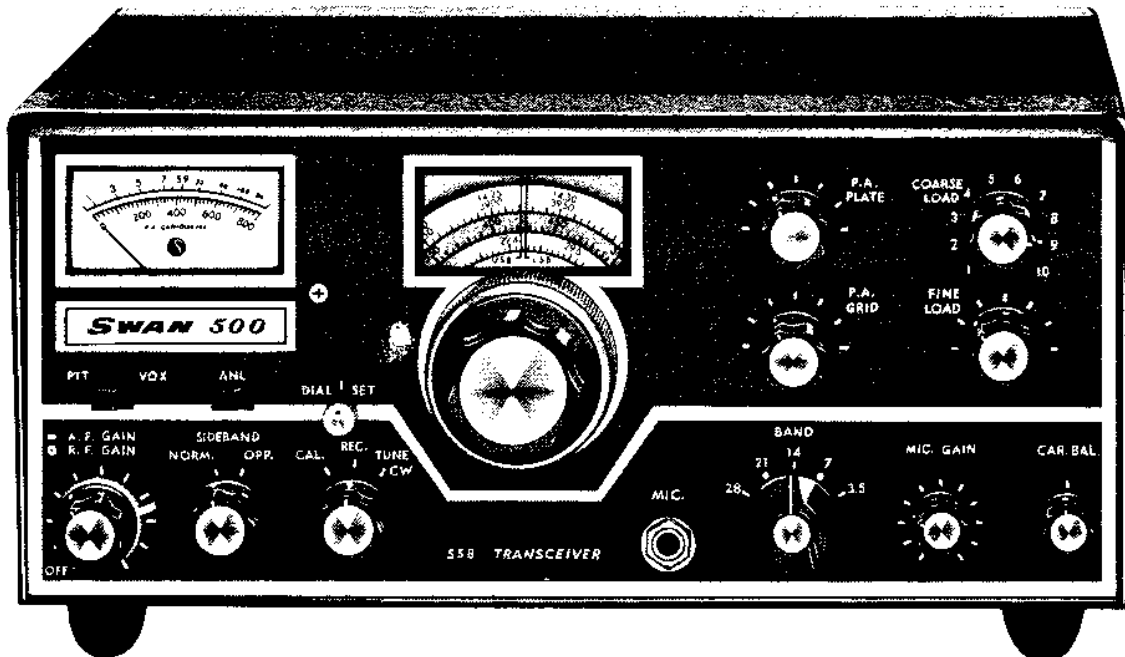


OPERATION and MAINTENANCE MODEL 500 SERIES Single Sideband Transceiver



INTRODUCTION

The Swan Model 500 Single Sideband Transceiver together with its accessories and optional equipment, is designed to be used in either CW or SSB modes on all portions of the 80-, 40-, 20-, 15-, and 10 meter amateur radio bands. MARS frequencies may also be covered by using the Model 405X oscillator accessory.

The model 500 generates a single sideband signal by means of crystal lattice filter, and the transceiver operation automatically tunes the transmitter to the received frequency. Provisions are included in the transceiver for operation on either upper or lower sideband.

Basic circuitry of the single conversion design has been proven in several thousand of the popular Swan transceivers. Mechanical, electrical, and thermal stability is exceptionally high. All oscillators are temperature compensated and voltage regulated. Push-to-talk operation is standard, with provision for plugging in the Model VX-1 accessory Vox unit for automatic voice control.

The basic transceiver provides coverage of all portions of the 80 through 10- meter amateur bands. In addition to this, the amplifier circuits will tune to most MARS frequencies near the 80-, 40-, and 20-meter bands. By using the Model 405X crystal oscillator accessory, MARS operation is thus possible.

With a suitable power supply, operation may be fixed, portable, or mobile. Power input on all bands exceeds 480 watts, PEP, on single sideband, 360 watts on CW, and 125 watts on AM. The model 500 includes automatic gain control, (AGC), automatic level control, (ALC), automatic noise limiter, (ANL), and grid block keying.

Part I of the instruction manual covers the basic transceiver. Part II covers the recommended power supplies, Model 117-XC for ac operation and Model 14-117 for 12-volt dc operation. Part III provides information on various accessories.

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SPECIFICATIONS:

FREQUENCY RANGES

80 Meters	3.5 to 4.0 mc.
40 Meters	7.0 to 7.5 mc.
20 Meters	13.85 to 14.350 mc.
15 Meters	21.0 to 21.5 mc.
10 Meters	28.0 to 29.7 mc.

POWER INPUT

Single Sideband, Suppressed Carrier:
480 watts, PEP, minimum on all bands.
CW:
360 watts, dc input on all bands.
AM (Single Sideband with Carrier):
125 watts dc input on all bands.

DISTORTION

Distortion products down approx. 30 db.

UNWANTED SIDEBAND SUPPRESSION

Unwanted sideband down more than 50 db.

CARRIER SUPPRESSION

Carrier suppression greater than 60 db.

RECEIVER SENSITIVITY

Less than 0.5 microvolt at 50 ohms impedance for signal-plus-noise ratio of 10 db.

AUDIO OUTPUT AND RESPONSE

Audio output, 4 watts to 3.2 ohm load. Response essentially flat from 300 to 3000 cps in both receive and transmit.

TRANSMITTER OUTPUT

Wide-range Pi-network output matches antennas essentially resistive from 15 to 500 ohms impedance, with coarse and fine load adjustment.

METERING

Power amplifier cathode current 0-800 ma on transmit, S-Meter 0-70 db over S9 on receive.

FRONT PANEL CONTROLS

CAL-Rec-Tune/CW, AF-RF Gain, Mic. Gain, Bandswitch, Carrier Balance, PA Plate Tune, PA Grid Tune, PA Load Course, PA Load Fine, VOX-PTT Switch, ANL Switch, Dial set.

REAR PANEL CONTROLS AND CONNECTIONS

Bias potentiometer, CW key jack, Jones plug power connector, Vox connector, Antenna jack, S-Meter zero, Auxilliary relay switching, Out-board VFO connector.

VACUUM TUBE COMPLEMENT

V1	6EW6 VFO Amplifier
V2	12BE6 Transmitter Mixer
V3	6GK6 Driver
V4	6HF5 Power Amplifier
V5	6HF5 Power Amplifier
V6	12BZ6 Receiver RF Amplifier
V7	12BE6 Receiver Mixer
V8	6EW6 First IF Amplifier
V9	12BA6 Second IF Amplifier
V10	12AX7 Product Detector/Receive Audio
V11	6BN8 AGC Amplifier/Rectifier
V12	6GK6 Audio Amplifier
V13	7360 Balanced Modulator
V14	12BA6 Carrier Oscillator
V15	12AX7 Mic. Amplifier/Transmit Audio
V16	OA2 Voltage Regulator
V17	12BA6 100KC Calibrator

DIODE AND TRANSISTOR COMPLEMENT

Q1	2N706 Oscillator
Q2	2N706 Emitter Follower
D401	TS-2 ALC Diode
D402	TS-2 ALC Diode
D1601	1N2974A Zener voltage regulator
D1602	TS-2 Relay Silencing Diode
D1603	TS-2 AGC Charging bypass

POWER REQUIREMENTS

Filaments	12.6 volts, 5.5 amps, ac or dc
Relay	12 volts dc, 250 ma.
Bias	-110 volts dc, 100 ma.
Med. voltage	275 volts dc, 150 ma.
High voltage	800 volts dc, 500 ma. Peak Trans.

DIMENSIONS AND WEIGHT

Height	5-1/2 in.	Depth	11 in.
Width	13 in.	Weight	17-1/4 lb.

A. CIRCUIT THEORY

GENERAL DISCUSSION

The Swan 500 transceiver provides single sideband, suppressed carrier transceive operation, and generates the single sideband signal by means of a crystal lattice filter. To permit a logical discussion of this mode of operation, certain definitions are necessary. In a normal AM signal, (double sideband with carrier), a radio frequency signal is modulated with an audio frequency signal. This is considered by many to be merely a case of varying the amplitude of the carrier at an audio rate. In fact, however, there are actually sideband frequencies generated, which are the results of mixing the RF and the AF signals. These sidebands are the sum of, and the difference between the two heterodyned signals. In the detection of this conventional AM signal, the two sidebands are mixed with the carrier to recover and reproduce the audio intelligence. This is an inefficient means of transmission, because only 25 percent of the transmitted power is used to transmit intelligence. There are other attendant drawbacks, also. The bandwidth of AM voice transmission is approximately 6 kc, while the actual demodulated audio is only approximately 3 kc. The result is inefficient use of the frequency band, and over half of the allotted band is unusable due to heterodynes, interference, and congestion.

In the single sideband, suppressed carrier mode of transmission, only one of the sideband signals is transmitted. The other sideband and the carrier are suppressed to negligible level. In addition to increasing the transmission efficiency by a factor of four, single sideband effectively doubles the number of stations or channels which can be used in a given band of frequencies.

It should be remembered that in the single sideband, suppressed carrier mode of transmitting, the unwanted sideband and carrier are only suppressed, not entirely eliminated. Thus, with a transmitted signal from a transmitter with 50 db sideband suppression, the other or unwanted sideband will be present, and will be transmitted, but its level will be 50 db below the wanted sideband. When this signal is received at a level of 20 db over S9, the unwanted sideband will be present at a level of approximately S5. The same is true of carrier suppression. With carrier suppression of 60 db, and a signal level of 20 db over S9, carrier will be present at a level of approximately S3 to S4.

In the Model 500 transceiver, the single sideband suppressed carrier signal is generated by the crystal lattice filter method. For details, refer to the schematic diagram, and to Figures 1, 2, and 3.

SIGNAL GENERATION

When the push-to-talk switch on the microphone is pressed, the transmitter portion of the transceiver is activated, and it generates a single sideband, sup-

pressed carrier signal in the following manner. Carrier is generated by V14 Carrier Oscillator, which is a Pierce oscillator with the crystal operating in parallel resonance. This stage operates in both the transmit and receive modes. When transmitting, the RF output of the oscillator is injected into the control grid of the Balanced Modulator, V13. This balanced modulator is a beam deflection tube, and operates similar to a cathode ray tube in that the electron beam from the cathode is deflected to one output plate or the other by the charge appearing on the deflection plates. The carrier signal fed to the control grid of the balanced modulator appears on both plates of the output. The two plates are connected to Transformer Z1301 in push-pull, so the carrier signal cancels itself out in Z1301. The deflection plate DC voltages are adjusted by means of the carrier balance control so that the RF being fed to the output plates will cancel out, and the output from Z1301 will be zero. Audio signals from the Microphone Amplifier, V15, are applied as a modulating voltage to one deflection plate, and the two sidebands resulting from the sum and difference frequencies of the audio and carrier signals appear in the output of transformer Z1301. Carrier suppression is approximately 60 db.

The double sideband, suppressed carrier signal is then coupled from the secondary winding of Z1301 to the crystal filter, which suppresses the lower sideband, and permits only the upper sideband to be fed to the First IF Amplifier, V8. The carrier frequency is generated at approximately 5172.8 kc, normal sideband. With the opposite sideband crystal, the carrier crystal frequency will be 5176.3 kc, and this positions the double sideband signal on the other side of the filter response curve, attenuating the upper sideband by at least 50 db. In the single conversion mixing process, these sidebands become inverted on 80 and 40 meters. Thus the Swan-500 normally operates on lower sideband on 80 and 40, while on 20, 15, and 10 meters normal operation is on upper sideband.

Q1, the VFO 2N706 Oscillator, operates in the common base configuration as a Colpitts oscillator. Q2, the Emitter Follower is used for isolation and impedance matching purposes. The extremely good regulation achieved through using the Zener diode regulator D1601 across the bias supply voltage, also contributes to the stability. Bandswitching is accomplished by changing the tank circuit coil. The VFO in the Model 500 exhibits extremely good stability after the initial warm-up period. Drift from a cold start will be less than 1 kc for the first hour on 80-, 40-, and 20-meter bands, and less than 2 kc on 10 and 15 meters. After the initial warm-up period, drift will be negligible.

The single sideband, suppressed carrier signal from the First IF Amplifier is fed to the Transmitter.

