NAVSHIPS 0967-128-6010

TECHNICAL MANUAL
FOR
TEST SET RADIO FREQUENCY POWER
TS-1771/U

DEPARTMENT OF THE NAVY
Bureau of Ships

Publication: 15 November 1965

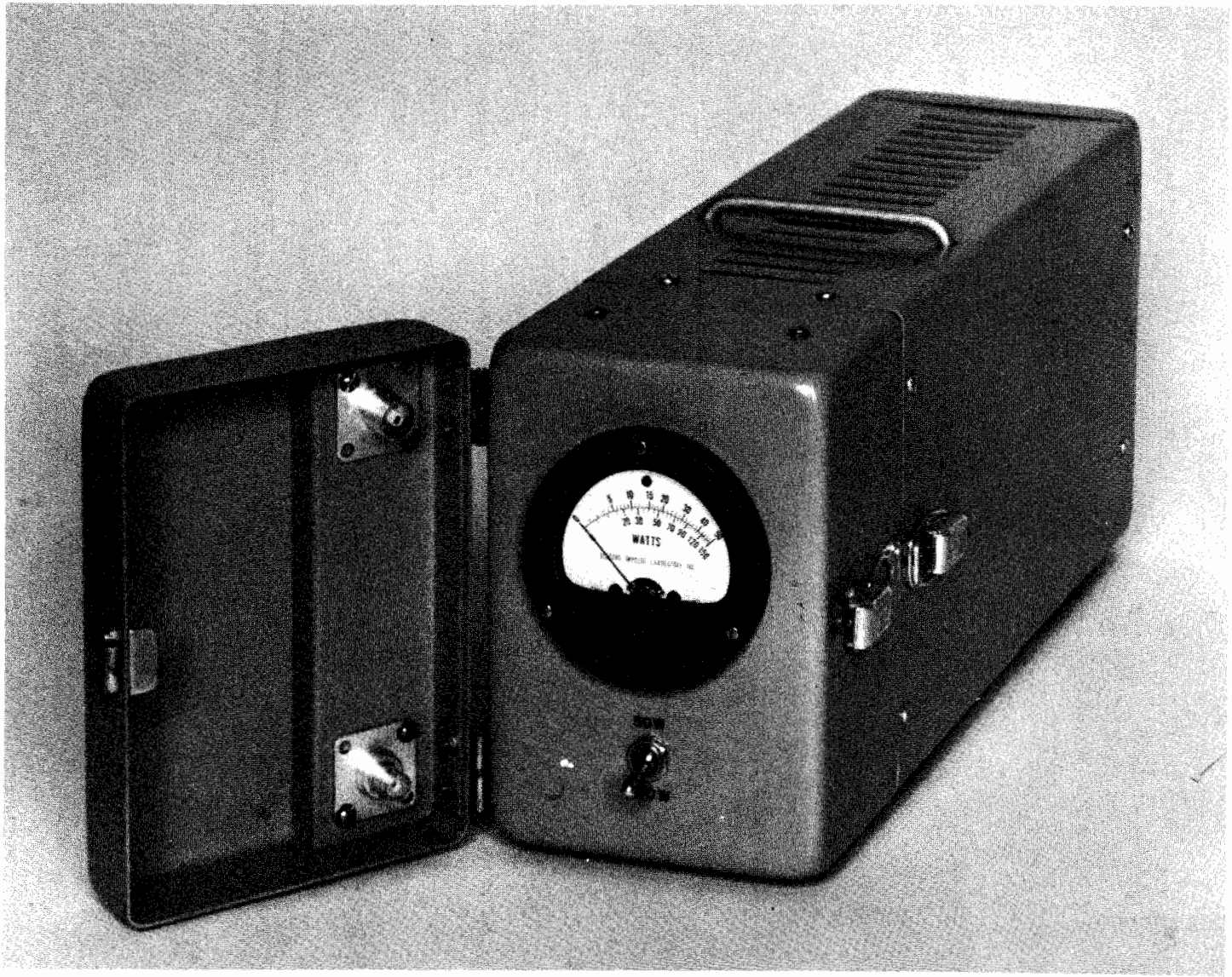
LIST OF EFFECTIVE PAGES

Page Numbers	Change in Effect
Title	Original
ii to iii	Original
1-1 to	Original
2-1 to 2-2	Original
3-1 to 3-7	Original

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES



Test Set, Radio Frequency Power TS-1771/U

SECTION 1

GENERAL INFORMATION

1-1. SCOPE OF MANUAL .

