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DEPARTMENT OF THE ARMY TECHNICAL MANUAL

OPERATOR, ORGANIZATIONAL, FIELD AND DEPOT
MAINTENANCE MANUAL

WATTMETER AN/URM-120



HEADQUARTERS, DEPARTMENT OF THE ARMY
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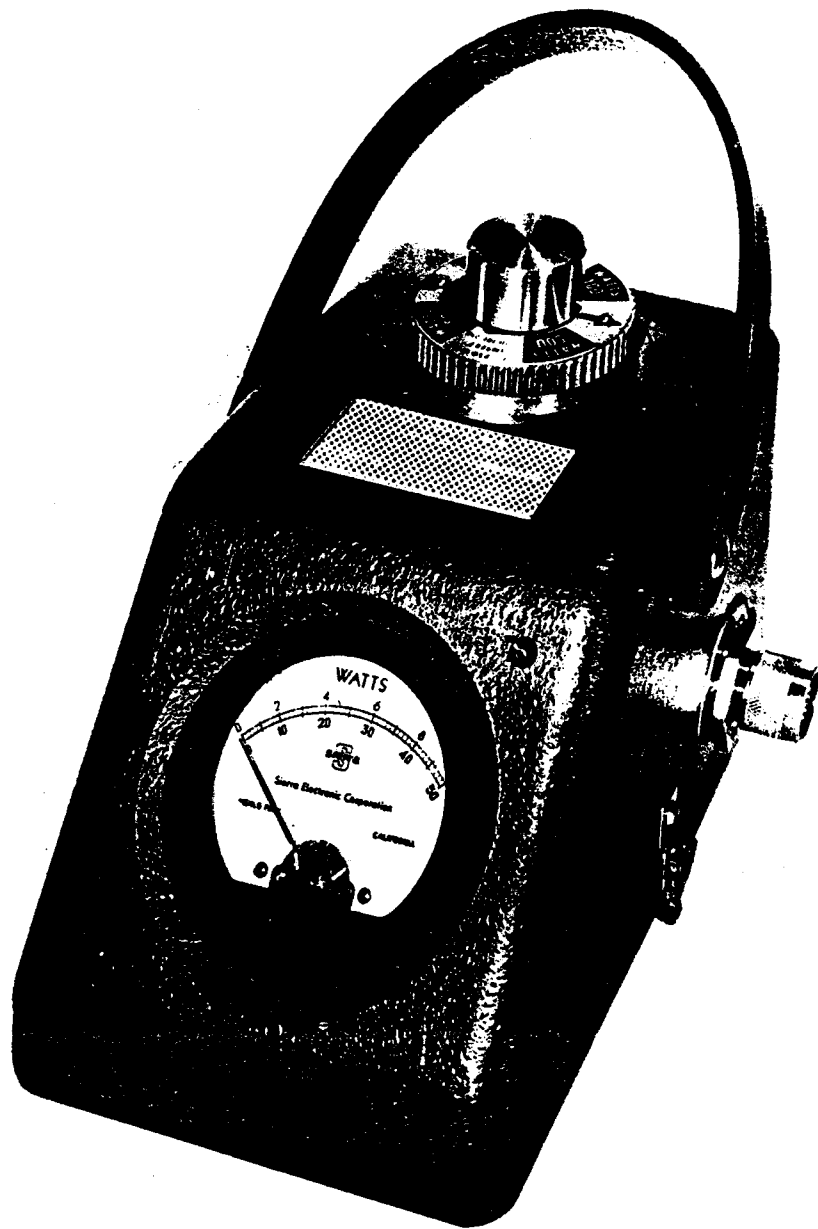


Figure 1-1. Wattmeter AN/URM-120

SECTION I

INTRODUCTION AND DESCRIPTION

1-1. IDENTIFICATION OF EQUIPMENT.

1-2. This publication contains instructions for operation and maintenance of Wattmeter AN/URM-120, manufactured by Sierra Electronics Company, Menlo Park, California, under Bureau of Aeronautics Contract NOas 59-0238-f.

1-3. GENERAL DESCRIPTION.

1-4. Wattmeter AN/URM-120 (figure 1-1) is designed to measure incident and reflected r-f power from 10 to 1000 watts within a frequency range of 2 to 1000 mc. Three coupler-detectors, each rated to cover a portion of this frequency range (table 1-1), are supplied with the wattmeter.

1-5. The wattmeter is housed in a small metal case weighing about 6-1/2 pounds and is about 7 inches wide, 6-5/8 inches high and 7-1/2 inches deep. It contains a coaxial primary line, indicating meter, and cable for interconnecting the meter to a coupler-detector. The coupler-detector has a knurled knob which projects through a hole in the top of the wattmeter case. On the knurled knob is a nameplate to indicate power range, and centered on the nameplate is the power range knob which can be rotated 360 degrees to any desired power range. The coupler-detector rotates only 180 degrees along the coaxial line. Two type-N connectors, one male and one female, are located on either side of the wattmeter case for connection between the power source and load.

1-6. Upper and lower parts of the wattmeter case are held together with quick acting fasteners, which permit easy access to the coupler-detector, the primary line, and the indicating meter. The primary line is held by four screws to the lower part of the case, and the meter yoke is held against the inside front slope of the case by four screws. Three plastic wedges, circled by a metal band and clamp, keep the coupler-detector seated above the primary line.

1-7. The coupler-detector is considered a separate part of the wattmeter only in the sense that it can be removed from the wattmeter case and replaced with a similar unit differing only in frequency and power characteristics. Three separate coupler-detectors are supplied with the wattmeter. Selection of a particular unit will depend upon the power source to be measured. Characteristics of each coupler-detector are tabulated in table 1-1.

1-8. Although the wattmeter case assembly and coupler-detector function together, they can be stored separately when not in use. Principle elements of the case assembly are the indicating meter and primary line of the directional coupler.

1-9. PRINCIPLES OF OPERATION.

1-10. Power measurements are made by inserting the proper coupler-detector and connecting the wattmeter in series with the coaxial transmission line between the load and the r-f power source. To determine incident power, the arrow on the coupler-detector is rotated toward the load and the power range knob is positioned for peak meter reading. The reading is taken directly from the graduated meter scale which is made to correspond to the power range selected. Reflected power is also determined by peak meter reading, but the coupler-detector is rotated in the opposite direction toward the r-f source.

1-11. In effect, rotation of the coupler-detector orients the directional coupler which responds only to a wave traveling in a particular direction on the primary transmission system, while being unaffected by a wave traveling in the opposite direction on the primary line. A standard diode rectifier in the coupler-detector rectifies the energy picked up by the coupler. This energy is then measured across a known 50-ohm impedance system and metered as incident or reflected power. (See figure 1-2.)