I MODEL 500 TRANSCEIVER

A. Circuit Theory (Cont)

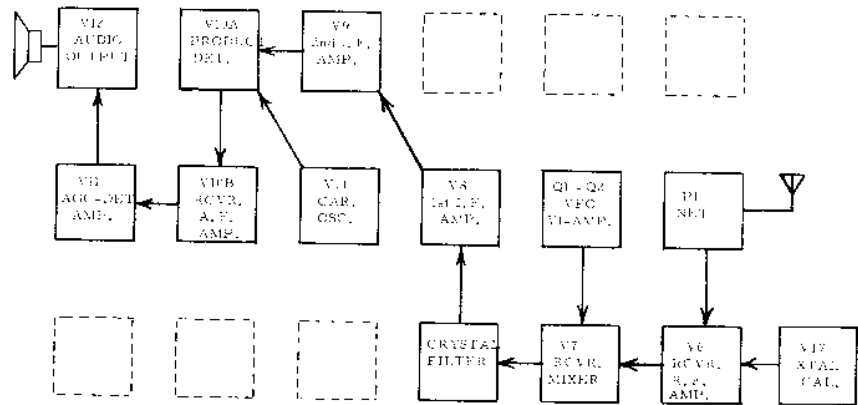


FIGURE 1 BLOCK DIAGRAM, RECEIVE MODE

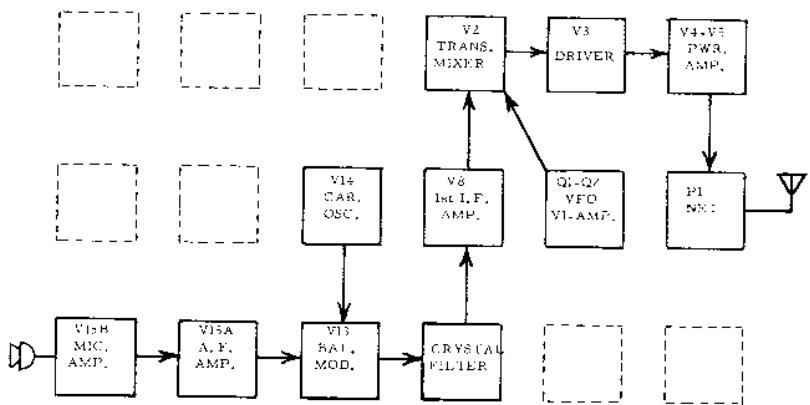


FIGURE 2 BLOCK DIAGRAM, TRANSMIT MODE

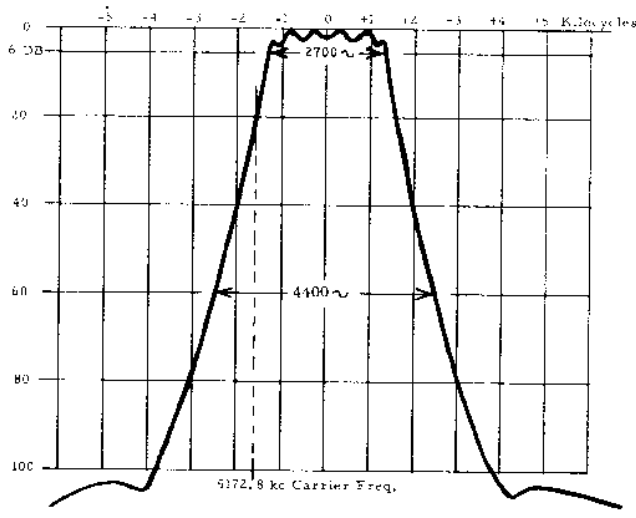


FIGURE 3 CRYSTAL FILTER, TYPICAL CHARACTERISTIC

I MODEL 500 TRANSCEIVER

A. Circuit Theory (Cont)

SIGNAL GENERATION (cont)

Mixer, V2, where it is heterodyned with the VFO signal. The resultant signal at the desired transmit frequency is amplified by the Driver, V3, and the Power Amplifiers, V4 and V5. The signal from the VFO Amplifier is initiated in the transistorized VFO-Emitter Follower circuit Q1, Q2. The signal from the VFO is routed to the VFO Amplifier, and on 40 and 80 meters, is subtractively mixed with the single sideband signal from the IF Amplifier to result in LSB operation. On 20, 15, and 10 meters, the frequencies are additively mixed, resulting in output on the upper sideband.

When in TRANSMIT, the gain of the First IF Amplifier is controlled through the Automatic Level Control network D401-D402, etc., to control the gain of the stage in response to the average input power to the Power Amplifiers. This ALC system will compensate for any extremely strong input signals, but does not completely eliminate the necessity of proper adjustment of the Mic. Gain Control. This feature will help prevent the transmitter from flat topping and spurious emissions, but considerable distortion may occur if the Mic. Gain Control is not properly adjusted. Refer to Operating Instructions.

TUNE AND CW OPERATION

(See page 9 for Tuning Instructions)

Normally, the frequency of the carrier oscillator is approximately 300 cps outside the 6 db passband of the crystal lattice filter. In TUNE position, the frequency of the carrier oscillator is moved approximately 500 cps to place it well within the passband of the crystal lattice filter. A similar procedure is followed for CW to allow full carrier output during CW operation. During CW operation, the cathode of V15A is disconnected from ground. This allows CW operation with no accidental audio modulation from the microphone.

RECEIVE

In RECEIVE position, or at any time when the transmitter is not in TRANSMIT, all circuits used in transmitting are disabled through the relay controlled circuits, K1, K2. The relays are energized for transmitting and de-energized for receiving. Relay K2, when de-energized, allows signals from the transmitting tank circuit and antenna to be fed to the Receiver RF Amplifier, V6, where they are amplified and then fed to the control grid of the Receiver Mixer, V7. The local oscillator signal from the VFO Amplifier is now used to heterodyne the received signal to the IF frequency. All IF amplification is accomplished at this frequency, nominally 5174.5 kc, through V8 and V9 IF amplifiers. In the Product Detector V10A, the IF signal is heterodyned with the carrier frequency generated by Carrier Oscillator, V14. The resultant audio signal is then put thru a noise clipper network

which is in or out of circuit by selection of ANL switch. The signal is then amplified by V10B, which then couples to V11, the AGC amplifier, and V12, the output audio stage.

FREQUENCY CALIBRATION

Frequency calibration of the Model 500 is in 5 kc increments on 80-, 40-, 20-, and 15-meters, and in 20 kc increments on 10M. 80- and 20-meters are calibrated directly on the upper dial scale. 40- and 15-meters are calibrated from zero to 500 on the green tinted center scale, and 10-meters is calibrated directly on the lower dial scale.

The two red indicator lines on the dial window represent the passband of the transceiver, and the actual carrier frequency depends on which sideband is in use. For upper sideband, carrier frequency is read with the left hand indicator line. For lower sideband, use the right hand line.

Dial accuracy and tracking are very good on the 500, but caution must always be observed when operating near band edges. Measuring the frequency with the 100 kc calibrator when working near band edges is recommended.

DIAL SET

A dial-set has been provided so that dial adjustment can be made at any 100 kc point of the dial. With calibrator on, set the dial to any 100 kc point closest to the frequency you wish to work. Now adjust dial-set control to zero-beat the VFO with the 100 kc Calibrator. This provides greater accuracy of dial readout.

CAUTION: Care must be exercised when tuning for the 100 kc harmonics of the calibrator. Several spurious image signals may be heard, although they will be somewhat weaker than the actual harmonics.

TRANSMIT AND RECEIVE SWITCHING

Transmit and receive switching is performed by relays K1 and K2. In TRANSMIT position, only those tubes that operate in the transmit mode are operative, all others being biased to cutoff through the relay contacts. In the RECEIVE position, with the relays de-energized, the tubes that are used only in transmit are cut off in the same manner. Relay K2 when de-energized, feeds signals from the output pi-network to the receiver, and is used also to control external switching circuits. In transmit position the meter indicates the combined cathode current of the two power amplifiers. In receive position, it indicates the voltage across R903 in the screen grid of the Second IF Amplifier, V9, which is inversely proportional to the AGC voltage used to control the gain of the tube. Thus, the meter indicates the relative strength of received signals.

POWER RATING

The Swan 500 is capable of 480 watts, PEP input under steady state two-tone test conditions, when operated with any of the recommended power supplies. The peak envelope power, when voice modulated, is considerably greater, typically 500 watts, or more.

I MODEL 500 TRANSCEIVER

A. Circuit Theory (Cont)

Recommended power supplies produce a no-load plate voltage of approximately 925 volts. Under TUNE conditions, or CW operation, this voltage will drop to approximately 720 volts. Under steady state two-tone modulation, the voltage will drop to approximately 750 volts. If the power amplifier idling current is 50 ma, and the two-tone current, just before flat-topping, is 375 ma, the peak two-tone current will be 560 ma. Under these conditions the PEP input will be 750 volts times 560 ma, = 420 watts. Under voice modulation, because average power is considerably less, the power amplifier plate and screen voltages will be maintained higher, even during voice peaks, by the power supply filter capacitors. Peak plate current will therefore also be higher than with two-tone test conditions. Under typical operating conditions, peak plate current before flat-topping will be 625 ma at 800 volts, to result in an input of 500 watts, PEP. Readings of cathode current will not reflect this 500 watt power input, however, because of the damping in the cathode current meter. Cathode current readings under normal voice input should not exceed approximately 150 to 175 ma.

POWER AMPLIFIER PLATE DISSIPATION

There is often a misunderstanding about the plate dissipation of tubes operated as AB1 amplifiers under voice modulation. In the Swan 500, while in the transmit position, and with no modulation, the plate voltage will be 890 volts, the plate current 50 ma, and the power input will be 45 watts.

Authorities agree that the average voice power is 10 to 20 db below peak voice power. Normally some peak clipping in the power amplifier can be tolerated, and a peak-to-average ratio of only 6 db may sometimes occur. Under such conditions, the average power input will be 125 watts, and average plate current will be 156 ma. With power amplifier efficiency of 65 percent, plate dissipation will be 44 watts, or 22 watts per tube. The 6HF5 is rated at 28 watts, continuous duty cycle, in normal TV service. Thus it can be seen that under normal operating conditions, the power amplifier tubes in the Swan 500 are not being driven very hard. Note, however, that proper modulation level must be maintained by correct setting of Mic. Gain, and that the length of time in TUNE position must be limited to not more than 30 sec. at a time.

B. INSTALLATION

GENERAL

The Swan 500 transceiver has been designed to provide the utmost in ease of operation, stability, versatility, and enjoyment. Maximum enjoyment from your Swan will depend to a great extent on the installation. For fixed station or portable use, operation with the Model 117-XC power supply

provides a compact arrangement with maximum ease of operation. All switching is performed in the transceiver. For mobile installations, the Model 14-117 supply provides similar switching arrangements, and speaker output may be fed to an optional 3 x 5 speaker with mounting provisions on the inside of 500 cabinet. Alternately, the speaker output may be fed through the car broadcast radio speaker.

POWER SUPPLY

The Swan Models 117-XC or 230-XC Power Supplies provide all necessary voltages required by the transceiver for AC operation. The supplies come equipped with a pre-wired plug and cable, all ready for plugging into the transceiver. The Model 14-117 supply for mobile operation includes all necessary cables, connector plug, fuses, and installation hardware. The Jones plug for connection to the transceiver is furnished with the unit.

Power requirements for the Swan 500 are listed in the following table. Pin connections to the Jones type power connector are listed as an aid in connecting other brands or home-brew supplies.

EXTERNAL SPEAKER CONNECTIONS

Audio output from the transceiver is provided at pin 12 of the Jones plug, and to a terminal lug located near V12 audio output tube on top of chassis for optional "3 x 5" internal speaker. The other speaker lead goes to the common chassis ground at pin 6 of Jones plug or to ground terminal at the terminal strip. For mobile installations, mounting a "3 x 5" internal speaker makes the installation simple. In case you wish to use the car broadcast radio speaker a DPDT selector switch should be installed to select either the broadcast radio or transceiver output. (See Figure 8).

Provisions for headphones will be found on front of AC Power Supply. (See Page 17) It is recommended that high impedance phones be used for best results.

