UNCLASSIFIED

INSTRUCTION MANUAL

for

ANTENNA TUNING SYSTEM MODEL ATS-2 (AN/URA-27)

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N. Y. OTTAWA, ONTARIO

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
C101	CAPACITOR, fixed: mica; .01 ufd, ±10%, char. B, 300 wvdc.	Line Filter	CM35B103K
C102	CAPACITOR, fixed: mica; .01 ufd, ±10%, char. B, 300 wvdc. Same as C101.	Line Filter	CM35B103K
C103	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc.	RF Bypass	CC-100-16
C104	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C105	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C106	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C107	CAPACITOR, fixed: mica; .01 ufd, ±10%, char. B, 300 wvdc. Same as C101.	RF Bypass	CC-100-16
C108	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C109	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C110	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C111	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C112	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C113	CAPACITOR, fixed: dry electrolytic; polarized; 10 ufd, 300 wvdc, char. C.	DC Filter	CE64C100N
C114	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C115	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C116	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C117	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C118	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
CR101	RECTIFIER, metallic: half wave; 130 volts; 65 ma.	Rectifier	RX-104
E101	TERMINAL STRIP, barrier type: molded phenolic, 10 brass nickel plated 6-32 binding head machine screws.		TM-100-10
F101	FUSE, cartridge type: 2.0 amp.	Line Fuse	FU-100-2.0
I101	LAMP, incandescent: min. bayonet base; 6/8 volts, 0.15 amp, T-3-1/4 bulb.	Stop Indicator	BI-101-47
I102	LAMP, neon: min. bayonet base; 110/125 volts, 1/25 watt, T-3-1/4 bulb.	AC Power Ind.	BI-100-51
I103	LAMP, neon: min. bayonet base; 110/125 volts, 1/25 watt, T-3-1/4 bulb.	Overload Ind.	BI-100-51
J101	CONNECTOR, receptacle: female.	To Directional Coupler	MS3102A2027S
J102	CONNECTOR, receptacle: female.	To Antenna Coupler	MS3102A14S2P
J103	CONNECTOR, receptacle.	To Xmtr Interlock	MS3102A14S1P
J104	RECEPTACLE; male twist lock: 2 contacts, 10 amps at 200 v; 15 amps at 125 v.	To Power Line	JJ-100
K101	RELAY, armature: octal; SPDT; 5,000 ohms, silver contacts rated at 2 amps at 115 V AC; 7.2 pull-in ma.	Fwd Power Overload	RL-120-5-502
K102	RELAY, armature: octal; SPDT; 5,000 ohms, silver contacts rated at 2 amps at 115 V AC; 7.2 pull-in ma. Same as K101.	Refl. Power Overload	RL-120-5-502
K103	RELAY, armature: dual; locking 4 PDT; 1460 ohms, 33 ma; silver contacts rated at 5 amps at 115 V AC.	Overload	AR-115
M101	METER, S.W.R.: dual meter forward and reflected power.	SWR Indicator	MR-112
M102	METER, reactance/resistance/ humidity: 260 ohms, ±10%, 0-200 ua movement.	Multiple Ind.	MR-100-7
MP101	KNOB, instrument type: black phenolic; 1-1/8 in. dia. x 5/8 in. deep; fits 1/4 in. shaft.		MP-109-2
MP102	KNOB, instrument type: black phenolic; 1-1/8 in. dia. x 5/8 in. deep; fits 1/4 in. shaft. Same as MP101.		MP-109-2
R101	RESISTOR, fixed: wire wound; 1000 ohms, 25 watts.	Current Limiting I101	RW-111-20

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
R102	RESISTOR, variable: composition; 25000 ohms, ±20%, 2 watts, linear taper.	Calibrate Adj.	RV4ATXA253B
R103	RESISTOR, variable: composition; 100,000 ohms, ±20%, 2 watts, linear taper.	Calibrate Adj.	RV4ATXA104B
R104	RESISTOR, variable: composition; 100,000 ohms, ±20%, 2 watts, linear taper. Same as R103.	Calibrate Adj.	RV4ATXA104B
R105	RESISTOR, variable: composition; 25000 ohms, ±20%, 2 watts, linear taper. Same as R102.	Calibrate Adj.	RV4ATXA253B
R106	RESISTOR, fixed: composition; 100,000 ohms, ±10%, 1 watt.	Current Limiting I102	RC30GF104K
R107	RESISTOR, fixed: composition; 27,000 ohms, ±10%, 1 watt.	Hum. Bridge Res.	RC30GF273K
R108	RESISTOR, variable: composition; 50,000 ohms, ±20%, 2 watts, linear taper.	Hum. Bridge Res.	RV4ATXA503B
R109	RESISTOR, fixed: composition; 27,000 ohms, ±10%, 1 watt. Same as R107.	Hum. Bridge Res.	RC30GF273K
R110	RESISTOR, fixed: composition; 27,000 ohms, ±10%, 1 watt. Same as R107.	Hum. Bridge Res.	RC30GF273K
R111	RESISTOR, fixed: composition; 75,000 ohms, ±5%, 1 watt.	Hum. Bridge Res.	RC30GF753J
R112	RESISTOR, fixed: composition; 82,000 ohms, ±10%, 1 watt.	Hum. Bridge Res.	RC30GF823K
R113	RESISTOR, fixed: composition; 360,000 ohms, ±5%, 1 watt.	Current Limiting	RC30GF364J
R114	RESISTOR, fixed: composition; 160,000 ohms, ±5%, 1 watt.	Current Limiting	RC30GF164J
R115	RESISTOR, fixed: composition; 22 ohms, ±10%, 1 watt.	DC Filter	RC30GF220K
R116	RESISTOR, fixed: wire wound; 1000 ohms, ±5%, 10 watts.	Current Limiting V101	RW-109-24
R117	RESISTOR, fixed: composition; 15,000 ohms, ±10%, 2 watts.	Voltage Divider	RC42GF153K
R118	RESISTOR, fixed: composition; 15,000 ohms, ±10%, 2 watts. Same as R117.	Voltage Divider	RC42GF153K
R119	RESISTOR, fixed: composition; 4700 ohms, ±10%, 1 watt.	Relay Shunt K102	RC30GF472K
R120	RESISTOR, variable: composition; 1000 ohms, ±20%, 2 watts, linear taper.	Refl. Trip Adj.	RV4ATXA102B

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
R121	RESISTOR, variable: composition; 1000 ohms, ±20%, 2 watts, linear taper. Same as R120.	For. Trip Adj.	RV4ATXA102B
R122	RESISTOR, variable: composition; 250 ohms, ±20%, 2 watts, linear.	Tune Trip Adj.	RV4ATXA251B
R123	RESISTOR, fixed: composition; 100,000 ohms, ±10%, 1 watt. Same as R106.	Current Limiting I103	RC30GF104K
S101	SWITCH, rotary: 4 positions, 30°detent; 2 sections, non-shorting, mycalex insulation.	Power Switch	SW-208
S102	SWITCH, push-button: momentary, slow make and break; 2 circuit n.o.and n.c.; 1 amp, 125 VAC.	S201 Control	SW-227
S103	SWITCH, lever type: 3 position, non-locking.	Reactance Inc., Decr. Switch	SW-213
S104	SWITCH, rotary: 3 position, non-locking, spring return; silver contacts; 45 deg. angle of throw.	Hum. React. Res. Switch	SW-214
S105	SWITCH, push-button: momentary, slow make and break; 2 circuit n.o. and n.c.; 1 amp, 125 VAC. Same as S102.	K102 Reset	SW-227
S106	SWITCH, toggle: DPDT, 3 amp, 250 v.	Tune/Operate Switch	ST-22N
T101	TRANSFORMER, power: pri. 115/230 v, 50/60 cps; sec. 12.6 v at 1 amp, 123/117 v at .35 amp; 2-3/4 in. lg x 2-3/8 in. wide x 3-13/16 in. high o/a.	Main Power Trans.	TF-207
V101	TUBE, electron: voltage regulator, 7 pin miniature.	Voltage Reg.	OC2
V102	TUBE, electron: mediummu, duo-triode, 9 pin miniature.	Overload Amp.	12AT7
XF101	HOLDER, fuse.	Holder for F101	FH-100-3
XI101	SOCKET, indicator: w/red frosted lens.	Socket for I101	TS-106-1
XI102	SOCKET, indicator: w/white frosted lens.	Socket for I102	TS-106-2
XK101	SOCKET, octal.	Socket for K101	TS-101-P01
XK102	SOCKET, octal. Same as XK101.	Socket for K102	TS-101-P01
XV101	SOCKET, miniature, 7 pin.	Socket for V101	TS-102-P01
XV102	SOCKET, miniature, 9 pin.	Socket for V102	TS-103-P01

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
A301	COUPLER ASSEMBLY: consists of the following items: NOTE: TMC Part ATS-50CU-2 Coupler Assembly, is replaced as a unit. It requires precise alignment at the factory before use.		ATS-50CU-2
C301	CAPACITOR, fixed: ceramic; feed thru type; 750 uufd, ±20%, 500 wvdc, char. P. Not a replaceable item. See A301.	Voltage Divider	CC-108-1P750M
C302	CAPACITOR, variable: glass; 0.8 to 10.0 uufd, 3000 wvdc, quartz dielectric. Not a replaceable item. See A301.	Voltage Divider Null Balancing	CV-102
C303	CAPACITOR, fixed: ceramic; feed thru type; 750 uufd, ±20%, 500 wvdc, char. P. Same as C301. Not a replaceable item. See A301.	Bypass	CC-108-1P750M
C304	CAPACITOR, fixed: ceramic; feed thru type; 750 uufd, ±20%, 500 wvdc, char. P. Same as C301. Not a replaceable item. See A301.	Voltage Divider	CC-108-1P750M
C305	CAPACITOR, variable: glass; 0.8 to 10.0 uufd, 3000 wvdc, quartz dielectric. Same as C302. Not a replaceable item. See A301.	Voltage Divider Equalizer Bal.	CV-102
C306	CAPACITOR, fixed: ceramic; feed thru type; 750 uufd, ±20%, 500 wvdc, char. P. Same as C301. Not a replaceable item. See A301.	Bypass	CC-108-1P750M
C307	CAPACITOR, fixed: mica; button style; 1500 uufd, ±10%, 300 wvdc, char. X. Not a replaceable item. See A301.	R.F. Bypass	CB21PX152K
C308	CAPACITOR, fixed: mica; button style; 1500 uufd, ±10%, 300 wvdc, char. X. Same as C307. Not a replaceable item. See A301.	R.F. Bypass	CB21PX152K
CR301	CRYSTAL DIODE, high frequency. Not a replaceable item. See A301.	Rect. Reflector Power	1N277
CR302	CRYSTAL DIODE, high frequency. Same as CR301. Not a replaceable item. See A301.	Rectifier Fwd. Power	1N277
J301	CONNECTOR, receptacle: female; teflon insulated. Not a replaceable item. See A301.	To Xmitter	UG-560/U

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
J302	CONNECTOR, receptacle: female; teflon insulated. Same as J301. Not a replaceable item. See A301.	To Ant. Coupler	UG-560/U
J303	CONNECTOR, receptacle: female; 4 contacts. Not a replaceable item. See A301.	To Monitor-Cont.	MS3102A-14S-2S
L301	CHOKE, RF.: 2500 millihenries, 100 ma, molded phenolic. Not a replaceable item. See A301.	R.F. Decoupling	CL-140-1
L302	CHOKE, R.F.: L=185 uhy ±15 uhy, Q=less than 50 at 790 kc test frequency. Not a replaceable item. See A301.	R.F. Decoupling	A-1544
L303	CHOKE, R.F.: 2500 millihenries, 100 ma, molded phenolic. Same as L301. Not a replaceable item. See A301.	R.F. Decoupling	CL-140-1
L304	CHOKE, R.F.: L=185 uhy,±15 uhy, Q=less than 50 at 790 kc test frequency. Same as L302. Not a replaceable item. See A301.	R.F. Decoupling	A-1544
L305	CHOKE, R.F.: L=185 uhy ±15 uhy, Q=less than 50 at 790 kc test frequency. Not a replaceable item. See A301.	R.F. Blocking D.C. Return	A-1126
R301	RESISTOR, fixed: 0.6 ohms, +10% -20%, 40 watts, carbon deposit on Pyrex glass. Not a replaceable item. See A301.	Voltage Divider	RR-122-0.6

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
A201	ASSEMBLY, coil: consists of tank coil, coil mounting supports, contact wheel, contact wheel shaft, and coil lug.	Tuning Coil	AC-106
A202	ASSEMBLY, coil: consists of coil, coil mounting supports and insulators.	Loading Coil	AC-104
A203A	ASSEMBLY, switch: consists of wafer and rotor.	p/o Position Indicator	AS-114
A203 B,C,D	ASSEMBLY, switch: consists of complete switch plus all jumpers teflon sleeving.	Transformer and Capacitor Switch	AS-113
B201	MOTOR, reversible: split phase, 2 pole, 115 v AC, 50/60 cps, 38 watts.	Drives L201	MO-108
B202	MOTOR, unidirectional (CW): 2 pole, 115 v AC, 50/60 cps, 20 watts.	Drives S201	MO-109
C201	CAPACITOR, fixed: air dielectric; 46 uufd, 12 plates, 0.250 air gap.	Tuning Cap.	CO-105
C202	CAPACITOR, fixed: paper dielectric; 10 ufd, ±10%, 1000 wvdc, char. F.	Motor Starting B201	CP70B1FG106K
C203	CAPACITOR, fixed: ceramic; 0.01 ufd, +80 -20%, 500 wvdc.	Bypass Cap.	CC-100-16
C204	CAPACITOR, fixed: ceramic; 0.01 ufd, +80 -20%, 500 wvdc. Same as C203.	Bypass Cap.	CC-100-16
C205	CAPACITOR, fixed: ceramic; 0.01 ufd, +80 -20%, 500 wvdc. Same as C203.	Bypass Cap.	CC-100-16
C206	CAPACITOR, fixed: ceramic; 0.01 ufd, +80 -20%, 500 wvdc. Same as C203.	Bypass Cap.	CC-100-16
C207	CAPACITOR, fixed: ceramic; 0.01 ufd, +80 -20%, 500 wvdc. Same as C203.	Bypass Cap.	CC-100-16
C208	CAPACITOR, fixed: ceramic; 0.01 ufd, +80 -20%, 500 wvdc. Same as C203.	Bypass Cap.	CC-100-16
C209	CAPACITOR, fixed: ceramic; 0.01 ufd, +80 -20%, 500 wvdc. Same as C203.	Bypass Cap.	CC-100-16
C210	CAPACITOR, fixed: ceramic; 0.01 ufd, +80 -20%, 500 wvdc. Same as C203.	Bypass Cap.	CC-100-16
C211	CAPACITOR, fixed: ceramic; 0.01 ufd, +80 -20%, 500 wvdc. Same as C203.	Bypass Cap.	CC-100-16
C212	CAPACITOR, fixed: ceramic; 0.01 ufd, +80 -20%, 500 wvdc. Same as C203.	Bypass Cap.	CC-100-16

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
E201	TERMINAL,STRIP, barrier type: plastic; 10 terminals.		TM-100-10
E202	INSULATOR, feed thru, bowl type.	Ant. Connector	AX-196
E203	INSULATOR, pillar: round; white glazed steatite; 1 in. lg. x 3/4 in. diam. tapped 10-32 x 3/8 in. deep each end.		NS3W0308
E205	TERMINAL STRIP, barrier type: plastic; 5 terminals.		TM-102-5
E206	BUSHING, feed thru: steatite insulators, neoprene gland, hot tinned brass stud, 7/8 in. dia. x 2-1/8 in. lg. o/a.		NS-118-3
L201	Not a replaceable item. Part of A201.		
L202	Not a replaceable item. Part of A201.		
MP201	TERMINAL TUBE: type D; mounts in 1 in. hole; 2-5/8 in. lg. x 1-1/8 in. dia. o/a.	RF Cable Feed	PO-181
MP202	TERMINAL TUBE: type B; mounts in 3/4 in. hole 2-3/8 in. lg. x 1-1/8 in. dia. o/a.	Control Cable	PO-182
MP203	COUPLING, flexible: steatite; peak volts 5000.		MC-114-2
MP204	COUPLING, flexible: steatite; peak volts 5000. Same as MP203.		MC-114-2
R201	RESISTOR, variable: composition; 10,000 ohms, ±10%	Res. Meter Adj.	RV105ATRL105A
R202	RESISTOR, fixed: composition; 15000 ohms, ±5%, 1 watt.	Volt. Divider	RC30GF153J
R203	RESISTOR, fixed: composition; 3000 ohms, ±5%, 1/2 watt.	Volt. Divider	RC20GF302J
R204	RESISTOR, fixed: composition; 9100 ohms, ±5%, 1 watt.	Volt. Divider	RC30GF912J
R205	RESISTOR, fixed: composition; 1800 ohms, ±5%, 1 watt.	Volt. Divider	RC30GF182J
R206	RESISTOR, fixed: composition; 3300 ohms, ±5%, 1/2 watt.	Volt. Divider	RC20GF332J
R207	RESISTOR, fixed: composition; 3300 ohms, ±5%, 1/2 watt. Same as R206.	Volt. Divider	RC20GF332J
R208	RESISTOR, fixed: composition; 3300 ohms, ±5%, 1/2 watt. Same as R206.	Volt. Divider	RC20GF332J

SYM.	DESCRIPTION	FUNCTION	TMC PART OR PART NO.
R209	RESISTOR, fixed: composition; 3300 ohms, ±5%, 1/2 watt. Same as R206.	Volt. Divider	RC20GF332J
R210	SENSOR, humidity: plug in type; 1-11/64 in. dia. x 2-3/4 in. lg.	Humidity Sensor	RR-128
S201	Not a replacement item. Part of A203.		
S202	SWITCH, micro: push; 10 amps at 125/250 v AC; 1/2 amp at 125 v DC.	Reactance Stop	SW-189
S203	SWITCH, micro: push; 10 amps at 125/250 v AC; 1/2 amp at 125 v DC. Same as S202.	Reactance Stop	SW-189
S204	SWITCH, micro: roller; 15 amp at 125 VAC; solder terminals.	Meter Switch	SW-260
T201	TRANSFORMER, R.F.: audio; input 13 or 17, 50 or 70, 200 or 250 ohms; output 50 or 70 ohms; 2-30 Mc frequency range; 4 in. wide x 4-11/16 in. lg. x 4-15/16 in. high o/a.	Impedance Matching Transformer	TR-151
XR210	SOCKET, miniature: 4 pin; 4-5/64 in. dia. x 15/32 in. high w/o lugs; retainer ring mtg.	Socket R210	TS-144

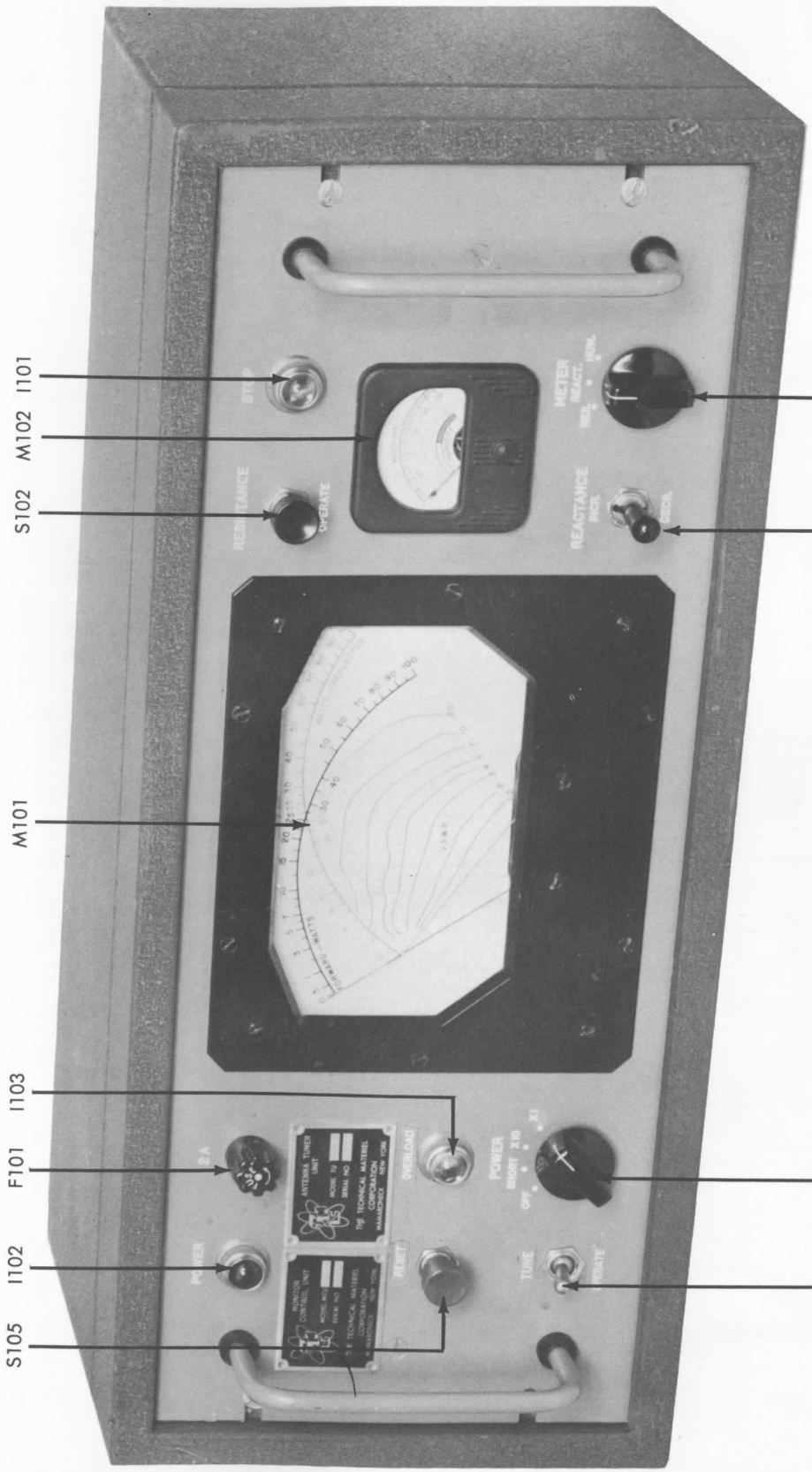


Figure 5-1 Front View, Model ATS-MCU-2

PH-941

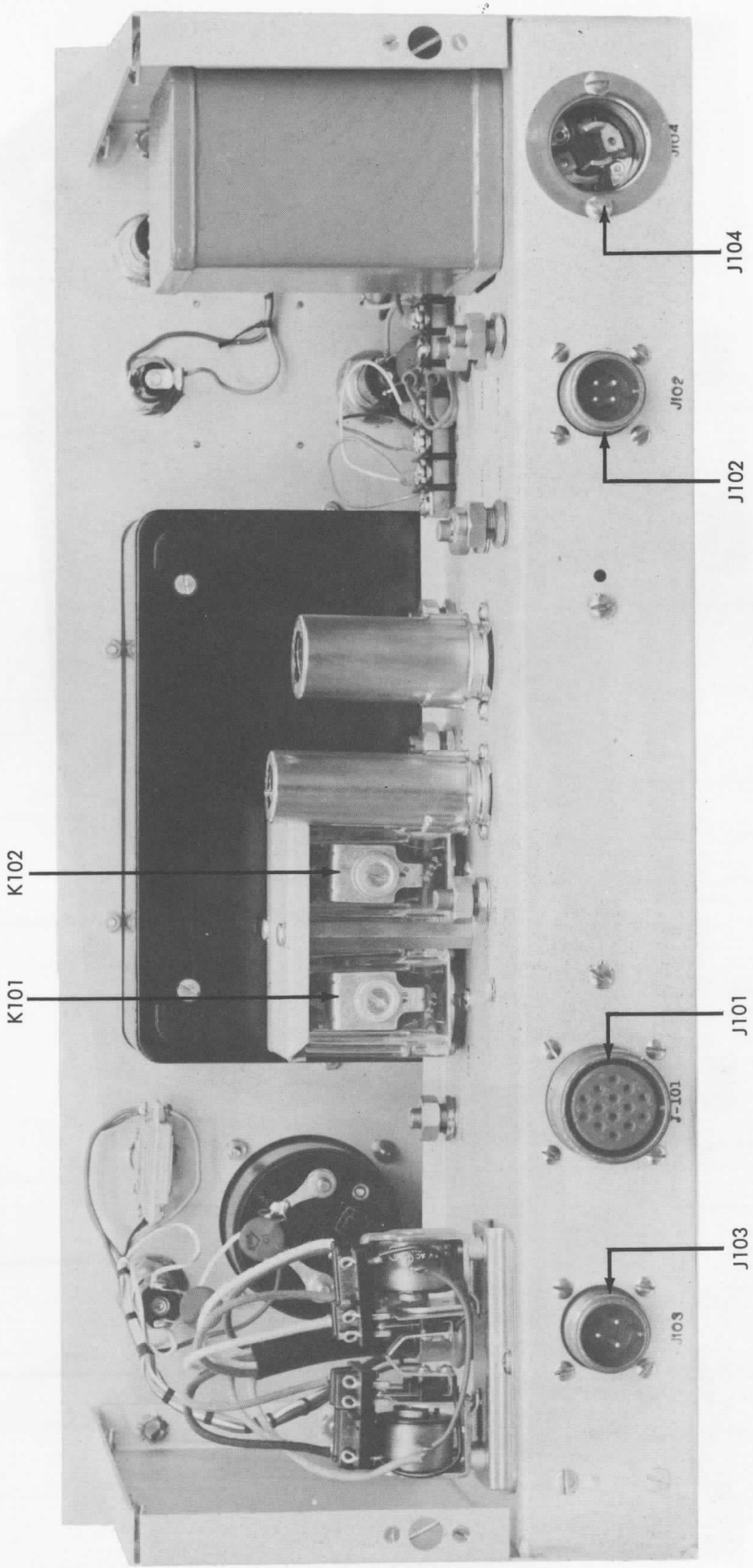


Figure 5-2 Rear View, Model ATS-MCU-2

PH-956

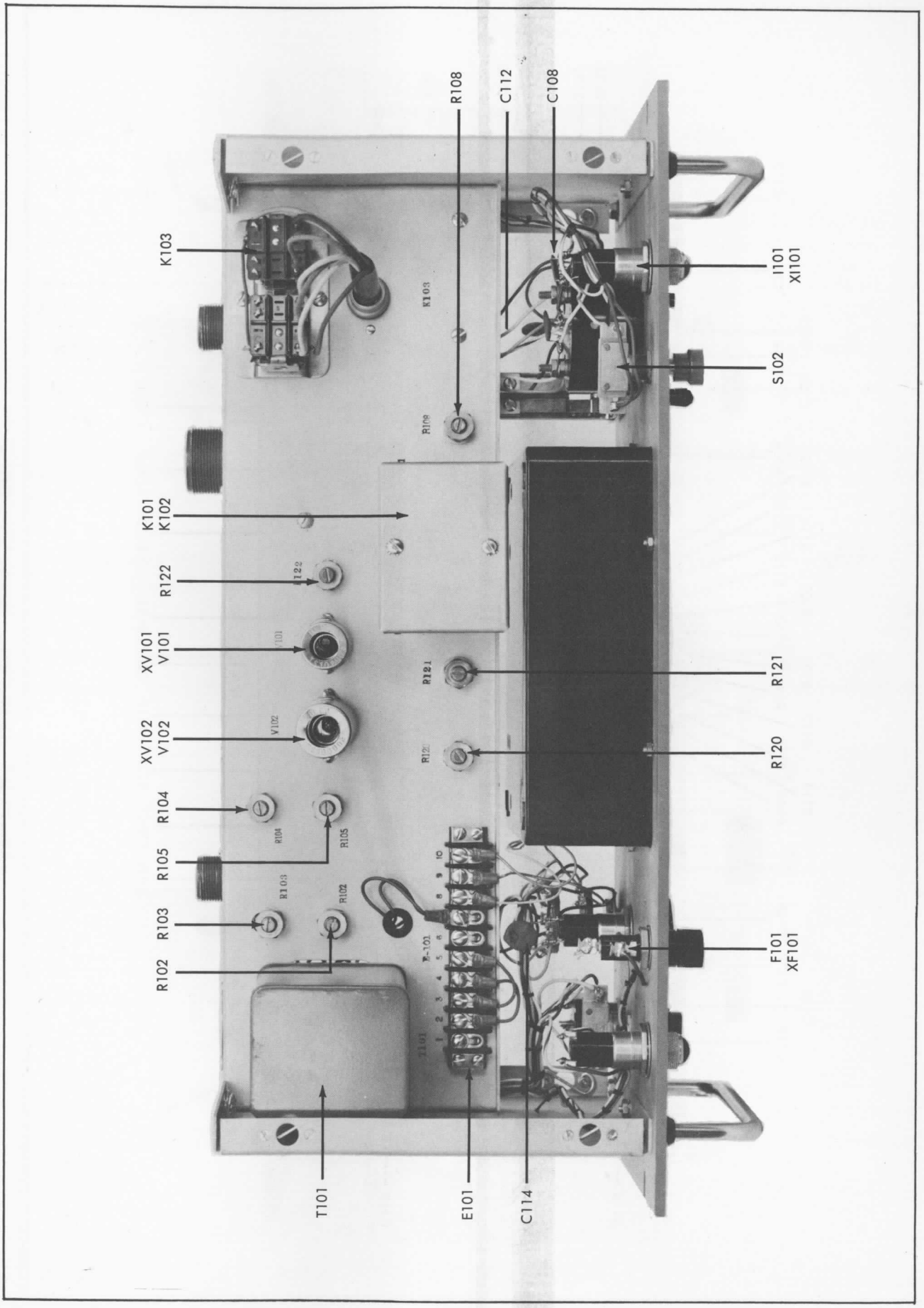
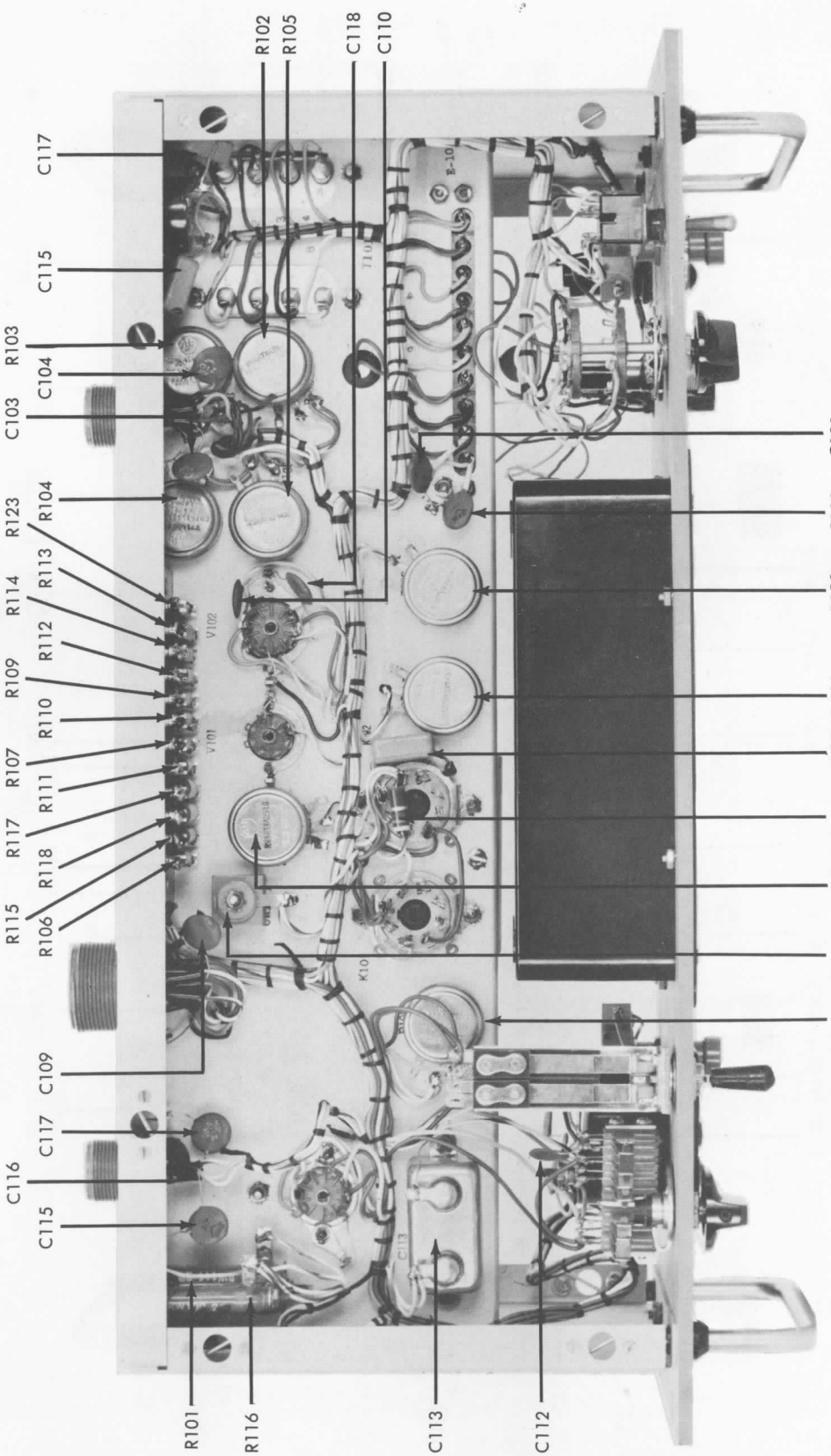


