Manual -510-0341

SOUTHERN AVIONICS COMPANY

MANUFACTURERS OF LOW FREQUENCY RADIOBEACONS AND ASSOCIATED PRODUCTS

ANTENNA COUPLER

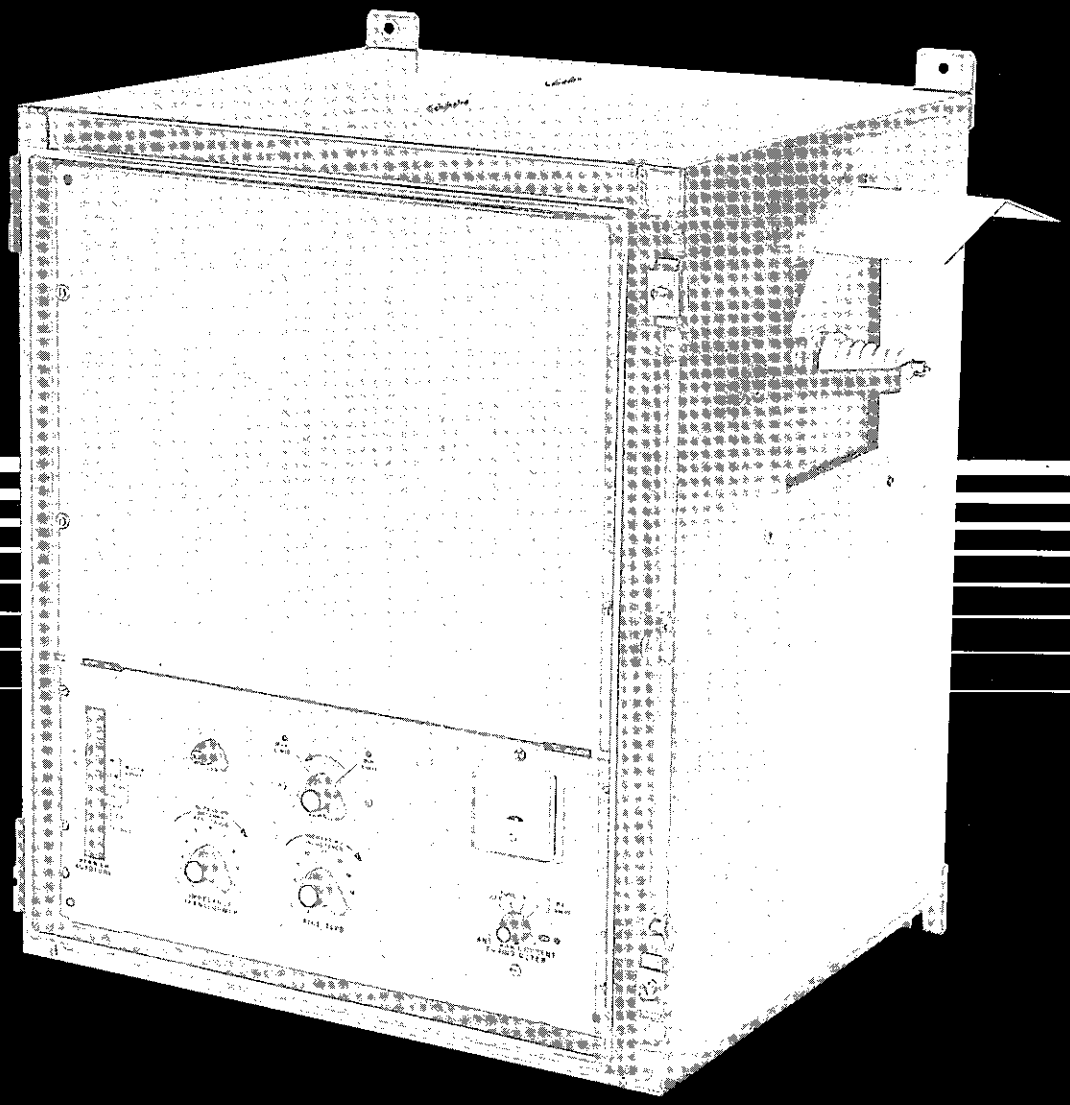
MODEL PC-1000A

BOX 5345, BEAUMONT, TEXAS 77706-0345 USA; TELEPHONE: (409) 842-1717; CABLE: SAC; TELEX: 77-9450

PARTS ORDERING INFORMATION

Parts are listed on each assembly drawing or schematic. When ordering parts, include complete description and your transmitter serial number.

Antenna Coupler



All Metal Coupler With Electronically Controlled, Motor Driven Automatic Tuning

Handles Power Up To 1500 Watts Peak

SOUTHERN AVIONICS COMPANY SAC

Antenna Coupler

MODELS PC-1000 & PC-3000

SPECIFICATIONS

- **LIGHTNING PROTECTION:** Lightning gap at the antenna terminal.
- **WORKING CONDITION:**
  - Ambient temperature, –50° to +70°C
  - Relative humidity 0 to 100%
  - High salinity as encountered at offshore locations
  - Designed for outdoor mounting at the base of the antenna
- **POWER REQUIREMENTS:** 48V DC, 500mA, supplied to coupler from Southern Avionics transmitters. Optional 115/230 VAC, 50 - 400 Hz, supply for use with other transmitters.
- **INPUT IMPEDANCE:** 50 ohms.

  FREQUENCY: 190 - 625 KHz.

	PC - 1000	PC – 3000
LOAD IMPEDANCE:	2-25 ohms resistance 200-1500pF capacitance	2-25 ohms resistance 700-1500pF capacitance
POWER:	500 watts peak, 200 watts continuous	1500 watts peak, 600 watts continuous
METERING:	Antenna current and tuning. Single meter with a four position switch.	
	OFF, TUNE, 4A, 2A	OFF, TUNE, 8A, 4A

FOR MORE INFORMATION, WRITE OR TELEPHONE.

SOUTHERN AVIONICS COMPANY

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BOX 5345, BEAUMONT, TEXAS 77706-0345 USA; TELEPHONE: (409) 842-1717; CABLE: SAC; TELEX: 77-9450

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LIST OF ILLUSTRATIONS

1. SPECIFICATIONS: PC-1000 ANTENNA COUPLER.

INPUT IMPEDANCE: 50 ohms.

LOAD IMPEDANCE: 2 to 25 ohms resistance, 200 to 1500 pF capacitance.

FREQUENCY: 190 - 625 KHz with a 200 to 1500 pF load.

POWER INPUT: Up to 500 watts peak, 200 watts continuous.

METERING: Antenna current and tuning. Single meter with a four position switch; OFF, TUNE, HIGH, LOW. A reflected power measurement is used for a tuning indication.

TUNING: Large coil with coarse taps and fine taps and a rotatable shorted ring. The coarse tap is selected with a solder connection behind a removable panel. The fine tap is selected with a switch. The autotune system drives the shorted ring for exact tuning.

LIGHTNING PROTECTION: Lightning gap at the antenna terminal.

WORKING CONDITION: Ambient temperature, -50°C to 70°C; relative humidity 0 to 100%; high salinity as encountered in offshore conditions. The antenna coupler is designed for outdoor mounting at the base of the antenna.

POWER REQUIREMENTS: 48V DC, 500 mA, supplied to coupler from Southern Avionics transmitters. Optional 115/230 VAC, 50-500 Hz supply for use with other transmitters.

SIZE: 22.5" (57 cm) wide, 21.5" (55 cm) deep, and 26.5" (67 cm) high.

WEIGHT: 46 pounds (21 kg).

MOUNTING: Mounts with two horizontal mounting brackets included with the coupler. Brackets attach to the rear of the coupler with 1/4" x 1-1/4" bolts. The coupler bracket assembly attaches to a metal or wooden pole using 3/8" bolts or screws on 27.8" (70.5 cm) vertical spacing. Vertical brackets that attach to the sides of the coupler with 1/4" x 1" bolts are included for mounting on offshore platform guard rails. 3/8" x 3-3/8" U bolts are included to attach the brackets to the guard rails.

ACCESS: Access to the tuning controls and meters is available through the hinged front access door. Access to the coarse taps on the loading coil is available through the removable panel above the tuning controls panel.

ELECTRICAL CONNECTIONS: RF input to type N coax connector on lower left exterior coupler wall. Coupler control wire connections to internal terminal block TB1 mounted above the Autotune PWB enclosure. A stuffing tube is furnished for control cable passage through the exterior wall. Ground connection to ground lug on exterior coupler wall. Antenna connection to 1/4" threaded rod in antenna feedthrough bushing.

2. GENERAL DESCRIPTION: PC-1000 ANTENNA COUPLER

The antenna coupler couples the 50 ohm output of the transmitter to a SAC Mast Antenna, "T" Antenna, "H" Antenna, or Guyed Mast Antenna.

The coupler consists of an impedance transformer, a large tapped coil with a rotatable shorted ring, and a meter. The shorted ring is driven by a motor that is controlled by the Autotune Motor Drive PWB in the coupler.

The coupler is mounted in a metal enclosure with dimensions 22.5" (57 cm) wide, 21.5" (55 cm) deep, 26.5" (67 cm) high and is designed for outdoor mounting.

