15/U: An assembly of silver plated brass parts and polystyrene insulator; consists of a retained knurled shell 1 1/16 inch outside diameter and 5/8 inch long on a shell 1 9/32 outside diameter, 1 1/16 inch long, necked to 3/8 inch outside diameter 1/4 inch long. Over-all length of assembly 1 5/8 inches. Inside diameter of necked end accommodates shield of Radio Frequency Cable RG-38/U and a male center contact is drilled to accept the center conductor of Radio Frequency Cable RG-38/U. The knurled shell fits male threads on Radio Frequency Check UG-23/U. Male center contact and a concentric split sleeve fit contact sleeve and body of Radio Frequency Jack UG-23/U. The concentric sleeve has an extended taper end which fits over cable insulation and inside cable shield. Cable shield is soldered to this end of concentric sleeve at assembly.	Connects *lossy* line to thermocouples.	Cundy-Bettoney Co., Inc. Type N Plug No. 49288.	Bird Dwg. No. 2216
P-102	*2Z7390-108 —— ——	RADIO FREQUENCY ADAPTER UG-108/U: Silver plated brass shell 1 5/8 inches long, 3/4 inch outside diameter, 1 1/16 inches long shouldered down to 5/8 inch outside diameter 9/16 inch long. The 3/4 inch end is threaded, bored and fitted with a female center contact to accept Radio Frequency Plug UG-100/U. The 5/8 inch outside diameter end is threaded, bored and fitted with a female center contact sleeve to accept Radio Frequency Plug UG-21/U.	Connects Cord CG-123/U to thermocouple.	Diamond Instrument Co. RF Adapter UG-108/U.	Bird Dwg. No. 2098
P-103	2Z3021-107	CONNECTOR, male contact: Radio Frequency Plug UG-21/U connector body with silver plated brass collar, 5/16 inch ID., pressed into end of body which normally fits on cable, 1 round male contact, 3/4 inch OD., 1 1/4 inch long silver plated brass shell, 5/8 inch-24 male thread on one end, female on other.	Connects Tuning Stub TN-87/AP to 9 inch cord and transmitter.	Bird Eng'g. Co. Part No. 2436.	Bird Dwg. No. A2436
P-104	2Z8799-220	CONNECTOR, male contact; AN3102-14S-2P 4 round male contacts, 1 3/16 inch base, 2 9/32 inch long, die cast aluminum shell, 7/8 inch-20 male thread.	Provides electrical disconnect between housing and base assemblies of Radio Frequency Wattmeter TS-118/AP.	American Phenolic Corp. AN3102-14S-2P.	Bird Dwg. No A2443
R-101	3Z6005-117 —— ——	RESISTOR, fixed: Composition; over-all resistance 50 ohms ± 10%; no taps; 35 watts; ceramic insulation; 1 1/8 inches outside diameter 10 1/2 inches long; furnished without leads or terminals; no mounting provided.	Terminates *lossy* line.	International Resistance Co. Type MPO.	Bird Dwg. No. 2227
R-102	3Z6200-9 —— ——	RESISTOR, fixed: Composition; over-all resistance 2000 ohms ± 10%; no taps; 1 watt; bakelite insulation; 1/4 inch outside diameter 1 1/4 inches long; axial tinned copper wire leads; no mounting provided.	Reduces voltage across lamp in pilot light.	International Resistance Co. Type BT-1, 1 watt 2000 ohm.	Bird Dwg. No. 2208

*Not available as a spare part; listed for reference only.

TABLE OF PARTS (Continued)

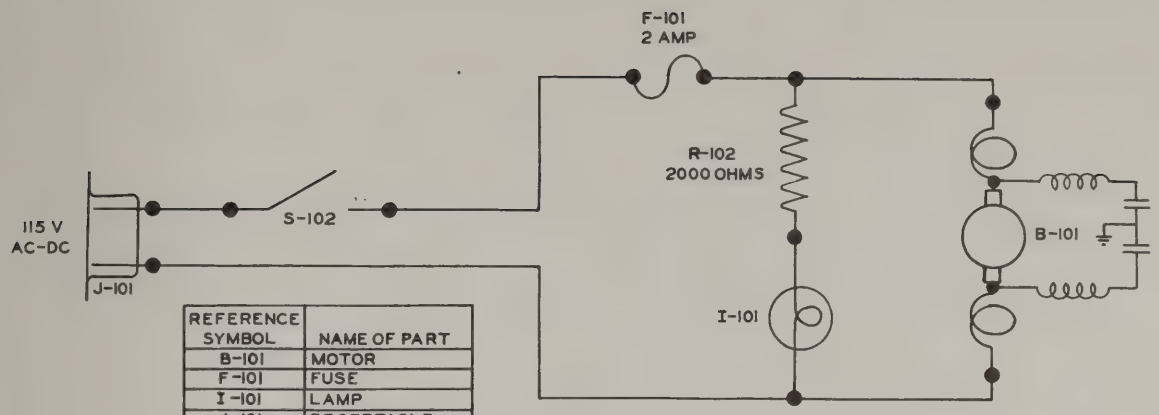
MODEL: RADIO FREQUENCY WATTMETER TS-118/AP