This instruction book covers the description, operation and maintenance of Test Set, Radio Frequency Power, TS-1771/U.

1-2. PURPOSE AND APPLICATION.

The Test Set is a portable, dual range radio frequency (r.f.) absorption type wattmeter used to measure power output and loss in coaxial transmission lines and to assist in tuning and trouble-shooting of transmitting equipment. It may also be employed as a dummy load, a modulation monitor or an r.f. resistor. The equipment is capable of operation under ship and shore installation conditions.

1-3. DESCRIPTION.

1-3.1 The Test Set is a self-contained instrument consisting of two basic sections; a power dissipating unit (dummy load) and a meter unit with a protective cover. The meter unit is detachable from the dummy load and may be removed up to 25 feet on its attached cable for remote operation. The hinged protective cover is detachable for convenience and contains two accessory r. f. input connectors.

1-3.2 The dummy load consists of metal film on glass resistors tapped to provide the operating voltage for the meter unit and mounted in a special arrangement between two side plates to provide the proper electrical characteristics and maximum heat dissipation. The type N female r. f. connector on the rear is removable and interchangeable with the type C and BNC female accessory connectors. A spare crystal rectifier is contained in a shielded housing on the opposite end of the dummy load where the 25 feet long cable is stored.

1-3.3 The meter unit contains a sensitive microammeter with the scale calibrated to read watts in two ranges. A two position switch connects the meter into the circuit through a resistive calibrating network.

1-4. REFERENCE DATA.

1-4.1 NAMEPLATE DATA.

a.	NOMENCLATURE -----	Test Set, Radio Frequency Power
b.	TYPE/MODEL---- ----	TS-1771/U
c.	FEDERAL STOCK NO. -	6625-788-8599
d.	MANUFACTURER -----	Electro Impulse Laboratory, Inc. Red Bank, N. J.

1-4.2 ELECTRICAL CHARACTERISTICS.

a.	POWER RANGES------	0-50 watts and 0-150 watts
b.	FREQUENCY RANGE --	30-1000 mc.
c.	ACCURACY (based on full scale value at room ambient, approx. 23° C)	30-600 mc ±5% 600-800 mc ±10% 800-1000 mc ±20%
d.	POWER DISSIPATION --	150 watts max. at 40° C ambient.
e.	POWER DERATING----	1% per °C above 40°C
f.	INPUT IMPEDANCE ---	50 ohms. (nominal)
g.	VSWR (max.)------- --	1.15 to 1
h.	RADIO INTERFERENCE	(min.) 60 db below applied power

1-4.3 MECHANICAL CHARACTERISTICS.

a.	SIZE	Length 21-1/2 inch Witdh 6 inch Height 8 inch
b.	WEIGHT	13 lbs. (approx.)

SECTION 2

INSTALLATION AND OPERATION

2-1. INSTALLATION.

The Test Set is a portable, bench type, test instrument that has no special installation requirement. No power is required for operation other than the r.f. power source to be measured or terminated.

2-2. OPERATION.

2-2.1 To operate the Test Set as an r.f. wattmeter for power measurements perform the following steps in the order in which they appear.

a. Place the Test Set in a clear area so that air may flow freely around and above the unit.

CAUTION

Do not confine the Test Set or cover the ventilating slots in any manner as this will restrict the natural convection cooling required for proper operation and may result in damage to the equipment.

b. Unlatch the protective cover and swing it open or remove it by lifting up causing separation at the hinges.

c. Place the power range switch in the 150 watts position.

d. Connect the r.f. power source to be measured to the input connector.