The optional coupler power supply furnishes 50V DC for operation of the autotuning system and metering circuits. The power supply operates from 115/230 VAC, 50-500 Hz, and is required when the coupler is used with transmitters not manufactured by Southern Avionics Company.

3. FUNCTIONAL DESCRIPTION: PC-1000. Figure 3-1 is a block diagram of the PC-1000 Antenna Coupler.

3.1 IMPEDANCE TRANSFORMER: The impedance transformer matches the 50 ohm output impedance of the transmitter to any impedance from 2 to 25 ohms. The impedance transformation is chosen by selecting one of eleven taps in the transformer secondary.

3.2 TUNER: The tuner is a 240 turn coil with taps for coarse adjustment and a rotatable shorted turn for fine adjustment. Tuning range is from 22 uH to 3.6 mH which is sufficient to tune any practical antenna in the 190 - 625 KHz frequency range.

3.3 AUTOTUNE: The autotune circuit compares the phase of the voltage and current at the input to the coupler and turns the shorted ring in the tuner in the proper direction to tune the antenna system.

3.4 ANTENNA CURRENT/TUNING METER: This meter indicates antenna current in two ranges. It also detects reflected power to indicate tuning. The meter function is determined by a four position switch that selects OFF, TUNE, HIGH, or LOW.

3.5 COUPLER POWER SUPPLY (OPTIONAL): The coupler power supply is available for use where the coupler is not powered from a Southern Avionics Company manufactured transmitter. The coupler supplies 50V DC to the coupler meter and autotune circuits while accepting power from the 115/230 VAC, 50-500 Hz main supply.

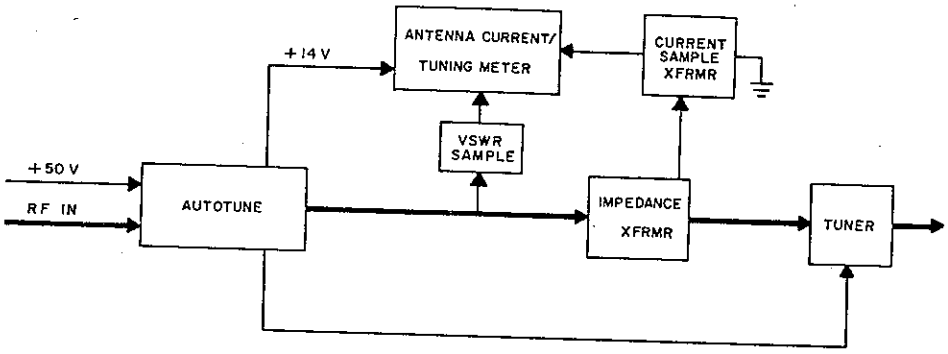


FIGURE 3-1
PC-1000 BLOCK DIAGRAM

4. DETAILED CIRCUIT ANALYSIS: PC-1000. See Figure 4-1 for an overall schematic of the PC-1000 antenna coupler, Figures 4-2 and 4-3 for a schematic and assembly drawing of the Antenna Current/Tuning Meter,and Figures 4-4 and 4-5 for a schematic and assembly drawing of the Autotune PWB. Figures 4-6 and 4-7 are the schematic and assembly drawing of the optional coupler power supply.

4.1 IMPEDANCE TRANSFORMER: The impedance transformer is bifilar wound on a ferrite toroid. The secondary has 11 taps and is designed to transform a secondary load between 2 and 25 ohms to a 50 ohm input impedance. Tap selection is made with a switch on the front panel of the coupler. An air core transformer connected to the low potential end of the impedance transformer secondary samples the antenna current to provide a signal for the Antenna Current Meter.

4.2 TUNER: This 240 turn coil has a transformer coupled shorted ring that can be turned manually or by the autotune motor. The 44 turns physically below the tuning ring are tapped every 4 turns for a fine tuning adjustment. The 200 turns above the tuning ring are tapped at 5 turns, 10 turns, 20 turns, and thereafter in 20 turn steps, to the top of the coil. The upper tap selection is made with a solder connection behind a removable panel. The lower tap selection is made with a switch on the front panel.

The autotune system automatically turns the tuning ring in a direction to tune the antenna system. If the correct taps have been chosen, the ring will stop when the system is tuned and change automatically when the system detunes due to changes in the antenna environment. If the correct tap has not been chosen, the tuning ring will move to a MAX or MIN limit and an LED indicator on the coupler front panel will indicate whether more or less inductance is needed. A manual knob for the tuning ring is also available on the coupler front panel. The tuning ring is capable of varying the total inductance approximately $\pm$ 5% depending on the combination of taps.

Maximum inductance with the full coil is 3.5 mH $\pm$ 130 uH. Minimum inductance is 25 uH $\pm$ 3 uH. This is sufficient to tune a 200 to 1500 pF antenna from 190 KHz to 625 KHz. Tables are given in Section 7 showing the tuning range for SAC's Mast Antenna, Guyed Mast Antenna, and Symmetrical "T" Antenna.

4.3 AUTOTUNE: See Figures 4-4 and 4-5 for a schematic and assembly drawing of the Autotune Motor Drive PWB. The autotune system is an electronic antenna tuning system located in the antenna coupler and comprises the Autotune Motor Drive PWB, the Limit Switch PWB, and the Tuning Motor

and Tuning Ring Assembly. The relative phase of the current and voltage signals to the 50 ohm RF input of the coupler are compared by electronic circuits to determine if the antenna system is tuned inductive, resistive, or capacitive. A properly tuned antenna system is considered to have a zero relative phase difference between voltage and current. As the system changes so that the load exhibits reactive components, whether inductive or capacitive, no retuning action will be taken until the phase magnitude exceeds a level determined by the tolerance adjust control (R16) on the Autotune PWB. When this level of phase error is exceeded, the logic circuits will activate the tuning motor in the proper direction to return the system to a resistive load state. Motor drive continues until a relative phase change is detected, indicating passage of tuning through a resistive state. Circuits on the Autotune Motor Drive PWB prevent any tuning action during periods of low or no input signals, during transmitter Ident, and when the Setup/Run Switch (S1) is in the Setup position.

RF current from the transmitter passes through T1 of the Autotune Motor Drive PWB. Limiting amplifiers U1 and U2 amplify and square the current and voltage signals and feed them into U3 for determination of the magnitude of the phase difference between the current and voltage signals. The output of U3, pin 11, is filtered by R12 and C10 to produce a DC voltage at TP1 (Brown) proportional to the phase difference. The DC voltage is compared by voltage comparator U5 with a reference voltage at TP2 (Red) set by the tolerance adjust control (R16). As the TP1 voltage becomes more positive than the TP2 voltage, the output of U5, pin 7, changes from 0 V to +14 V to indicate an out of tolerance antenna tuning condition. The tolerance limit set by the tolerance adjust control (R16) is adjustable to accommodate different antenna and frequency conditions. U3 outputs at pins 3 and 4 are compared by type "D" flip-flop U4 to determine whether the current signal is leading or lagging the voltage signal. If the voltage signal is leading the current signal as with an antenna tuned to the inductive side of resonance, the data input, pin 2 of U4, will become positive just before the positive transistion of the clock input, pin 3. On the positive clock transition, the Q output, pin 5, of U4 is latched into the same state as the U4 data input, pin 2, with a logic 1 (+14 V) indicating an inductive antenna condition. This condition is also indicated by LED DS1. As the U5 output, pin 7, changes from 0 V to +14 V, to signal an out of tolerance tuning condition, the positive transition will cause the antenna condition to be latched at U4, pin 9, and through the logic of U7 will determine the motor drive direction. The U5 output, pin 7, also latches the flip-flop contained in U6, into "drive" state, with a logic 0 (0 V) at U6, pin 3. If

the Setup/Run Switch (S1) is in the Run position, if the input signals are high enough to trigger Q1, and if no ident signal is present to trigger Q3, the motor will be activated with +14 V at U7, pin 10, and 0 V at U7, pin 6. DS2 will light, and the motor will rotate to decrease the inductance of coupler transformer T3.