JONES PLUG CONNECTIONS

	Pin	Nominal	Minimum	Maximum
High Voltage	8	800 VDC 500 MA	600 VDC Low Pwr.	1200 VDC Hi. Power
Medium Voltage	10	275 VDC 150 MA	225 VDC	325 VDC
Bias Voltage	3	-110 VDC 100 MA	-100 VDC	-130 VDC
Filament Voltage	4	12.6 V* 5.5 amp	11.5 V	14.5 V
Relay Voltage	5	12 VDC 250 MA	10 VDC	14.5 VDC
*AC or DC				

I MODEL 500 TRANSCEIVER

B. Installation (Cont)

MICROPHONE

The microphone input is designed for high impedance microphones only. The choice of microphone is important for good speech quality, and should be given serious consideration. The crystal lattice filter in the transceiver provides all the restriction necessary on audio response, and further restriction in the microphone is not required. It is more important to have a microphone with a smooth, flat response throughout the speech range. The microphone plug must be a standard 1/4 in. diameter three-contact type. The tip connection is for push-to-talk relay control, the ring connector is the microphone terminal, and the sleeve is the common chassis ground. The microphone manufacturer's instructions should be followed in connecting the microphone cable to the plug. With many microphones, the push-to-talk button must be pressed to make the microphone operative. For VOX operation, this feature may be disabled, if desired, by opening the microphone case and permanently connecting the contacts which control the microphone.

ANTENNA

Any of the common antenna systems designed for use on the high frequency amateur bands may be used with the Swan transceiver, provided the input impedance of the transmission line is not outside the capability of the pi-output matching network. The transmission line should be of the coaxial cable type. An antenna system which shows a standing wave ratio of less than 4:1 when using 50 or 75 ohm coaxial transmission line, or a system that results in a transmission line input impedance that is essentially resistive, and between 15 and 500 ohms will take power from the transceiver with little difficulty. If open-wire or balanced type transmission line is used with the antenna, a suitable antenna tuner is recommended between the transceiver and the feedline. Methods of constructing and operating such tuners are described in detail in the ARRL Antenna Handbook, and similar publications. For operation on the 75- and 40- meter bands, a simple dipole antenna, cut to resonate in the most used portion of the band, will perform satisfactorily. For operation on the 10, 15, and 20 meter bands, the efficiency of the station will be greatly increased if a good directional rotary antenna is used. Remember that even the most powerful transmitter is useless without a proper and efficient antenna system.

MOBILE ANTENNA

Mobile antenna installations are critical, since any mobile antenna for use on the high frequency bands represents a number of compromises. Many amateurs lose the efficiency of their antenna through improper tuning. Points to remember about the mobile antenna used with the Swan 500 are:

1. The "Q" of the antenna loading coil should be as high as possible. There are several commercial models available which use high "Q" coils, including the Swan Model 45 and Model 55 5 band "Swantennas".
2. The loading coil must be capable of handling the power of the Model 500 without over heating. In TUNE position, the power output of the transceiver may exceed 250 watts. Wide spaced, heavy wire loading coils are essential.
3. The SWR bridge is a useful instrument, but unfortunately it is quite often misunderstood, and over rated in importance. Basically, the SWR bridge will indicate how closely the antenna load impedance matches the transmission line. With long transmission lines, such as will be used in many fixed station installations, it is desirable to keep the impedance match fairly close in order to limit power loss. This is particularly true at the higher frequencies. The longer the line, and the higher the frequency, the more important SWR becomes. However, in mobile installations the transmission line seldom exceeds 20 feet in length, and an SWR of even 4 to 1 adds very little to power loss. The only time SWR will indicate a low figure is when the antenna presents a load close to 50 ohms, but many mobile antennas will have a base impedance as low as 15 or 20 ohms at their resonant frequency. In such a case, SWR will indicate 3 or 4 to 1, and yet the system will be radiating efficiently.
4. The really important factor in your mobile antenna is that it should be carefully tuned to resonance at the desired frequency. The fallacy in using an SWR bridge lies in the fact that it is sometimes possible to reduce the SWR reading by detuning the antenna. Field strength may actually be reduced in an effort to bring SWR down. Since field strength is the primary goal, we recommend a Field Strength Meter for antenna tuning.
5. For antenna adjustments, the Swan-500 may be loaded lightly to about 100 ma. cathode current instead of the usual 500 ma. This will limit tube dissipation during adjustments, and will also help reduce interference on the frequency. In any case, do not leave the transmitter on for very long at one time. Turn it on just long enough to tune and load, and get a field strength reading.

Start out with the antenna whip at about the center of its adjustment range. Set the VFO to the desired operating frequency and then adjust P. A. TUNE for dip, and P. A. LOAD for 100 ma. Then observe the field strength reading. The Field Strength Meter may be set on top of the dash, on the hood, or at an elevated location some distance from the car.

Change the whip length a half inch, or so, at a time, retune the P.A. for 100 ma. loading each time, and check field strength. Continue this procedure until the point of maximum field strength is found. This adjustment

will be most critical on 75 meters, somewhat less critical on 40, etc., until on 10 meters the adjustment will be quite broad. After tuning the antenna to resonance, load the P. A. to full power.

CONTROL FUNCTIONS

<p>ON-OFF SWITCH (On AF & RF Gain Knob)</p>	<p>Turns power supply on and off</p>	<p>AF GAIN</p>	<p>Controls potentiometer R1201 in grid circuit of V12 AF Output, and controls audio volume.</p>
<p>CAL-REC-TUNE-CW Calibrate</p>	<p>All voltages are applied to transceiver. Grounds cathode of V17. Removes ground from cathode of V15A.</p>	<p>MAIN TUNING</p>	<p>Controls C1706 in frequency determining tank circuit of VFO.</p>
<p>Receive</p>	<p>All voltages are applied to transceiver.</p>	<p>PA GRID</p>	<p>Controls C1A and C1B in plate tanks of transmitter mixer and driver.</p>
<p>Transmit (Push-to-Talk)</p>	<p>12 volt dc circuit through relay K1 and K2 is completed, and tubes used only in receive are biased to cutoff.</p>	<p>PA TUNE</p>	<p>Controls C417 on pi-network to tune final power amplifier plate to resonance.</p>
<p>Tune-CW</p>	<p>All circuits for transmit are energized, as above. Capacitor C1401 in the carrier oscillator is removed from ground.</p>	<p>PA LOAD, Fine</p>	<p>Controls C420 in pi-network to match impedance of output load. Tunes input to Receiver RF Amplifier.</p>
<p>MIC. GAIN</p>	<p>Controls potentiometer R1503 in the grid of V15A and controls amount of audio to the balanced modulator.</p>	<p>PA LOAD, Coarse</p>	<p>Switches in progressively more capacitance in parallel with PA Load, Fine.</p>
<p>CAR. BALANCE</p>	<p>Controls potentiometer R1305 in the balanced modulator deflection plate circuit, and permits nulling out the carrier.</p>	<p>MAIN BANDSWITCH</p>	<p>Switches, plate coils, and associated capacitors of VFO, VFO Amplifier, V1, Transmitter Mixer, V2, and Driver, V3. Also switches tank coil of pi-coupling system and associated capacitors in PA output tank.</p>
<p>RF GAIN</p>	<p>Controls variable resistor R609, common in the grids of receiver mixer V7, RF Amplifier, V8 and V9 IF Amplifiers.</p>		

MODEL 500 TRANSCEIVER

C. OPERATION

Before connecting any cables to the Swan 500 perform the following steps:

1. Rotate the PA BIAS control on the rear chassis apron, fully counter clockwise.
2. Rotate the CAL-REC-TUNE-CW on the lower left of the front panel counter clockwise to REC.
3. Rotate the AF GAIN Control counter clockwise to operate the power switch to OFF.

POWER SUPPLY, ANTENNA AND GROUND CONNECTIONS

1. Connect wire from earth ground to ground stud provided on rear of chassis.
2. Connect a 50 to 75 ohm antenna feed-line to the coaxial connector on the rear chassis panel.
3. Connect the power supply cable to the Jones connector on the rear chassis apron.

4. Connect the power supply to the proper voltage source.

The Swan Model 500 may be operated from 117 volts, ac, 50 - 60 cycle power with the Model 117-XC power supply, or from 230 volts, 50 - 60 cycles with the Model 230-XC. The Model 500 may be operated from a 12 volt dc source with the Swan Model 14-117 power supply.

WARNING

DANGEROUS HIGH VOLTAGE IS PRESENT ON THE PLATE OF THE POWER AMPLIFIER WHENEVER THE POWER SUPPLY IS ENERGIZED. NEVER TURN POWER ON WHEN THE POWER AMPLIFIER COVER IS REMOVED. HIGH VOLTAGE IS ALSO PRESENT AT PIN EIGHT OF THE POWER PLUG.

RECEIVE OPERATION

1. Rotate the AF GAIN Control clockwise to about the 3 o'clock position. The power switch will operate applying filament, relay, bias, medium, and 800 volt high voltage to the transceiver.
2. Wait approximately one minute to allow the tube filaments to reach operating temperature. During this period, perform the following steps:
 - (a) Rotate the BANDSWITCH to desired band.
 - (b) Rotate MIC. GAIN fully counter-clockwise.
 - (c) Rotate CAR. BAL. control to the mid-scale position, with white dot on knob aligned with the long index mark on the panel.
 - (d) Preset PA PLATE control to mid-position.
 - (e) Preset PA GRID control to mid-position.
 - (f) Preset PA LOAD FINE to mid-position.
 - (g) Preset PA LOAD COARSE to position 1.
 - (h) Set tuning dial to desired operating frequency.
 - (i) Set RF GAIN control to approximately 3 o'clock position.
3. Carefully adjust the PA GRID and the PA PLATE controls for maximum receiver noise. **Note:** The PA GRID control resonates the transmitter driver stages and the receiver RF amplifier plate circuit. The PA PLATE and PA LOAD controls adjust the input and output capacitors in the transmitter power amplifier final plate circuit, as well as the receiver RF amplifier grid circuit. Proper adjustment of these controls in the receiver position will result in approximately resonant conditions in the transmitter stages.

RECEIVER TUNING — IMPORTANT, READ CAREFULLY.

Precise tuning of a single sideband signal is very important. Do not be satisfied to merely tune until the voice can be understood, but take the extra care of setting the dial to the exact spot where the voice sounds natural. Above all, avoid the habit of tuning so that the voice is pitched higher than normal. This is an unfortunate habit practiced by quite a number of operators. The following points help to explain the effects of mistuning:

1. If you tune so the received voice is higher than normal pitch, you will then transmit off frequency, and your voice will sound lower than normal pitch to the other station. He will probably retune his dial to make you sound right. If you keep this up, you'll gradually waltz one another across the band. If both of you are mistuning to an unnatural higher pitch, you'll waltz across the band

twice as fast. (And someone will no doubt be accused of frequency drift).

2. Mistuning results in serious harmonic distortion on the voice, and should be quite noticeable to the average ear. Some will claim that if they don't know how the other person's voice actually sounds, they can't tune him in properly, but this is not true. With a little practice, it will be fairly easy to tell. Some voices are relatively rich in harmonics, and are easier to tune in than a person with a "flat" voice. Also, a transmitter which is being operated properly with low distortion will be easier to tune in than one which is being over-driven and is generating excessive distortion. There is no mistaking when you have a station tuned right on the nose. It will sound just like "AM", so to speak. Mainly, avoid the habit of tuning so everyone sounds higher than normal pitch, or like Donald Duck. This is incorrect, unnecessary, and sounds terrible.
3. A vernier control for receive frequency, sometimes referred to as "incremental tuning", is not available on the Swan-500. Such a device is not necessary if proper tuning habits are exercised.
4. Your Swan-500 will automatically transmit on exactly the same frequency as the one to which you are listening. There is no adjustment for making them the same, since by using the same oscillator for both send and receive, it happens automatically. If separation of receive and transmit frequency control is desired, the model 406B or 410 VFO unit may be used. In this case the model 22 dual VFO adaptor must be installed in the 500.

TRANSMITTER TUNING

CAUTION

The Model 500 covers several frequency ranges outside the amateur bands. Care must be exercised not to transmit on these frequencies.

Tuning of the transmitter is not complicated, provided the few simple steps are followed in the correct order. Do not attempt initial tuneup without first performing the procedures for Receive operation described above. The following procedures assume that the unit has been checked out in Receive position, and a high impedance push-to-talk microphone is inserted in the MIC. JACK.