TABLE 1-1. Coupler-Detector Characteristics

Model No.	Freq. Range (MC)	Power Range (Watts)	Insertion VSWR (Max. value with type-N connectors on primary line)	
			Lowest Power Range	3 Highest Power Ranges
CU-753/URM-120	2-30	50, 100, 500, 1000	1.08	1.08
CU-754/URM-120	25-250	10, 50, 100, 500	1.08	1.05
CU-755/URM-120	200-1000	10, 50, 100, 500	1.08	1.05

- * C101-1400 MMF (CU-753)
- C101-280 MMF (CU-754)
- C101-52.5 MMF (CU-755)
- R102-1.5K (CU-753 AND CU-755)
- R102-270 Ω (CU-754)

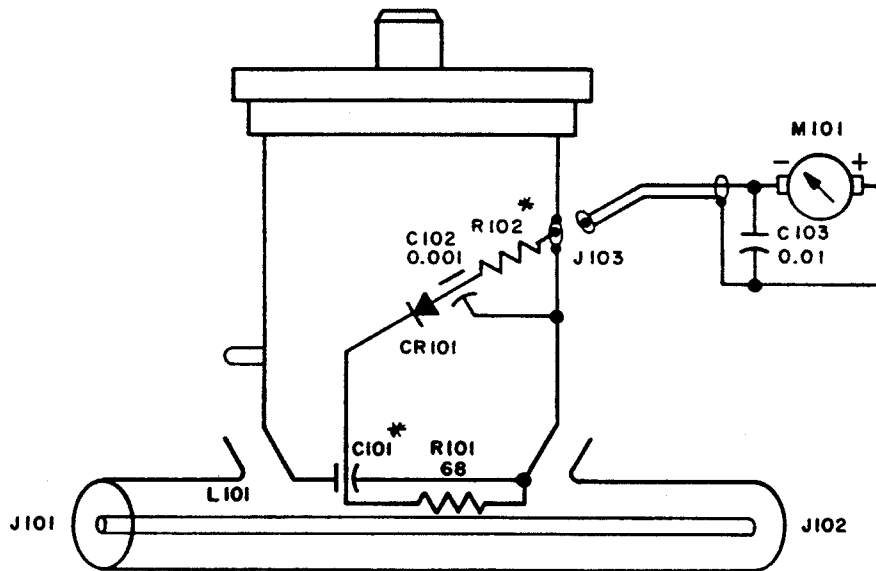


Figure 1-2. Wattmeter AN/URM-120, Schematic Diagram

SECTION II

SPECIAL SERVICE TOOLS

2-1. SPECIAL TOOLS.

2-2. No special tools are required other than a standard screw driver and Allen wrench set.

SECTION III

PREPARATION FOR USE, STORAGE, AND SHIPMENT

3-1. PREPARATION FOR USE.

3-2. In preparing the wattmeter for use, open the case and visually inspect the meter and directional coupler for damage and dirt. If the unit does not appear in good condition and cannot be corrected by following the procedure outlined in Chapter V, the unit should be replaced.

3-3. PREPARATION FOR STORAGE.

3-4. When storing the wattmeter, cover with a plastic

all-purpose cover or place wattmeter in a carrying case, if one is supplied. The coupler-detectors must be stored with a plastic cup placed over the secondary line.

3-5. PREPARATION FOR SHIPMENT.

3-6. Special precautions against possible damage must be taken when shipping the wattmeter. Make certain that the unit is well wrapped and padded. A "fragile" stamp must appear on the outside of the box.

SECTION IV

OPERATION INSTRUCTIONS

4-1. INTRODUCTION.

4-2. After determining that the r-f power source has been turned off, connect the wattmeter in the transmission line either at the load or r-f source. Make certain that connections are tight.

4-3. CONNECTION OF COUPLER-DETECTOR.

4-4. Use the following procedure for inserting the coupler-detector:

a. Disengage the two quick action fasteners on sides of wattmeter case.

b. Remove case cover.

c. Select proper coupler-detector from table 1-1.

d. Insert coupler-detector into receptacle on primary line.

e. When coupler-detector appears to be properly seated, snap receptacle clamp fastener closed.

f. Remove wire shunt from meter terminals.

g. Connect meter cable and replace cover on case.

4-5. PURPOSE OF OPERATING CONTROLS

4-6. Only two controls are necessary to operate the wattmeter. One is the knurled-topped coupler-detector itself which can be rotated 180 degrees. The large arrow on top of the coupler-detector will point in the direction of power flow. For example, if the arrow points toward the load it is in position for incident power measurement. A circular nameplate with power ranges etched on its surface is attached to the top of each coupler-detector.

4-7. The power range knob, on top and in the center of the nameplate, rotates within but independently of the coupler-detector. The knob can be rotated 360

degrees to any desired power range shown on the circular nameplate. The power range knob adjusts the distance between the secondary and primary lines by extending or retracting the secondary line. For example, the secondary line is moved closer to the primary line for a 10-watt measurement than for a 1000-watt measurement.

4-8. WATTMETER OPERATION.

4-9. Use the following procedure to operate the wattmeter:

a. Place power range knob in position higher than rated power of r-f source.

NOTE

It is assumed that rated power of the r-f source is known. If the rated power is not known, place the power range knob in the highest power position before the power source is turned on.

b. To measure incident power, rotate coupler-detector so that power flow indicating arrow points toward load.

c. Apply r-f power to line under test.

d. Rotate power range knob from original power range toward next lower power range, selecting proper power range for measuring power of r-f source under test.

e. Observe point at which meter peaks and record incident power reading.

f. To measure reflected power, set power range knob to highest position and rotate coupler-detector so that arrow points toward r-f source.

g. Repeat steps a through e. Record reading.

h. To check consistency of readings, repeat procedure for incident power measurement and compare results to reading originally obtained.

i. After power measurements have been completed, replace wire shunt on meter terminals.

4-10. INTERPRETING POWER MEASUREMENTS.

4-11. In measuring r-f power, the wattmeter functions as a test instrument to determine the efficiency of an entire antenna system. This is done in two ways. The first calculates the voltage standing wave ratio (VSWR) of the load. The other method calculates the power absorbed by the load.

4-12. VSWR MEASUREMENT. The VSWR of the load may be determined from the chart (figure 4-1) after incident and reflected power meter readings have been obtained. As an example, if the incident power is 50 watts and the reflected power is 5.5 watts, the VSWR of the load is 2.0. This result is obtained by reading the diagonal line which crosses the intersection of the Pi vertical and Pr horizontal lines. For a more precise answer, the following formula can be used:

$$VSWR = \frac{\sqrt{P_i} + \sqrt{P_r}}{\sqrt{P_i} - \sqrt{P_r}}$$

4-13. POWER ABSORBED BY LOAD. The r-f power absorbed by the load can be determined by subtracting the reading of the reflected power from the reading of the incident power. For example, if the incident power reading is 50 watts and the reflected power reading is 5.5 watts, the power absorbed by the load is 50 watts minus 5.5 watts or 44.5 watts.

4-14. ERRORS INCORPORATED IN MEASUREMENTS. Because the wattmeter employs a peak reading type of metering circuit calibrated on the basis of a sinusoidal r-f waveform, it is subject to errors produced by harmonic distortion and by imperfect directivity of the directional coupler. Harmonic distortion can be minimized by using a low-pass filter, but not too much can be done about imperfect directivity.

4-15. To compensate for errors caused by imperfect directivity and harmonic distortion, a ± 5 percent full-scale tolerance is used in calculations of reflected power. Percentage of error due to imperfect directivity in incident power measurements is for all practical purposes negligible. However, error caused by harmonic distortion is appreciable and is taken into account. For example, suppose conditions indicate an incident power of 40 watts and a reflected power of 2 watts. If the incident power is read on the 50-watt scale, the error will not exceed ± 2.5 watts (± 5 percent times 50 watts full scale), regardless of the directivity of the coupler-detector.

4-16. The following is an example of how error is accounted for in reflected power readings:

incident power = 40 watts

reflected power = 2 watts (reading taken with a coupler-detector having a directivity of 25db (300:1) on the 5-watt scale)

$$\text{error} = \pm \left[\frac{5 \text{ percent full scale} \times 5W + \text{measured incident power}}{300} \right]$$

$$= \pm \left[0.05 \times 5W + \frac{40W}{300} \right]$$

$$= \pm 0.38 \text{ watt.}$$

If the reflected power reading is taken with a coupler-detector having a directivity of 20db (100:1) and is indicated on the 5-watt scale, its error will be:

$$\pm \left[\frac{5 \text{ percent full scale} \times 5W + \text{measured incident power}}{100} \right]$$

$$= \pm 0.65 \text{ watt}$$

See table 4-1 for calculation of error in reflected power measurement.