NOTE

THE TEST SET is supplied with a type N female connector installed. If the mating male plug on the cable from the r.f. power source is type C or BNC, interchange the input connector with the appropriate connector stored in the protective cover. This is done by removing the mounting screws and pulling the connector straight away from the unit. Adapters from one series to another are not recommended because of the error introduced into the line which will cause the meter to read lower than the r.f. power applied.

e. Apply the r.f. power to be measured. Refer to paragraph f. for limitations. If the reading is less than 50 watts and increased sensitivity is desired, place the meter range switch in the 50 watts position. The meter reading observed is the r.f. power absorbed by the dummy load termination.

CAUTION

To prevent possible damage to the meter, avoid overloading the Test Set beyond the full scale value of the range selected.

f. 150 watts may be applied continuously to the Test Set at room ambient temperatures up to 40° C (104°F). For ambient temperatures above 40° C the maximum input power must be reduced 1.5 watts for each degree Centigrade. Table 2-1 may be used as a guide.

TABLE 2-1

TEMPERATURE VS. INPUT POWER

Room Ambient Temperature	Max. Input Power in Watts
40° C (104°F)	150
45° C (113°F)	142.5
50° C (122°F)	135
55° C (131°F)	127.5
60° C (140°F)	120
65° C (149°F)	112.5

g. For remote operation the meter unit may be separated from the dummy load by unfastening the latches on the sides and uncoiling the cable from the rack on the inside end of the dummy load.

EXAMPLE: One application of this type of operation would be to locate the dummy load near the output of a transmitter and the meter unit near the panel controls where the meter could be readily observed while adjusting or trouble-shooting the transmitter.

2-2.2 To operate the Test Set as a dummy load only, perform the steps a. through f. except that the meter range switch should be left in the 150 watts position to protect the meter.

2-3. OPERATOR'S MAINTENANCE.

Because of the extreme simplicity and ruggedness of the Test Set no special maintenance other than routine cleaning is required. The outside surfaces should be wiped free of dust and dirt when necessary. The use of solvents for cleaning is not recommended. Whenever the Test Set is left disconnected, keep the dust cap in place on the input connector.

SECTION 3

MAINTENANCE

3-1. PREVENTIVE MAINTENANCE.

The Test Set is very simple and rugged in design. No special maintenance is required other than calibration, at periods determined by usage, to certify the accuracy of the instrument.

3-2. TROUBLE SHOOTING.

3-2.1 Troubleshooting the Test Set may be performed with an ohmmeter capable of measuring 10 to 10,000 ohms and reference to the schematic diagram Fig. 3-2.

3-2.2 D.C. METER, M1 TEST.

The only part which cannot be tested with an ohmmeter is the meter. This test requires special equipment and knowledge of circuits and instruments for the testing of sensitive d. c. microammeters. The meter may be tested, out of the circuit, as a microammeter with a full scale deflection of 200 microamperes ±2%.

3-2.3 TERMINATION RESISTOR AT1, TEST.

The load resistor may be tested for open with an ohmmeter, however, it should not be considered as serviceable unless tested in the following manner. An accurate resistance measuring instrument such as Resistance Bridge, ZM-48/U, good to 1% or better at 50 ohms is required. Use low resistance leads, preferably a short length of cable with a UG-21E/U plug on one end. Measure the load resistor to 50 ohms nominal with acceptable limits of 47.5 to 52.5 ohms.

3-2.4 Table 3-1 is a guide to common troubles, their probable cause and remedy.

TABLE 3-1

TROUBLESHOOTING CHART

Symptom	Cause	Remedy
Meter does not operate when r.f. is applied.	Defective Crystal diode.	Replace diode see paragraph 3-3.1
	Open attenuator assembly AT2	Replace attenuator see paragraph 3-3.2
	Open load resistor assembly AT-1	Replace load resistor see paragraph 3-3.3
	Defective meter M1	Replace meter.
Meter indicator sticks.	Defective meter	Replace meter
Meter reads incorrectly.	Change in load resistor characteristics	Replace load resistor see paragraph 3-3.3
	Meter circuit not adjusted properly.	Recalibrate see paragraph 3-3.4

3-3. REPAIR.

After localizing the trouble to a particular part or assembly corrective action is performed as defined in the following instructions. If it is necessary to replace any electrical part except the input connector the Test Set must be recalibrated.