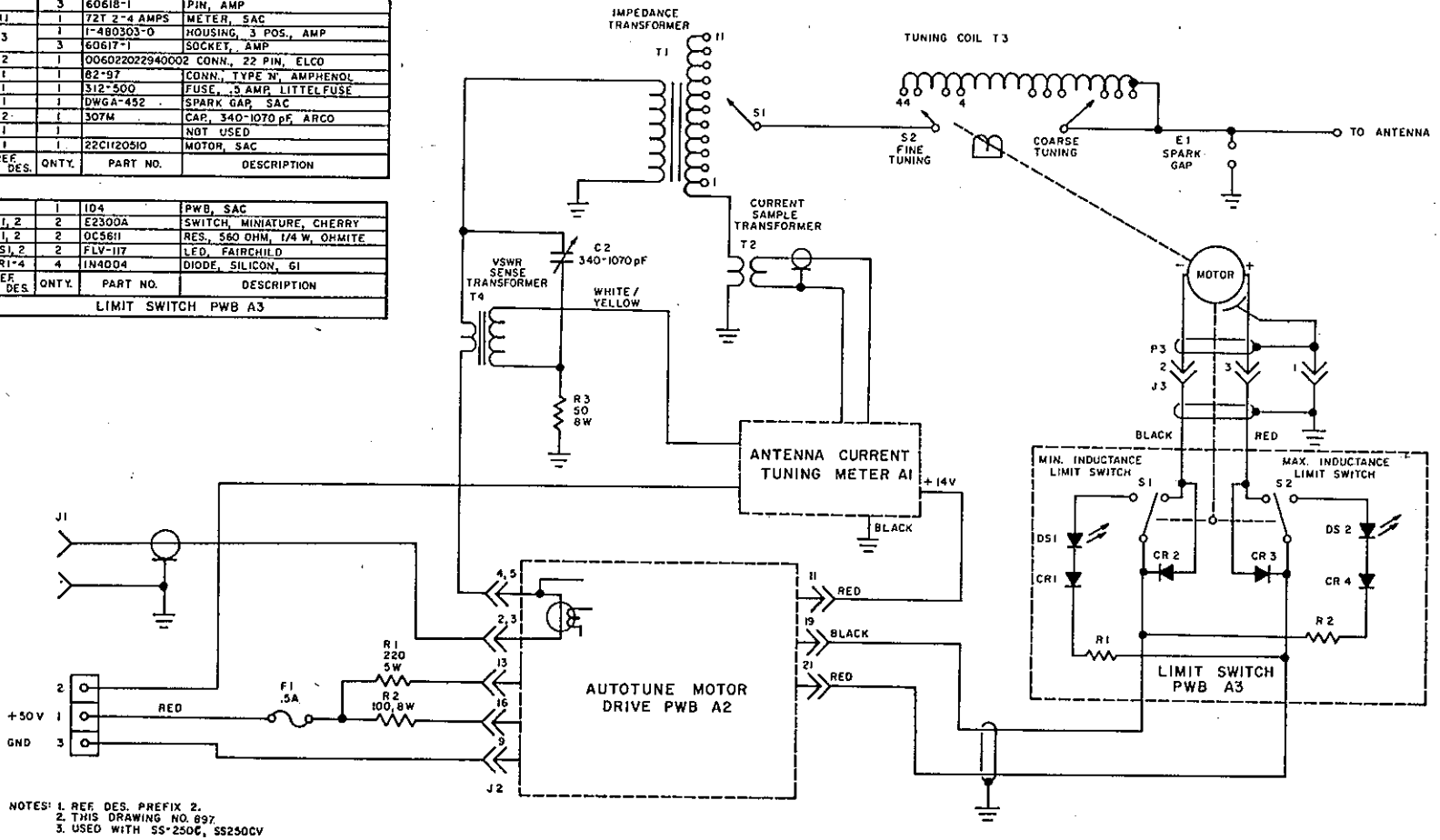
Rotation will continue until the logic signals at pins 8 and 9 of U3 differ, indicating that the antenna tuning has transitioned from an inductive to a capacitive condition. The motor halts with the U6 flip-flop reset until an out of tolerance condition is again sensed.

4.4 ANTENNA CURRENT/TUNING METER: See Figures 4-2 and 4-3 for a schematic and assembly drawing of the Antenna Current/ Tuning Meter. The RF signal from the current sample transformer is developed across R1 and R2, amplified by Q1 and detected by Q2. The detected signal is calibrated with R10 and R11 and fed to the 1 mA meter.

An RF signal proportional to reflected power is generated by T4 and C2 in the antenna coupler and fed to Q3 on the Antenna Current/Tuning Meter PWB for detection. The detected signal is fed through R12 to the 1 mA meter.

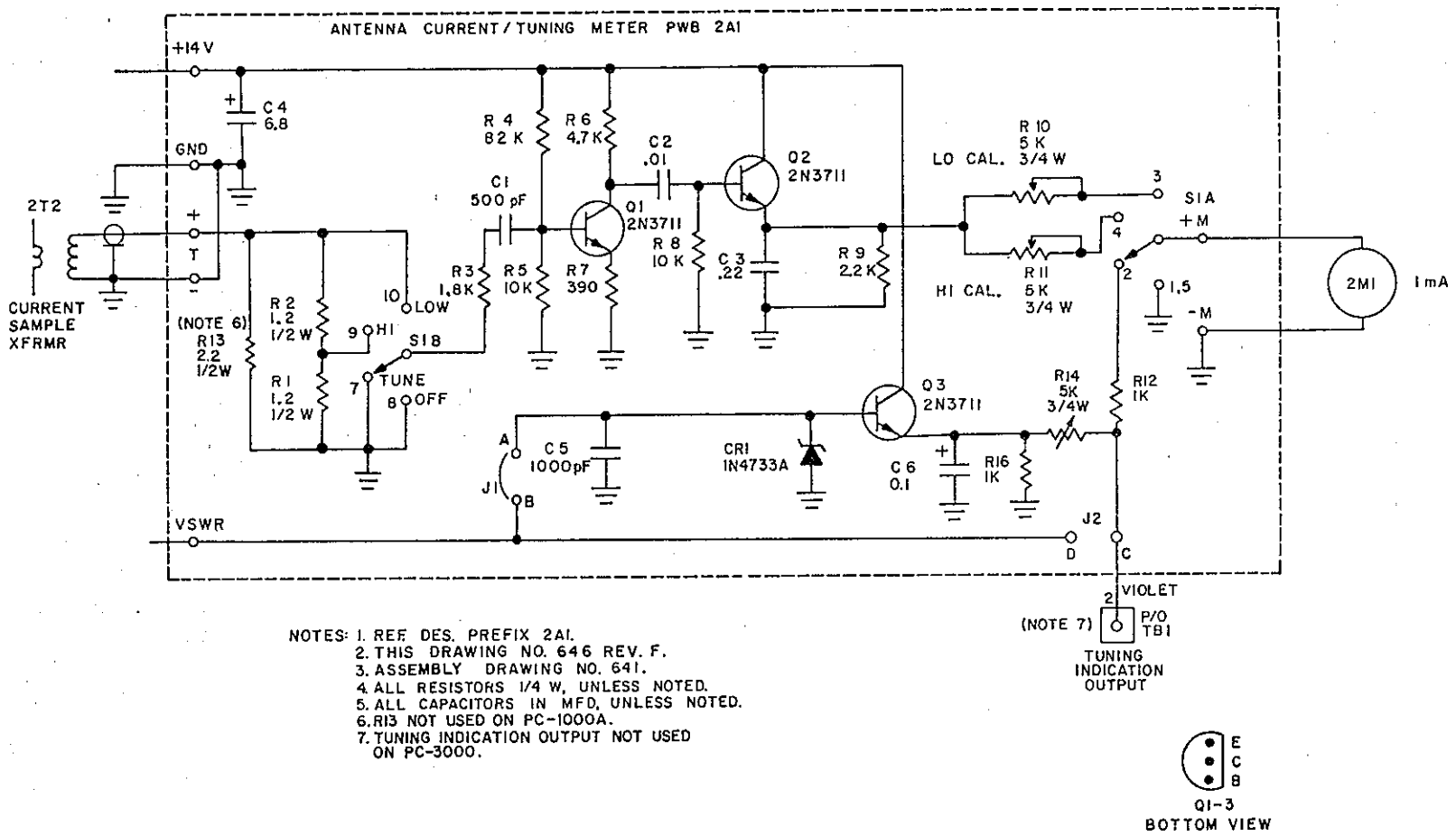
ITEM	REF DES.	QNTY.	PART NO.	DESCRIPTION
19	TB1	1	3-140	TERMINAL BLOCK, CINCH
18	T4	1	C-884	TRANSFORMER, VSWR SENSE, SAC
17	T3	1	C-802	COIL, TUNING, SAC
16	T2	1	C-440	TRANSFORMER, CURRENT, SAC
15	T1	1	C-455	TRANSFORMER, IMPEDANCE, SAC
14	S1, 2	2	111-11	SWITCH, II POSITION, OHMITE
13	R3	1	1514	RES., 50 OHM, 8 W, OHMITE
12	R2	1	1516	RES., 100 OHM, 8 W, OHMITE
11	R1	1	4600	RES., 220 OHM, 5 W, OHMITE
10	P3	1	1-480305-0	PIN HOUSING, 3 POS., AMP
		3	60618-1	PIN, AMP
9	M1	1	72T 2-4 AMPS	METER, SAC
8	J3	1	1-480303-0	HOUSING, 3 POS., AMP
		3	60617-1	SOCKET, AMP
7	J2	1	006022022940002	CONN., 22 PIN, ELCO
6	J1	1	82-97	CONN., TYPE 'N', AMPHENOL
5	F1	1	312-500	FUSE, .5 AMP, LITTELFUSE
4	E1	1	DWGA-452	SPARK GAP, SAC
3	C2	1	307M	CAP, 340-1070 pF, ARCO
2	C1	1		NOT USED
1	B1	1	22C1120510	MOTOR, SAC

ITEM	REF DES.	QNTY.	PART NO.	DESCRIPTION
5		1	104	PWB, SAC
4	S1, 2	2	E2300A	SWITCH, MINIATURE, CHERRY
3	R1, 2	2	OC5611	RES., 560 OHM, 1/4 W, OHMITE
2	DS1, 2	2	FLV-117	LED, FAIRCHILD
1	CR1-4	4	1N4004	DIODE, SILICON, GI
LIMIT SWITCH PWB A3				