Figure 5-3 Top View, Model ATS-MCU-2



PH-958

Figure 5-4 Bottom View, Model ATS-MCU-2

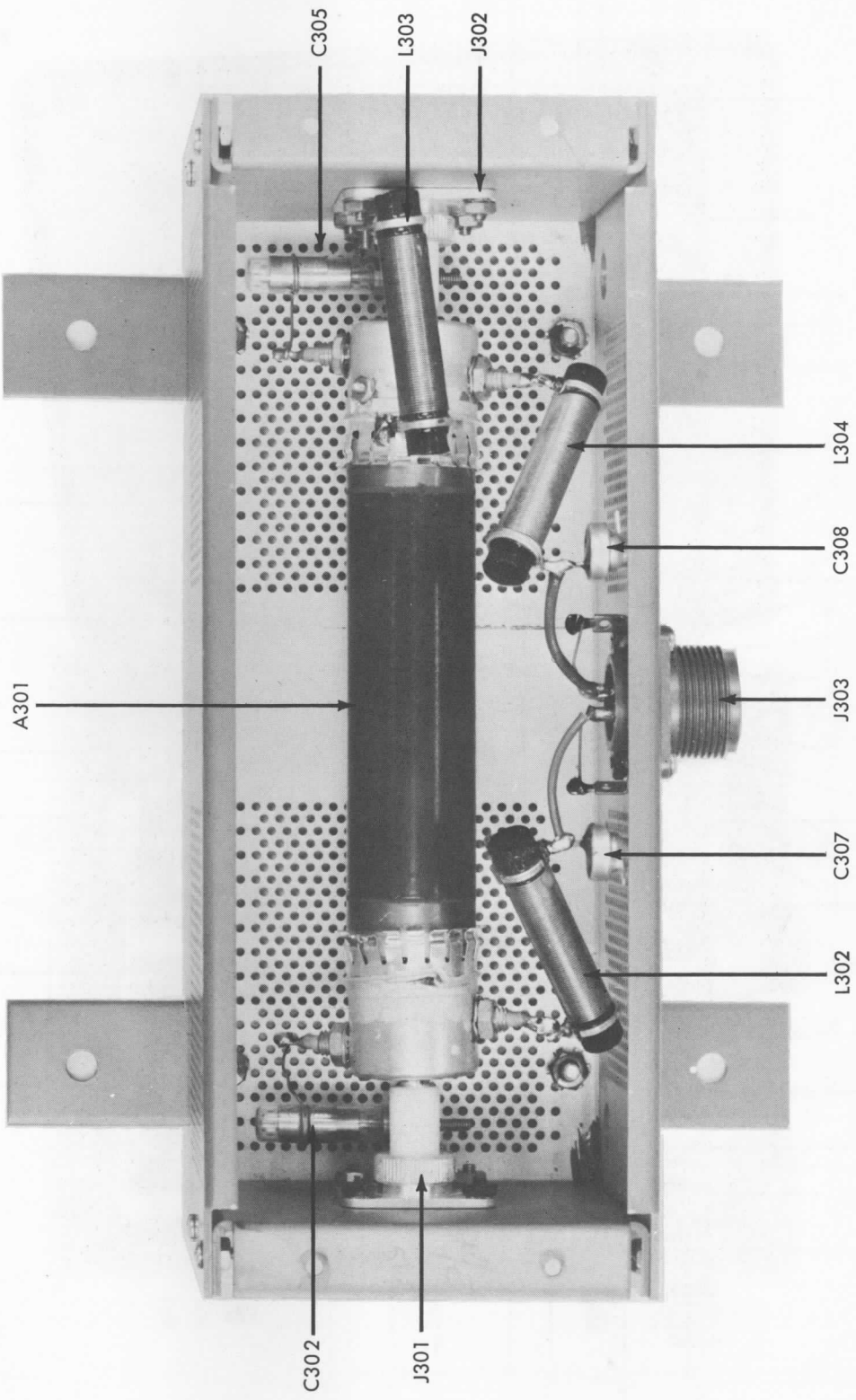


Figure 5-5 Top View, Model ATS-CU-2

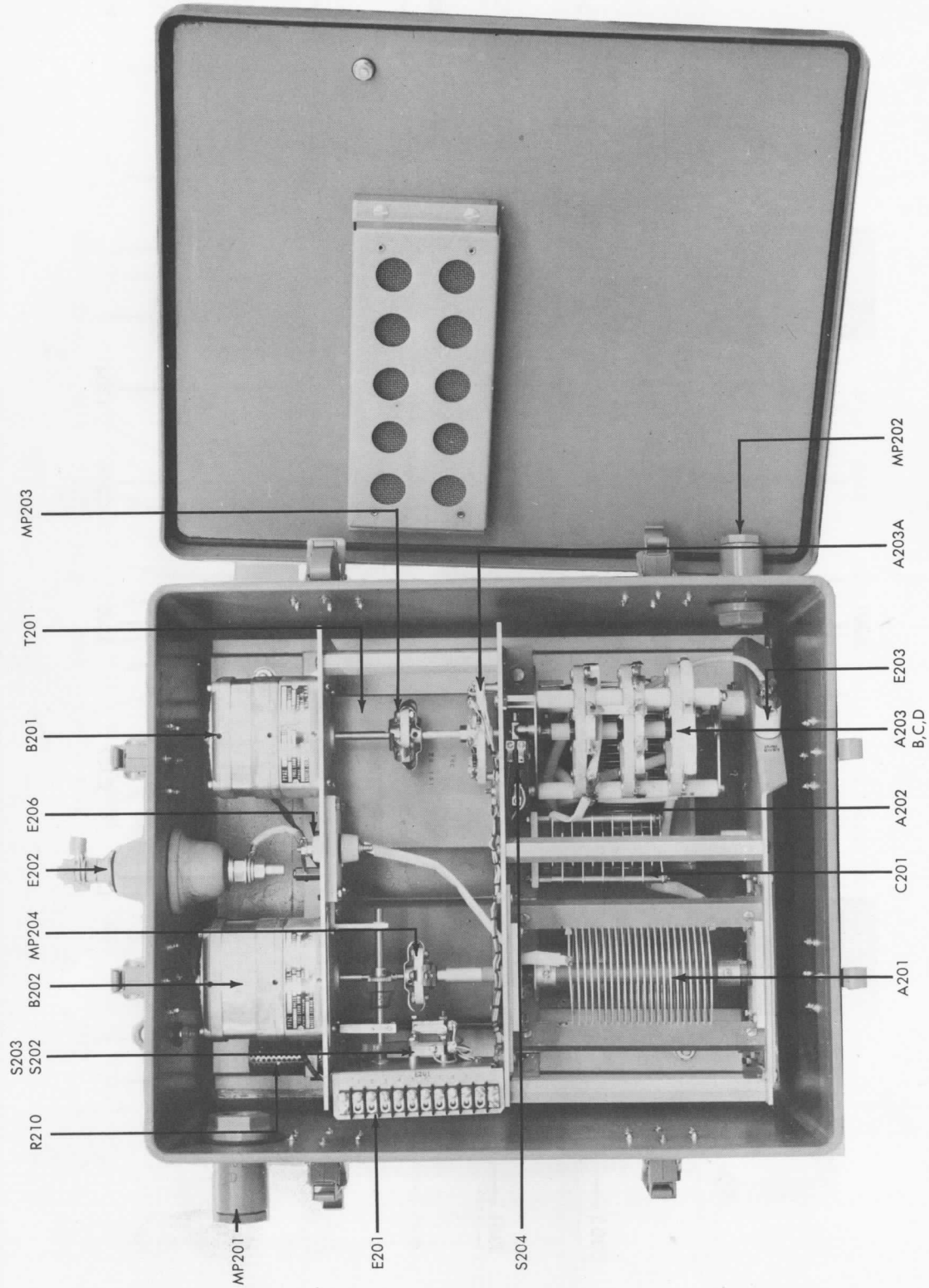


Figure 5-6 Top View, Model ATS-TU-2

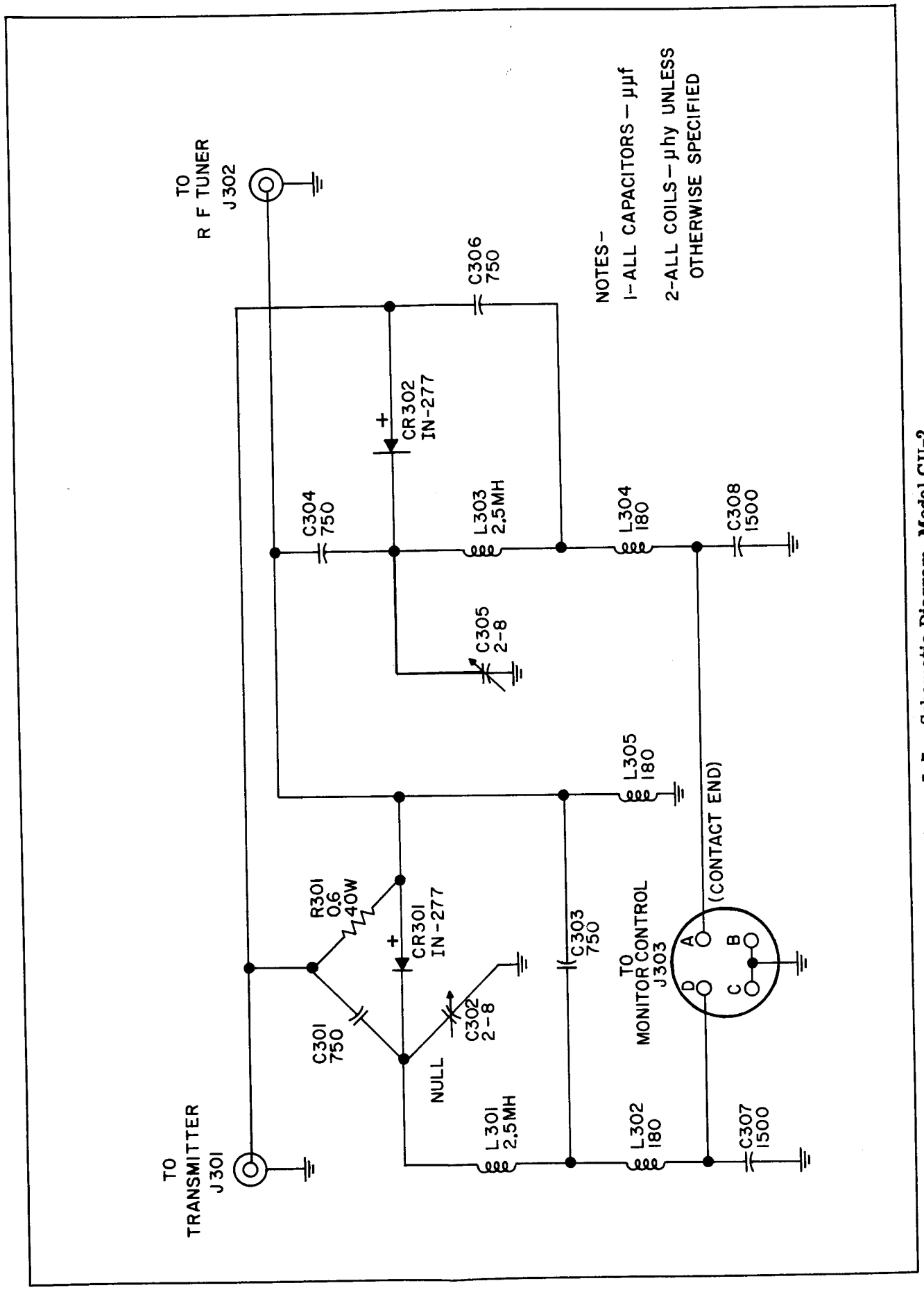
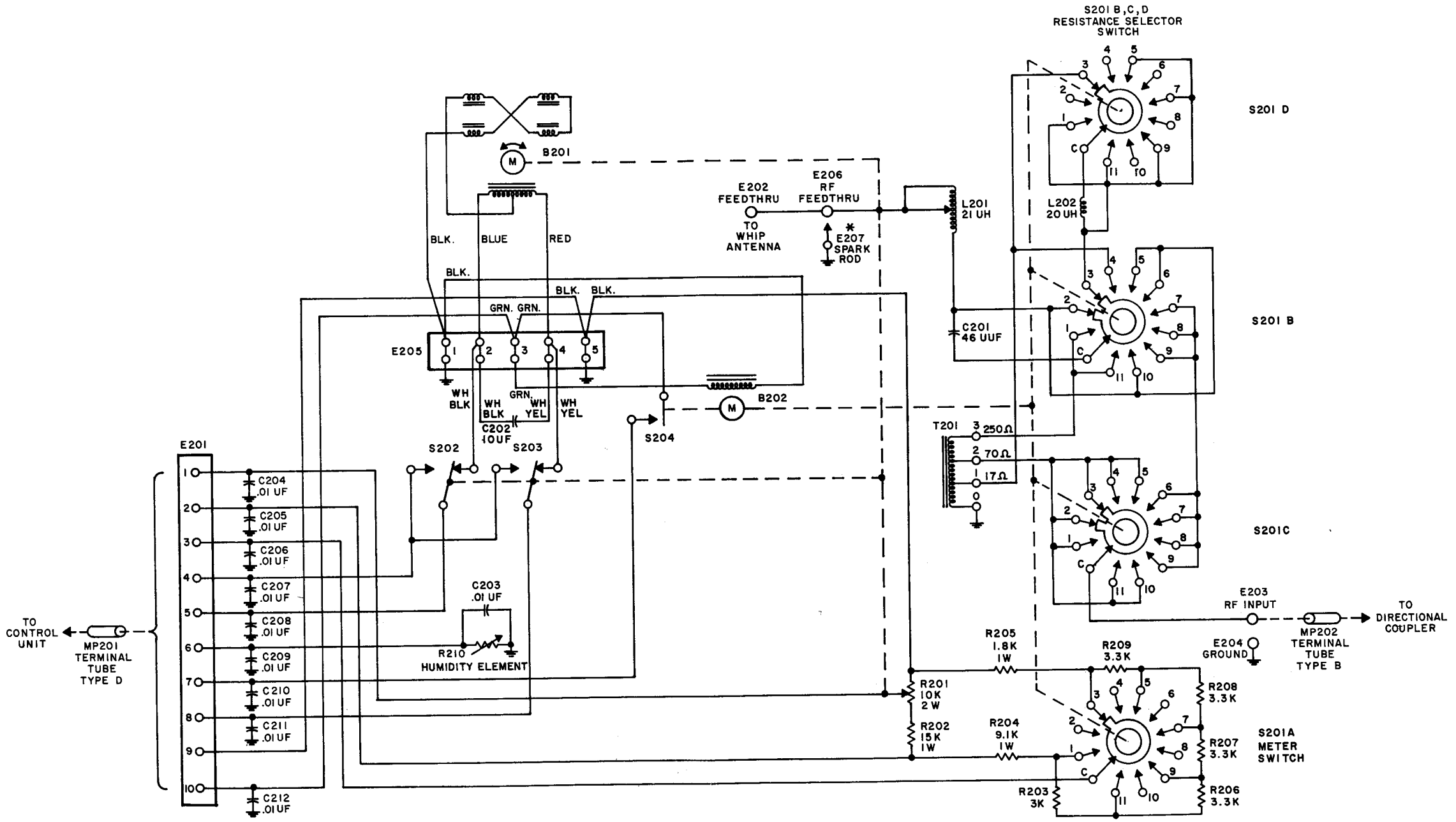


Figure 5-7 Schematic Diagram, Model CU-2

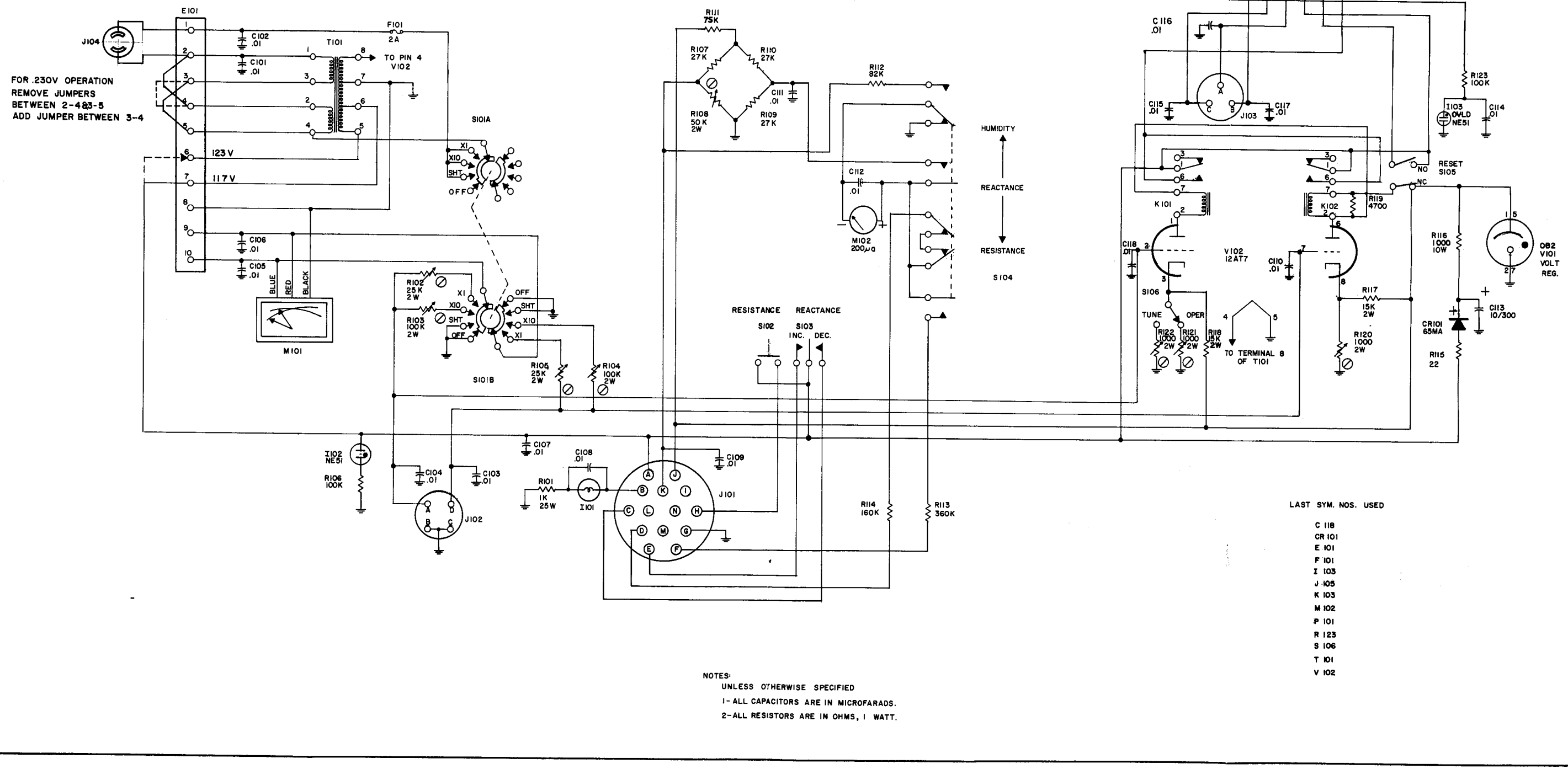


NOTES-
1. ALL RESISTORS ARE 1/2 WATT, UNLESS OTHERWISE SPECIFIED.

LAST SYMBOLS-

B201
C212
E207
L202
MP202
R210
S204
T201

Figure 5-8. Schematic Diagram, Model TU-2



LAST SYM. NOS. USED

C 118
CR 101
E 101
F 101
I 103
J 105
K 103
M 102
P 101
R 123
S 106
T 101
V 102

NOTES:
UNLESS OTHERWISE SPECIFIED
1- ALL CAPACITORS ARE IN MICROFARADS.
2-ALL RESISTORS ARE IN OHMS, 1 WATT.

CK-406

Figure 5-9. Schematic Diagram, Model MCU-2

SECTION III
INSTALLATION AND OPERATION

3-1 INSTALLATION

3-1-1 The TMC Model ATS-2, Antenna Tuning System, has been designed for ease of installation and minimum effort in operation. Each unit of the system is packed in an individual shipping container, and should be carefully unpacked. Packing material should be examined for loose items before discarding. A close visual inspection should be made to determine any physical damage due to rough handling during shipment. If damage is found, notify the carrier immediately.

3-1-2 The unit is designed for operation from 115 volt, 50-60 cycle or 230 volt 50-60 cycles. The unit is shipped for 115 volt AC operation. A simple wiring change on E101 is necessary to change the Model ATS-2 to 230 volt AC operation. See Figure 5-3. Remove the jumpers on E101 connecting terminal 3 and 5 and terminal 2 and 4. Connect a jumper from terminal 3 to 4.

3-1-3 Variations in the line voltage may effect the calibration of meter, M102. Check the calibration as described in Paragraph 4-3-2.

3-1-4 If excessive voltage drop occurs in the 10 wire control cable, another voltage tap is provided on the line transformer. Normally, terminal 7 on E101 (117 V) is used. If a voltage of 110 volts or less is experienced at the control motor terminals, when in operation, use terminal 6 on E101 (123 V) to make up the voltage drop in the 10 wire cable.

3-1-5 The units comprising the Antenna Tuning System are placed and installed as shown in Figure 3-1.

3-1-6 The CONTROL MONITOR and the DIRECTIONAL COUPLER are installed at the transmitter site. The DIRECTIONAL COUPLER should be located as close as possible to the transmitter output. The RF TUNER should be installed at the base of the 35 ft. whip antenna with a connecting lead of approximately 30 inches or less. The CONTROL MONITOR operates from a 115 or 230 volt 50-60 cycle power line.

3-1-7 The NULL adjustment, made on the DIRECTIONAL COUPLER, is dependent upon the characteristics of the system (cable lengths, etc.) with which the unit is used. The adjustment procedure is found in 4-3.

3-2 OPERATION

3-2-1 DESCRIPTION OF CONTROLS

3-2-1-1 All controls on the CONTROL MONITOR are readily identified by their markings and are arranged for ease of operation. The function of each control is as follows:

A. POWER switch controls the 115 or 230 volt AC input to the CONTROL MONITOR, the motor circuits, and indicator circuits of the RF TUNER. The switch also controls the range of the dual-pointer meter.

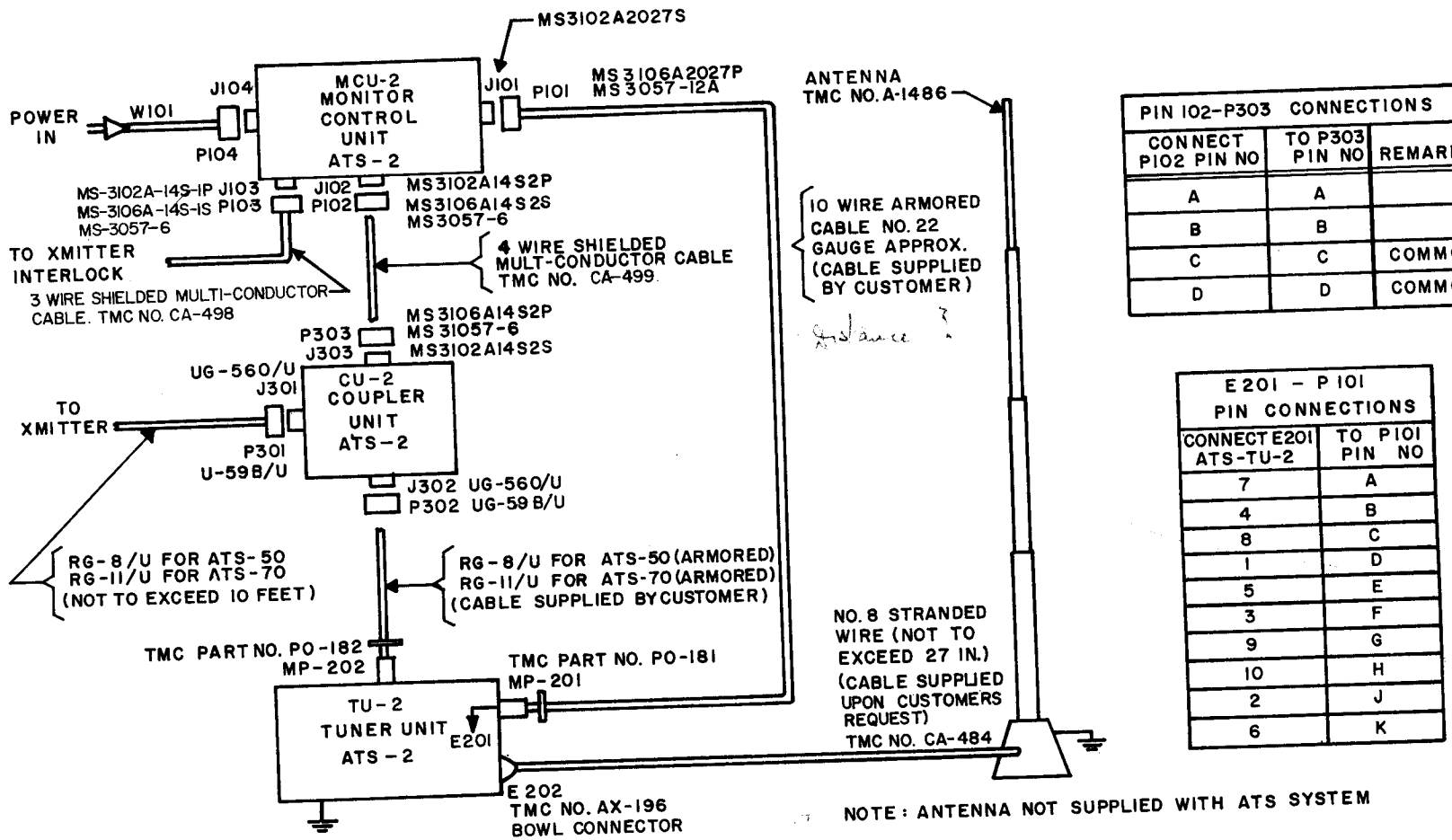
B. REACTANCE control is a 3 position lever action switch that returns to a neutral-center open circuit position when released. This switch controls the direction of the reversible motor that drives the contact on the variable inductance. When the control is held in the INCR position, the motor rotates in a direction to increase the reactance of the coil. When the switch is held in the DECR position, the motor rotates in a direction to decrease the reactance of the coil.

C. RESISTANCE control is a momentary contact push button switch. This switch controls the unidirectional motor that drives the switch to select the particular auto-transformer tap required to match the antenna resistance. The switch contacts RESISTANCE positions 1 to 6 in a clockwise direction, then repeats the cycle.

D. METER switch is a 3 position rotary switch that returns to the REACT. position when released. When in the RES. position, read the red RESISTANCE scale of the 2 inch rectangular meter calibrated 1 to 6. See Table 1 for complete description of the RED SCALE. When in the REACT. range position, read the upper black REACTANCE scale calibrated in arbitrary units from 0 to 100. This scale gives an approximate position of the motor driven short on the variable inductor. The 0 position represents minimum inductance while 100 represents the maximum inductance.

E. The HUM. position is used to give an indication of the amount of moisture present in the RF TUNER case. When the meter reads on the red portion of the lower HUMIDITY scale, moisture is settling out in the case.