1. Press Push-to-Talk to place unit in TRANSMIT, read the cathode current on the meter.
2. Quickly rotate the CAR. BAL. control on the front panel until the meter reads minimum cathode current.
3. Next, adjust the PA BIAS control on the rear of the chassis until the meter reads 50 ma.

4. If this is the first time the transceiver is being tuned on this band, set the PA LOAD switch to position 5. After experience in tuning up, the control may be set to whatever position has been found to be optimum on each respective band. Now, in rapid succession:
 - (a) Turn the CAR. BAL. control clockwise until a slight increase in meter reading is obtained.
 - (b) Rotate the PA GRID control for maximum meter reading.
 - (c) Rotate the PA PLATE control for minimum meter reading.
 - (d) Adjust car. bal. for a reading of 150 ma.

IMPORTANT—Tuning the PA PLATE for minimum, or "dip", is known as "resonating" the power amplifier plate circuit, and is very important to preserving tube life. If the transceiver is held in Transmit or TUNE position for more than a few seconds while out of resonance and with some grid drive, the 6HF5 tubes may be severely damaged. For this reason we repeat: **CAUTION**—Do not hold the transceiver in Transmit or TUNE position for any length of time without "dipping" the PA PLATE control. The PA GRID must first be "peaked" as in (b), above, and this requires some carrier supplied as described in (a), so it can be seen that these steps must be performed quickly. If the PA LOAD control is too far clockwise, it may not be possible to find a "dip" with the PA PLATE control. For this reason, be sure to observe the first sentence in this section, Step 4.

5. Rotate the CAL-REC. TUNE switch to TUNE position. Quickly check the PA PLATE control for "dip" or minimum reading. If the meter dips to less than 500 ma., increase loading by rotating the PA LOAD controls clockwise. After each increase in PA LOAD resonate the PA PLATE again; that is, adjust it for dip. Continue increasing PA LOAD until the PA PLATE dips to 450-500 ma. Then switch back to RECEIVE. **NOTE:** For 10 meter operation it will be necessary first to repeak the PA grid control for maximum output in the tune position.

CAUTION: Do not hold the transceiver in TUNE position for more than 30 seconds at a time, even though PA PLATE is resonated. With full grid drive to the 6HF5 PA tubes, which you have in TUNE position, they are dissipating considerably more power than they do during normal voice transmission, so a short tuning period must be observed.

6. Under some conditions, it may not be possible to load up to 500 ma. This may occur with lower than normal line voltage or tubes not quite up to par, particularly on 10 and 15 meters. The current increase when tuning the

plate circuit off resonance will provide a clue as to how far the power amplifier can be loaded. If the meter swings up to 600 or 700 ma. on either side of resonance, it will be easy to load up to 500 or even more. But, if the tubes draw just 500 ma. off resonance, you can only load to 400 or 450 ma. This is not necessarily a sign that you have a problem. Peak input power with voice modulation will still be 400 watts when you load to 400 ma. in TUNE position. A new pair of PA tubes may allow you to load higher, or possibly a new driver tube will help. Primarily, the level to which you can load will serve as an indication of when tubes are deteriorating. If you can load to 500 ma. when the set is new, and after a few months of operating you cannot get above 400 ma., or so, it is probably time to replace the 6HF5 tubes, and possibly the 6GK6 driver. The other tubes should also be checked at that time.

7. **AVERAGE PA LOAD SWITCH POSITIONS.** The following positions are for a 50 ohm non-inductive load, and indicate approximately where the PA LOAD switch will end if the antenna and coaxial cable are well matched.

BAND	PA LOAD SWITCH
80	POS. 7
40	8
20	9
15	9
10	10

A large deviation from these positions indicates a possible matching problem, although operation may still be quite satisfactory. PA LOAD switch positions below 5 will generally be needed only with very low impedance loads, such as a 75 meter mobile antenna with center loading coil.

8. **VOICE TRANSMISSION.** After tuning up as outlined above, press the Push-to-Talk button on the mike and carefully set the CAR. BAL. control for minimum meter reading. While speaking into the mike, slowly rotate the MIC. GAIN control until occasional peak reading of 175 to 200 ma. are obtained. With most microphones, the MIC. GAIN control will be set between 9 and 12 o'clock, but it may vary considerably. The ALC circuit will help limit cathode current to about 200 ma., but turning the MIC. GAIN up too high will still produce flat-topping and spurious signals, so it is important to hold it down. The meter is quite heavily damped, and its reading with average voice modulation may not look very impressive, but the voice peaks are going well over the 480 watt power rating of your Swan transceiver, and signal reports will verify this fact. **NOTE:** Transceiver will not modulate with Function Switch in CAL. position.

8. TRANSMITTER TUNING WITH SWR BRIDGE OR FIELD STRENGTH METER.

If either of these instruments is available, they are highly recommended as a better method of tuning the PA Amplifier, since they provide a direct indication of relative output. With the SWR Bridge in Forward position, or with the Field Strength Meter set to pick up a portion of the radiated power, simply adjust the PA TUNE and PA LOAD controls for maximum output. This must be done quickly, limited to about 30 seconds, to limit tube dissipation as previously mentioned. This method will result in maximum possible output and efficiency, as well as maximum linearity. You will probably find that cathode current readings end up somewhat less than 500 ma. on 10 meters because grid drive is the least on this band. On 80 meters where grid drive is the greatest, maximum output will be reached at more than 500 ma. These are a normal condition.

NOTE—The cathode current level to which the PA is loaded will have no bearing on tube life. When transmitting with normal voice modulation, average power input will be the same regardless of how high or low the PA was loaded while tuning. Peak output, linearity, and lowest distortion will go along with maximum loading. In other words, you will not extend tube life by loading to a lesser degree. The secret to long tube life is simply to keep TUNE-up periods short and not too frequent.

AM OPERATION (Single Sideband With Carrier)

1. Tune transmitter to full output on single sideband as described above.
2. Rotate MIC GAIN control to minimum full CCW.
3. With Push-to-Talk pressed, rotate CAR. BAL. control until cathode current is approximately 150 ma.
4. While talking in a normal tone of voice into the microphone, increase MIC GAIN setting until the meter kicks upward slightly. This setting will result in excellent AM transmission.

CW OPERATION—SPECIAL NOTE

1. Tune transmitter to full output same as for SSB operation. Then adjust carrier balance for a meter reading of approximately 2/3 the maximum tune-up reading. For example: If tune-up results in 400 ma. cathode current, adjust carrier balance for approximately 275 ma., or if tune-up reading is 500 ma., then reduce to approximately 350 ma. for CW, etc. Note: This reduction in drive is essential on 15 meters in order to eliminate a possible spurious radiation.
2. Insert CW Key in the Key Jack provided on the back of the 500. Use a standard 1/4 inch diameter 2 circuit phone plug.
3. Switch to TUNE-CW position to transmit. Back to RECEIVE for receiving.

D. ALIGNMENT AND TROUBLESHOOTING

GENERAL

The following procedures are given in the order performed during the factory alignment for the transceiver. For home servicing, only partial alignment may be necessary. Read all procedures carefully before commencing either partial or complete alignment. See Figures 4 and 5 for component placement.

Equipment Required

1. Calibrated audio frequency signal generator, range 200 to 5000 cps.
2. 500 watt dummy load with output meter
3. Vacuum tube voltmeter
4. Walsco 2543 coil adjustment tool
5. Field strength meter
6. Calibrated RF Signal Generator

Pre-Alignment Conditions

1. Neutralizing capacitors C413 set to mid-point and C315 set to approximately 3/4 turn from full compression.
2. Peak IF transformers for maximum background noise with AF and RF gain full clockwise (either bottom or top core adjustment).
3. Loosely couple field strength meter to C318 (off pin 9 of V4) with alligator clip on ceramic capacitor body.
4. Transmit bias potentiometer full counter-clockwise (maximum bias).

VFO AMPLIFIER PLATE CIRCUIT ALIGNMENT

With VTVM from pin 1 of V7, Receiver Mixer, to ground, on -15 volt scale, adjust VFO Amplifier Plate coils for peak VTVM heading as follows:

Band	VFO Frequency (kc)	Dial Frequency (kc)	Coil
80	8,975	3,800	L104
40	12,300	7,125	L103
15	16,050	21,225	L102
10	23,325	28,500	L101

TRANSMITTER MIXER AND DRIVER PLATE CIRCUIT ALIGNMENT

1. Remove screen voltage from V4 and V5 by disconnecting the wire from terminal strip immediately adjacent to V5 base. (A, Fig. 5).

I MODEL 500 TRANSCEIVER

Operation (Cont.)

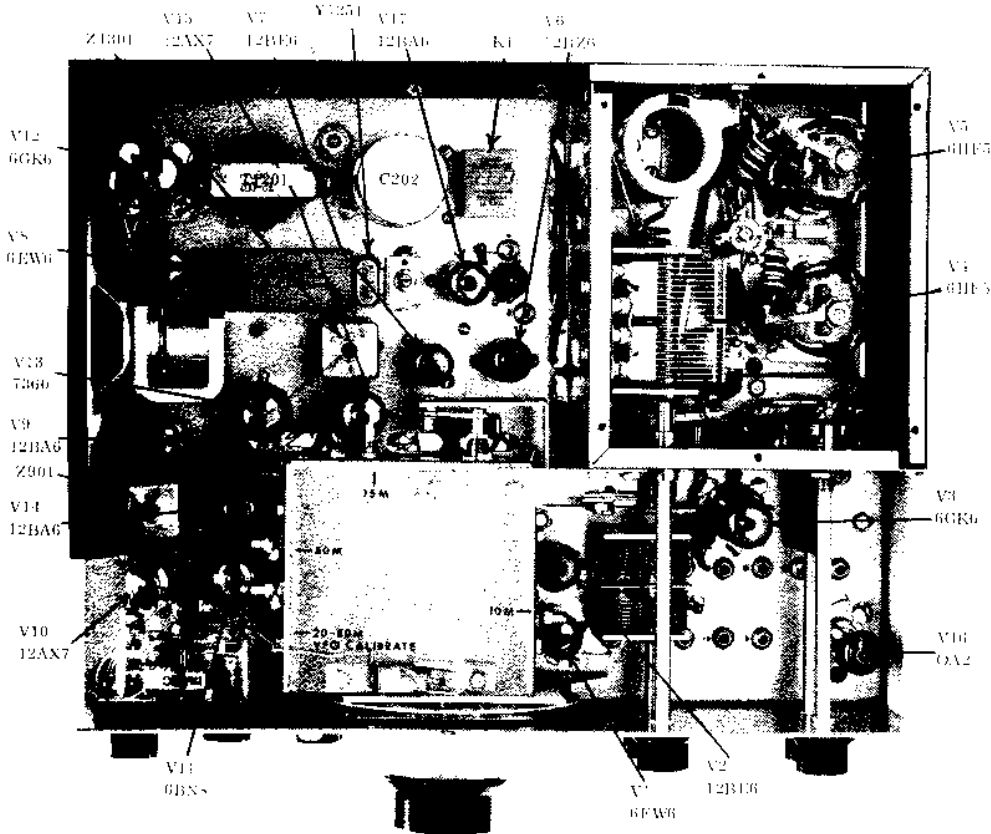
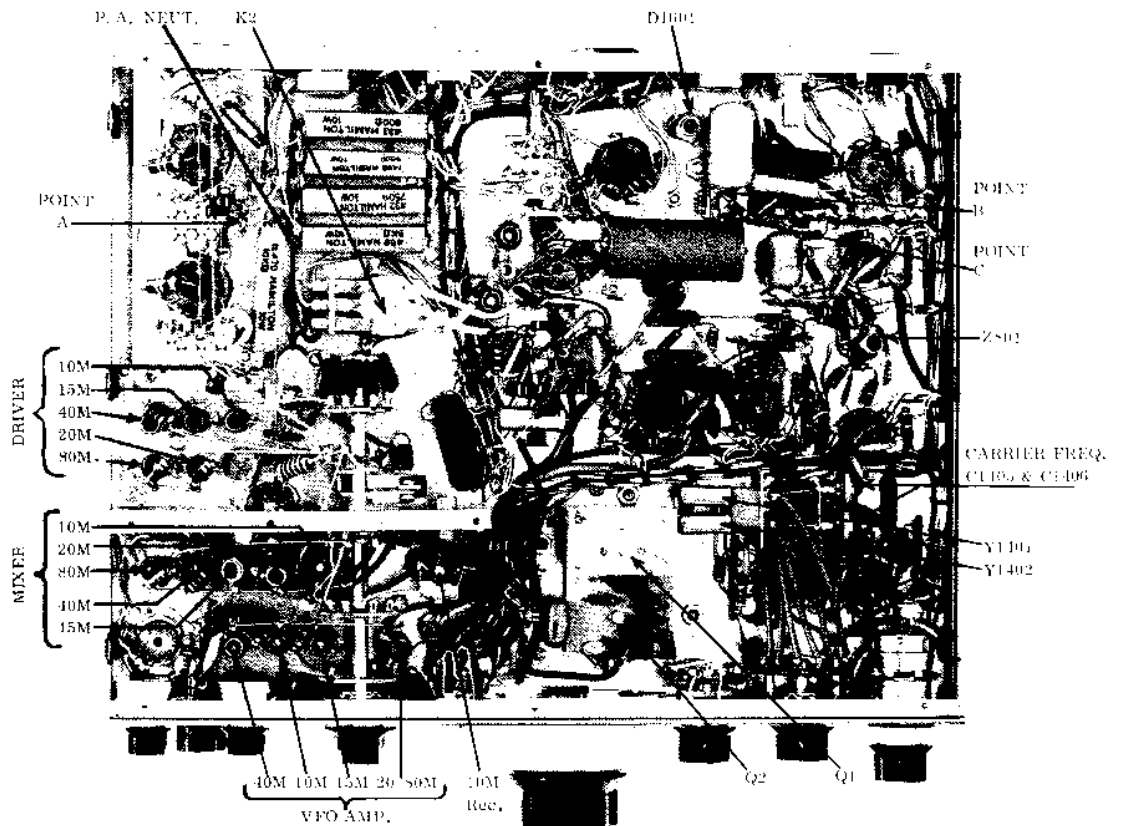