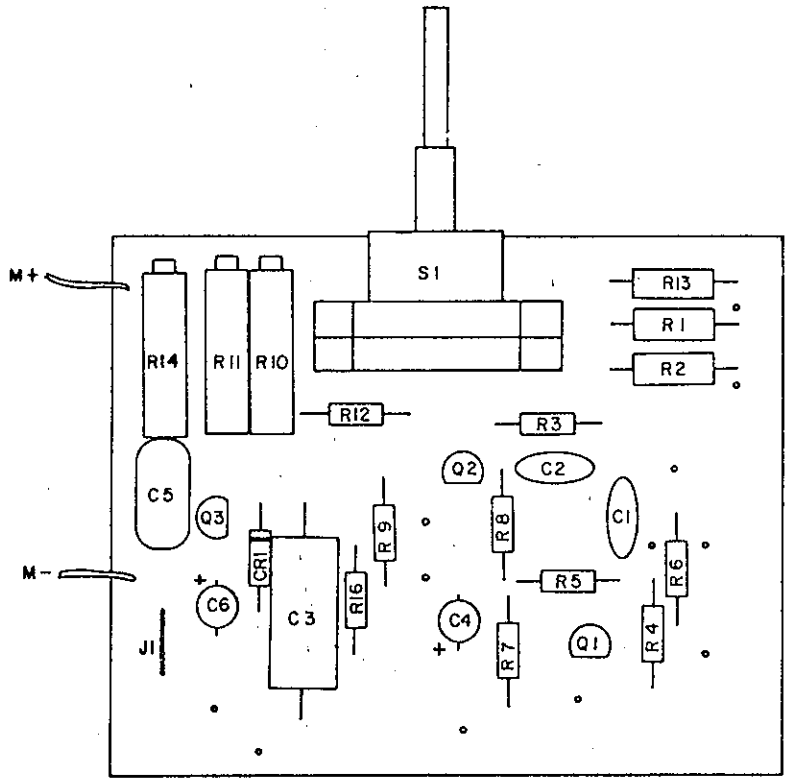
NOTES: 1. REF. DES. PREFIX 2.
2. THIS DRAWING NO. 897.
3. USED WITH SS-2500, SS2500CV

FIGURE 4-1
PC-1000A ANTENNA COUPLER SCHEMATIC



NOTES:
1. REF DES. PREFIX 2A1.
2. THIS DRAWING NO. 646 REV. F.
3. ASSEMBLY DRAWING NO. 641.
4. ALL RESISTORS 1/4 W, UNLESS NOTED.
5. ALL CAPACITORS IN MFD, UNLESS NOTED.
6. R13 NOT USED ON PC-1000A.
7. TUNING INDICATION OUTPUT NOT USED ON PC-3000.

FIGURE 4-2
ANTENNA CURRENT / TUNING METER
PWB SCHEMATIC



REF. DES.	QTY.	PART NUMBER	DESCRIPTION
C1 C2	1 1	DM15-501J TGS10	Cap., 500 pf, 500V, Dip Mica, Arco Cap., .01 mfd, 100V, Disc Ceramic, Sprague
C3 C4 C5	1 1 1	192P2249K8 196D685X9025J DM15-102J	Cap., .22 mfd, 80V, Tantalum, Sprague Cap., 6.8 mfd, 25V, Sprague Cap., 1000 pf, 500V, Dip Mica, Arco
C6 CR1	1 1	196D104X9035HA1 1N4733A	Cap., .1 mfd, 35V, Sprague Diode, 5.1V, Zener, Motorola
*M1 *M1	1 1	72T 2-4 Amps 72T 4-8 Amps	Meter, PC-1000A, SAC Meter, PC-1000B and PC-3000, SAC
Q1-3 R1,2 R3	3 2 1	2N3711 OE12G1 OC1821	Transistor, Silicon, NPC Res., 1.2 Ohm, 1/2W, 10%, CC, Ohmite Res., 1.8K, 1/4W, 10%, CC, Ohmite
R4 R5,8 R6	1 2 1	OC8231 OC1031 OC4721	Res., 82K, 1/4W, 10%, CC, Ohmite Res., 10K, 1/4W, 10%, CC, Ohmite Res., 4.7K, 1/4W, 10%, CC, Ohmite
R7 R9 R10,11,14	1 1 3	OC3911 OC2221 3006P-1-502	Res., 390 Ohm, 1/4W, 10%, CC, Ohmite Res., 2.2K, 1/4W, 10%, CC, Ohmite Res., 5K, 3/4W, Pot., Bourns
R12,16 R13	2 1	OC1021 OE22G1	Res., 1K, 1/4W, 10%, CC, Ohmite Res., 2.2 Ohm, 1/2W, 10%, CC, Ohmite, (PC-3000 Only)
S1	1 1	12X30B-4 DWG 1175 REV B	Switch, RCL Blank PWB 118, SAC
REF. DWGS.	0 0	DWG 641 REV F BOM 641 REV E	Antenna Current/Tuning Meter PWB Assembly Bill of Material
*Not Shown	0	DWG 646 REV F	Antenna Current/Tuning Meter Schematic

NOTES
1. THIS DRAWING NO. 641 REV. F.
2. REF. DES. PREFIX 2A1.
3. SCHEMATIC DRAWING NO. 646 REV. F.
4. PART NO. PWB 118-641.
5. 2M1 NOT SHOWN.
6. BOM 641 REV. E.

FIGURE 4-3
ANTENNA CURRENT/TUNING METER
PWB ASSEMBLY

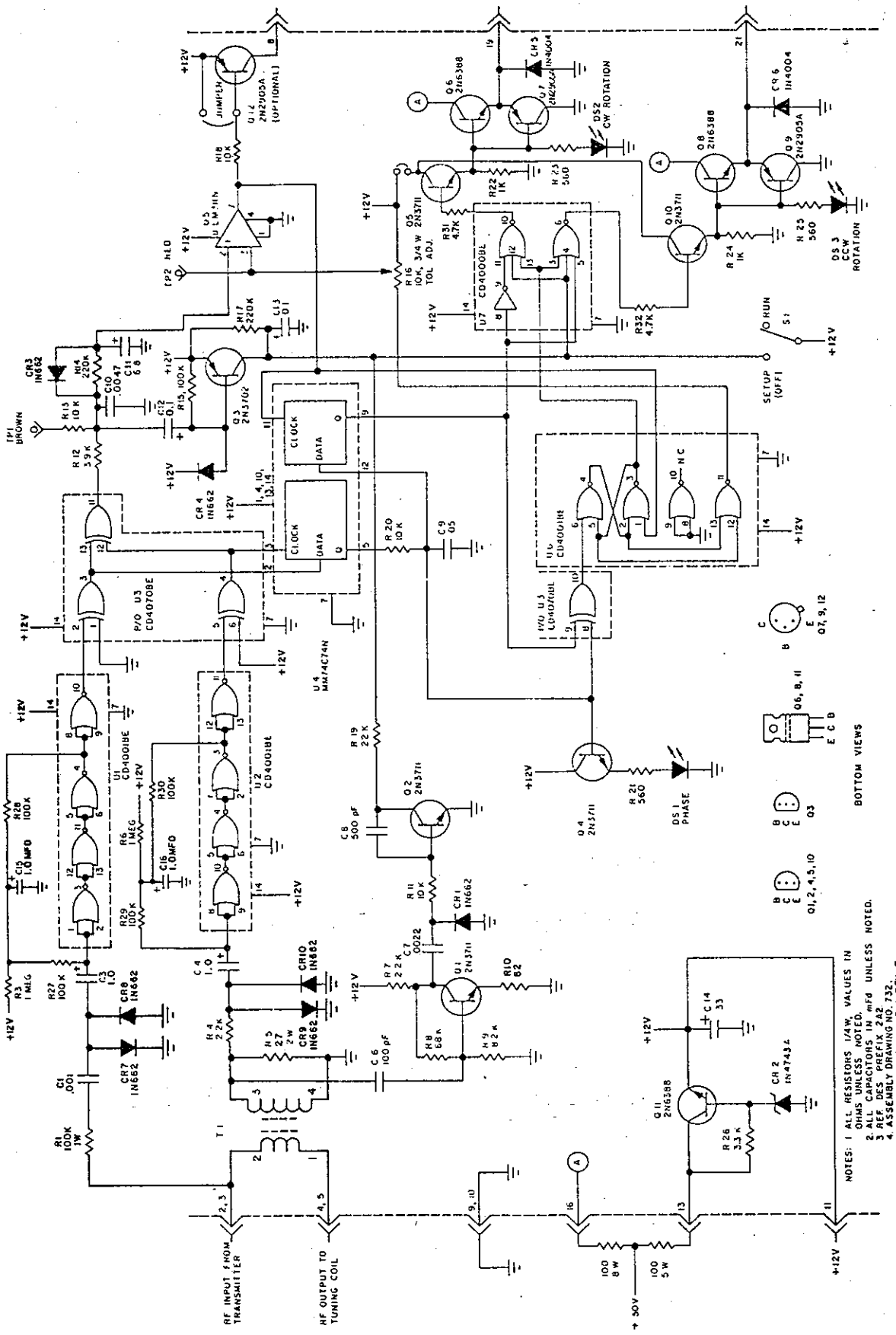
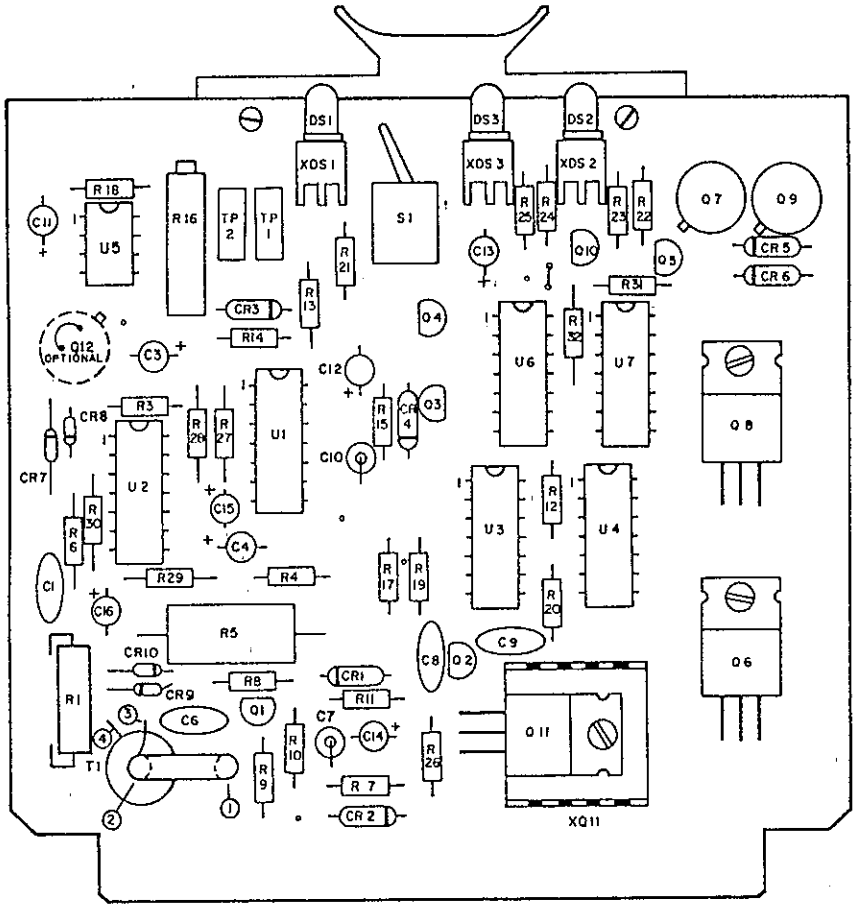