3-3.1 Crystal Diode, CR1, Replacement.

a. Remove the meter unit from the dummy load.

b. Remove the eight screws around the edge of the meter end of the dummy load. Remove two screws near the connector on the opposite end and carefully remove the case from the termination resistor assembly.

c. Unfasten the connector at the bottom of the load resistor thus exposing the base of the diode at its installed position in the body of the connector.

d. Remove the diode and replace it with a new one being certain to align the new diode properly before applying pressure.

e. Reconnect the connector at the bottom of the load resistor.

f. Reassemble the dummy load in the reverse order of step b.

g. If the diode supplied as a spare in the retainer on the end of the dummy load is used recalibration should not be necessary. If another diode is used the Test Set should be recalibrated, See paragraph 3-3.4.

h. Reconnect the meter unit to the dummy load. The Test Set is now ready for use.

3-3.2 Attenuator, AT2, Replacement.

a. Remove the termination resistor as in paragraph 3-3.1a, b, and c, and remove the diode.

b. Remove four screws mounting the crystal diode housing and pull the housing straight away from the load resistor.

c. Remove the retaining ring and extract the attenuator assembly and replace it with a new one.

d. Reassemble in the reverse order being certain to align all parts properly.

3-3.3 Termination Resistor, AT1, Replacement.

a. Remove the termination resistor assembly as in paragraph 3-3.1a and b.

b. Remove four screws mounting the crystal diode housing and allow it to hang on the cable.

c. Remove two screws in the center of the plate and four screws in the end of the termination. Remove the connector. Refer to figure 3-1.

d. Reassemble in the reverse order using the replacement termination resistor.

3-3.4 Calibration Procedure.

3-3.4.1 The Test Set may be calibrated with 60 cycles per second line power. This procedure, when carefully performed, will yield the specified accuracy of the instrument when used to measure r.f. See paragraph 1-4.2.

3-3.4.2 Equipment Required.

a. Variable ratio transformer (variac) 0-130 volts, 500 volt-amperes minimum rating.

b. Wattmeter, Sensitive Research Instrument Corp. Model VAW or equivalent with minimum capability of measuring 150 watts, rated 100 volts at 2 amperes and 3/4 of 1% accuracy.

c. Electrolytic capacitor. 1000 mfd. 6 volts D. C. W.

3-3.4.3 Procedure.

a. Remove the protective cover from the meter. Remove the meter unit from the dummy load.