FIGURE 4
TOP VIEW,
MODEL 500
TRANSCEIVER

FIGURE 5
BOTTOM VIEW,
MODEL 500
TRANSCEIVER



2. Connect VTVM across R412, 4.7K resistor between pins 1 and 2 of terminal strip, using 15 volt scale. (Points B and C, Fig. 5).

Procedure:

Adjust band switch and P.A. Grid as shown, and adjust coils for peak VTVM reading as follows, with function switch in Tune position:

Band	P.A. Grid	Dial Freq. (kc)	Adjust
80	12 o'clock	3,800	L205, Z1301 C1402, L1305
40	11 o'clock	7,150	L204, L304
20	11 o'clock	14,150	L203, L303
15	2 o'clock	21,450	L202, L302
10	2:30 o'clock	29.7	L201, L301

*Note: If VTVM and field strength meter exceed full scale reading, switch to REC. position, actuate push-to-talk circuit, and insert carrier with carrier balance control to keep reading on scale. Field strength meter and VTVM must both peak at same time since it is possible to tune the coils to the VFO frequency on 10 meters. Care must be taken that the coils be tuned properly.

Following the above procedures, replace screen wire to pin 1 of terminal strip adjacent to V5.

ALIGNMENT OF 5175 KC FILTER TRAP

With RF and AF gain at midscale, feed 5175 kc signal to antenna connector and adjust L602 until the heterodyne signal is nulled to minimum.

ALIGNMENT OF 13 MC FILTER TRAP

Tune VFO to 14,325 kc, insert RF signal to antenna at 13,000 kc and tune RF generator for heterodyne signal in speaker. Adjust L603 and L604 for minimum heterodyne signal.

ADJUSTMENT OF CARRIER FREQUENCY

- A. With dummy load and output meter attached, tune transceiver for maximum output.
- B. Null out carrier with PTT pressed and set resting plate current to 50 ma with bias pot.
- C. Connect AF generator to MIC JACK, adjust MIC. GAIN full CCW.

Procedure:

1. With AF generator at 1500 cps. increase MIC. GAIN to produce a 100 ma. reading on the meter.
2. Adjust Z801 for maximum meter reading.
3. Adjust both top and bottom cores of Z1301 for maximum meter reading.
4. Adjust MIC. GAIN for meter reading of 300 ma.
5. Set AF generator to 300 cps. Adjust C1402 for meter reading of 75 ma.

P.A. NEUTRALIZATION

With P.A. coarse load in position 1, set freq. to 14.150, PA Plate control at 9 o'clock, insert carrier and peak P.A. Grid control, adjusting Car. Bal. control for 200 MA. Turn PA control slowly through resonance. Cathode current should dip smoothly and rise to 200 MA on the low capacity side of resonance. If, instead, there is a peak above 200 MA either side of the dip, stop rotation of the PA plate control at the peak and adjust C413 to reduce I_p to 200 MA. Repeat above check and readjust as necessary to obtain the desired smooth dip. For 10 meters, use above procedure but adjust #C 315.

ADJUSTMENT OF L601

With transceiver tuned to 28.8 mc, and RF and AF gain at maximum, adjust L601 for maximum background noise.

S-METER ADJUSTMENT

With antenna disconnected and with RF Gain fully clockwise, set R605, located on rear panel, for zero meter reading. Make sure no local signals are being received. It will be noticed that a slight change in S-meter zero setting will change when switching from band to band. Also, when using the ANL circuit there will be a decrease in the S-Meter reading. This is normal.

VFO ALIGNMENT

A locking type trimmer condenser is provided for each VFO range, of which there are four. The same range is used on both 20 and 80 meters. Dial tracking has been factory set by pruning the coil, and will not ordinarily require further adjustment.

When dial calibration changes beyond the adjusting range of the front panel dial set control, calibration may be restored by carefully adjusting the trimmer for that range. It may be necessary to loosen the locknut. Be sure to tighten it again.

The following chart lists the actual oscillating frequency of the VFO at band edges:

Dial Frequency	Oscillator Frequency
3500 (13.85)	8673 KC
3800 (14.15)	8973
4000 (14.35)	9173
7000	12,173
7200	12,373
7300	12,473
21,000	15,827
21,250	16,077
21,450	16,277
28,000	22,827
28,500	23,327
29,000	23,827
29,700	24,527

TROUBLESHOOTING GUIDE	
DEFECT	POSSIBLE CAUSE
PA IDLING CURRENT UNSTABLE	<ol style="list-style-type: none"> 1. Defective 6HF5 - See NOTE. 2. Defective Bias Potentiometer 3. Defective Bias Supply
INABILITY TO LOAD TO 400-500 MA. (SEE PAGE 10)	<ol style="list-style-type: none"> 1. PA Grid Improperly Tuned 2. Bandswitch Improperly Set 3. Antenna Not Resonant at Frequency 4. Defective Transmission Line 5. Defective Mobile Antenna Coil 6. V2, V3, V4, V5 Defective 7. R407 or R408 Defective
INSUFFICIENT CARRIER SUPPRESSION	<ol style="list-style-type: none"> 1. Carrier Balance Control Improperly Adjusted 2. Defective 7360 Balanced Modulator 3. Carrier Oscillator Frequency Incorrect
INSUFFICIENT SIDEBAND SUPPRESSION	<ol style="list-style-type: none"> 1. Excessive MIC. Gain 2. Incorrect PA Load Adjustment 3. Carrier Oscillator Frequency Incorrect
MICROPHONICS IN RECEIVER	<ol style="list-style-type: none"> 1. Z901 Improperly Tuned 2. V14, V10, V8, V7, or V6 Defective
LOW RECEIVER SENSITIVITY	<ol style="list-style-type: none"> 1. PA Grid, Plate, or Load Improperly Set 2. Bandswitch Improperly Set 3. K2 Back Contacts Defective 4. V6, V7, V8, V9, V10, V11, V12 Defective

NOTE: It is recommended that the final tubes be replaced with General Electric tubes for neutralization purposes.

TUBE TYPE	VOLTAGE CHART											
	PIN NO.											
	1	2	3	4	5	6	7	8	9	10	11	12
V1 6EW6	R	0	.75	6.3	0	130	130	0				
	T	0	.75	6.3	0	125	125	0				
V2 12BE6	R	-90	0	12.6	0	245	240	.90				
	T	-2.0	0	12.6	0	245	100	0				
V3 6GK6	R	0	-30	0	6.3	0	0	255	255	0		
	T	0	-6.0	0	6.3	0	0	250	250	0		
V4 6HF5	R	6.3	-	-	0	-.75	0	-	0	-.75	0	0
	T	6.3	-	-	.12	-.75	215	-	215	-.75	.12	0
V5 6HF5	R	12.6	-	-	0	-.75	0	-	0	.75	0	-.6.3
	T	12.6	-	-	.12	-.75	215	-	215	-.75	.12	-.6.3
V6 12BZ6	R	-.05	.8	0	6.3	230	140	0				
	T	-.5	0	0	6.3	230	-20	0				
V7 12BE6	R	-3.0	0	12.6	0	235	75	.1				
	T	-3.0	0	12.6	0	210	-20	.3				
V8 6EW6	R	-1	.5	12.6	6.3	240	130	0				
	T	-1	0.5	12.6	6.3	205	120	0				
V9 12BA6	R	-.05	0	12.6	0	230	105	3.2				
	T	-.5	0	12.6	0	220	-15	0				
V10 12AX7	R	110	-.05	1	12.6	0	160	0	1.5	6.3		
	T	40	-.25	.5	12.6	0	155	-100	5	6.3		
V11 6BN8	R	0.2	2.5	0.2	12.6	6.3	0	200	4	70		
	T	0	2.3	0	12.6	6.3	-.3	100	.2	40		
V12 6GK6	R	0	-.6	-	12.6	6.3	-	240	230	0		
	T	0	-.21	-	12.6	6.3	-	250	220	0		
V13 7360	R	0	0	-.90	6.3	0	225	225	25	25		
	T	0	70	0	6.3	0	135	135	23	23		
V14 12BA6	R	-7	0	0	12.6	60	100	1				
	T	-7	0	0	12.6	50	100	1				
V15 12AX7	R	95	0	0.8			70	0.2	0	0		
	T	50	0	0.3	6.3	-6.3	50	0.2	0	0		
V16 0A2	R	150	-	-	-	-	150	0				
	T	150	-	-	-	-	150	0				
V17 12BA6	R	0	0	12.6	0	240	240	70				
	T	0	0	12.6	0	240	240	70				
All Voltage Measurements Made With Simpson 260, 20 K Ohms per Volt, Or Equivalent												