F. STANDING WAVE INDICATING METER consists of a dual pointer meter with scales calibrated for FORWARD power, REFLECTED power, and VOLTAGE STANDING WAVE RATIO (VSWR). The FORWARD and REFLECTED power scales are calibrated 0-100 watts. The scale readings are multiplied by the factor indicated

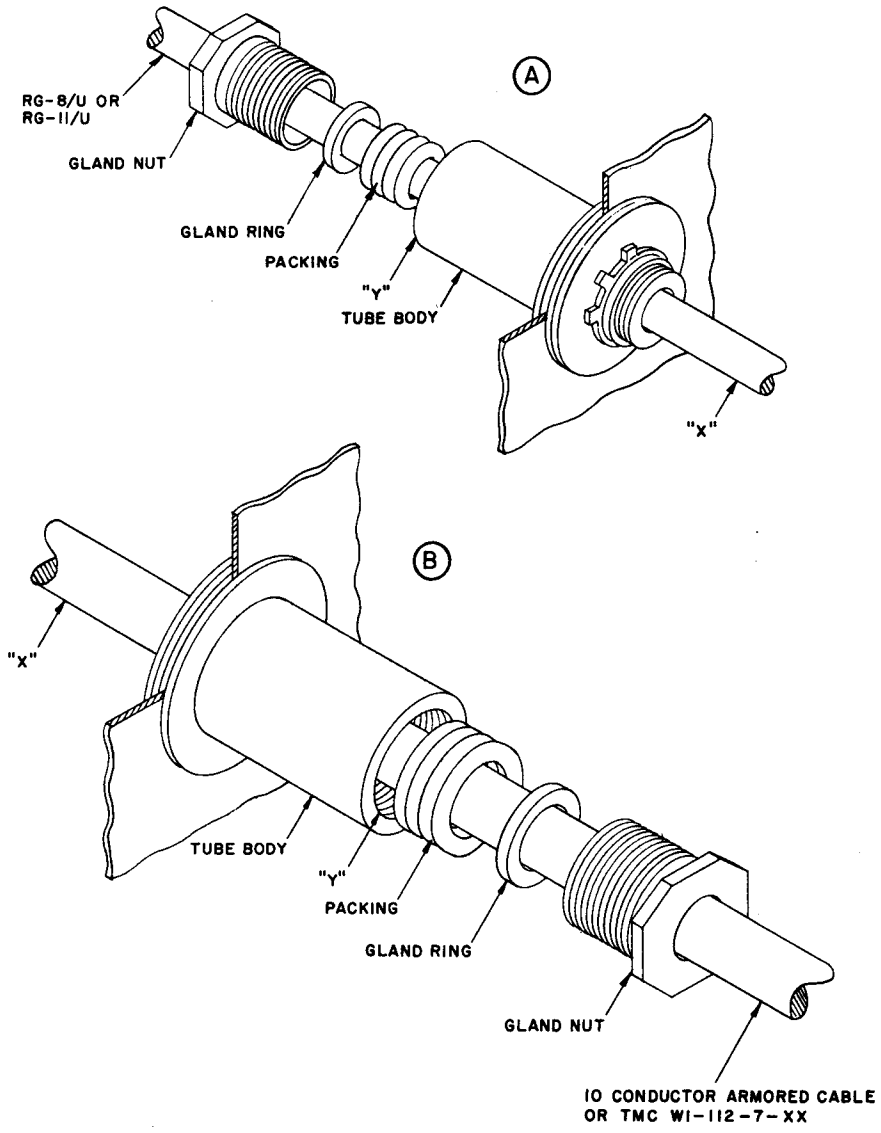


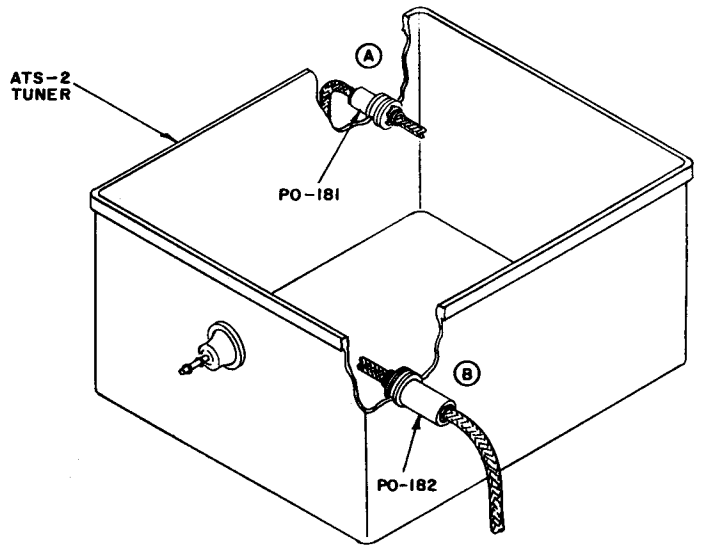
PIN 102-P303 CONNECTIONS		
CONNECT P102 PIN NO	TO P303 PIN NO	REMARKS
A	A	
B	B	
C	C	COMMON
D	D	COMMON

E 201 - P 101 PIN CONNECTIONS	
CONNECT E201 ATS-TU-2	TO P101 PIN NO
7	A
4	B
8	C
1	D
5	E
3	F
9	G
10	H
2	J
6	K

Figure 3-1 Interconnect Diagram, Model ATS-2

ID-232





TERMINAL TUBE LOCATION

NOTE

1. REMOVE FROM TUBE BODY, GLAND NUT AND GLAND RING.
2. INSERT CABLE THROUGH GLAND NUT, GLAND RING AND TUBE BODY. ALLOW ENOUGH CABLE AT "X" FOR STRIPPING AND CONNECTION TO TERMINAL BOARD.
3. WIND PACKING AROUND CABLE AND PRESS INTO TUBE TO WITHIN 3/8" OF "Y" TO ALLOW FOR GLAND RING AND GLAND NUT.

Figure 3-2 Assembly Instructions for Terminal Tubes

by the POWER switch. The VSWR on the transmission line is indicated by the point of intersection of the FORWARD and REFLECTED power meter pointers.

G. STOP indicator is used to indicate when either the minimum or maximum inductance values have been reached. Micro switches are incorporated to prevent the reactance tuning motor from overdriving at either end of the coil travel. The switches break the motor circuit and energize the STOP indicator.

H. RESET switch operates the latching relay to return it to the original position if it has been tripped by the overload circuit because of too high VSWR or transmitter power.

J. TUNE/OPERATE switch in the TUNE position limits the amount of power used to 100 watts when tuning the unit. This prevents damage which might result due to operating the RESISTANCE control when the transmitter is operated at higher power. The transmitter will be disabled by the overload circuit if more than 100 watts is used in this position.

3-2-2 TUNING PROCEDURE

3-2-2-1 The initial tuning, required to produce a minimum VSWR on the transmission line, must be performed at reduced transmitter power. This will prevent overheating of the components in the DIRECTIONAL COUPLER, particularly when the VSWR is greater than 3. Keep the maximum power output below 100 watts so that all tuning may be done with the POWER switch in the X1 position and the TUNE/OPERATE switch in the TUNE position.

3-2-2-1-1 If, for example, it is desired to operate the transmitter at 4 Mc (antenna location is dry) proceed as follows:

A. Turn the POWER switch on the CONTROL MONITOR to the X10 position.

B. Refer to Table 2. For 4 Mc (dry), the antenna looks like 13.2 -j244 ohms. This will best be matched by RESISTANCE position 1 which covers 2 to 35 ohms resistance (see Table 1).

C. Place the METER switch in the RES. position. Observe what position the scale indicates. For instance, suppose it is indicating position 4.

D. Depress the RESISTANCE control for about two seconds and then release. The motor will drive the switch and will automatically stop at position 5. Depress the RESISTANCE control again for two seconds and release. The switch will stop at indicated position 6. Repeat this procedure until the desired position is reached. Keep in mind the switch rotates with a sequence of 1, 2, 3, 4, 5, 6 and repeats.

NOTE

Table 2 indicates the approximate values of resistance as well as reactance that can be expected from a 35 ft. whip antenna over a 2 to 32 Mc range. This table can be used to approximate settings of the ATS-2 before operation. During operation the VSWR meter is the best tuning guide.

E. Place the POWER switch in the X10 position and the METER switch in the REACT. position.

F. Place the TUNE/OPERATE switch in TUNE position.

G. Turn the transmitter on and adjust the power output to not more than 100 watts. If 100 watts is exceeded, the overload relay will trip, shutting off the transmitter. If this occurs, reduce power and press RESET switch.

H. Observe the power output on both the FORWARD and REFLECTED meter scales. If below 100 watts advance the POWER control to X1.

J. Observe particularly the REFLECTED power and operate the REACTANCE control in either the INCR. or DECR. direction to minimize the REFLECTED power reading. This will produce a minimum VSWR of 2.5 to 1 or less.

CAUTION

REACTANCE SCALE READINGS SHOULD NEVER EXCEED 20 WHEN FREQUENCIES OVER 10 MC ARE BEING TUNED.

K. Place TUNE/OPERATE switch on OPERATE.

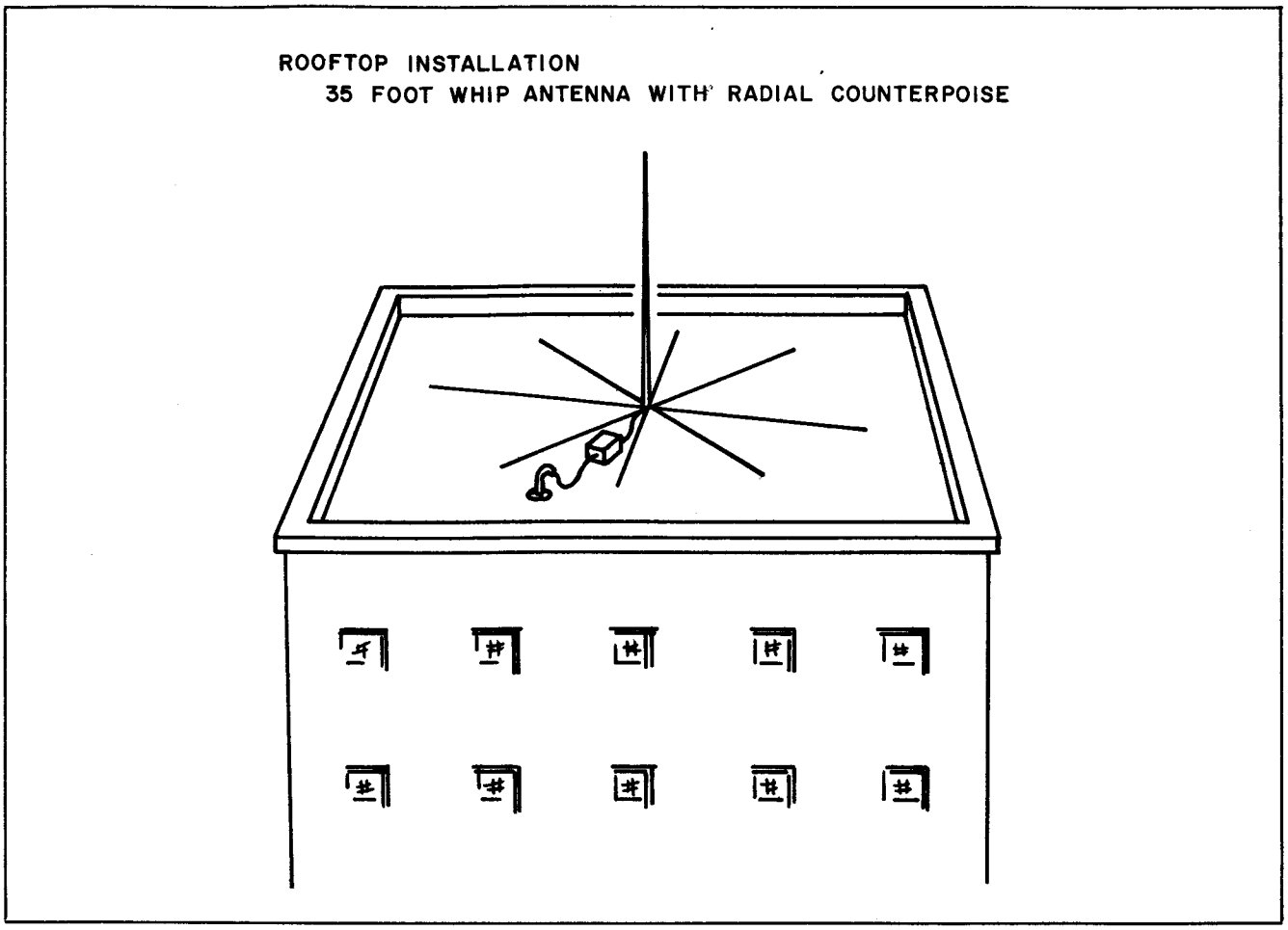
L. Place the POWER switch in the X10 position and increase the transmitter output not to exceed 1000 watts.

CAUTION

THE RESISTANCE CONTROL MUST NOT BE OPERATED WHEN THE TRANSMITTER OUTPUT IS IN EXCESS OF 100 WATTS. SERIOUS DAMAGE TO THE EQUIPMENT WILL RESULT IF THIS IS NOT OBSERVED.

Readjust the REACTANCE control until minimum REFLECTED power (and minimum VSWR) is observed on the meter.

M. The POWER switch can now be placed in the SHORT position (meter-shorted) to guard against damage to the meter due to surges in the transmitter power output.



Rooftop Installation, 35 foot whip antenna with radial counterpoise.

For Steps B, C and J Table 3a or 3b (whichever applies) will be found useful. This table was compiled for the development of this system. It will give approximate RESISTANCE as well as approximate REACTANCE positions for various frequencies.

MODIFICATION OF TRANSMITTER INTERLOCKS

Some of the TMC Models GPT-750 require modification of the interlock circuit in order to utilize the overload circuit of the Model ATS-2. These changes are simple, and will provide protection for the equipment.

For all Models GPT-750( )-1 request the TMC Modification Kit (S-436) which will be provided free of charge.

Make the following changes on all Models GPT-750( )-2 carrying serial numbers lower than 621.

1. Disconnect the wire going to S504 (RTF-2) interlock from terminal 11, E501.
2. Connect this wire to terminal 26 of E502.
3. Connect a MWC18(16) J903 wire or equivalent from terminal 11, E501, to terminal 28, E502, shaping the wire to follow the adjacent cabling.

COUNTERPOISE FOR 35 FOOT VERTICAL WHIP ANTENNA

Performance of a vertical whip antenna is usually improved when 6 to 12 radials (35 foot heavy guage) are installed at the base of the antenna. These radials are best located in the plane of the base of the antenna at an angle of 90 degrees to the mast and spaced at equal angles 30 to 60 degrees apart. The radials are best made from #6 copperweld wires cut to length and securely joined together at a point of intersection near the antenna base. A connection is then made from this junction to one of the metal mounting lugs of the RF Tuner of the ATS-2.

Use of these radials is especially recommended for rooftop installations or in locations where ground conductivity is not optimum.

SECTION IV
MAINTENANCE

4-1 GENERAL

4-1-1 The Model ATS-2 has been designed for long term trouble free duty. Little attention beyond normal maintenance is required. Any maintenance to the equipment should be performed by a competent technician.

4-2 PREVENTIVE MAINTENANCE

4-2-1 In order to prevent failure of the equipment due to corrosion, dust, and other destructive ambient conditions, the inside of each unit should be thoroughly inspected for signs of dirt, dampness, molding, charring or corrosion. This should be done periodically depending upon the severity of conditions. Correct any defect with a cleaning agent of proven quality.

4-3 CALIBRATION

4-3-1 VSWR METER

CAUTION

THIS SECTION REQUIRES THE USE OF RF ENERGY FROM THE TRANSMITTER. FOLLOW INSTRUCTIONS CAREFULLY. EACH TIME THE PROCEDURE CALLS FOR TRANSMITTER POWER TO BE OFF USE THE FINAL PLATES SWITCH OR ITS EQUIVALENT.

Have the following equipment available for use:

Adjustment tool, TMC No. TP-110, supplied with ATS-2
DIRECTIONAL COUPLER
CONTROL MONITOR
70 ohm, 1000 watt Resistive Load for ATS(70)-2
50 ohm, 1000 watt Resistive Load for ATS(50)-2
See note following Step X.
Transmitter used with system.
RF VTVM

A. Connect the 50 ohm resistive load to J303 of the DIRECTIONAL COUPLER.

B. Couple system cabling according to Figure 3-1. The RF TUNER is not used.

C. Turn R102, R103, R104 and R105 of the CONTROL MONITOR to minimum resistance (fully clockwise). Remove V102 from its socket. The tube will be returned to its socket in a later step. Keep the tube in a safe place.

D. If pointers of the VSWR meter do not rest on zero, adjust them to zero by slowly turning screwheads at pointer hubs.

E. Turn POWER switch to X1 position.

F. Tune the Transmitter to an output frequency of 6.0 Mc on low power (less than 100 watts).

G. With Transmitter output level at minimum, slowly increase the drive until VSWR Meter indicates 100 on the FORWARD power black scale.

H. Adjust the NULL capacitor, C308, of the DIRECTIONAL COUPLER until the reflected power red scale of the VSWR Meter indicates minimum.

J. Turn the Transmitter OFF. REVERSE the RF cables on the DIRECTIONAL COUPLER by connecting the 50 ohm load to J302 and the Transmitter to J303.

K. Turn the Transmitter ON. Increase power until the REFLECTED power scale of the VSWR meter reads 100.

L. Adjust the EQUALIZER capacitor, C307, on the DIRECTIONAL COUPLER until FORWARD power reads minimum.

M. Turn the Transmitter final plates OFF. Restore cable connections of the DIRECTIONAL COUPLER to normal operating positions (Transmitter to J302; load to J303).

N. Adjust R102, R103, R104 and R105 to maximum resistance (fully counter-clockwise.)

P. Connect the RF VTVM across the 50 ohm resistive load at J303 of the DIRECTIONAL COUPLER.

Q. Turn the Transmitter ON and adjust its output level until the RF VTVM indicates 70.7 volts on the ATS(50)-2 or 83.7 volts on the ATS (70)-2.

R. Adjust R102 of the CONTROL MONITOR until FORWARD power of the VSWR meter reads 100.

S. Turn the Transmitter OFF. Reverse RF connections to the DIRECTIONAL COUPLER as before so that the Transmitter connects to J303.

T. Turn the Transmitter ON. Adjust power output to read 70.7 volts on the ATS(50)-2 or 83.7 volts on the ATS(70)-2.

U. Adjust R105 of the CONTROL MONITOR until REFLECTED power of the VSWR meter reads 100.

V. Turn the Transmitter OFF. Restore the RF cables and load of the DIRECTIONAL COUPLER to their normal operating positions.

W. Turn the POWER switch of the DIRECTIONAL COUPLER to X10 position.

X. Turn the Transmitter ON and adjust its output level to 224 volts on the ATS(50)-2 or 265 volts on the ATS(70)-2 as read on the RF VTVM.

NOTE

If a 1000 watt dummy load is not available, see Table 5 for alternative voltages and powers. 4-3

Y. Adjust R103 of the CONTROL MONITOR until the FORWARD power scale of the VSWR Meter reads 1000 (100 x 10).

Z. Turn the Transmitter OFF. Reverse the connections to the DIRECTIONAL COUPLER.

AA. Turn the Transmitter ON and check 224 volts for the ATS(50)-2 or 265 volts for the ATS (70)-2 output level on the RF VTVM.

BB. Adjust R104 of the CONTROL MONITOR until REFLECTED power scale of the VSWR Meter indicates 1000 watts.

CC. Turn the Transmitter OFF. Restore connections to the DIRECTIONAL COUPLER to their normal operating positions. See Figure 3-1.

DD. Replace V102 in its socket.

4-3-2 METER M102

4-3-2-1 HUMIDITY INDICATION

A. Disconnect cable from J101 on the CONTROL MONITOR.

B. Turn the POWER switch to SHORT position.

C. Hold the METER switch in HUM. position.

D. If the meter does not indicate 0, adjust R108 until it does.

4-3-2-2 REACTANCE INDICATION

A. Connect the 10 wire control cable between the CONTROL MONITOR and RF TUNER.

B. Turn the POWER switch to SHORT.

C. Operate the REACTANCE control in the INCR position until the STOP indicator lights.

D. M102 should read 100.

4-4 OVERLOAD CIRCUIT ADJUSTMENT

4-4-1 EQUIPMENT REQUIRED

Complete ATS-2
Transmitter
Vacuum tube voltmeter
Antenna
1000 watt dummy load, if available

4-4-2 PROCEDURE

A. Make connections as shown in Figure 3-1. (If 1000 watt dummy load is available).

B. Turn POWER switch on the CONTROL MONITOR to the X1 position.

C. Set the TUNE/OPERATE switch on the CONTROL MONITOR to TUNE position.

D. Allow 2 minutes for tube warm-up.

E. Turn R120, R121 and R122 on the CONTROL MONITOR fully counter-clockwise for maximum resistance.

F. Adjust the transmitter for 100 watts output. Use a frequency which will allow the transmitter to be tuned for a standing wave ratio of unity (1:1). For example 6 Mc might be used.

G. Turn R122 clockwise until the latching relay K103 of the unit trips to cut transmitter power.

H. Reduce transmitter power. Press RESET switch on the CONTROL MONITOR to reset K103. Increase transmitter power slowly until the power required for this step is reached. When 100 watts is reached, K103 will again trip to cut the transmitter off. If this does not occur, readjustment of R122 is necessary. Repeat the above until R122 is correctly adjusted.

J. When R122 is correctly set, carefully tighten its lock nut.

K. Turn POWER switch on the CONTROL MONITOR to the X10 position. Turn TUNE/OPERATE switch to OPERATE position.

L. Adjust the transmitter output to 1200 watts. Note that the FORWARD power indication of the VSWR meter will exceed full scale by approximately 1/4 inch. If the transmitter available is not rated for 1000 watts output, tune the transmitter used for maximum output.

M. Turn R121 clockwise until K103 trips to cut transmitter power. Proceed as in step H above until R121 is properly adjusted.

N. When R121 is correctly set, carefully tighten its lock nut.

P. Press the RESET switch to reset K103 and reactivate the transmitter.

Q. Reduce transmitter power to 1000 watts. If transmitter available is not rated for 1000 watts, leave its output at maximum.

R. Using the REACTANCE switch on the CONTROL MONITOR, vary the inductance until the VSWR meter indicates a standing wave ratio of 4 to 1.

S. Turn R120 clockwise until K103 trips to cut transmitter power. Proceed as in step H above until R120 is properly adjusted.

T. When R120 is properly set, carefully tighten its lock nut.

4-5 MECHANICAL ADJUSTMENTS

4-5-1 READJUSTMENT OF INDUCTANCE DRIVE SYSTEM

A. Connect the RF TUNER to the CONTROL MONITOR as shown in Figure 3-1.

B. Remove cover from RF TUNER case.

C. Loosen set screws that hold worm gear and switch actuating levers to control shaft of R201.

TABLE 4-1 ROTARY SWITCH OPERATION FOR ANTENNA MATCHING

RESISTANCE POSITION	T201 TAP #	T201 OHMS	COVERS ANTENNA RESISTANCE RANGE	COVERS ANTENNA REACTANCE RANGE
1	1	17	2 - 35	0 to -j850
2 *	1	17	2 - 35	0 to +j750
3	2	70	35 - 140	0 to -j850
4 *	2	70	35 - 140	0 to +j750
5	3	250	125 and higher	0 to -j850
6 *	3	250	125 and higher	0 to +j750

NOTE: The odd number switch positions are used when the antenna exhibits -j or capacitive reactance. The even number switch positions are used when the antenna exhibits +j or inductive reactance.

* Indicates - 46 uufd (C201) added in series.

D. Turn POWER switch to SHORT position.

E. Hold REACTANCE switch in DECR position until motor driven tap of L201 is 1/4 turn from end of coil (end away from motor).

F. Turn R201 control shaft by hand until reading of M102 is zero.

G. Tighten worm gear set screws.

H. Turn POWER switch OFF.

J. Turn lever that actuates S203 until it depresses the switch plunger.

K. Tighten set screws that lock lever in place on shaft.

L. Turn POWER switch to SHORT position.

M. Hold REACTANCE switch in INCR position until motor driven tap is 1/4 turn from the other end of the coil.

N. Turn POWER switch OFF.

P. Turn lever that actuates S202 until it depresses the switch plunger.

Q. Lock lever in place on shaft by tightening set screws.

R. The mechanism should now stop automatically when motor driven tap reaches 1/4 turn from either end of the coil.

4-6 DESSICANT

4-6-1 A 16 unit bag of dessicant is attached to the inside of the RF TUNER case cover to help prevent moisture from gathering on the components within. Should the humidity indicator show that a change of dessicant is necessary, replace with a fresh bag. Allow a reasonable amount of time for chemical action to register change on humidity meter reading. If the meter does not then indicate a sufficient drop in humidity, check its calibration.

4-7 SPARK GAP

4-7-1 The spark gap is provided for protection of the unit from static charges. The gap should be set at approximately 1/8 (.125).

TABLE 4-2 35 FOOT WHIP ANTENNA MEASUREMENTS

WET CONDITIONS			
MC	RES. OHMS	REACT. OHMS	SUGGESTED ANT. RES. POSITION #
2	8.0	-j400	1
3	10.8	-j317	1
3.5	16.4	-j287	1
4	17.3	-j237	1
4.5	18.2	-j200	1
5	18.0	-j160	1
6	43	-j33	3
7	54.0	0	4
8	130	+j88	6
9	230	+j152	6
10	492	-j128	5
11	318	-j237	5
12	100	*-j418	3
13	32	*-j385	1
14	30	*-j357	1
15	25	-j292	1
16	13.3	+j23	2
17	38.2	+j188	4
18	22	-j155	1
19	33.5	-j36	3
20	59	-j105	3
22	61.5	-j6.8	3
24	32	-j200	1
26	68.5	*-j190	3
28	43.5	*-j178	4
30	47.2	-j133	4

DRY CONDITIONS			
MC	RES. OHMS	REACT. OHMS	SUGGESTED ANT. RES. POSITION
2	7.8	-j430	1
3	9.2	-j350	1
3.5	12.7	-j293	1
4	13.2	-j244	1
4.5	13.4	-j190	1
5	13.7	-j158	1
6	40	-j67	3
7	50	+j16	4
8	149	+j109	6
9	288	+j90	6
10	438	-j22	5
11	308	-j246	5
12	45	*-j418	3
13	30	*-j385	1
14	25	*-j350	1
15	23	-j283	1
16	28	+j84	2
17	34.6	+j74	2
18	18.9	-j134	1
19	33	-j163	3
20	52.8	-j60	3
22	114	-j50	3
24	28	-j160	1
26	94	*-j193	3
28	40	*-j180	4
30	35.5	-j136	4

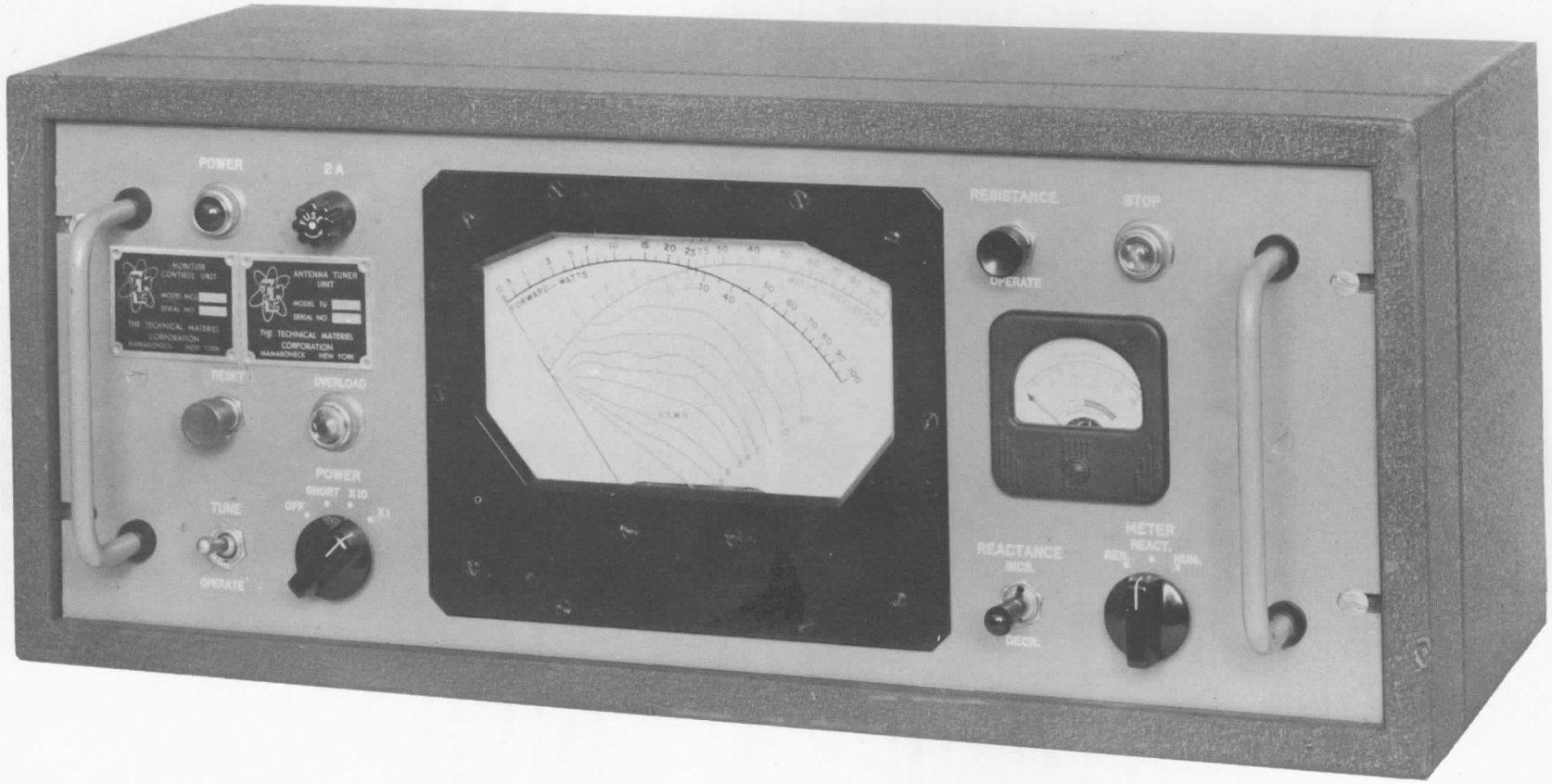
* Indicates - more than

NOTE: These measurements were made at a site fairly free from obstructions. It is possible that at other locations there will be variances in both ANTENNA RESISTANCE and REACTANCE.