4-17. In addition to measuring incident and reflected power, the wattmeter can also be used to determine the percent of modulation by measuring power under modulated conditions (Pm) and power under c-w conditions

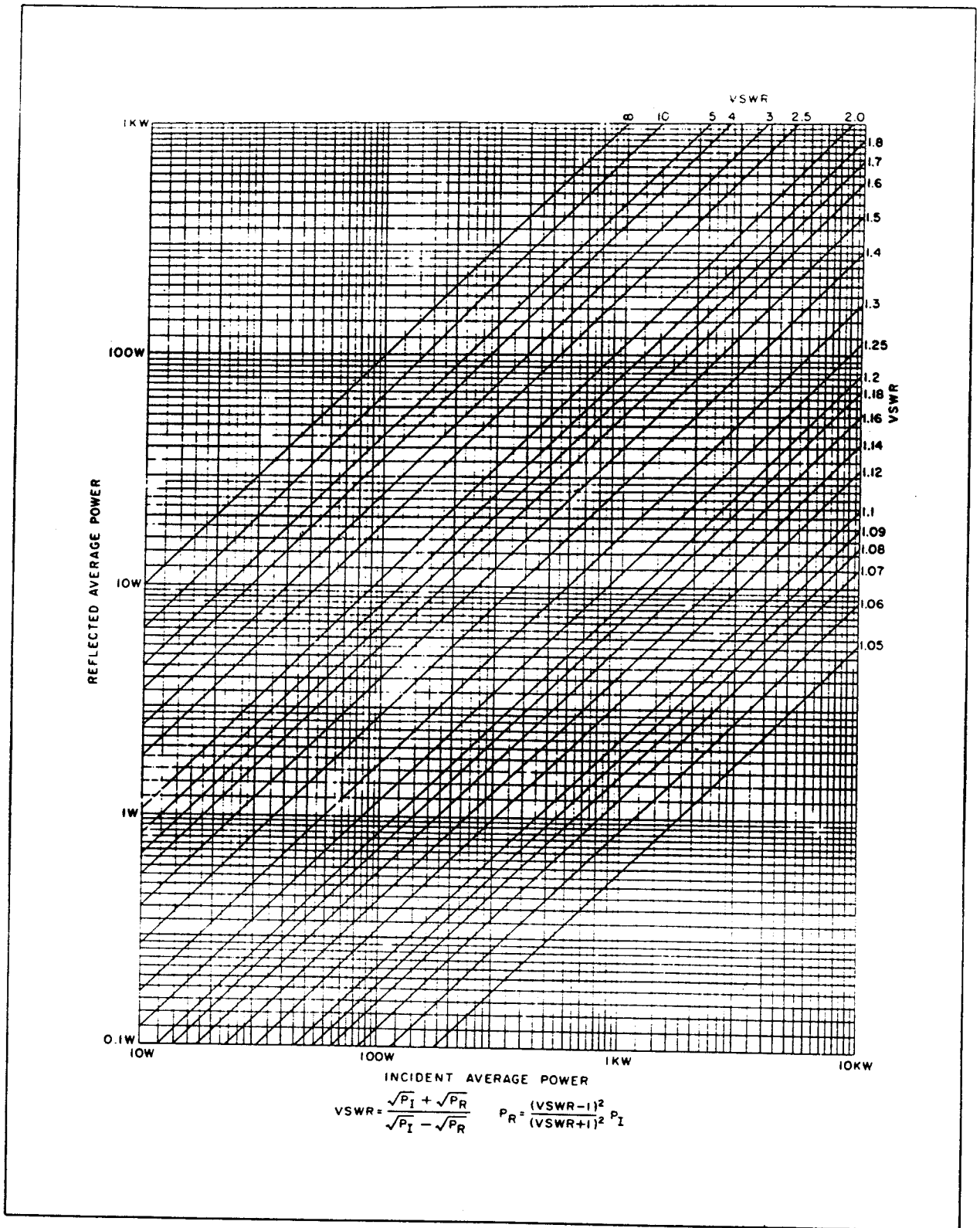


Figure 4-1. Graph of Relation Between Incident Power, Reflected Power, and VSWR.

(P_{cw}). Percent of modulation can then be calculated by the following formula:

$$\text{percent of modulation} = 141 \left(\frac{P_m}{P_{cW}} - 1 \right).$$

This formula is based on the principle that the average

power of a symmetrical wave modulated carrier increases over the c-w level because of the additional power developed in the side bands. The wattmeter is capable of measuring this increase in power because of the detector square law characteristic and the linear power scale.

TABLE 4-1. Reflected Power Error Calculations

Coupler-Detector Model No.	Reflected Power Error Calculations
CU-753/URM-120	± 5% of full scale + $\frac{\text{measured incident power}}{500}$
CU-754/URM-120	± 5% of full scale + $\frac{\text{measured incident power}}{500}$
CU-755/URM-120	± 5% of full scale + $\frac{\text{measured incident power}}{500}$

SECTION V

MAINTENANCE AND LUBRICATION

5-1. MAINTENANCE.

5-2. Normal maintenance only should be required on this instrument providing it receives normal use. When the coupler-detector is removed, care must be taken to prevent dirt or grit particles from entering the primary line. Foreign particles should not be allowed to collect on the mating surfaces between the coupler-detector and the primary line.

CAUTION

The coupling loop should not be cleaned because any distortion in shape will destroy meter calibration.

Wherever the coupler-detector is removed from the primary line, the power range knob should be set to the highest power range.

Use plastic cap provided to protect end of the coupler-detector when it is not in use.

5-3. LUBRICATION

5-4. After disassembly or calibration of the wattmeter, add a small dab of approved lubricant to the head of each adjustment screw.

SECTION VI

TROUBLE SHOOTING

6-1. TROUBLE SHOOTING ANALYSIS .

6-2. Under certain conditions insertion of the power wattmeter between the r-f source and the r-f load may cause a change in the r-f power delivered to the load. This occurs when the transmission line is mis-matched at the r-f load. The result is an extension of the effective line length when the wattmeter is inserted. The short section of line contained in the wattmeter changes the electrical length of the system and therefore causes a change in the impedance into which the power source must work. This condition may be handled by one of the following methods:

a. Retune or readjust r-f power source for normal delivery.

b. Add section of transmission line to power wattmeter such that combined length of added section and wattmeter equals one-half wavelength for frequency in use. Remove added section when wattmeter is removed from system. The electrical length of wattmeter primary line with type-N connectors is 19.7 cm.

c. Permanently include short section of transmission line in r-f load equal to electrical length of line contained within wattmeter. When using wattmeter, remove short section of line to maintain over-all electrical length of system transmission line.

6-3. TROUBLE SHOOTING PROCEDURE.

6-4. The following malfunctions (table 6-1) which can occur in the wattmeter are not the complete list, and should be used only as a guide:

TABLE 6-1. Trouble Shooting Table (See figure 1-2)

Trouble	Probable Cause	Remedy
No meter indication for incident or reflected power.	1. Open resistor R102 in coupler-detector.	Replace part.
	2. Shorted capacitor C101 or C102.	Replace part.
	3. Shorted meter capacitor C103.	Replace part.
	4. Meter shunt not removed.	Remove shunt.