E. PARTS LIST

CAPACITORS

C101	.002, 20% 1 KV Disc	C416	270, 5% 2500V Mica	C1306	.01 +80-20% 500V Disc
C102	.01, +80-20%, 500V Disc	C417	320 pf P.A. Tune	C1401	27, 5% 500V Mica
C103	.002, 20% 1 KV Disc	C418	50 10% 6 KV Disc	C1402	50, 5% 500V Mica
C104	.01, +80-20%, 500V Disc	C419	100 10% 6 KV Disc	C1403	50, 5% 500V Mica
C105	.01, +80-20%, 500V Disc	C420	410 pf P.A. Fine Load	C1404	15, 5% 500V Mica
C106	50, 5% 500V Mica	C421	Two 150 ± 5% 1000 WV Mica	C1405	6-30 pf Ceramic Trimmer
C201	.01, +80-20%, 500V Disc	C422	Two 150 ± 5% 1000 WV Mica	C1406	6-30 pf Ceramic Trimmer
C202	40-30-10-20 Mfd. 450-450-450-25 WV Elect.	C423	330, 10% 500V Mica	C1407	.01 +80-20% 500V Disc
C203	.002, 20% 1 KV Disc	C424	330, 10% 500V Mica	C1501	.01, 400V Mylar
C204	.001, 5% 500V Mica	C425	330, 10% 500V Mica	C1502	.01 +80-20% 500V Disc
C205	82, 5% 500V Mica	C426	330, 10% 500V Mica	C1503	.01 +80-20% 500V Disc
C206	24, 5% 500V Mica	C427	330, 10% 500V Mica	C1504	100, 20% 1 KV Disc
C207	120, 5% 500V Mica	C428	330, 10% 500V Mica	C1505	.01 +80-20% 500V Disc
C208	27, 5% 500V Mica	C429	330, 10% 500V Mica	C1506	20 mf 25VDC
C209	20, 5% 500V Mica	C430	.002, 20% 1 KV Disc	C1507	.47 200V
C210	27, 5% 500V Mica	C431	.47 10% 100V Mylar	C1601	80 mf, 150 WV Electrolytic
C211	50, 5% 500V Mica	C432	.01 Disc SM	C1602	.01 +80-20% 500V Disc
C212	1.5-20pf Mica Trimmer	C601	.01 +80-20%, 500V Disc	C1603	1 MF 50V
C213	3.3 pf 10% 500V Ceramic	C602	.01 +80-20%, 500V Disc	C1604	2 MF 50V
C214	.1 mf 10% 200V Mylar	C603	.01 +80-20%, 500V Disc	C1701	270, 2% SM
C215	100, 5% 500V Mica	C604	10, 5% 500V Mica	C1702	470, 5% SM
C216	-5, 10% NPO Disc	C605	5, 10% NPO	C1703	430, 2% SM
C217	10, 5% 500V Mica	C606	100, 5% Mica	C1704	27, 5% SM
C218	100, 5% 500V Mica	C607	1.5-20 pf Mica Trimmer	C1705	430, 2% SM
C219	1.5-20 pf Mica Trimmer	C701	30, 10% 1 KV Disc	C1706	5-12 Main Tuning
C301	.01 +80-20%, 500V Disc	C702	30, 10% 1 KV Disc	C1707	.01, 500V Disc
C302	.01 +80-20%, 500V Disc	C703	.01 +80-20% 500V Disc	C1708	5 pf Trimmer
C303	100 5% 500V Mica	C704	220 5% 500V Mica	C1709	22, N 220 Disc
C305	100, 5% 500V Mica	C705	430 5% 500V Mica	C1710	10, N 150 Disc
C306	27, 5% 500V Mica	C709	.01, +80-20% 500V Disc	C1711	5, N 150 Disc
C307	50, 5% 500V Mica	C802	.01, +80-20% 500V Disc	C1712	5 pf Trimmer
C308	.002, 20% 1 KV Disc	C803	.01, +80-20% 500V Disc	C1713	10, N 150 Disc
C309	510, 5% 500V Mica	C804	10, 10% 1 KV Disc	C1714	25 NPO Disc
C310	540, 5% 500V Mica	C805	.01, +80-20% 500V Disc	C1715	5 pf Trimmer
C311	100, 5% 500V Mica	C806	50 5% N750 Disc	C1716	.01 500V Disc
C312	680, 5% 500V Mica	C807	50 5% N750 Disc	C1717	2 pf Dial Set
C313	50, 5% 500V Mica	C901	.01 +80-20% 500V Disc	C1718	22, N 75 Disc
C314	91, 5% 500V Mica	C902	.01 +80-20% 500V Disc	C1719	39 NPO Disc
C315	1.5-20 pf Mica Trimmer	C903	.01 +80-20% 500V Disc	C1720	5 pf Trimmer
C316	15, 20% 3KV Disc	C904	.01 +80-20% 500V Disc	C1721	5, N 75 Disc
C317	330, 5% 500V Mica	C1001	100, 5% 500V Mica	C1751	5-80 Ceramic Trimmer
C318	.002, 20% 1 KV Disc	C1002	220, 20% 1 KV Disc	C1752	150, 5% 500V Mica
C319	68pf DM15	C1003	.002, 20% 1 KV Disc	C1A-B	85 pf per section
C320	1.5-20pf Mica Trimmer	C1004	.001, 20% 1 KV Disc		
C401	.002, 20% 1 KV Disc	C1005	.001, 20% 1 KV Disc		
C402	.002, 20% 1 KV Disc	C1006	.22 mf 200VDC		
C403	.01, +80-20%, 500V Disc	C1007	500, 20% 1 KV Disc		
C404	.01, +80-20%, 500V Disc	C1008	.002 20% 1 KV Disc		
C405	.01, +80-20%, 500V Disc	C1009	.002 20% 1 KV Disc		
C406	10 mf 150 WV Electrolytic	C1101	.001 20% 1 KV Disc		
C407	.01, +80-20%, 500V Disc	C1102	.01 +80-20% 500V Disc		
C408	.01, +80-20%, 500V Disc	C1104	.001 500V Disc		
C409	.01, +80-20%, 500V Disc	C1201	.01 +80-20% 500V Disc		
C410	.002, 1 KV Disc	C1202	220 20% 1 KV Disc		
C411	.002, 20% 2 KV Disc	C1203	.0047 10% 1000V Mylar		
C412	.002, 20% 2 KV Disc	C1204	.1 200VDC		
C413	20 pf P.A. Neut. Trimmer	C1301	.01 +80-20% 500V Disc		
C414	15, 20% 3 KV Disc	C1302	220 20% 1 KV Disc		
C415	270, 5% 2500V Mica	C1303	.01 +80-20% 500V Disc		
		C1304	.002 20% 1 KV Disc		
		C1305	.01 +80-20% 500V Disc		

RESISTORS

R101	82 ohms
R102	56 ohms
R103	47K - 1 watt
R104	12K - 2 watt
R201	27K
R202	18K - 2 watt
R203	4.7K - 1 watt
R204	6.8K
R205	6.8K
R206	4.7K
R207	27K
R301	100K
R302	270K
R303	100 ohms
R304	10K

R305	8.2K	R1404	27K	L1702	40M - VFO Coil
R306	10K	R1405	1K	L1703	15M - VFO Coil
R401	2.2 Meg	R1501	150K	L1704	10M - VFO Coil
R402	1K	R1502	1K	L1705	RFC - 200 uh
R403	100 ohms	R1503	1 Meg. MIC GAIN Pot.	L1706	RFC - 200 uh
R404	100 ohms	R1504	270K	TRANSFORMERS	
R405	Selected	R1505	2.2 Meg.	Z301	Parasitic Suppressor
R406	470 - 5% - 1/2 W	R1506	47K	Z401	Parasitic Suppressor
R407	10K - 10 watt	R1601	800 - 10 watt	Z501	Parasitic Suppressor
R408	1 ohm - 5% - 1 watt	R1602	900 - 10 watt	Z801	5175 kc I.F. Trans.
R409	1 ohm - 5% - 1 watt	R1603	27K	Z901	5175 kc I.F. Trans.
R410	10K Bias Pot.	R1604	27K	Z1301	5175 kc BAL. MOD. Trans.
R411	10K - 1 watt	R1605	750 - 10 watt	T1201	A.F. Output Trans.
R412	4.7K	R1606	6K - 10 watt	SWITCHES	
R413	4.7K	R1608	100K	S-1	Power On-Off
R601	1K	R1609	470K	(part of AF & RF Gain Control)	
R602	56 ohms	R1610	270K	S-2	CAL-REC-TUNE-CW
R603	47K - 1 watt	R1611	270K	S-3	VOX PTT
R604	1K	R1612	10K RF Gain Pot.	S-4	A-B-C-D-E-F Bandswitch
R701	27K	R1613	270K	S-5	PA Coarse Load
R702	22K - 1 watt	R1614	27K	S-6	Sideband Selector
R801	470 ohms	R1701	1K, 5%	S-7	ANL ON-OFF Switch
R802	56 ohms	R1702	1K, 5%	S-46	OSC. Selector
R803	47K	R1703	1K, 5%	DIODES	
R804	1K	R1704	470 ohms 5%	D401	TS-2 ALC Diode
R902	100 ohms	R1705	2.7K	D402	TS-2ALC Diode
R903	27K - 1 watt	R1706	2.7K	D1001	IN 34A ANL
R904	47 ohms	R1707	470 ohms 5%	D1002	IN 34A ANL
R905	100K	R1751	1 Meg.	D1601	IN 2974A Zener
R906	100K - 5%	R1752	27K	D1602	TS-2 Relay Quieting
R907	1K SMeter Zero	R1753	100K	D1603	TS-2 AGC Charging bypass
R1001	10K	COILS		RELAYS	
R1002	1K	L101	23 mc - 2 uh	K1	4PDT Relay, 12 VDC Coil
R1003	100K	L102	16 mc - 4 uh	K2	PDT Relay, 12 VDC Coil
R1004	270K	L103	12 mc - 7 uh	CRYSTALS	
R1005	2.2 Meg.	L104	9 mc - 4 uh	Y1401	5176.8 KC Car. Osc.
R1006	2.2 Meg.	L201	28 mc - 2 uh	Y1402	5172.8 KC Car. Osc.
R1007	270K	L202	21 mc - 2 uh	Y1751	100 KC Crystals Calibrator
R1008	1 Meg.	L203	14 mc - 3.2 uh	TUBES	
R1009	2.7K	L204	7 mc - 3.6 uh	V1	6EW6 VFO Amplifier
R1010	100K	L205	4 mc - 11 uh	V2	12BE6 Trans. Mixer
R1101	470K	L206	RFC - 200 uh	V3	6GK6 P.A. Drive
R1102	1K	L207	5173 kc Trap - Toroid	V4	6HF5 Power Amplifier
R1103	47K	L301	28 mc - 2 uh	V5	6HF5 Power Amplifier
R1104	2.7K	L302	21 mc - 2 uh	V6	12BZ6 Rec. R.F. Amp.
R1105	270K	L303	14 mc - 3.2 uh	V7	12BE6 Rec. Mixer
R1106	120, 1 watt	L304	7 mc - 3.6 uh	V8	6EW6 1st I.F. Amp.
R1201	1 Meg. A.F. Gain Po	L305	4 mc - 11 uh	V9	12BA6 2nd I.F. Amp.
R1202	470K	L306	RFC - 200 uh	V10	12AX7 Prod. Det./Rec. A. F.
R1203	270K	L401	14 mc - 0.8 uh	V11	6BN8 AGC Amp./Rect.
R1204	470K	L402	4 mc - 6 uh	V12	6GK6 A.F. Output Amp.
R1301	47K	L403	RFC - 38 uh	V13	7360 Bal. Mod.
R1302	47K	L404	RFC - 200 uh	V14	12BA6 Carrier Oscillator
R1303	150K	L405	RFC - 55 uh	V15	12AX7 Mic. Amplifier
R1304	4.7K	L406	RFC - 17 uh	V16	OA12 Voltage Regulator
R1305	5K CAR. BAL. Pot.	L601	28 mc - 1.2 uh	V17	12VA6 100 kc Oscillator
R1306	47K	L602	5175 kc - 90 uh	TRANSISTORS	
R1307	47K	L603	13 mc, 30 uh	Q1	2N706
R1308	100K	L604	13 mc, 1.5 uh	Q2	2N706
R1309	100K	L605	18 mc, 17 uh		
R1310	27K	L701	RFC - 200 uh		
R1401	1 Meg.	L1001	RFC - 200 uh		
R1402	270 ohm	L1701	80/20M - VFO Coil		
R1403	27K				

G. POWER SUPPLIES

GENERAL DESCRIPTION:

The Swan Universal Power Supply systems are designed to provide all necessary voltages required by Swan Transceiver models 240, 250, 300-C, 350, 400, and 500. The model 117-X basic A.C. supply is designed for an input of 117 volts at 50 or 60 cycles. The model 230-X is identical except that it operates with either 117 or 230 volts. For fixed station use, the 117-X or 230-X is installed in a cabinet which matches the Swan transceivers. This cabinet also contains a speaker, phone jack, and indicator light. The complete combination is designated as model 117-XC or 230-XC. The A.C. line cord plugs into the back of the supply. In the 230-XC, provision for changing from 117 to 230 volts input is made by simply changing line cords. Wiring changes are taken care of in the line cord plug.

12 VOLT OPERATION: (

A D.C. Module attaches to the back of the A.C. supply and converts it for 12 volts D.C. input. The model 14-X D.C. Module is for negative ground systems, the most common type. (For positive ground systems, the model 14-XP D.C. module is available.) The combined units are designated as model 14-117 or 14-230 depending on which A.C. supply is used. The positive ground models are designated as model 14P-117 or 14P-230.

With the versatility of this power supply design, a number of advantages become apparent. The D.C. supply may be operated from an A.C. line by detaching the D.C. module, making a simple wiring change, and plugging in an A.C. cord. (See instructions under "Mobile Installation.")