FIGURE 4-4

AUTOTUNE MOTOR DRIVE PWB SCHEMATIC



NOTES: 1. REF. DES. PREFIX 2A2.
2. THIS DRAWING NO. 732. REV. J.
3. SCHEMATIC DRAWING NO. 749 REV. F.
4. BOM 732 REV. J.

FIGURE 4-5
AUTOTUNE MOTOR DRIVE PWB ASSEMBLY

REF. DES.	QTY.	PART NUMBER	DESCRIPTION
C1	1	5GAD10	Cap., .001 mFd, 1000V, Sprague
C3,4,15,16	4	196D105X9035H	Cap., 1.0 mFd, 35V, Tant., Sprague
C6	1	CM05ED101J03	Cap., 100 pF, 500V, DSM, CDE
C7	1	192P2229R8	Cap., .0022 mFd, 80V, Sprague
C8	1	DM15-501J.	Cap., 500 pF, 500V, DSM, Arco
C9	1	TGS50	Cap., .05 mFd, 100V, Sprague
C10	1	192P4729R8	Cap., .0047 mFd, 80V, Sprague
C11	1	196D685X9025J	Cap., 6.8 mFd, 25V, Tant., Sprague
C12,13	2	196D104X9035HA1	Cap., .1 mFd, 35V, Tant., Sprague
C14	1	196D336X9025P	Cap., 33 mFd, 25V, Tant., Sprague
CR1,3,4,7,8,9,10	7	1N662	Diode, Silicon, TI
CR2	1	1N4743A	Diode, Zener, 13V, Motorola
CR5,6	2	1N4004	Diode, Silicon, GI
DS1-3	3	MV5753	LED, Red, GI
Q1,2,4,5,10	5	2N3711	Transistor, NPC
Q3	1	2N3702	Transistor, TI
Q6,8,11	3	2N6388	Transistor, RCA
Q7,9	2	2N2905A	Transistor, Motorola
Q12	1	2N2905A	Transistor (optional F/assy, Jumper Installed), Motorola
R1	1	OG1041	Res., 100K, 10%, 1W, CC, Ohmite
R22,24	2	OC1021	Res., 1K, 10%, 1/4W, CC, Ohmite
R3,6	2	OC1051	Res., 1 meg, 10%, 1/4W, CC, Ohmite
R4,7	2	OC2221	Res., 2.2K, 10%, 1/4W, CC, Ohmite
R5	1	OH2701	Res., 27 Ohm, 10%, 2W, CC, Ohmite
R8	1	OC6831	Res., 68K, 10%, 1/4W, CC, Ohmite
R9	1	OC8221	Res., 8.2K, 10%, 1/4W, CC, Ohmite
R10	1	OC8201	Res., 82 Ohm, 10%, 1/4W, CC, Ohmite
R11,13,18,20	4	OC1031	Res., 10K, 10%, 1/4W, CC, Ohmite
R12	1	OC3921	Res., 3.9K, 10%, 1/4W, CC, Ohmite
R14,17	2	OC2241	Res., 220K, 10%, 1/4W, CC, Ohmite
R15,27-30	5	OC1041	Res., 100K, 10%, 1/4W, CC, Ohmite
R16	1	3006P-1-103	Res., 10K, 3/4W, Pot., Bourns
R19	1	OC2231	Res., 22K, 10%, 1/4W, CC, Ohmite
R21,23,25	3	OC5611	Res., 560 Ohm, 10%, 1/4W, CC, Ohmite
R26	1	OC3321	Res., 3.3K, 10%, 1/4W, CC, Ohmite
R31,32	2	OC4721	Res., 4.7K, 10%, 1/4W, CC, Ohmite
S1	1	SF6TCX392	Switch, 2 Position, Cutler Hammer
T1	1	C-95 REV -	Transformer. SAC
TP1	1	325-108	Test Point, Brown, H.H. Smith
TP2	1	325-102	Test Point, Red, H.H. Smith
U1,2,6	3	CD4001BE	Int. Ckt., RCA
U3	1	CD4070BE	Int. Ckt., RCA
U4	1	MM74C74N	Int. Ckt., National
U5	1	LM311N	Int. Ckt., National
U7	1	CD4000BE	Int. Ckt., RCA
XDS1-3	3	909-235	LED Mount, Bivar
XPWB142	1	6200	Card Puller, SAE
XQ11	1	6073-B	Heatsink, Thermalloy
XQ7,9,12	3	77175N	Transistor Pad, Thermalloy
	1	DWG 1276 REV G	Blank PWB 142 Rev F. SAC
	2	25614BHMSS	Screw, BDGH MSCR, 2-56x1/4, SS 18-8
	2	2SLWS	Lockwasher, #2 Split, SS 18-8
	2	256HNS	Nut, 2-56 Hex, SS 18-8
	3	63214BHMSS	Screw, BDGH MSCR, 6-32x1/4, SS 18-8
	3	632HNS	Nut, 6-32 Hex, SS 18-8