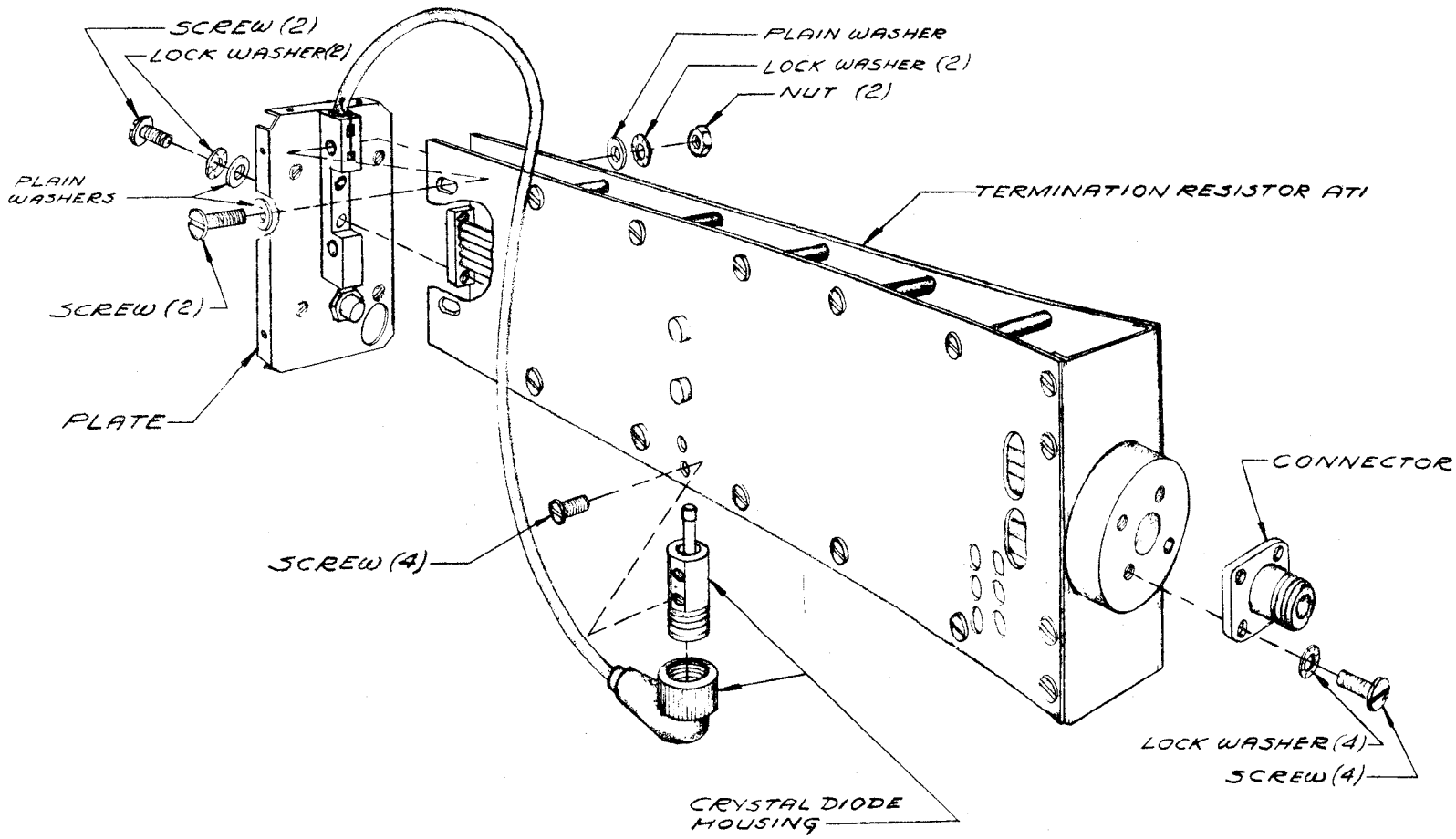


Figure 3-1 Termination Resistor Assy

b. Connect the equipment as shown in figure 3-2. Observe the polarization of the a.c. power line connections which maintains the case of the Test Set at ground potential. The connection to the input connector may be made with a short length of cable with a UG-21E/U plug on one end. Connect the negative (-) side of the electrolytic capacitor to the terminal marked AC CALIB TERM and the positive side to any convenient ground point on the dummy load.

c. Set the meter range switch on the Test Set to 150 watts. Set the variac to give a reading of 120 watts on the wattmeter and adjust the series resistor R7 to read 120 watts on the Test Set meter.

d. Set the variac to give a reading of 30 watts on the wattmeter and adjust the shunt resistor R8 to read 30 watts on the Test Set meter.

e. Repeat steps c. and d. until the Test Set meter and the wattmeter readings agree at each power level without adjustment.

f. Set the Test Set meter range switch to 50 watts. Set the variac for 50 watts and adjust the series resistor R5 to read 50 watts on the meter.

g. Set the variac for 15 watts and adjust the shunt resistor R8 to read 15 watts on the meter.

g. Repeat steps f. and g. until the Test Set meter and the wattmeter readings agree at each power level without adjustment.

NOTE

If a variable resistor has been replaced or was previously tampered with, the initial starting position of the control would be approximately center.

i. Disconnect the test equipment, including the electrolytic capacitor, reassemble the Test Set and the instrument is ready for use.

