80-01AVS

SOUTHERN AVIONICS COMPANY

MANUFACTURERS OF LOW FREQUENCY RADIOBEACONS AND ASSOCIATED PRODUCTS

Non-Directional Radiobeacon

NDB

Model SS-800AVS

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.

NON-DIRECTIONAL RADIOBEACON (NDB)

MODEL ______________________

SERIAL NO. ______________________

Output Power ____________ watts (nominal)

Assigned Channel Frequency ____________ KHz

Carrier Crystal Frequency ____________ KHz

Identifier Crystal Frequency ____________ KHz

Effective Tone Frequency ____________ KHz

Identification ____________

NOTE: Above measurement and adjustments made at Southern Avionics Company in Beaumont, Texas, before shipment.

INSTALLATION NOTES:

Antenna Resistance ____________ Ohms

Antenna Current ____________ Amps

Antenna Power Input ____________ Watts

FCC RADIO STATION LICENSE

NAME ______________________

CALL SIGN ______________________

FILE NO. ______________________

INSTALLED BY ______________________

LICENSE NO. ______________________

DATE ______________________

SOUTHERN AVIONICS COMPANY
MANUFACTURERS OF LOW FREQUENCY RADIOBEACONS AND ASSOCIATED PRODUCTS
5055 BELMONT, POST OFFICE BOX 5345, BEAUMONT, TEXAS 77702, USA
TELEPHONE: (713) 842-1717, CABLE: SAC, TELEX: 77-9450

LIMITED WARRANTY

SOUTHERN AVIONICS COMPANY (hereinafter called COMPANY) warrants to the original purchaser for a period of one year from the date of delivery to the original purchaser, that the goods sold pursuant to this COMPANY invoice were at the time of the delivery, free from defects resulting from faulty material or workmanship. THIS LIMITED WARRANTY IS IN LIEU OF ALL OTHER REPRESENTATIONS AND EXPRESS WARRANTIES. This warranty is made for the benefit of the initial purchaser only and is not made for the benefit of any party other than initial purchaser. This warranty applies only if the goods are submitted to normal use and service and does not apply if the goods are misused.

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In the event purchaser chooses to commence an action for breach of warranty or breach of contract arising out of the sale of the goods pursuant to this invoice, the purchaser must commence such action within one year after the cause of action accrues.

THE REMEDY PROVIDED HEREIN SHALL BE THE SOLE AND EXCLUSIVE REMEDY FOR BREACH OF THIS WARRANTY, FOR ANY BREACH OF ANY IMPLIED WARRANTY EXISTING AND APPLICABLE UNDER THE LAW (TO THE EXTENT THAT ANY SUCH WARRANTY HAS NOT BEEN SUCCESSFULLY NEGATED AND DISCLAIMED HEREINABOVE), AND FOR ANY ACT OF NEGLIGENCY OR ANY OTHER TORTIOUS ACT COMMITTED BY COMPANY, AND IN NO EVENT SHALL THE COMPANY BE LIABLE TO PURCHASER OR ANY THIRD PARTY FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES RESULTING FROM ANY DEFECT IN THE GOODS OR ANY FAILURE OF THE GOODS TO CONFORM WITH THIS WARRANTY OR ANY IMPLIED WARRANTY EXISTING AND APPLICABLE UNDER THE LAW (TO THE EXTENT THAT ANY SUCH IMPLIED WARRANTY HAS NOT BEEN SUCCESSFULLY NEGATED AND DISCLAIMED HEREINABOVE).

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

TABLE OF CONTENTS

NON-DIRECTIONAL RADIOBEACON (NDB)

SECTION 1

INTRODUCTION

1.1 Specifications

1.2 General Description

1. INTRODUCTION.

1.1 Specifications, SS-800AV

QUALIFICATIONS: Meets applicable requirements of the Federal Aviation Administration (FAA). Federal Communications Commission (FCC), and International Civil Aviation Organization (ICAO).

FREQUENCY: 190 - 625 KHz.

FREQUENCY CONTROL AND STABILITY: Crystal controlled, stability is 0.01% (-45^{o} to 70^{o}C), 0.005% (-10 to 70^{o}C), 0.001% (0^{o} to 40^{o}C).

TYPE OF EMISSION: A0/A2, A3, A0/A2/A3; Keyed code tone modulation of an RF carrier. Optional voice modulation of RF carrier, simultaneous voice and code tone modulation of an RF carrier, non-simultaneous voice and code tone modulation of an RF carrier.

POWER OUTPUT: Continuously adjustable 5 to 100 watts carrier power. Power increases during modulation.

MODULATION: Keyed 400 Hz or 1020 Hz tone, International Morse Code; any combination of letters or numerals, and/or optional voice modulation. Modulation percentage adjustable 0-100 percent. Code modulation percent to 100% with voice signal absent or to 20% with voice signal present.

BANDWIDTH: Either 800 or 2040 Hz depending on tone frequency. 1000 Hz to 6000 Hz for voice transmission.

HARMONIC DISTORTION: All harmonics are more than 60 db below the 50 watt carrier, measured at a dummy antenna simulating either a SAC Mast Antenna or "T" Antenna.

CIRCUIT PROTECTION: Lightning protection on power line and antenna connection. Circuit breaker in power line. Fuse in power line to final circuit. Zener protection on transistors in final circuit. Special current and voltage limiting circuit on 50 V DC line.

METERING: RF output power, DC current in one of the final transistors, DC voltmeter.

WORKING CONDITIONS: Continuous unattended operation in the following environments: ambient temperature, (-50^{o} to +70^{o}C); relative humidity, 0-100%; high salinity as encountered in offshore conditions.

AUTOMATIC SHUTDOWN: Transmitter shuts down with loss of tone or continuous tone, or extreme distortion due to a change in load, or when power falls below a preset value.

AUDIO LINE INPUT: Balanced, 600 ohms ±20%, -17 dBm nominal. Will accept -28 dBm to +5 dBm. (0 dBm=1 mW into 600 ohms). Audio line direct current shall not exceed 3 mA DC.

TRANSMITTER AUDIO LINE CONTROL CIRCUITS:

Squelch - Allows line input signals to pass through to the modulator when the line signals exceed the squelch trip point. Controls code signal modulation level (to 95% with line signal absent, to 20% with line signal present). Operates with fast attack, slow decay characteristics. Squelch level adjustable from -30 dBm to +5 dBm.

AGC - Maintains a constant average modulation level for line input signals. At maximum sensitivity, AGC stage will accept input levels of -28 dBm to +5 dBm without modulation percent change. Attack and decay times adjusted for voice type line signals.

Over-Modulation Control - Limits modulation of carrier to 100% on severe overload of AGC circuits. Allows clipping of voice signals to increase average modulation percentage.

INPUT POWER: 115/230 VAC ±20%, 50-500 Hz, 400 watts maximum, or 48 VDC, 6 amperes maximum.

EMERGENCY BATTERY SUPPLY (Optional): When emergency batteries are used, the transmitter automatically keeps the batteries charged when AC power is available, and automatically switches to batteries on loss of AC power. Four 72 ampere hour, 12V fully charged batteries will operate the SS-800AV for approximately 8 (eight) hours.

INSTALLATION REQUIREMENTS: The SS-800AV is supplied in a weatherproof enclosure. The SS-800AV and the antenna coupler are suitable for pole mounting out-of-doors.

APPROXIMATE DIMENSIONS:

	Radiobeacon Net/Boxed	Antenna Coupler Net/Boxed
Height	26/31 in.	24/33 in.
Width	14/21 in.	20/26 in.
Depth	7/17 in.	20/26 in.
Weight	42/60 lbs.	46/80 lbs.

NOTE: Spare parts if ordered are packed with Radiobeacon. Add 5 lbs. to boxed weight.

SPECIFICATIONS FOR ELECTRICAL CONNECTION BETWEEN AUDIO SOURCE AND TRANSMITTER SITE:

For short distances of up to 300 feet, direct connection of the audio drive source to the transmitter audio input may be made through a twisted wire pair or 600 ohm open wire pair. For greater distances, equalization of the audio line may be required to prevent loss of the higher audio frequencies.

For installation requiring the use of leased telephone circuits from the audio source to the transmitter site, the following should be specified when ordering the circuit:

1. Line impedance 600 ohm, balanced, audio only.

2. Line equalization for frequencies 400 Hz to 2800 Hz.

3. Maximum line input +5 dBm.

4. Normal equipment input -8 dBm.

5. Maximum line loss -12 dB.

6. If D.C. current is present on the telephone pair, the D.C. current shall be isolated from the transmitter audio input. Maximum D.C. component to the transmitter audio input is 3 mADC.

7. Line coupling devices installed at the transmitter shall not be such that R.F. energy emitted from the transmitting antenna will be demodulated in the coupling device with the demodulated audio appearing as an audio input to the transmitter. Coupling devices containing varistors should not be used unless R.F. energy is bypassed.

1.2 General Description - SS-800AV

1.2.1 Transmitter: The Model SS-800AV non-directional beacon is an amplitude modulated transmitter with an adjustable output power of up to 50 watts carrier power. The carrier is modulated by an internal keyer audio oscillator and/or by a voice type audio signal derived from an optional audio line input. The internal audio oscillator can be factory programmed for 400 Hz or 1020 Hz.

The transmitter operates on 115/230 VAC, 50-500 Hz or 48 VDC.

An automatic shutdown circuit is included that automatically shuts down the transmitter if power falls below an adjustable level, if the "ident" signal fails, or if extreme distortion is present. When a dual system is used, the shutdown signal is used to transfer to the standby transmitter.

A current and voltage limiter protects the transmitter from line surges or voltage and current surges in the final due to accidental shorts or improper tuning.

The transmitter is in a rain-tight enclosure that permits it to be mounted out-of-doors at the base of the antenna.

1.2.2 Antenna Coupler: The PC-1000 Antenna Coupler is used between the SS-800AV and a SAC Mast Antenna, 52-foot Guyed Mast Antenna, or "T" Antenna to present a 50 ohm load to the NDB at frequencies between 190 and 625 KHz. The "T" Antenna is the only antenna recommended for voice modulation.

The coupler consists of a large tapped coil, a tuning ring, an autotune system, and a metering circuit.

1.2.3 Special note concerning antenna selection for AM and Voice Modulation Systems:

Bandwidth limitations of small low-frequency transmitting antennas may present severe limitations to the transmission of wide-band signals such as voice or AM double sideband signals. The effect of these limitations is a reduction in the transmitted sideband levels and thus a reduction in the reception range of the transmitted intelligence without an appreciable effect on carrier range. The extent of this effect is dependent upon antenna type, audio frequency, and transmitter frequency.

The Symmetrical "T" Antenna can be recommended for any audio and transmitter frequency combination. The bandwidth is reasonably broad, with little sideband attenuation. The Mast Antenna, the "H" Antenna, and the 52-foot Guyed Mast Antenna must be considered as narrowband antennas. If possible these antennas should not be used with voice bandwidth signals. The use of these antennas with A0/A2 tone code signals should be limited if possible to 400 Hz tone frequencies. Higher frequencies may exceed the bandwidth limits of the antennas.

The Symmetrical "T" Antenna is recommended for all land installations wherever space is available. It is a wire antenna with a 55-foot vertical section and a 300-foot top hat. This antenna requires two poles or towers for support.

1.2.4 Battery System (Optional): The Battery Standby Unit provides a 48-volt standby Battery System to operate the Southern Avionics Company Radiobeacon. It automatically switches to standby power in the event of failure of the primary 115/230 volt power source. A battery charger is an integral part of the unit. It comes with all connecting cables. Any good-grade commercial batteries can be used. The shelter described below should be used with the battery standby system.

1.2.5 Shelter (Optional): The small prefabricated steel shelter makes an ideal shelter for the radiobeacon equipment, including the batteries when battery standby is used. There is ample out-of-weather work space and enough room for additional storage. Security is provided by the door handle lock.

1.2.6 Transfer System (For Dual Systems): An optional Automatic Transfer Unit is used where there are two transmitters, one of which is on a standby basis. The unit transfers the antenna and power from the primary transmitter to the standby transmitter when the antenna current drops to a predetermined level or the primary transmitter shuts down for any reason. The Automatic Transfer Unit is housed in a single weatherproof enclosure suitable for pole mounting out-of-doors. It is fully equipped with all connecting cables, etc.

1.2.7 Monitor/Alarm Receiver (Optional): The SAC radiobeacon Monitor is an optional piece of equipment that is designed for monitor service in the 190 to 625 KHz aircraft and marine radio navigation service. This receiver activates an alarm (both visual and aural) if the output power drops below a predetermined level or if the identifying code fails. This Automatic Monitor meets all of the requirements of the Federal Aviation Administration (FAA) pertaining to "Off the Air" monitoring requirements of NDB facilities that are used in connection with an FAA Approved Instrument Approach.

1.2.8 Voltage Regulator (Optional): SAC Radiobeacons will operate with a ±20% tolerance on the AC supply voltage without damage to the equipment. In addition, the Radiobeacon is protected from large voltage surges. The optional Voltage Regulator should be used only in those cases where the supply voltage is expected to be greater than 20% above normal or less than 20% below normal for sustained periods of time. The Voltage Regulator will accept input voltages from 50 to 250 VAC at frequencies from 45 to 66 Hz with an output voltage of 115 or 230 VAC.

1.2.9 Time Share System (Optional): A time sharing system is available which allows a number of beacons to be activated according to a precisely timed schedule, on a completely automatic basis. It is used mainly where there are several transmitters operating on a single frequency. This is a common offshore situation when one company has many offshore structures, but is allowed only one frequency.

NON-DIRECTIONAL RADIOBEACON (NDB)

SECTION 2

THEORY OF OPERATION

2. THEORY OF OPERATION:

2.1 Block Diagram Theory - SS-800AV

The SS-800AV signal is generated at low level by amplitude modulating the output of a crystal controlled carrier oscillator with an audio signal. The audio signal is derived from the summing of a voice type line input signal with a keyed tone code signal.

The audio signal to the modulator is controlled by squelch and automatic-gain-controlled circuitry. Audio line inputs greater than the squelch threshold level are permitted to pass through to the modulator. Amplitude of the line input signals is maintained by the A.G.C. circuit.

The code signal is generated by the Keyer and the Recycle Board. The 1020 Hz or 400 Hz output of a code tone oscillator is gated on and off by a logic signal from the keyer. A second gating circuit operated by the squelch detector permits high amplitude code modulation during voice signal absence and low amplitude code modulation during voice signal presence.

The modulated R.F. signal is filtered and then fed into a linear amplifier consisting of a class A preamplifier, a push-pull class AB driver stage, and a parallel push-pull class AB final amplifier.

The signal then goes to the antenna system which consists of the antenna coupler and the antenna.

The power supply is a conventional full wave supply capable of delivering 8 amps at 50 volts. The transmitter uses up to 6 amps at full power thus leaving an ample supply for battery charging.

The optional battery system acts as a trickle charger which supplies current to the battery supply whenever the battery voltage is below 48 volts. If the D.C. supply voltage drops below 48 V, the batteries supply current to the transmitter. It also triggers a special identifying code which alerts anyone monitoring the facility that the transmitter is operating on emergency battery power.

Output current is sensed at the final stage to provide an automatic shutdown capability. A current and voltage limiter protects the final circuit from line surges, or voltage and current surges in the final.

D.C. current in one of the final transistors, and RF output power are metered. A DC voltmeter with probe is also built in.

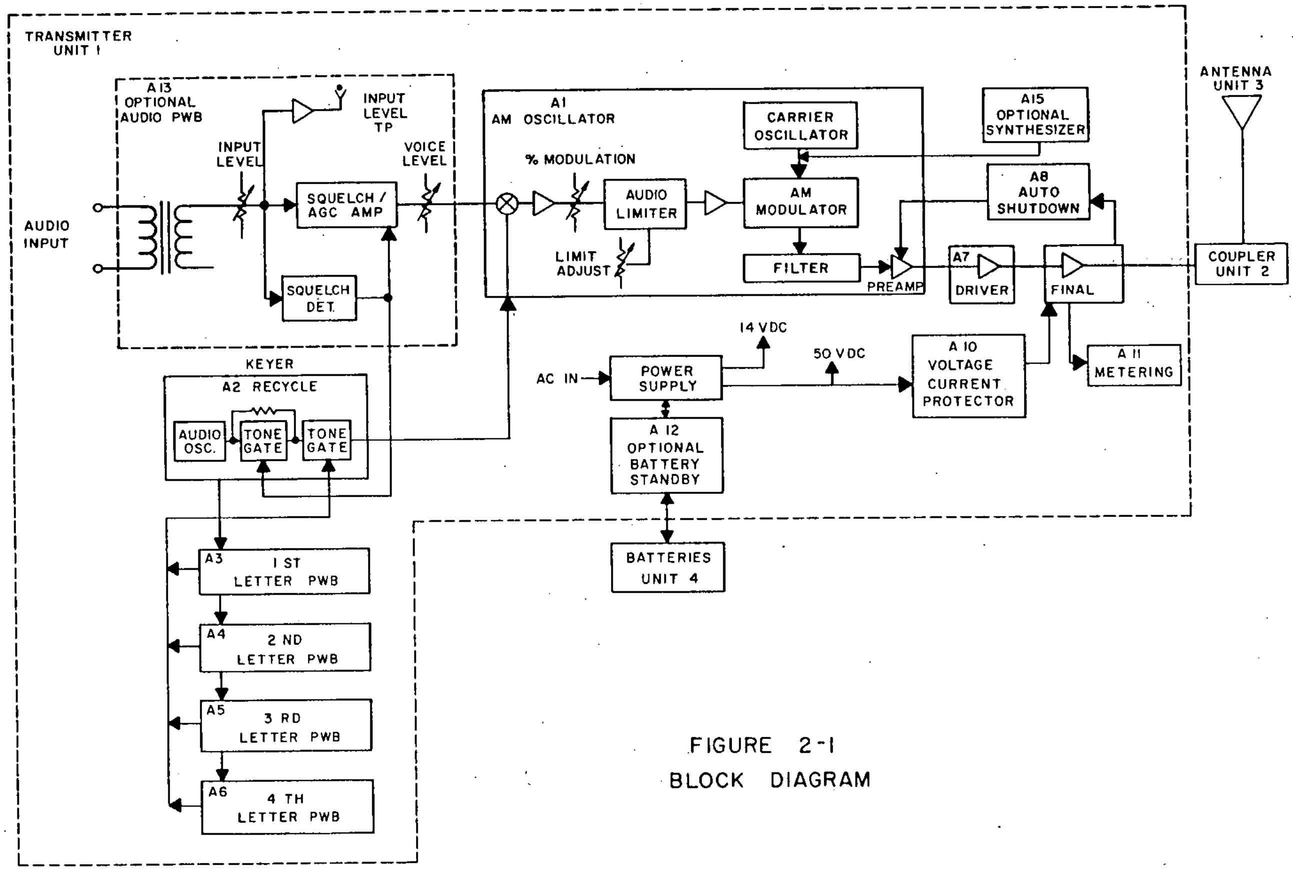
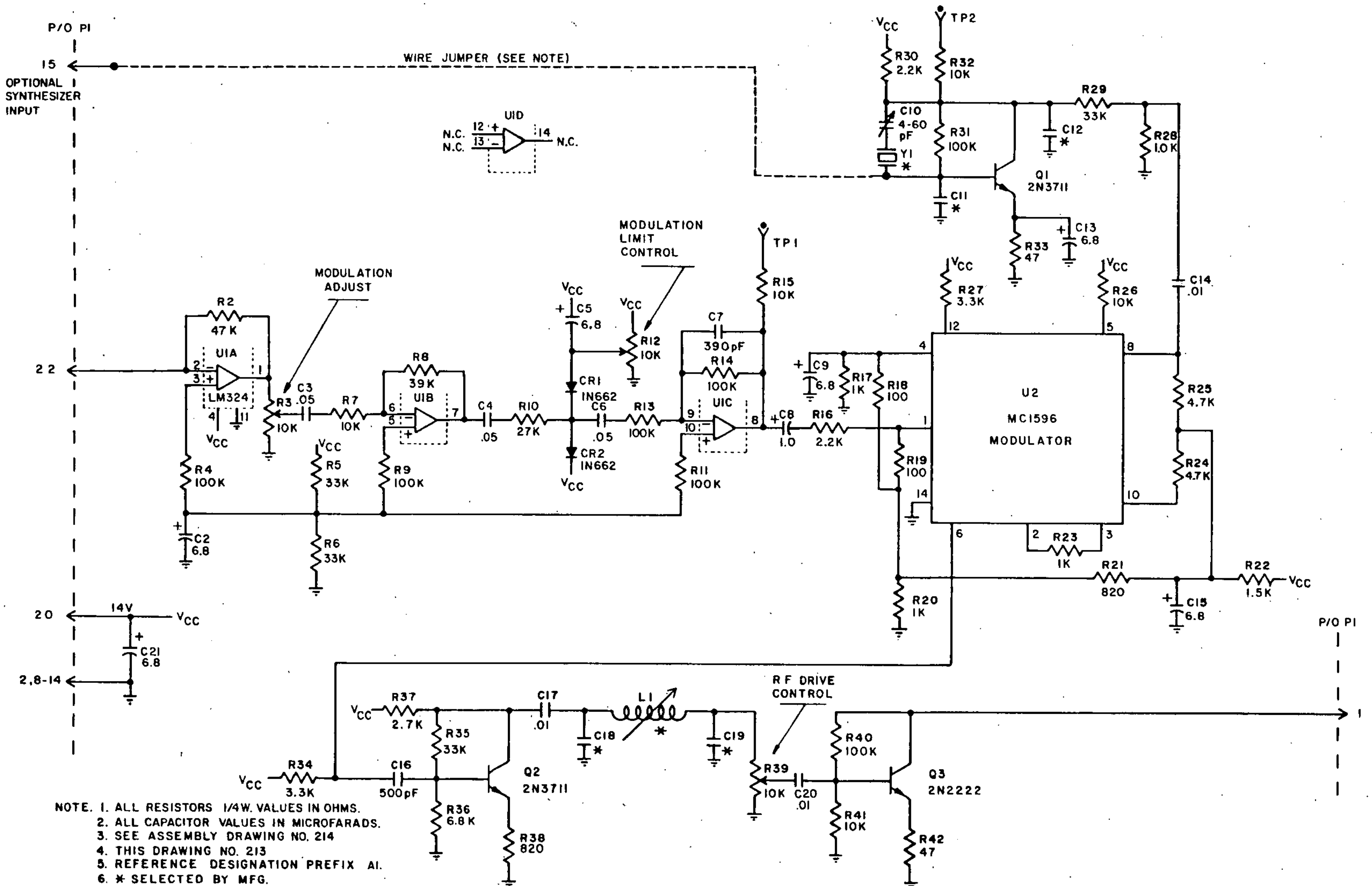


FIGURE 2-1
BLOCK DIAGRAM

2.2 Detailed Theory - SS-800AV

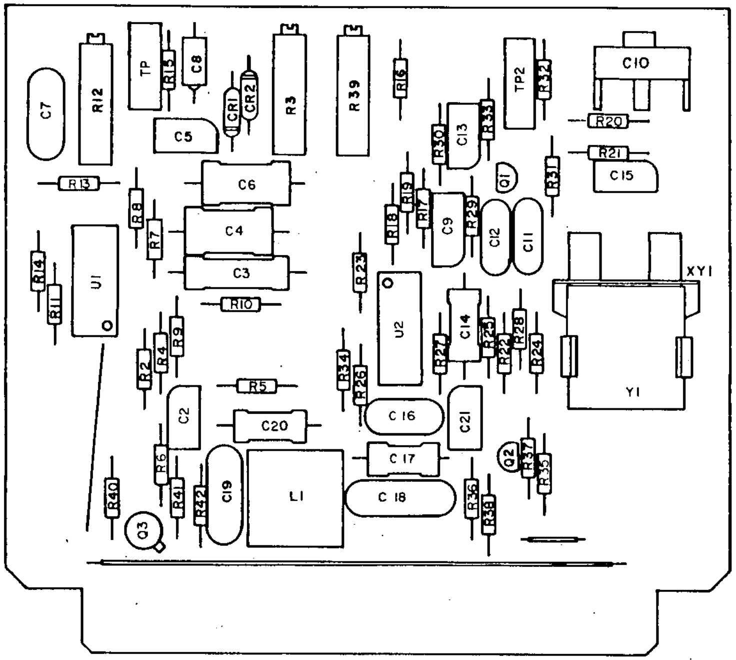
2.2.1 AM Oscillator PWB: See Figures 2-2 and 2-3 for a schematic and assembly drawing of the AM Oscillator PWB. The R.F. carrier is generated by Q1 and its associated components and is applied to the carrier input, pin 8, of the RF modulator integrated circuit U2. After the RF carrier is amplitude modulated in U2, it is filtered by C18, L1, and C19 and applied through RF DRIVE control R39 and Q3 to the Driver PWB. The switched +14 volts for Q3 is furnished through the Driver PWB from the Autoshutdown PWB.

The audio input signals to the AM Oscillator PWB are derived from the AM Recycle PWB and/or from the optional Audio PWB. The audio signals are combined in amplifier U1A and applied to Modulation Adjust control R3. The adjusted audio signal is directed through amplifier U1B to the CR1, CR2 symmetrical clipper circuit. Amplifier U1C rolls off the high frequency audio components and applies the signal to the modulator integrated circuit. Test point TP1 allows the audio input to the modulator to be examined.



NOTE.
1. ALL RESISTORS 1/4W. VALUES IN OHMS.
2. ALL CAPACITOR VALUES IN MICROFARADS.
3. SEE ASSEMBLY DRAWING NO. 214
4. THIS DRAWING NO. 213
5. REFERENCE DESIGNATION PREFIX A1.
6. * SELECTED BY MFG.
7. FOR SYNTHESIZER OPERATION, WIRE JUMPER INSTALLED BETWEEN PWB PIN 15 AND Q1 BASE. SELECTED COMPONENTS C11, C12, Y1 NOT INSTALLED.

FIGURE 2-2
AM OSCILLATOR PWB SCHEMATIC



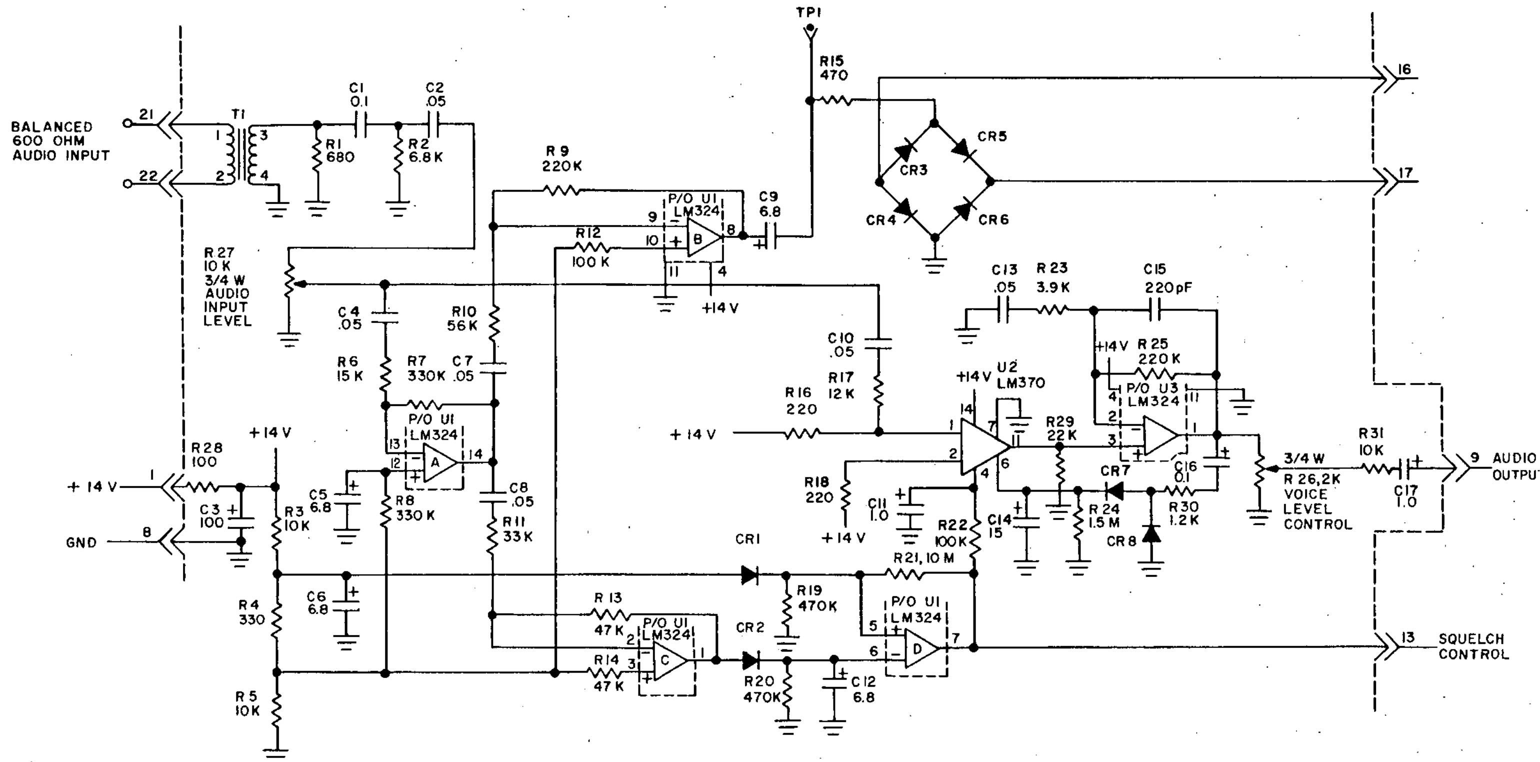
NOTES: 1. MASTER DWG NO. 215.
2. SCHEMATIC DWG NO. 213.
3. THIS DWG NO. 214.
4. C1 AND R1 ARE DELETED.
5. REF. DES. PREFIX A1.