Reference Symbol	*Army Stock Number Navy Stock Number British Ref. Number*	*Name of Part and Description*	*Function*	*Mfr. and Desig. or Standard Type*	*Cont. or Govt.' Dwg. or Spec. No.*
R-103	3Z6001E5 —— ——	RESISTOR, fixed: Wire wound; 15.9 ohms ±10%; ½ watt; ¼ inch diameter, 11/16 inch long; silk insulation; inductive winding; bakelite core, two 1½ inch flexible axial wire leads; mounts by soldering leads to switch terminals.	Meter multiplier.	Bird Engineering Co. Part No. 2230	Bird Dwg. No. 2230
S-101	3Z9825-58.10 —— ——	SWITCH, meter selector: Rotary type; 2 poles, 2 to 5 positions (3 positions used) one section; 1 ampere at 6 volts rating; brass, silver plated contacts, non-shorting; bakelite insulation; plate carrying terminals is 1⅞ inches wide, 2 inches long, main portion of switch is 1 inch deep, mounting bushing projects above main portion 9/16 inch; mounts by passing bushing through 25/64 inch diameter hole and fastening with nuts provided with switch; solder lug type terminals; ¼ inch diameter shaft is shortened by Bird Engineering Co. to project 15/32 inch beyond end of mounting bushing.	Selects meter ranges.	Centralab Division, Globe Union Inc. Catalog No. 1405.	Bird Dwg. No. 2083
S-102	3Z9859-8.113 —— ——	SWITCH: Toggle; SPST; 250 volt 3 amperes; laminated bakelite; 13/32 inch x 15/32 inch x ⅞ inch body and centrally located 13/32 inch diameter x 9/16 inch long mounting bushing, with lever projecting ½ inch from end of bushing; bushing is threaded and provided with suitable mounting nuts to allow mounting through 31/64 inch diameter hole in panel.	Opens and closes blower motor circuit.	Hart & Hegeman No. 1300	Bird Dwg. No. 2082
W-101	*1F4B91 ——	CABLE, coaxial: Radio Frequency Cable RG-38/U; single solid bare copper wire conductor No. 17 Brown & Sharpe Gauge (.0453 inch diameter); rubber insulation; characteristic impedance 50 ohms; double shield of braided tinned copper wire, no covering; outside diameter ¼ inch; type N fittings necessary; procured in coils, 100 to 400 feet per coil.	Dissipates r-f power from transmitter.	Western Electric Corporation D-163296 Cable, Without Outer Cotton Braid and Wax Impregnation.	Bird Dwg. No. 2217
W-102		CABLE ASSEMBLY R-F: Consists of a 100-foot length of Radio Frequency Cable RG-38/U (ref. W-101) terminated on one end with a soldering flange (ref. H-105); other end terminated with Radio Frequency Plug UG-15/U.	Completes circuit between thermocouples and terminating resistor, also dissipates part of r-f power.	Bird Engineering Co. Part No. 2272	Bird Dwg. No. 2272
	3F5875-87	TUNING STUB TN-87/AP: Silver plated brass with black wrinkle finish on aluminum base. 15½ inches x 3¼ inches x 1⅜ inches. Consisting essentially of a section of slotted line with shorting plunger and equipped with connectors Radio Frequency Plug UG-21/U and Radio Frequency Jack UG-23/U for connecting between thermocouple of Radio Frequency Wattmeter TS-118/AP and transmitter with capacity coupled output. Frequency range 220 mc. to 1880 mc.	Provides D.C. path for thermocouple current. When measuring power of transmitters having capacity coupled output.	Bird Engineering Co. Part No. 2298	Bird Dwg. No. C2298

	6D10105-5A	CHART, CALIBRATION: A lithographed print, black on white on both sides of two ply bristol board stock $9\frac{11}{16}$ inches x $7\frac{13}{16}$ inches, and dipped in fungicidal lacquer, low power curves on one side and medium power curves on the other; bound between clear cellulose acetate sheets .015 inch thick and the edges sealed with cellophane tape and fungicidal lacquer.	Translates meter reading into watts with reference to transmitter output frequency.	Bird Engineering Co. Part No. 2243-A	Bird Dwg. No. C-2243-A
	6D10105-6A	CHART, CALIBRATION: A lithographed print, black on white on both sides of two ply bristol board stock $9\frac{11}{16}$ inches x $7\frac{15}{16}$ inches, and dipped in fungicidal lacquer, high power curves on one side and extra high power curves on the other; bound between clear cellulose acetate sheets .015 inch thick and the edges sealed with cellophane tape and fungicidal lacquer.	Translates meter reading into watts with reference to transmitter output frequency.	Bird Engineering Co. Part No. 2244-A	Bird Dwg. No. C-2244-A