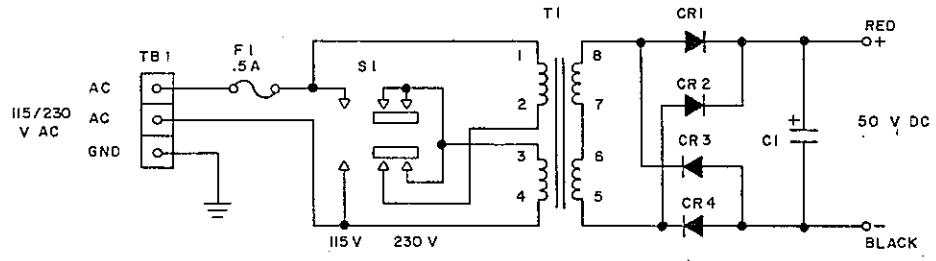
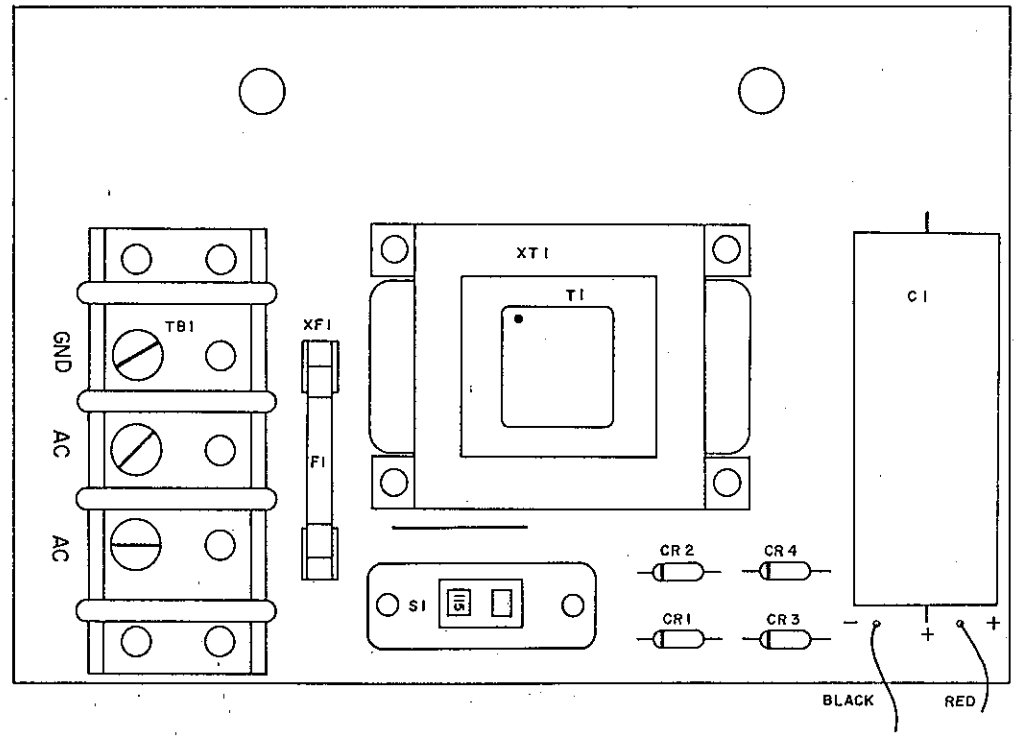


FIGURE 4-6

PC-1000/3000 POWER SUPPLY SCHEMATIC



NOTES: 1. THIS DRAWING NO. 529
2. SCHEMATIC IS NO. 528

FIGURE 4-7

PC-1000/3000 POWER SUPPLY ASSEMBLY

ITEM	REF DES.	QNTY.	PART NO.	DESCRIPTION
9		1	PWB 116	PWB, COUPLER POWER SUPPLY, SAC
8	XT1	1	24BR	TRANSFORMER BRACKET, SIGNAL
7	XF1	1	102068	FUSEHOLDER CLIP, LITTLEFUSE
6	TB1	1	3-142Y	TERMINAL BLOCK, CINCH
5	T1	1	DPC34-700	TRANSFORMER, 34 VAC, SIGNAL
4	S1	1	46206FLR	SWITCH, DPDT, SWITCHCRAFT
3	F1	1	312-500	FUSE, 1/2 AMP, 250 V, LITTLEFUSE
2	CR1-4	4	IN4004	DIODE, SILICON, GI
1	C1	1	TC75501A	CAP, 500 mfd, 75 V, MALLORY

5. ANTENNAS: The range of a beacon and antenna depends on many variables and cannot be guaranteed. The field strength can be calculated if the ground conductivity is known, but the field strength needed depends on the background environmental noise which depends on location. A field strength of 70uV/m is generally adequate in the United States and Europe, but may not be sufficient in latitudes between 30°N and 30°S. Range figures given in the following sections are based on average ground conductivity and a field strength of 70uV/m.

5.1 MAST ANTENNA: The Mast Antenna is a short vertical monopole with capacitive top loading and inductive center loading. It was designed for use where space is severely limited, such as an offshore structure. It is centerloaded to be resonant at approximately 500 KHz for operation between 190 and 415 KHz and at approximately 900 KHz for operation between 415 and 625 KHz. Tuning below the resonant frequency is accomplished with the antenna coupler. There are two versions of this antenna; one designed to be mounted on land, the other on drilling platforms or ships. Neither antenna requires guying. A capacitive hat at the top of the 34-foot Mast Antenna consists of six 8-foot radials. These can be shortened if necessary for clearance on drilling platforms. The counterpoise system used for land installations consists of sixteen 60-foot radials made of #10 copper wire with 6-foot ground rods at each end and one in the center. The offshore version of the Mast Antenna uses the platform structure and the water for the ground system.

The range depends on ground condition, frequency, the ADF, and atmospheric noise which in turn depends on location and time. Range with a 100 watt transmitter for most locations in the United States and with one of the lower priced ADF's is from 50 to 70 miles for frequencies above 250 KHz except over low conductivity ground. SAC does not recommend this antenna for land installations at frequencies below 250 KHz. The "T" Antenna is far superior at all frequencies and should be used whenever space permits. The 50-foot Guyed Mast is recommended for land installation where the "T" cannot be used. Calculated range over sea water with a 100 watt transmitter is 40 miles at 200 KHz, increasing to 100 miles at 400 KHz.

Ideally, this antenna should be in a clear area; however, this is very seldom feasible on offshore structures. Large obstacles close to the antenna will affect the directional properties and the tuning of the antenna. If possible, the antenna should be installed with a clear area in the direction of the most traffic.

The Mast Antenna is electrically very similar to a 200 pF capacitor in series with a small resistor. See Figure 5-1 for a plot of the capacitive reactance. The resistance of the antenna is dependent on many conditions over which the manufacturer has no control. The ground condition, for example, is extremely important. In a high conductivity ground region, the resistance will be fairly low. This is especially true on offshore oil rigs where the ground system consists of a large metal structure over salt water. On the other hand, if the ground conductivity is low, the resistance can become quite large. For example, permafrost in Alaska generally makes a very poor ground and in most cases a special counterpoise system must be used. Without a special counterpoise system, the antenna resistance may be as high as 50 ohms and the antenna efficiency will be very low.

5.2 "H" ANTENNA: The "H" Antenna is used on the helipad of offshore structures where there is no clear area to install the Mast Antenna. It is a wire structure that is installed on the perimeter of the helipad. The transmitter is mounted directly beneath it so that the vertical portion of the antenna is the offshore structure itself. Electrical characteristics vary, depending mostly on the size of the helipad, but are generally similar to the Mast Antenna. Range is also comparable with the Mast in most cases.

5.3 50-FOOT GUYED MAST ANTENNA: This antenna is a guyed vertical monopole with capacitive top loading that was designed for land installation where space is limited. The capacitive top hat consists of six 8-foot radials. The counterpoise system consists of sixteen 60-foot radials made of #10 copper wire with 6-foot ground rods at each end and one in the center. The antenna is guyed at the top and center.

The calculated range with the Guyed Mast Antenna exceeds the Mast Antenna, but is less than the "T" Antenna under the same conditions. This antenna is recommended for land installation where space does not permit use of the "T" Antenna.

The Guyed Mast Antenna is electrically very similar to a 300 pF capacitor in series with a small resistor. See Figure 5-1 for a plot of the capacitive reactance. The resistance of the antenna is dependent on many conditions over which the manufacturer has no control. The ground condition, for example, is extremely important. In a high conductivity ground region, the resistance will be fairly low. On the other hand, if the ground conductivity is low, the resistance can become quite large. For example, permafrost in Alaska generally makes a very poor ground and in most

cases a special counterpoise system must be used. Without a special counterpoise system, the antenna resistance may be as high as 50 ohms and the antenna efficiency will be very low.

5.4 SYMMETRICAL "T" ANTENNA: The Symmetrical "T" Antenna is recommended if sufficient land is available. This antenna requires a plot of ground approximately 150 feet by 350 feet.

The calculated range with the "T" Antenna and a 100 watt transmitter for most locations in the United States and with one of the lower priced ADF's is from 80 to 100 miles except over low conductivity ground.

These range figures are for the standard "T" Antenna with a height of 55 to 60 feet. A long range "T" Antenna with a height of 80 to 85 feet has a range of 100 to 120 miles with a 100 watt transmitter. If even more range is desired, SAC can supply "T" Antennas with heights up to 200 feet.

The standard "T" is electrically very similar to a 1000 pF capacitor in series with a small resistor. See Figure 5-1 for a plot of the capacitive reactance. The resistance of the antenna is dependent on many conditions over which the manufacturer has no control. The ground condition, for example, is extremely important. In a high conductivity ground region, the resistance will be fairly low. On the other hand, if the ground conductivity is low, the resistance can become quite large. For example, permafrost in Alaska generally makes a very poor ground and in most cases a special counterpoise system must be used. Without a special counterpoise system the antenna resistance may be as high as 50 ohms and the antenna efficiency will be very low.