TABLE 6-1. Trouble Shooting Table (Cont)

Trouble	Probable Cause	Remedy
	5. Coaxial cable from meter to coupler-detector disconnected or broken. 6. Faulty diode CR101 in coupler-detector. 7. Transmitter inoperative.	Repair cable. Replace diode. Turn on power.
High VSWR	1. Defective load. 2. Short or open transmission line. 3. Corroded connectors.	Repair or replace. Repair. Repair.
Intermittent or inconsistent meter reading.	1. Faulty load. 2. Faulty transmission line. 3. Meter needle sticks.	Replace. Replace or repair. Check for bearing damage.

SECTION VII
OVERHAUL INSTRUCTIONS

7-1. SPECIAL OVERHAUL TOOLS.

7-2. No special overhaul tools are required to overhaul the wattmeter. The only tools used include an ordinary screwdriver, a No. 4 Allen wrench, and a 1/2-inch hexagonal socket wrench.

7-3. DISASSEMBLY.

7-4. The indicating meter, coupler-detector, and primary line of the wattmeter can be removed only after the case has been opened. To open the case (figure 9-1), release the quick-acting fasteners that hold the upper and lower sections of the wattmeter case together.

7-5. METER.

7-6. To remove the meter from the upper section (figure 9-2), remove the four mounting screws that secure the meter yoke and lift both the yoke and meter from the case.

7-7. COUPLER-DETECTOR.

7-8. Three plastic wedges hold the coupler-detector in the primary line. To remove the coupler-detector, disconnect the meter cable from the side of the unit and release the clamp holding the three plastic wedges against the unit. Twist the unit and carefully pull up. If the unit does not come free immediately, check the plastic wedges to see that they are not interfering with removal.

7-9. Refer to figure 9-3 and disassemble the coupler-detector in accordance with the following procedure:

a. Using a small screwdriver, loosen setscrew in power range knob (1) and remove knob.

b. Remove the two screws (2) and lockwashers (3) that hold nameplate (4) to machined knob (6) and remove nameplate.

c. Using a 1/2-inch hexagonal socket wrench, remove the crystal diode assembly (23 through 34) from the machined slug (11).

d. Using a No. 4 Allen wrench, remove the four screws (5) that hold the machined knob (6) to the sleeve (21).

e. Lift cam (9) from top of machined slug (11).

f. Lift machined slug (11) and its contents from sleeve (21).

g. Remove the four screws (19) that secure the loop mounting plate (15) to the bottom of machined slug (11).

h. Remove the two spring-retaining caps (13) and the two slug-loading springs (12).

i. Using a low-wattage soldering iron, unsolder pickup loop (18) from capacitor (14) and resistor (17) and remove pickup loop.

j. Remove capacitor (14) from insert in loop mounting plate (15).

k. Remove resistor (17) from resistor mounting cup (16) on loop mounting plate (15).

7-10. PRIMARY LINE.

7-11. The primary line is separated from the case by removing the four mounting screws at the bottom of the case.

7-12. CRYSTAL DIODE ASSEMBLY.

7-13. Refer to figure 9-3 and disassemble the crystal diode in accordance with the following procedure:

a. Remove diode insulating washer (23) from crystal diode (25).

b. Remove diode cap (24) from end of crystal diode (26).

NOTE

The diode cap is used only on coupler-detectors No. 180-1000 and No. 181-1000.

c. Remove crystal diode (26); resistor-capacitor assembly consisting of capacitor (27), resistor (28), and resistor insulating bushing (29); and tubing (31).

NOTE

When replacing the crystal diode, be sure to wrap upper portion of diode with short strip of 1/4-inch Scotch tape.

7-14. CLEANING.

7-15. Periodically clean all internal and external surfaces of the wattmeter using a clean, lint-free cloth. No attempt should ever be made, however, to clean the coupling loop as any distortion in shape would destroy meter calibration and accuracy.

7-16. INSPECTION.

7-17. Periodically inspect the wattmeter for evidence of damage or wear. Special attention should be given to the coupling loop and to the plastic inserts that hold

Section VII
Paragraphs 7-17 to 7-25

the coupler-detector in place. The loop must not be displaced from its calibrated position.

7-18. REPLACEMENT.

7-19. The crystal diode is the only part requiring special instructions for replacement. Replace the diode in accordance with the following procedure:

- a. Using a 1/2-inch hexagonal socket wrench, remove crystal diode assembly from side of the coupler-detector.
- b. Lightly tap side of coupler-detector assembly to remove crystal diode.
- c. Refer to Section IX for replacement crystal diode part.

NOTE

When replacing a crystal diode be sure to wrap upper portion of diode with short strip of 1/4-inch Scotch tape.

7-20. REASSEMBLY.

7-21. All reassembly procedures are made by reversing the order of disassembly as outlined in paragraph 7-3.

7-22. CALIBRATION.

7-23. The wattmeter may be recalibrated or checked for accuracy by using the following equipment:

- a. Appropriate power signal source.
- b. Low-pass filter (Sierra Model 184 Series or Hewlett-Packard 360 Series).
- c. Fifty-ohm terminations (Sierra Model 160 series).
- d. Directional coupler (Sierra Model 138A or 150 with special coupling factor calibration to ± 0.16 db).

e. Power meter (Hewlett-Packard 430C special calibration at ± 2 percent accuracy). This or any other combination of power measuring equipment having equivalent accuracy and standards may be used.

7-24. CALIBRATION PROCEDURE.

7-25. Calibration may be checked at any frequency within the range of the coupler-detector involved. Connect the coupler-detector into the test setup shown in figure 7-1 and proceed as follows:

- a. Remove power range knob and circular nameplate from top of coupler-detector.
- b. Replace power range knob, being certain that set screw is tightened on shaft flat.
- c. Rotate knob to proper power range using circular nameplate as guide. Arrow on nameplate should point toward side of coupler-detector which contains meter cable plug.
- d. Rotate coupler detector to read power flowing toward termination.
- e. Apply power from signal source and adjust level until bolometer-power meter combination gives desired reading. Be sure to take into account the coupling factor of the directional coupler at the frequency being used.

f. Note reading on wattmeter meter.

NOTE

The reading on the wattmeter meter can be adjusted within narrow limits by means of an adjustment screw provided for each power range. The adjustment screws are inside the coupler-detector and are accessible through holes in the top of coupler-detector. The appropriate adjustment screw is adjacent to the dot or arrow on the power range knob.