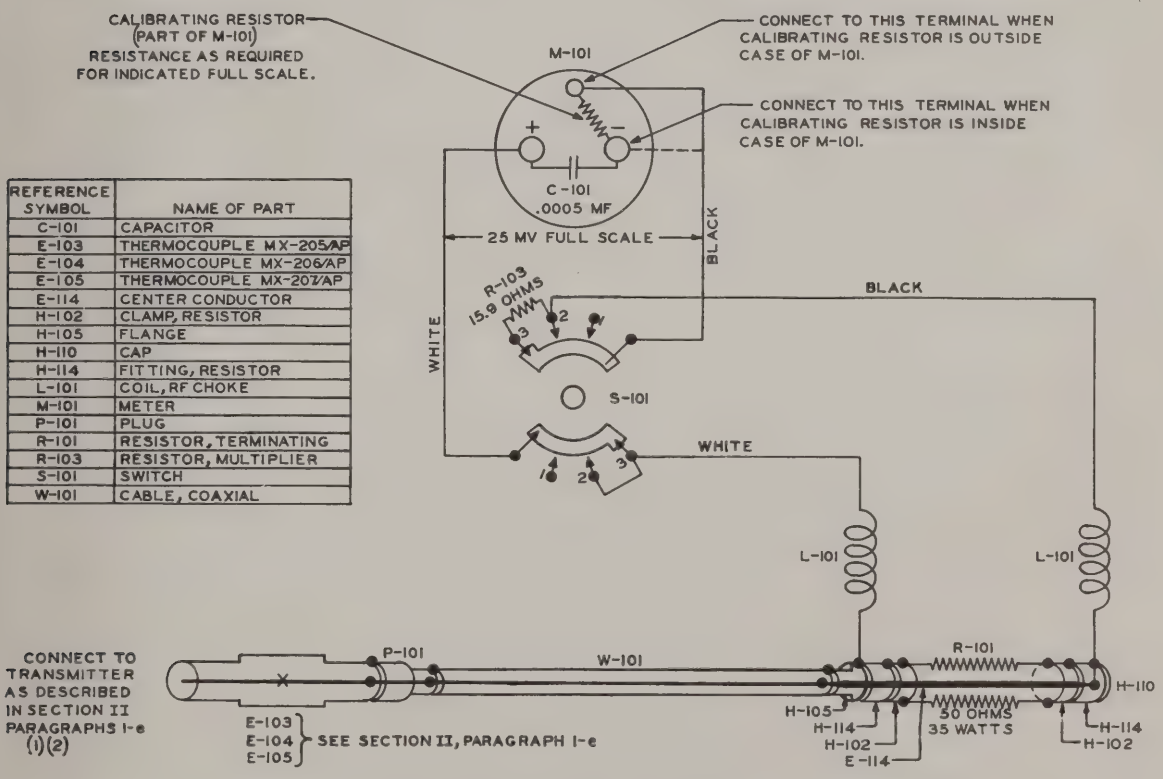
*Not available as a spare part; listed for reference only.

SECTION VII
DRAWINGS



REFERENCE SYMBOL	NAME OF PART
B-101	MOTOR
F-101	FUSE
I-101	LAMP
J-101	RECEPTACLE
R-102	RESISTOR
S-102	SWITCH

Figure 7-1. Radio Frequency Wattmeter TS-118/AP—Blower Motor Circuit, Schematic Diagram



REFERENCE SYMBOL	NAME OF PART
C-101	CAPACITOR
E-103	THERMOCOUPLE MX-205/AP
E-104	THERMOCOUPLE MX-206/AP
E-105	THERMOCOUPLE MX-207/AP
E-114	CENTER CONDUCTOR
H-102	CLAMP, RESISTOR
H-105	FLANGE
H-110	CAP
H-114	FITTING, RESISTOR
L-101	COIL, RF CHOKE
M-101	METER
P-101	PLUG
R-101	RESISTOR, TERMINATING
R-103	RESISTOR, MULTIPLIER
S-101	SWITCH
W-101	CABLE, COAXIAL

Figure 7-2. Radio Frequency Wattmeter TS-118/AP—R-F Power Measuring Circuit, Schematic Diagram

U. S. GOVERNMENT PRINTING OFFICE: 1957 O -430618