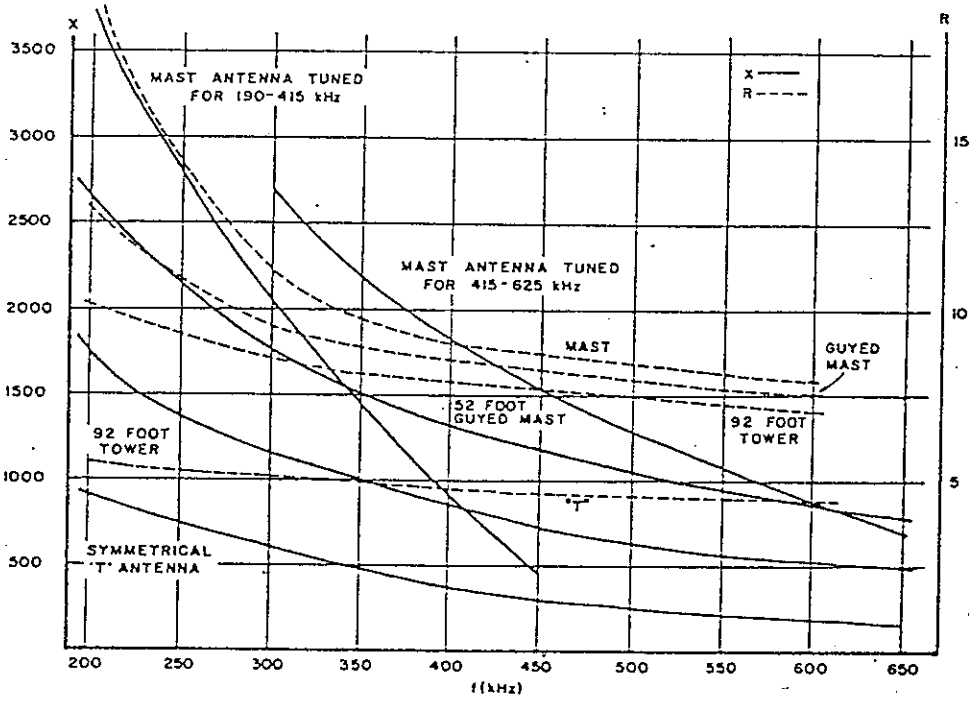


FIGURE 5-1
ANTENNA IMPEDANCE

6. INSTALLATION: PC-1000.

1. Locate the two coupler mounting brackets and attach to tne coupler enclosure.

2. Mount the PC-1000 to the H-beam, wooden post, tower legs, or offshore platform with the appropriate supplied hardware.

3. Remove the access panel located above the tuning controls panel.

4. Locate the antenna feedthrough insulator bushing, and carefully insert into the glass insulator panel according to the instruction sheet packaged with the insulator. Do not over tighten or stress the insulator components.

5. Connect the wire from the top of the coil assembly in the coupler to the insulator bushing. Attach the copper tube antenna lead to the external end of the insulator bushing.

6. Locate and install the lightning arrestor with the two screws located between the insulator bushing and the front access door. Adjust the spark gap if necessary to approximately 1" (2.5 cm).

7. Connect the RG-8 cable from the RF output of the transmitter to the type N connector on the coupler wall.

8. Attach two #10 ground wires from the counterpoise system or offshore platform frame to the copper ground lug on the side of the coupler.

9. Insert the coupler control cable through the wire bushing on the coupler wall and attach the individual wires to the screw terminals on the terminal block TB1. Attach +50V DC to terminal 1 and ground to terminal 3. Dress the control wires away from the coupler tuning coil to prevent high voltage arcing.

10. If the optional power supply is to be used, mount the power supply to the left vertical mounting rail above TB1 and the Autotune PWB. Attach the red wire (+50V) from the power supply to TB1 terminal 1. Attach the black wire (Ground) from the power supply to TB1 terminal. No other wires should be attached to TB1. Attach the AC ground wire to the terminal block screw marked GND on the coupler power supply. Attach the 115/230 VAC and AC return wires to the two terminals marked AC on the power supply. Switch the AC voltage

select switch S1 on the power supply to 115 V or 230 VAC as appropriate. Do not apply AC power at this time.

11. Set all taps according to Figures 7-2 through 7-5. Fine tuning taps are chosen with a front panel switch. The coarse tap is chosen by connecting a clip lead to the proper coil tap behind the coil access panel. A permanent connection will be made later.

7. ANTENNA TUNE-UP:

NOTES AND PRECAUTIONS

Extremely high voltages exist on and around the tuning coil and antenna wires when RF power is applied to the coupler. Always remove RF drive when changing coarse or fine taps.

Never remove the Autotune PWB without removing RF drive and removing the DC 1/2 Amp fuse on the coupler control panel. Serious damage to the Autotune PWB may result.

1. Set the coarse and fine taps according to figures 7-2 through 7-5. These are representative tuning charts for various Southern Avionics antenna systems and represent a starting point for tuning to other antenna systems. A clip is furnished on the RF output lead to facilitate initial coarse tap selection. After final tap selections, remove the clip and trim the wire to the proper length insuring that at least 2 inches (5 cm) separates the wire from both the coil and the coupler enclosure. Dress the wire to avoid sharp bends which may lead to high voltage corona discharge, and solder the wire to the selected coil coarse tap.

2. Set the IMPEDANCE TRANSFORMER switch to position 11.

3. Check all connections between the transmitter and the coupler. Check that the RF drive control on the transmitter is fully off.

4. Set the SETUP/RUN switch on the Autotune PWB in the coupler to RUN.

5. Apply power to the transmitter and the coupler.

6. Slowly increase the RF drive while observing the VSWR and power meters on the transmitter. Only a small drive level should be required to cause the Autotune system to begin to tune the meters. Go to Step 10 if the antenna is tuned.

   NOTE: The autotune system will not attempt to drive the tuning motor if the RF current is too low or if a modulating signal is present.

7. Check the transmitter VSWR indication or the coupler TUNE indication to determine if the antenna is tuned. The antenna is tuned if the VSWR is very low. Go to Step 10 if the antenna is tuned.

8. Rotate the VERNIER tuning knob from one limit to the other. If the Autotune motor starts to tune the antenna, release the VERNIER tuning knob, and go to Step 10.

9. Turn RF drive control off, change the FINE TAP knob to the next lower tap and repeat Steps 6, 7, and 8. If the antenna still did not tune, change the FINE TAP to the next higher tap and repeat Steps 6, 7, and 8. Continue this bracketing procedure until the Autotune motor starts to tune the antenna. NOTE: If the FINE TAP is on Tap 4, and it is necessary to decrease the inductance, change the COARSE TAP to the next lower tap and change the FINE TAP to Tap 44. Or if the FINE TAP is on Tap 44, and it is necessary to increase the inductance, change the COARSE TAP to the next higher tap and change the FINE TAP to Tap 4. It may be necessary to change the FINE TAP a few times before the inductance will be the same as it was before the COARSE TAP was changed.

10. The system is tuned correctly when the VERNIER tuning knob is in the center of its range or slightly to the left. If the VERNIER tuning knob is not in this position or is at a limit, it will be necessary to change the FINE TAP. Increasing a FINE TAP will cause the VERNIER tuning to move toward MIN and decreasing a FINE TAP will cause the VERNIER tuning to move toward MAX.

11. Set the IMPEDANCE TRANSFORMER switch to the position shown in Figure 7-1. Increase the RF drive and note the VSWR reading. Turn the RF drive off.

12. Repeat Step 11 with the IMPEDANCE TRANSFORMER switch in the positions above and below that of Step 11, and select the position showing the lowest VSWR reading.

13. The TOL ADJ pot on the Autotune PWB adjusts the sensitivity of the Autotune circuits to changes in the antenna tuning. If the pot is adjusted too far counterclockwise, the tuning system will "hunt" with the motor oscillating back and forth rapidly. If the adjustment is too far clockwise, the sensitivity will not be sufficient to detect antenna changes and no tuning will take place. Rotate the adjustment counterclockwise until the motor begins to oscillate and then rotate clockwise until the oscillation stops. Further clockwise rotation may be required to prevent motor activation during transmitter keying.

14. Remove all power and make a permanent COARSE TAP connection by cutting the tap wire to length and soldering it to the tap lug on the coil. Bend the tap wire so that at least two inches of clearance is maintained between it and the coil.