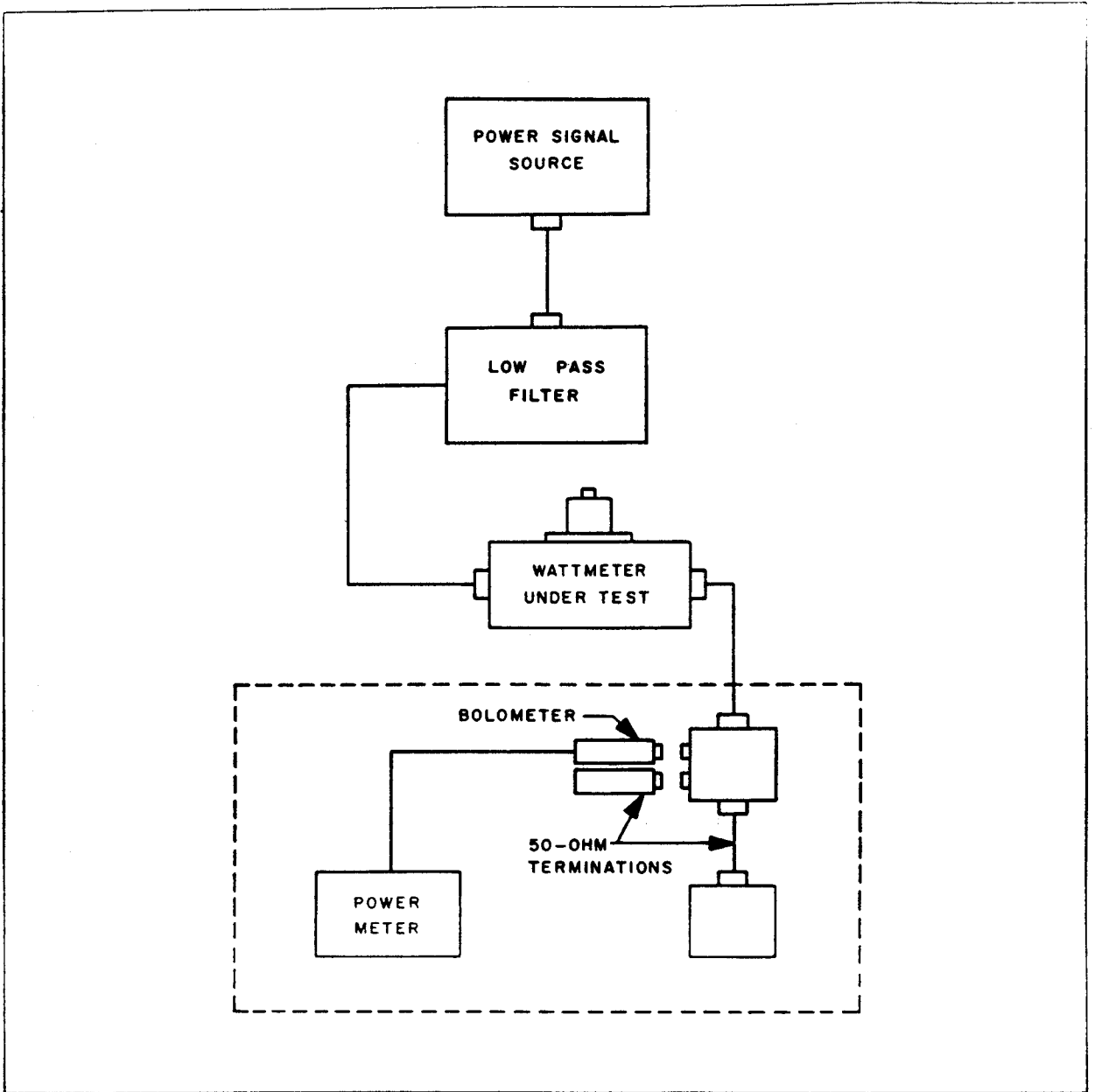


Figure 7-1. Coupler-Detector Test Set-up

SECTION VIII

INTRODUCTION TO ILLUSTRATED PARTS BREAKDOWN

8-1. PURPOSE OF BREAKDOWN.

8-2. This Illustrated Parts Breakdown provides information on components, assemblies, and detail parts of Wattmeter AN/URM-120 for identification, requisitioning, issuance of parts, and for illustrating assembly and disassembly relationships which can be used in conjunction with Section VII of this handbook. This breakdown is divided into four main categories; the Introduction, the Parts List, the Numerical Index, and the Reference Designation Index.

8-3. SCOPE OF BREAKDOWN.

8-4. This breakdown incorporates all details of the nomenclatured item. The contract number, serial number, and NAVAER type designation appear on the name plate of the Wattmeter.

8-5. GROUP ASSEMBLY PARTS LIST.

8-6. GENERAL.

8-7. Each assembly listed is followed immediately by its detail parts, properly indented thereunder to show their relationship to the assembly. Detail parts of the complete wattmeter which are not included in any assembly but which are used in conjunction with, which attach to or which mount a certain assembly are listed, in line with the major assembly, either preceding the first detail part or following the last detail part of the assembly.

8-8. EXPLANATION OF COLUMN DETAILS.

8-9. FIGURE AND INDEX NUMBERS. The figure and index numbers, which are numerically arranged in the Group Assembly Parts List, are used mainly to assist in locating a part in the Group Assembly Parts List after it has been found in the Numerical Index.

8-10. PART NUMBERS. JAN or AN part numbers are used, wherever available, to identify parts. Since this instrument is a commercial item rather than one which has been designed in accordance with JAN or AN standards, most of the parts do not carry JAN or AN identifying numbers. For those parts, the manufacturer's identity is located in parentheses following the description of the item.

8-11. DESCRIPTION. The description consists, principally, of a manufacturer's, and JAN or AN drawing title to identify each part.

8-12. UNITS PER ASSEMBLY. In the case of assemblies, the quantities listed in the "Units per Assy" column of the Group Assembly Parts List are the total quantities used per wattmeter at the location indicated,

while the detailed parts indented under the assemblies are the quantities used per assembly. The quantities specified, therefore, are not necessarily the total used per wattmeter. Refer to the Numerical Index (Section X) for the total quantities used per wattmeter.

8-13. USABLE ON CODE. Part variations within the components of the wattmeter, due to slight differences within the coupler-detector plug in assemblies are identified by the letters A, B, or C, immediately following the description in the "Usable on Code" column. In the cases where this column is left blank, the parts listed are common to all wattmeters produced and delivered as part of this contract.

<u>Item</u>	<u>Usable on Code</u>
Coupler-Detector CU-753/URM-120	A
Coupler-Detector CU-754/URM-120	B
Coupler-Detector CU-755/URM-120	C

8-14. NUMERICAL INDEX.

8-15. The Numerical Index (Section X) lists all the identifying part numbers given in the Group Assembly Parts List.

8-16. PART NUMBER LISTING.

8-17. The part numbers are listed in accordance with the following numerical part-number filing system:

a. The order of precedence in beginning the part-number arrangement on the extreme left hand position of the part number is as follows:

Letters A through Z
 Numerals 0 through 9

NOTE

Alphabetical O's are considered as numerical zeros.

-b. The order of precedence in continuing the part-number arrangement on the second and succeeding positions of the part number from left to right is as follows:

Space (blank column)
 Diagonal (/)
 Point (.)
 Dash (-)
 Letters A through Z
 Numerals 0 through 9

8-18. SOURCE CODES, MAINTENANCE CODES, AND RECOVERABILITY CODES.

8-19. Source codes are codes which indicate to a consumer a source for a part required in the maintenance or repair of an article. Specifically, these codes indicate whether the material is to be requisitioned from the supply system; to be manufactured; to be obtained from salvage; not to be replaced since the next higher assembly is to be installed; not to be replaced due to the impracticability of replacement; to be procured for the specific requirement; to use local discretion regarding obtaining a replacement; or failure of the part indicates a requirement for complete overhaul or scrapping of the assembly or equipment.

8-20. **CODE "P" -- ITEMS PURCHASED, SUPPLY SYSTEM STOCK.** Code "P" is applied to items which are purchased in view of known or anticipated usage and which are relatively simple to manufacture within the Navy, if necessary.

8-21. Code "P1" is applied to items which are purchased in view of known or anticipated usage and which are very difficult, impractical, or uneconomical to manufacture within the Navy.

8-22. Code "P2" is applied to items for which little usage is anticipated but which are purchased in limited quantity for insurance purposes. Items coded "P2" are difficult to manufacture, require special tooling and/or stock not normally available within the Naval establishment, or require long production lead time.

8-23. Code "P3" is applied to detail items which are purchased in quantity in accordance with the life expectancy of the part. Items coded "P3" are deteriorative in nature and may require special storage conditions.

8-24. Code "P4" is applied to end items which are procured for initial outfitting only and which are replaced by salvage, manufacture or assembly at the lowest capable level of maintenance.