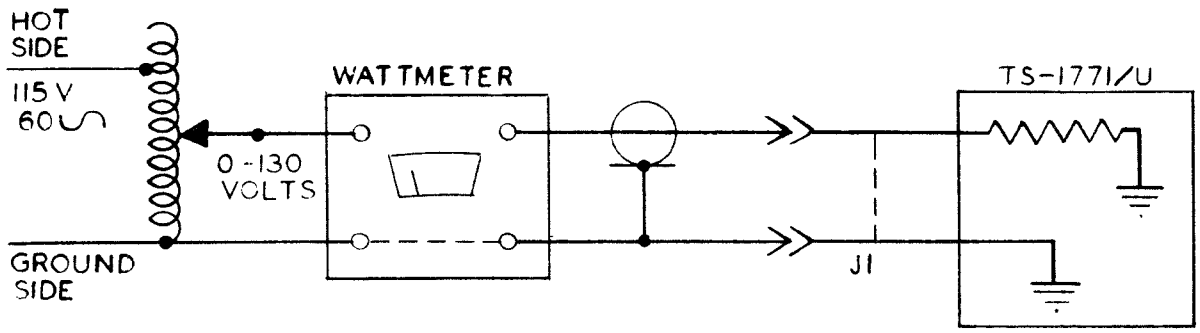


Figure 3-2 Diagram Calibration Equipment Connection

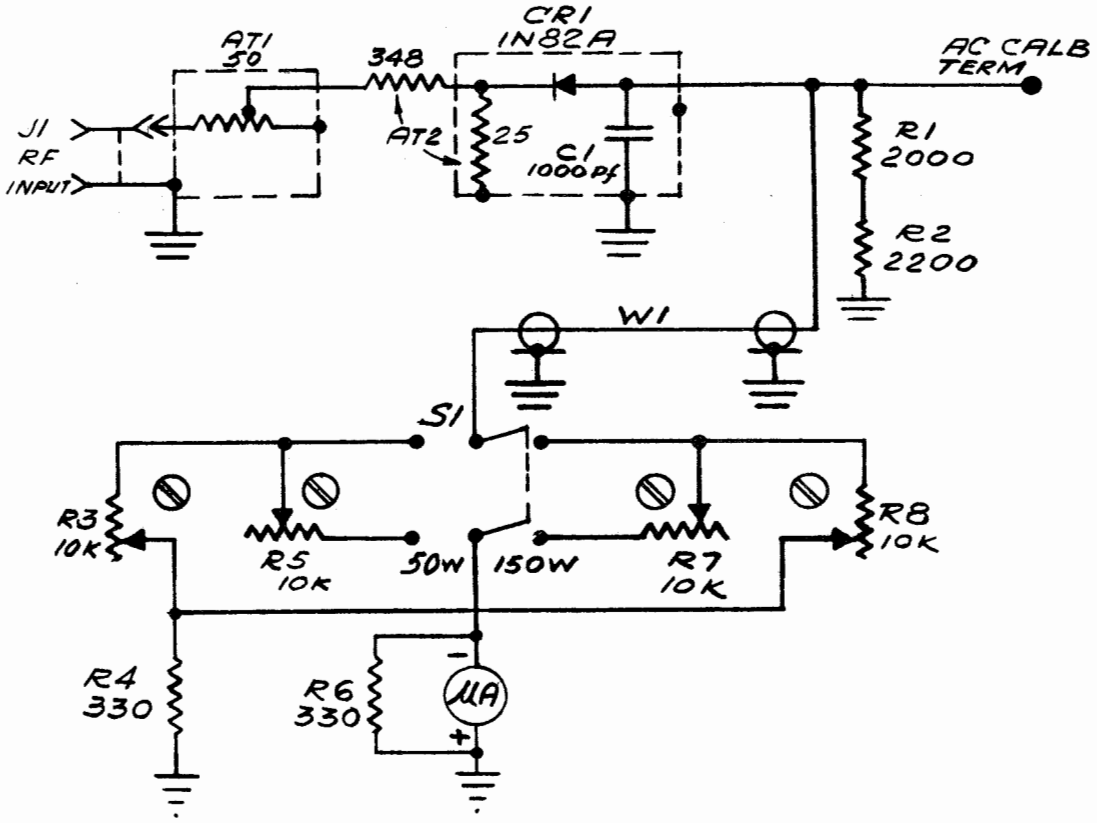


Figure 3-3. TS-1771/U, Schematic Diagram

TABLE 3-2. TABLE OF REPLACEABLE PARTS

This table lists the replaceable parts for the Test Set, TS-1771/U by reference symbols shown on schematic Diagram Fig. 3-3.