15. Replace the front access door.

f(kHz)	MAST ANTENNA	52 FOOT GUYED MAST	"T"
190-220	9	7	5
220-250	8	7	4
250-290	7	6	4
290-625	6	6	4

FIGURE 7-1
IMPEDANCE TRANSFORMER TAPS

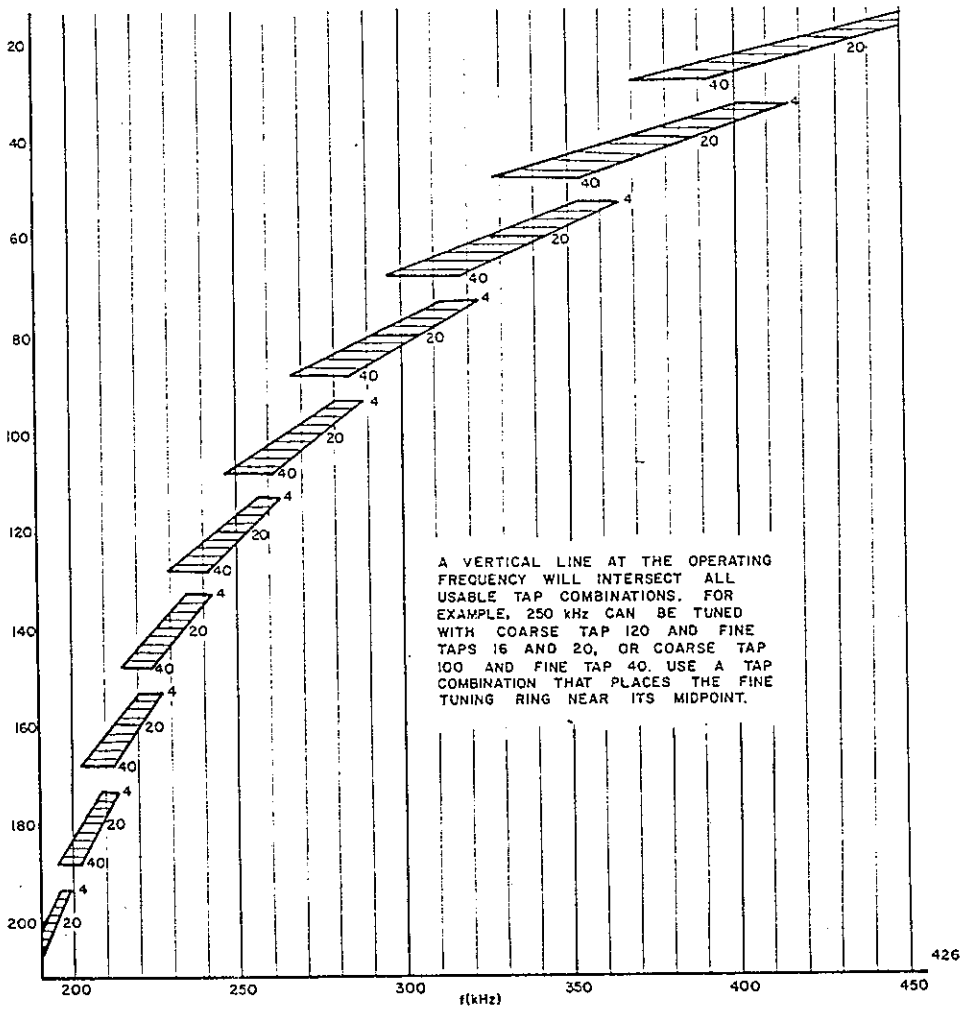


FIGURE **7-2**
MAST ANTENNA AND PC-1000
MAST TUNED FOR 190-415 kHz

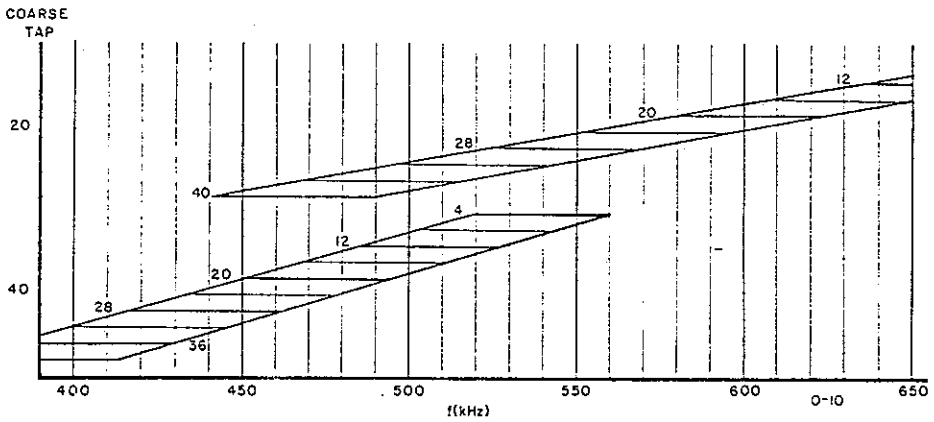


FIGURE **7-3**

MAST ANTENNA AND PC-1000

MAST TUNED FOR 415-625 kHz

A VERTICAL LINE AT THE OPERATING FREQUENCY WILL INTERSECT ALL USABLE TAP COMBINATIONS. FOR EXAMPLE, 450 kHz CAN BE TUNED WITH COARSE TAP 40 AND FINE TAPS 20, 24, AND 28 OR COARSE TAP 20 AND FINE TAP 40. USE A TAP COMBINATION THAT PLACES THE FINE TUNING RING NEAR ITS MIDPOINT.

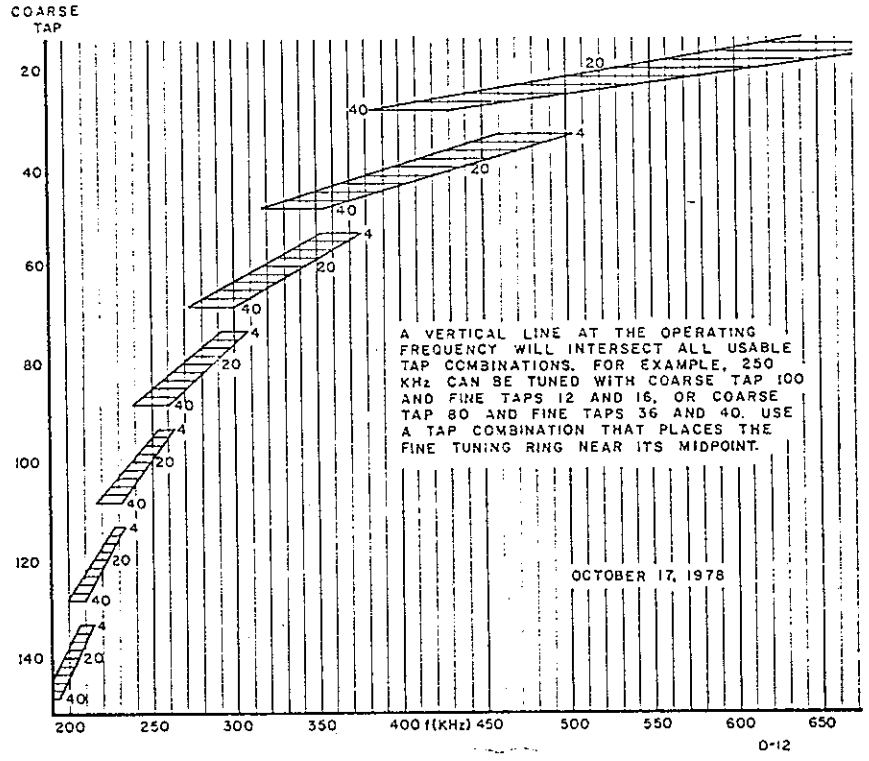


FIGURE **7-4**
50 FOOT GUYED MAST AND PC-1000

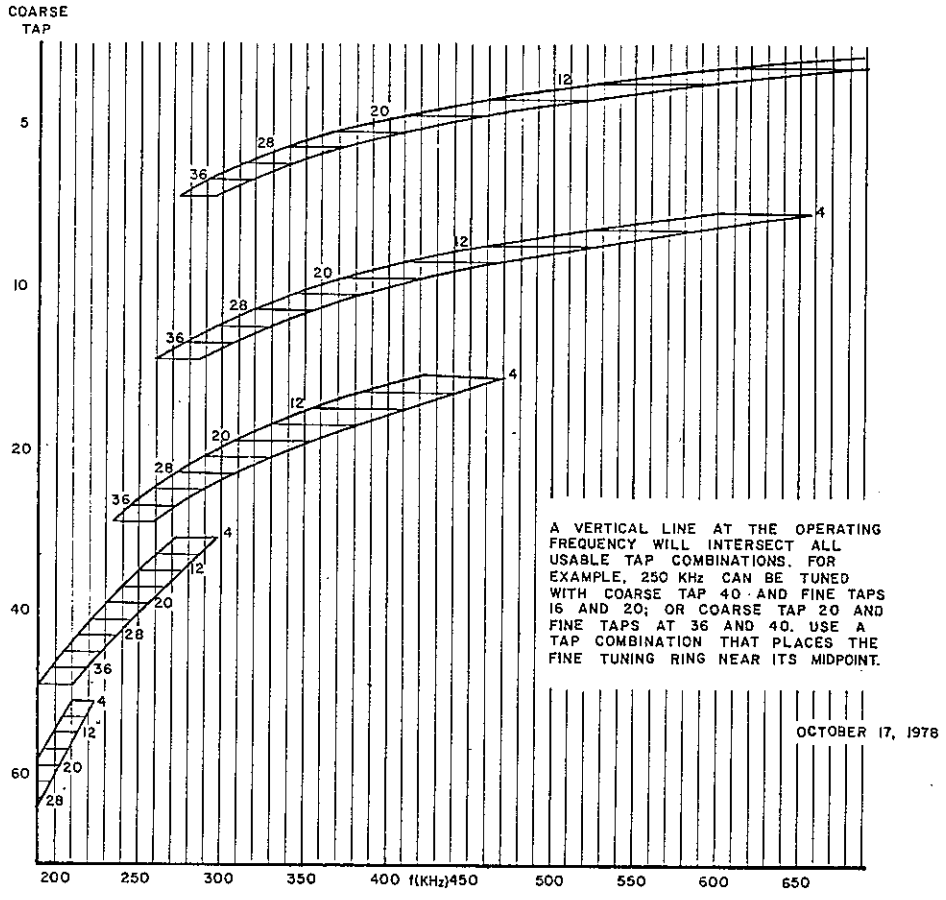


FIGURE 7-5
SYMMETRICAL "T" ANTENNA
AND PC-1000