The matching A.C. supply, model 117-XC or 230-XC, may be converted easily to 12 volts input by attaching the 14-X D.C. module to the back. This provides for portable or emergency operation from a 12 volt battery. There may also be times when it will be desirable to operate temporarily in an automobile, such as during a vacation trip, field day, or emergencies. The 117-XC can be set on the floor or front seat, and with the 14-X attached it becomes a 12-volt power supply, complete with speaker.

SPECIFICATIONS:

Power Rating: 200 watts average, 500 watts peak.

Input:

Model 117-X: 117 volts nominal, 50-60 cycles

Model 230-X: 230 volts or 117 volts, 50-60 cycles.

Model 14-X: 13 volts D.C. nominal, 40 amps peak.

Output:

800 volts at 200 ma. average, 600 ma. peak.

275 volts at 150 ma. continuous.

110 volts negative bias, at 100 ma.

12 volts D.C. at 200 ma., relay supply.

12.6 volts A.C. at 5.5 amps. (with A.C. input only)

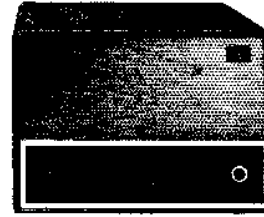


Fig. 6. MODEL 117-XC
AC POWER SUPPLY WITH SPEAKER

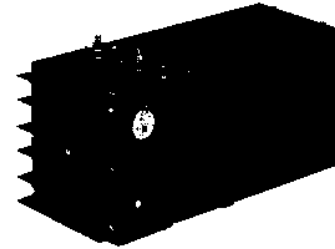


Fig. 7 MODEL 14-117
DC POWER SUPPLY

Battery Drain with Swan Transceiver

Rec: 3.5 amps. Trans: 16 amps average, 40 amps peak (not including filament drain of transceiver).

DESIGN:

Both the A.C. and D.C. sections are conservatively designed for long, reliable service with a minimum failure rate. At the same time, they are designed for easy access and servicing for those times when it is required. Any component can be readily checked out and replaced in a matter of moments. The D.C. module and A.C. supply can be detached quickly from one another and tested individually, thus isolating the source of trouble.

The A.C. supply is quite conventional, using a silicon rectifier bridge for the medium voltage, and another for high voltage. The 117-X has a single primary winding for 117 volt input, while the 230-X has a pair of primary windings which connect in parallel for 117 volts, and in series for 230 volts. The switching is taken care of in the A.C. line cord plug.

The D.C. module uses two power transistors for switching in a flip-flop oscillator circuit. A large portion of the cost in this unit is in the transistors where no compromise has been made. They are rated at 60 amperes, with a 45 volt rating. A diode spike clipping circuit provides additional protection against one of the common sources of transistor failure.

MOBILE INSTALLATIONS READ CAREFULLY

The 12 volt electrical system in an automobile will sometimes generate high voltage transients. This can be caused by the starter motor, the alternator or generator, or loose wiring, and can represent a serious hazard to the transistors in your DC power supply. By selecting the best transistors available for the application, your Swan supply is capable of absorbing a good deal of abuse, but there is a limit to what even the best transistors can take and for this reason we strongly urge that you read the following notes completely, and follow them carefully.

- (1) Clean and tighten the battery terminals and clamps.
- (2) Tighten battery cables where they attach to the starter solenoid and engine block.
- (3) Inspect battery cables for corrosion or wear. Replace them if they look questionable.
- (4) Check battery condition frequently. If the cells do not hold a similar charge or water level, replace the battery.
- (5) Check alternator, (or generator), and regulator connections for tightness. Also, primary ignition wiring, horn wiring, lights, etc.
- (6) Check the charging voltage from the alternator. Often the regulator is misadjusted, and the voltage setting may be excessive. It should not read more than 14.5 volts at normal engine speeds.

POWER SUPPLY INSTALLATION:

- (A) Connect the primary leads from the power supply directly to the battery terminals. Mount the ceramic fuse block with 50 amp. fuse in series with the positive lead. (With positive ground systems, the fuse goes in the negative lead). If possible, drill and tap a hole in the battery post itself for a contact stud. The more intimately the supply is connected to the battery, the less chance there is for voltage transients to reach it. Solder lugs are provided for the ends of the various leads.
- (B) The filament line comes prewired to the Jones plug, and has an in-line 9 amp. fuse. Connect this line to the ignition switch accessory terminal, as recommended in the schematic, Fig. 8. In most cars the 12 volts at this terminal is switched off while twisting the ignition key to start the engine. Thus, the relay in the power supply will also be turned off, and the transistors will not be subjected to the sharp transients put out by the starter motor. **NOTE:** The car radio is normally connected to the accessory terminal for the same reason. It may be more convenient to locate the 12 volt line going to the car radio, and splice into it with the transceiver filament line. Look for

SWAN MODEL 14-X D.C. MODULE

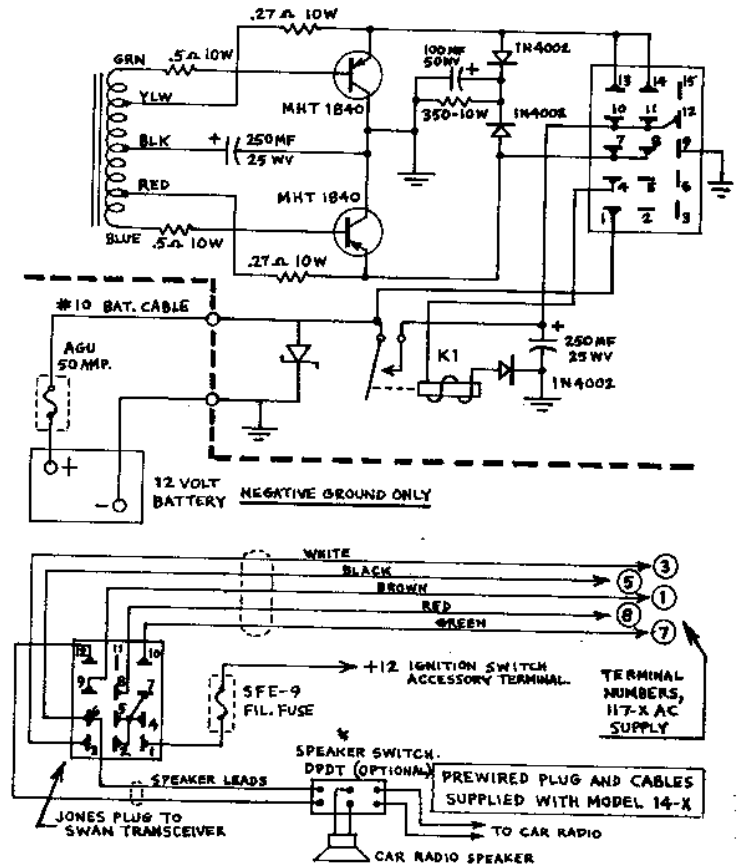


FIG. 8 MODEL 14-X D.C. MODULE

the car radio fuse, and connect to this circuit on the "hot side".

POWER SUPPLY PROTECTION—A Zener diode is installed in the Swan 14-X DC module for added protection. It is an 18 volt Zener which connects across the input terminals of the power supply. It conducts only when the input exceeds 18 volts, thus has no effect on normal operation. Transient voltage pulses which go beyond the 18 volt level will be absorbed by the diode, thus preventing them from reaching the transistors. This protection will be effective so long as the diode is operative. If transients reach a high enough level, or a long enough duration, the diode will eventually fail, and literally burn out. After this, the transistors are on their own, and will most likely fail for the same reason. (See Warranty Policy)

SPEAKER CONNECTIONS: Speaker leads coming from the Jones plug go to an under dash speaker, or to a speaker selector switch which may be installed as illustrated. Another arrangement which works well is to install a rear seat speaker for the car radio, and then connect the front speaker only to the transceiver.

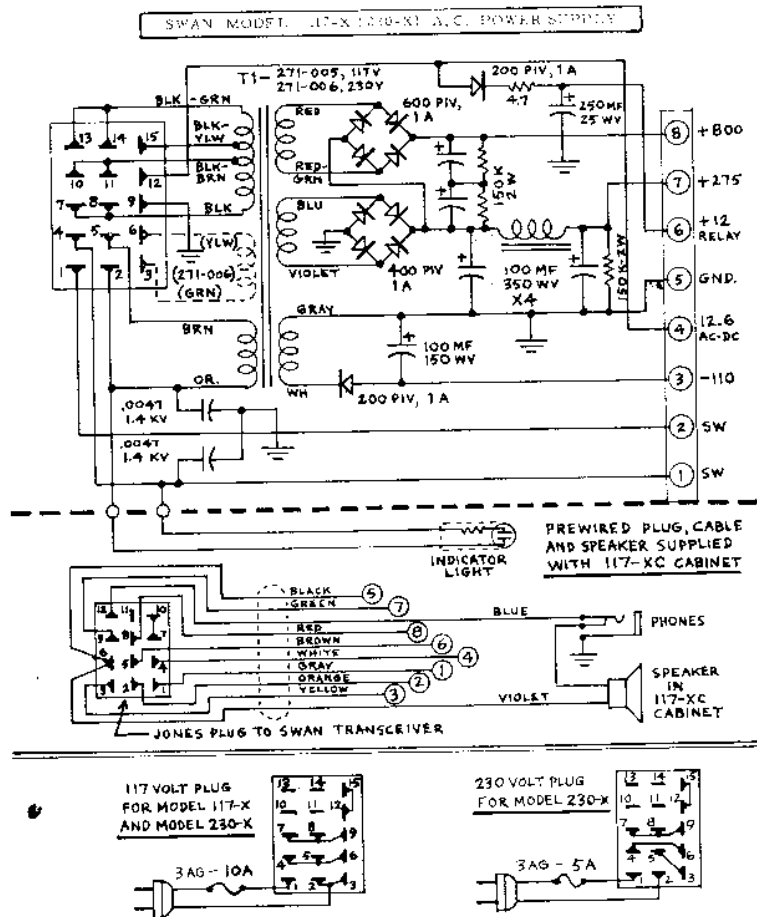


FIG. 9 MODEL 117-X (230-X) POWER SUPPLY

A.C. OPERATION: The 12 volt power supply may be operated from an A.C. line by two methods.

- (A) Detach the D.C. Module, and plug in an A.C. line cord in place of it. Before applying power, disconnect the brown cable wire going to terminal (1) of the A.C. supply and connect a jumper from terminal (1) to (2). Temporarily tape the brown wire to keep it from shorting to ground, since it will be carrying 12 volts D.C. Now the power supply will operate when the A.C. line is plugged in, although the transceiver filaments will still be operating on the battery. This arrangement will be useful primarily for checking out the A.C. portion of the supply when trouble shooting.
- (B) To operate the transceiver entirely on the A.C. line, it will be necessary to do the following: Disconnect the 5 wire cable going from the the transceiver to the A.C. portion of the supply. Replace it temporarily with a 10 wire cable and hook-up as illustrated in the schematic diagram Fig. 9. This is the same cable and speaker hook-up used in the matching cabinet, 117-XC. Using the D.C. supply in this manner will prove useful for portable or

emergency operation from the car when A.C. power is available.

If frequent A.C. as well as D.C. operation with the mobile supply is contemplated, both the 5 wire and 10 wire cables may be connected simultaneously to the supply. Thus, when operating on D.C., the 5 wire cable is plugged into the transceiver, and on A.C. operation the 10 wire cable is used.

MATCHING CABINET:

Ordinarily the A.C. supply will be purchased complete in a matching cabinet as either model 117-XC or 230-XC. However, in some cases an owner may have purchased a 117-X or 230-X basic supply only, perhaps in a D.C. supply combination, and he may wish later on to mount it in a matching cabinet. For this purpose the cabinet with speaker and cables is available separately. The basic A.C. supply mounts inside with three screws, and the pre-wired cable connects as shown in the schematic. Connections to the phone jack and speaker have already been made. Two leads from the indicator light must be run through the grommet and soldered to the terminals provided at the bottom of the

supply. Refer to the schematic for clarification. The A.C. line cord is also provided with the matching cabinet kit. These line cords are available separately also, and come normally wired and stamped for 117 volts. 230 volt line cords are also available on special order, or the 117 volt line cord may easily be wired for 230 volts by referring to the schematic. Note that the 230 volt line cord will work only with the 230-X basic A.C. supply. The 117 volt line cord will work with either the 117-X or 230-X.