FIGURE 2-3
AM OSCILLATOR PWB ASSEMBLY

(CONT. NEXT COLUMN)

REF. DES.	QNTY	PART NO.	DESCRIPTION
R10	1	0C2735	RESISTOR, 27K, .25W, OHMITE
R8	1	0C3935	RESISTOR, 39K, .25W, OHMITE
R7,15,26, 32,41	5	0C1035	RESISTOR, 10K, .25W, OHMITE
R5,6,29,35	4	0C3335	RESISTOR, 33K, .25W, OHMITE
R3,12,39	3	3006P-1-103	RESISTOR, VARIABLE, 10K, .75W, 10%, BOURNS
R4,9,11 13,14,31,40	7	0C1045	RESISTOR, 100K, .25W, OHMITE
R1	0	0C2235	RESISTOR, 22K, .25W, OHMITE
Q3	1	2N2222	TRANSISTOR, SILICON, NPN, MOTOROLA
Q1,2	2	2N3711	TRANSISTOR, SILICON, NPN, NTC
L1	1		INDUCTOR, VARIABLE, MILLER
		9056	120 - 280 µH (200 - 250 KHZ)
		9056	120 - 280 µH (250 - 340 KHZ)
		9056	120 - 280 µH (340 - 500 KHZ)
		9055	60 - 120 µH (500 - 680 KHZ)
		9054	28 - 60 µH (1600 - 1800 KHZ)
CR1, 2	2	1N662	DIODE, SILICON, T. I.
C19	1		CAPACITOR, 80V, SPRAGUE
		192P5629R8	.0056 MFD (200 - 250 KHZ)
		192P3329R8	.0033 MFD (250 - 340 KHZ)
			CAPACITOR, 500V, ARCO
		DM15-202J	2000 PF (340 - 500 KHZ)
		DM15-202J	2000 PF (500 - 680 KHZ)
		DM15-501J	500 PF (1600 - 1800 KHZ)
C18	1		CAPACITOR, 80V, SPRAGUE
		192P3329R8	.0033 MFD (200 - 250 KHZ)
		192P2229R8	.0022 MFD (250 - 340 KHZ)
			CAPACITOR, 500V, ELMENCO
		DM15-102J	1000 PF (340 - 500 KHZ)
		DM15-102J	1000 PF (500 - 680 KHZ)
		DM15-221J	220 PF (1600 - 1800 KHZ)
C11,12	2		CAPACITOR, 500V, ARCO
		DM15-202J	2000 PF (200 - 250 KHZ)
		DM15-102J	1000 PF (250 - 340 KHZ)
		DM15-751J	750 PF (340 - 500 KHZ)
		DM15-501J	500 PF (500 - 680 KHZ)
		DM15-151J	150 PF (1600 - 1800 KHZ)
C10	1	404	CAPACITOR, 4-60 PF, ELMENCO
C8	1	CS13BF105K	CAPACITOR, 1.0 MFD, 35V, SPRAGUE
C7,16	2	DM15-501J	CAPACITOR, 500 PF, 500V, ARCO
C4,6	2	192P1049R8	CAPACITOR, .1 MFD, 80V, SPRAGUE
C3	1	192P4739R8	CAPACITOR, .047 MFD, 80V, SPRAGUE
C2,5,9, 13,15,21	6	TIM685K 035P04	CAPACITOR, 6.8 MFD, 35V, MALLORY
C14, 17, 20	3	192P 1039R8	CAPACITOR, .01 MFD, 80V, SPRAGUE
R2	1	0C4731	RESISTOR, 47K, .25W, OHMITE
	1	59	PCB, OSCILLATOR, VOICE MODULATION, SAC
Y1	1	SAC Y1	CRYSTAL, QUARTZ, SAC
XY1	1	8000-AG7	SOCKET, CRYSTAL, AUGAT
U2	1	MC1596L	INT. CKT., MOTOROLA
U1	1	LM324N	INT. CKT., NAT'L. SEMICONDUCTOR
TP2	1	325-105	TEST POINT, BLUE, H.H. SMITH
TP1	1	325-107	TEST POINT, YELLOW, H.H. SMITH
R37	1	0C2725	RESISTOR, 2.7K, .25W, OHMITE
R36	1	0C6825	RESISTOR, 6.8K, .25W, OHMITE
R33,42	2	0C4705	RESISTOR, 47 OHM, .25W, OHMITE
R27,34	2	0C3325	RESISTOR, 3.3K, .25W, OHMITE
R24,25	2	0C4725	RESISTOR, 4.7K, .25W, OHMITE
R22	1	0C1525	RESISTOR, 1.5K, .25W, OHMITE
R21,38	2	0C8215	RESISTOR, 820 OHM, .25W, OHMITE
R18,19	2	0C1015	RESISTOR, 100 OHM, .25W, OHMITE
R17,20, 23,28	4	0C1025	RESISTOR, 1K, .25W, OHMITE
R16,30	2	0C2225	RESISTOR, 2.2K, .25W, OHMITE

2.2.2 Audio PWB (Optional): See Figures 2-4 and 2-5 for a schematic and assembly drawing of the Audio PWB. The balanced 600 ohm audio input is connected to impedance matching transformer T1. R1 functions as an impedance matching load for the audio input to the Audio PWB. C1, C2, and R2 comprise a high pass filter with a cut-off frequency of 500 Hz. R27 adjusts the audio input level to operational amplifier U1A and AGC (automatic gain control)/squelch amplifier U2. The output of U1A is fed into operational amplifiers U1B and U1C. The output operational amplifier U1B is rectified by CR3 through CR6 and is used to indicate the audio input level. Operational amplifiers U1C, U1D, and the associated components form a squelch detection circuit. The output of this circuit controls the AGC/squelch amplifier on the Audio PWB and transmission gate A on the AM Recycle PWB. U2, U3 and the associated components form the AGC/Squelch Amplifier circuit. The DC voltage developed at U2 pin 6 controls the gain of U2. For example, if the audio output of U3 increases, the DC voltage at U2 pin 6 will also increase. The larger the DC voltage at U2 pin 6, the lower the gain of U2 and therefore, the lower the audio output of U3. R26 adjusts the audio voice level to the AM Oscillator PWB. A voltage at U2 pin 4 either turns the AGC/squelch amplifier on (OV) or off (14V). With no audio input, the output of U1D is 14V, therefore, turning off the AGC/squelch amplifier.



NOTES:
1. ALL DIODES IN4004.
2. ALL RESISTORS 1/4 W, 10%, UNLESS NOTED.
3. ALL CAPACITORS IN mfd, UNLESS NOTED.
4. THIS DRAWING NO. 470.
5. PWB 109.
6. REF. DES. PREFIX A13.

FIGURE 2-4

AUDIO PWB SCHEMATIC
VOICE MODULATION

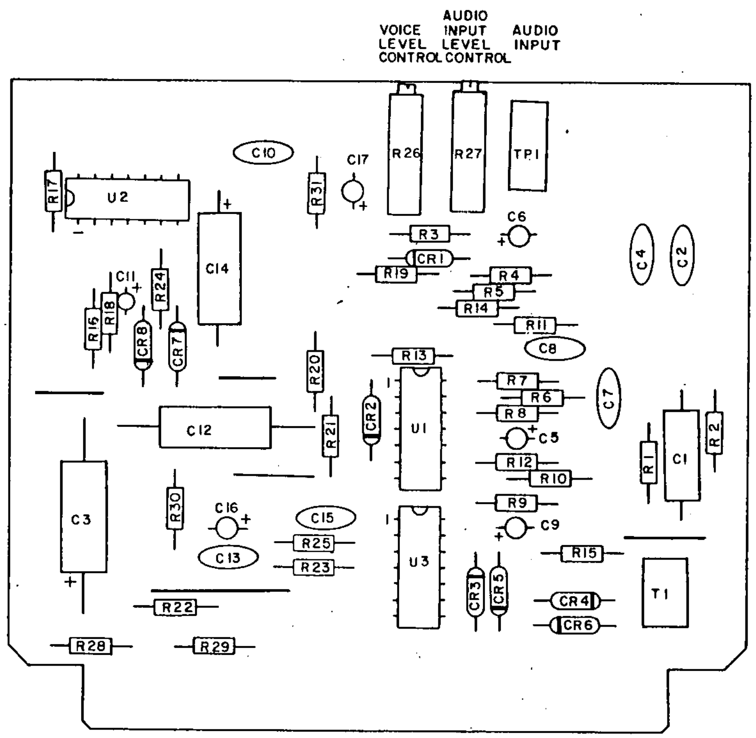


FIGURE 2-5
AUDIO PWB ASSEMBLY
VOICE MODULATION

NOTES: 1. REF. DES. PREFIX A13
2. THIS DWG NO. 475

ITEM	REF. DES	QNTY.	PART NO.	DESCRIPTION
39	XT1	1	SP-310	TRANSFORMER SHIELD, TRIAD
38		1	109	PWB, AUDIO, SAC
37	R30	1	OC1221	RES., 1.2 K, 1/4 W, 10%, OHMITE
36	R29	1	OC2231	RES., 22 K, 1/4 W, 10%, OHMITE
35	R28	1	OC1011	RES., 100 OHMS, 1/4 W, 10%, OHMITE
34	T1	1	SP70	TRANSFORMER, TRIAD
33	TP1	1	325-108	TESTPOINT, BROWN, H.H. SMITH
32	U2	1	LM370N	INT. CKT., NATIONAL
31	U1,3	2	LM324N	INT. CKT., NATIONAL
30	R27	1	3006P-1-103	RES., 10 K, VARIABLE POT., BOURNS
29	R26	1	3006P-1-202	RES., 2 K, VARIABLE POT., BOURNS
28	R24	1	OC1551	RES., 1.5 MEG, 1/4 W, 10%, OHMITE
27	R23	1	OC3921	RES., 3.9 K, 1/4 W, 10%, OHMITE
26	R21	1	OC1061	RES., 10 MEG, 1/4 W, 10%, OHMITE
25	R19,20	2	OC4741	RES., 470 K, 1/4 W, 10%, OHMITE
24	R17	1	OC1231	RES., 12 K, 1/4 W, 10%, OHMITE
23	R16,18	1	OC2211	RES., 220 OHMS, 1/4 W, 10%, OHMITE
22	R15	1	OC4711	RES., 470 OHMS, 1/4 W, 10%, OHMITE
21	R13,14	2	OC4731	RES., 47 K, 1/4 W, 10%, OHMITE
20	R12,22	2	OC1041	RES., 100 K, 1/4 W, 10%, OHMITE
19	R11	1	OC3331	RES., 33 K, 1/4 W, 10%, OHMITE
18	R10	1	OC5631	RES., 56 K, 1/4 W, 10%, OHMITE
17	R9,25	2	OC2241	RES., 220 K, 1/4 W, 10%, OHMITE
16	R7,8	2	OC3341	RES., 330 K, 1/4 W, 10%, OHMITE
15	R6	1	OC1531	RES., 15 K, 1/4 W, 10%, OHMITE
14	R4	1	OC3311	RES., 330 OHMS, 1/4 W, 10%, OHMITE
13	R3,5,31	3	OC1031	RES., 10 K, 1/4 W, 10%, OHMITE
12	R2	1	OC6821	RES., 6.8 K, 1/4 W, 10%, OHMITE
11	R1	1	OC6811	RES., 680 OHMS, 1/4 W, 10%, OHMITE
10	CR1,2, 3-8	8	IN4004	DIODE, GI
9	C16	1	196D104X903 5HA1	CAP., .1 MFD, 35 V, DIP TANT., SPRAGUE
8	C15	1	DM15221J03	CAP., 220 PF, 500V, DIPPED SILVER, MICA, ARCO
7	C14	1	500D156G025BB7	CAP., 15 MFD, 25 V, ELECTROLYTIC, SPRAGUE
6	C12	1	CSR13D685K	CAP., 68 MFD, 15 V, MALLORY
5	C11,17	2	196D105X903 5HA1	CAP., 1 MFD, 35 V, DIP TANT., SPRAGUE
4	C5,6,9	3	196D685X902 5JA1	CAP., 6.8 MFD, 25 V, DIP TANT., SPRAGUE
3	C3	1	500D107G025DD7	CAP., 100 MFD, 25 V, ELECTROLYTIC, SPRAGUE
2	C2,4,7, 8,10,13	6	TGS50	CAP., .05 MFD, 100V, DISC CERAMIC, SPRAGUE
1	C1	1	192P1049R8	CAP., .1 MFD, 80 V, TANTULUM, SPRAGUE

2.2.3 Keyer:

2.2.3.1 General: The Southern Avionics Keyer is an all solid state International Morse Code generator. The Keyer is designed to generate an identifier of any sequence of letters or numerals automatically at a rate of approximately seven words per minute.

The Keyer consists of a Recycle Board, and Letter Boards plus inter-connecting wiring.

The Recycle Board has three primary functions: First, to initiate a trigger pulse used to interrogate the Letter Board in position No.1; second, to delay forming another trigger pulse until approximately three seconds after the last letter has been formed; and third, to generate the gated audio tone.

Each Letter Board contains a number of serially connected monostable multivibrators connected in such a manner as to form the dots, dashes, and spaces required to form a letter.

Each board provides an interrogating pulse to the following letter board socket, thus cycling the Letter Boards in a sequence determined by their socket positions. Where a special code is required, such as two or more sequences of letters and then a long pause or a long dash, etc., keyers can be furnished to supply as many letters and/or numberals as required with any timing desired.

2.2.3.2 Letter Board: These boards consist of a series of monostable multivibrators, or "one-shots". Each "one-shot" can generate a dot or dash depending on its R-C time constant.

For example, consider the letter "D" (-··). There are only three characters so the first "one-shot" is not used. A jumper is placed at J3 to couple the input trigger to the second "one-shot".

A negative trigger signal is applied to pin 19. This signal comes from the Recycle Board if "D" is the first letter, or from a letter board otherwise. It is a negative pulse supplied through a 10K resistor in series with a 1 mFd capacitor. This switches Q3 off which makes the collector voltage positive. This positive voltage is coupled through CR2 to the logic line which goes to the Recycle board and starts the dash for the letter "D". The dash will terminate after the 1mFd capacitor is charged through R9, Q3 is switched on, and Q4 is switched off. The pause signal will remain until C3 is charged and Q4 is switched on again.

This switches Q5 off. The positive voltage at the collector of Q5 is coupled through CR3 to the logic line and the second character of the letter "D" (a dot) begins. To generate a dot, R15 is installed. This causes the time constant of the charging circuit for C4 to be smaller. When C4 is charged through the parallel combination of R15 and R16, Q4 is switched on again, Q5 is switched off, and the pause signal is generated. As C5 is charged, Q6 is switched on, Q7 is switched off, and the third character of the letter "D" (a dot) is begun. After C6 is charged through the parallel R22 and R23, Q7 is again turned on and the pause signal begins. This pause signal is longer because of the 1 meg charging path for C7. When C7 becomes charged, Q8 is turned on and the negative signal from the collector of Q8 starts the cycle again at the next Letter Board. The trigger-out connection on the last Letter Board is open.

Letter Boards will usually be programmed before shipment from the factory. However, if the "Identifier" is not known before shipment, unprogrammed boards will be supplied. An unprogrammed Keyer may be placed in service by performing the following operations on each letter board:

(a) Place a jumper in one of the jumper positions J4 through J1. This jumper marks the start of the letter and would be placed in J4 for a four bit letter, J3 for a three bit letter, etc.

(b) Observing the Letter Board schematic and assembly drawing, the letter bits will now be generated in sequence from left to right on the schematic starting with the jumpered stage. Dashes will be generated automatically and any dash may be changed to a dot by adding a 220K ohm resistor in parallel as shown in dotted lines.

<u>2.2.3.3 Number Board:</u> Number Boards are electronically identical to Letter Boards except for the addition of a fifth multivibrator circuit to generate the fifth "bit" of a number.

Programming a Number Board follows the same procedures as programming a Letter Board. Place a Jumper at 5, and place 220K ohm resistors in positions where a dot is to be generated. Note that the first "bit" is position 5, the second "bit is position 4, etc.

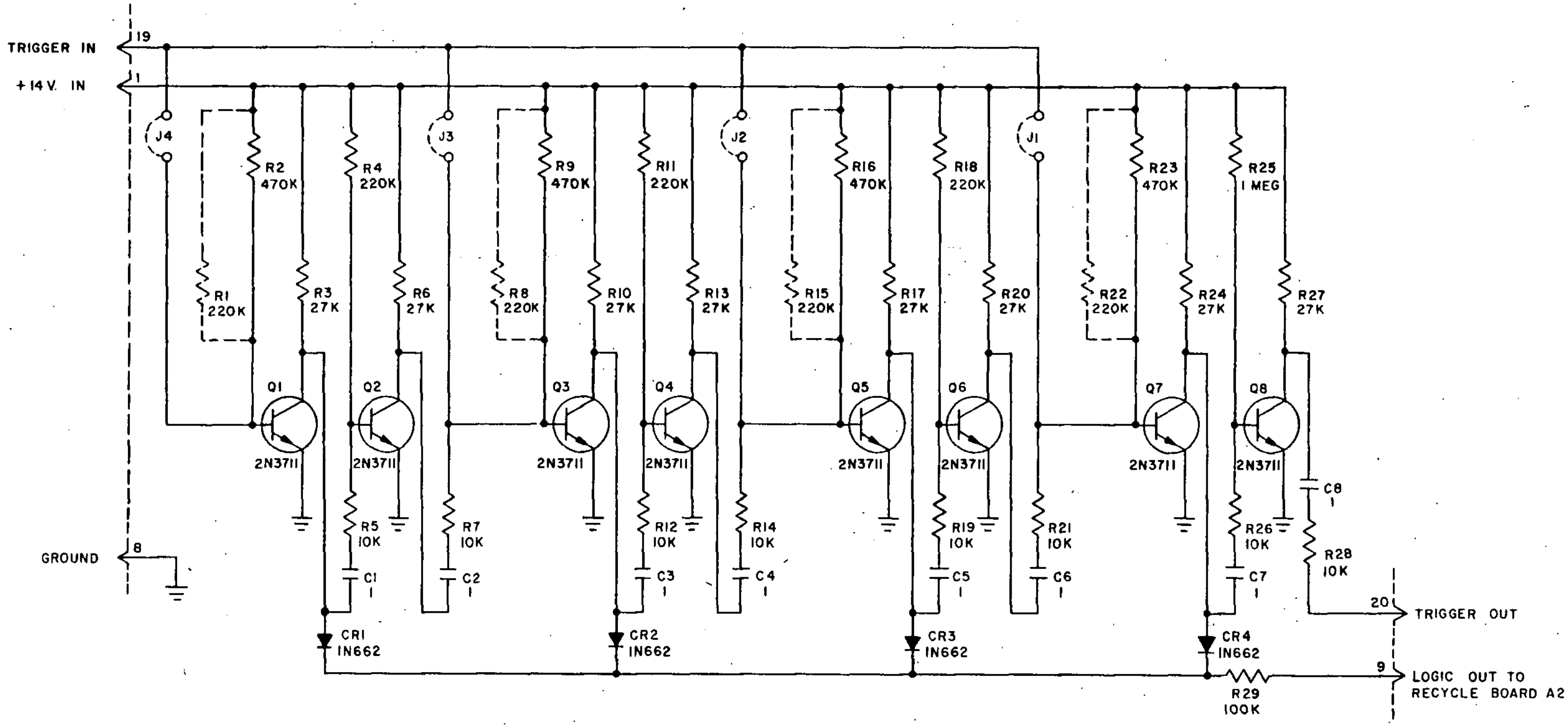
<u>2.2.3.4 AM Recycle PWB:</u> See Figures 2-10 and 2-11 for a schematic and assembly drawing of the AM Recycle PWB. The AM Recycle PWB operates in a normal code identification mode whenever switch S1 on the AM Recycle Board is in the "IDENT" position. When S1 is in the "CONT." position, a continuous tone is generated, and when the switch S1 is in the "CARR." position, a steady carrier with no modulation is produced.

With switch S1 in the "IDENT" position and no code being produced, capacitor C1 begins charging through resistors R3, R4, and R5 and reaches approximately +7 volts in 3.5 seconds. When C1 reaches this level, unijunction transistor Q3 fires, creating a trigger pulse through C2, R7, Q4, C3, and R10. The trigger pulse activates the first Letter Board of the identification sequence (see "Letter Board").

The Logic Output of the Letter Boards causes Q1 and Q2 to turn "ON" during keyed code tone output periods. When Q1 and Q2 are "ON", the potential on C1 is discharged through CR1, R4, and R5. At the end of the identification sequence, C1 begins to charge as described above, and the identification sequence begins again.

When S1 is in the "CONT." position, C1 is prevented from charging and initiating the ident sequence. C1 is discharged through CR1, R4, R5, and to ground by S1. The identification code or continuous tone logic signal is taken from the collector of Q2 through R23, to pin 3 of integrated circuit U2 (Quad Transmission Gate).

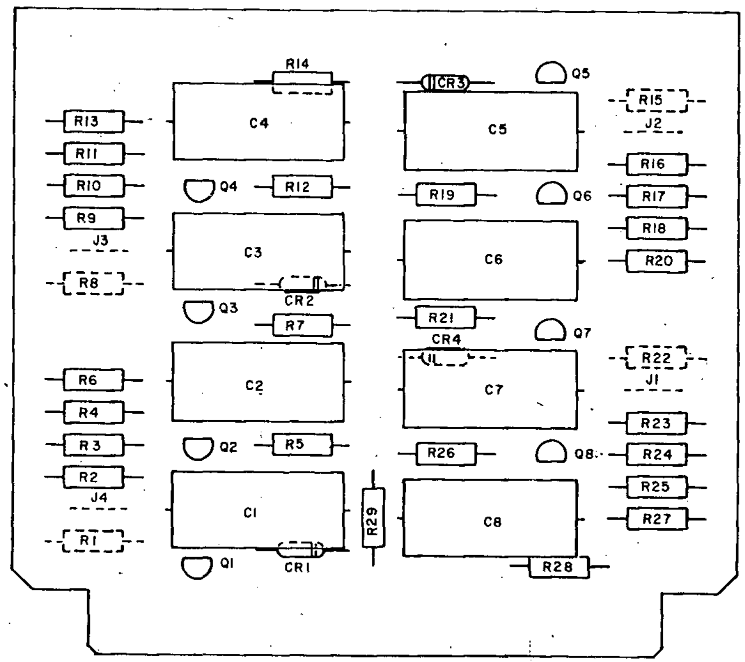
Integrated circuit U1 (Operational Amplifier) and its associated circuitry functions as an audio oscillator to provide an identification tone (1020 Hz or 400 Hz) to pin 1 of U2. The passage of the tone from pin 1 to pins 2 and 3 of U2 is controlled by logic signals produced on the optional Audio PWB. Without an Audio PWB installed, R20 pulls up U2 pin 13, the transmission Gate A control line, and the audio signal passes through Gate A without attenuation. The passage of the tone from pin 3 of U2 through transmission gate B to pin 4 of U2 is controlled by the code signal present at U2 pin 6, with 0 volts at pin 6, and thus +14V at pins 5 and 9 allowing tone passage through transmission gate B. The audio signal passes through PWB pin 14 or 17 to the audio input, pin 22 of the AM Oscillator PWB. When the Audio PWB senses the presence of a voice input, squelch control input PWB pin 15 will go low to 0 volts. This will cause U2 gate A to stop conducting. The audio tone will bypass gate A through R19 at a reduced amplitude, causing the code amplitude to be about 20% during voice signal presence.



NOTES.
1. REFERENCE DESIGNATION PREFIX A3.
2. ALL RESISTOR VALUES IN OHMS, 1/2 W. 10% UNLESS NOTED.
3. ALL CAPACITOR VALUES IN MFD UNLESS NOTED.
4. SEE ASSEMBLY DRAWING NO. 189
5. DRAWING NO. 187

LETTER BOARD SCHEMATIC

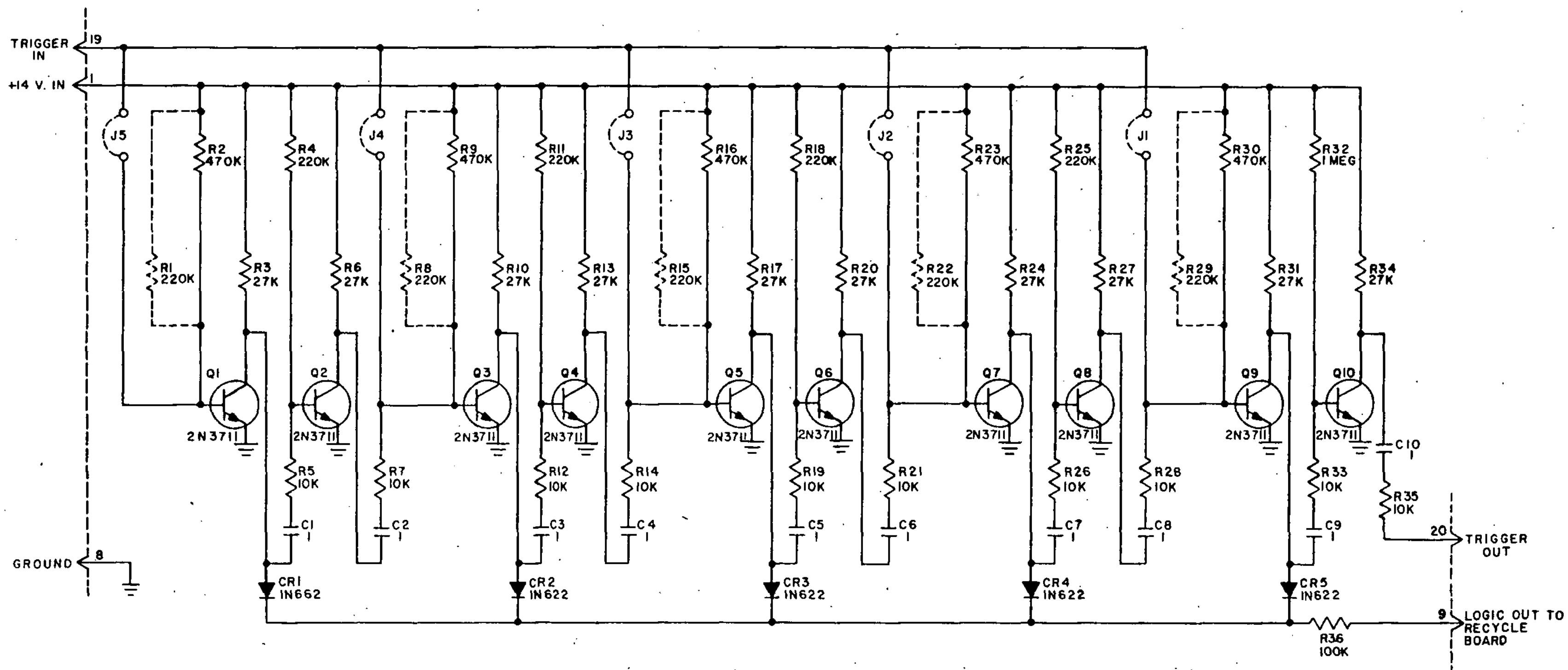
FIG. 2-6



NOTES. 1. REFERENCE DESIGNATION PREFIX A3,
2. SEE SCHEMATIC DRAWING NO. 187
3. SEE MASTER DRAWING NO. 188 REV. A
4. DRAWING NO. 189 REV. A

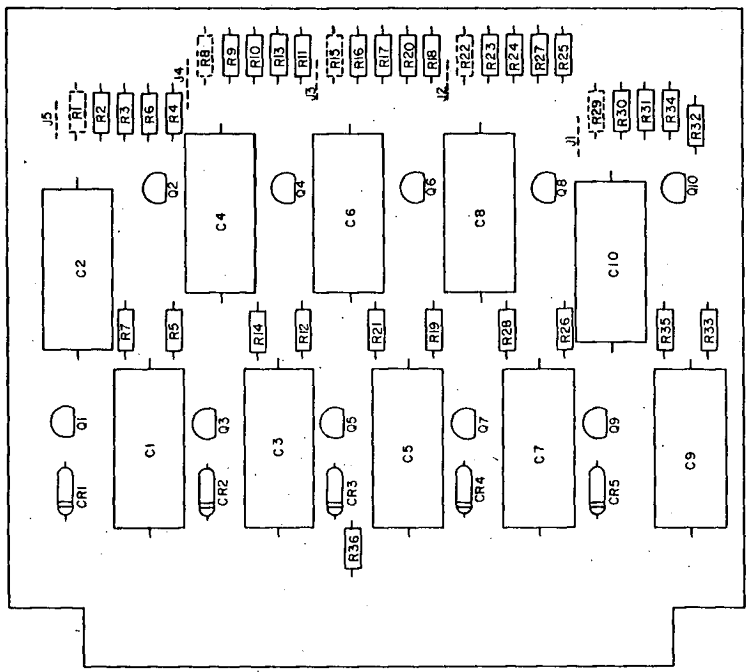
LETTER BOARD ASSEMBLY
FIG. 2-7

REF DES	QTY	PART NO.	DESCRIPTION
-	1	188 REV A	LETTER PCB, SAC
R29	1	OE1041	RESISTOR, 100K, ½W.10% OHMITE
R25	1	OE1051	RESISTOR, 1MEG. ½W.10% OHMITE
R5, 7, 12, 14, 19, 21, 26, 28	8	OE1031	RESISTOR, 10K, ½W, 10%, OHMITE
R3, 6, 10, 13, 17, 20, 24, 27	8	OE2731	RESISTOR, 27K, ½W, 10%, OHMITE
R2, 9, 16, 23	4	OE4741	RESISTOR, 470K, ½W 10% OHMITE
R1, 4, 8, 11, 15, 18, 22	7	OE2241	RESISTOR, 220K, ½W, 10% OHMITE
Q 1, 2, 3, 4, 5, 6, 7, 8	8	2N3711	TRANSISTOR, TI
CR1, 2, 3, 4	4	1N662	DIODE, T.I.
C1, 2, 3, 4, 5, 6, 7, 8	8	MMW-2W1	CAPACITOR, 1 MFD, 200V. CDE



NOTES: 1. REFERENCE DESIGNATION PREFIX A3
2. ALL RESISTOR VALUES IN OHMS, 10%, 1/4W.
3. ALL CAPACITOR VALUES IN MFD.
4. SEE ASSEMBLY DRAWING NO. 297.
5. THIS DRAWING NO. 296.