TABLE 4-3 VOLTAGE ACROSS LOAD VS POWER

VOLTAGE ACROSS RESISTIVE LOAD MEASURED WITH RF VTVM		CORRESPONDING READING OF FORWARD WATTS SCALE
ATS (50)-2	ATS (70)-2	
224	265	1000
200	237	800
173	205	600
141	167	400
100	118	200
86.6	102	150
70.7	83.7	100

SECTION V
PARTS LIST



PH-942

Figure 1-2 Monitor Control Unit, Model MCU-2

PH-941

Figure 1-3 Directional Coupler Unit, Model CU-2

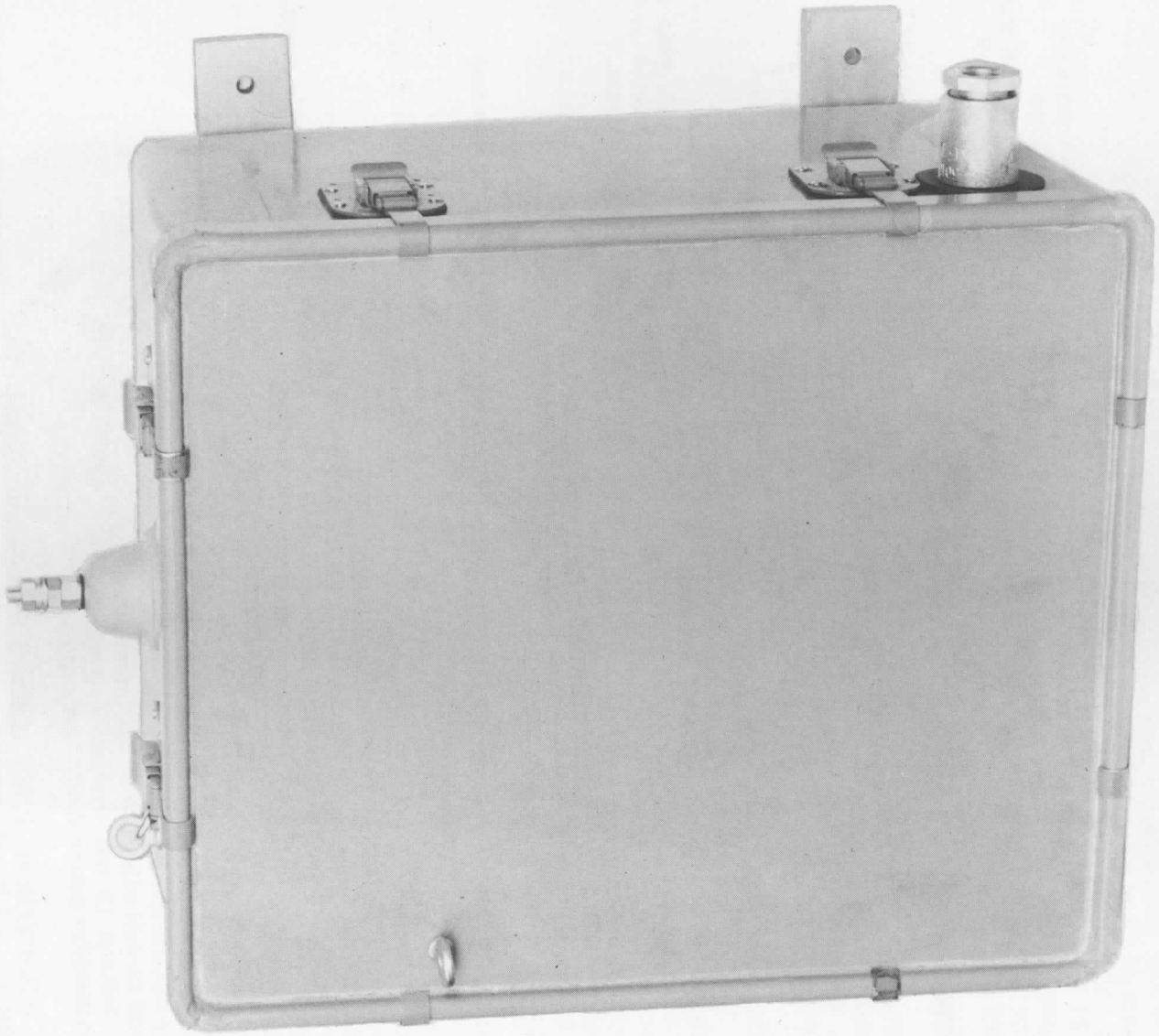


Figure 1-4 RF Tuning Unit, Model TU-2

PH-943

SECTION I
GENERAL DESCRIPTION

1-1 PURPOSE AND BASIC PRINCIPLES

1-1-1 The TMC Model ATS-2, Antenna Tuning System, has been designed to couple the output of any 1000 watt transmitter with a nominal output impedance of 50 ohms to a 35 ft. vertical whip antenna. The system covers the frequency range of 2 to 32 Mc with very little insertion loss. The ATS-2 provides the necessary inductance and capacitance to resonate the antenna to the operating frequency.

1-2 DESCRIPTION OF UNIT

1-2-1 The Model ATS-2 is shown in Figure 1-1. The Model ATS-2 consists of three units, the RF TUNER, the CONTROL MONITOR, and the DIRECTIONAL COUPLER.

1-2-2 The RF TUNER employs a helical transmission line as an inductance tuning element whose electrical length is varied by a motor-driven rolling contact. The capacitor is a fixed air dielectric type. A ferrite core auto-transformer with taps, which are selected by a motor-driven rotary switch, is used to match various antenna resistance values. A humidity sensing circuit is also incorporated in the unit.

1-2-3 The CONTROL MONITOR is equipped with two meters, controlling switches, and an overload protection circuit. A triple scale two inch meter indicates the position of the motor-driven short on the helical transmission line, the position of the antenna resistance selector switch, or the amount of moisture present in the RF TUNER. The large dual pointer meter indicates the forward and reflected transmitter power, and indicates, at the intersection of the two pointers, the Voltage Standing Wave Ratio (VSWR). Switches are located on the front panel to remotely control the motors in the RF TUNER. The overload circuit will disable the transmitter to prevent damage to the equipment when the VSWR or transmitter power exceed preset levels.

1-2-4 The DIRECTIONAL COUPLER is a balanced RF Bridge, and is calibrated to operate in conjunction with a 50 ohm coaxial line. Balancing and equalizing controls are provided.

1-3 TECHNICAL SPECIFICATIONS

FREQUENCY RANGE:
2 to 32 Mc

POWER RATING:
RF TUNER - 1000 watts continuous
100% modulated
DIRECTIONAL COUPLER - 1000 watts with a maximum VSWR of 3.0

TRANSMISSION LINE:
RG-11/U (70 ohms) for ATS-(70)-2
RG-8/U (50 ohms) for ATS (50)-2

INPUT IMPEDANCE:
Nominally 70 ohms for ATS(70)-2
Nominally 50 ohms for ATS(50)-2

OUTPUT IMPEDANCE:
Matches transmitter to a 35 ft. whip antenna with a resistance of 2-500 ohms and a reactance from -j850 to +j750 ohms.

STANDING WAVE RATIO:
Better than 2.5 to 1.

OUTPUT CONNECTION: (to antenna)
Bowl type insulator

DIRECTIVITY OF DIRECTIONAL COUPLER:
Better than 30 db

EFFICIENCY:
Better than 80% over the 2-32 Mc range.

CONTROL MONITOR CONTROLS:
Overload RESET
TUNE/OPERATE
POWER
RESISTANCE OPERATE
REACTANCE

The equipment is manufactured in accordance with JAN/MIL standards wherever practicable. All parts and assemblies meet or exceed the highest quality standards.

SECTION II
THEORY OF OPERATION

2-1 THE RF TUNER

2-1-1 A 35 foot whip antenna has two basic properties which must be accommodated by an effective matching device. They are its resistance and reactance. The value of each can vary according to operating frequency and environmental conditions at the antenna site such as the location of ground objects and the weather.

2-1-2 Matching an antenna to a transmission line requires that:

A. The antenna be made non-reactive (resonant).

B. The antenna resistance equal the characteristic impedance of the line.

If this is not done, the length of the line will be critical with frequency, and reflected power will result in losses.

2-1-3 In the first case, the antenna may display either inductive or capacitive reactance depending upon the operating conditions (there are only four frequencies in the range of 2-32 Mc at which a 35 ft. whip antenna will be in resonance unaided). The symbol +j is used before the reactance value in ohms to denote inductive reactance; -j to denote capactive reactance. A capacitive antenna is, in effect, electrically shorter than the nearest resonant wavelength. Such an antenna is normally tuned by the addition of series inductance. When an antenna displays capacitive reactance of -j305 ohms for example, the VSWR meter will indicate a minimum standing wave ratio if an inductive reactance of +j305 is added in series. This brings the algebraic sum of all reactances to zero. When this is accomplished the antenna becomes a purely resistive load. See Figure 2-1.

2-1-4 When the antenna is inductive, however, it is electrically longer than the nearest resonant wavelength. Resonance is achieved with the addition of series capacitance (C201). In the ATS-2 system, this capacitor is not adjustable, but when used will change an inductive antenna with a reactance up to +j750 ohms to some value of capacitive reactance. The variable inductance (L201) is then used for final adjustment to antenna resonance. If operation is at 9 Mc, for example, and the antenna reactance is inductive at +j235 ohms, then C201 a 46 mmf capacitor, (Xc = 385 ohms at 9 Mc) is added in series with the antenna. The algebraic sum of these two reactances is -j385 ohms plus +j235 ohms or -j150. The antenna reactance, now capacitive, is then brought to zero by use of +j150 ohms from the variable coil, L201. When this is accomplished the antenna becomes a purely resistive load. See Figure 2-2.

2-1-5 Resistance matching is accomplished by use of the auto-transformer T201. Table 1 indicates how one of the three T201 taps is used to match any antenna resistance of 2 to 500 ohms to a 50 ohm transmission line (ATS (50)-2 or any antenna resistance of 2 to 650 ohms to a 70 ohm transmission line (ATS (70) -2). When matching an antenna of 175 ohms resistance and -j305 reactance, for example, the auto transformer tap nearest 175 ohms in value should be chosen. In this case switch position 3 (250 ohms) is used. Notice that position 4 is also 250 ohms but it adds the 46 mmf capacitor as well. This, however, is not desired for tuning a capacitive antenna. After +j305 is added from the variable coil (L201) to reduce the antenna to a pure resistance, the standing wave ratio can be read from the meter or predicted mathematically as follows:

$$\text{VSWR} = \frac{\text{Antenna Resistance}}{\text{Tap Resistance}} \quad \text{or}$$

$$\frac{\text{Tap Resistance}}{\text{Antenna Resistance}}$$

The larger resistance is always in the numerator. In the above case the VSWR would be:

$$\frac{\text{Tap Resistance}}{\text{Antenna Resistance}} = \frac{250}{175} = 1.43$$

2-2 CIRCUIT ANALYSIS

2-2-1 THE DIRECTIONAL COUPLER

2-2-1-1 The DIRECTIONAL COUPLER is a sensing device for the VSWR meter circuit. Figure 2-3 shows that the coupler is essentially an RF bridge, one leg of which (R_O) is the resistance of the antenna and the coaxial line. If R_O should change to some value other than 50 ohms the bridge will be unbalanced and register a proportionate meter reading.

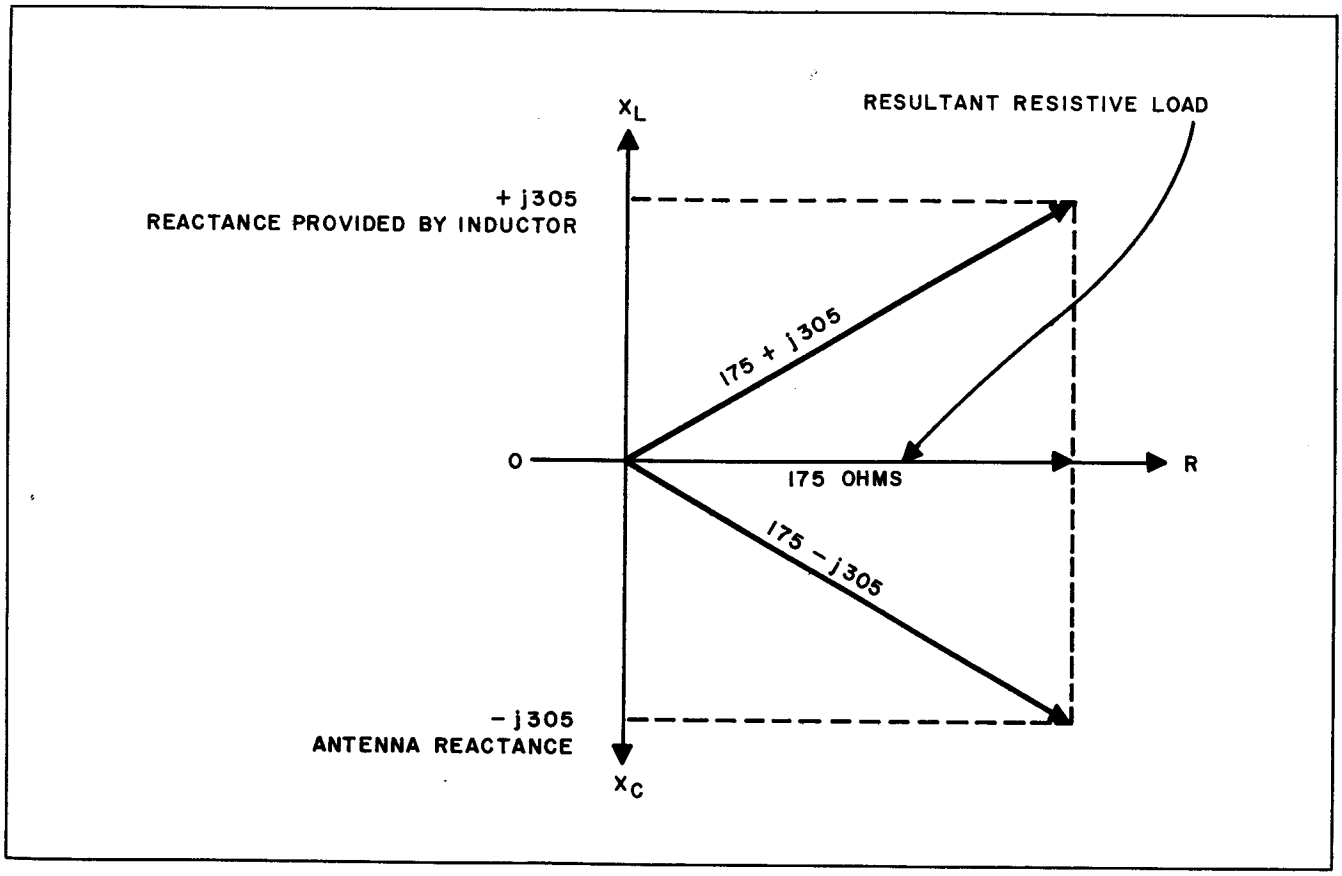


Figure 2-1 Capacitive Antenna

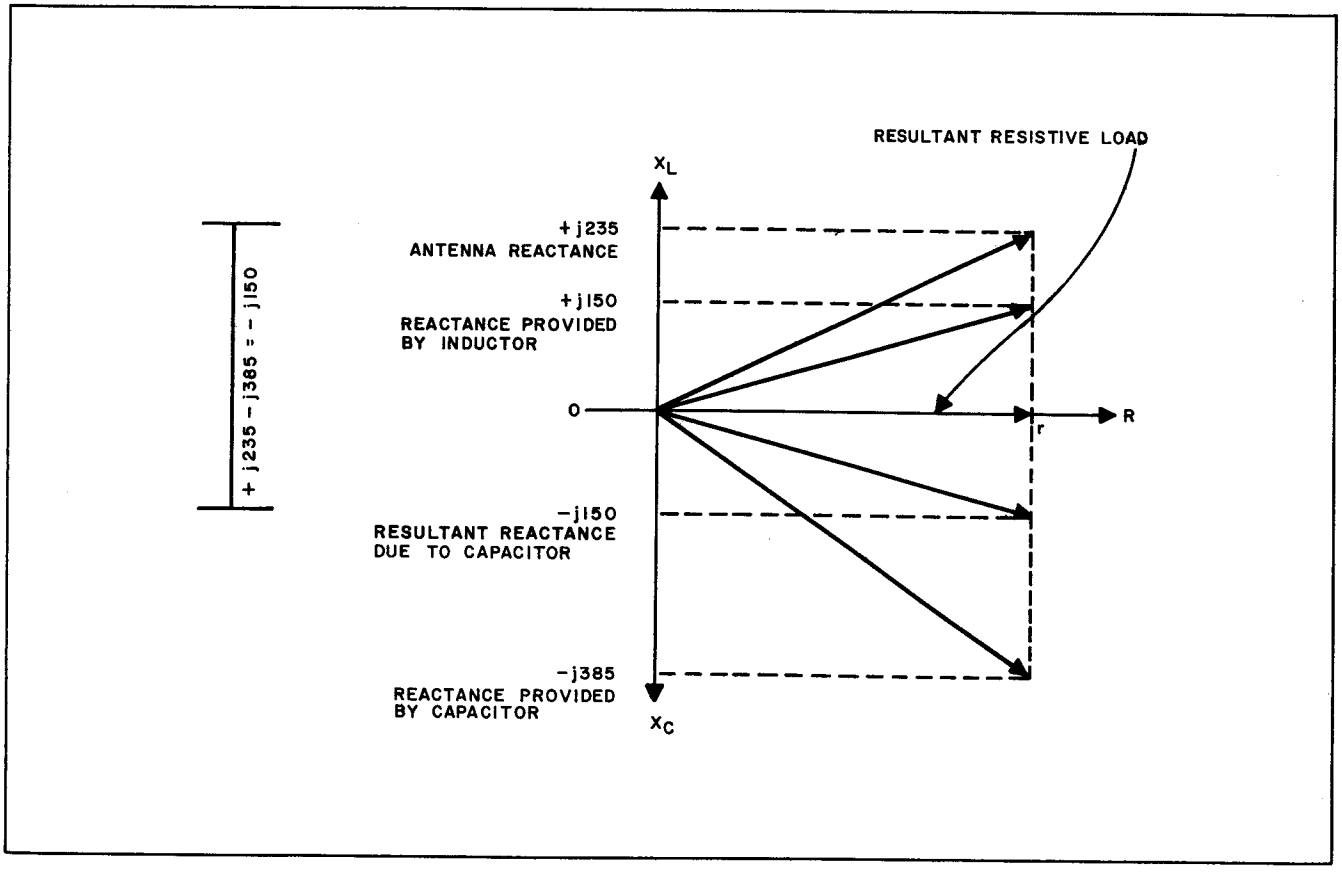


Figure 2-2 Inductive Antenna

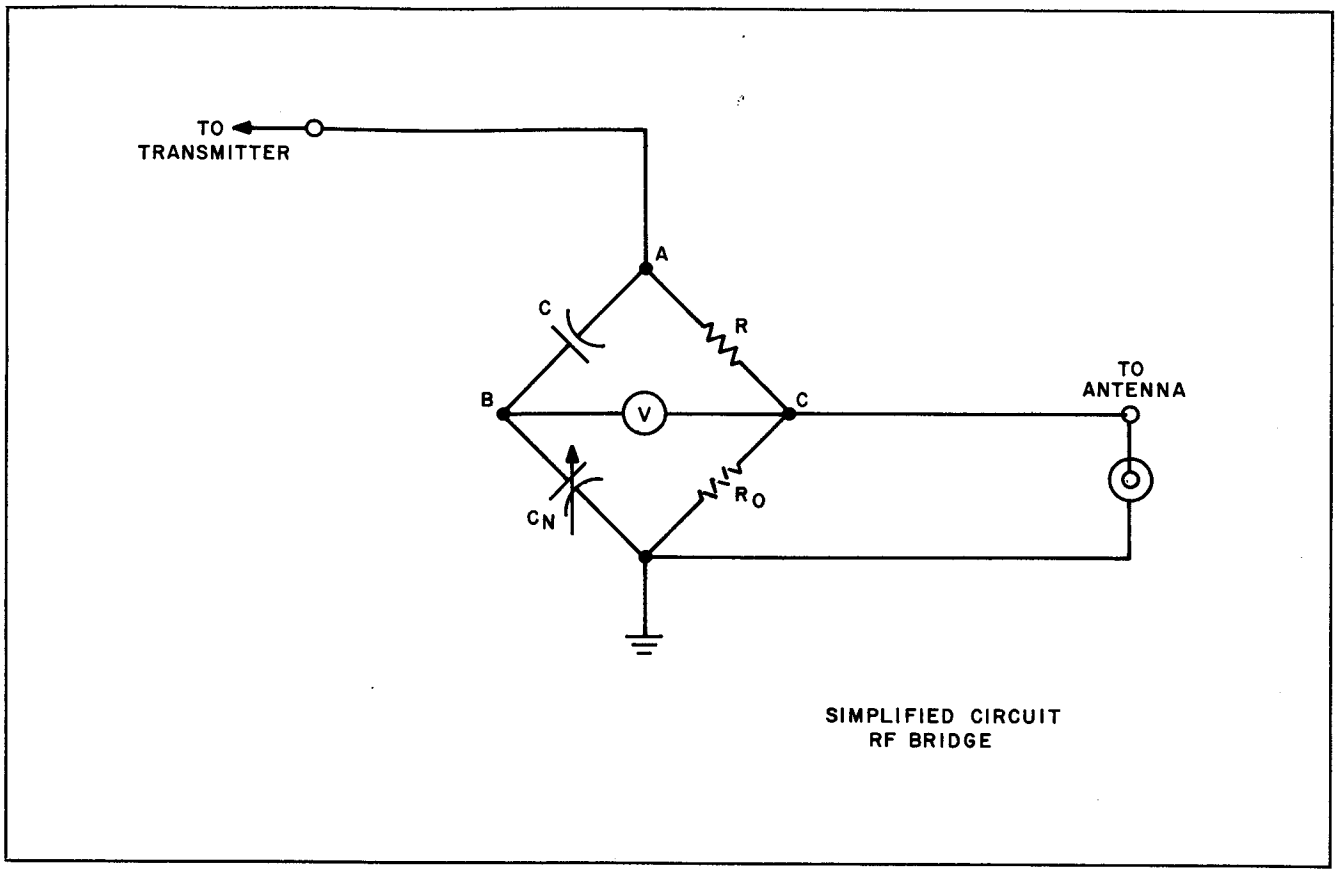


Figure 2-3 Simplified Circuit, R. F. Bridge

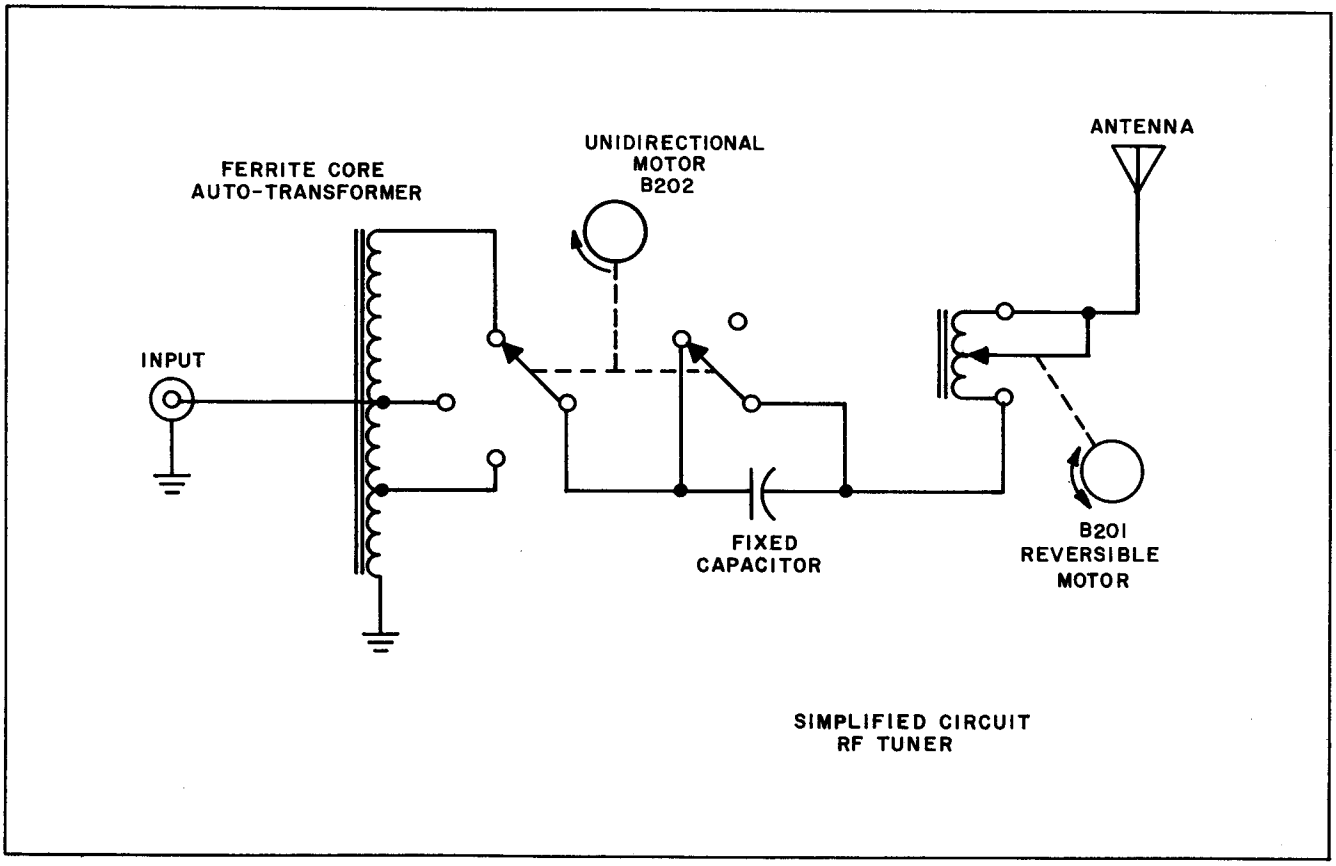


Figure 2-4 Simplified Circuit, R.F. Tuner

2-2-2 CONTROL MONITOR

2-2-2-1 The CONTROL MONITOR serves as the control, indicator, overload protector, and power supply unit of the ATS-2 system. Switches on the front panel provide control of the motors in the RF TUNER.

2-2-2-2 The large dual pointer meter has three scales which may be read simultaneously. The pointer tips indicate Forward and Reflected power measurements while the point of intersection of both pointers indicates the standing wave ratio on a special third scale. This third scale is composed of lines labeled with VSWR values. If the intersection of the pointer falls anywhere on a line, the VSWR is equal to the line number. Readings between lines may be interpolated. The small meter indicates Resistance, Reactance, and Humidity depending upon the position of the selector switch. For Resistance the actual meter movement is in response to the position of the S201A rotor in the voltage divider network wired to that section. The Reactance position of the small meter indicates the location of the moving tap of L201, the inductive tuning device. The sensing element for the meter in this measurement is R201 which is geared to the system and produces a voltage drop porportional to the tap position. The Humidity Sensing Element is essentially a resistor whose value changes with the amount of moisture in the RF TUNER case. This special element is the variable leg of a resistance bridge comprised of R110, R107, R109 and the calibration adjustment, R108.

2-2-2-3 The overload protector is dependent upon the transmitter power and the VSWR. When the transmitter power exceeds 1000 watts or the VSWR exceeds 4 to 1 the relays in the plate circuit of V102 will trip, disabling the transmitter. When in TUNE position, the relay will trip at 100 watts transmitter power.

2-2-2-4 The transformer, T101, provides voltages to operate the motors in the RF TUNER and operate V102. Some of the current from the transformer is rectified, filtered and voltage regulated for the plate circuit of V102.

UNCLASSIFIED

INSTRUCTION MANUAL

for

ANTENNA TUNING SYSTEM MODEL ATS-2 (AN/URA-27)

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N. Y. OTTAWA, ONTARIO

IN-214

Issue Date: 23 December 1959

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TMC NUMBER	NAME	NOMENCLATURE	NOUN
ATS(50)-2	Antenna Tuning System	AN/URA-27	Antenna Coupler Group
ATS-MCU-2	Monitor Control Unit	C-2995/URA-27	Control - Indicator
ATS-50CU-2	Directional Coupler Unit	CU-773/URA-27	Coupler, Directional
ATS-50TU-2	Antenna Tuner Unit	CU-772/URA-27	Coupler, Antenna

ATS(70)-2	Antenna Tuning System		
ATS-MCU-2	Monitor Control Unit	C-2995/URA-27	Control - Indicator
ATS-70CU-2	Directional Coupler Unit		
ATS-70TU-2	Antenna Tuner Unit		

PLEASE NOTE

Wherever information in this manual applies to both the ATS(50)-2 and the ATS (70)-2, the unit will be referred to as the ATS-2. When impedance of the unit is mentioned, 50 ohms is used. However, users of Model ATS (70)-2 should assume this impedance to be 70 ohms.

This notation does not imply that the equipment or values may be interchanged. The ATS (50)-2 and the ATS (70)-2 are similar but distinctly seperate systems.