8-25. **CODE "M" MANUFACTURE - ITEMS NOT PURCHASED.** Code "M-F" is applied to items which are capable of being manufactured within Class "C", "D", "E" or "F" activities. Items coded "M-F" have no anticipated or relatively low usage, or possess restrictive installation or storage factors. Code "M-F" will not be applied to an item when the same item is coded in the "P" series for other applications and system support is maintained; when the item appears in the Navy Stock List of Federal Stores or the Electronic Supply Office List of Common Electronic Parts in the Electronic Supply System; or when supply support responsibility for the item has been vested in another inventory manager. With respect to support equipment, the manufacturing activity may alter the design, material and processes provided that fit, function, use, and safety are not impaired.

8-26. Code "M-O" is applied to items which are capable of being manufactured within Class "A" or "B" activities. Items coded "M-O" have no anticipated or relatively low usage, or possess restrictive installation or storage factors. Code "M-O" will not be applied

to an item when the same item is coded in "P" series for other applications and system support is maintained, when the item appears in the Navy Stock List of Federal Stores or the Electronic Supply Office List of Common Electronic Parts in the Electronic Supply System; or when supply support responsibility for the item has been vested in another inventory manager. With respect to support equipment, the manufacturing activity may alter the design, material and processes provided that fit, function, use, and safety are not impaired.

8-27. **CODE "A" -- ASSEMBLE - ASSEMBLY NOT PURCHASED.** Code "A-F" is applied to assemblies which are not purchased but which are to be assembled within Class "C", "D", "E" or "F" activities prior to installation. At least one of the items in the assembly must be a coded "P" series item which carries an individual part number and description.

8-28. Code "A-O" is applied to assemblies which are not purchased but which are to be assembled within Class "A" or "B" activities prior to installation. At least one of the items in the assembly must be a coded "P" series item which carries an individual part number and description.

8-29. **CODE "N" - NOT STOCKED - WILL BE PURCHASED ON DEMAND.** Code "N" is applied to items which do not meet established criteria for stocking and which are normally readily available from commercial sources. Items coded "N" will be purchased on demand in accordance with applicable procedures. This type item is for immediate consumption and will not be stock numbered. With respect to support equipment, equivalent items may be substituted for specific "N" coded items provided fit, function, use, and safety are not impaired.

8-30. **CODE "X".** Code "X" is applied to main structural members or similar items which, if required, would suggest extensive repair. The need for an item, or items, coded "X" will normally result in a recommendation for complete overhaul or retirement of equipment from service.

8-31. Code "X1" is applied to items for which purchase of the next larger assembly source coded in the "P" series is justified; e.g., an internal detail item, such as welded segments inseparable from the assembly, an item which must be machined and installed with other items in a matched set, or an item of an assembly which, if required, would suggest extensive reconditioning of each assembly.

8-32. Code "X2" is applied to items which are not purchased for stock but may be acquired for use through salvage or one time purchase. Activities requiring such items will attempt to obtain from salvage; if not obtainable from salvage, reasonably locally manufactured or procurable, such items will be requisitioned through normal supply channels with supporting justification. Repeated requests may justify a change to the "P" series code.

8-33. **CODE "U".** Code "U" is applied when not of supply significance.

8-34 MAINTENANCE CODE DEFINITIONS. Maintenance codes as applied to purchased items are codes which reflect known or anticipated usage at levels of maintenance as defined in reference (b). Maintenance code "O" indicates Class "A" or "B". Maintenance code "F" indicates Class "C", "D", "E" or "F". Maintenance codes shall be omitted from end item support equipment. Maintenance codes as applied to manufacture and/or assembly are to be assigned as directed by this instruction.

8-35. RECOVERABILITY CODE DEFINITIONS. Recoverability codes are codes which reflect the recoverability characteristics of items removed from equipment at time of maintenance, repair or overhaul; i.e., repairable, salvageable or consumable.

a. Code "R" - Repairable. Items which are economical and practical to repair on a scheduled basis. Replacements are obtained from the supply system on an exchange basis, if and when possible; i.e. an item may be lost or damaged beyond recognition.

b. Code "S" - Salvageable. Items which are economical and practical to salvage and which may be placed in "Ready for Issue" condition. "S" coded items are not normally scheduled in the overhaul program and may contain items or materials which are usable, valuable or critical, and which may be placed in the supply system for issue.

c. Code "C" - Consumable. Items that are neither repairable nor salvageable.

8-36. TOTAL QUANTITY.

8-37. The "Total Quantity" column in the Numerical Index lists the total units required per wattmeter. Where more than one detail part, subassembly, or assembly of a component is covered in the Illustrated Parts Breakdown, the largest total quantity will be shown.

8-38. REFERENCE DESIGNATION INDEX.

8-39. This index lists all reference designations shown on the schematic diagram.

8-40. REFERENCE DESIGNATION.

8-41. A reference designation consists of one or two capital letters followed by a group of numbers. These combinations are used in order to identify a detail part, subassembly, or assembly with respect to its location in a photograph, schematic, or wiring diagram.

8-42. ALPHABETICAL PORTION OF REFERENCE DESIGNATION The following is an alphabetically arranged list showing the type of part indicated by the letters.

<u>Letter</u>	<u>Part</u>
A	Structural parts (panels, frames, castings, etc.)
C	Capacitors of all types.
CR	Rectifiers
E	Miscellaneous electrical parts (terminal boards, insulators, knobs, brushes, etc.)
J	Jacks and receptacles (fixed connectors)
L	Inductors (r-f and a-f)
M	Meters of all types
O	Mechanical parts (bearings, shafts, etc.)
R	Resistors (fixed, variable, potentiometers)
Y	Crystals, mechanical oscillators

8-43. NUMERICAL PORTION OF REFERENCE DESIGNATION. Normally, more complex electronic instruments and systems have reference designators assigned in such a manner that a quick identity can be made to either an assembly, subassembly, or component. This wattmeter is relatively simple, having very few electrical parts, and the reference symbols begin at 100.

8-44. EXPLANATION OF TERMS, ABBREVIATIONS, AND SYMBOLS.

8-45. TERMS.

8-46. The term "AR" in the quantity column indicates bulk parts used "as required," while the term "Ref" in the quantity column indicates that the item is listed for "reference purposes" only.

8-47. ABBREVIATIONS.

8-48. The abbreviations used in this breakdown are listed in ANA Bulletin No. 261.

8-49. MANUFACTURERS' NAME CODE SYMBOLS.

8-50. Normally, each part supplied by the manufacturer for use by the prime contractor is identified as to its manufacturer by a code symbol in parentheses following the description of the part in the Group Assembly Parts List. This code will be furnished as a part of the first revision of this handbook when source codes, etc. are assigned.

8-51. HOW TO USE THE ILLUSTRATED PARTS BREAKDOWN.

8-52. To permit complete identification of all parts, the procedure in table 8-1 is to be followed:

TABLE 8-1 Parts Identification Procedure

<u>Given</u>	<u>To Find:</u>	<u>Use Applicable Procedure</u>
Reference Designation	Figure Stock Number Part Number	a. Refer to Section XI. b. Locate reference designation. c. Figure index, stock number, and part number are listed opposite reference designation.
	Source Code Figure Index Quantity per Article	a. Refer to Section XI. b. Locate reference designation. c. Part number is listed opposite reference designation. d. Refer to Section X, using part number. e. Source code, figure index, and quantity per article are listed opposite part number.
	Illustration Part Number Description Units per Assembly Usable on Code	a. Refer to Section XI. b. Locate reference designation. c. Figure index is listed opposite reference designation. d. Refer to Section IX, using figure index. e. Part number, description, units per assembly, and usable on code are listed opposite the part number.
Part Number	Stock Number Source Code Figure Index Quantity per Article	a. Refer to Section X. b. Locate part number. c. Stock number, source code, figure index, and quantity per article are listed opposite the part number.
	Illustration Description Units per Assembly Usable on Code	a. Refer to Section X. b. Locate part number. c. Figure index is listed opposite part number. d. Refer to Section IX, using figure index. e. Description, units per assembly, and usable on code are listed opposite figure index.
Location of Part	Illustration Figure Index Part Number Description Units per Assembly	a. Refer to Table of Contents. b. Locate Group Assembly. c. Page number is listed opposite Group Assembly. d. Refer to Section IX, using page number. e. Locate figure index of part in illustration. f. Refer to Group Assembly Parts List following illustration, using figure index. g. Part number, description, units per assembly, and usable on code are listed opposite figure number.
	Stock Number Source Code Quantity per Article	a. Refer to Table of Contents. b. Locate Group Assembly. c. Page number is listed opposite Group Assembly. d. Refer to Section IX, using page number. e. Locate figure index of part in illustration. f. Refer to Group Assembly Parts List following illustration, using figure index. g. Part number is listed opposite figure index. h. Refer to Section X, using part number. i. Locate part number. j. Stock number, source code, and quantity per article are listed opposite part number.