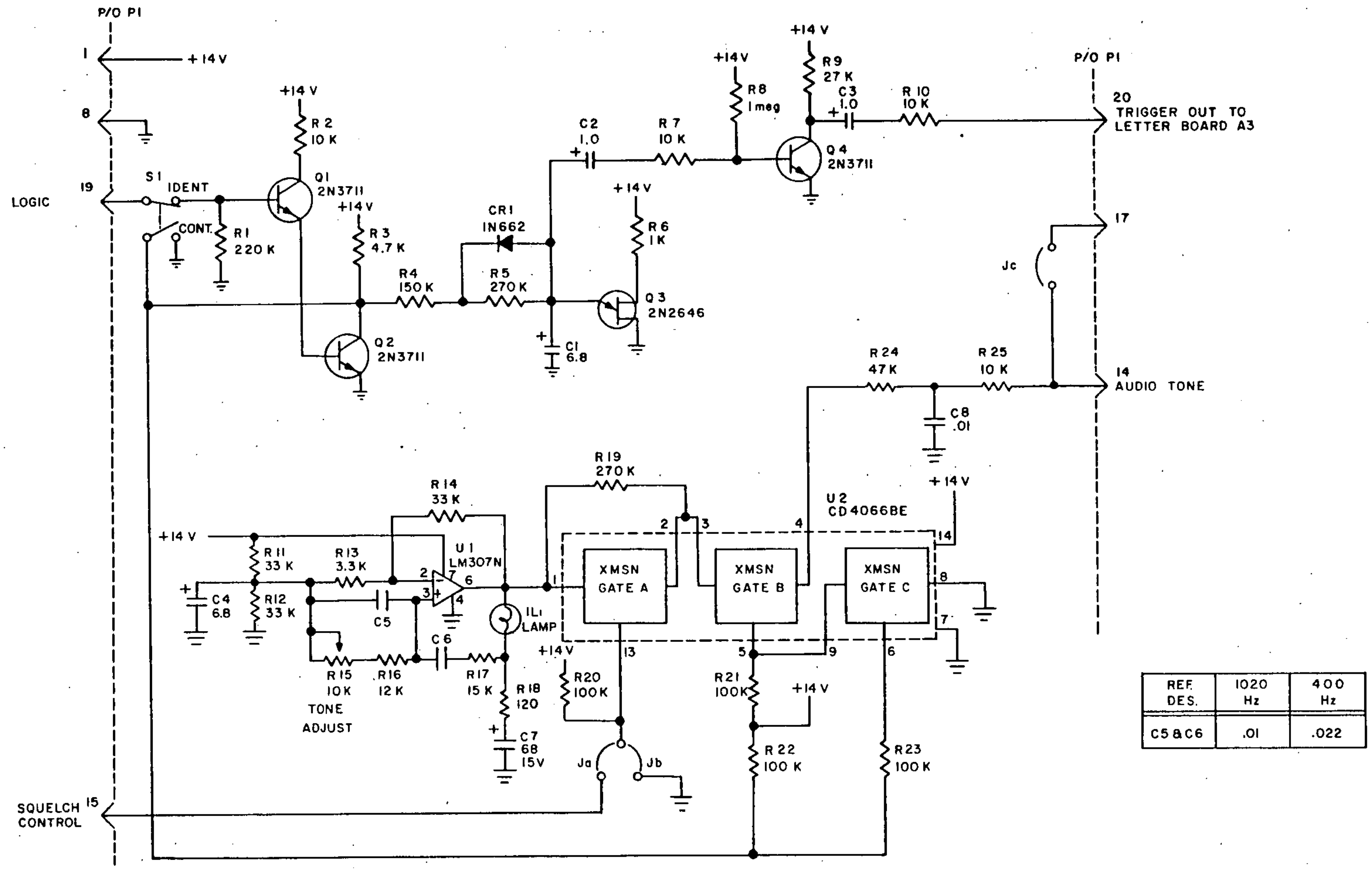
NUMBER BOARD SCHEMATIC
FIGURE 2-8



NOTES: 1. REFERENCE DESIGNATION PREFIX A3.
2. SEE SCHEMATIC DRAWING NO. 296.
3. THIS DRAWING NO. 297.

NUMBER BOARD ASSEMBLY
FIGURE 2-9

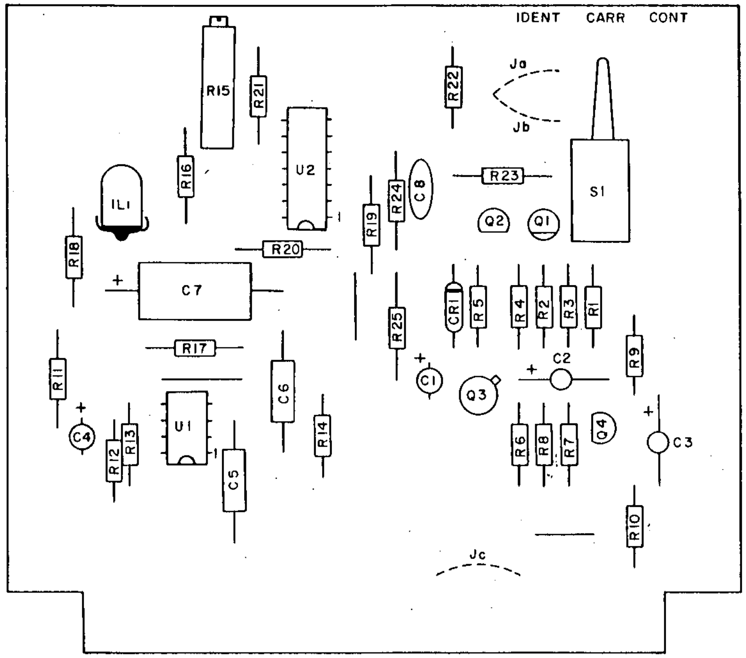
REF. DES.	QTY.	PART NO.	DESCRIPTION
	1		PC BOARD, SAC
R36	1	OC1041	RESISTOR, 100K, ¼W. 10%, OHMITE
R32	1	OC1051	RESISTOR, 1 MEG. ¼W. 10%, OHMITE
R5, 7, 12, 14, 19, 21, 26, 28, 33, 35	10	OC1031	RESISTOR, 10K, ¼W. 10%, OHMITE
R3, 6, 10, 13, 17, 20 24, 27, 31, 34	10	OC2731	RESISTOR, 27K, ¼W. 10%, OHMITE
R2, 9, 16, 23, 30	5	OC4741	RESISTOR, 470K, ¼W. 10%, OHMITE
R4, 11, 18, 25	4	OC2241	RESISTOR, 220K, ¼W. 10%, OHMITE
R1, 8, 15, 22, 29	*	OC2241	RESISTOR, 220K, ¼W. 10%, OHMITE * USE FOR PROGRAMMING
Q1-10	10	2N3711	TRANSISTOR, NPC
CR1-5	5	1N662	DIODE, TI
C1-10	10	MMW-2W1	CAPACITOR 1.0 MFD 200V, CDE



REF. DES.	1020 Hz	400 Hz
C5 & C6	.01	.022

NOTES: 1. ALL RESISTORS 1/4 W, 10% UNLESS NOTED.
2. ALL CAPACITORS IN MFD UNLESS NOTED.
3. ASSEMBLY DRAWING NO. 513.
4. THIS DRAWING NO. 510.
5. REF. DES. PREFIX A2.

FIGURE 2-10
AM RECYCLE PWB SCHEMATIC



NOTES: 1. REF. DES. PREFIX A2.
2. PWB 60.
3. THIS DRAWING NO. 513.

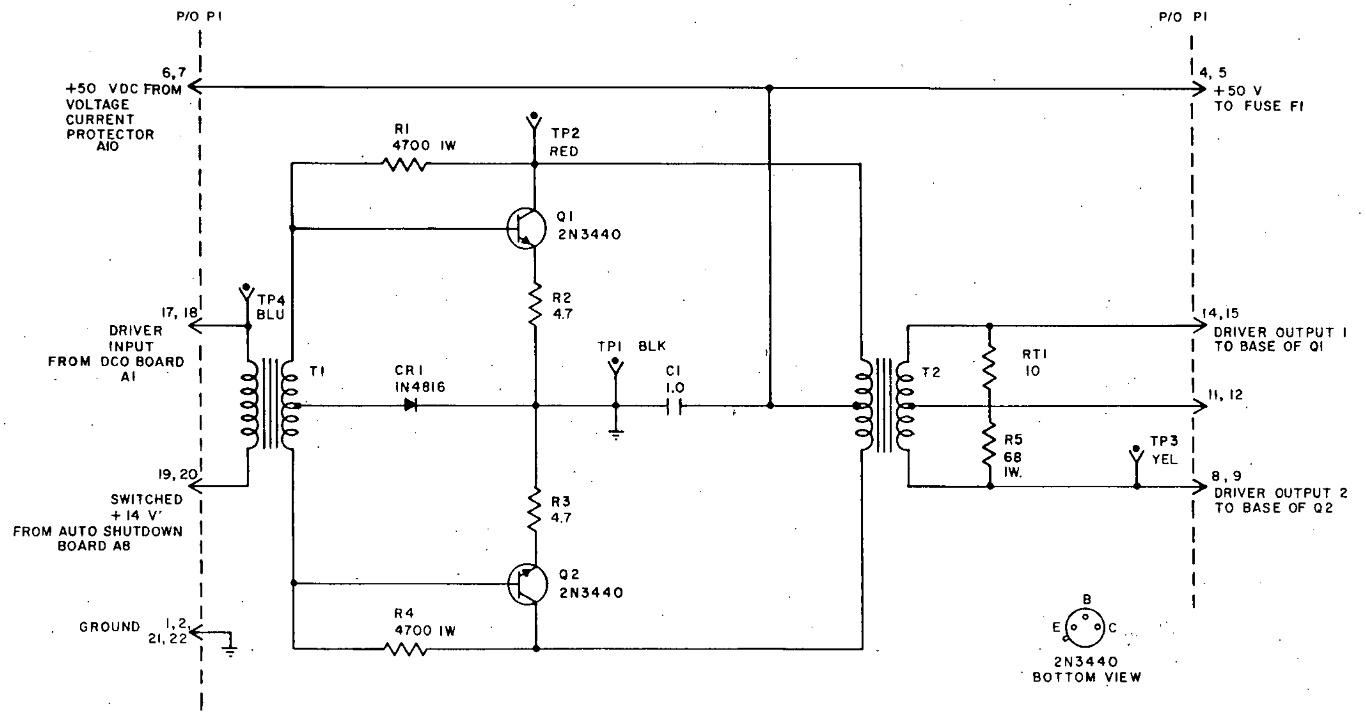
FIGURE 2-11

AM RECYCLE PWB ASSEMBLY

ITEM	REF. DES.	QNTY.	PART NO.	DESCRIPTION
29		1	60	PWB, VOICE MOD. RECYCLE, SAC
28	U2	1	CD4066BE	INT. CKT., RCA
27	U1	1	LM307N	INT. CKT., NATIONAL SEMI.
26	S1	1	SF6TBX392	SWITCH, 3 POS., CUTLER HAMMER
25	R24	1	OC4731	RES., 47 K, 1/4 W, 10%, OHMITE
24	R20-23	4	OC1041	RES., 100 K, 1/4 W, 10%, OHMITE
23	R18	1	OC1211	RES., 120 OHM, 1/4 W, 10%, OHMITE
22	R17	1	OC1531	RES., 15 K, 1/4 W, 10%, OHMITE
21	R16	1	OC1231	RES., 12 K, 1/4 W, 10%, OHMITE
20	R15	1	3006P-103	RES., 10 K, 3/4 W, POT, BOURNS
19	R13	1	OC3321	RES., 3.3 K, 1/4 W, 10%, OHMITE
18	R11,12,14	3	OC3331	RES., 33 K, 1/4 W, 10%, OHMITE
17	R9	1	OC2731	RES., 27 K, 1/4 W, 10%, OHMITE
16	R8	1	OC1051	RES., 1 meg, 1/4 W, 10%, OHMITE
15	R6	1	OC1021	RES., 1 K, 1/4 W, 10%, OHMITE
14	R5, 19	2	OC2741	RES., 270 K, 1/4 W, 10%, OHMITE
13	R4	1	OC1541	RES., 150 K, 1/4 W, 10%, OHMITE
12	R3	1	OC4721	RES., 4.7 K, 1/4 W, 10%, OHMITE
11	R2,7,10,25	4	OC1031	RES., 10 K, 1/4 W, 10%, OHMITE
10	R1	1	OC2241	RES., 220 K, 1/4 W, 10%, OHMITE
9	Q3	1	2N2646	TRANSISTOR, GE
8	Q1,2,4	3	2N3711	TRANSISTOR, TI
7	IL1	1	CM1869	LAMP, 14 mA, 10V, CHICAGO MINIATURE
6	CR1	1	IN662	DIODE, TI
5	C8	1	TGS10	CAP., .01 mfd, 100 V, DISC CER., SPRAGUE
4	C7	1	CSR13D686KL	CAP., 68 mfd, 15 V, SPRAGUE
3	C5,6	2	192P1049R8	CAP., .01 mfd, 80 V, SPRAGUE 1020 Hz
			192P2239R8	CAP., .022 mfd, 80 V, SPRAGUE 400 Hz
2	C2, 3	2	196D105X9035HA1	CAP., 1.0 mfd, 35 V, DIP TANT., SPRAGUE
1	C1, 4	2	196D685X9025JA1	CAP., 6.8 mfd, 25 V, DIP TANT., SPRAGUE

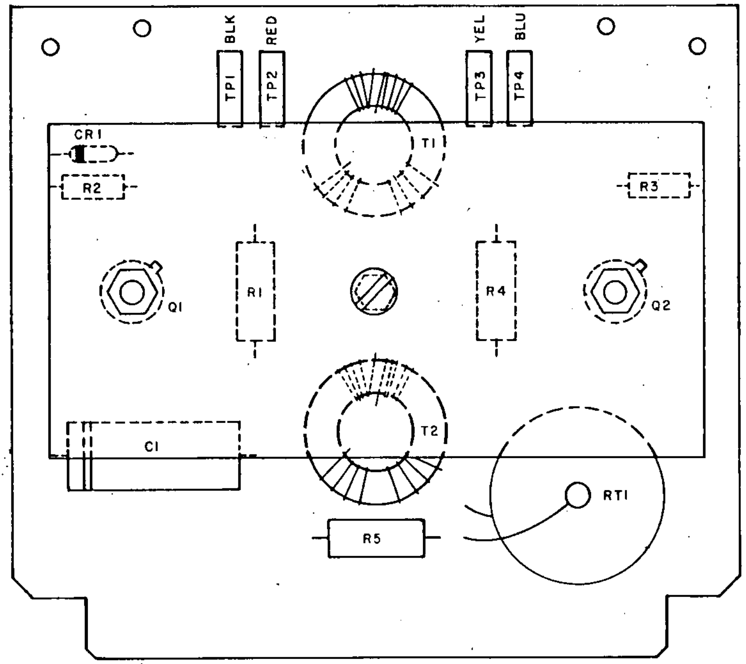
2.2.4 Driver Board: Q1 and Q2 form a class AB push-pull driver for the final. The input signal from Q3 on the oscillator board is transformer coupled through T1 to this stage and the output signal is coupled to the final stage through T2.

Test point four (TP4, blue) is used to monitor the signal from the preamp and the DC voltage on the preamp. This voltage is controlled by the automatic shutdown circuit. Test point 2 (TP2, red) is used to monitor the driver output as well as the DC supply voltage (50V). Test point 3 (TP3, yellow) is used to monitor the input signal to the final as well as the bias voltage on the final amplifier. The black test point (TP1) is ground.



NOTES: 1. REFERENCE DESIGNATION PREFIX A7.
2. CAPACITOR VALUES IN MFD UNLESS NOTED.
3. RESISTOR VALUES IN OHMS, ±10%, 1/2W UNLESS NOTED.
4. THIS DRAWING NO. 159.

DRIVER BOARD SCHEMATIC
FIG. 2-12

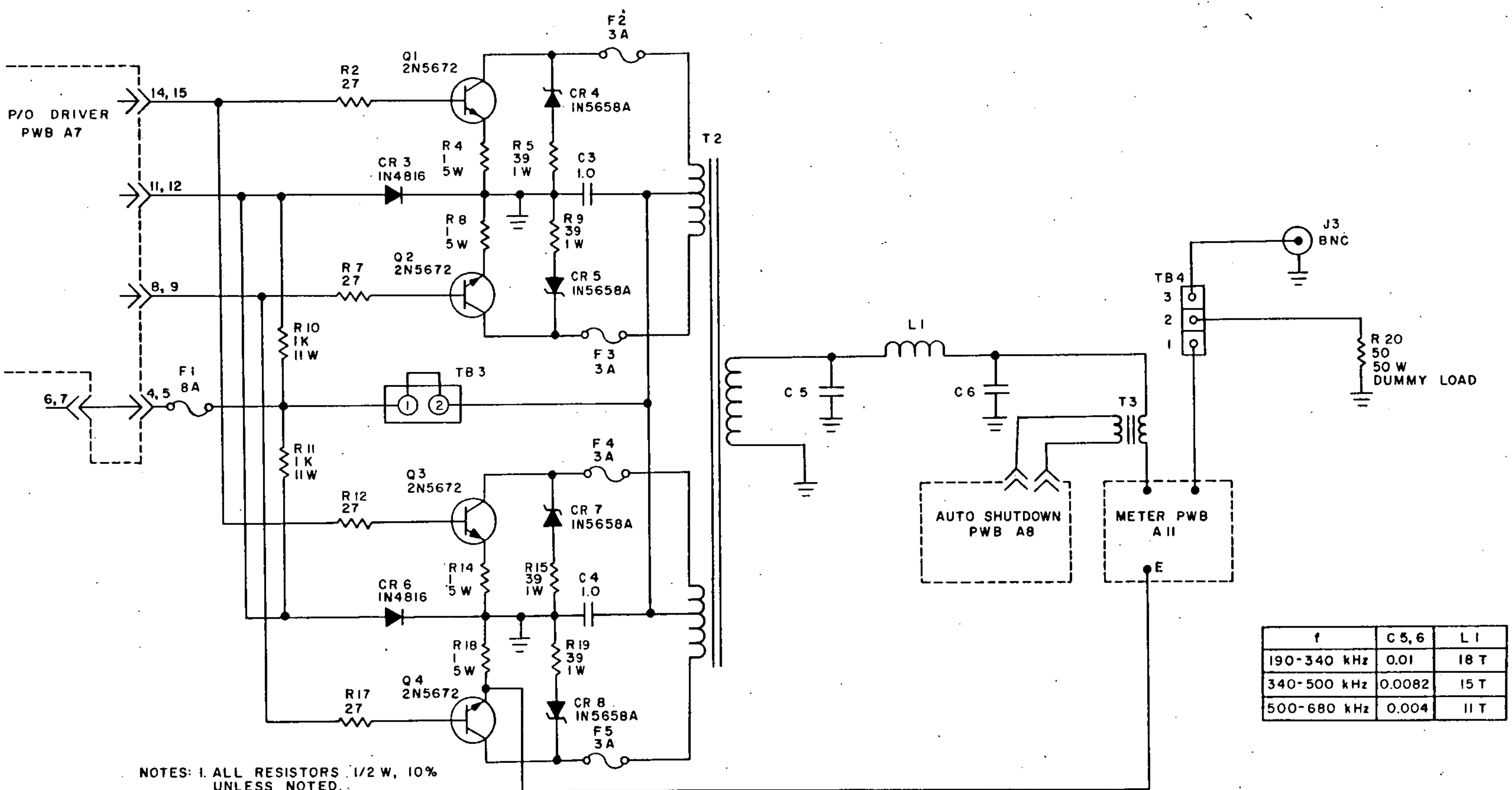


NOTES: 1. REFERENCE DESIGNATION PREFIX A7.
2. THIS DRAWING NO. 158.

DRIVER BOARD ASSEMBLY
FIG. 2-13

REF DES	QNTY	PART NO	DESCRIPTION
	1	156	DRIVER P C B, SAC
	2		HEX NUT, SS 6-32
	4		LOCKWASHER, INT STAR SS #6
	1		MACH. SCREW, BIND HD SS, 6-32 x 1/4
	1		MACH. SCREW, BIND HD SS 6-32 x 3/8
	1	8423	SPACER, H. H. SMITH
	2	7717-5N	MTG PAD, THERMALLOY
	1		HEATSINK, SAC
XQ1,2	2		HEATSINK, SAC
TP4	1	325-105	TESTPOINT, BLU, H. H. SMITH
TP3	1	325-107	TESTPOINT, YEL, H. H. SMITH
TP2	1	325-102	TESTPOINT, RED, H. H. SMITH
TP1	1	325-103	TESTPOINT, BLK, H. H. SMITH
T2	1	174	TRANSFORMER (SAC)
T1	1	172	TRANSFORMER (SAC)
RT1	1	2D904	THERMISTOR (NATL LEAD)
R5	1	0G650	RESISTOR 65Ω, 1W, 10% OHMITE
R2,3	2	0E47G1	RESISTOR 4.7Ω, 1/2 W, 10% OHMITE
R1,4	2	0G472	RESISTOR 4.7K, 1W, 10% OHMITE
Q1,2	2	2N3440	TRANSISTOR (FSC)
CR1	1	1N4516	DIODE (GI)
C1	1	MMW-2W1	CAPACITOR, 1MFD (CDE)

2.2.5 Final Stage: The final stage is a parallel push-pull class AB amplifier formed by Q1, Q2, Q3 and Q4. These transistors are matched at the factory with a specific range of current gain. CR4, CR5, CR7, CR8, R5, R9, R15 and R19 provide protection when an inductive load or open circuit causes large voltage spikes at the transistor collectors. T2 combines the two push-pull circuits and impedance matches the circuits to a 50 ohm output. The pi network, C5, L1 and C6, is a lowpass filter.



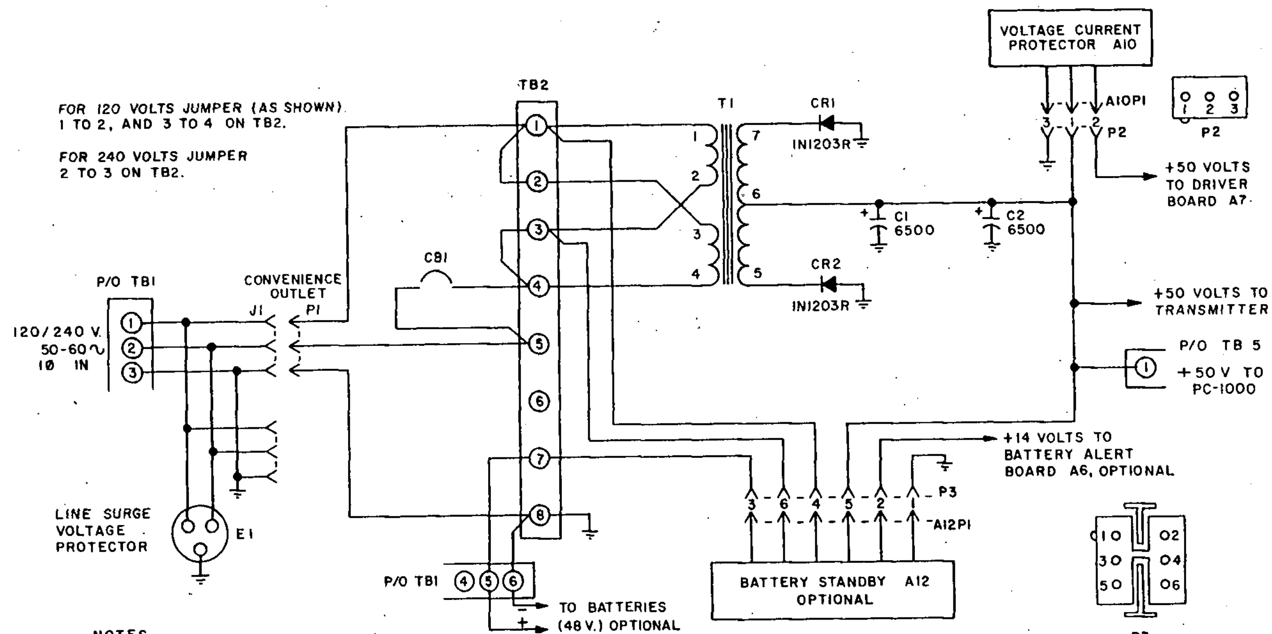
f	C5,6	L1
190-340 kHz	0.01	18 T
340-500 kHz	0.0082	15 T
500-680 kHz	0.004	11 T

NOTES:
1. ALL RESISTORS 1/2 W, 10% UNLESS NOTED.
2. ALL CAPACITORS IN MFD.
3. THIS DRAWING NO. 660.
4. REF DES. PREFIX I.

FIGURE 2-14
SS-800AV FINAL STAGE SCHEMATIC

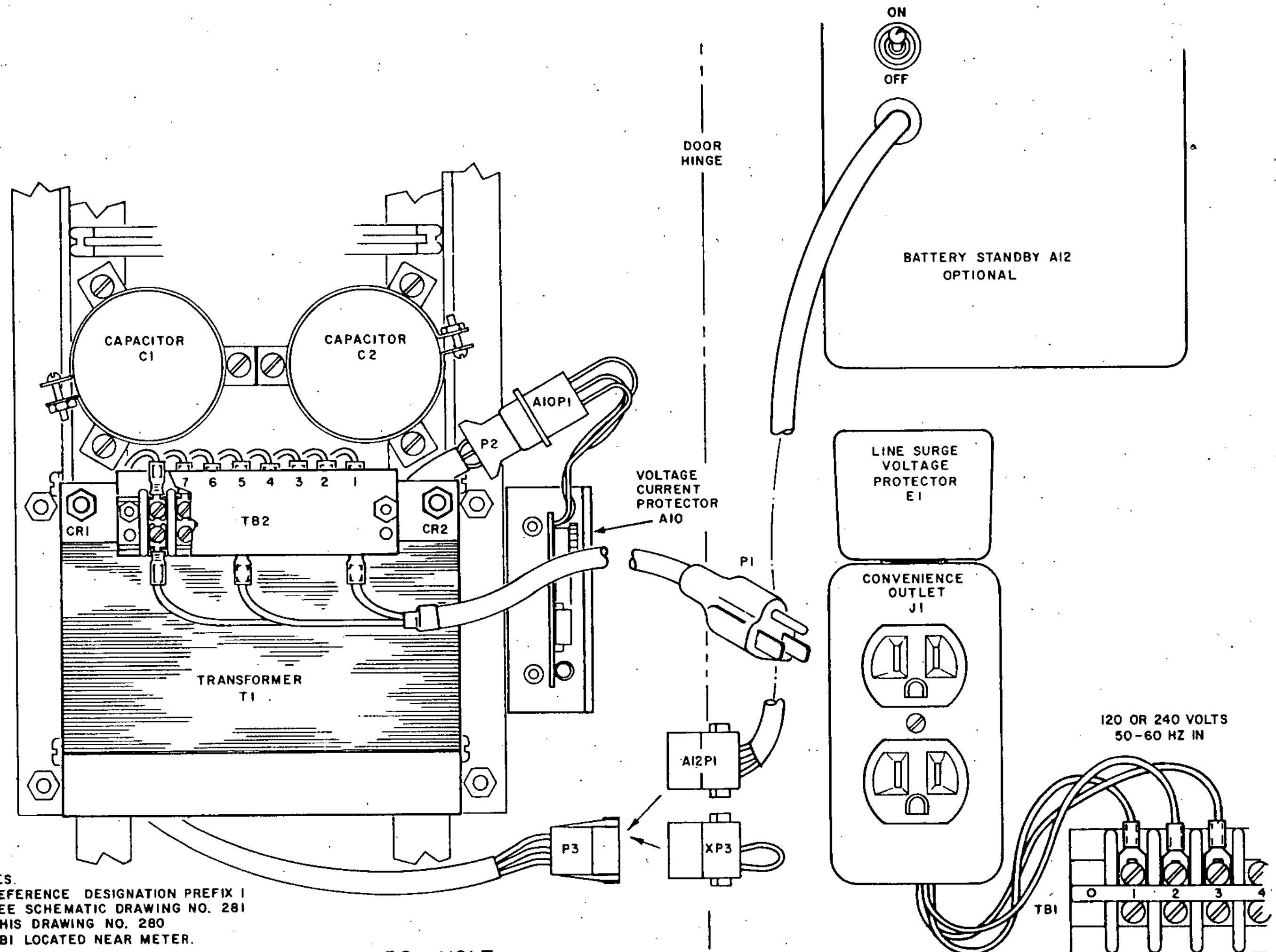
2.2.6 Power Supply: The main supply is a full wave rectified capacitance filtered 50 VDC supply. At normal loading of about 6 amps, the peak to peak ripple will be approximately one volt.

The 14 volt regulated supply for the Keyer, Oscillator Board, Audio Board, DCO Board, and Auto Shutdown Board is mounted on the Auto Shutdown Board. The supplied current is approximately 85 ma. to the circuit boards.



NOTES
1. REFERENCE DESIGNATION PREFIX 1.
2. CAPACITOR VALUES IN MICROFARADS.
3. IF BATTERY STANDBY IS NOT USED, USE PLUG XP3 WITH PINS 3 AND 5 JUMPERED.
4. SEE 50 VOLT POWER SUPPLY DRAWING NO. 280
5. THIS DRAWING NO. 281

FIGURE 2-15
50 VOLT POWER SUPPLY SCHEMATIC



NOTES.
1. REFERENCE DESIGNATION PREFIX 1
2. SEE SCHEMATIC DRAWING NO. 281
3. THIS DRAWING NO. 280
4. CB1 LOCATED NEAR METER.

50 VOLT
POWER SUPPLY
FIG. 2-16

2.2.7 Battery System: The optional Battery Standby System automatically switches the transmitter to battery power in case of AC power failure, and automatically keeps the batteries charged under normal conditions.

An added feature of this circuit is a special identification code when operating on battery power. Whenever the batteries supply power, an additional code sequence is added to the normal identification signal. This code sequence consists of five dots at a faster rate than normal. The special Battery Alert Board used for this identification is the same as the standard Number Board described in 2.2.2 except for two resistor changes that cause the rate of transmission to increase. These resistor changes cause the length of the dot as well as the pause between the dots to be smaller than the standard timing used in the normal identification signal.

When S1 is closed and the batteries are properly connected, there are two current paths. If AC is present, there will be 50 V. at S1 and 48 V. or less at the battery terminals. Current will flow through CR1, Q1, R2, and R3 to trickle charge the batteries. The more current that flows the more Q2 will be turned "on" and the more Q1 will be turned "off". This action limits the charging current to approximately 2 amps maximum. If AC voltage is lost, K1 will be de-energized and current will flow through CR2, RT1, and RT2 to supply power to the transmitter. The voltage drop across CR2 when the batteries are supplying power turns "on" Q3 which supplies 14 V. to the special Battery Alert Board. RT1 and RT2 are used to limit the current surge from the batteries if the battery system is switched on when no voltage is present at the 50 V. line.