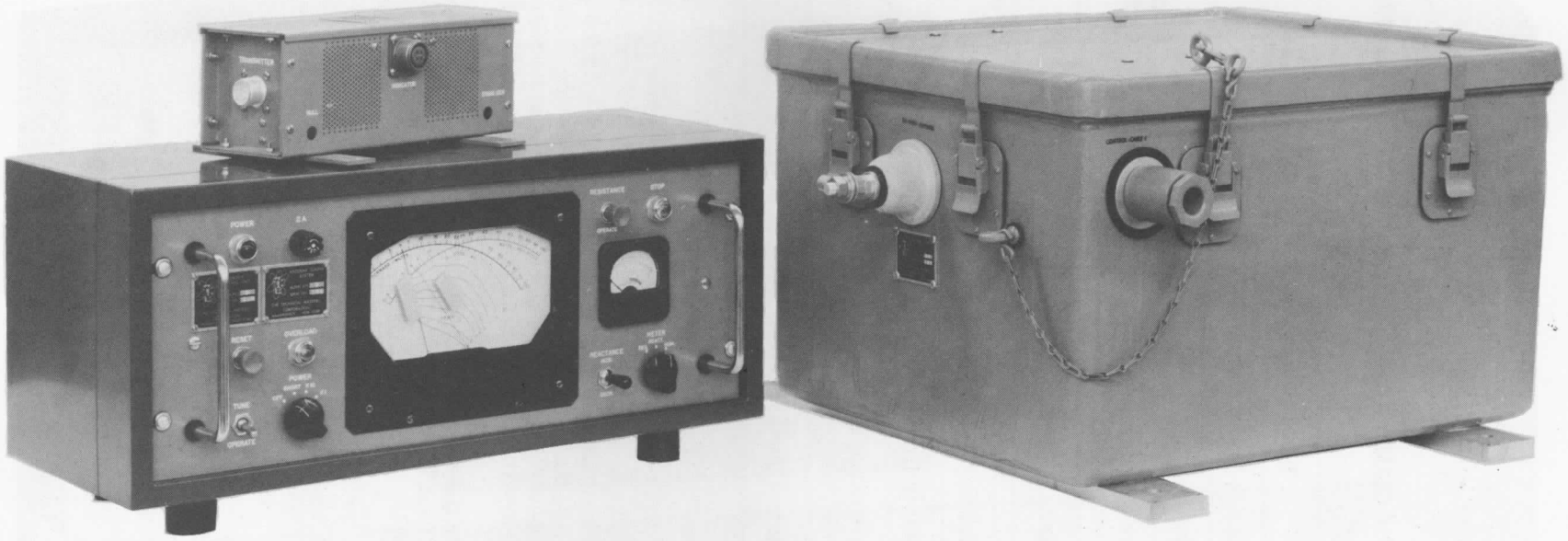

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Figure 1-1 Front View, Model ATS-2

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PLEASE NOTE

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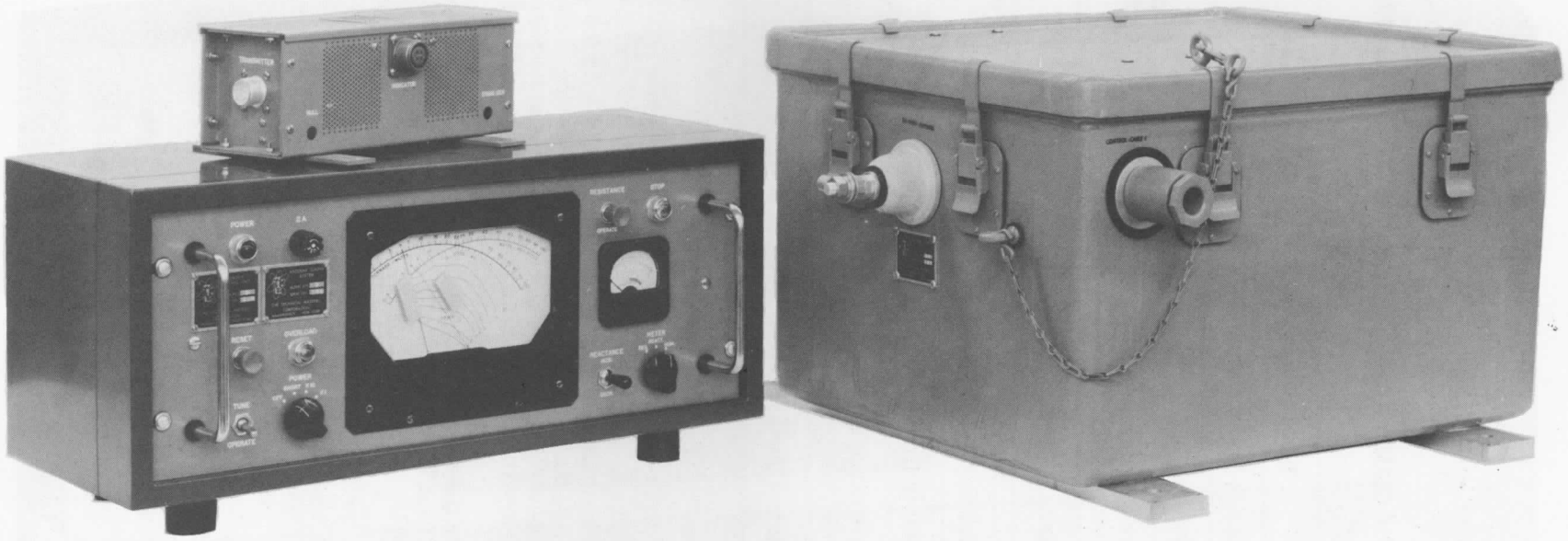

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Figure 1-1 Front View, Model ATS-2

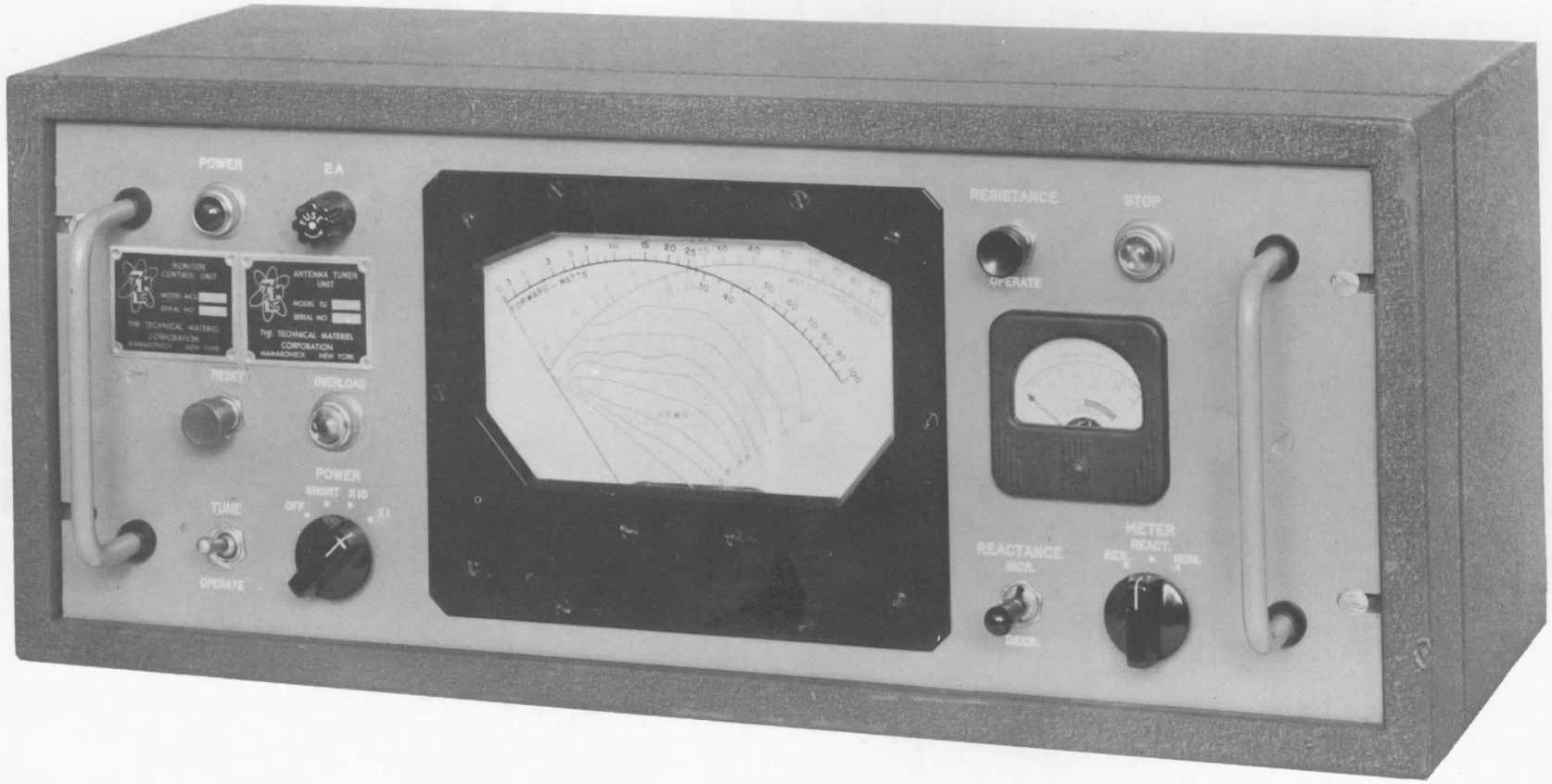

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Figure 1-2 Monitor Control Unit, Model MCU-2

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Figure 1-3 Directional Coupler Unit, Model CU-2

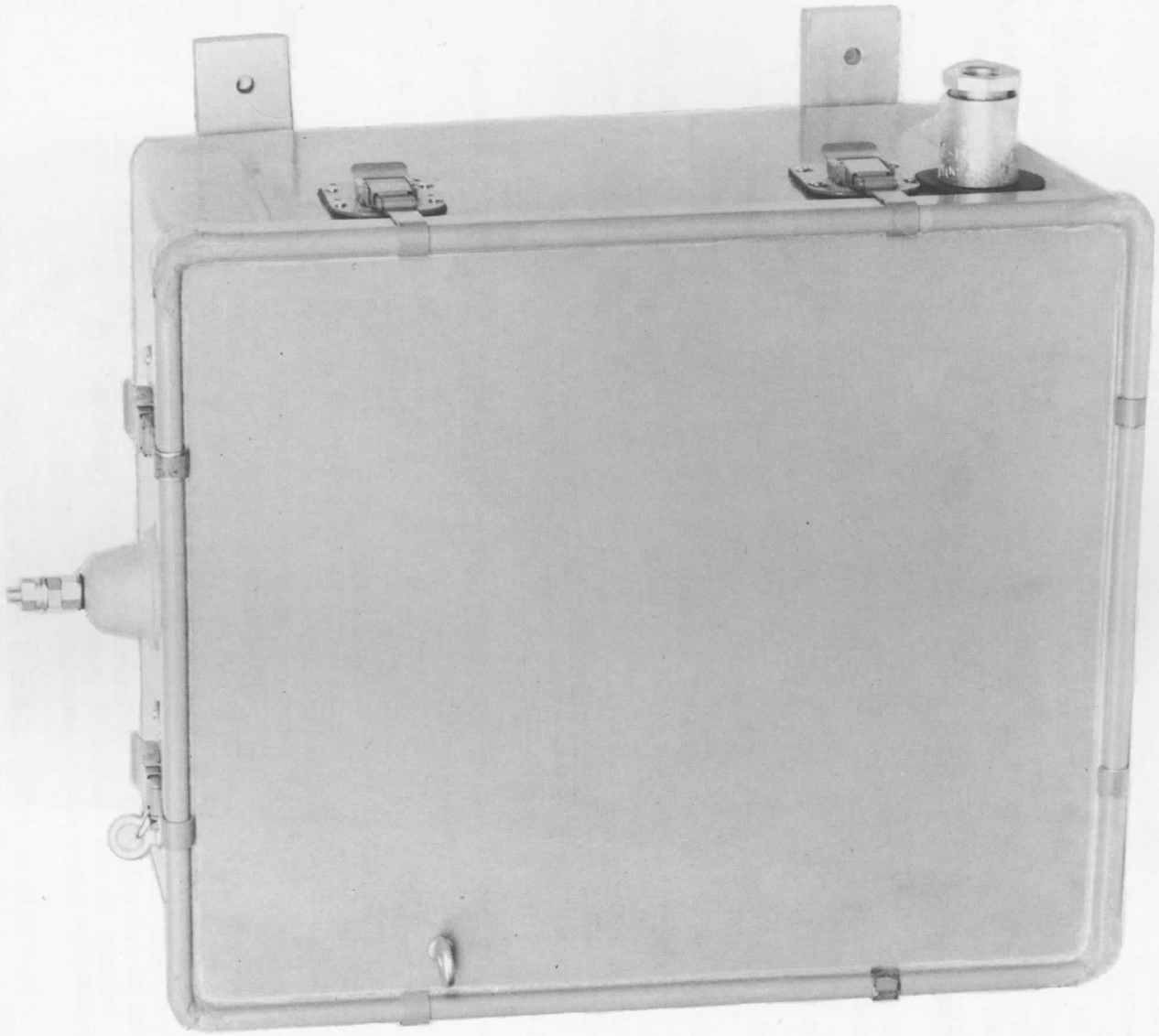


Figure 1-4 RF Tuning Unit, Model TU-2

PH-943

SECTION I
GENERAL DESCRIPTION

1-1 PURPOSE AND BASIC PRINCIPLES

1-1-1 The TMC Model ATS-2, Antenna Tuning System, has been designed to couple the output of any 1000 watt transmitter with a nominal output impedance of 50 ohms to a 35 ft. vertical whip antenna. The system covers the frequency range of 2 to 32 Mc with very little insertion loss. The ATS-2 provides the necessary inductance and capacitance to resonate the antenna to the operating frequency.

1-2 DESCRIPTION OF UNIT

1-2-1 The Model ATS-2 is shown in Figure 1-1. The Model ATS-2 consists of three units, the RF TUNER, the CONTROL MONITOR, and the DIRECTIONAL COUPLER.

1-2-2 The RF TUNER employs a helical transmission line as an inductance tuning element whose electrical length is varied by a motor-driven rolling contact. The capacitor is a fixed air dielectric type. A ferrite core auto-transformer with taps, which are selected by a motor-driven rotary switch, is used to match various antenna resistance values. A humidity sensing circuit is also incorporated in the unit.

1-2-3 The CONTROL MONITOR is equipped with two meters, controlling switches, and an overload protection circuit. A triple scale two inch meter indicates the position of the motor-driven short on the helical transmission line, the position of the antenna resistance selector switch, or the amount of moisture present in the RF TUNER. The large dual pointer meter indicates the forward and reflected transmitter power, and indicates, at the intersection of the two pointers, the Voltage Standing Wave Ratio (VSWR). Switches are located on the front panel to remotely control the motors in the RF TUNER. The overload circuit will disable the transmitter to prevent damage to the equipment when the VSWR or transmitter power exceed preset levels.

1-2-4 The DIRECTIONAL COUPLER is a balanced RF Bridge, and is calibrated to operate in conjunction with a 50 ohm coaxial line. Balancing and equalizing controls are provided.

1-3 TECHNICAL SPECIFICATIONS

FREQUENCY RANGE:
2 to 32 Mc

POWER RATING:
RF TUNER - 1000 watts continuous
100% modulated
DIRECTIONAL COUPLER - 1000 watts with a maximum VSWR of 3.0

TRANSMISSION LINE:
RG-11/U (70 ohms) for ATS-(70)-2
RG-8/U (50 ohms) for ATS (50)-2

INPUT IMPEDANCE:
Nominally 70 ohms for ATS(70)-2
Nominally 50 ohms for ATS(50)-2

OUTPUT IMPEDANCE:
Matches transmitter to a 35 ft. whip antenna with a resistance of 2-500 ohms and a reactance from -j850 to +j750 ohms.

STANDING WAVE RATIO:
Better than 2.5 to 1.

OUTPUT CONNECTION: (to antenna)
Bowl type insulator

DIRECTIVITY OF DIRECTIONAL COUPLER:
Better than 30 db

EFFICIENCY:
Better than 80% over the 2-32 Mc range.

CONTROL MONITOR CONTROLS:
Overload RESET
TUNE/OPERATE
POWER
RESISTANCE OPERATE
REACTANCE

The equipment is manufactured in accordance with JAN/MIL standards wherever practicable. All parts and assemblies meet or exceed the highest quality standards.

SECTION II
THEORY OF OPERATION

2-1 THE RF TUNER

2-1-1 A 35 foot whip antenna has two basic properties which must be accommodated by an effective matching device. They are its resistance and reactance. The value of each can vary according to operating frequency and environmental conditions at the antenna site such as the location of ground objects and the weather.

2-1-2 Matching an antenna to a transmission line requires that:

A. The antenna be made non-reactive (resonant).

B. The antenna resistance equal the characteristic impedance of the line.

If this is not done, the length of the line will be critical with frequency, and reflected power will result in losses.

2-1-3 In the first case, the antenna may display either inductive or capacitive reactance depending upon the operating conditions (there are only four frequencies in the range of 2-32 Mc at which a 35 ft. whip antenna will be in resonance unaided). The symbol +j is used before the reactance value in ohms to denote inductive reactance; -j to denote capactive reactance. A capacitive antenna is, in effect, electrically shorter than the nearest resonant wavelength. Such an antenna is normally tuned by the addition of series inductance. When an antenna displays capacitive reactance of -j305 ohms for example, the VSWR meter will indicate a minimum standing wave ratio if an inductive reactance of +j305 is added in series. This brings the algebraic sum of all reactances to zero. When this is accomplished the antenna becomes a purely resistive load. See Figure 2-1.

2-1-4 When the antenna is inductive, however, it is electrically longer than the nearest resonant wavelength. Resonance is achieved with the addition of series capacitance (C201). In the ATS-2 system, this capacitor is not adjustable, but when used will change an inductive antenna with a reactance up to +j750 ohms to some value of capacitive reactance. The variable inductance (L201) is then used for final adjustment to antenna resonance. If operation is at 9 Mc, for example, and the antenna reactance is inductive at +j235 ohms, then C201 a 46 mmf capacitor, (Xc = 385 ohms at 9 Mc) is added in series with the antenna. The algebraic sum of these two reactances is -j385 ohms plus +j235 ohms or -j150. The antenna reactance, now capacitive, is then brought to zero by use of +j150 ohms from the variable coil, L201. When this is accomplished the antenna becomes a purely resistive load. See Figure 2-2.

2-1-5 Resistance matching is accomplished by use of the auto-transformer T201. Table 1 indicates how one of the three T201 taps is used to match any antenna resistance of 2 to 500 ohms to a 50 ohm transmission line (ATS (50)-2 or any antenna resistance of 2 to 650 ohms to a 70 ohm transmission line (ATS (70) -2). When matching an antenna of 175 ohms resistance and -j305 reactance, for example, the auto transformer tap nearest 175 ohms in value should be chosen. In this case switch position 3 (250 ohms) is used. Notice that position 4 is also 250 ohms but it adds the 46 mmf capacitor as well. This, however, is not desired for tuning a capacitive antenna. After +j305 is added from the variable coil (L201) to reduce the antenna to a pure resistance, the standing wave ratio can be read from the meter or predicted mathematically as follows:

$$\text{VSWR} = \frac{\text{Antenna Resistance}}{\text{Tap Resistance}} \quad \text{or}$$

$$\frac{\text{Tap Resistance}}{\text{Antenna Resistance}}$$

The larger resistance is always in the numerator. In the above case the VSWR would be:

$$\frac{\text{Tap Resistance}}{\text{Antenna Resistance}} = \frac{250}{175} = 1.43$$

2-2 CIRCUIT ANALYSIS

2-2-1 THE DIRECTIONAL COUPLER

2-2-1-1 The DIRECTIONAL COUPLER is a sensing device for the VSWR meter circuit. Figure 2-3 shows that the coupler is essentially an RF bridge, one leg of which (R_O) is the resistance of the antenna and the coaxial line. If R_O should change to some value other than 50 ohms the bridge will be unbalanced and register a proportionate meter reading.

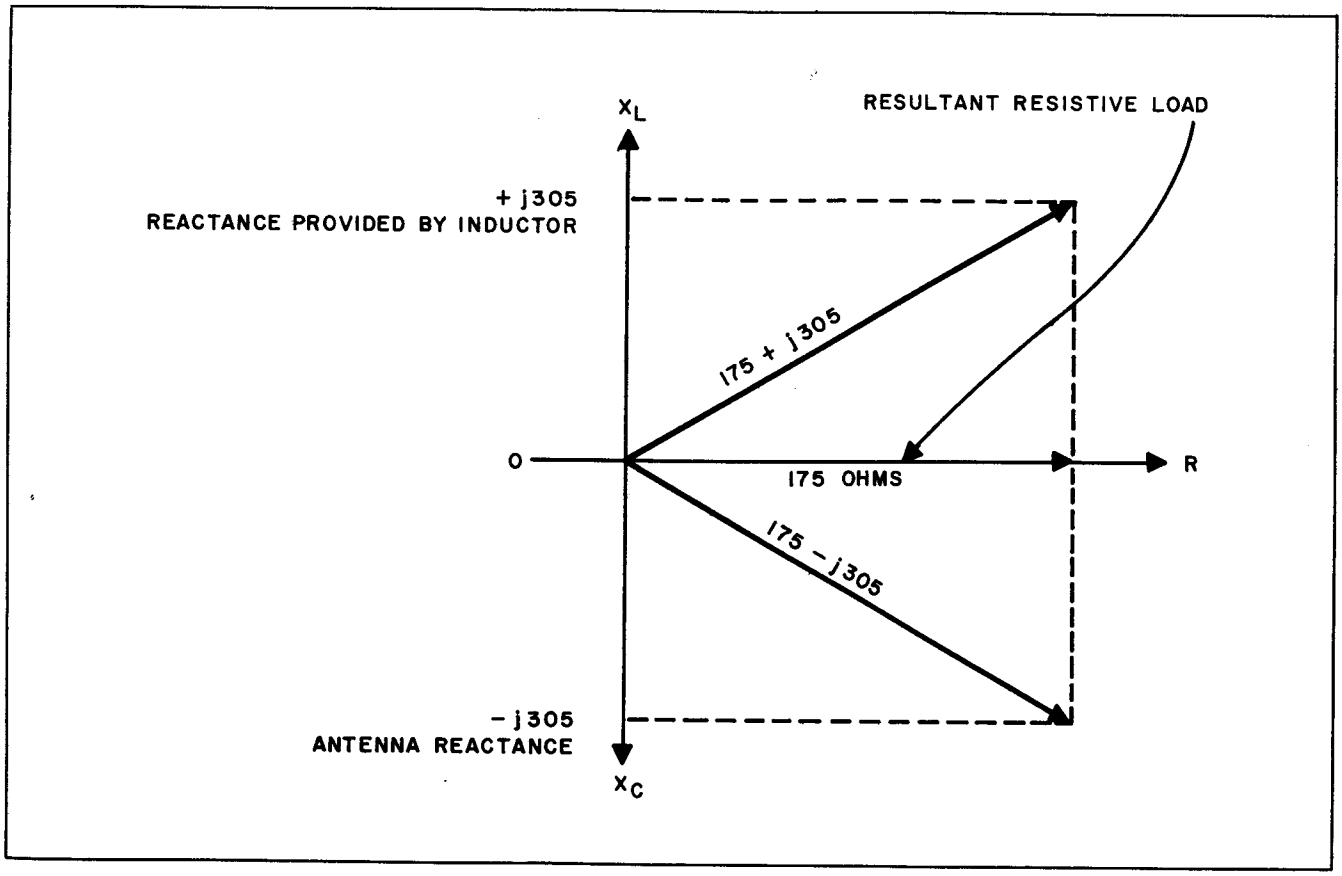


Figure 2-1 Capacitive Antenna

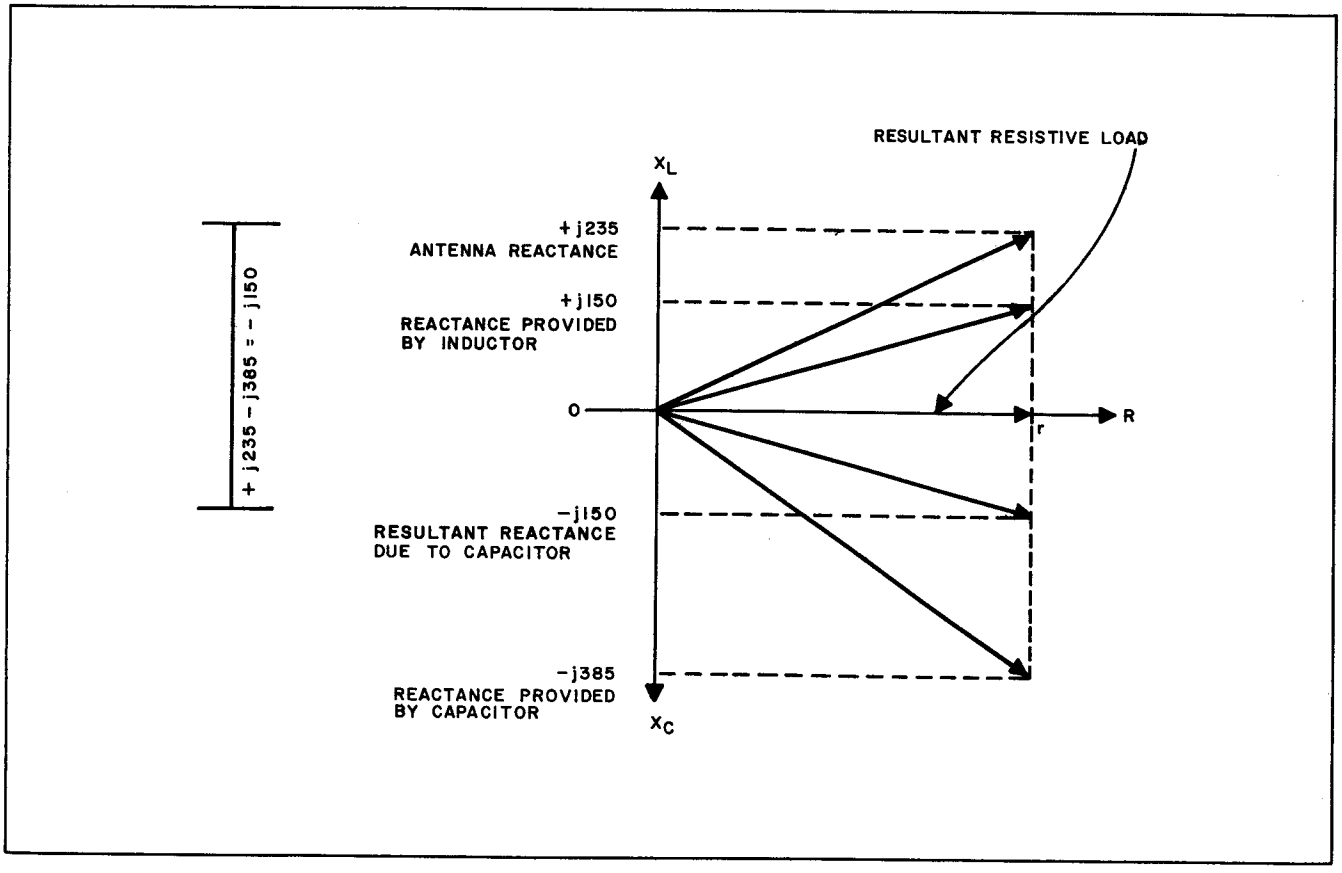


Figure 2-2 Inductive Antenna

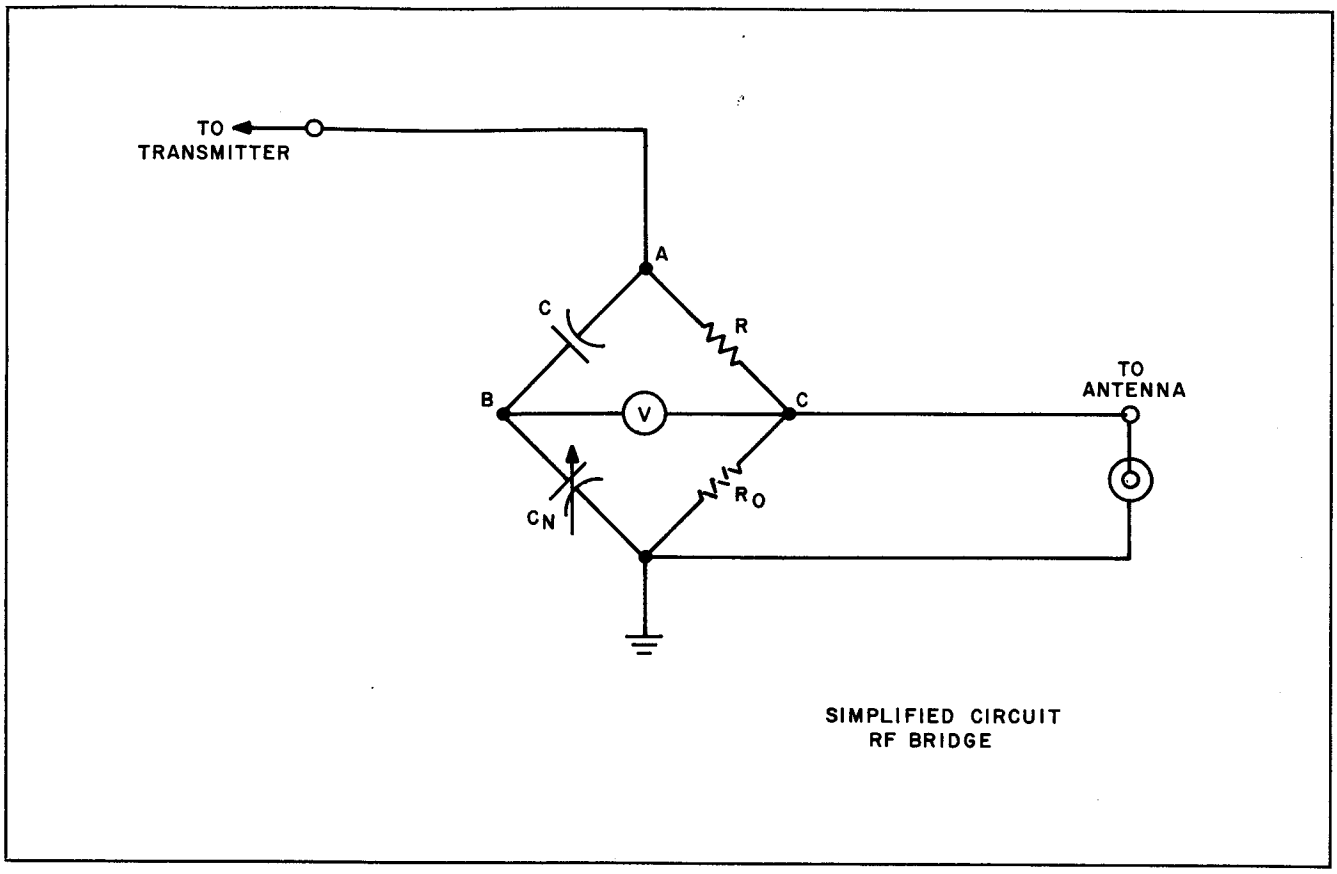


Figure 2-3 Simplified Circuit, R. F. Bridge

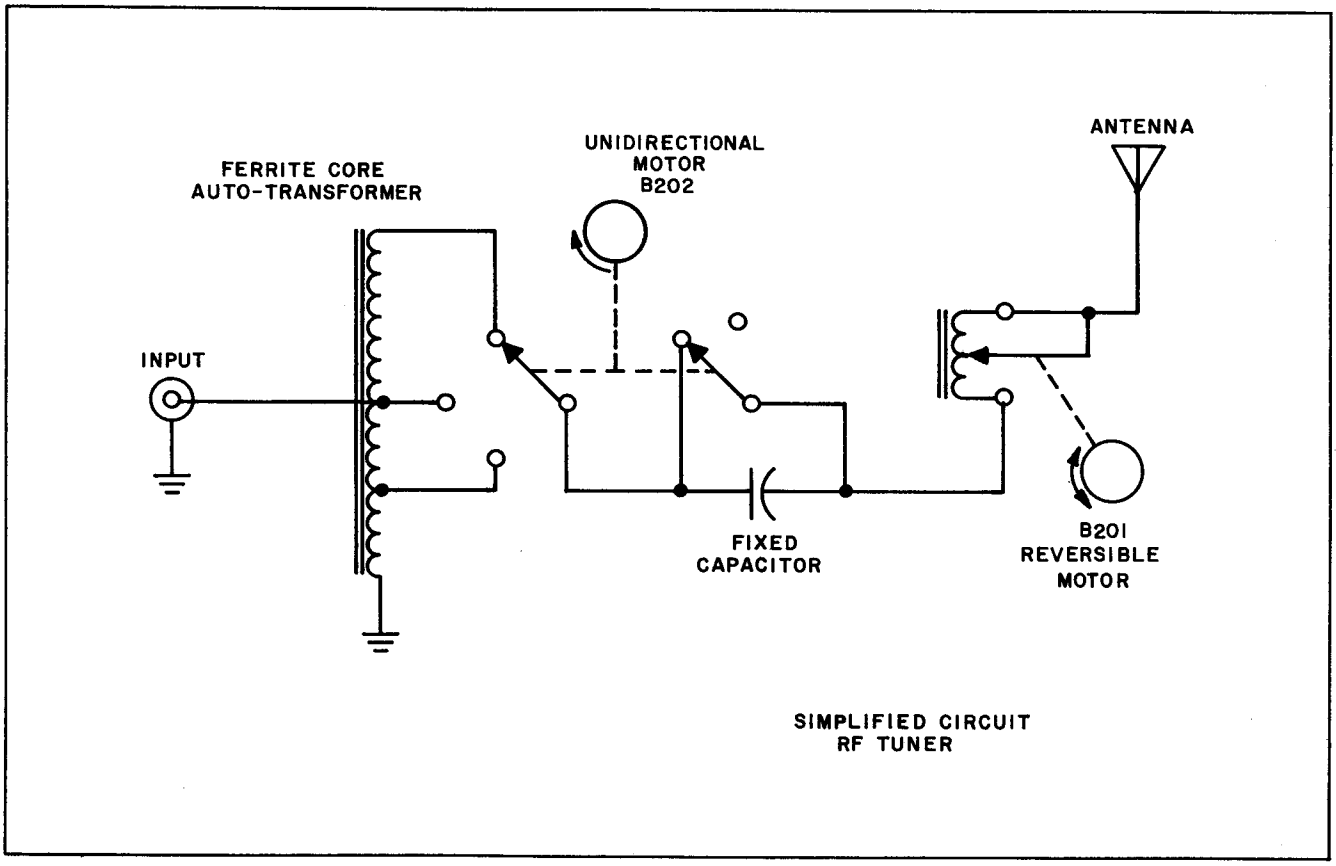


Figure 2-4 Simplified Circuit, R.F. Tuner

2-2-2 CONTROL MONITOR

2-2-2-1 The CONTROL MONITOR serves as the control, indicator, overload protector, and power supply unit of the ATS-2 system. Switches on the front panel provide control of the motors in the RF TUNER.