SYMBOL	NAME AND DESCRIPTION	LOCATING FUNCTION
AT1	TERMINATION RESISTOR, metal film resistor assy., 50 ohms tapped at 20 ohms from ground end. Two rectangular side plates in a tapered configuration, 11-1/4 in. lg x 5 in. h x 1-3/4 in. w; boss 1-3/4 in. dia. x 3/4 in. lg. on wide end. Electro Impulse Lab. Inc. part/dwg, C 2000	Housed in ventilated protective case.
AT2	ATTENUATOR ASSEMBLY, 25 ohm disc resistor, 348 ohm metal film resistor one side, chuck type contact opposite side. 1-3/8 in. lg. x 1/2 in. major dia. Electro Impulse Lab. Inc. part/dwg A 1988	Retained in crystal diode housing at 20 ohm tap on AT 1
C1	CAPACITOR disc type feed through 1000 pf, part no. CB76RE102G	Retained in crystal diode housing.
CP1	CONNECTOR RECEPTACLE type C, female 1-1/16 in. lg. x 1 in. square. Four 1/8 in. dia. holes on 23/32 in. square. Brass Silver plated. Electro Impulse Lab. Inc. part/dwg A2097	Accessory connector in meter protective cover.
CP2	CONNECTOR RECEPTACLE, type BNC female 1-1/16 in. lg. x 1 in. square. Four 1/8 in. dia holes on 23/32 in. square Brass Silver plated. Electro Impulse Lab. Inc. part/dwg. A 2098.	Accessory connector in meter protective cover.
CR1	CRYSTAL DIODE, rectifier 3/4 in. lg x 3/32 in. dia., glass body, brass terminals. Sylvania Electric Products Inc. part No. 1N82A	Retained in crystal housing.
J1	CONNECTOR, RECEPTACLE, type N female 1-1/16 in. lg. x 1 in. square, Four 1/8 in. dia. holes on 23/32 in. square. Brass Silver plated. Electro Impulse Lab. Inc. part/dwg. A 1561	R F Input connector.
M1	METER ELECTRICAL panel type, ruggedized, hermetically sealed, 3-1/2 in. dia. Three 5/32 dia. holes equally spaced on 3-1/8 in. dia bolt circle. 200 micro ampere full scale deflection. Special scale calibrated 0-50 and 0-150. Electro Impulse Lab. Inc. part/dwg B1992.	R F power indicator.

SYMBOL	NAME AND DESCRIPTION	LOCATING FUNCTION
R1	RESISTOR, thermal, 2000 ohms ±25% at 25° C 1/2 in. lg. x 5/32 dia. with 2-0.031 dia nickel wire leads Victory Engineering Corp. Part No. 32A2	Temperature compensation
R2	RESISTOR, fixed composition, 2200 ohms ± 10%, 1/2 watt Part No. RC20GF222K	Temperature compensation limiter.
R3, R5 R7, R8	RESISTOR, variable, wire wound 10,000 ohms ±10% normal torque, linear taper, 2 watts part no. RA20NASB103A	Series and shunt calibrating controls in meter case
R4, R6	RESISTOR, fixed, composition 330 ohms ±10%, 1/2 watt part no. RC20GF331K	End limiting resistor for shunt calibrating controls.
S1	SWITCH, TOGGLE, DPDT part no. MS25100-23	Meter range selector switch.

NAVSHIPS NO. _____ USER ACTIVITY COMMENT SHEET Vol. No. _____

(Fold on dotted lines on reverse side, staple in corner, and send to Bureau of Ships, Code 240, Washington 25, D. C.)

PROBLEM AREA:

Both sides of this form to be reproduced locally as required.

Fold

DEPARTMENT OF THE NAVY
BUREAU OF SHIPS
WASHINGTON 25, D.C.

OFFICIAL BUSINESS

POSTAGE AND FEES PAID
NAVY DEPARTMENT

CHIEF, BUREAU OF SHIPS
PUBLICATIONS AND INFORMATION RETRIEVAL BRANCH
DEPARTMENT OF THE NAVY
WASHINGTON 25, D. C.

Fold