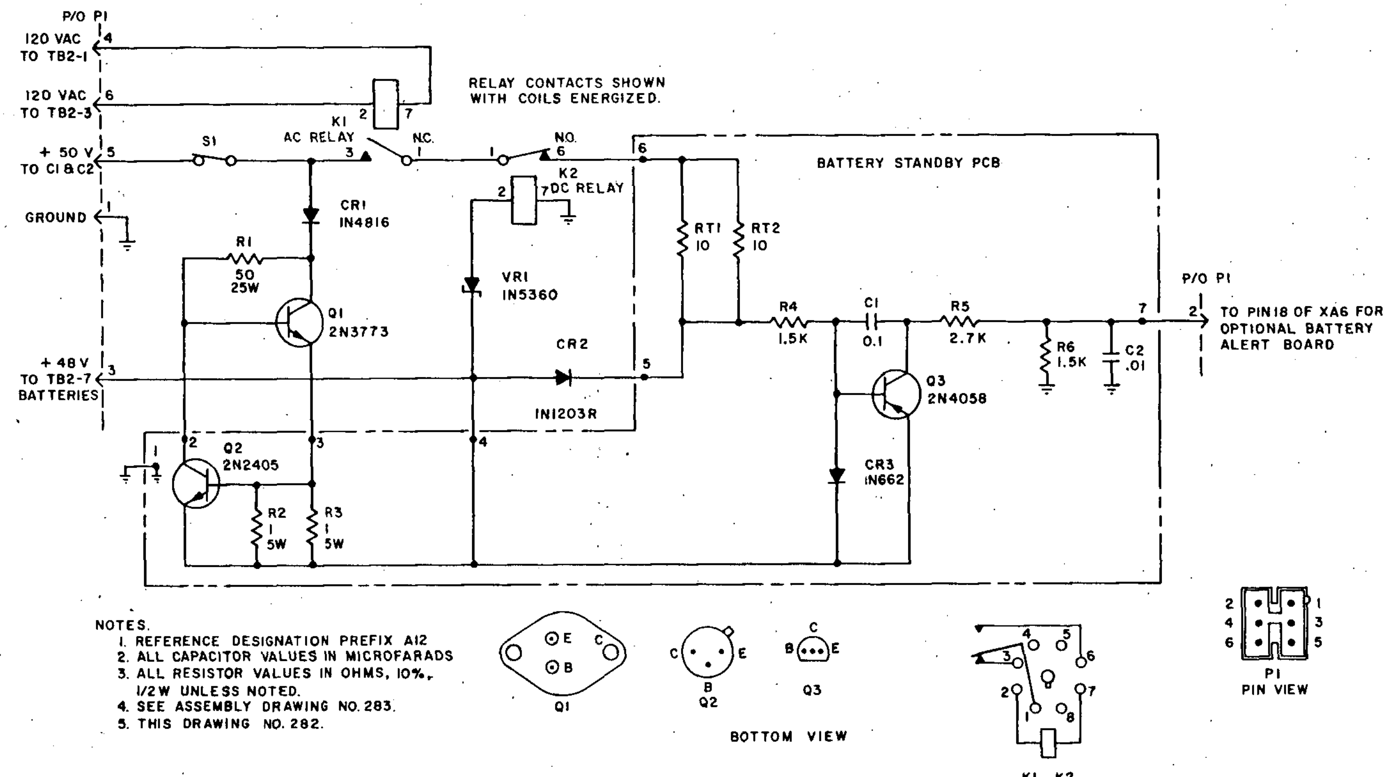
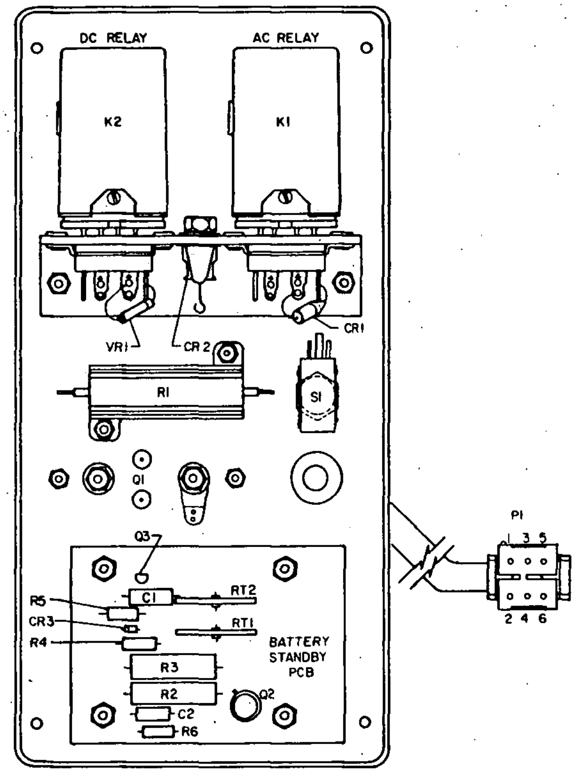


FIGURE 2-17
BATTERY STANDBY SCHEMATIC

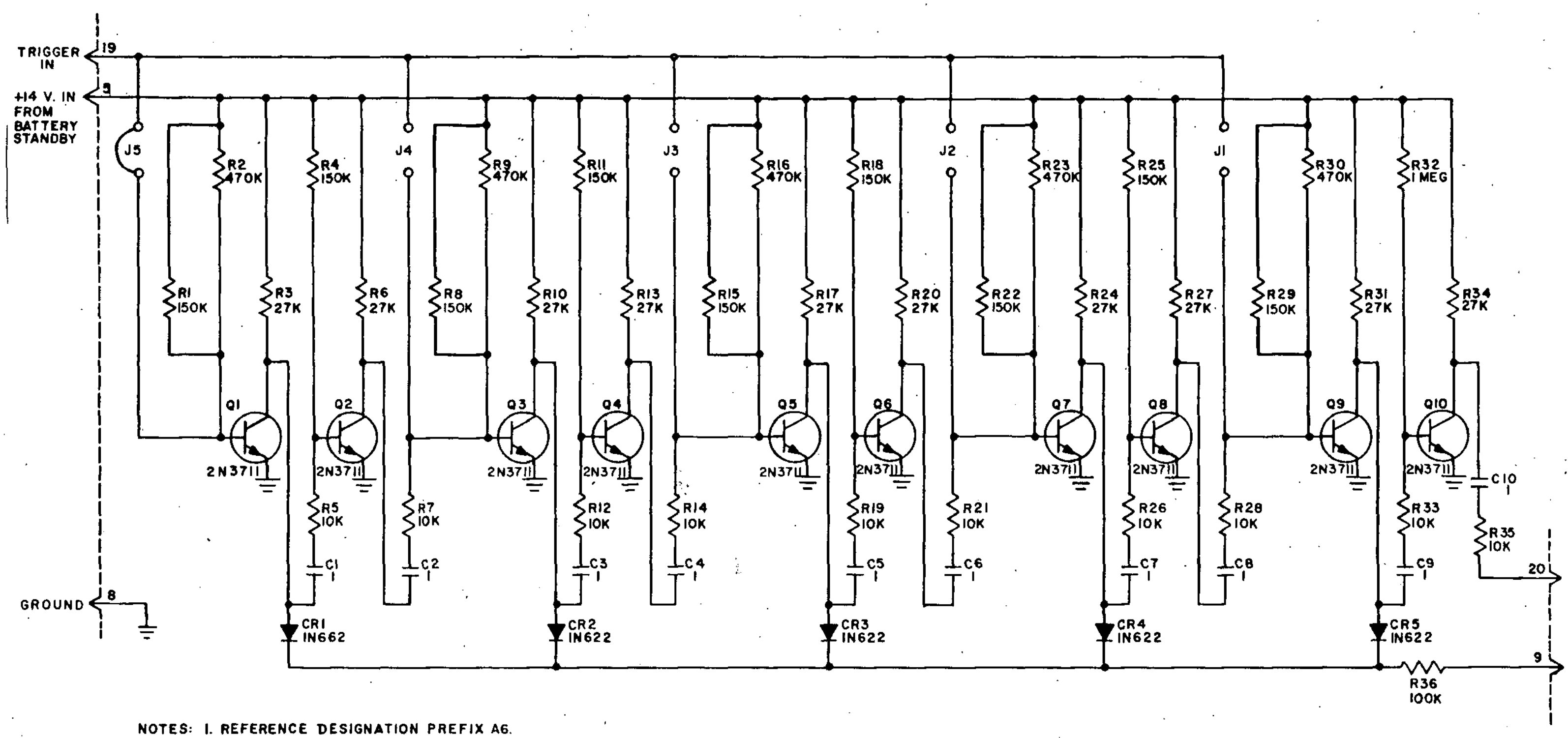


NOTES:

1. REFERENCE DESIGNATION PREFIX A12
2. SEE SCHEMATIC DRAWING NO. 282
3. THIS DRAWING NO. 283

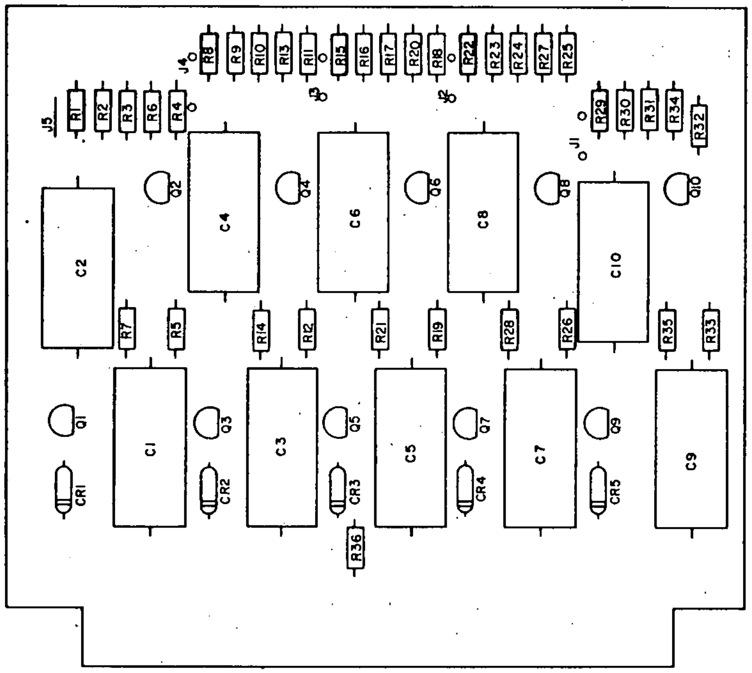
FIGURE 2-18
BATTERY STANDBY ASSEMBLY

REF DES	QTY	PART NO.	DESCRIPTION
			WIRE- SEE WIRING DIAGRAM
	1	7004-D	COVER, NYLON FOR TO3, TEKNA
	1	1416	#6 LOCKING TERMINAL LUG H.H. SMITH
	4		MACH SCREW #6-32 x 3/8
	4		HEX NUTS #4-40
	4		SLOTTED LOCK WASHERS #4 SS
	4		MACH SCREW 4-40 x 3/8 SS
	2		NYLON SHOULDER WASHERS
	8		HEX NUTS #6-32
	6		SLOTTED LOCK WASHER #6 SS.
			MACH SCREW #6-32 S.S.
	4	8503	SPACER, ROUND #6 x 1/2" HH SMITH
	1	1043-C	GROMMET, 1/2" RUBBER, BC
			RELAY SOCKET BRACKET, SAC
			BATTERY STANDBY ENCLOSURE, SAC
	1		BATTERY STANDBY PCB, SAC
VR1	1	1N5360	DIODE MOTOROLA
S1	1	20994CS	SWITCH, SPST, ARROW-HART
RT1, 2	2	2D904	THERMISTOR, 10 OHM, NATIONAL
R5	1	OE2721	RESISTOR 2.7K 1/2 W. 10% OHMITE
R4, 6	2	OE1521	RESISTOR, 1.5K, 1/2 W. 10% OHMITE
R2, 3	2	452E1R05	RESISTOR, 1 OHM 5 WATT, SPRAGUE
R1	1	TM50W	RESISTOR, 50 OHM, 1% NI TEPRO (APPLY THERMAL COMPOUND TO UNDERSIDE OF RESISTOR)
P1	1	1-480340-0	PLUG, PIN HOUSING, AMP
Q3	1	2N4038	TRANSISTOR NATIONAL
Q2	1	2N2405	TRANSISTOR MOTOROLA
Q1	1	2N3773	TRANSISTOR MOTOROLA (APPLY THERMAL COMPOUND & MICA INSULATING WAFER)
K2	1	KAP5D6	RELAY 24 VDC. POTTER BRUMFIELD
K1	1	KAP5AG	RELAY 120 VAC, POTTER BRUMFIELD
CR3	1	1N662	DIODE TI
CR2	1	1N1203R	DIODE NAE
CR1	1	1N4816	DIODE IR
C2	1	192P10392R8	CAPACITOR .01 MFD 80 V, SPRAGUE
C1	1	192P10492R8	CAPACITOR 0.1 MFD 80V, SPRAGUE



NOTES: 1. REFERENCE DESIGNATION PREFIX A6.
2. ALL RESISTOR VALUES IN OHMS, 10%, 1/4 W
3. ALL CAPACITOR VALUES IN MFD
4. SEE ASSEMBLY DRAWING NO. 299.
5. THIS DRAWING NO. 298.

BATTERY ALERT BOARD SCHEMATIC
FIG. 2-19



NOTES: 1. REFERENCE DESIGNATION PREFIX A6.
2. SEE SCHEMATIC DRAWING NO. 298.
3. THIS DRAWING NO. 299.

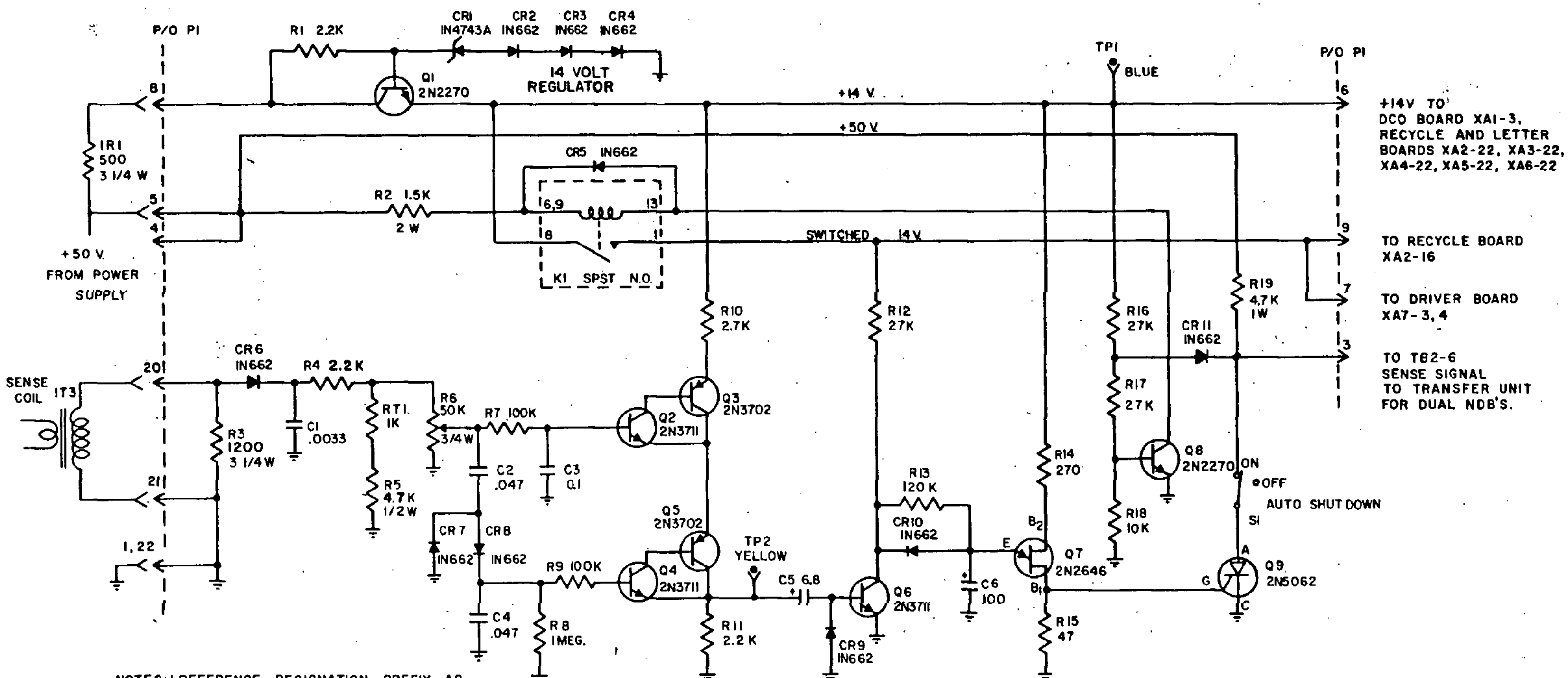
BATTERY ALERT BOARD ASSEMBLY
FIG. 2-20

REF DES	QNTY	PART NO.	DESCRIPTION
	1		PC BOARD, SAC
R36	1	OC1041	RESISTOR 100K, 1/4W, 10% OHMITE
R32	1	OC1051	RESISTOR 1 MEG, 1/4W, 10% OHMITE
R5, 7, 12, 14, 19, 21, 26, 28, 33, 35	10	OC1031	RESISTOR, 10K, 1/4W, 10%, OHMITE
R3, 6 10, 13 17, 20, 24, 27, 31, 34	10	OC2731	RESISTOR, 27K, 1/4W, 10%, OHMITE
R2, 9, 16 23, 30	5	OC4741	RESISTOR, 470K, 1/4W, 10% OHMITE
R1, 4, 8, 11, 15, 18, 22, 25, 29	9	OC1541	RESISTOR 150K, 1/4W, 10%, OHMITE
Q1-10	10	2N3711	TRANSISTOR, NPC
CR1-5	5	1N662	DIODE, TI
C1-10	10	MMW-2W1	CAPACITOR 1.0MFD 200V., CDE

2.2.8 Auto Shutdown Board: The Automatic Shutdown Board incorporates detectors and logic circuits to monitor output current and modulation.

The output RF current level is coupled by a sense coil to the board input where it is detected by diode CR6. The demodulated signal has both a DC component proportional to RF current level, and an AC component proportional to the modulation level. The level of these components is adjusted by R6. The two components are then separated with the DC component going to Q2 and Q3, and the AC component to diodes CR7 and CR8 where it is demodulated and used to drive Q4 and Q5. With RF level and modulation present, a slowly varying voltage of one to two volts is normally seen at test point 2 (yellow). This turns Q6 on, which prevents C6 from charging. If the voltage level at the test point drops below approximately +.75 volts because of low RF input or no tone, Q6 will be turned off and C6 will charge through resistors R12 and R13 firing unijunction transistor Q7 after a nominal 25 second delay. If the tone is on continuously, C5 will charge, and Q6 will not turn on with the same end result. Q7 fires the SCR which then applies a zero volt signal to the base of Q8, turning Q8 and relay K1 off, and removing the 14 volt supply from the preamplifier. This completely turns off the RF output until the SCR is again reset by opening switch S1.

Also included on the Auto Shutdown Board is a 14 volt regulated power supply which supplies power to all circuit boards in the transmitter.



NOTES: 1. REFERENCE DESIGNATION PREFIX A8.
2. RESISTOR VALUES IN OHMS, 10%, 1/4W UNLESS NOTED.
3. CAPACITORS IN MFD UNLESS NOTED.
4. ASSEMBLY DRAWING NO. 146.
5. DRAWING NO. 147

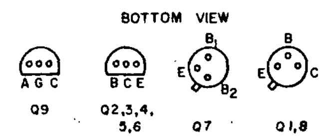
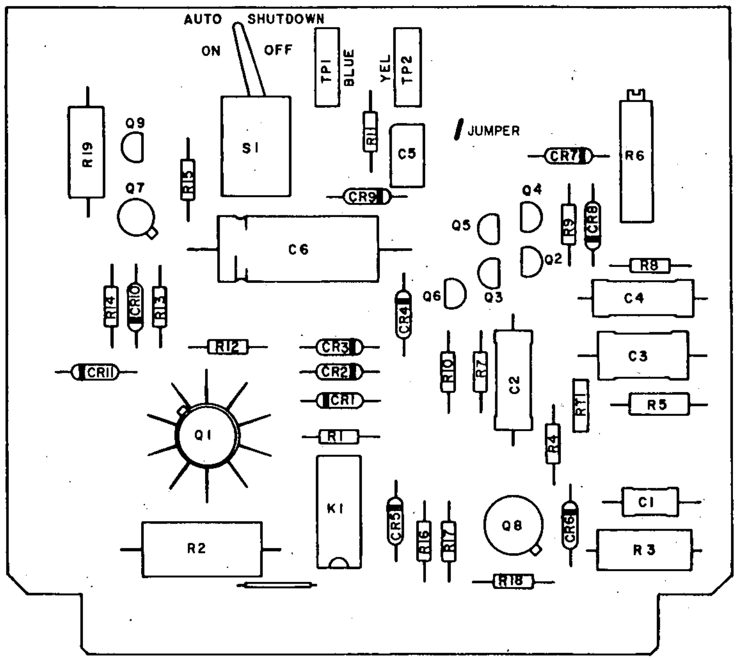


FIGURE 2-21
AUTO SHUTDOWN BOARD SCHEMATIC



REF DES PREFIX A8

FIGURE 2-22
AUTO SHUTDOWN BOARD ASSEMBLY

NOTES: 1. SEE DRAWING NO. 147 FOR SCHEMATIC.
2. SEE DRAWING NO. 148 FOR MASTER DRAWING.
3. REF DES PREFIX A8.
4. DRAWING NO. 146.

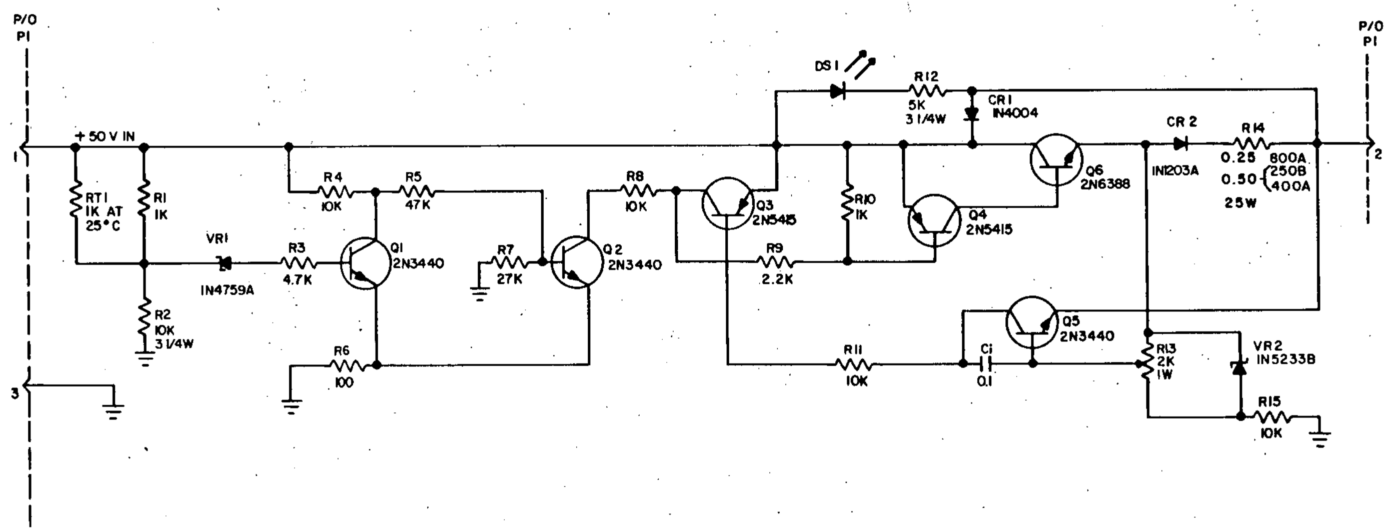
REF. DES.	QUAN.	PART NO.	DESCRIPTION
	1	148	PCB, SAC.
TP2	1	325-107	TEST POINT, YELLOW, H.H. SMITH
TP1	1	325-105	TEST POINT, BLUE, H.H. SMITH
RT1	1	CA31J1	THERMISTER, 1K, FENWAL
S1	1	SF6TC X392	SWITCH, TOGGLE, 2 POSITION, C-H
R19	1	OG4721	RESISTOR, COMP., 4.7K 10% 1W, OHMITE
R18	1	OC1031	RESISTOR, COMP., 10K 10% 0.25 W, OHMITE
R15	1	OC4701	RESISTOR, COMP., 47Ω 10% 0.25 W, OHMITE
R14	1	OC2711	RESISTOR, COMP., 270 10% 0.25W, OHMITE
R13	1	OC1241	RESISTOR, COMP., 120K 10% 0.25W, OHMITE
R12,16,17	3	OC2731	RESISTOR, COMP., 27K 10% 0.25 W, OHMITE
R10	1	OC2721	RESISTOR, COMP., 2.7K 10% 0.25W, OHMITE
R8	1	OC1051	RESISTOR, COMP., 1M, 10% 0.25W, OHMITE
R7,9	2	OC1041	RESISTOR, COMP., 100K 10% 0.25W, OHMITE
R6	1	3006P-1-503	RESISTOR, VAR., 50K 10% 0.75W, BOURN
R5	1	OE4721	RESISTOR, COMP., 4.7K 10% 1/2W, OHMITE
R4	1	OC2221	RESISTOR, COMP., 2.2K 10% 0.25W, OHMITE
R3	1	4425	RESISTOR, WW, 1.2K 10% 3.25W, OHM
R2	1	OH1521	RESISTOR, COMP., 1.5K 10% 2W, OHMITE
R1,11	2	OC2221	RESISTOR, COMP., 2.2K 10% .25 W, OHM
Q9	1	2N5062	SILICON CONTROLLED RECTIFIER, UNITRODE
Q7	1	2N2646	TRANSISTOR, SILICON, UNIJUNCTION GE
Q3,5	2	2N3702	TRANSISTOR, SILICON, PNP, TI
Q2,4,6	3	2N3711	TRANSISTOR, SILICON, NPN, TI
Q1,8	2	2N2270	TRANSISTOR, SILICON, NPN, MOTOROLA
K1	1	W107DIP-3	RELAY SPST, MAGNECRAFT
CR 2,3,4,5,6,7,8,9,10,11	10	1N662	DIODE, SILICON, TI
CR1	1	1N4743A	DIODE, SILICON, ZENER ITT
C6	1	500D 107G025DD7	CAPACITOR, ELECT, 100 mfd, 25V, SPRAGUE
C5	1	TIM685K 035POY	CAPACITOR, TANT, 6.8 mfd. 35V, MALLORY
C3	1	192P1049R8	CAPACITOR, POLY, .1mfd., 80V, SPRAGUE
C2,4	2	192P4739R8	CAPACITOR, POLY, .047mfd, 80 V, SPRAGUE
C1	1	192P3329R8	CAPACITOR, POLY, .0033mfd, 80V, SPRAGUE

2.2.9 Voltage Current Protector: The Voltage Current Protector allows current to pass through a transistor switch, Q6, and on to the final amplifier for a supply voltage of less than 60 volts and supply current of less than approximately 3 to 8 amperes, depending upon the setting of resistor R13. Supply current to the final amplifier is interrupted if supply voltage or current exceed either of these limits.

During operation within normal limits of voltage and current, pass transistor Q6 conducts, allowing current to pass on to the transmitter final amplifier. Bias current for Q6 is furnished from Q4 to Q2 which are both conducting. Transistors Q1, Q3 and Q5 are not conducting.

As the input voltage rises above approximately 60 volts, zener diode VR1 conducts forward, biasing Q1. Q1 and Q2 act as a Schmidt trigger, with Q2 turning off rapidly as Q1 begins conduction. Bias current for the pass transistor Q6 is interrupted as Q2 turns off, removing power from the finals. As input voltage again drops below 60 volts, Q1 ceases conduction, Q2 turns on, and with bias restored to Q6, power to the finals is restored.

Current flowing to the final amplifier is sensed as a voltage drop across CR2 and R14. With an operating current of less than the limit set by R13, the voltage drop across CR2 and R14 is not sufficient to forward bias the base emitter junction of Q5. As this current is exceeded, Q5 begins conduction, and through Q3 and Q4 removes the bias current from Q6. Operation changes rapidly from conducting to non-conducting states, limiting current to the final amplifiers.



NOTES

1. REFERENCE DESIGNATION PREFIX A10.
2. ALL RESISTOR VALUES IN OHMS, 10%, 1/4W UNLESS NOTED.
3. ALL CAPACITOR VALUES IN MFD.
4. SEE ASSEMBLEY DRAWING NO. 289.
5. THIS DRAWING NO. 324.