2-2-2-2 The large dual pointer meter has three scales which may be read simultaneously. The pointer tips indicate Forward and Reflected power measurements while the point of intersection of both pointers indicates the standing wave ratio on a special third scale. This third scale is composed of lines labeled with VSWR values. If the intersection of the pointer falls anywhere on a line, the VSWR is equal to the line number. Readings between lines may be interpolated. The small meter indicates Resistance, Reactance, and Humidity depending upon the position of the selector switch. For Resistance the actual meter movement is in response to the position of the S201A rotor in the voltage divider network wired to that section. The Reactance position of the small meter indicates the location of the moving tap of L201, the inductive tuning device. The sensing element for the meter in this measurement is R201 which is geared to the system and produces a voltage drop porportional to the tap position. The Humidity Sensing Element is essentially a resistor whose value changes with the amount of moisture in the RF TUNER case. This special element is the variable leg of a resistance bridge comprised of R110, R107, R109 and the calibration adjustment, R108.

2-2-2-3 The overload protector is dependent upon the transmitter power and the VSWR. When the transmitter power exceeds 1000 watts or the VSWR exceeds 4 to 1 the relays in the plate circuit of V102 will trip, disabling the transmitter. When in TUNE position, the relay will trip at 100 watts transmitter power.

2-2-2-4 The transformer, T101, provides voltages to operate the motors in the RF TUNER and operate V102. Some of the current from the transformer is rectified, filtered and voltage regulated for the plate circuit of V102.

SECTION III
INSTALLATION AND OPERATION

3-1 INSTALLATION

3-1-1 The TMC Model ATS-2, Antenna Tuning System, has been designed for ease of installation and minimum effort in operation. Each unit of the system is packed in an individual shipping container, and should be carefully unpacked. Packing material should be examined for loose items before discarding. A close visual inspection should be made to determine any physical damage due to rough handling during shipment. If damage is found, notify the carrier immediately.

3-1-2 The unit is designed for operation from 115 volt, 50-60 cycle or 230 volt 50-60 cycles. The unit is shipped for 115 volt AC operation. A simple wiring change on E101 is necessary to change the Model ATS-2 to 230 volt AC operation. See Figure 5-3. Remove the jumpers on E101 connecting terminal 3 and 5 and terminal 2 and 4. Connect a jumper from terminal 3 to 4.

3-1-3 Variations in the line voltage may effect the calibration of meter, M102. Check the calibration as described in Paragraph 4-3-2.

3-1-4 If excessive voltage drop occurs in the 10 wire control cable, another voltage tap is provided on the line transformer. Normally, terminal 7 on E101 (117 V) is used. If a voltage of 110 volts or less is experienced at the control motor terminals, when in operation, use terminal 6 on E101 (123 V) to make up the voltage drop in the 10 wire cable.

3-1-5 The units comprising the Antenna Tuning System are placed and installed as shown in Figure 3-1.

3-1-6 The CONTROL MONITOR and the DIRECTIONAL COUPLER are installed at the transmitter site. The DIRECTIONAL COUPLER should be located as close as possible to the transmitter output. The RF TUNER should be installed at the base of the 35 ft. whip antenna with a connecting lead of approximately 30 inches or less. The CONTROL MONITOR operates from a 115 or 230 volt 50-60 cycle power line.

3-1-7 The NULL adjustment, made on the DIRECTIONAL COUPLER, is dependent upon the characteristics of the system (cable lengths, etc.) with which the unit is used. The adjustment procedure is found in 4-3.

3-2 OPERATION

3-2-1 DESCRIPTION OF CONTROLS

3-2-1-1 All controls on the CONTROL MONITOR are readily identified by their markings and are arranged for ease of operation. The function of each control is as follows:

A. POWER switch controls the 115 or 230 volt AC input to the CONTROL MONITOR, the motor circuits, and indicator circuits of the RF TUNER. The switch also controls the range of the dual-pointer meter.

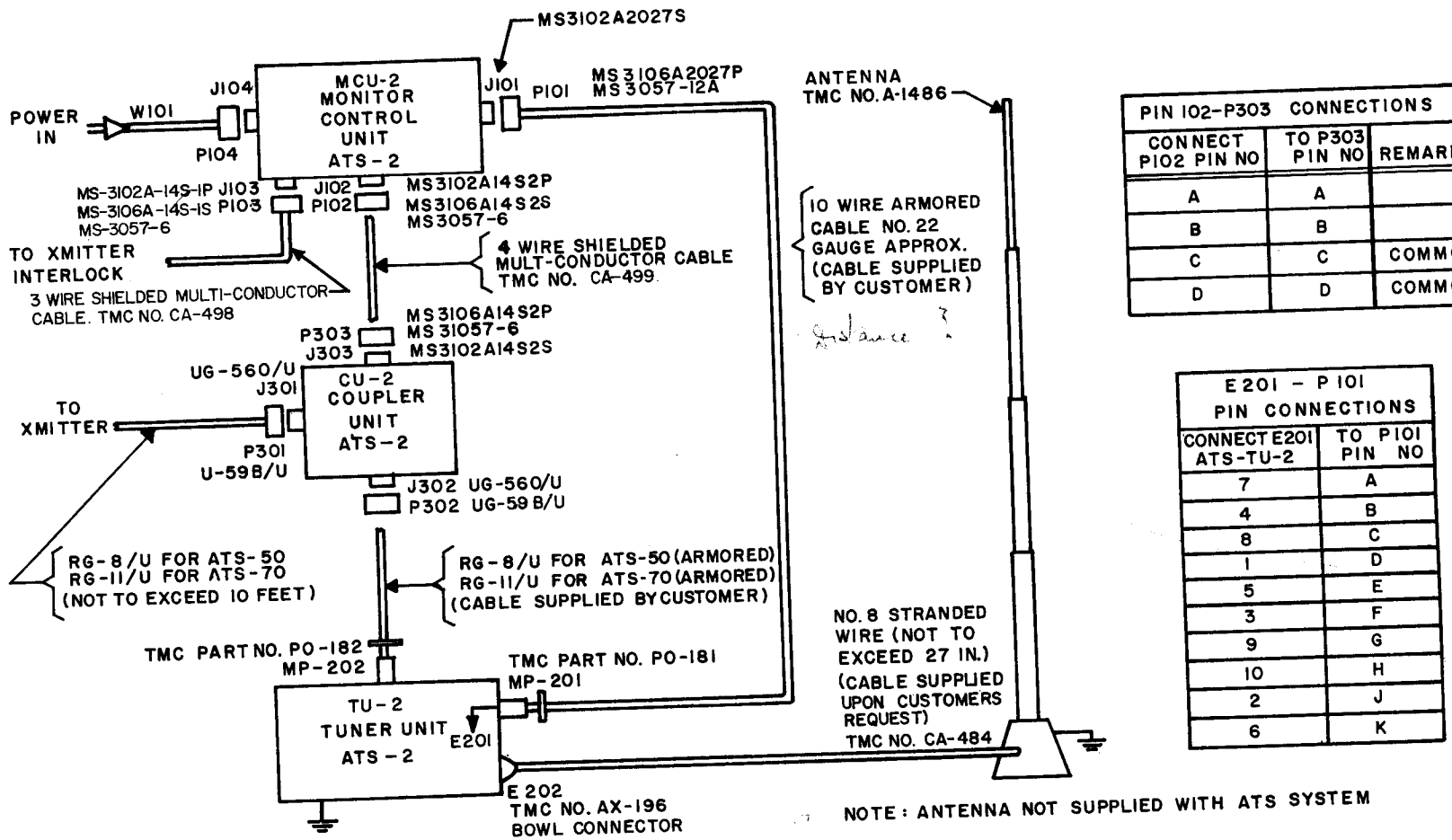
B. REACTANCE control is a 3 position lever action switch that returns to a neutral-center open circuit position when released. This switch controls the direction of the reversible motor that drives the contact on the variable inductance. When the control is held in the INCR position, the motor rotates in a direction to increase the reactance of the coil. When the switch is held in the DECR position, the motor rotates in a direction to decrease the reactance of the coil.

C. RESISTANCE control is a momentary contact push button switch. This switch controls the unidirectional motor that drives the switch to select the particular auto-transformer tap required to match the antenna resistance. The switch contacts RESISTANCE positions 1 to 6 in a clockwise direction, then repeats the cycle.

D. METER switch is a 3 position rotary switch that returns to the REACT. position when released. When in the RES. position, read the red RESISTANCE scale of the 2 inch rectangular meter calibrated 1 to 6. See Table 1 for complete description of the RED SCALE. When in the REACT. range position, read the upper black REACTANCE scale calibrated in arbitrary units from 0 to 100. This scale gives an approximate position of the motor driven short on the variable inductor. The 0 position represents minimum inductance while 100 represents the maximum inductance.

E. The HUM. position is used to give an indication of the amount of moisture present in the RF TUNER case. When the meter reads on the red portion of the lower HUMIDITY scale, moisture is settling out in the case.

F. STANDING WAVE INDICATING METER consists of a dual pointer meter with scales calibrated for FORWARD power, REFLECTED power, and VOLTAGE STANDING WAVE RATIO (VSWR). The FORWARD and REFLECTED power scales are calibrated 0-100 watts. The scale readings are multiplied by the factor indicated

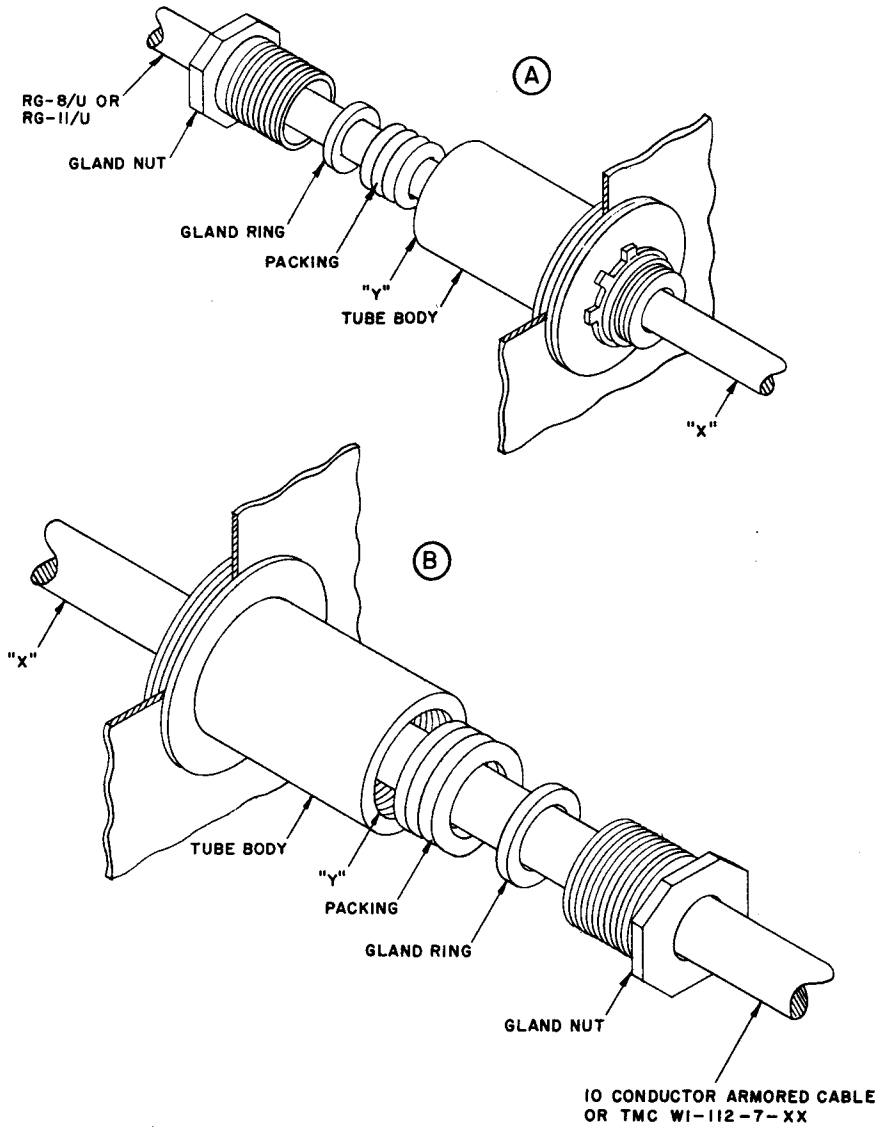


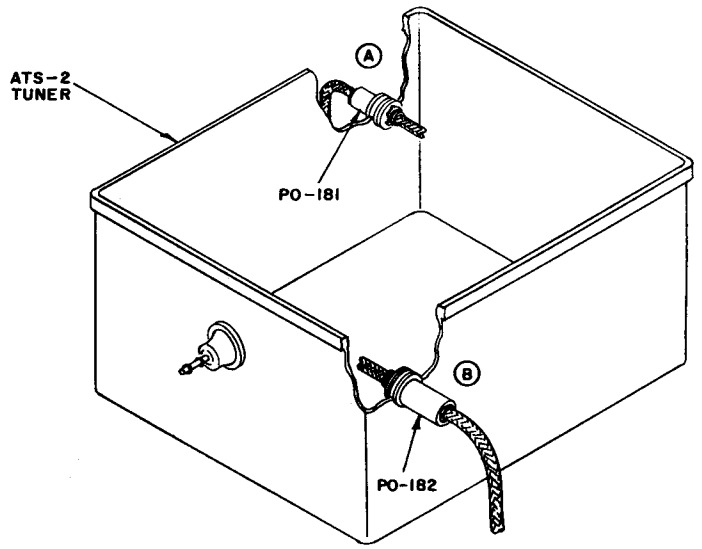
PIN 102-P303 CONNECTIONS		
CONNECT P102 PIN NO	TO P303 PIN NO	REMARKS
A	A	
B	B	
C	C	COMMON
D	D	COMMON

E 201 - P 101 PIN CONNECTIONS	
CONNECT E201 ATS-TU-2	TO P101 PIN NO
7	A
4	B
8	C
1	D
5	E
3	F
9	G
10	H
2	J
6	K

Figure 3-1 Interconnect Diagram, Model ATS-2

ID-232





TERMINAL TUBE LOCATION

NOTE

1. REMOVE FROM TUBE BODY, GLAND NUT AND GLAND RING.
2. INSERT CABLE THROUGH GLAND NUT, GLAND RING AND TUBE BODY. ALLOW ENOUGH CABLE AT "X" FOR STRIPPING AND CONNECTION TO TERMINAL BOARD.
3. WIND PACKING AROUND CABLE AND PRESS INTO TUBE TO WITHIN 3/8" OF "Y" TO ALLOW FOR GLAND RING AND GLAND NUT.

Figure 3-2 Assembly Instructions for Terminal Tubes

by the POWER switch. The VSWR on the transmission line is indicated by the point of intersection of the FORWARD and REFLECTED power meter pointers.

G. STOP indicator is used to indicate when either the minimum or maximum inductance values have been reached. Micro switches are incorporated to prevent the reactance tuning motor from overdriving at either end of the coil travel. The switches break the motor circuit and energize the STOP indicator.

H. RESET switch operates the latching relay to return it to the original position if it has been tripped by the overload circuit because of too high VSWR or transmitter power.

J. TUNE/OPERATE switch in the TUNE position limits the amount of power used to 100 watts when tuning the unit. This prevents damage which might result due to operating the RESISTANCE control when the transmitter is operated at higher power. The transmitter will be disabled by the overload circuit if more than 100 watts is used in this position.

3-2-2 TUNING PROCEDURE

3-2-2-1 The initial tuning, required to produce a minimum VSWR on the transmission line, must be performed at reduced transmitter power. This will prevent overheating of the components in the DIRECTIONAL COUPLER, particularly when the VSWR is greater than 3. Keep the maximum power output below 100 watts so that all tuning may be done with the POWER switch in the X1 position and the TUNE/OPERATE switch in the TUNE position.

3-2-2-1-1 If, for example, it is desired to operate the transmitter at 4 Mc (antenna location is dry) proceed as follows:

A. Turn the POWER switch on the CONTROL MONITOR to the X10 position.

B. Refer to Table 2. For 4 Mc (dry), the antenna looks like 13.2 -j244 ohms. This will best be matched by RESISTANCE position 1 which covers 2 to 35 ohms resistance (see Table 1).

C. Place the METER switch in the RES. position. Observe what position the scale indicates. For instance, suppose it is indicating position 4.

D. Depress the RESISTANCE control for about two seconds and then release. The motor will drive the switch and will automatically stop at position 5. Depress the RESISTANCE control again for two seconds and release. The switch will stop at indicated position 6. Repeat this procedure until the desired position is reached. Keep in mind the switch rotates with a sequence of 1, 2, 3, 4, 5, 6 and repeats.

NOTE

Table 2 indicates the approximate values of resistance as well as reactance that can be expected from a 35 ft. whip antenna over a 2 to 32 Mc range. This table can be used to approximate settings of the ATS-2 before operation. During operation the VSWR meter is the best tuning guide.

E. Place the POWER switch in the X10 position and the METER switch in the REACT. position.

F. Place the TUNE/OPERATE switch in TUNE position.

G. Turn the transmitter on and adjust the power output to not more than 100 watts. If 100 watts is exceeded, the overload relay will trip, shutting off the transmitter. If this occurs, reduce power and press RESET switch.

H. Observe the power output on both the FORWARD and REFLECTED meter scales. If below 100 watts advance the POWER control to X1.

J. Observe particularly the REFLECTED power and operate the REACTANCE control in either the INCR. or DECR. direction to minimize the REFLECTED power reading. This will produce a minimum VSWR of 2.5 to 1 or less.

CAUTION

REACTANCE SCALE READINGS SHOULD NEVER EXCEED 20 WHEN FREQUENCIES OVER 10 MC ARE BEING TUNED.

K. Place TUNE/OPERATE switch on OPERATE.

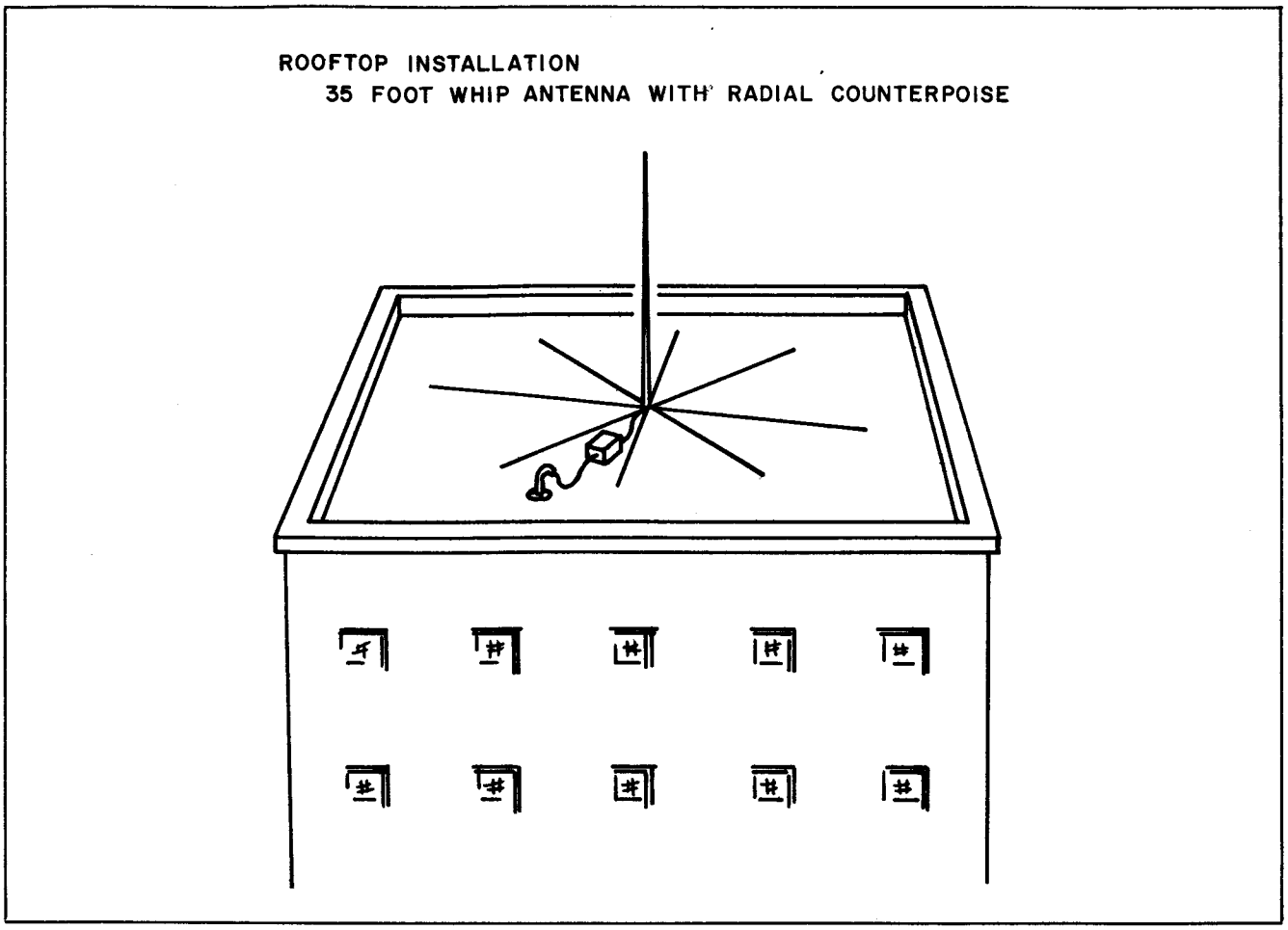
L. Place the POWER switch in the X10 position and increase the transmitter output not to exceed 1000 watts.

CAUTION

THE RESISTANCE CONTROL MUST NOT BE OPERATED WHEN THE TRANSMITTER OUTPUT IS IN EXCESS OF 100 WATTS. SERIOUS DAMAGE TO THE EQUIPMENT WILL RESULT IF THIS IS NOT OBSERVED.

Readjust the REACTANCE control until minimum REFLECTED power (and minimum VSWR) is observed on the meter.

M. The POWER switch can now be placed in the SHORT position (meter-shorted) to guard against damage to the meter due to surges in the transmitter power output.



Rooftop Installation, 35 foot whip antenna with radial counterpoise.

For Steps B, C and J Table 3a or 3b (whichever applies) will be found useful. This table was compiled for the development of this system. It will give approximate RESISTANCE as well as approximate REACTANCE positions for various frequencies.

MODIFICATION OF TRANSMITTER INTERLOCKS

Some of the TMC Models GPT-750 require modification of the interlock circuit in order to utilize the overload circuit of the Model ATS-2. These changes are simple, and will provide protection for the equipment.

For all Models GPT-750( )-1 request the TMC Modification Kit (S-436) which will be provided free of charge.

Make the following changes on all Models GPT-750( )-2 carrying serial numbers lower than 621.

1. Disconnect the wire going to S504 (RTF-2) interlock from terminal 11, E501.
2. Connect this wire to terminal 26 of E502.
3. Connect a MWC18(16) J903 wire or equivalent from terminal 11, E501, to terminal 28, E502, shaping the wire to follow the adjacent cabling.

COUNTERPOISE FOR 35 FOOT VERTICAL WHIP ANTENNA

Performance of a vertical whip antenna is usually improved when 6 to 12 radials (35 foot heavy guage) are installed at the base of the antenna. These radials are best located in the plane of the base of the antenna at an angle of 90 degrees to the mast and spaced at equal angles 30 to 60 degrees apart. The radials are best made from #6 copperweld wires cut to length and securely joined together at a point of intersection near the antenna base. A connection is then made from this junction to one of the metal mounting lugs of the RF Tuner of the ATS-2.

Use of these radials is especially recommended for rooftop installations or in locations where ground conductivity is not optimum.

SECTION IV
MAINTENANCE

4-1 GENERAL

4-1-1 The Model ATS-2 has been designed for long term trouble free duty. Little attention beyond normal maintenance is required. Any maintenance to the equipment should be performed by a competent technician.

4-2 PREVENTIVE MAINTENANCE

4-2-1 In order to prevent failure of the equipment due to corrosion, dust, and other destructive ambient conditions, the inside of each unit should be thoroughly inspected for signs of dirt, dampness, molding, charring or corrosion. This should be done periodically depending upon the severity of conditions. Correct any defect with a cleaning agent of proven quality.

4-3 CALIBRATION

4-3-1 VSWR METER

CAUTION

THIS SECTION REQUIRES THE USE OF RF ENERGY FROM THE TRANSMITTER. FOLLOW INSTRUCTIONS CAREFULLY. EACH TIME THE PROCEDURE CALLS FOR TRANSMITTER POWER TO BE OFF USE THE FINAL PLATES SWITCH OR ITS EQUIVALENT.

Have the following equipment available for use:

Adjustment tool, TMC No. TP-110, supplied with ATS-2
DIRECTIONAL COUPLER
CONTROL MONITOR
70 ohm, 1000 watt Resistive Load for ATS(70)-2
50 ohm, 1000 watt Resistive Load for ATS(50)-2
See note following Step X.
Transmitter used with system.
RF VTVM

A. Connect the 50 ohm resistive load to J303 of the DIRECTIONAL COUPLER.

B. Couple system cabling according to Figure 3-1. The RF TUNER is not used.

C. Turn R102, R103, R104 and R105 of the CONTROL MONITOR to minimum resistance (fully clockwise). Remove V102 from its socket. The tube will be returned to its socket in a later step. Keep the tube in a safe place.

D. If pointers of the VSWR meter do not rest on zero, adjust them to zero by slowly turning screwheads at pointer hubs.

E. Turn POWER switch to X1 position.

F. Tune the Transmitter to an output frequency of 6.0 Mc on low power (less than 100 watts).

G. With Transmitter output level at minimum, slowly increase the drive until VSWR Meter indicates 100 on the FORWARD power black scale.

H. Adjust the NULL capacitor, C308, of the DIRECTIONAL COUPLER until the reflected power red scale of the VSWR Meter indicates minimum.

J. Turn the Transmitter OFF. REVERSE the RF cables on the DIRECTIONAL COUPLER by connecting the 50 ohm load to J302 and the Transmitter to J303.

K. Turn the Transmitter ON. Increase power until the REFLECTED power scale of the VSWR meter reads 100.

L. Adjust the EQUALIZER capacitor, C307, on the DIRECTIONAL COUPLER until FORWARD power reads minimum.

M. Turn the Transmitter final plates OFF. Restore cable connections of the DIRECTIONAL COUPLER to normal operating positions (Transmitter to J302; load to J303).

N. Adjust R102, R103, R104 and R105 to maximum resistance (fully counter-clockwise.)

P. Connect the RF VTVM across the 50 ohm resistive load at J303 of the DIRECTIONAL COUPLER.

Q. Turn the Transmitter ON and adjust its output level until the RF VTVM indicates 70.7 volts on the ATS(50)-2 or 83.7 volts on the ATS (70)-2.

R. Adjust R102 of the CONTROL MONITOR until FORWARD power of the VSWR meter reads 100.

S. Turn the Transmitter OFF. Reverse RF connections to the DIRECTIONAL COUPLER as before so that the Transmitter connects to J303.

T. Turn the Transmitter ON. Adjust power output to read 70.7 volts on the ATS(50)-2 or 83.7 volts on the ATS(70)-2.

U. Adjust R105 of the CONTROL MONITOR until REFLECTED power of the VSWR meter reads 100.

V. Turn the Transmitter OFF. Restore the RF cables and load of the DIRECTIONAL COUPLER to their normal operating positions.

W. Turn the POWER switch of the DIRECTIONAL COUPLER to X10 position.

X. Turn the Transmitter ON and adjust its output level to 224 volts on the ATS(50)-2 or 265 volts on the ATS(70)-2 as read on the RF VTVM.

NOTE

If a 1000 watt dummy load is not available, see Table 5 for alternative voltages and powers. 4-3

Y. Adjust R103 of the CONTROL MONITOR until the FORWARD power scale of the VSWR Meter reads 1000 (100 x 10).

Z. Turn the Transmitter OFF. Reverse the connections to the DIRECTIONAL COUPLER.

AA. Turn the Transmitter ON and check 224 volts for the ATS(50)-2 or 265 volts for the ATS (70)-2 output level on the RF VTVM.

BB. Adjust R104 of the CONTROL MONITOR until REFLECTED power scale of the VSWR Meter indicates 1000 watts.