8-53. ORDERING SPARE PARTS.

8-54. Each Service using this list has established certain depots and service groups for the storage and issuance 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, or the type, model, or drawing number, is not to be interpreted as author-

ization to field agencies to attempt to purchase identical or comparable spare parts directly from the manufacturer, or from wholesale or retail store, except under emergency conditions, as covered by existing regulations of the Service concerned. The parts chosen for use in this instrument have probably been chosen for special qualities not available in standard components, and the use of a standard component may result in decreased life or lowered performance.

SECTION IX
GROUP ASSEMBLY PARTS LIST

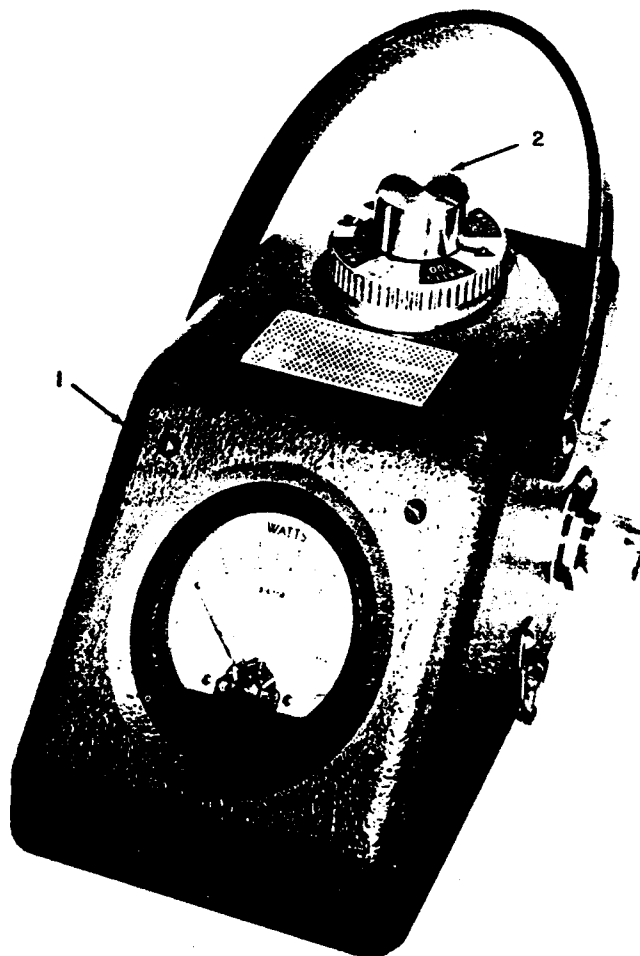


Figure 9-1. Wattmeter AN/URM-120, Oblique View

FIG. & INDEX NO.	PART NO.	DESCRIPTION							UNITS PER ASSY	USABLE ON CODE
		1	2	3	4	5	6	7		
9-1	AN/URM-120	WATTMETER AN/URM-120	.	.	.	.	.	.	1	
-1	TS-1285/URM-120	WATTMETER TS-1285/URM-120	.	.	.	.	.	.	1	
-2	CU-753/URM-120	COUPLER-DETECTOR CU-753/URM-120	.	.	.	.	.	.	1	
-2	CU-754/URM-120	COUPLER-DETECTOR CU-754/URM-120	.	.	.	.	.	.	1	
-2	CU-755/URM-120	COUPLER-DETECTOR CU-755/URM-120	.	.	.	.	.	.	1	
-3	CY-2606/URM-120	CASE, Wattmeter CY-2606/URM-120	.	.	.	.	.	.	1	

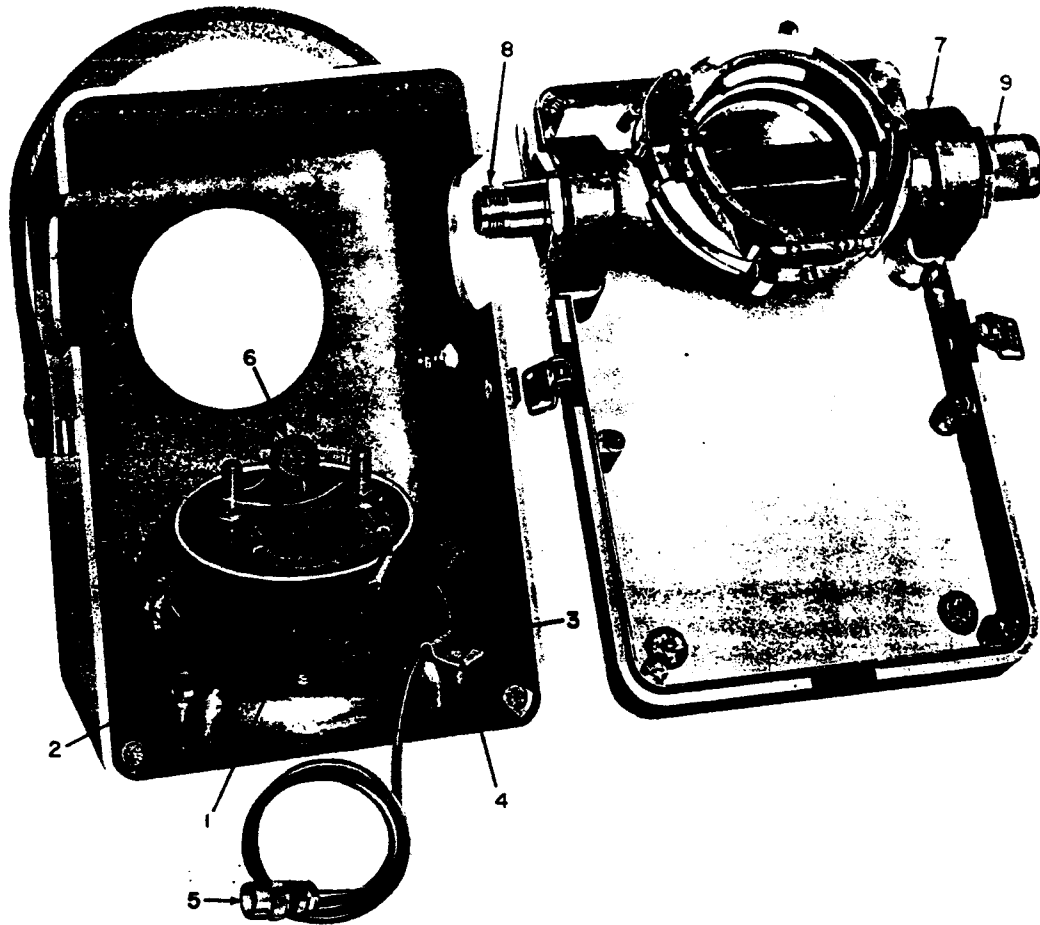


Figure 9-2. TS-1285/URM-120, Internal Views

FIG. & INDEX NO.	PART NO.	DESCRIPTION							UNITS PER ASSY	USABLE ON CODE	
		1	2	3	4	5	6	7			
9-2-1	118X5	.	METER.	Power (see figure 9-1. item 1 for next higher assembly)					1		
			(ATTACHING PARTS)								
-2		.	YOKE,	Meter					1		
-3		.	SCREW,	Rd hd, No. 6-32 by 1 in. lg					4		
-4		.	NUT,	Hex. No. 6-32					4		
			-----*								
-5	146X10	.	.	CONNECTOR,	Coaxial, female, type MB				1		
-6	14X103	.	.	CAPACITOR,	Fixed, ceramic, 0.01 mfd, 450V dc				1		
-7		.	PRIMARY LINE								
-8	146X12	.	.	CONNECTOR,	Coaxial, male, type N				1		
-9	146X13	.	.	CONNECTOR,	Coaxial, female, type N				1		