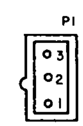
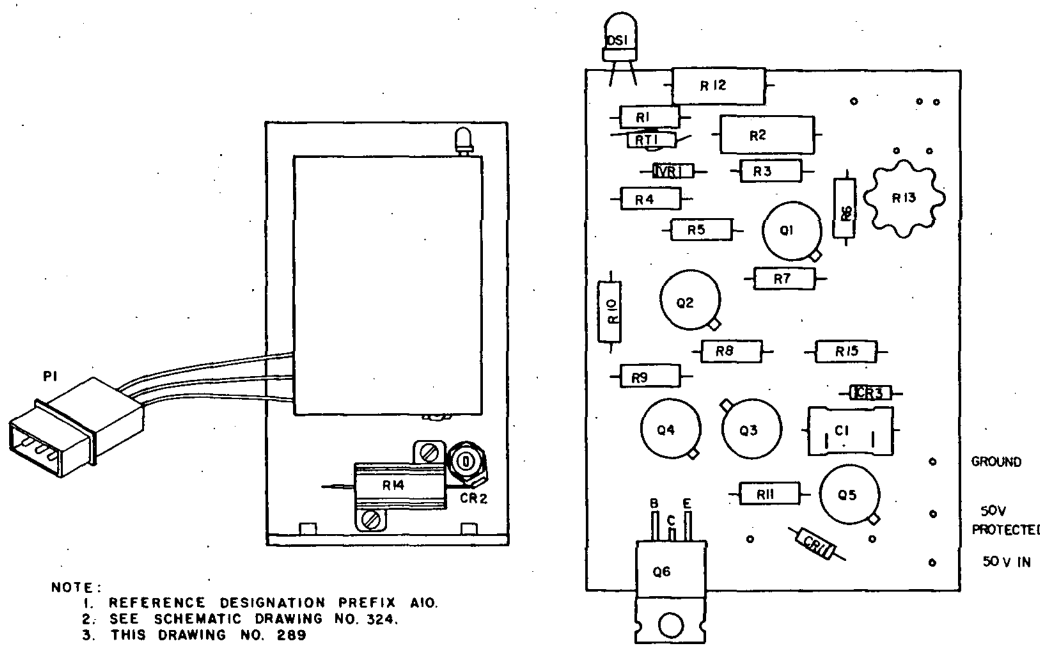


FIGURE 2-23

VOLTAGE CURRENT PROTECTOR SCHEMATIC



NOTE:
1. REFERENCE DESIGNATION PREFIX A10.
2. SEE SCHEMATIC DRAWING NO. 324.
3. THIS DRAWING NO. 289

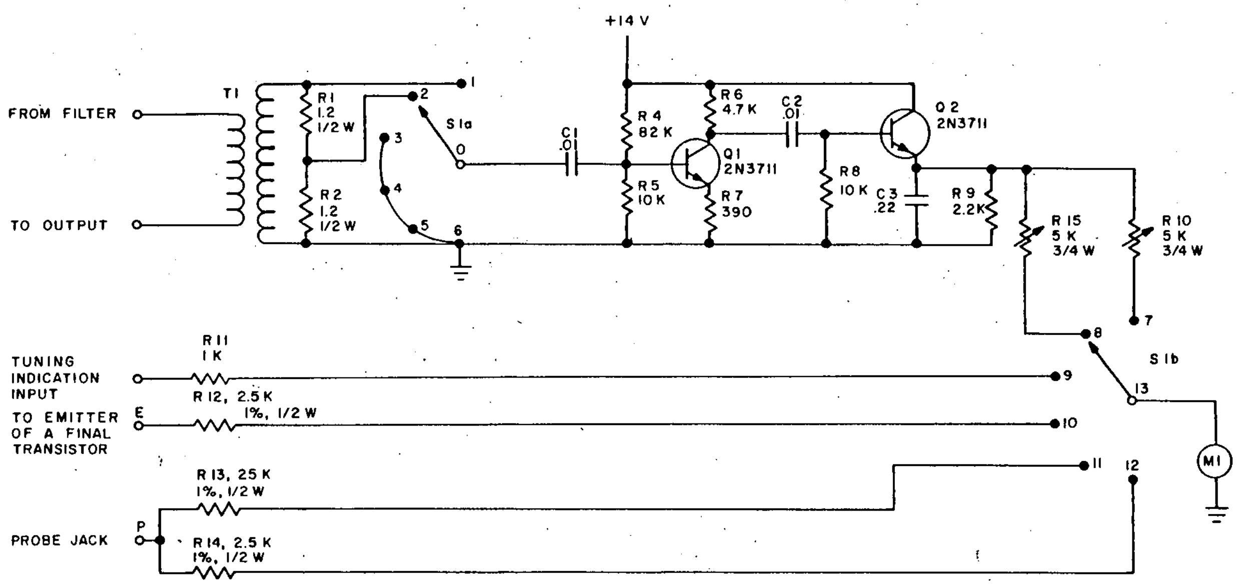
FIGURE 2-24

VOLTAGE CURRENT PROTECTOR ASSEMBLY

REF. DES.	QNTY.	PART NUMBER	DESCRIPTION
VR1	1	1N4759A	DIODE, ZENER, MOTOROLA
RT1	1	CA31J1	THERMISTOR, 1K, FENWAL
R14	1	RH-25	RES. FOR 800 XMTR. - 25W, .25OHM, 12 " " 250 " - .5 OHM, TEPRO.
R13	1	3345-P-1-202T	RES., VARIABLE, 2K, 1W, BOURNS POTENTIOMETER
R12	1	4442	RES., 5K, 3¼ W, OHMITE
R9	1	OE2221	RES., 2.2K, ½W, 10% OHMITE
R7	1	OE2731	RES., 27K, ½W, 10% OHMITE
R6	1	OE1011	RES. 100 OHM, ½W, 10% OHMITE
R5	1	OE4731	RES., 47K, ½W, 10% OHMITE
R4, 8, 11, 15	4	OE1031	RES., 10K, ½W, 10% OHMITE
R3	1	OE4721	RES., 4.7K ½W, 10% OHMITE
R2	1	4454	RES., 10K, 3¼ W, OHMITE
R1,10	2	OE1021	RES., 1K, ½W, 10% OHMITE
Q6	1	2N6388	TRANSISTOR, IDI (WITH MICA)
Q3,4	2	2N5415	TRANSISTOR, SOLOTRON
Q1,2,5	3	2N3440	TRANSISTOR, FSC
DS1	1	FLV117	DIODE, LIGHT EMITTING, FSC
CR3	1	1N5233	DIODE, ITT
CR2	1	1N1203A	DIODE, NAE
CR1	1	1N4004	DIODE, ITT
C1	1	192P1049R8	CAPACITOR, .1 MFD. 80V, 10% SPRAGUE

2.2.10 Metering Circuit. The Metering Circuit provides measurements of RF output power, DC current in one of the final transistors, and two DC voltage scales.

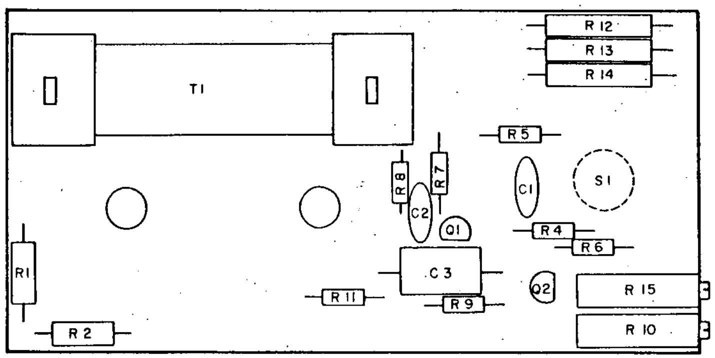
The RF power is measured by using a current transformer in the output circuit. The emitter volts measurement is a DC voltage measurement across one of the one ohm emitter resistors, and thus gives a direct measurement of DC current in the final transistors. Two voltage ranges are also provided for external measurements with a probe.



NOTES: 1. REF DES. PREFIX A11.
2. ALL RESISTORS 1/4 W, 10% UNLESS NOTED.
3. ALL CAPACITORS IN MFD UNLESS NOTED.
4. THIS DRAWING NO. 643.
5. R3 DELETED.

FIGURE 2-25

METER PWB SCHEMATIC



NOTES: 1. S1 MOUNTED ON SOLDER SIDE.
2. THIS DRAWING NO. 642.
3. REF. DES. PREFIX A11.

FIGURE 2-26
METER PWB ASSEMBLY

ITEM	REF. DES.	QNTY	PART NO.	DESCRIPTION
17	T1	1	C-440	TRANSFORMER, SAC
16	S1	1	12-RCB-6-J-PC	SWITCH, 2 POLE, 6 POS., PC MOUNT, RCL
15	R 13	1	WS15	RES., 25 K, 1/2 W, 1%, PENN
14	R12,14	2	WS15	RES., 2.5 K, 1/2 W, 1%, PENN
13	R11	1	OC1021	RES., 1 K, 1/4 W, 10%, OHMITE
12	R10,15	2	3006P-1-502	RES., 5 K, 3/4 W, POT., BOURNS
11	R 9	1	OC2221	RES., 2.2 K, 1/4 W, 10%, OHMITE
10	R 7	1	OC3911	RES., 390 OHM, 1/4 W, 10%, OHMITE
9	R6	1	OC4721	RES., 4.7 K, 1/4 W, 10%, OHMITE
8	R5,8	2	OC1031	RES., 10 K, 1/4 W, 10%, OHMITE
7	R 4	1	OC8231	RES., 82 K, 1/4 W, 10%, OHMITE
6	R 3			DELETED COMPONENT
5	R1,2	2	OE12G1	RES., 1.2 OHM, 1/2 W, 10%, OHMITE
4	Q1, 2	2	2N3711	TRANSISTOR, SILICON, NPC
3	C 3	1	192P2249R8	CAP., .22 mfd, 80 V, TANTALUM, SPRAGUE
2	C 2	1	TGS10	CAP., .01 mfd, 100 V, DISC CER., SPRAGUE
1	C 1	1	TGS10	CAP., .01 mfd, 100 V, DISC CER., SPRAGUE

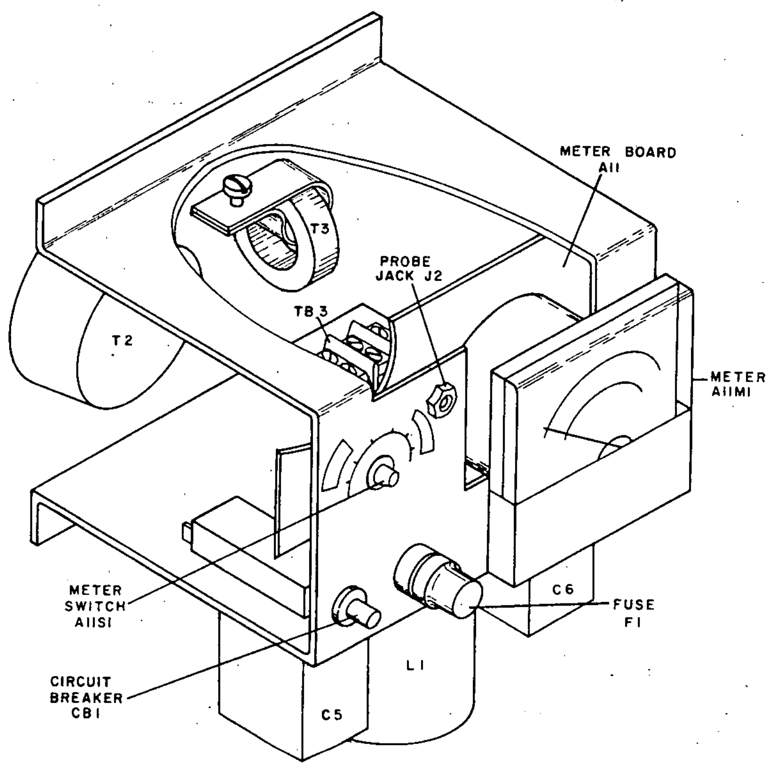


FIGURE 2-27
METER BRACKET ASSEMBLY

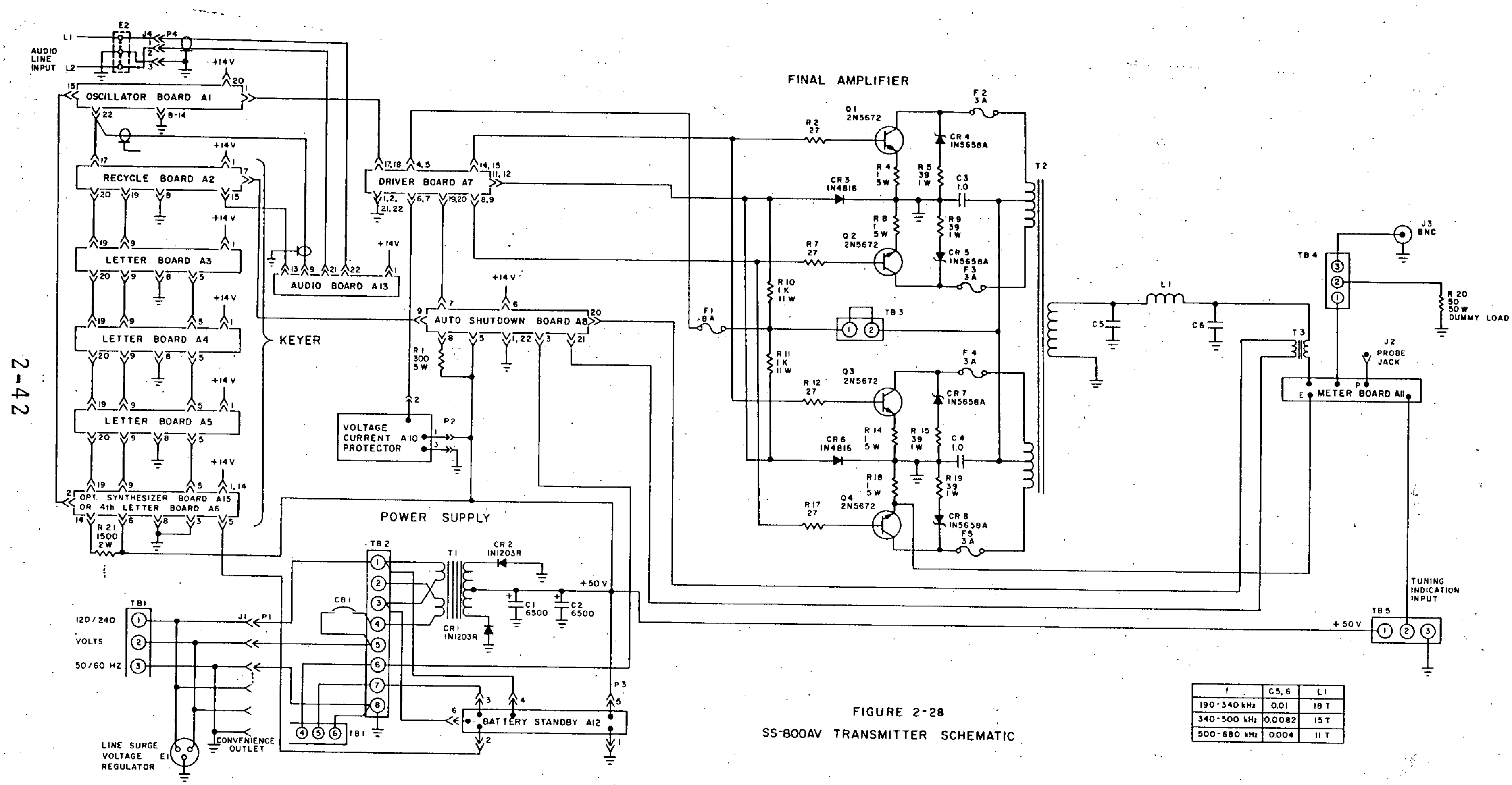


FIGURE 2-28

SS-800AV TRANSMITTER SCHEMATIC

f	C5, 6	L1
190-340 kHz	0.01	18 T
340-500 kHz	0.0082	15 T
500-680 kHz	0.004	11 T

NOTES:
1. REF. DES. PREFIX 1.
2. ALL CAPACITORS IN MFD.
3. ALL RESISTORS 1/2 W, VALUES IN OHMS.
4. THIS DRAWING NO. D-677.

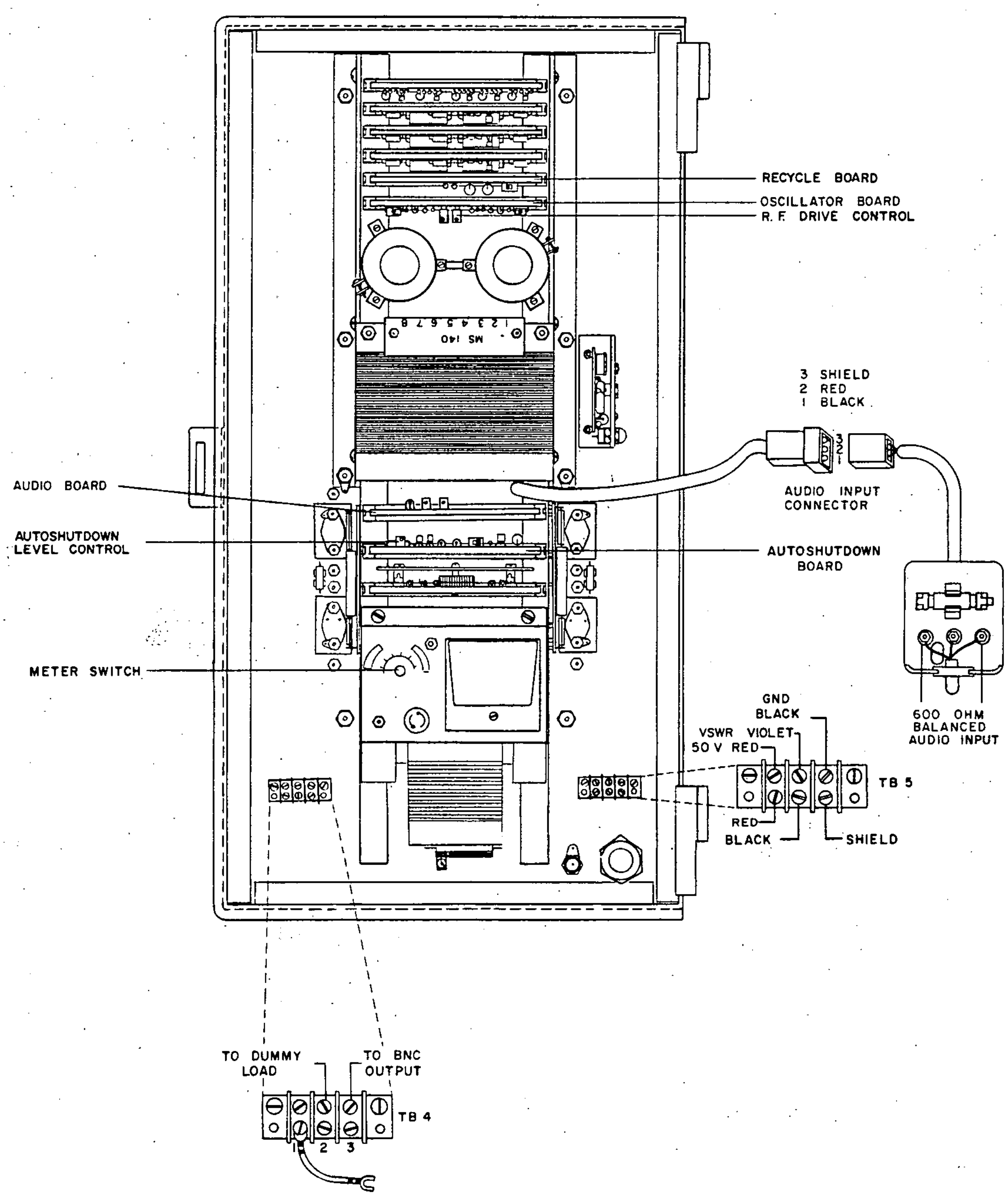


FIGURE 2-29
SS-800AV TRANSMITTER

2.3 Block Diagram Theory - PC-1000: Figure 2-30 is a block diagram of the PC-1000 Antenna Coupler.

2.3.1 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.

2.3.2 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.

2.3.3 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.

2.3.4 Antenna Current/Tuning Meter: This meter indicates antenna current in two ranges; 0-2A and 0-4A. A reflected power measurement is used to indicate tuning. The meter function is determined by a four position switch that selects OFF, TUNE, 4A, 2A.

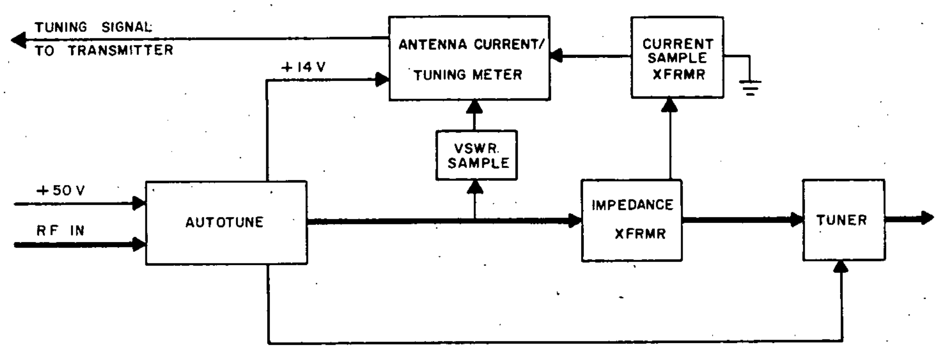


FIGURE 2-30
PC-1000 BLOCK DIAGRAM

2.4 Detailed Theory - PC-1000: See Figure 2-31 for an overall schematic of the PC-1000 antenna coupler, Figure 2-32 and 2-33 for a schematic and assembly drawing of the Antenna Current/Tuning Meter, and Figure 2-34 and 2-35 for a schematic and assembly drawing of the Autotune PWB.

2.4.1 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.

2.4.2 Tuner: This 240 turn coil has a transformer coupled shorted ring that can be turned manually or by the autotune motor. The forty turns physically below the tuning ring are tapped every four 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 ±5% depending on the combination of taps.

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

2.4.3 Autotune: See Figures 2-34 and 2-35 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 Run/Setup Switch (S1) is in the Setup position.

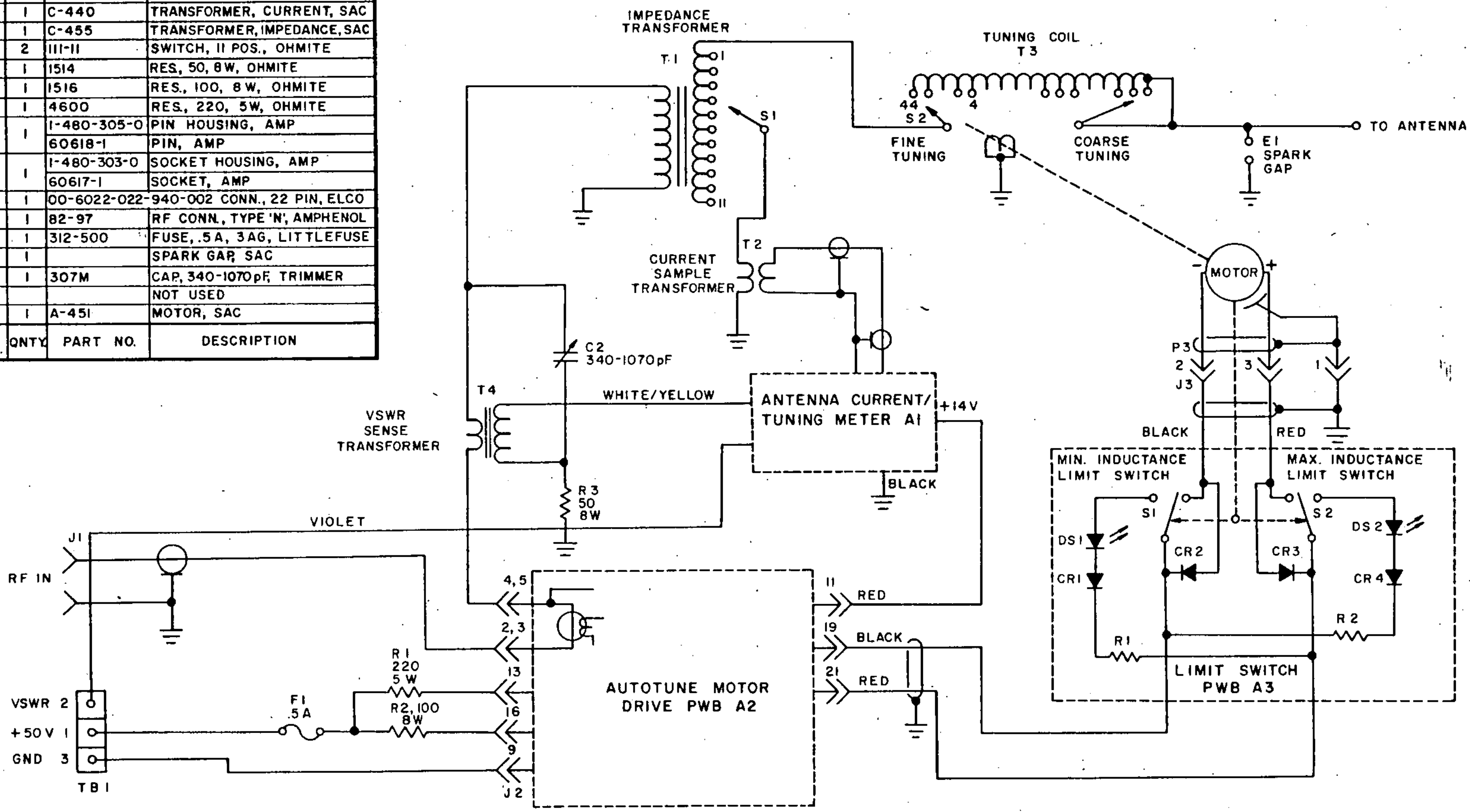
RF current from the transmitter passes through T1 of the Autotune Motor Drive PWB. Limiting amplifiers U1 and U2 amplify and square the current and voltage signals. The output of U3, pin 11, is filtered by R12 and C10 to produce a DC voltage at TP1 (Brown) proportional to the phase difference. The DC voltage is compared by voltage comparator U5 with a reference voltage at TP2 (Red), set by tolerance adjust control (R16). As the TP1 (Brown) voltage becomes more positive than the TP2 voltage, the output 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 output 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 transition of clock input, pin 13. On the positive clock transition, the Q output, pin 5, of U4 is latched into the same state as the U4, pin 2 data input with a logic 1 (+14V) indicating an inductive antenna condition. This condition is also indicated by LED DS1. As the U5, pin 7, output changes from 0 V to +14V, 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, pin 7 output also latches the flip-flop contained in U6, into a "drive" state with a logic 0 (0V) at U6, Pin 3. If the Run/Setup 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 +14V at U7, pin 10 and 0V 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.

2.4.4 Antenna Current/Tuning Meter: See Figure 2-32 and Figure 2-33 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, C1, 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 and also back to the tuning meter in the transmitter.

ITEM	REF. DES.	QNTY.	PART NO.	DESCRIPTION
18	TB1	1	3-140	TERMINAL BLOCK, CINCH
17	T4	1	C-438	TRANSFORMER, VSWR, SAC
16	T3	1	C-454	TUNING COIL, SAC
15	T2	1	C-440	TRANSFORMER, CURRENT, SAC
14	T1	1	C-455	TRANSFORMER, IMPEDANCE, SAC
13	S1, 2	2	111-11	SWITCH, 11 POS., OHMITE
12	R3	1	1514	RES. 50, 8W, OHMITE
11	R2	1	1516	RES., 100, 8W, OHMITE
10	R1	1	4600	RES., 220, 5W, OHMITE
9	P3	1	1-480-305-0	PIN HOUSING, AMP
			60618-1	PIN, AMP
8	J3	1	1-480-303-0	SOCKET HOUSING, AMP
			60617-1	SOCKET, AMP
7	J2	1	00-6022-022-940-002	CONN., 22 PIN, ELCO
6	J1	1	82-97	RF CONN., TYPE 'N', AMPHENOL
5	F1	1	312-500	FUSE, .5A, 3AG, LITTLEFUSE
4	E1	1		SPARK GAP, SAC
3	C2	1	307M	CAP, 340-1070pF, TRIMMER
2	C1			NOT USED
1	B1	1	A-451	MOTOR, SAC

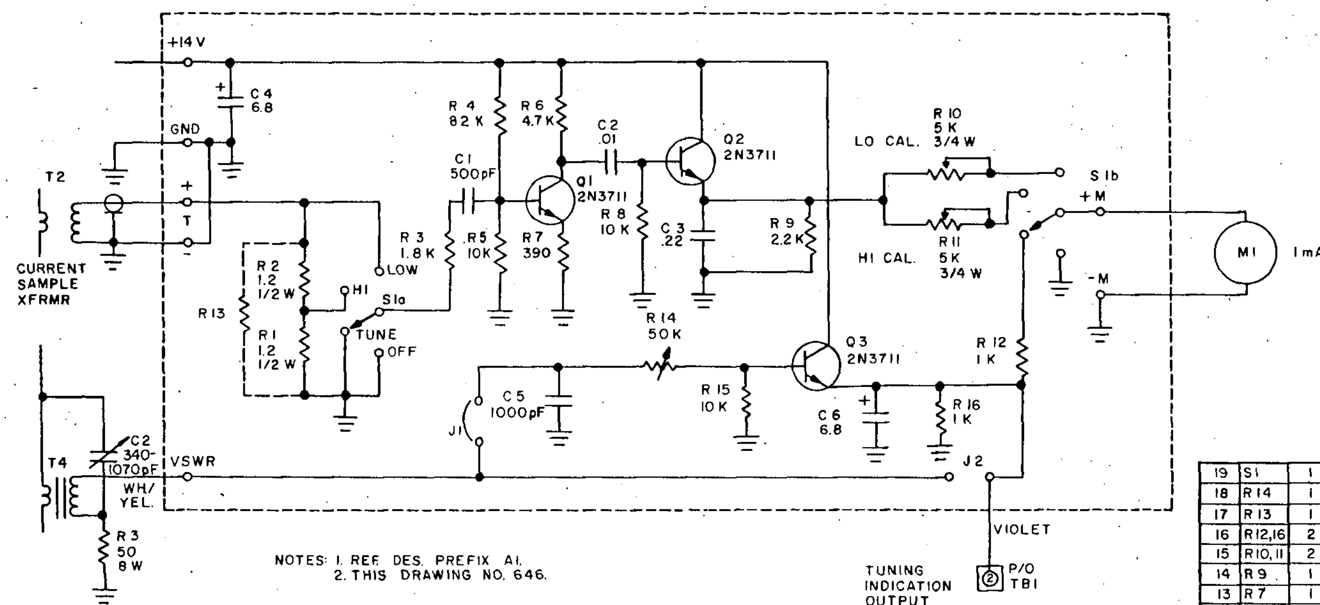


NOTES: 1. ALL RESISTOR VALUES IN OHMS.
2. THIS DRAWING NO. 647.
3. REF. DES. PREFIX 2.

FIGURE 2-31

PC-1000 ANTENNA COUPLER SCHEMATIC

ITEM	REF. DES.	QNTY.	PART NO.	DESCRIPTION
4	S1, 2	2	E2300A	SWITCH, MINIATURE, CHERRY
3	R1, 2	2	OC5611	RES., 560, 1/4 W, OHMITE
2	DS1,2	2	FLV-117	LED, FAIRCHILD
1	CR1-4	4	IN4004	DIODE, SILICON, GI
LIMIT SWITCH PWB A3				



NOTES: 1. REF. DES. PREFIX A1.
2. THIS DRAWING NO. 646.