CC. Turn the Transmitter OFF. Restore connections to the DIRECTIONAL COUPLER to their normal operating positions. See Figure 3-1.

DD. Replace V102 in its socket.

4-3-2 METER M102

4-3-2-1 HUMIDITY INDICATION

A. Disconnect cable from J101 on the CONTROL MONITOR.

B. Turn the POWER switch to SHORT position.

C. Hold the METER switch in HUM. position.

D. If the meter does not indicate 0, adjust R108 until it does.

4-3-2-2 REACTANCE INDICATION

A. Connect the 10 wire control cable between the CONTROL MONITOR and RF TUNER.

B. Turn the POWER switch to SHORT.

C. Operate the REACTANCE control in the INCR position until the STOP indicator lights.

D. M102 should read 100.

4-4 OVERLOAD CIRCUIT ADJUSTMENT

4-4-1 EQUIPMENT REQUIRED

Complete ATS-2
Transmitter
Vacuum tube voltmeter
Antenna
1000 watt dummy load, if available

4-4-2 PROCEDURE

A. Make connections as shown in Figure 3-1. (If 1000 watt dummy load is available).

B. Turn POWER switch on the CONTROL MONITOR to the X1 position.

C. Set the TUNE/OPERATE switch on the CONTROL MONITOR to TUNE position.

D. Allow 2 minutes for tube warm-up.

E. Turn R120, R121 and R122 on the CONTROL MONITOR fully counter-clockwise for maximum resistance.

F. Adjust the transmitter for 100 watts output. Use a frequency which will allow the transmitter to be tuned for a standing wave ratio of unity (1:1). For example 6 Mc might be used.

G. Turn R122 clockwise until the latching relay K103 of the unit trips to cut transmitter power.

H. Reduce transmitter power. Press RESET switch on the CONTROL MONITOR to reset K103. Increase transmitter power slowly until the power required for this step is reached. When 100 watts is reached, K103 will again trip to cut the transmitter off. If this does not occur, readjustment of R122 is necessary. Repeat the above until R122 is correctly adjusted.

J. When R122 is correctly set, carefully tighten its lock nut.

K. Turn POWER switch on the CONTROL MONITOR to the X10 position. Turn TUNE/OPERATE switch to OPERATE position.

L. Adjust the transmitter output to 1200 watts. Note that the FORWARD power indication of the VSWR meter will exceed full scale by approximately 1/4 inch. If the transmitter available is not rated for 1000 watts output, tune the transmitter used for maximum output.

M. Turn R121 clockwise until K103 trips to cut transmitter power. Proceed as in step H above until R121 is properly adjusted.

N. When R121 is correctly set, carefully tighten its lock nut.

P. Press the RESET switch to reset K103 and reactivate the transmitter.

Q. Reduce transmitter power to 1000 watts. If transmitter available is not rated for 1000 watts, leave its output at maximum.

R. Using the REACTANCE switch on the CONTROL MONITOR, vary the inductance until the VSWR meter indicates a standing wave ratio of 4 to 1.

S. Turn R120 clockwise until K103 trips to cut transmitter power. Proceed as in step H above until R120 is properly adjusted.

T. When R120 is properly set, carefully tighten its lock nut.

4-5 MECHANICAL ADJUSTMENTS

4-5-1 READJUSTMENT OF INDUCTANCE DRIVE SYSTEM

A. Connect the RF TUNER to the CONTROL MONITOR as shown in Figure 3-1.

B. Remove cover from RF TUNER case.

C. Loosen set screws that hold worm gear and switch actuating levers to control shaft of R201.

TABLE 4-1 ROTARY SWITCH OPERATION FOR ANTENNA MATCHING

RESISTANCE POSITION	T201 TAP #	T201 OHMS	COVERS ANTENNA RESISTANCE RANGE	COVERS ANTENNA REACTANCE RANGE
1	1	17	2 - 35	0 to -j850
2 *	1	17	2 - 35	0 to +j750
3	2	70	35 - 140	0 to -j850
4 *	2	70	35 - 140	0 to +j750
5	3	250	125 and higher	0 to -j850
6 *	3	250	125 and higher	0 to +j750

NOTE: The odd number switch positions are used when the antenna exhibits -j or capacitive reactance. The even number switch positions are used when the antenna exhibits +j or inductive reactance.

* Indicates - 46 uufd (C201) added in series.

D. Turn POWER switch to SHORT position.

E. Hold REACTANCE switch in DECR position until motor driven tap of L201 is 1/4 turn from end of coil (end away from motor).

F. Turn R201 control shaft by hand until reading of M102 is zero.

G. Tighten worm gear set screws.

H. Turn POWER switch OFF.

J. Turn lever that actuates S203 until it depresses the switch plunger.

K. Tighten set screws that lock lever in place on shaft.

L. Turn POWER switch to SHORT position.

M. Hold REACTANCE switch in INCR position until motor driven tap is 1/4 turn from the other end of the coil.

N. Turn POWER switch OFF.

P. Turn lever that actuates S202 until it depresses the switch plunger.

Q. Lock lever in place on shaft by tightening set screws.

R. The mechanism should now stop automatically when motor driven tap reaches 1/4 turn from either end of the coil.

4-6 DESSICANT

4-6-1 A 16 unit bag of dessicant is attached to the inside of the RF TUNER case cover to help prevent moisture from gathering on the components within. Should the humidity indicator show that a change of dessicant is necessary, replace with a fresh bag. Allow a reasonable amount of time for chemical action to register change on humidity meter reading. If the meter does not then indicate a sufficient drop in humidity, check its calibration.

4-7 SPARK GAP

4-7-1 The spark gap is provided for protection of the unit from static charges. The gap should be set at approximately 1/8 (.125).

TABLE 4-2 35 FOOT WHIP ANTENNA MEASUREMENTS

WET CONDITIONS			
MC	RES. OHMS	REACT. OHMS	SUGGESTED ANT. RES. POSITION #
2	8.0	-j400	1
3	10.8	-j317	1
3.5	16.4	-j287	1
4	17.3	-j237	1
4.5	18.2	-j200	1
5	18.0	-j160	1
6	43	-j33	3
7	54.0	0	4
8	130	+j88	6
9	230	+j152	6
10	492	-j128	5
11	318	-j237	5
12	100	*-j418	3
13	32	*-j385	1
14	30	*-j357	1
15	25	-j292	1
16	13.3	+j23	2
17	38.2	+j188	4
18	22	-j155	1
19	33.5	-j36	3
20	59	-j105	3
22	61.5	-j6.8	3
24	32	-j200	1
26	68.5	*-j190	3
28	43.5	*-j178	4
30	47.2	-j133	4

DRY CONDITIONS			
MC	RES. OHMS	REACT. OHMS	SUGGESTED ANT. RES. POSITION
2	7.8	-j430	1
3	9.2	-j350	1
3.5	12.7	-j293	1
4	13.2	-j244	1
4.5	13.4	-j190	1
5	13.7	-j158	1
6	40	-j67	3
7	50	+j16	4
8	149	+j109	6
9	288	+j90	6
10	438	-j22	5
11	308	-j246	5
12	45	*-j418	3
13	30	*-j385	1
14	25	*-j350	1
15	23	-j283	1
16	28	+j84	2
17	34.6	+j74	2
18	18.9	-j134	1
19	33	-j163	3
20	52.8	-j60	3
22	114	-j50	3
24	28	-j160	1
26	94	*-j193	3
28	40	*-j180	4
30	35.5	-j136	4

* Indicates - more than

NOTE: These measurements were made at a site fairly free from obstructions. It is possible that at other locations there will be variances in both ANTENNA RESISTANCE and REACTANCE.

TABLE 4-3 VOLTAGE ACROSS LOAD VS POWER

VOLTAGE ACROSS RESISTIVE LOAD MEASURED WITH RF VTVM		CORRESPONDING READING OF FORWARD WATTS SCALE
ATS (50)-2	ATS (70)-2	
224	265	1000
200	237	800
173	205	600
141	167	400
100	118	200
86.6	102	150
70.7	83.7	100

SECTION V
PARTS LIST

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
C101	CAPACITOR, fixed: mica; .01 ufd, ±10%, char. B, 300 wvdc.	Line Filter	CM35B103K
C102	CAPACITOR, fixed: mica; .01 ufd, ±10%, char. B, 300 wvdc. Same as C101.	Line Filter	CM35B103K
C103	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc.	RF Bypass	CC-100-16
C104	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C105	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C106	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C107	CAPACITOR, fixed: mica; .01 ufd, ±10%, char. B, 300 wvdc. Same as C101.	RF Bypass	CC-100-16
C108	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C109	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C110	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C111	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C112	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C113	CAPACITOR, fixed: dry electrolytic; polarized; 10 ufd, 300 wvdc, char. C.	DC Filter	CE64C100N
C114	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C115	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C116	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C117	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16
C118	CAPACITOR, fixed: ceramic; .01 ufd, +80 -20%, 500 wvdc. Same as C103.	RF Bypass	CC-100-16

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
CR101	RECTIFIER, metallic: half wave; 130 volts; 65 ma.	Rectifier	RX-104
E101	TERMINAL STRIP, barrier type: molded phenolic, 10 brass nickel plated 6-32 binding head machine screws.		TM-100-10
F101	FUSE, cartridge type: 2.0 amp.	Line Fuse	FU-100-2.0
I101	LAMP, incandescent: min. bayonet base; 6/8 volts, 0.15 amp, T-3-1/4 bulb.	Stop Indicator	BI-101-47
I102	LAMP, neon: min. bayonet base; 110/125 volts, 1/25 watt, T-3-1/4 bulb.	AC Power Ind.	BI-100-51
I103	LAMP, neon: min. bayonet base; 110/125 volts, 1/25 watt, T-3-1/4 bulb.	Overload Ind.	BI-100-51
J101	CONNECTOR, receptacle: female.	To Directional Coupler	MS3102A2027S
J102	CONNECTOR, receptacle: female.	To Antenna Coupler	MS3102A14S2P
J103	CONNECTOR, receptacle.	To Xmtr Interlock	MS3102A14S1P
J104	RECEPTACLE; male twist lock: 2 contacts, 10 amps at 200 v; 15 amps at 125 v.	To Power Line	JJ-100
K101	RELAY, armature: octal; SPDT; 5,000 ohms, silver contacts rated at 2 amps at 115 V AC; 7.2 pull-in ma.	Fwd Power Overload	RL-120-5-502
K102	RELAY, armature: octal; SPDT; 5,000 ohms, silver contacts rated at 2 amps at 115 V AC; 7.2 pull-in ma. Same as K101.	Refl. Power Overload	RL-120-5-502
K103	RELAY, armature: dual; locking 4 PDT; 1460 ohms, 33 ma; silver contacts rated at 5 amps at 115 V AC.	Overload	AR-115
M101	METER, S.W.R.: dual meter forward and reflected power.	SWR Indicator	MR-112
M102	METER, reactance/resistance/ humidity: 260 ohms, ±10%, 0-200 ua movement.	Multiple Ind.	MR-100-7
MP101	KNOB, instrument type: black phenolic; 1-1/8 in. dia. x 5/8 in. deep; fits 1/4 in. shaft.		MP-109-2
MP102	KNOB, instrument type: black phenolic; 1-1/8 in. dia. x 5/8 in. deep; fits 1/4 in. shaft. Same as MP101.		MP-109-2
R101	RESISTOR, fixed: wire wound; 1000 ohms, 25 watts.	Current Limiting I101	RW-111-20

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
R102	RESISTOR, variable: composition; 25000 ohms, ±20%, 2 watts, linear taper.	Calibrate Adj.	RV4ATXA253B
R103	RESISTOR, variable: composition; 100,000 ohms, ±20%, 2 watts, linear taper.	Calibrate Adj.	RV4ATXA104B
R104	RESISTOR, variable: composition; 100,000 ohms, ±20%, 2 watts, linear taper. Same as R103.	Calibrate Adj.	RV4ATXA104B
R105	RESISTOR, variable: composition; 25000 ohms, ±20%, 2 watts, linear taper. Same as R102.	Calibrate Adj.	RV4ATXA253B
R106	RESISTOR, fixed: composition; 100,000 ohms, ±10%, 1 watt.	Current Limiting I102	RC30GF104K
R107	RESISTOR, fixed: composition; 27,000 ohms, ±10%, 1 watt.	Hum. Bridge Res.	RC30GF273K
R108	RESISTOR, variable: composition; 50,000 ohms, ±20%, 2 watts, linear taper.	Hum. Bridge Res.	RV4ATXA503B
R109	RESISTOR, fixed: composition; 27,000 ohms, ±10%, 1 watt. Same as R107.	Hum. Bridge Res.	RC30GF273K
R110	RESISTOR, fixed: composition; 27,000 ohms, ±10%, 1 watt. Same as R107.	Hum. Bridge Res.	RC30GF273K
R111	RESISTOR, fixed: composition; 75,000 ohms, ±5%, 1 watt.	Hum. Bridge Res.	RC30GF753J
R112	RESISTOR, fixed: composition; 82,000 ohms, ±10%, 1 watt.	Hum. Bridge Res.	RC30GF823K
R113	RESISTOR, fixed: composition; 360,000 ohms, ±5%, 1 watt.	Current Limiting	RC30GF364J
R114	RESISTOR, fixed: composition; 160,000 ohms, ±5%, 1 watt.	Current Limiting	RC30GF164J
R115	RESISTOR, fixed: composition; 22 ohms, ±10%, 1 watt.	DC Filter	RC30GF220K
R116	RESISTOR, fixed: wire wound; 1000 ohms, ±5%, 10 watts.	Current Limiting V101	RW-109-24
R117	RESISTOR, fixed: composition; 15,000 ohms, ±10%, 2 watts.	Voltage Divider	RC42GF153K
R118	RESISTOR, fixed: composition; 15,000 ohms, ±10%, 2 watts. Same as R117.	Voltage Divider	RC42GF153K
R119	RESISTOR, fixed: composition; 4700 ohms, ±10%, 1 watt.	Relay Shunt K102	RC30GF472K
R120	RESISTOR, variable: composition; 1000 ohms, ±20%, 2 watts, linear taper.	Refl. Trip Adj.	RV4ATXA102B

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
R121	RESISTOR, variable: composition; 1000 ohms, ±20%, 2 watts, linear taper. Same as R120.	For. Trip Adj.	RV4ATXA102B
R122	RESISTOR, variable: composition; 250 ohms, ±20%, 2 watts, linear.	Tune Trip Adj.	RV4ATXA251B
R123	RESISTOR, fixed: composition; 100,000 ohms, ±10%, 1 watt. Same as R106.	Current Limiting I103	RC30GF104K
S101	SWITCH, rotary: 4 positions, 30°detent; 2 sections, non-shorting, mycalex insulation.	Power Switch	SW-208
S102	SWITCH, push-button: momentary, slow make and break; 2 circuit n.o.and n.c.; 1 amp, 125 VAC.	S201 Control	SW-227
S103	SWITCH, lever type: 3 position, non-locking.	Reactance Inc., Decr. Switch	SW-213
S104	SWITCH, rotary: 3 position, non-locking, spring return; silver contacts; 45 deg. angle of throw.	Hum. React. Res. Switch	SW-214
S105	SWITCH, push-button: momentary, slow make and break; 2 circuit n.o. and n.c.; 1 amp, 125 VAC. Same as S102.	K102 Reset	SW-227
S106	SWITCH, toggle: DPDT, 3 amp, 250 v.	Tune/Operate Switch	ST-22N
T101	TRANSFORMER, power: pri. 115/230 v, 50/60 cps; sec. 12.6 v at 1 amp, 123/117 v at .35 amp; 2-3/4 in. lg x 2-3/8 in. wide x 3-13/16 in. high o/a.	Main Power Trans.	TF-207
V101	TUBE, electron: voltage regulator, 7 pin miniature.	Voltage Reg.	OC2
V102	TUBE, electron: mediummu, duo-triode, 9 pin miniature.	Overload Amp.	12AT7
XF101	HOLDER, fuse.	Holder for F101	FH-100-3
XI101	SOCKET, indicator: w/red frosted lens.	Socket for I101	TS-106-1
XI102	SOCKET, indicator: w/white frosted lens.	Socket for I102	TS-106-2
XK101	SOCKET, octal.	Socket for K101	TS-101-P01
XK102	SOCKET, octal. Same as XK101.	Socket for K102	TS-101-P01
XV101	SOCKET, miniature, 7 pin.	Socket for V101	TS-102-P01
XV102	SOCKET, miniature, 9 pin.	Socket for V102	TS-103-P01

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
A301	COUPLER ASSEMBLY: consists of the following items: NOTE: TMC Part ATS-50CU-2 Coupler Assembly, is replaced as a unit. It requires precise alignment at the factory before use.		ATS-50CU-2
C301	CAPACITOR, fixed: ceramic; feed thru type; 750 uufd, ±20%, 500 wvdc, char. P. Not a replaceable item. See A301.	Voltage Divider	CC-108-1P750M
C302	CAPACITOR, variable: glass; 0.8 to 10.0 uufd, 3000 wvdc, quartz dielectric. Not a replaceable item. See A301.	Voltage Divider Null Balancing	CV-102
C303	CAPACITOR, fixed: ceramic; feed thru type; 750 uufd, ±20%, 500 wvdc, char. P. Same as C301. Not a replaceable item. See A301.	Bypass	CC-108-1P750M
C304	CAPACITOR, fixed: ceramic; feed thru type; 750 uufd, ±20%, 500 wvdc, char. P. Same as C301. Not a replaceable item. See A301.	Voltage Divider	CC-108-1P750M
C305	CAPACITOR, variable: glass; 0.8 to 10.0 uufd, 3000 wvdc, quartz dielectric. Same as C302. Not a replaceable item. See A301.	Voltage Divider Equalizer Bal.	CV-102
C306	CAPACITOR, fixed: ceramic; feed thru type; 750 uufd, ±20%, 500 wvdc, char. P. Same as C301. Not a replaceable item. See A301.	Bypass	CC-108-1P750M
C307	CAPACITOR, fixed: mica; button style; 1500 uufd, ±10%, 300 wvdc, char. X. Not a replaceable item. See A301.	R.F. Bypass	CB21PX152K
C308	CAPACITOR, fixed: mica; button style; 1500 uufd, ±10%, 300 wvdc, char. X. Same as C307. Not a replaceable item. See A301.	R.F. Bypass	CB21PX152K
CR301	CRYSTAL DIODE, high frequency. Not a replaceable item. See A301.	Rect. Reflector Power	1N277
CR302	CRYSTAL DIODE, high frequency. Same as CR301. Not a replaceable item. See A301.	Rectifier Fwd. Power	1N277
J301	CONNECTOR, receptacle: female; teflon insulated. Not a replaceable item. See A301.	To Xmitter	UG-560/U

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
J302	CONNECTOR, receptacle: female; teflon insulated. Same as J301. Not a replaceable item. See A301.	To Ant. Coupler	UG-560/U
J303	CONNECTOR, receptacle: female; 4 contacts. Not a replaceable item. See A301.	To Monitor-Cont.	MS3102A-14S-2S
L301	CHOKE, RF.: 2500 millihenries, 100 ma, molded phenolic. Not a replaceable item. See A301.	R.F. Decoupling	CL-140-1
L302	CHOKE, R.F.: L=185 uhy ±15 uhy, Q=less than 50 at 790 kc test frequency. Not a replaceable item. See A301.	R.F. Decoupling	A-1544
L303	CHOKE, R.F.: 2500 millihenries, 100 ma, molded phenolic. Same as L301. Not a replaceable item. See A301.	R.F. Decoupling	CL-140-1
L304	CHOKE, R.F.: L=185 uhy,±15 uhy, Q=less than 50 at 790 kc test frequency. Same as L302. Not a replaceable item. See A301.	R.F. Decoupling	A-1544
L305	CHOKE, R.F.: L=185 uhy ±15 uhy, Q=less than 50 at 790 kc test frequency. Not a replaceable item. See A301.	R.F. Blocking D.C. Return	A-1126
R301	RESISTOR, fixed: 0.6 ohms, +10% -20%, 40 watts, carbon deposit on Pyrex glass. Not a replaceable item. See A301.	Voltage Divider	RR-122-0.6

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
A201	ASSEMBLY, coil: consists of tank coil, coil mounting supports, contact wheel, contact wheel shaft, and coil lug.	Tuning Coil	AC-106
A202	ASSEMBLY, coil: consists of coil, coil mounting supports and insulators.	Loading Coil	AC-104
A203A	ASSEMBLY, switch: consists of wafer and rotor.	p/o Position Indicator	AS-114
A203 B,C,D	ASSEMBLY, switch: consists of complete switch plus all jumpers teflon sleeving.	Transformer and Capacitor Switch	AS-113
B201	MOTOR, reversible: split phase, 2 pole, 115 v AC, 50/60 cps, 38 watts.	Drives L201	MO-108
B202	MOTOR, unidirectional (CW): 2 pole, 115 v AC, 50/60 cps, 20 watts.	Drives S201	MO-109
C201	CAPACITOR, fixed: air dielectric; 46 uufd, 12 plates, 0.250 air gap.	Tuning Cap.	CO-105
C202	CAPACITOR, fixed: paper dielectric; 10 ufd, ±10%, 1000 wvdc, char. F.	Motor Starting B201	CP70B1FG106K
C203	CAPACITOR, fixed: ceramic; 0.01 ufd, +80 -20%, 500 wvdc.	Bypass Cap.	CC-100-16
C204	CAPACITOR, fixed: ceramic; 0.01 ufd, +80 -20%, 500 wvdc. Same as C203.	Bypass Cap.	CC-100-16
C205	CAPACITOR, fixed: ceramic; 0.01 ufd, +80 -20%, 500 wvdc. Same as C203.	Bypass Cap.	CC-100-16
C206	CAPACITOR, fixed: ceramic; 0.01 ufd, +80 -20%, 500 wvdc. Same as C203.	Bypass Cap.	CC-100-16
C207	CAPACITOR, fixed: ceramic; 0.01 ufd, +80 -20%, 500 wvdc. Same as C203.	Bypass Cap.	CC-100-16
C208	CAPACITOR, fixed: ceramic; 0.01 ufd, +80 -20%, 500 wvdc. Same as C203.	Bypass Cap.	CC-100-16
C209	CAPACITOR, fixed: ceramic; 0.01 ufd, +80 -20%, 500 wvdc. Same as C203.	Bypass Cap.	CC-100-16
C210	CAPACITOR, fixed: ceramic; 0.01 ufd, +80 -20%, 500 wvdc. Same as C203.	Bypass Cap.	CC-100-16
C211	CAPACITOR, fixed: ceramic; 0.01 ufd, +80 -20%, 500 wvdc. Same as C203.	Bypass Cap.	CC-100-16
C212	CAPACITOR, fixed: ceramic; 0.01 ufd, +80 -20%, 500 wvdc. Same as C203.	Bypass Cap.	CC-100-16

SYM.	DESCRIPTION	FUNCTION	TMC DWG. OR PART NO.
E201	TERMINAL,STRIP, barrier type: plastic; 10 terminals.		TM-100-10
E202	INSULATOR, feed thru, bowl type.	Ant. Connector	AX-196
E203	INSULATOR, pillar: round; white glazed steatite; 1 in. lg. x 3/4 in. diam. tapped 10-32 x 3/8 in. deep each end.		NS3W0308
E205	TERMINAL STRIP, barrier type: plastic; 5 terminals.		TM-102-5
E206	BUSHING, feed thru: steatite insulators, neoprene gland, hot tinned brass stud, 7/8 in. dia. x 2-1/8 in. lg. o/a.		NS-118-3
L201	Not a replaceable item. Part of A201.		
L202	Not a replaceable item. Part of A201.		
MP201	TERMINAL TUBE: type D; mounts in 1 in. hole; 2-5/8 in. lg. x 1-1/8 in. dia. o/a.	RF Cable Feed	PO-181
MP202	TERMINAL TUBE: type B; mounts in 3/4 in. hole 2-3/8 in. lg. x 1-1/8 in. dia. o/a.	Control Cable	PO-182
MP203	COUPLING, flexible: steatite; peak volts 5000.		MC-114-2
MP204	COUPLING, flexible: steatite; peak volts 5000. Same as MP203.		MC-114-2
R201	RESISTOR, variable: composition; 10,000 ohms, ±10%	Res. Meter Adj.	RV105ATRL105A
R202	RESISTOR, fixed: composition; 15000 ohms, ±5%, 1 watt.	Volt. Divider	RC30GF153J
R203	RESISTOR, fixed: composition; 3000 ohms, ±5%, 1/2 watt.	Volt. Divider	RC20GF302J
R204	RESISTOR, fixed: composition; 9100 ohms, ±5%, 1 watt.	Volt. Divider	RC30GF912J
R205	RESISTOR, fixed: composition; 1800 ohms, ±5%, 1 watt.	Volt. Divider	RC30GF182J
R206	RESISTOR, fixed: composition; 3300 ohms, ±5%, 1/2 watt.	Volt. Divider	RC20GF332J
R207	RESISTOR, fixed: composition; 3300 ohms, ±5%, 1/2 watt. Same as R206.	Volt. Divider	RC20GF332J
R208	RESISTOR, fixed: composition; 3300 ohms, ±5%, 1/2 watt. Same as R206.	Volt. Divider	RC20GF332J

SYM.	DESCRIPTION	FUNCTION	TMC PART OR PART NO.
R209	RESISTOR, fixed: composition; 3300 ohms, ±5%, 1/2 watt. Same as R206.	Volt. Divider	RC20GF332J
R210	SENSOR, humidity: plug in type; 1-11/64 in. dia. x 2-3/4 in. lg.	Humidity Sensor	RR-128
S201	Not a replacement item. Part of A203.		
S202	SWITCH, micro: push; 10 amps at 125/250 v AC; 1/2 amp at 125 v DC.	Reactance Stop	SW-189
S203	SWITCH, micro: push; 10 amps at 125/250 v AC; 1/2 amp at 125 v DC. Same as S202.	Reactance Stop	SW-189
S204	SWITCH, micro: roller; 15 amp at 125 VAC; solder terminals.	Meter Switch	SW-260
T201	TRANSFORMER, R.F.: audio; input 13 or 17, 50 or 70, 200 or 250 ohms; output 50 or 70 ohms; 2-30 Mc frequency range; 4 in. wide x 4-11/16 in. lg. x 4-15/16 in. high o/a.	Impedance Matching Transformer	TR-151
XR210	SOCKET, miniature: 4 pin; 4-5/64 in. dia. x 15/32 in. high w/o lugs; retainer ring mtg.	Socket R210	TS-144