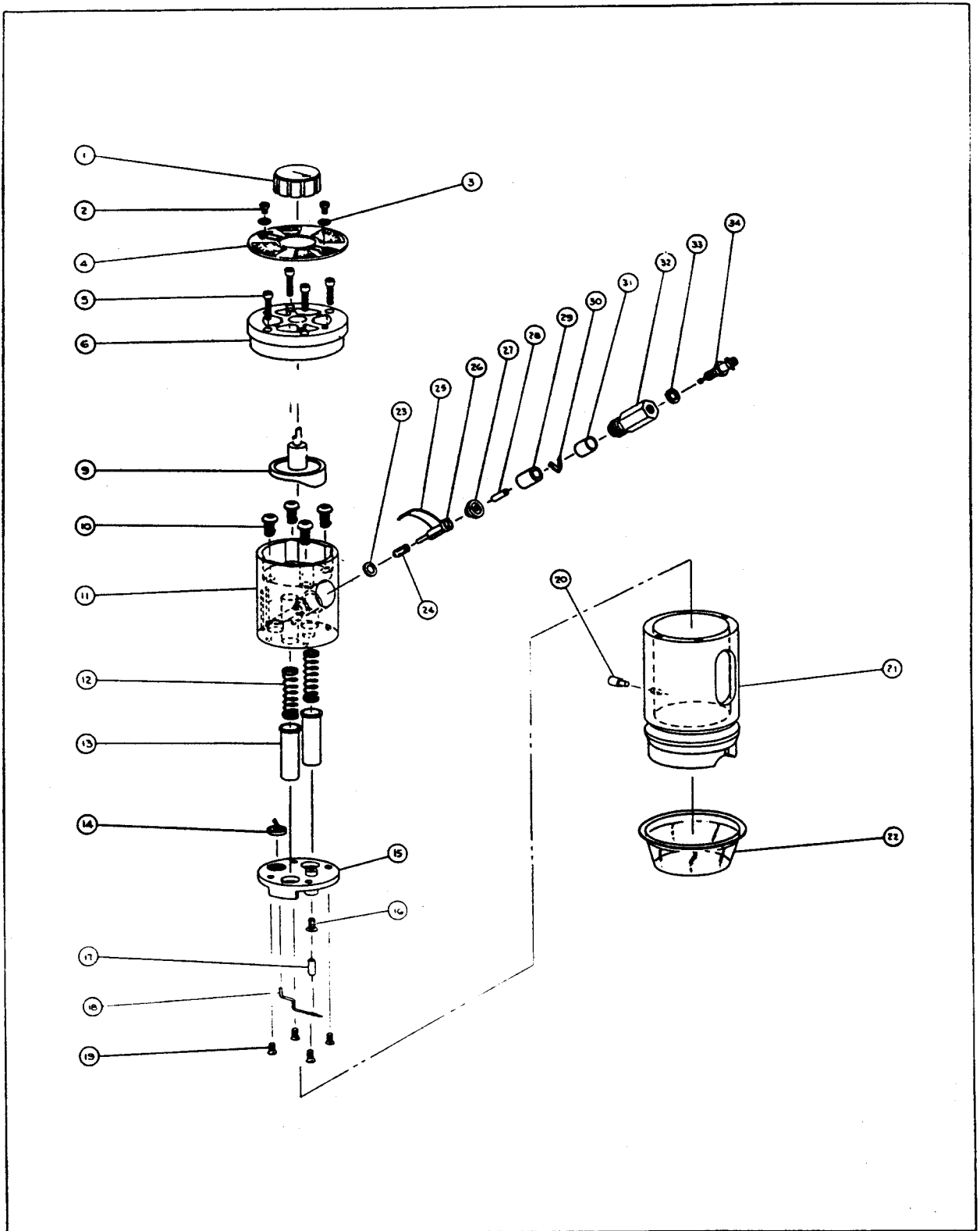


Figure 9-3. Coupler-Detector, Exploded View

SECTION X
NUMERICAL INDEX

STOCK NO.	PART NO.	FIGURE AND INDEX NO.	SOURCE CODE	TOTAL QUANTITY
	CU-753/URM-120	9-2-10		1
	CU-754/URM-120	9-2-10		1
	CU-755/URM-120	9-2-10		1
	SP-4845-1	9-3-32		3
	SP-4847-1	9-3-29		3
	SP-4848-1	9-3-30		3
	SP-4850-2	9-3-15		1
	SP-4855-1	9-3-13		6
	SP-4857-2	9-3-21		2
	SP-4864-1	9-3-20		3
	SP-4872-1	9-3-12		6
	SP-4985-1	9-3-23		3
	SP-4987-1	9-3-10		12
	SP-6556-1	9-3-18		1
	SP-6557-1	9-3-18		1
	SP-6832-2	9-3-16		1
	SP-7285-2	9-3-15		1
	SP-7287-3	9-3-11		2
	SP-7288-3	9-3-6		3
	SP-7543-2	9-3-21		1
	SP-7545-2	9-3-18		1
	SP-7583-1	9-3-16		1
	SP-10078-2	9-3-15		1
	SP-10080-3	9-3-11		1
	SP-10095-1	9-3-22		1
	SP-10095-2	9-3-22		2
	SP-10176-2	9-3-4		1
	SP-10438-3	9-3-9		3
	TS-1285/URM-120	9-1		1
	14X103	9-2-6		1
	18A142-SS	9-3-14		1
	18A281	9-3-14		1
	18A500	9-3-14		1
	26B102	9-3-27		3
	50X680	9-3-17		3
	52X182	9-3-28		2
	52X271	9-3-28		1
	105X2	9-3-26		1
	105X4	9-3-26		2
	118X5	9-2-1		1
	146X10	9-2-5		1
	146X11	9-3-34		3
	146X12	9-2-8		1
	146X13	9-2-9		1
	160X10	9-3-1		3
	195X14	9-3-4		1
	195X15	9-3-4		1

SECTION XI
REFERENCE DESIGNATION INDEX

REFERENCE DESIGNATION	FIGURE INDEX	STOCK NO.	PART NO.
C101	9-3-14		18A142-SS 18A281 18A500 26B102 14X103 105X2 105X4 146X13 146X12 146X11 SP-6556-1 SP-6557-1 SP-7545-2 118X5 146X10 50X680 52X182 52X271
C102	9-3-27		
C103	9-2-3		
CR101	9-3-26		
J101	9-2-9		
J102	9-2-8		
J103	9-3-34		
L101	9-3-18		
M101	9-2-1		
P101	9-2-5		
R101	9-3-17		
R102	9-3-28		

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