FIGURE 2-32

ANTENNA CURRENT/TUNING METER
PWB SCHEMATIC

ITEM	REF. DES.	QNTY	PART NO.	DESCRIPTION
19	S1	1	12-X30B-6-J	SWITCH, RCL
18	R14	1	3006P-1-503	RES., 50 K, 3/4 W, POT., BOURNS
17	R13	1	OE22G1	RES., 2.2OHM, 1/2 W, OHMITE (PC-30)
16	R12,16	2	OC1021	RES., 1 K, 1/4 W, 10%, OHMITE
15	R10, 11	2	3006P-1-502	RES., 5 K, 3/4 W, POT., BOURNS
14	R9	1	OC2221	RES., 2.2 K, 1/4 W, 10%, OHMITE
13	R7	1	OC3911	RES., 390 OHM, 1/4 W, 10%, OHMITE
12	R6	1	OC4721	RES., 4.7 K, 1/4 W, 10%, OHMITE
11	R5,8,15	3	OC1031	RES., 10 K, 1/4 W, 10%, OHMITE
10	R4	1	OC8231	RES., 82 K, 1/4 W, 10%, OHMITE
9	R3	1	OC1821	RES., 1.8 K, 1/4 W, 10%, OHMITE
8	R1, 2	2	OE12G1	RES., 1.2 OHM, 1/2 W, 10%, OHMITE
7	Q1-3	3	2N3711	TRANSISTOR, SILICON, NPC
6	M1	1	A-449	METER, 0-1mA, SAC (PC-30)
			A-448	METER, 0-1mA, SAC (PC-10)
5	C5	1	DM15-102J	CAP., 1000pF, 500V, DIP MICA, ARCO
4	C4, 6	2	TIM685K035POY	CAP., 6.8mfd, 35V, MALLORY
3	C3	1	192P2249R8	CAP., .22mfd, 80V, TANT., SPRAGUE
2	C2	1	TGS10	CAP., .01mfd, 100 V, CER. D., SPRAGUE
1	C1	1	DM15-501J	CAP., 500pF, 500V, DIP MICA, ARCO

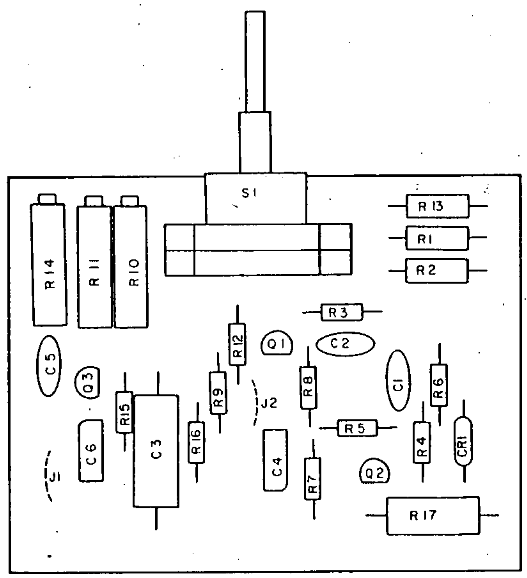
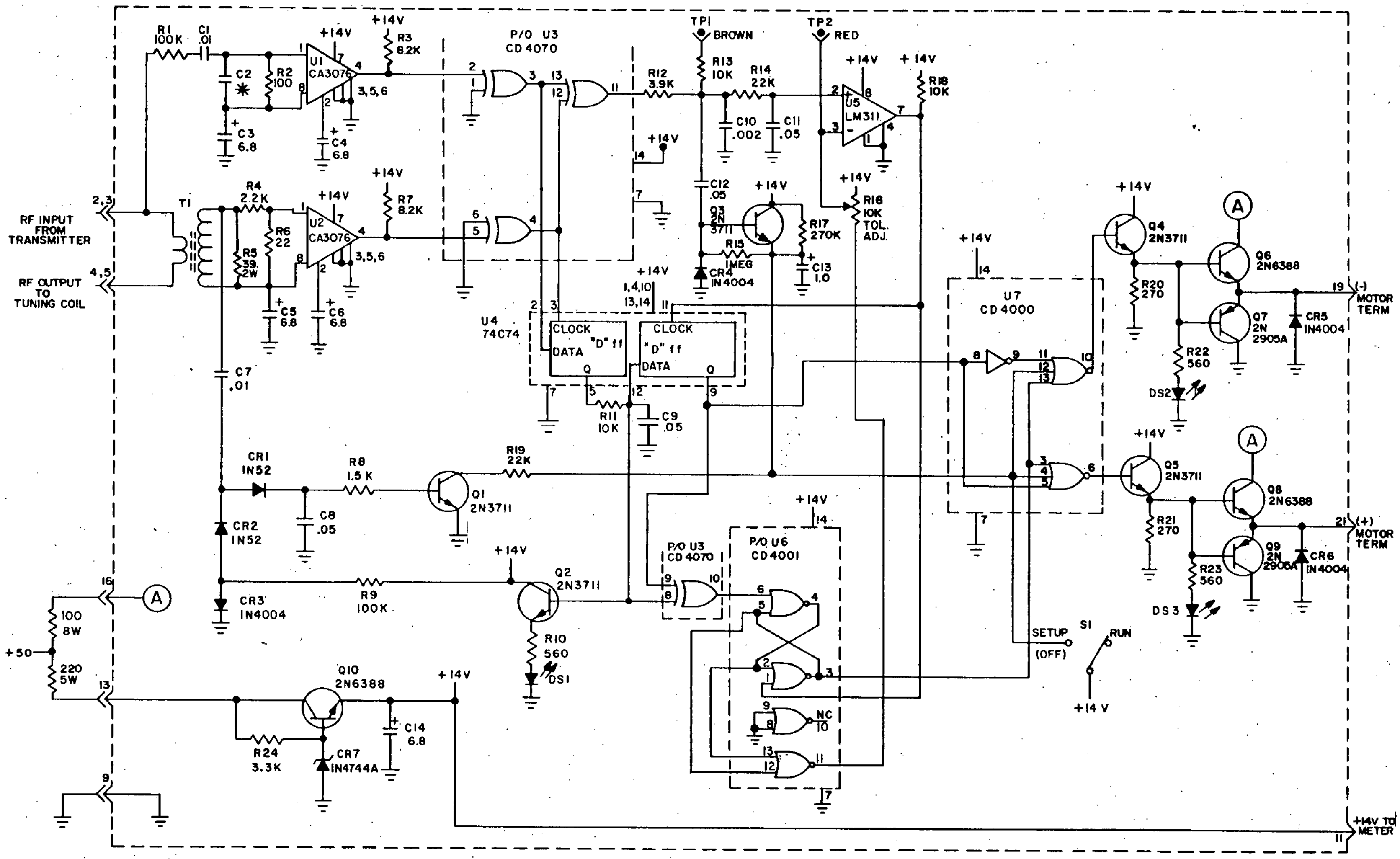


FIGURE 2-33
ANTENNA CURRENT/TUNING METER
PWB ASSEMBLY

NOTES: 1. CR1 AND R17 USED ON 1000 "H" ONLY
2. THIS DWG. NO. 668
3. USE J1 FOR ON BOARD VSWR.
4. USE J2 FOR EXTERNAL VSWR.
5. REF. DES. PREFIX A1

ITEM	REF. DES	QNTY	PART NO.	DESCRIPTION
19	S1	1	12-X30B-6-J	SWITCH, RCL
18	R17	1	4430	RES., 2K, 3 1/4W, 5%, WW, OHMITE
17	R14	1	3006P-1-503	RES., 50K, 3/4W, POT., BOURNS
16	R12,16	2	OC1021	RES., 1K, 1/4W, 10%, OHMITE
15	R10,11	2	3006P-1-502	RES., 5K, 3/4W, POT., BOURNS
14	R9	1	OC2221	RES., 2.2K, 1/4W, 10%, OHMITE
13	R7	1	OC3911	RES., 390 OHM, 1/4W, 10%, OHMITE
12	R6	1	OC4721	RES., 4.7K, 1/4W, 10%, OHMITE
11	R5,8,15	3	OC1031	RES., 10 K, 1/4W, 10%, OHMITE
10	R4	1	OC8231	RES., 82 K, 1/4W, 10%, OHMITE
9	R3	1	OC1821	RES., 1.8 K, 1/4 W, 10%, OHMITE
8	R1,2	2	OE12G1	RES., 1.2 OHM, 1/2 W., 10%, OHMITE
7	Q1-3	3	2N3711	TRANSISTOR, NPN, SILICON, NPC
6	CR1	1	1N4743 A	DIODE, ZENER, 13V, 1 W, MOTOROLA
5	C5	1	DM15-102 J	CAP, 1000pF, 500V., DIP MICA, ARCO
4	C4,6	2	TIM685K035POY	CAP, 6.8mFd, 35V., MALLORY
3	C3	1	192P2249R8	CAP., .22mFd, 80 V., TANTALUM, SPRAGUE
2	C2	1	TGS 10	CAP., .01 mFd, 100V., DISC CER., SPRAGUE
1	C1	1	DM15-501J	CAP., 500 pF, 500V., DIP MICA, ARCO



NOTES:

1.) REF. DES. A2.

2.) ALL RESISTORS IN OHMS, 1/4 WATT, 10% TOL. UNLESS OTHERWISE NOTED.

3.) ALL CAPACITORS IN MICROFARADS UNLESS OTHERWISE NOTED.

4.) THIS DRAWING NUMBER 444.

FIGURE 2-34
AUTOTUNE MOTOR DRIVE PWB SCHEMATIC

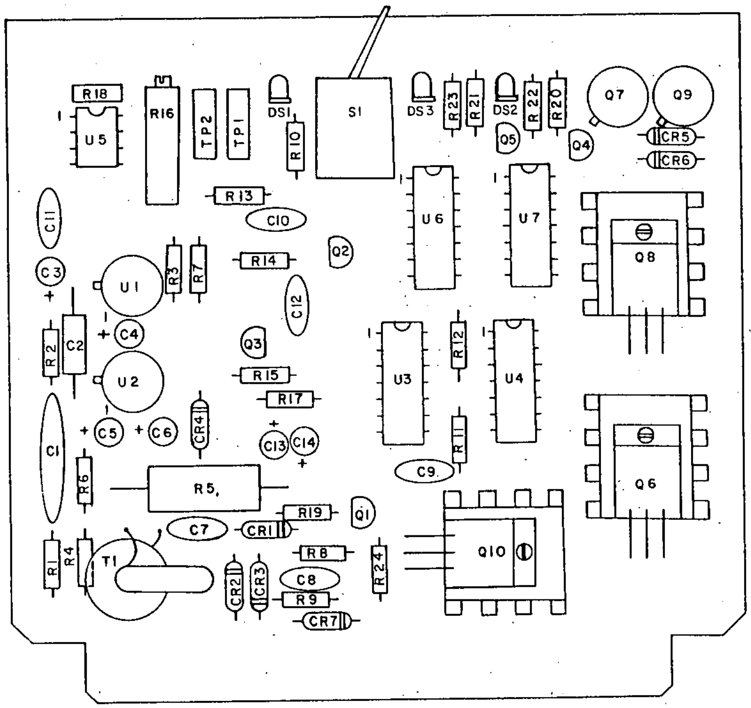


FIGURE 2-35
AUTOTUNE MOTOR DRIVE PWB
ASSEMBLY

NOTES: 1. THIS DRAWING NUMBER 443.
2. PWB 87.
3. REF. DES. PREFIX A2.

ITEM	REF DES.	QNTY.	PART NO.	DESCRIPTION
42	XQ7,9	2	7717-5N	TRANSISTOR PADS, THERMALLOY
41	XQ6, 8,10	3	6073B	HEATSINK, THERMALLOY
40	U7	1	CD4000BE	INT. CKT., RCA
39	U6	1	CD4001BE	INT. CKT., RCA
38	U5	1	LM311N	INT. CKT., NATIONAL
37	U4	1	MM74C74N	INT. CKT., NATIONAL
36	U3	1	CD4070BE	INT. CKT., RCA
35	U1,2	2	CA3076	INT. CKT., RCA
34	TP2	1	325-102	TESTPOINT, RED, H.H. SMITH
33	TP1	1	325-108	TESTPOINT, BROWN, H.H. SMITH
32	T1	1	C-95	TRANSFORMER, SAC
31	S1	1	SF6TCX392	SWITCH, 2 POS. MIN., CUTLER HAMMER
30	R24	1	OC3321	RES., 3.3 K, ¼W, 10%, OHMITE
29	R20,21	2	OC2711	RES., 270 OHM, ¼W, 10%, OHMITE
28	R17	1	OC2741	RES., 270 K, ¼W, 10%, OHMITE
27	R16	1	3006P-1-103	RES., VARIABLE, BOURNS
26	R15	1	OC1051	RES., 1 MEG, ¼W, 10%, OHMITE
25	R14,19	2	OC2231	RES., 22 K, ¼W, 10%, OHMITE
24	R12	1	OC3921	RES., 3.9 K, ¼W, 10%, OHMITE
23	R11, 13,18	3	OC1031	RES., 10 K, ¼W, 10%, OHMITE
22	R10, 22,23	3	OC5611	RES., 560 OHM, ¼W, 10%, OHMITE
21	R8	1	OC1521	RES., 1.5 K, ¼W, 10%, OHMITE
20	R6	1	OC2201	RES., 22 OHM, ¼W, 10%, OHMITE
19	R5	1	OH3901	RES., 39 OHM, 2 W, 10%, OHMITE
18	R4	1	OC2221	RES., 2.2 K, ¼W, 10%, OHMITE
17	R3,7	2	OC8221	RES., 8.2 K, ¼W, 10%, OHMITE
16	R2	1	OC1011	RES., 100 OHM, ¼W, 10%, OHMITE
15	R1,9	2	OC1041	RES., 100 K, ¼W, 10%, OHMITE
14	Q7,9	2	2N2905A	TRANSISTOR, MOTOROLA
13	Q6, 8,10	3	2N6388	TRANSISTOR, RCA
12	Q1-5	5	2N3711	TRANSISTOR, NPC
11	DS1-3	3	FLV-117	LED INDICATOR, FAIRCHILD
10	CR7	1	1N4744A	DIODE, ZENER, MOTOROLA
9	CR3-6	4	1N4004	DIODE, SILICON, GI
8	CR1,2	2	1N52A	DIODE, GERMANIUM, MOTOROLA
7	C13	1	196D105X 9035HA1	CAP., 1 MFD, 35 V, TANTALUM, SPRAGUE
6	C10	1	5GA-D20	CAP., .002 MFD, 1000 V, DISC CER., SPRAGUE
5	C8,9, 11,12	4	TGS50	CAP., .05 MFD, 100 V, DISC CER., SPRAGUE
4	C7	1	TGS10	CAP., .01 MFD, 100 V, DISC CER., SPRAGUE
3	C3,4, 5,6,14	5	196D685X9 025JA1	CAP., 6.8 MFD, 25 V, TANTALUM, SPRAGUE
2	C2	1	DM15-561J	CAP., 560 PF, 500 V, DSM, ARCO
1	C1	1	5HK-S10	CAP., .01 MFD, 1000 V DISC CER., SPRAGUE

2.5 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.

Special Note Concerning Antenna Selection for AM and Voice Modulation Systems:

Bandwidth limitations of small low-frequency transmitting antennas may present severe limitations on the transmission of wide-band signals such as voice or AM double sideband signals. The effect of these limitations is a reduction in the transmitted sideband levels and thus a reduction in the reception range of the transmitted intelligence without an appreciable effect on carrier range. The extent of this effect is dependent upon antenna type, audio frequency, and transmitter frequency.

The Symmetrical "T" antenna can be recommended for any audio and transmitter frequency combination. The bandwidth is reasonably broad, with little sideband attenuation. The Mast Antenna, the "H" Antenna, and the 52-foot Guyed Mast Antenna must be considered as narrow-band antennas. If possible these antennas should not be used with voice bandwidth signals. The use of these antennas with AO/A2 tone code signals should be limited if possible to 400 Hz tone frequencies. Higher frequencies may exceed the bandwidth limits of the antenna.

2.5.1 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 on offshore structures. It is center-loaded 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 35-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 six-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 with the Mast Antenna and the SS-800AV depends on ground condition, frequency, the ADF, and atmospheric noise which in turn depends on location and time. Range for most locations in the United States 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 52-foot Guyed Mast is recommended for land installations where the "T" cannot be used. Calculated range over sea water with the Mast Antenna and the SS-800AV 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 2-36 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.

2.5.2 "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.

2.5.3 52-Foot Guyed Mast Antenna: This antenna is a guyed vertical monopole with capacitive top loading that was designed for land installations 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 2-36 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.

2.5.4 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 the SS-800AV 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. 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 2-36 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.

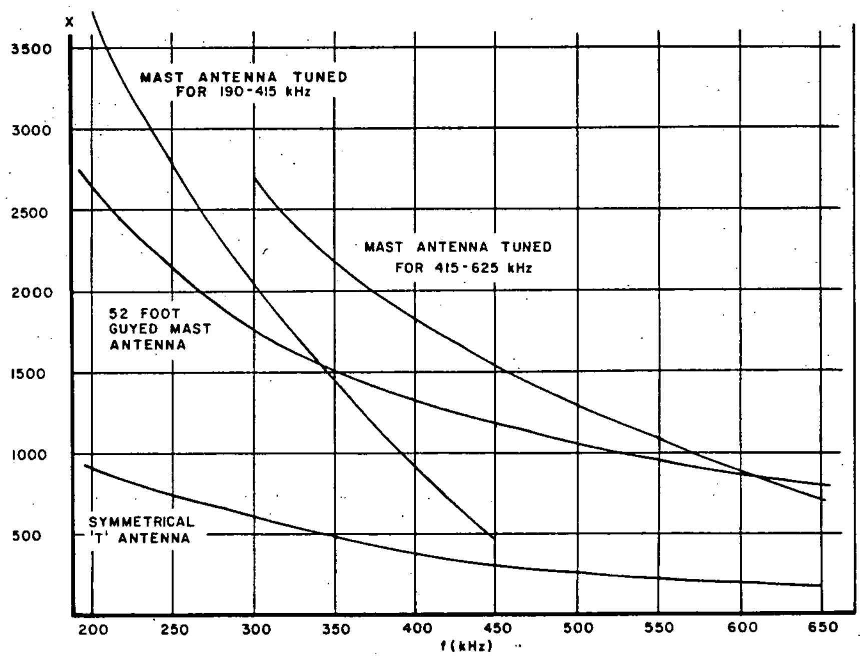


FIGURE 2-36
ANTENNA REACTANCE

NON-DIRECTIONAL RADIOBEACON (NDB)

SECTION 3

INITIAL TUNE-UP AND ANTENNAS

3.1 Transmitter Installation

3.2 Code Tone Modulation Alignment

3.3 Audio Board Operating Mode Selection

3.4 Voice Modulation Alignment (optional)

3.5 PC-1000 Installation

3.6 Antenna Tune-Up

3. INITIAL TUNE-UP AND ANTENNAS:

3.1 Transmitter Installation:

1. Mount the transmitter to the H-beam, wooden pole, tower legs, offshore platform, or building wall with the appropriate supplied hardware. Installation details are shown in the antenna installation manual.

2. Attach the groundwire from the counterpoise system or offshore platform to the copper ground lug on the transmitter.

3. Insert the coupler control cable through the stuffing tube on the transmitter door and connect to TB5. See Figure 2-29. Terminal 1 is +50V DC, terminal 2 is VSWR, and terminal 3 is ground.

4. Connect the RG-58 to the BNC RF output connector on the transmitter door. Connect the jumper on TB4 from Terminal 1 to Terminal 3.

5. Run the 115 VAC or 230 VAC through the supplied sheath and connect to terminals 1, 2, and 3 on TB1 in the transmitter cabinet. Terminal 3 is ground and terminals 1 and 2 are the AC input. See Figures 2-16 and 2-28. Do NOT apply power at this time.

6. If the optional Audio Board is installed, connect the balanced audio line input to the two outer screws of the audio line input protector E2. Note the precautions and specifications listed in 1.1, Specifications For Electrical Connection Between Audio Source and Transmitter Site.

* 3.2 Code Tone Modulation Alignment.

See Figures 2-29 and 3-1 for the location of all transmitter controls.

1. Connect the transmitter RF output to the Dummy Load by placing the jumper on Terminal Block TB4 between screw terminals 1 and 2.

2. Set the Automatic Shutdown Board switch to "OFF".

3. Remove the RF shield from the transmitter chassis to allow access to the AM and voice modulation circuit boards.

* Procedures of Section 3.2 are performed at the factory before shipment. These steps may be omitted during initial equipment installation if desired.

4. Adjust the following controls on the AM Oscillator Board fully counterclockwise:

   a. Modulation Adjust. (R3)
   b. Modulation Limit Control. (R12)
   c. RF Drive Control. (R39)

   NOTE: These controls are 15 turn pots and possess a slight detent action at the limits of rotation.

5. Adjust the following controls on the Audio Board (optional) fully clockwise:

   a. Audio Input Level.
   b. Voice Level Control.

6. Remove the AM Oscillator Board from its connector. Install an Extender Board in the AM Oscillator Board connector and install the AM Oscillator Board in the Extender Board.

7. Place the Recycle Board ident mode switch (S1) in the CARR (carrier only) position.

8. Connect an oscilloscope to the dummy load terminal, TB4 Terminal 2. Apply AC power to the transmitter. Adjust the RF Drive Control (R39) clockwise until the oscilloscope indicates approximately 50 volts p-p across the dummy load.

9. Place the Recycle Board ident mode switch (S1) in the CONT (continuous tone) position.

10. Adjust the pi-filter inductor (L1) on the AM Oscillator board for a maximum RF voltage on the oscilloscope. Caution: Use only a non-ferrous adjustment tool with L1.

11. Rotate the Modulation Adjust Control (R3) clockwise to obtain 95% modulation on the oscilloscope.

12. Rotate the Modulation Limit control (R12) clockwise until the modulation percentage just starts to decrease. Rotate R12 counterclockwise until the effect of R12 on the waveform just disappears.

3.3 Audio Board Operating Mode Selection:

Selection of the various mode options is accomplished by the placement of jumpers on the AM Recycle Board and by placement of switch S1. Circuit operation is controlled by the voice line input signal through the action of the Squelch/AGC circuit on the Audio Board. This circuit acts with a fast attack, slow decay characteristic in the presence of a voice line signal.

Select the desired optional mode as follows:

MODE	DESCRIPTION	TO SELECT
1	Continuous high level voice,no code.	Install Audio Board-AM RECYCLE BOARD switch S1 on CARR (carrier only).
2	Continuous high level code,no voice.	AM RECYCLE BOARD installed. Switch S1 on IDENT. AUDIO BOARD not installed or no line signal applied. Jumpers Ja and Jc installed on AM RECYCLE BOARD. No Jumper Jb installed.
3	Continuous high level voice with continuous low level code in back ground.	AM RECYCLE BOARD installed. Switch S1 on IDENT. AUDIO BOARD installed. Jumpers Jb and Jc installed on AM RECYCLE BOARD. No Jumper Ja installed.
4	High level voice with low level code in background while voice signal present on audio line. High level code only when voice signal absent.	AM RECYCLE BOARD installed. Switch S1 on IDENT. AUDIO BOARD installed. Jumpers Ja and Jc installed on AM Recycle Board. No Jumper Jb installed. Resistor R19 on the AM Recycle Board adjusts the low level code modulation percentage.

MODE	DESCRIPTION	TO SELECT
5	High level voice without code signal while voice signal present. High level code only while voice signal absent.	AM RECYCLE BOARD installed. Switch S1 on IDENT. Audio Board installed. Jumpers Ja and Jc installed on AM Recycle Board. No Jumper Jb installed Resistor R19 removed from the AM Recycle Board.

TABLE 3-1

Unless otherwise requested, the modulation system will be programmed at the factory for Operating Mode 4.

3.4 Voice Modulation Alignment (optional):

1. Apply a continuous tone of 1000 Hz through the audio source to the transmitter site. The nominal signal level at the transmitter site should be approximately -8dBm. (OdBm=1mW into 600 ohms). Audio line inputs of -28dBm to +5 dBm can be utilized.

2. Connect the Audio input connectors P4-J4 together to apply the audio signal to the Audio Board.

3. Attach an AC Voltmeter between TP1 on the Audio Board and ground. Adjust the Audio Input control (R27) for a voltage level at the test point of 1 Volt RMS.

4. Place the Recycle Board ident mode switch (S1) in the CARR position.

5. Adjust the VOICE LEVEL control (R26) for 50% Modulation as indicated on an oscilloscope monitoring the dummy load voltage.

6. Remove AC power. Remove the AM Oscillator Board and Extender Board and replace the AM Oscillator Board in its socket.

7. Place the AM Recycle Board switch S1 in the IDENT position and replace the shield around the Keyer and Oscillator boards.

3.5 PC-1000 Installation:

1. Locate the two horizontal coupler mounting brackets and attach to the rear of the coupler enclosure with the ¼" x 1¼" bolts in each corner of the rear cover.

2. Mount the PC-1000 to the H-beam, wooden pole, tower legs, or offshore platform with the appropriate supplied hardware. Installation details are shown in the antenna installation manual.

3. Release the front access door by rotating the four captive ¼" bolts counterclockwise until the threads disengage and the door can be swung open. Remove the access panel located above the tuning controls panel.

4. Locate the antenna feed-through 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 antenna wire 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-58 cable from the RF output of the transmitter to the type N connector on the coupler wall.

8. Attach the ground wire 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, VSWR to terminal 2, and ground to terminal 3. Dress the control wires away from the coupler tuning coil to prevent high voltage arcing.

10. Set all taps according to Figures 3-2 through 3-6. 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. Set the Impedance Transformer Switch to Pos. 11. Set the Setup/Run switch on the Autotune PWB to Run.

3.6 Antenna Tune-Up:

See Figures 2-29 and 3-1 for the location of all transmitter controls.

1. Check all connections between the transmitter and coupler. Check that the RF DRIVE control on the AM Oscillator Board is fully CCW. Set the switch on the Recycle Board to CARR. Set the switch on the Autoshutdown Board to OFF. Connect the Jumper on TB4 from Terminal 1 to Terminal 3.

2. If Audio Board (optional) is installed, disconnect P4 from J4 on the audio cable attaching the input audio line protector E2 to the rail assembly.

3. Apply AC power. The EMITTER VOLTS scale should read 0.1 to 0.2 volts.

4. Set the meter switch on the transmitter to EMITTER VOLTS and adjust the RF DRIVE for a reading of approximately 0.5 volts. Only a small drive level should be required to cause the Autotune system to begin to tune the coupler.

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

5. If the autotune motor turned and the Vernier Tuning knob stopped between its MAX and MIN limits, the system is tuned. Check this by rotating the Vernier Tuning knob slightly to see if the autotune motor retunes the system. If the system is tuned, go to Step 7.

CAUTION: ALWAYS TURN THE RF DRIVE FULLY CCW BEFORE CHANGING THE COARSE OR FINE TAPS, OR THE IMPEDANCE TRANSFORMER TAP IN THE COUPLER.

6. If the autotune motor did not tune the system, the initial tuning point may be too remote from the resonance point to allow sufficient current in the autotune sensing circuit. It will be necessary to change the tuning taps. Turn the

RF DRIVE down and change a fine tuning tap. Set the meter switch on the transmitter to EMITTER VOLTS and adjust the RF DRIVE for a reading of approximately 0.5 volts. If the system does not tune repeat this procedure with all of the fine tuning taps. If the system will not tune after all of the fine tuning taps have been tried, it will be necessary to change a coarse tap. Be sure that the RF DRIVE is down and change a coarse tap by moving the temporary clip lead.

7. Repeat Step 5 until the system is tuned.

8. The best position for the Vernier Tuning knob, is halfway between the MAX and MIN limits or slightly toward MAX. Decreasing a fine tuning tap will cause the vernier tuning to move toward MAX and increasing a fine tuning tap will cause the vernier tuning to move toward MIN.

9. Figure 3-2 shows the proper impedance transformer tap under "average" conditions. Check that the RF DRIVE is CCW and set the Impedance Transformer Switch to the position shown in Figure 3-2. Set the meter switch on the transmitter to the 200W scale and adjust RF DRIVE for a reading of 100W. Set the meter switch on the transmitter or the coupler to TUNE and note the indication. Turn the RF DRIVE down and change the Impedance Transformer Switch one position. Increase RF DRIVE to 100W and note the TUNE indication again. Repeat this procedure until the Impedance Transformer tap is found that gives the lowest indication with the meter in the TUNE position.

10. Place the Recycle PWB switch in the IDENT position and adjust R16 (Tol. Adj.) on the coupler Autotune PWB counterclockwise until the Autotune motor begins to chatter. Turn the Tol. Adj. pot clockwise until all chattering just stops. Remove transmitter power. Remove the clip on the RF output lead. 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. Install the coil enclosure cover above the coupler control panel.

11. Automatic Shutdown Adjustment: The automatic shutdown system automatically shuts down the transmitter if the power drops to a predetermined level or if the identifying code fails.

(a) Set the RF output to the desired automatic shutdown level, usually half-power.

(b) Set the Meter Switch to the 2.5 VDC scale and connect the test probe from the PROBE JACK to the yellow (TP2) test point on the Automatic Shutdown Board.

(c) Place Switch S1 on the Recycle Board to CONT and adjust the Auto Shutdown Level Control on the Auto Shutdown Board until the test point voltage reads 0.75 VDC. Remove test probe from the yellow test point.

(d) Readjust the RF DRIVE control for full power. This completes the adjustment for automatic shutdown. Engage the automatic shutdown by setting the ON/OFF Switch to the ON position. If the switch is left in the OFF position, the shutdown feature is bypassed.

12. Automatic Shutdown Test: To check the automatic shutdown feature for "IDENT" failure, place S1 on the Recycle Board in CONT. After a delay of 15 to 60 seconds, the transmitter will shut down. Reset the system by switching the ON/OFF switch to OFF and then back to ON. To check for the decrease of power shutdown feature, decrease the power to a level below the desired automatic shutdown level. After a delay of 15 to 60 seconds, the transmitter will shut down. Reset the system, and readjust the RF DRIVE for full power. The Automatic Shutdown System will also shut down the transmitter if extreme distortion is present.

13. Reconnect the audio input connectors J4 to P4 and apply the proper audio signal to the audio line input.

14. Check that S1 on the Recycle Board is in IDENT and that the ON/OFF Switch on the Automatic Shutdown Board is ON. This completes the tune-up procedure.

Southern Avionics Company has attempted to make this tune-up procedure as complete as possible and to anticipate any problems that may be encountered. If there are any questions, or if you have any suggestions, please contact us.