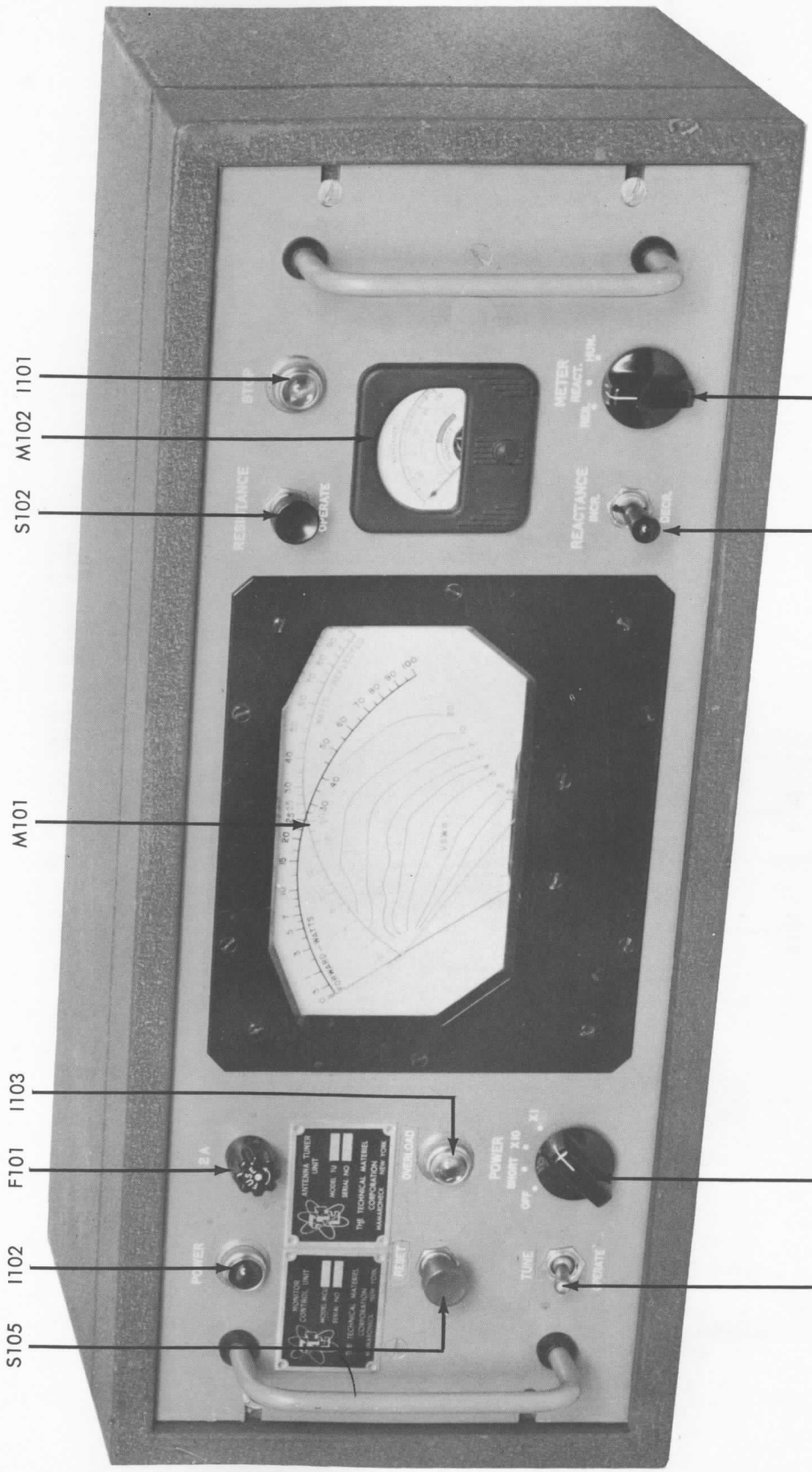


Figure 5-1 Front View, Model ATS-MCU-2

PH-941

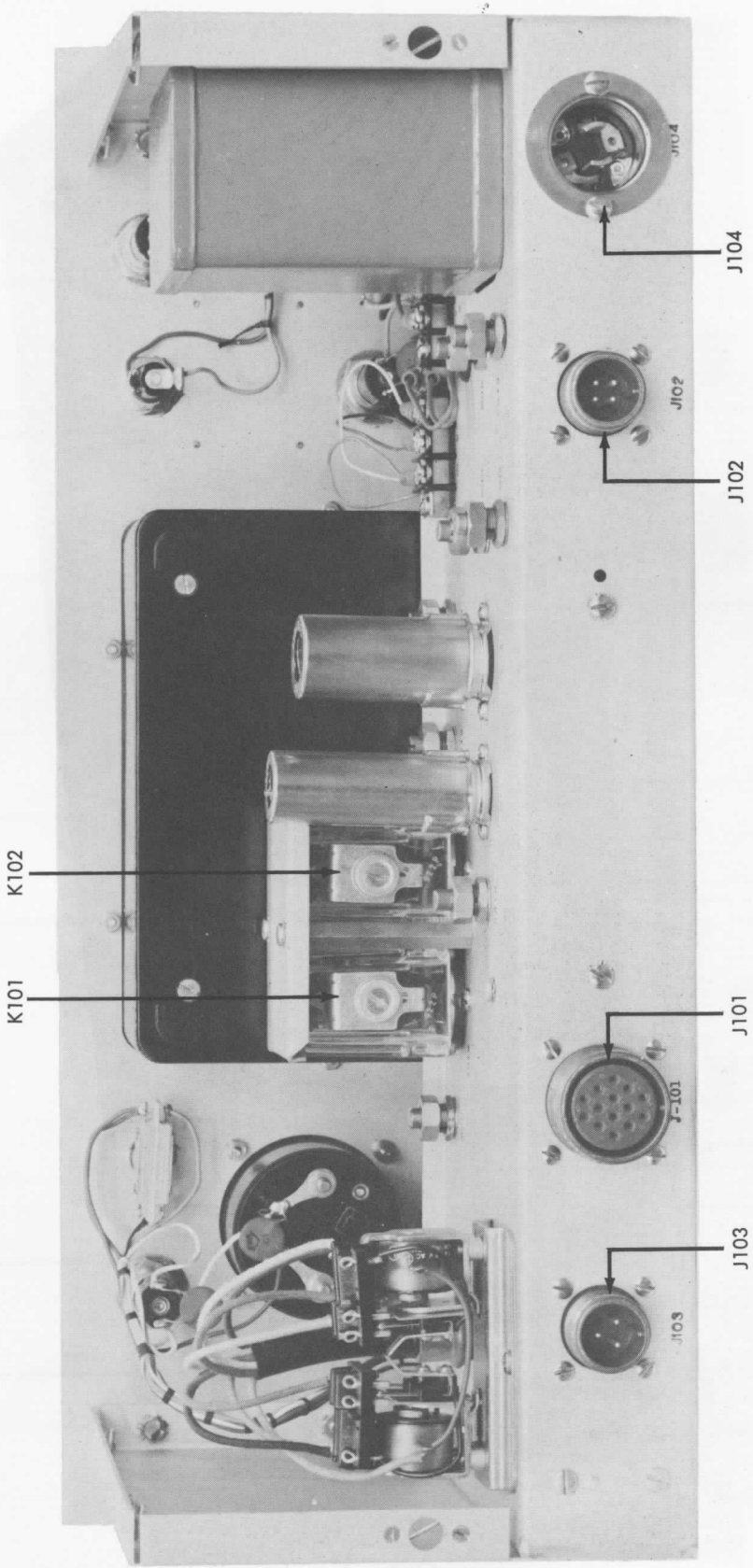


Figure 5-2 Rear View, Model ATS-MCU-2

PH-956

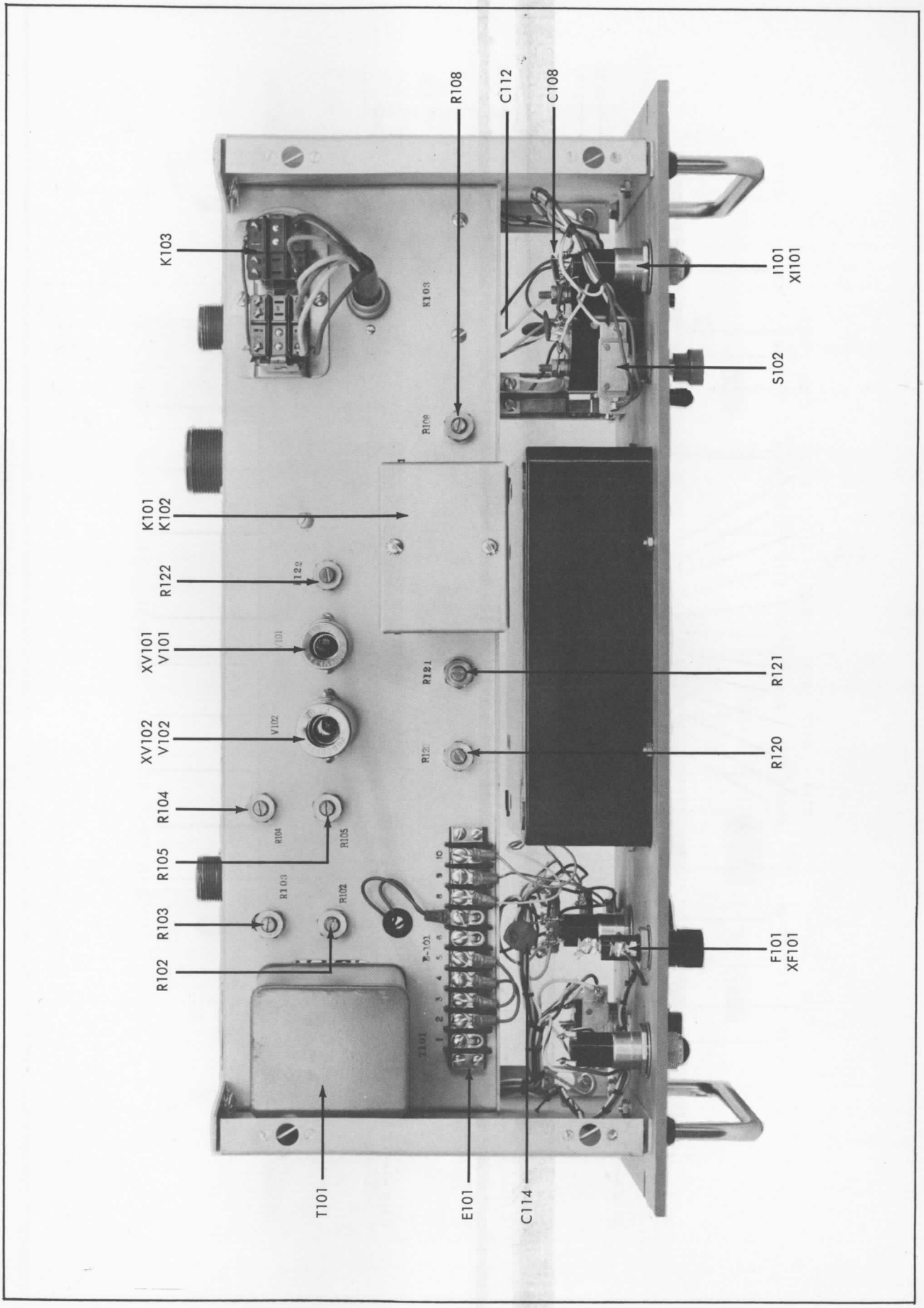
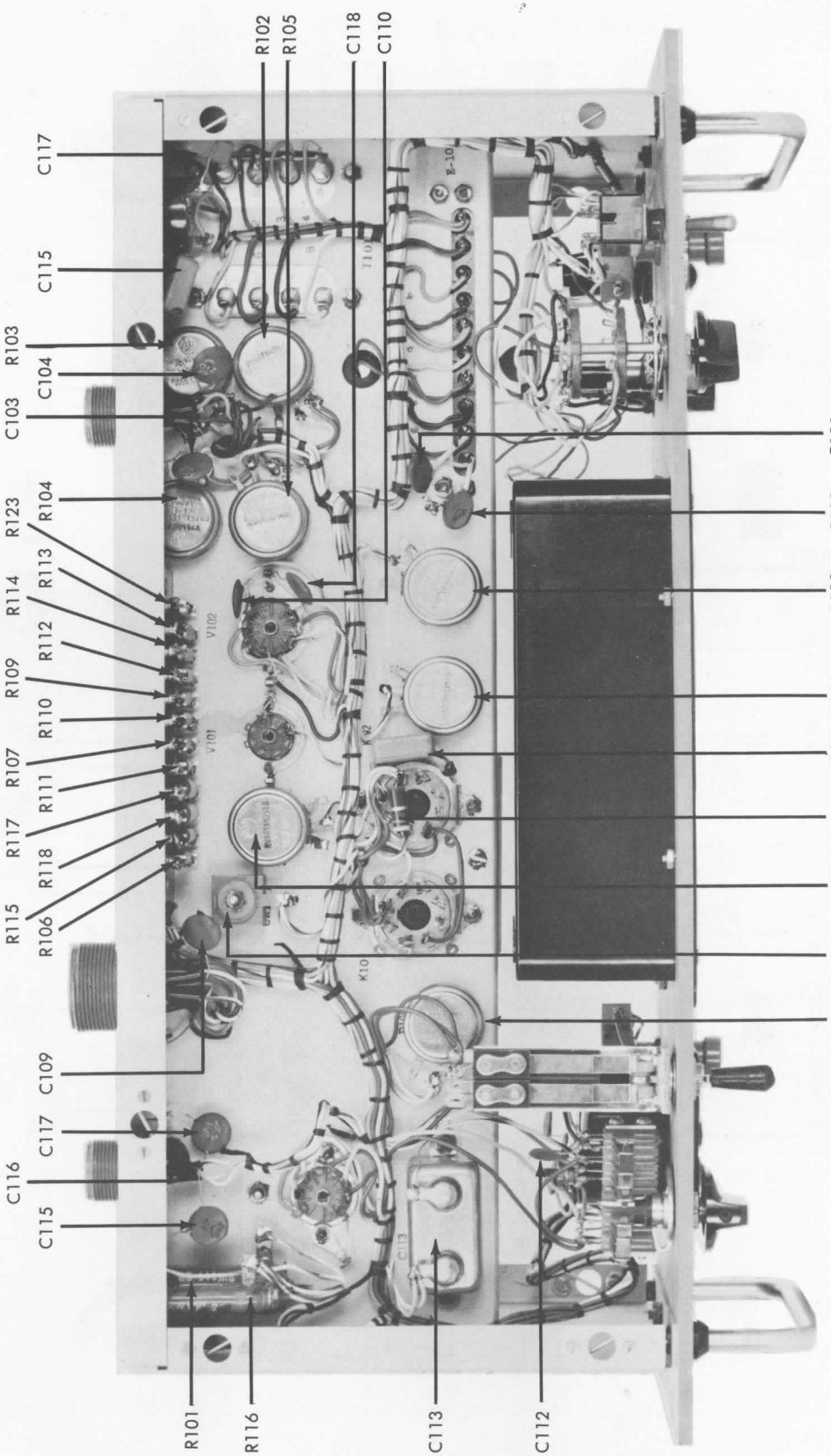


Figure 5-3 Top View, Model ATS-MCU-2



PH-958

Figure 5-4 Bottom View, Model ATS-MCU-2

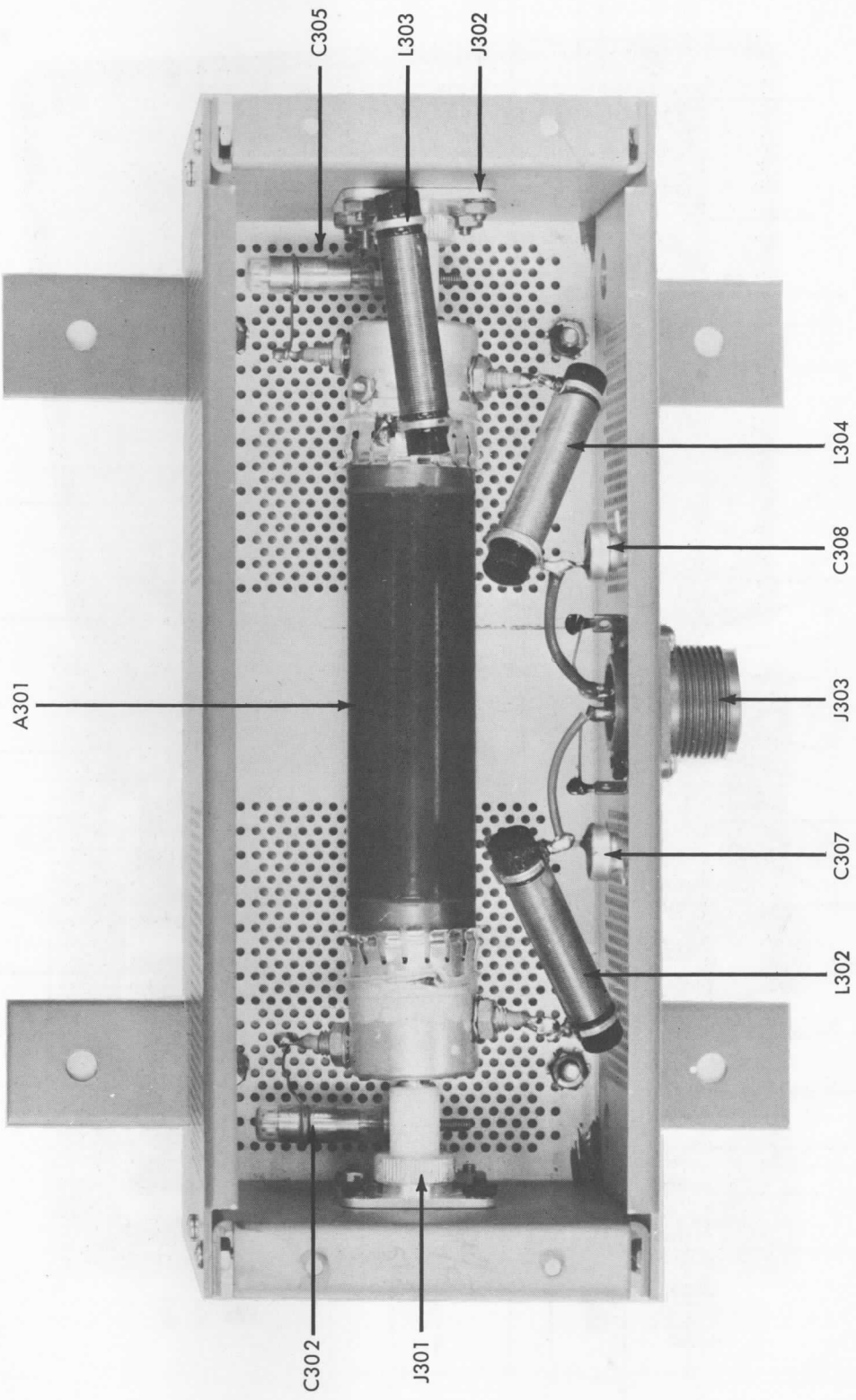


Figure 5-5 Top View, Model ATS-CU-2

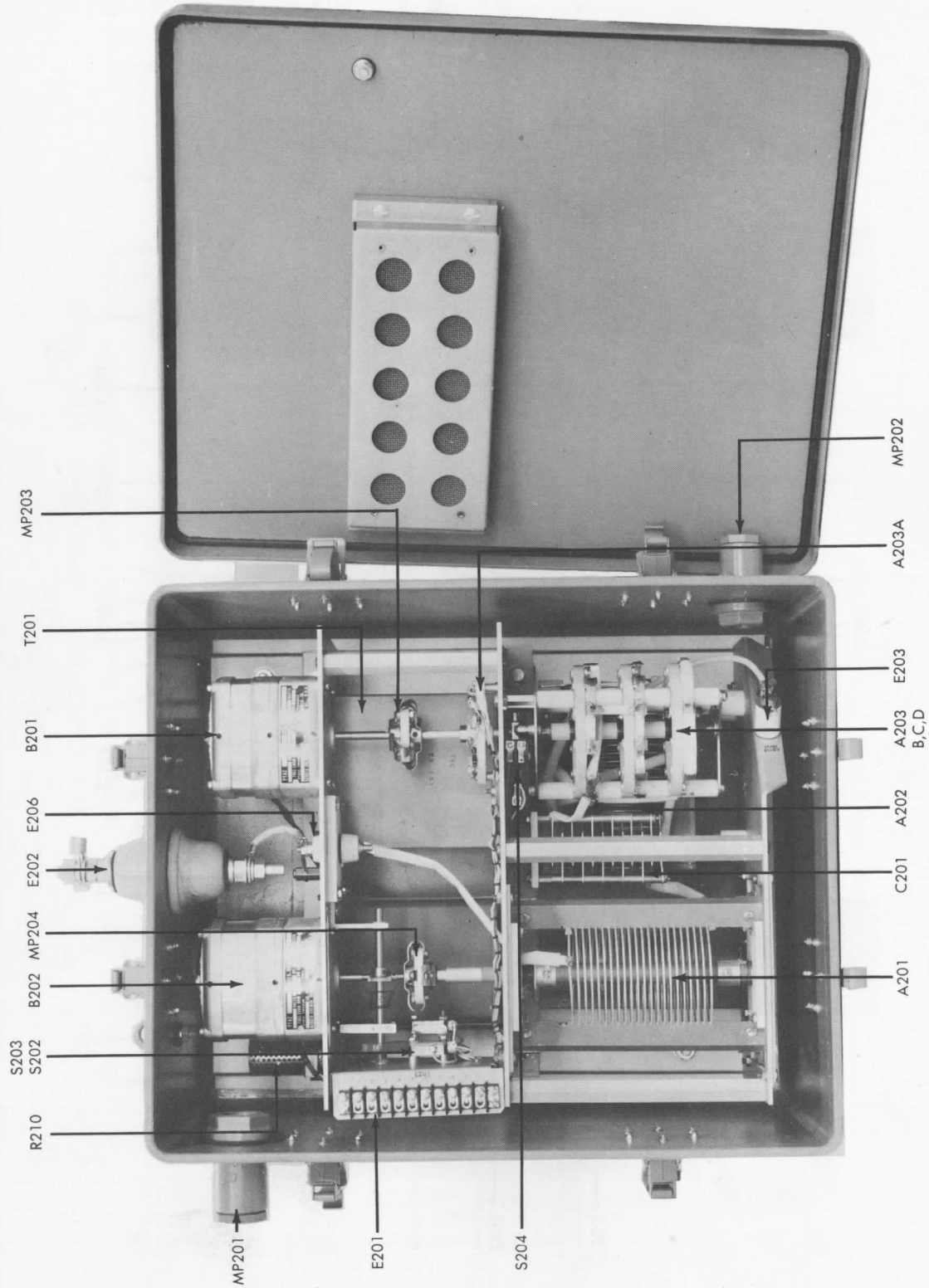


Figure 5-6 Top View, Model ATS-TU-2

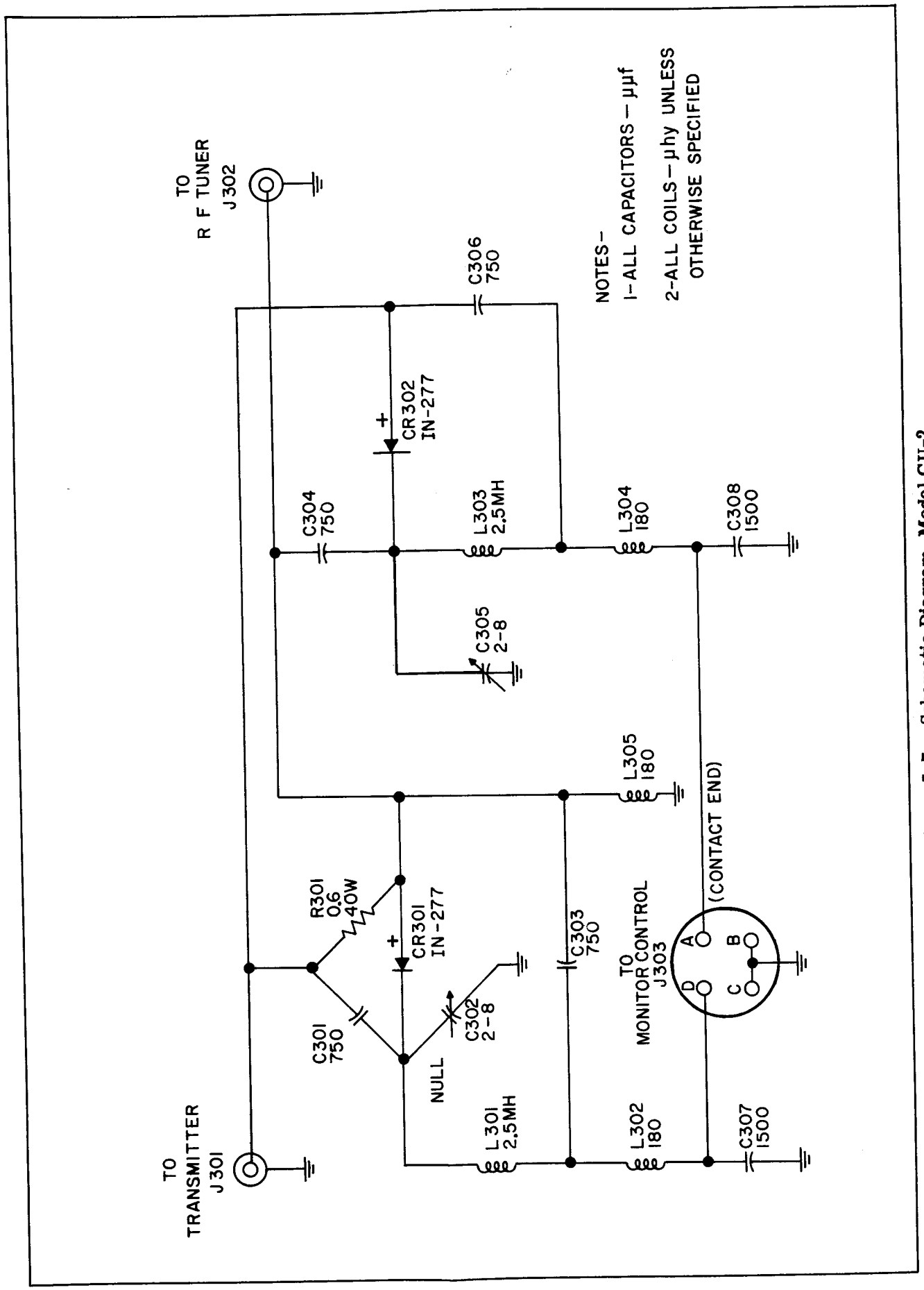
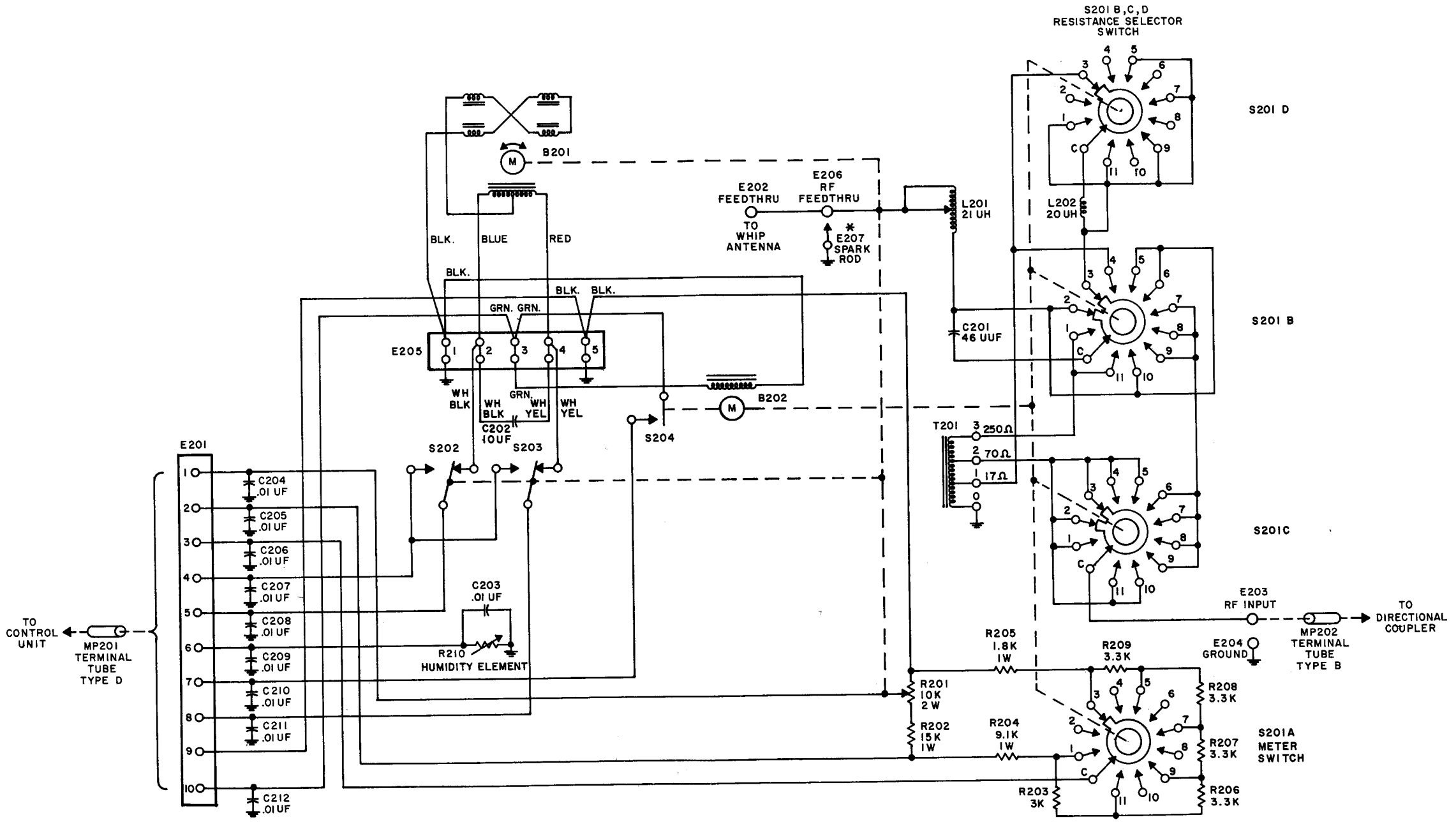


Figure 5-7 Schematic Diagram, Model CU-2

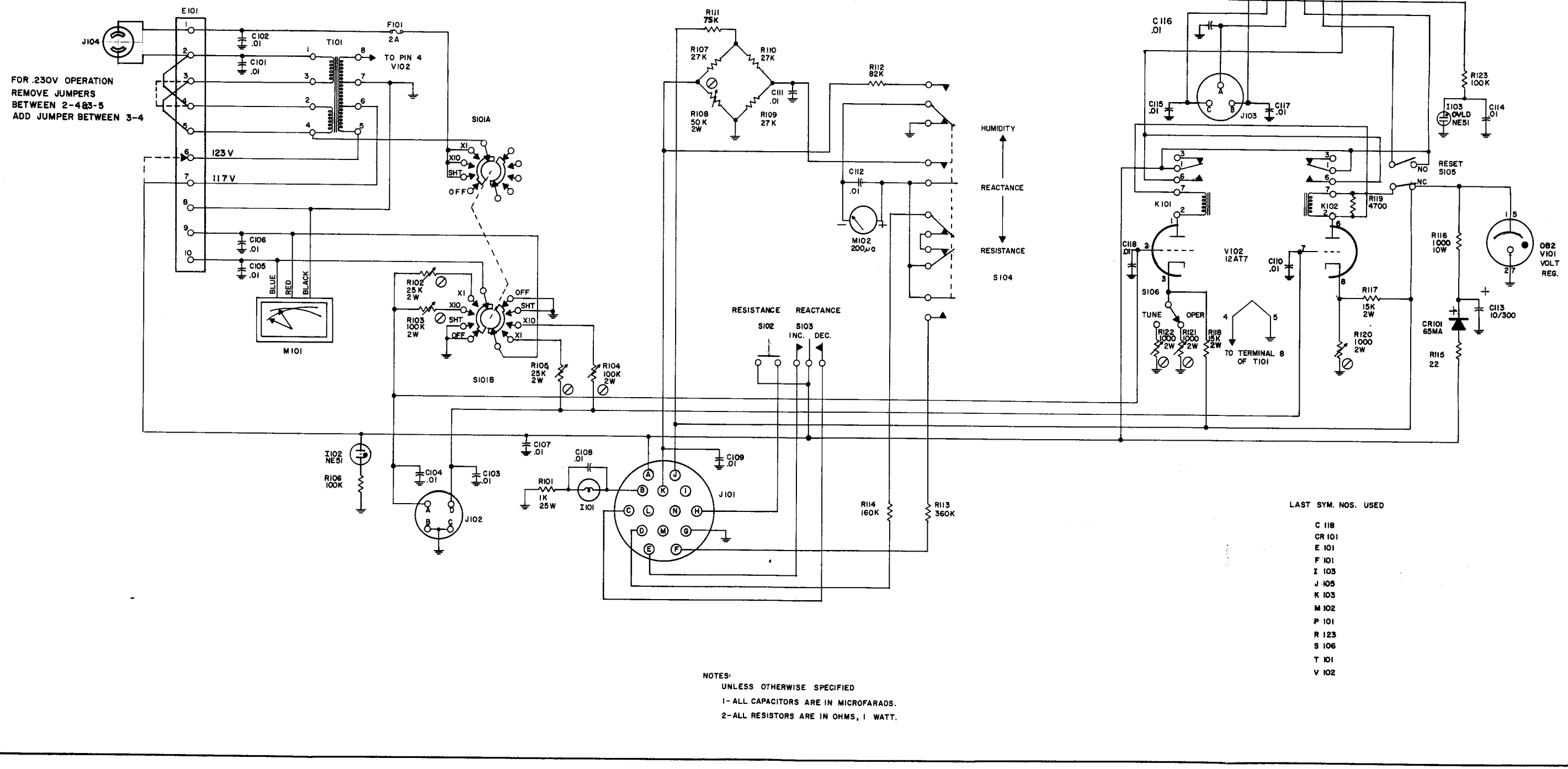


NOTES-
1. ALL RESISTORS ARE 1/2 WATT, UNLESS OTHERWISE SPECIFIED.

LAST SYMBOLS-

B201
C212
E207
L202
MP202
R210
S204
T201

Figure 5-8. Schematic Diagram, Model TU-2



LAST SYM. NOS. USED

C 118
CR 101
E 101
F 101
I 103
J 105
K 103
M 102
P 101
R 123
S 106
T 101
V 102

NOTES:
UNLESS OTHERWISE SPECIFIED
1- ALL CAPACITORS ARE IN MICROFARADS.
2-ALL RESISTORS ARE IN OHMS, 1 WATT.

CK-406

Figure 5-9. Schematic Diagram, Model MCU-2