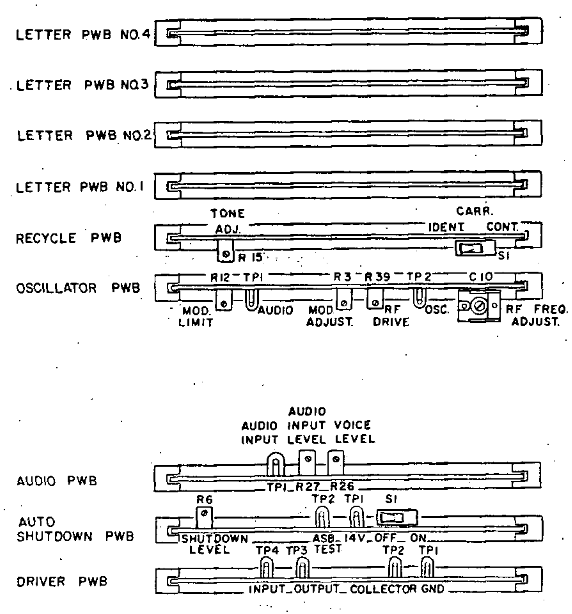


FIGURE 3-1
CONTROL AND TESTPOINT POSITIONS

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 3-2
IMPEDANCE TRANSFORMER TAPS

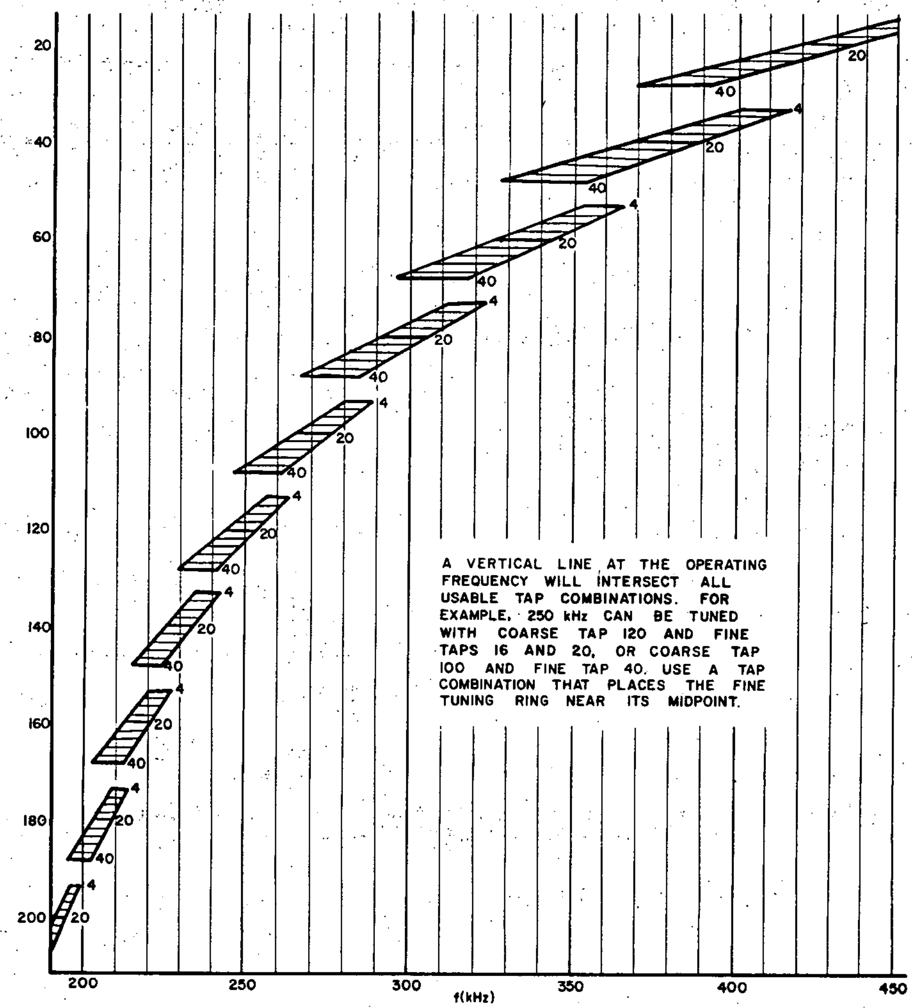
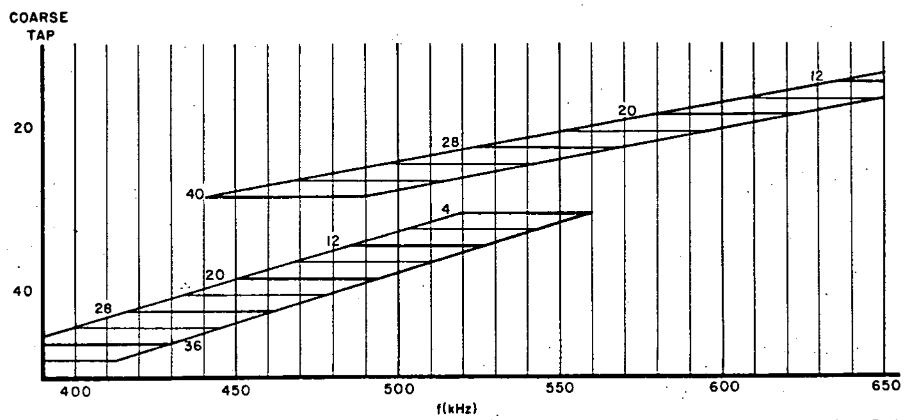


FIGURE 3-3
MAST ANTENNA AND PC-1000
MAST TUNED FOR 190-415 kHz



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 3-4

MAST ANTENNA AND PC-1000

MAST TUNED FOR 415-625 kHz

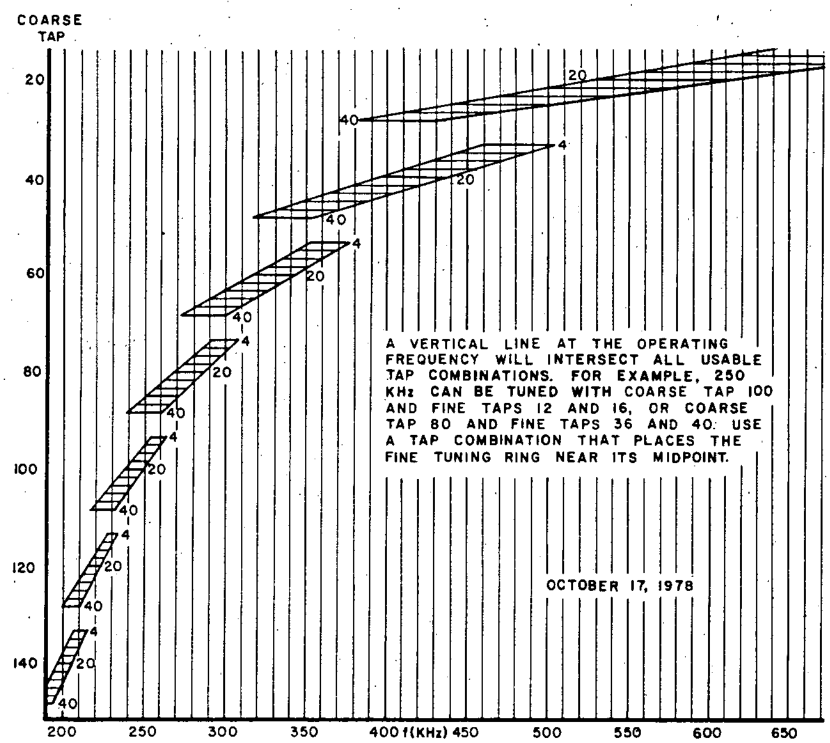


FIGURE 3-5
52 FOOT GUYED MAST AND PC-1000

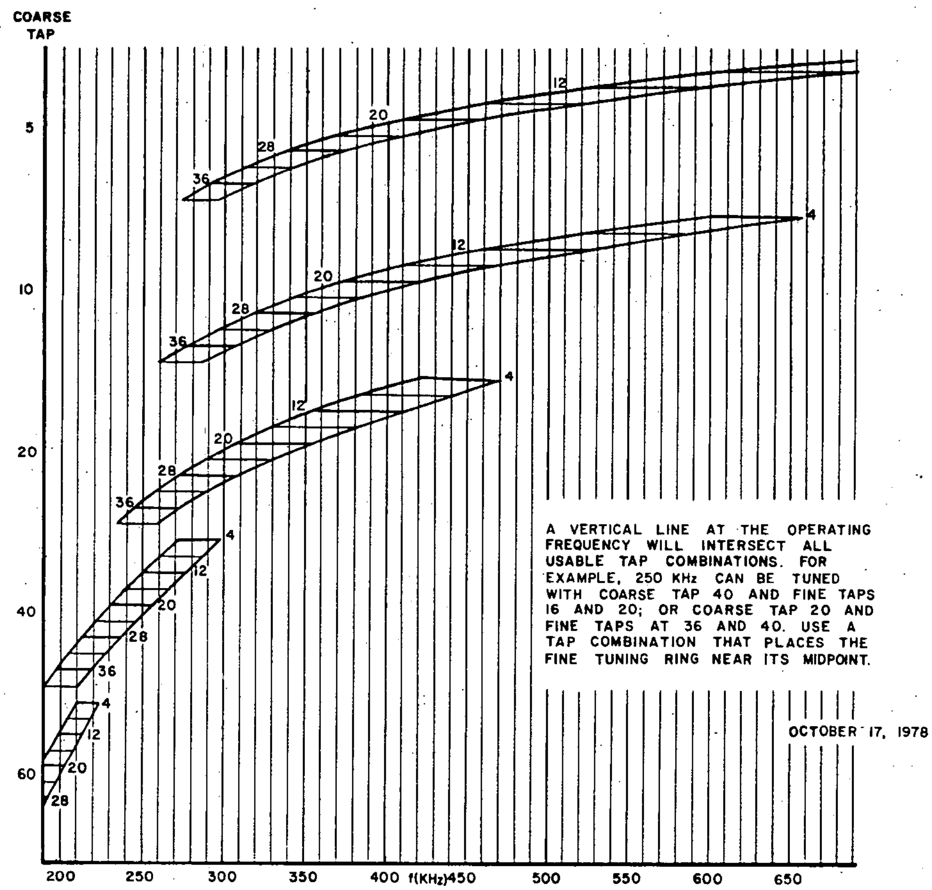


FIGURE 3-6
SYMMETRICAL "T" ANTENNA
AND PC-1000

NON-DIRECTIONAL RADIOBEACON (NDB)

SECTION 4

MAINTENANCE

4.1 Cautions and Test Equipment List

4.2 System Alignment and Calibration

4.3 Preventive Maintenance

4.4 Corrective Maintenance

4. MAINTENANCE.

4.1 Cautions and Test Equipment List.

4.1.1 General Precautions. During operation, extremely high voltages are present at the output of the transmitter, anywhere in the vicinity of the antenna coupler, and on the antenna itself. Carelessness in working around the equipment can result in severe electrical shock.

When working with the equipment, follow standard correct service procedure. Avoid working with the equipment while standing in a wet area forming a good ground. All other applicable safety procedures should be utilized as much as possible.

Transistors may be damaged by careless or improper measuring techniques, particularly when checking resistance. When measuring voltages, insulate all the probe except the tip as a momentary short circuit can destroy a transistor. Use a low wattage soldering iron, as excessive heat can damage semiconductor components.

Use only low wattage irons when working with components mounted on a P.C. board. Insufficient care or excessive heat in soldering and desoldering can lift component pads, thus destroying a circuit board. Use a Solder-Wick or equivalent when desoldering components.

4.1.2 Specific Precautions. When making low-level measurements in the transmitter, if possible, operate the transmitter into the Dummy Load. High level fields associated with the antenna coupler and antenna system may induce substantial signals into the test equipment, seriously compromising the measurements being made.

Many of the transistors and diodes used in an SS-Series radiobeacon are especially chosen for their particular circuit. Even if one of these transistors does cross match to a general replacement type (ECG, HEP, SK, etc.) these replacements MAY NOT substitute and should not be used. Replacement power transistors should be ordered from the factory in order to avoid the possibility of substantial damage to the transmitter.

4.1.3 Test Equipment List. The following equipment is recommended for testing an SS-Series transmitter:

4.1.3.1 Field Service or Checkout.

(1) VOM, Simpson 260 or equivalent
(2) Oscilloscope, Tektronix 211 or equivalent
(3) Standard electronics-type hand tools

(4) Low wattage soldering iron (25W) with chisel tip
(5) Plastic alignment tools, GC8606 and GC8275

4.1.3.2 System Alignment and Calibration.

(1) All of the above equipment
(2) Frequency counter usable in the range of 200 Hz to 680 KHz

4.2 System Alignment and Calibration. SS-Series radiobeacons do not normally need any adjustment in the way of alignment or calibration. However, if such procedures become necessary, the following alignment procedures must be observed:

4.2.1 AM Oscillator Board.

4.2.1.1 Preliminary. Before making any adjustment to the AM Oscillator Board, the following preliminary set up should be performed:

(1) With AC power removed, disconnect the antenna system and connect the dummy load by transferring the jumper on TB4 from the BNC terminal to the dummy load terminal. (See Figure 2-29.)

(2) Turn the RF DRIVE Control on the AM Oscillator Board to its full low level (counterclockwise) position.

(3) Put Switch S1 on the Recycle Board in the continuous carrier position (CARR.).

4.2.1.2 RF Frequency Adjustment.

(1) Connect a frequency counter to the dummy load.

(2) Apply AC power.

(3) Slowly turn the RF DRIVE control up until a reading is obtained on the frequency counter. NOTE THAT VOLTAGE ON THE DUMMY LOAD CAN EXCEED INPUT LIMITATIONS OF SOME FREQUENCY COUNTERS.

(4) Adjust trimming capacitor C13 (on the AM Oscillator Board) for the correct reading on the frequency counter.

4.2.1.3 AM Oscillator Board Filter Adjustment.

(1) Connect an oscilloscope to the dummy load.

(2) Apply AC power.

(3) Adjust the RF DRIVE control on the AM Oscillator Board for a reading of approximately 10 watts.

NOTE: IF THE FILTER IS BADLY OUT OF ADJUSTMENT, IT MAY BE IMPOSSIBLE TO GET AN RF OUTPUT READING UNTIL STEP 4 IS PERFORMED.

(4) Adjust the inductor L1 on the AM Oscillator Board for maximum undistorted output. If there is a large increase in RF power, decrease RF level with the RF DRIVE control in order to keep the power level at approximately 10 watts. The maximum signal on the scope should correspond to a maximum reading on the power meter.

4.2.1.4 Percent Modulation Adjustment.

See Sections 3.2 and 3.4.

4.2.2 Frequency Changes. The only tuned circuits in the transmitter are the output filter components, and the oscillator feedback capacitors and pi network on the AM Oscillator Board. In order to change frequencies:

(1) Change the crystal on the AM Oscillator Board.

(2) If necessary, change C11, C12, C18, C19, and L1 on the AM Oscillator Board according the the following table:

FREQUENCY	C11, C12	C18	C19	L1
200-250 KHz	2000 pf	0.0033	0.0056	120-280 uh
250-340 KHz	1000 pf	0.0022	0.0033	120-280 uh
340-500 KHz	750 pf	1000 pf	2000 pf	120-280 uh
500-680 KHz	500 pf	1000 pf	2000 pf	60-120 uh

(3) If necessary, change the output filter components. (See Figure 2-28 and Parts List in back of manual.)

(4) Perform the alignment procedures given in Paragraphs 4.2.1 and 4.2.3.

4.2.3 Antenna System Changes. After changing the transmitter frequency, the procedure to follow generally is to repeat the tune-up procedure given in Section 3.1 of the manual. However, if the change involves changing the transmitted frequency from below 415 KHz to above 415 KHz or vice-versa, simply following the tune-up procedure will not work if the mast antenna is being used. The SAC mast antenna is centerloaded to be resonant at approximately 500 KHz for operation between 200 and 415 KHz and at approximately 900 KHz for operation between 400 and 625 KHz. The resonant frequency of the antenna is chosen by selecting one of the two lower taps on the center coil. This is accomplished by lowering the antenna and then removing the protective cover from the center section of the antenna. The tap, which allows use of the full coil, sets the resonant frequency at approximately 500 KHz while the tap, allowing use of about one-half of the coil, sets the resonant frequency at approximately 900 KHz.

If the symmetrical "T" antenna is used, following the tune-up procedure will suffice.

Tune-up may now be accomplished by following the procedure given in Section 3-1 of the manual.

4.3 Preventive Maintenance. SAC radiobeacons are designed to be electrically maintenance free. Since the equipment is mounted out-of doors, it is suggested that periodic maintenance be performed to protect the equipment from the environment.

(1) Periodically, lubricate the door hinges and hasp screws.

(2) Tighten any loose nuts and bolts.

(3) With continued exposure to an extreme environment, the fiberglass parts of the antenna system may need to be cleaned and sealed. This is especially true in a salt water or high soot environment which is often encountered on offshore platforms and drilling ships.

4.3.1 Maintenance Log.

The following log is offered for ease and completeness of electrical checks. A complete record such as this will be of considerable help in diagnosing trouble in case of equipment failure.

ANTENNA RESISTANCE ____________

Date	RF Current	Emitter DC Voltage on Finals				Power	Loading Switch Position	Person Making Checks		Remarks
		Top Left	Top Right	Bottom Left	Bottom Right			Signature	FCC Lic#	

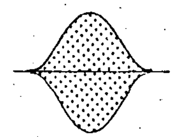
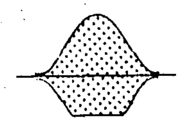
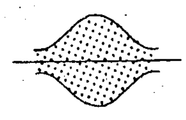
4.4 Corrective Maintenance.

4.4.1 Index to Testpoints. This index to testpoints is intended to allow the technician working with the SAC radiobeacon to quickly gain familiarity with the normal voltages and waveforms associated with an SS-Series transmitter.

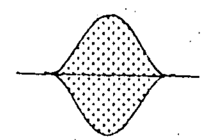
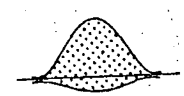
In addition, whenever possible, an attempt has been made to list some of the abnormal waveforms encountered when troubleshooting an SS-Series NDB and to indicate their probable cause.

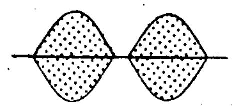
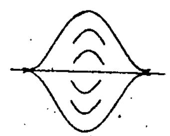
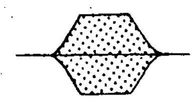
INDEX TO TESTPOINTS

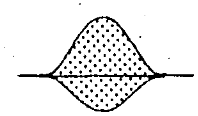
NOTE: Waveforms are measured with a Tektronix 211 or equivalent; voltages are measured with a Simpson 260 or equivalent. All measurements are made with respect to ground.

Circuit	Test Point	Mode	Indication	Remarks	Action
AM Oscillator Board Output and Driver Board Input.	TP4 (blue) on Driver Board.	S1 on Recycle Board in CONT. Shutdown Switch OFF. Full rated power into dummy load or antenna.	Waveforms 	Normal. 100% modulation. Peak-to-peak voltage will vary depending on drive requirements. Vp-p up to 25 volts is normal.	
				Drive level too high.	Reduce power by turning RF DRIVE control on AM Oscillator Board counterclockwise.
				Less than 100% modulation.	Adjust R3 on the AM Oscillator Board for 100% modulation.

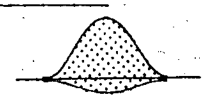
Circuit	Test Point	Mode	Indication	Remarks	Action
AM Oscillator Board Output and Driver Board Input.	TP4 (blue) on Driver Board.	S1 on Recycle Board in CONT. Shutdown switch OFF. Full rated power into dummy load or antenna.	DC Voltages +12 to +14.5 V	Normal.	
		S1 on Recycle Board in CONT. Shutdown switch ON. Full rated power into dummy load or antenna.	0 to 0.5 V	Shutdown circuit operating.	Reset shutdown switch. Check shutdown level. Check modulation.
Driver Output	TP2 (Red) on Driver Board.	S1 on Recycle Board in CONT. Shutdown switch OFF. Full rated power into dummy load or antenna.	DC Voltages +48 to +55 V	Normal.	

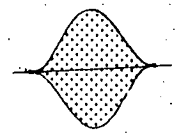
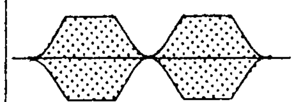
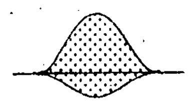
Circuit	Test Point	Mode	Indication	Remarks	Action
Driver Output.	TP2 (Red) on Driver Board.	S1 on Recycle Board in CONT. Shutdown switch OFF. Full rated power into dummy load or antenna.	DC Voltages 0 V	No output from +50 V power supply.	Check AC input voltage. Check circuit breaker in transmitter. If operating from batteries, determine that they are charged and battery standby switch is ON.
			Waveforms 	Normal. Peak-to-peak voltages will vary according to drive requirements of individual transmitters. Vp-p up to 100 volts is normal.	
				Asymmetrical waveform indicates one-half of driver stage not operating or large difference in gain between driver transistors.	Measure voltage across emitter resistor of each transistor; compare. Check AC waveform across emitter resistor.

Circuit	Test Point	Mode	Indication	Remarks	Action
Driver Output..	TP2 (red) on Driver Board.	S1 on Recycle Board in CONT. Shutdown switch OFF. Full rated power into dummy load or antenna.	Waveforms 	Distorted waveform indicating cutoff during part of operation.	Check TP4 waveform. Check biasing diode voltage in driver stage.
				Distortion in envelope indicated by white streaks in envelope.	Check for overdriving (waveform becomes clean when drive is reduced).
				Envelope squared indicates saturation of driver transistors due to excessive drive level, detuned antenna system, open in driver output transformer, etc.	Check final stage and antenna system for improper tuning or improper impedance matching. Reduce drive from DCO Board until waveform is not distorted, then test final stage.

Circuit	Test Point	Mode	Indication	Remarks	Action
Input to final.	TP3 (yellow) on Driver Board.	S1 on Recycle Board in CONT. Shutdown switch OFF. Full rated power into dummy load or antenna.	DC Voltages +0.6 V ±0.2 V	Normal. Bias voltage to final.	
			0 V	Bias diodes to final shorted. Fuse to final blown.	Remove AC power. Check forward and reverse resistance between TP3 and TP1 to check bias diodes to final.
			+50 V	Final bias diodes open. Final emitter resistors open. Final transistors shorted or open.	Remove AC power. Check final components.
			Waveform 	Normal. Peak-to-peak voltage may vary with individual transmitters.	

Circuit	Test Point	Mode	Indication	Remarks	Action
Driver Current.	Driver Board Emitter Resistor.	S1 on Recycle Board in CONT. Shutdown switch OFF. Full rated power into dummy load or antenna.	<u>DC Voltages</u> 0.2 V	Normal.	
			+50 V	Emitter resistor open. Driver transistors open or shorted.	Check driver stage.
			<u>Waveform</u> 	Normal. Peak-to-peak voltages may vary according to individual transmitters.	
Final Amplifier Emitter Current	Each final emitter resistor test point.	S1 on Recycle Board in CONT. Shutdown switch OFF. RF DRIVE control on DCO Board counter-clockwise (no power).	<u>DC Voltages</u> 0.2 V	Normal.	

Circuit	Test Point	Mode	Indication	Remarks	Action
Final Amplifier Emitter Current.	Each final emitter resistor test point.	S1 on Recycle Board in CONT. Shutdown switch OFF. RF DRIVE control on DCO Board counter-clockwise (no power).	<u>DC Voltages</u> 0 V	Bias diodes shorted. Final transistors shorted or open. Fuse in final blown.	Check final components.
		S1 on Recycle Board in CONT. Shutdown switch OFF. Full rated power into dummy load or antenna.	0.5 to 0.75 V 0.9 to 1.1 V 1.4 to 1.60 V	Normal. SS-250BV SS-500V SS-800AV	
			<u>Waveform</u> 	Normal. Voltage peak is approximately three times VDC.	
Final Amplifier Collector Voltage.	Each final collector (case).	S1 on Recycle Board in CONT. Shutdown switch OFF. Full rated power into dummy load or antenna.	<u>DC Voltages</u> +50 V	Normal.	

Circuit	Test Point	Mode	Indication	Remarks	Action
Final Amplifier Collector Voltage.	Each final collector (case).	S1 on Recycle Board in CONT. Shutdown switch OFF. Full rated power into dummy load or antenna.	Waveforms 	Normal. Peak-to-peak voltage as much as 100 volts.	
				Saturation. Too much drive, untuned antenna system.	Reduce drive, perform tune-up procedure.
				One side of push-pull amplifier circuit out. Final transistors not properly matched.	Check final amplifier circuitry.
Auto Shutdown Board.	TP2 (yellow) on Auto Shutdown Board.	Keyed modulation S1 on Recycle Board in IDENT. Shutdown switch ON. Full rated power into dummy load or antenna. 100% modulation.	Voltage at TP2 pulsates during ident from 0 to 1 - 2.5 V during keying. Transmitter output remains normal.	Normal.	

Circuit	Test Point	Mode	Indication	Remarks	Action
Auto Shutdown Board.	TP2 (yellow) on Auto Shutdown Board.	Keyed modulation S1 on Recycle Board in IDENT. Shutdown switch ON. Full rated power into dummy load or antenna. 100% modulation.	0 V	No keying in output circuit, malfunction Q2 through Q5, etc. R6 Auto Shutdown Board level adjust alignment improper.	Check transmitter output for keying. Perform resistance voltage measurements on circuit concerned. Repeat according to manual.
		Shutdown switch OFF.	Transmitter returns to normal output (without keying) from previous test.	Normal.	
			TP voltage drops to 0 but transmitter does not shut down after 15 to 60 second delay.	Circuit malfunction Q6, Q7, Q8. Switch S1 defective.	Check auto shutdown circuit.
		S1 on Recycle Board in CARR. Shutdown switch ON. Full rated power into dummy load or antenna.	0 V. Transmitter output current drops from normal current to 0 current suddenly after 15-60 second delay.	Normal.	

Circuit	Test Point	Mode	Indication	Remarks	Action
Auto Shutdown Board (+14 V regulated supply.	TP1 (blue) on Auto Shutdown Board.	AC power applied (or 48 VDC applied if operating from batteries).	+12.0 to +14.5 V	Normal.	

NON-DIRECTIONAL RADIOBEACON (NDB)

SECTION 5

PARTS LIST

5. PARTS LIST.-

5.1 Parts are listed by assembly. It is important that the entire reference designator and the part description be used when ordering parts. The serial number of the unit should also be included in any parts order.

REFERENCE DESIGNATOR	NAME OF PART AND DESCRIPTION	MANUFACTURER	PART NO.
L	TRANSMITTER ASSEMBLY SS-800AV	SAC	SS-800AV
C1	Capacitor, Electrolytic, 6500 mFd, 75 VDC	Mallory	FAH 6500-75-BE
C2	Same as 1C1		
C3	Capacitor, Mylar, 1 mFd, 200 VDC	CDE	MMW-2W1
C4	Same as 1C3		
C5	(190-340) Cap., 0.01 mFd, 1 KV	Sangamo	27110B103J00
	(340-500) Cap., 0.0082 mFd, 1 KV	Sangamo	27115B822J00
	(500-680) Cap., 2 ea. 2000 pFd, 1 KV	Arco	DM15-202J
C6	Same as 1C5		
CB1 *	Circuit Breaker, 5 amp *with Battery Standby Use 6 amp	E-T-A	44-100-P10 (Specify amps)
CR1	Diode, Silicon	NAE	1N1203R
CR2	Same as 1CR1		
CR3	Diode, Silicon	G.I.	1N4816
CR4	Diode, Silicon, Tranzsorb	GEN. SEMI.	1N5658A
CR5	Same as 1CR4		
CR6	Same as 1CR3		
CR7	Same as 1CR4		
CR8	Same as 1CR4		
E1	Line Surge Voltage Protector	G.E.	TLP175B
E2	Signal Circuit Protector	TII	300C
F1	Fuse, 5 amp	Littlefuse	312-005
F2	Fuse, 3 amp		
F3	Same as 1F2		
F4	Same as 1F2		
F5	Same as 1F2		
J1	Receptacle		
	120 VAC	Eagle	16301
	240 VAC	Slater	S-331-BR

REFERENCE DESIGNATOR	NAME OF PART AND DESCRIPTION	MANUFACTURER	PART NO.
J2	Probe Jack	H.H. Smith	1458-102
J3	BNC Connector	Amphenol	31-236
L1	Inductor, SAC Special		
	(190-340) 18T	SAC	C-442A
	(340-500) 15T	SAC	C-640
	(500-680) 11T	SAC	C-640A
M1	Meter, 0 - 1 mA	SAC	72 T SSCP
P1	Power Cord Plug		
	120 VAC	ITT	K-5146
	240 VAC	ITT	K-1443
P2	Socket, 3 Pin Housing	AMP	1-480303-0
P3	Socket, 6 Pin Housing	AMP	1-480270-0
Q1*	Transistor, Silicon, NPN	SAC	2N5672
Q2*	Same as 1Q1		
Q3*	Same as 1Q1		
Q4*	Same as 1Q1		
	*NOTE: 1Q1 through 1Q4 must be beta matched. Please specify beta desired when ordering.		
R1	Resistor, Wirewound, 300 ohm, 5W, 10%	Ohmite	4604
R2	Resistor, Composition, 27 ohm, 1/2W, 10%	Ohmite	OE2701
R3	Not Used		
R4	Resistor, Wirewound, 1 ohm, 5W, 5%, NI	Sprague	453E1R05
R5	Resistor, Composition, 39 ohm, 1W, 10%	Ohmite	OG3901
R6	Not Used		
R7	Same as 1R2		
R8	Same as 1R4		
R9	Same as 1R5		
R10	Resistor, Wirewound, 1K, 11W, 10%	Ohmite	4823
R11	Same as 1R10		
R12	Same as 1R2		

PARTS LIST

REFERENCE DESIGNATOR	NAME OF PART AND DESCRIPTION	MANUFACTURER	PART NO.
1			
R13	Not Used		
R14	Same as 1R4		
R15	Same as 1R5		
R16	Not Used		
R17	Same as 1R2		
R18	Same as 1R4		
R19	Same as 1R5		
R20	Resistor, 50 ohm, 50 Watt, N.I.	Tepro	TM50WC
R21	Resistor, Composition, 1500 ohm, 2W, 10%	Ohmite	OH1521
T1	Transformer, Power, 110/220V Primary, 80 V C.T. Secondary	Signal	7440
T2	Transformer, Final Stage Output	SAC	C-639
T3	Transformer, ASB Sensing	SAC	C-439
TB1	Terminal Block, 6 Terminals	Cinch Jones	6-542
TB2	Terminal Block, 8 Terminals	Cinch Jones	8-140
TB3	Terminal Block, 2 Terminals	Cinch Jones	2-140
TB4	Terminal Block, 3 Terminals	Cinch Jones	3-140
TB5	Same as 1TB4		

PARTS LIST

REFERENCE DESIGNATOR	NAME OF PART AND DESCRIPTION	MANUFACTURER	PART NO.
1A1	AM Oscillator Board Assembly See Figure 2-3	SAC	PWB-59 CMPLT
1A2	AM Recycle Board Assembly See Figure 2-11	SAC	PWB-60 CMPLT
1A3	Letter Board Assembly or Number Board Assembly, See Figure 2-7 or 2-9	SAC	PWB-28 CMPLT (Letter) PWB-40 CMPLT (Number)
1A4	Same as 1A3	SAC	
1A5	Same as 1A3	SAC	
1A6	If four letters and/or numerals or used 1A6 is the same as 1A3. If the optional Battery Standby is used, 1A6 is a Battery Alert Board Assembly. See Figure 2-20	SAC	PWB-40 CMPLT
1A7	Driver Board Assembly See Figure 2-13	SAC	PWB-51-50 CMPLT
1A8	Autoshutdown Board Assembly See Figure 2-22	SAC	PWB-50 CMPLT

PARTS LIST

REFERENCE DESIGNATOR	NAME OF PART AND DESCRIPTION	MANUFACTURER	PART NO.
1A9	Not Used		
1A10	Voltage Current Protector Assembly See Figure 2-24	SAC	VI-900 CMPLT
1A11	Meter PWB Assembly See Figure 2-26	SAC	PWB-123 CMPLT
1A12	Battery Standby Assembly See Figure 2-18	SAC	SSCBATSBCMPLT
1A13	Audio Board Assembly See Figure 2-5	SAC	PWB-109 CMPLT

PARTS LIST

REFERENCE DESIGNATOR	NAME OF PART AND DESCRIPTION	MANUFACTURER	PART NO.
2	Antenna Coupler	SAC	PC-1000
E1	Spark Gap	SAC	
F1	Fuse, 5 amp	Littlefuse	312-500
J1	R.F. Connector, Type 'N'	Amphenol	82-97
J2	Connector, 22 Pin	Elco	00-6022-022-940-002
J3	Socket, 3 Pin Housing	AMP	1-480-303-0
M01	Motor, Autotune	SAC	A-451
P3	Socket, 3 Pin Housing	AMP	1-480-305-0
R1	Resistor, Wirewound, 220 ohm, 5W, 10%	Ohmite	4600
R2	Resistor, Wirewound, 100 ohm, 8W, 10%	Ohmite	1516
S1	Switch, Power Tap, 11 Position	Ohmite	111-11
S2	Same as 2S1		
T1	Transformer, Impedance	SAC	C-455
T2	Transformer, Current Sense	SAC	C-440
T3	Tuning Coil	SAC	C-454
TB1	Terminal Block, 3 Terminals	Cinch Jones	3-140
INS1	Insulator, Feed through	H.H. Smith	9546

PARTS LIST

REFERENCE DESIGNATOR	NAME OF PART AND DESCRIPTION	MANUFACTURER	PART. NO.
2A1	Antenna Current/Tuning Meter PWB Assembly See Figure 2-32 and 2-33	SAC	PWB-118 CMPLT
2A2	Autotune Motor Drive PWB Assembly See Figure 2-35	SAC	PWB-87 CMPLT
2A3	Limit Switch PWB Assembly See Figure 2-31 (PC-1000 Antenna Coupler Schematic	SAC	PWB-104 CMPLT

SECTION 6

MODIFICATIONS TO EQUIPMENT

MODIFICATION 80-10

Modification:	Installation of Synthesizer PWB; PWB 128.
Purpose:	Synthesize RF carrier frequencies by a Phase-locked loop referenced to a crystal oscillator.
Date:	May 12, 1980
Components Furnished:	1. Synthesizer PWB; PWB 128. 2. Synthesizer Programming Board (s); PWB 129. 3. Manual change insert. 4. Alignment Tool GC No. 9440.
Equipment To Be Modified:	SSC and SSK series transmitters as required for programmable operating frequency.

1. Specifications:

1. Frequency Range: 190 KHz to 1999.5 KHz in 7 bands.

2. Band Selection: By insertion of an appropriate Synthesizer Programming PWB; PWB 129.

3. Operating Frequency Bands: (Any single band may be furnished with the Synthesizer PWB. Additional band programming boards are optional.)

   190 - 240 KHz
   240 - 320 KHz
   320 - 415 KHz
   415 - 650 KHz
   650 - 1000 KHz
   1000 - 1500 KHz
   1500 - 1999.5 KHz

   NOTE: Consult the transmitter manual to determine frequency limits of transmitter operation.

4. Frequency Incremental Spacing: 0.5 KHz.

5. Frequency Selection: Switch selection of operating frequency followed by oscillator adjustment to phase-lock indication.

6. Frequency Tolerance: .005% (-45°C to +70°C).

7. RF Output: Approximately 0.3Vp-p, open circuit.

8. Output Impedance: Approximately 50 ohms.

9. Power Input: +12V to +14V, 25 to 40 mA.

10. Environment: (When installed in SSC or SSK Series transmitter) Continuous unattended operation in the following environments: Ambient temperature, (-50° to +70°C); Relative humidity, 0-100%; High salinity as encountered in offshore conditions.

2. General Description: The Synthesizer PWB generates a steady RF carrier with frequency determined by programming switches located on the PWB. The accuracy of the carrier output is determined by a reference crystal oscillator operating at 2.048 MHz. The RF carrier is generated by a voltage-controlled LC oscillator operating at the carrier frequency, and phase-locked to the reference crystal oscillator. An LED indicator is furnished to indicate a "Locked" condition. Test points are furnished to facilitate initial setup and troubleshooting.

3. Detailed Circuit Analysis: See Figures 1, 2, and 3 for a schematic and an assembly drawing of the Synthesizer PWB and the Synthesizer Programming PWB. Q1 in conjunction with the components of the Synthesizer Programming PWB and CR1 form a voltage controlled Colpits oscillator. Coarse adjustment of the oscillator frequency is determined by the values of L1, C1, C2, C3, and C4 of PWB 129. L1 is adjusted during initial tuneup to bring the oscillator output to the correct frequency. As the desired frequency is approached, the phase-lock circuits of PWB 128 will "capture" control of the oscillator tuning by changing the DC bias voltage to capacitance diode CR1. Within the "capture" tuning region, changes to L1 will produce no change in the oscillator frequency but will cause changes in the CR1 bias voltage. If the oscillator output frequency is less than the switch selected frequency, the bias voltage will be forced to approximately 9 volts, or minimum capacitance in diode CR1. If the oscillator output frequency is higher than the switch selected frequency, the bias voltage will be approximately 0 volts, or maximum capacitance in diode CR1. Monitoring the bias voltage thus enables the technician to rapidly tune the oscillator to the selected frequency. Q2 buffers and amplifies the output of the Q1 oscillator to drive the RF output and the phase-lock logic circuits. The output of buffer Q2 is fed to programmable divider U3 where the oscillator frequency is divided by a number "N" equal to twice the number selected on the frequency programming switches. For example, if 342 KHz were selected on the programming switches, "N" would by equal to 684. With the oscillator operating at 342 KHz, an output pulse would occur from U3 at 342 KHz÷684 or 500 Hz. The output pulse width from U3 is equal to the length of one cycle at the operating frequency, or 2.9 microseconds at 342 KHz. The 500 Hz U3 output is compared by a phase detector in integrated circuit U2 with a reference 500 Hz signal produced by crystal oscillator and divider U1. The error voltage output from phase detector U2, consisting of a DC voltage with a small 500 Hz ripple, is applied through the low-pass filter (C6, R8, C5, R9, C4) to the capacitance diode CR1. This completes the control loop and enables the locking of the LC oscillator to the crystal reference oscillator. Q3, Q4, and DS1 furnish an indication of a "Locked" state whenever DS1 is lit. This is derived from a lock indication produced in phase-lock detector U2. The Synthesizer output signal is fed from pin 2 on the Synthesizer to a modified AM oscillator board or a dual carrier Synthesizer board.

4. Installation and Operation:

NOTE: To prevent damage to the L1 core, a correctly sized alignment tool must be used. The recommended alignment tool is a GC Electronics No. 9440 (furnished).

1. Remove power from the transmitter. Attach the Synthesizer Programming Board PWB 129 corresponding to the selected frequency band to the Synthesizer Board PWB 128.

2. Secure the two boards together with the #4 screws furnished.

3. Rotate the programming switches to the desired operating frequency. For example, to select 342 KHz, rotate S1 to 3, rotate S2 to 4, and rotate S3 to 2. S4-1 and S4-2 should both be OFF. If 342.5 KHz were required, placing S4-1 in the ON position would add 0.5 KHz to the 342 KHz frequency already selected. If 1,342 KHz were required, placing S4-2 in the ON position would add 1.0000 MHz to the previously selected frequency.

4. Attach a voltmeter to TP4 (Error Voltage) and TP1 (Ground). For best results, the voltmeter should be a high-impedance digital voltmeter, however, satisfactory results may be obtained with a 20,000 ohm/volt VOM.

5. Install the Synthesizer Board in its socket in the transmitter. This is the Synthesizer Board socket on the SS-1000 series transmitters or the 4th Letter Board socket on the SS-100 series transmitters (as modified) (See Figures 4 and 5).

6. Apply power to the transmitter.

7. Note the voltmeter reading. If the voltmeter reads 0, the LC oscillator is tuned above the selected frequency and beyond the phase-lock "capture" range. If the voltmeter reads approximately +8.5 to 9 volts, the LC oscillator is tuned below the selected frequency and beyond the phase-lock "capture" range. If the voltage is between 0.5 volts and 8 volts the LC oscillator is "Locked" to the reference oscillator and is on the selected frequency.

8. Adjust L1 by rotating the tuning slug to bring the oscillator frequency within the phase-lock "capture" range. Note: L1 is at maximum inductance when the tuning slug is flush with the top of the coil housing.

9. Adjust L1 for a voltmeter reading of +5.0 volts. The lock indicator LED, DS1, should be lit at this time if a high impedance voltmeter is used. If a 20,000 ohm/volt VOM is used, it will be necessary to remove the test lead from test point TP4 before the lock indication LED will be lit. Because stray signals present on the voltmeter leads may affect the spectral purity of the oscillator, the voltmeter should not be left attached to TP4 during normal transmitter operation.

   NOTE: With large variations in ambient temperature, some variations in the TP4 error voltage will be noted, with the voltage increasing gradually with increasing temperature. This does not indicate a change in frequency, and is permissable within the range of 2.0 volts to 7.0 volts. This should be sufficient to handle temperature variations of -60^{o}F (-51^{o}C) to +122^{o}F (+50C) from an initial setup temperature of 77^{o}F (+25^{o}C). Re-adjustment of the error voltage to +5V after arrival of the transmitter at the final ambient temperature is recommended to allow the greatest tolerance to temperature and component variation.

5. <u>Maintenance and Calibration</u>:

1. Reference Crystal Calibration. Attach a frequency counter to test point TP5. Select a frequency within the PWB 129 band selected and adjust the LC oscillator for 5 volts at TP4. Adjust trimmer capacitor C8 until the output frequency is the same as the switch-selected frequency.

2. SS-100 Series Transmitter frequency change. The SS-100 Series Transmitters can be furnished in 4 (four) bands from 190 to 680 KHz. The bands are 190-250, 250-340, 340-500, and 500-680. Band selection components include a Filter, an AM Oscillator Board (PWB 59), a Synthesizer Board (PWB 128), and a Synthesizer Programming Board (PWB 129). One of each of these components is furnished for operation on any one of the given bands. Components for operation on additional bands are available as an option. Frequency Programming Components for the various bands are indicated in Table 1.

FREQUENCY BAND	RF OUTPUT FILTER	AM OSCILLATOR PWB 59	SYNTHESIZER PROGRAMMING BOARD, PWB 129 (NOTE 1)	SYNTHESIZER BOARD, PWB 128
190-250 KHz	190-340 KHz	190-250 KHz	190-250 KHz	ALL BANDS
250-340 KHz		250-340 KHz	250-340 KHz	
340-500 KHz	340-500 KHz	340-500 KHz	340-415 415-650 KHz	
500-680 KHz	500-680 KHz	500-680 KHz	415-650 KHz	

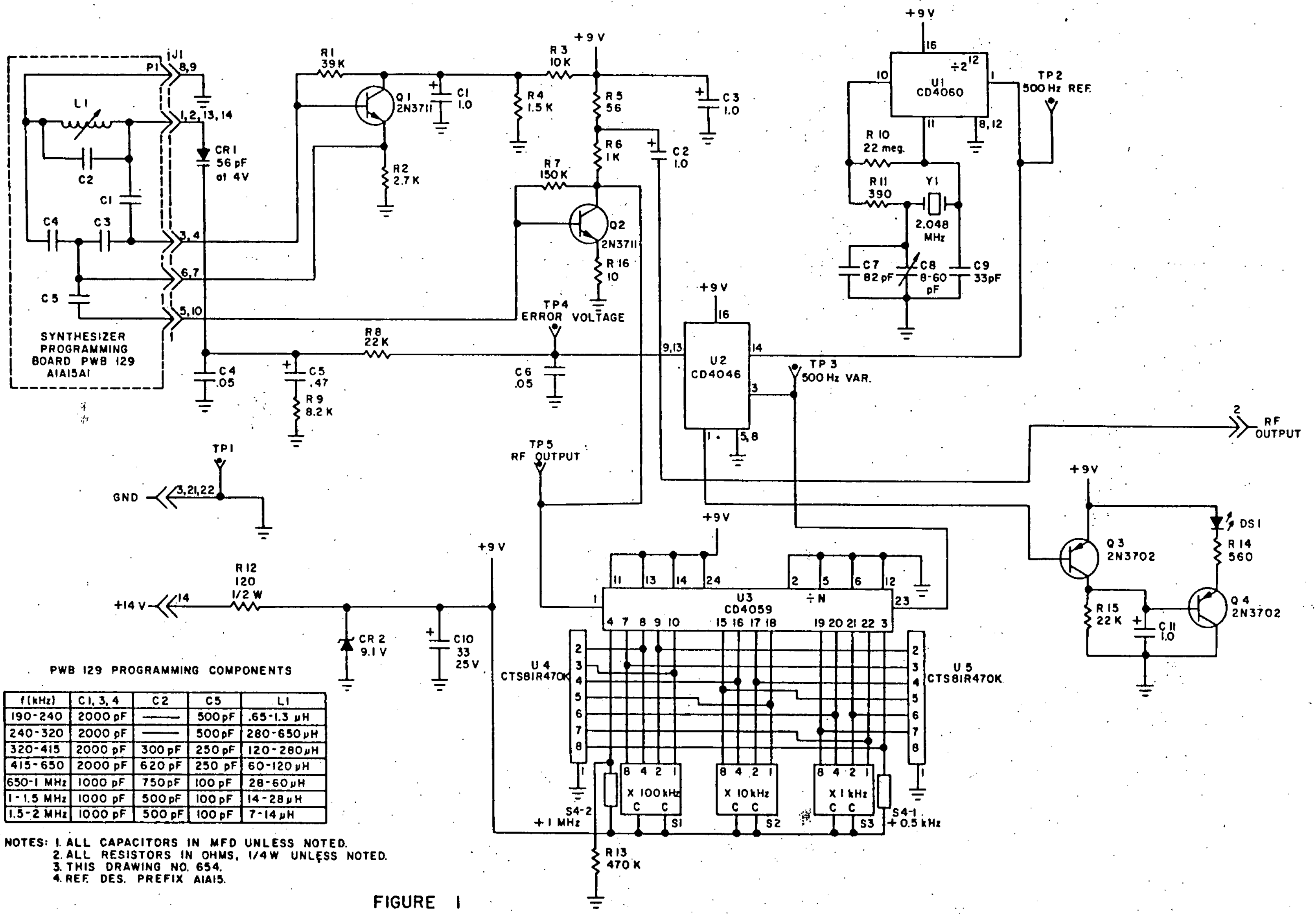
TABLE 1

3. SS-1000 Series Transmitter frequency change.
The SS-1000 Series Transmitters can be furnished in 4 (four) bands from 190 to 625 KHz and one band from 1500 to 1800 KHz. The bands are 190-240, 240-320, 320-415, 415-650, and 1500-1800 KHz. Band selection components include a Filter Module, an AM Oscillator Board (PWB 107), a Preamplifier Board (PWB 94A), a Synthesizer Programming Board (PWB 129), and a Synthesizer Board (PWB 128). One of each of these components is furnished for operation on any one of the given bands. Components for operation on additional bands are optionally available. Frequency programming components for the various bands are indicated in Table 2.

FREQUENCY BAND	RF OUTPUT FILTER MODULE	AM OSCILLATOR BOARD PWB 107	PREAMPLIFIER BOARD PWB 94A	SYNTHESIZER PROGRAMMING BOARD PWB 129	SYNTHESIZER BOARD PWB 128
190-240 KHz	190-320 KHz	190-240 KHz	190-240 KHz	190-240 KHz	ALL BANDS
240-320 KHz		240-320 KHz	240-320 KHz	240-320 KHz	
320-415 KHz	320-415 KHz	320-415 KHz	320-415 KHz	320-415 KHz	
415-650 KHz	415-650 KHz	415-650 KHz	415-650 KHz	415-650 KHz	
* 1500-1800 KHz	1500-1800 KHz	1500-2000 KHz	1500-2000 KHz	1500-2000 KHz	

*Available only with SS-1000 H Series.

TABLE 2



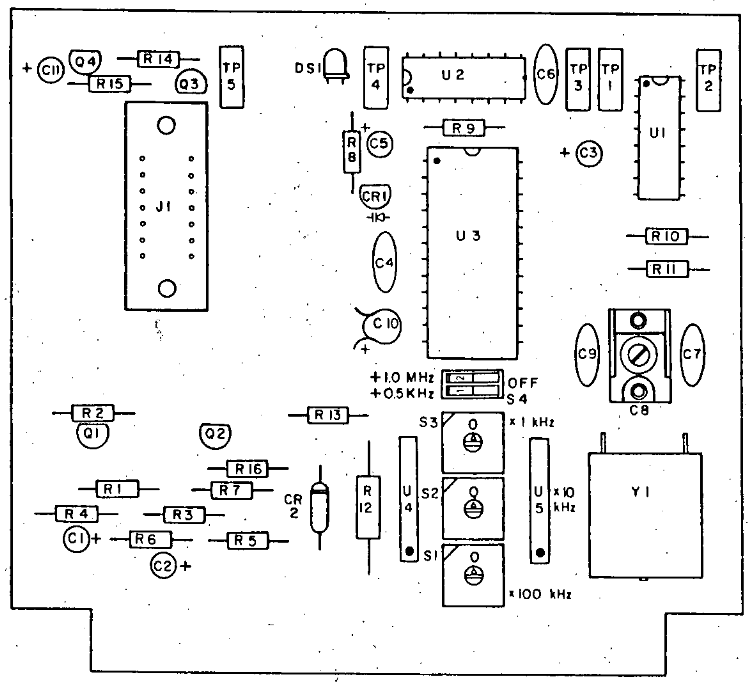
PWB 129 PROGRAMMING COMPONENTS

f (kHz)	C1, 3, 4	C2	C5	L1
190-240	2000 pF	———	500 pF	.65-1.3 μH
240-320	2000 pF	———	500 pF	280-650 μH
320-415	2000 pF	300 pF	250 pF	120-280 μH
415-650	2000 pF	620 pF	250 pF	60-120 μH
650-1 MHz	1000 pF	750 pF	100 pF	28-60 μH
1-1.5 MHz	1000 pF	500 pF	100 pF	14-28 μH
1.5-2 MHz	1000 pF	500 pF	100 pF	7-14 μH

NOTES: 1. ALL CAPACITORS IN MFD UNLESS NOTED.
2. ALL RESISTORS IN OHMS, 1/4W UNLESS NOTED.
3. THIS DRAWING NO. 654.
4. REF. DES. PREFIX A1A15.

FIGURE 1

SYNTHESIZER BOARD
PWB 128 SCHEMATIC

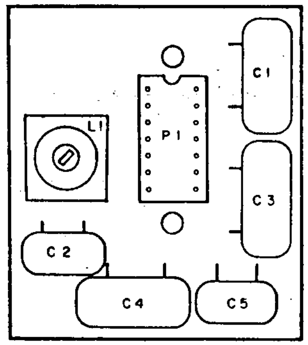


NOTES: 1. REF. DES. PREFIX A1A15.
2. THIS DRAWING NO. 652.

FIGURE 2

SYNTHESIZER PWB ASSEMBLY

ITEM	REF. DES.	QNTY.	PART NO.	DESCRIPTION
41	XS1-4	4	716AG2D	SOCKET, 16 PIN, IC, AUGAT
40	Y1	1		CRYSTAL, 2.048 MHz, 30 pF, .002%, S7 HOLDER, SENTRY
39	U4, 5	2	750-81-R470K	RES. NETWORK, CTS
38	U3	1	CD4059AE	INT. CKT., RCA
37	U2	1	CD4046AE	INT. CKT., RCA
36	U1	1	CD4060AE	INT. CKT., RCA
35	TP 5	1	325-104	TESTPOINT, GREEN, H. H. SMITH
34	TP 4	1	325-107	TESTPOINT, YELLOW, H. H. SMITH
33	TP 3	1	325-106	TESTPOINT, ORANGE, H. H. SMITH
32	TP 2	1	325-102	TESTPOINT, RED, H. H. SMITH
31	TP 1	1	325-103	TESTPOINT, BLACK, H. H. SMITH
30	S 4	1	240002G	SWITCH, MINI DIP, 2 POS., EECO
29	S 1-3	3	230002G	SWITCH, MICRO DIP, 10 POS., EECO
28	R 16	1	OC1001	RES., 10 OHM, 1/4 W, 10%, OHMITE
27	R 14	1	OC5611	RES., 560 OHM, 1/4 W, 10%, OHMITE
26	R 13	1	OC4741	RES., 470 K, 1/4 W, 10%, OHMITE
25	R 12	1	OE1211	RES., 120 OHM, 1/2 W, 10%, OHMITE
24	R 11	1	OC3911	RES., 390 OHM, 1/4 W, 10%, OHMITE
23	R 10	1	OC2261	RES., 22 MEG, 1/4 W, 10%, OHMITE
22	R 9	1	OC8221	RES., 8.2 K, 1/4 W, 10%, OHMITE
21	R 8, 15	2	OC2231	RES., 22 K, 1/4 W, 10%, OHMITE
20	R 7	1	OC1541	RES., 150 K, 1/4 W, 10%, OHMITE
19	R 6	1	OC1021	RES., 1 K, 1/4 W, 10%, OHMITE
18	R 5	1	OC5601	RES., 56 OHM, 1/4 W, 10%, OHMITE
17	R 4	1	OC1521	RES., 1.5 K, 1/4 W, 10%, OHMITE
16	R 3	1	OC1031	RES., 10 K, 1/4 W, 10%, OHMITE
15	R 2	1	OC2721	RES., 2.7 K, 1/4 W, 10%, OHMITE
14	R 1	1	OC3931	RES., 39 K, 1/4 W, 10%, OHMITE
13	Q3, 4	2	2N3702	TRANSISTOR, RAYTHEON
12	Q1, 2	2	2N3711	TRANSISTOR, RAYTHEON
11	J1	1	114-AG1A	SOCKET, 14 PIN IC, AUGAT
10	DS 1	1	FLV-117	LED, FAIRCHILD
9	CR 2	1	IN960B	DIODE, 9.1 V, 1/2 W, ZENER, MOT.
8	CR 1	1	MV2112	DIODE, TUNING, MOTOROLA
7	C 10	1	196D336X90 25PE4	CAP., 33 MFD, 25 V, DIPPED TANTALUM, SPRAGUE
6	C 9	1	CD15ED330J03	CAP., 33 PF, 500V, DIP SILVER MICA, CDE
5	C8	1	404	CAP., 8-60 PF, ARCO
4	C 7	1	DM15-820J03	CAP., 82 PF, 500V, DIP SILVER MICA, ARCO
3	C 5	1	196D474X90 35HA1	CAP., .47 MFD, 35 V, DIPPED TANTALUM, SPRAGUE
2	C 4, 6	2	TGS50	CAP., .05 MFD, 100V, CERAMIC, SPRAGUE
1	C 1, 2, 3, 11	4	196D105X90 35HA1	CAP., 1 MFD, 35 V, DIPPED TANTALUM, SPRAGUE



NOTES: 1. REF. DES. PREFIX A1A15A1.
2. THIS DRAWING NO. 653.

FIGURE 3

SYNTHESIZER PROGRAMMING PWB ASSEMBLY

ITEM	REF DES.	QNTY.	PART NO.	DESCRIPTION
6		1	129	PWB, SAC
5	P1	1	614-AG1	ADAPTER PLUG, AUGAT
			9052	IDCTR, VAR, MILLER, 7-14μH, 1.5-2 MHz
			9053	IDCTR, VAR, MILLER, 14-28μH, 1-1.5 MHz
			9054	IDCTR, VAR, MILLER, 28-60μH, 650-1 MHz
4	L1	1	9055	IDCTR, VAR, MILLER, 60-120μH, 415-650 kHz
			9056	IDCTR, VAR, MILLER, 120-280μH, 320-415 kHz
			9057	IDCTR, VAR, MILLER, 280-650μH, 240-320 kHz
			9058	IDCTR, VAR, MILLER, .65-1.3 mH, 190-240 kHz
			DM15-101J	CAP, 100 pF, 500 V, SIL. MICA, ARCO, 1.5-2 MHz
			DM15-101J	CAP, 100 pF, 500 V, SIL. MICA, ARCO, 1-1.5 MHz
			DM15-101J	CAP, 100 pF, 500 V, SIL. MICA, ARCO, 650-1 MHz
3	C5	1	DM15-251J	CAP, 250 pF, 500 V, SIL. MICA, ARCO, 415-650 kHz
			DM15-251J	CAP, 250 pF, 500 V, SIL. MICA, ARCO, 320-415 kHz
			DM15-501J	CAP, 500 pF, 500 V, SIL. MICA, ARCO, 240-320 kHz
			DM15-501J	CAP, 500 pF, 500 V, SIL. MICA, ARCO, 190-240 kHz
			DM15-501J	CAP, 500 pF, 500 V, SIL. MICA, ARCO, 1.5-2 MHz
			DM15-501J	CAP, 500 pF, 500 V, SIL. MICA, ARCO, 1-1.5 MHz
			DM15-751J	CAP, 750 pF, 500 V, SIL. MICA, ARCO, 650-1 MHz
2	C2	1	DM15-621J	CAP, 620 pF, 500 V, SIL. MICA, ARCO, 415-650 kHz
			DM15-301J	CAP, 300 pF, 500 V, SIL. MICA, ARCO, 320-415 kHz
				NOT USED, 240-320 kHz
				NOT USED, 190-240 kHz
			DM15-102J	CAP, 1000 pF, 500 V, SIL. MICA, ARCO, 1.5-2 MHz
			DM15-102J	CAP, 1000 pF, 500 V, SIL. MICA, ARCO, 1-1.5 MHz
			DM15-102J	CAP, 1000 pF, 500 V, SIL. MICA, ARCO, 650-1 MHz
1	C1, 3, 4	3	DM15-202J	CAP, 2000 pF, 500 V, SIL. MICA, ARCO, 415-650 kHz
			DM15-202J	CAP, 2000 pF, 500 V, SIL. MICA, ARCO, 320-415 kHz
			DM15-202J	CAP, 2000 pF, 500 V, SIL. MICA, ARCO, 240-320 kHz
			DM15-202J	CAP, 2000 pF, 500 V, SIL. MICA, ARCO, 190-240 kHz

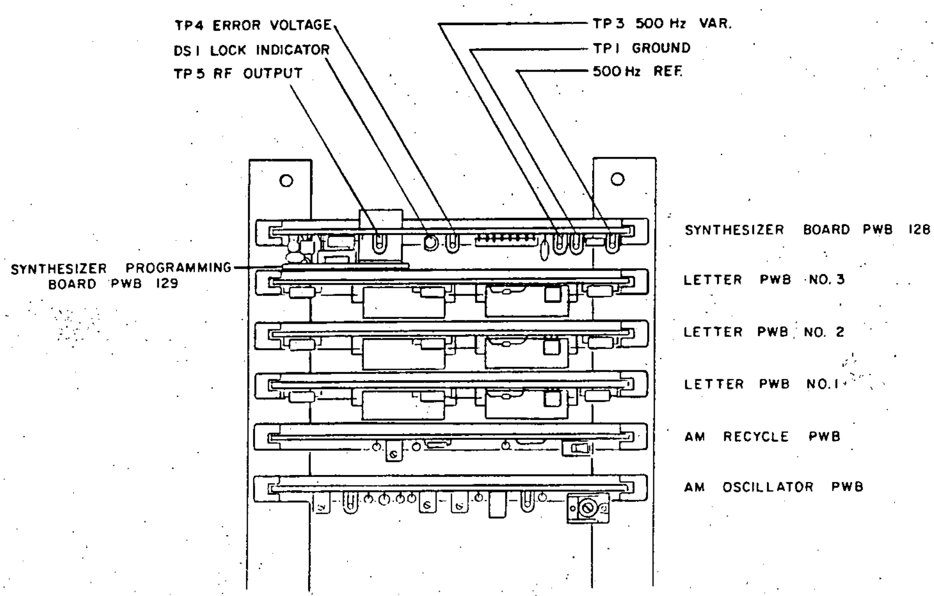


FIGURE 4

SYNTHESIZER INSTALLATION IN SS-100 SERIES TRANSMITTERS

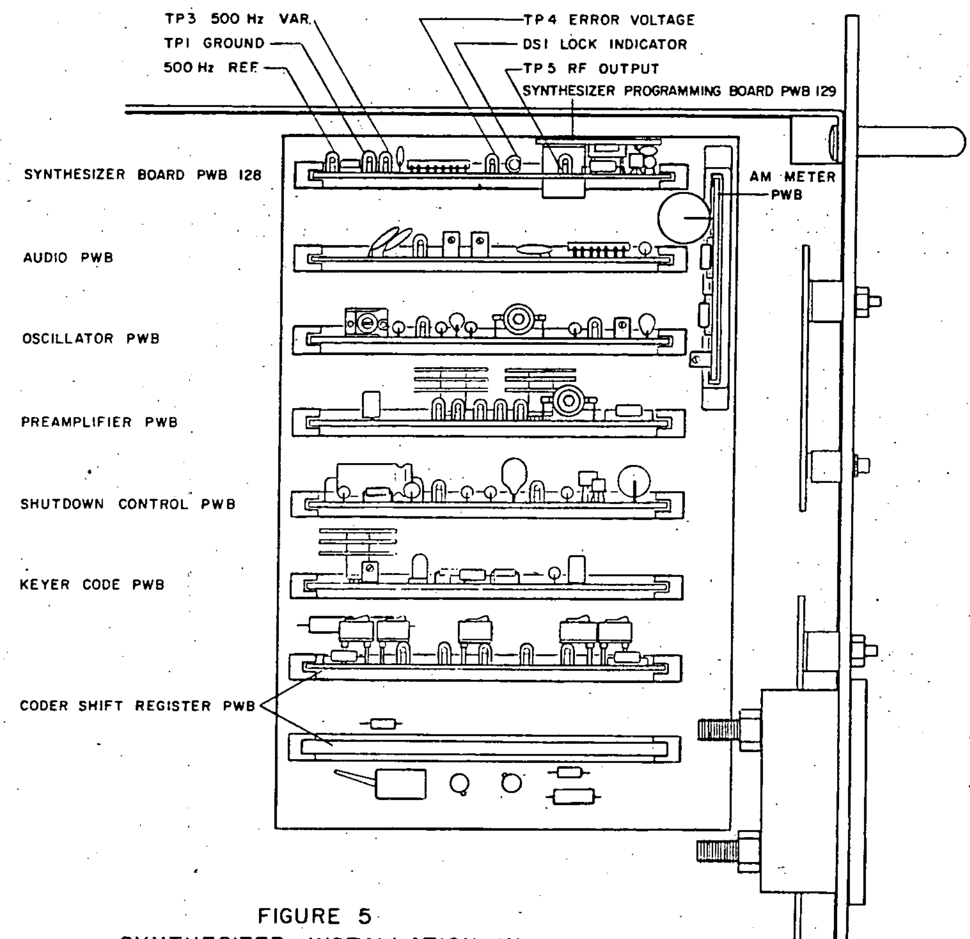


FIGURE 5
SYNTHESIZER INSTALLATION IN
SS-1000 SERIES TRANSMITTERS