POWER SUPPLY

WARRANTY POLICY—The normal guarantee on your Swan power supply is for a period of 90 days from date of purchase, and covers all components, material and workmanship. In the case of transistor failure, however, the warranty on them will be void if inspection proves that high transient voltages from the automobile were responsible. We will do all in our power to be fair and just in this determination. The warranty card must be filled out and mailed to the factory within 10 days from date of purchase. Do not ship a unit to the factory for servicing without prior authorization. Check with your dealer first, as he may be in a position to handle the service work more quickly. This warranty is void if the equipment has been misused or damaged.

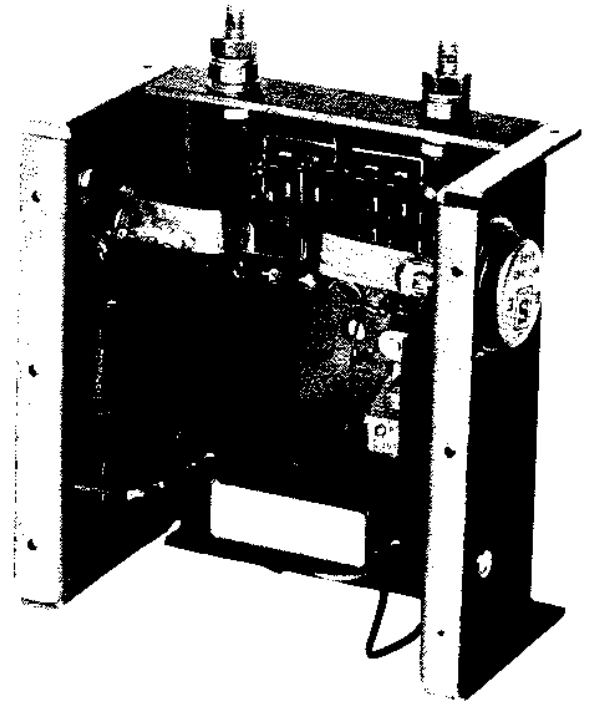


FIG. 10 MODEL 14-X, D.C. MODULE
INTERNAL VIEW

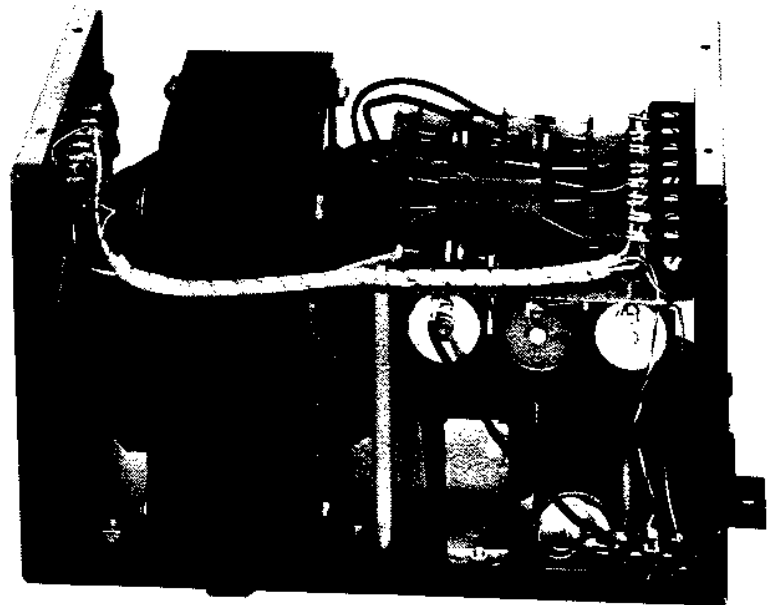
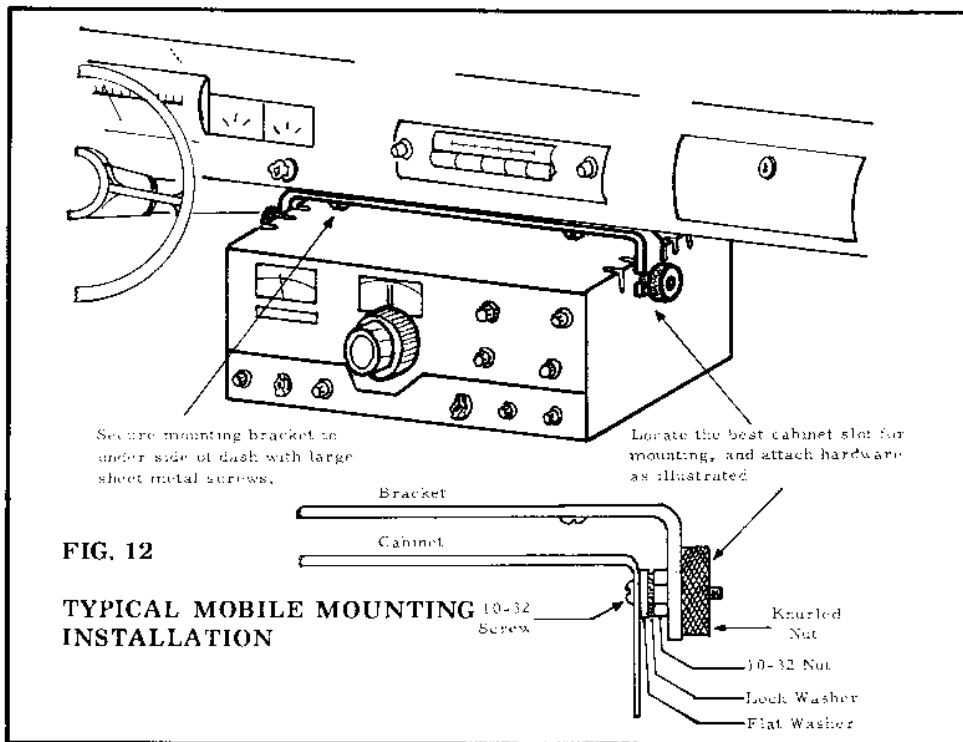


FIG. 11 MODEL 117-X BASIC AC POWER SUPPLY
INTERNAL VIEW



OUTBOARD VFO OPERATION WITH THE 500

Various outboard VFO operations are possible with the Swan 500.

SPLIT FREQUENCY OPERATION

For those desiring to work split frequency, transmit on one—receive on another, the model 22 DUAL VFO ADAPTOR is required. (See page 23) Complete instructions are also supplied with each model 22. The 22 adaptor plugs into the VFO accessory socket on back of the 500.

MARS OPERATION

The model 405X crystal oscillator has been designed for crystal control operation on NET and MARS frequencies and may be plugged directly into the accessory socket on back of the Swan 500 by removing the jumper plug. Plugging the Model 405X directly into the 500, automatically removes the inboard VFO from the circuit. In order to eliminate the trouble of having to plug in the Model 405X each time you wish to use it, it may be used in conjunction with the Model 22 adaptor which provides selection of the VFO you wish to use. (See page 23)

SWAN-405X CRYSTAL CONTROLLED OSCILLATOR

The Model 405X oscillator unit provides for added versatility with the Swan Model 350, 400 and 500 sideband transceiver by crystal controlling the operating frequency. Not only does this permit fixed frequency "net" operation in the 80, 40, and 20 meter amateur bands, but the 405X also permits operation outside the amateur bands for MARS, commercial, and other services.

The standard Model 350, 400 and 500 will tune the following ranges without modification:

3.5 mc Range:	3.2 to 4.6 mc
7 mc Range:	6.8 to 8 mc
14 mc Range:	13.8 to 15 mc

These ranges can be adjusted either up or down quite readily in the field or at the factory, if necessary.

NOTE 1: Earlier models of the 350 and 400 (produced prior to April 1965) may require slight modification to cover the ranges listed above.

NOTE 2: Frequencies between 4.8 and 5.6 mc cannot be used because of proximity to the 5175 kc I.F. system.

(A) USING THE 405X OSCILLATOR WITH THE SWAN-500

The 405X oscillator will plug directly into the VFO socket provided on back of the 500 with no modification.

If separate control of receive and transmit frequency is desired, the Model 22 Dual VFO adaptor is required. With the Model 22 adaptor plugged into the back of the 500, the 405X plugs into its "B" socket. The Model 22 adaptor has a selector switch which provides complete flexibility. Its position #1 provides transceive operation on the frequency of oscillator "A", (oscillator "A" is the internal VFO). In position #2 transmission will be on the frequency of oscillator "A" and reception on the frequency of oscillator "B" . . . Position #3 provides transceive operation on the frequency of oscillator "B".

405X CRYSTAL CONTROLLED EXTERNAL OSCILLATOR

For MARS operation, Net and other fixed channel operations.

SPECIAL NOTE: If both Upper and Lower Sideband operation is required on a given frequency channel, it will require two crystals in the 405X. This is because the I.F. carrier frequency moves 3 kc when the transceiver sideband selector control is switched. A corresponding 3 kc shift is required in the 405X in order to stay on the same frequency channel. Thus, if both sidebands are required, it will take two of the five crystal positions in the 405X. Upper and lower sideband on another channel will take up two more positions, leaving one more position available. Information is provided further on in these instructions for calculating crystal frequency. It is very important to remember that two controls must always be switched when changing sidebands. One is the sideband selector switch on the transceiver, and the other is the channel selector on the 405X.

(B) CALCULATION OF CRYSTAL FREQUENCIES.

- 1 - For operation between 3200 and 4600 kc, (3.5 mc band):
 - Lower Sideband (Normal): Channel frequency Plus 5173 kc
 - Upper Sideband (Opposite): Channel frequency Plus 5176 kc
- 2 - For operation between 6800 and 8000 kc,
 - Lower Sideband (Normal): Channel frequency Plus 5173 kc
 - Upper Sideband (Opposite): Channel frequency Plus 5176 kc
- 3 - For operation between 13,800 and 15,000 kc, (14 mc band):

- Upper Sideband (Normal): Channel frequency Minus 5173 kc
- Lower Sideband (Opposite): Channel frequency Minus 5176 kc

- 4 - For operation between 20,900 and 21,500 kc, (21 mc band):

- Upper Sideband, (Normal): Channel frequency Minus 5173 kc
- Lower Sideband, (Opposite): Channel frequency Minus 5176

(C) INSTRUCTIONS FOR ORDERING CRYSTALS:

NOTE: Swan Electronics does not supply crystals for the 405X oscillator. They must be ordered direct from a crystal manufacturer in the following typical manner:

Name & Address of
Crystal Manufacturer

Gentlemen:

Please ship the following crystal(s) in the HC-6/U type holder with .093 inch diam. pins:

Quantity	Frequency, plus or minus .0025 per cent, parallel resonance at 20 pf shunt capacity, 25 deg. cent.
----------	--

- kc
- kc
- (as calculated)..... kc
- kc
- kc

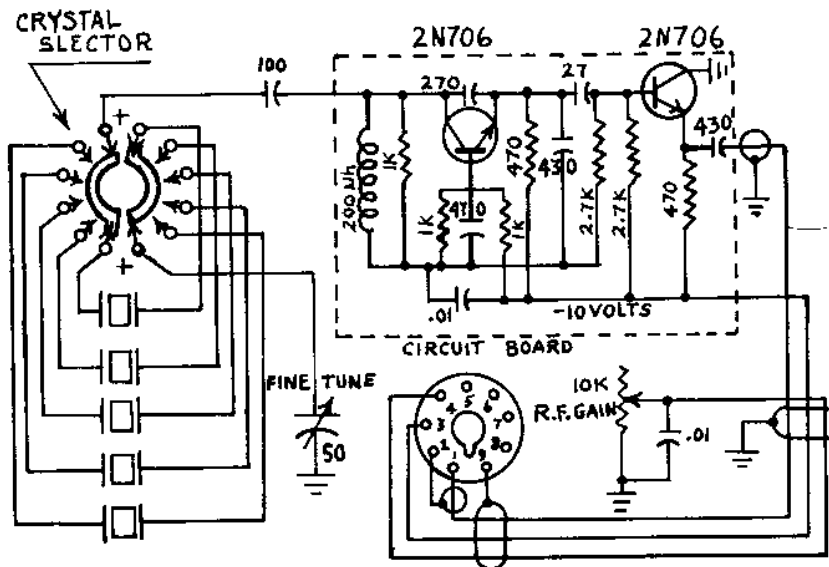
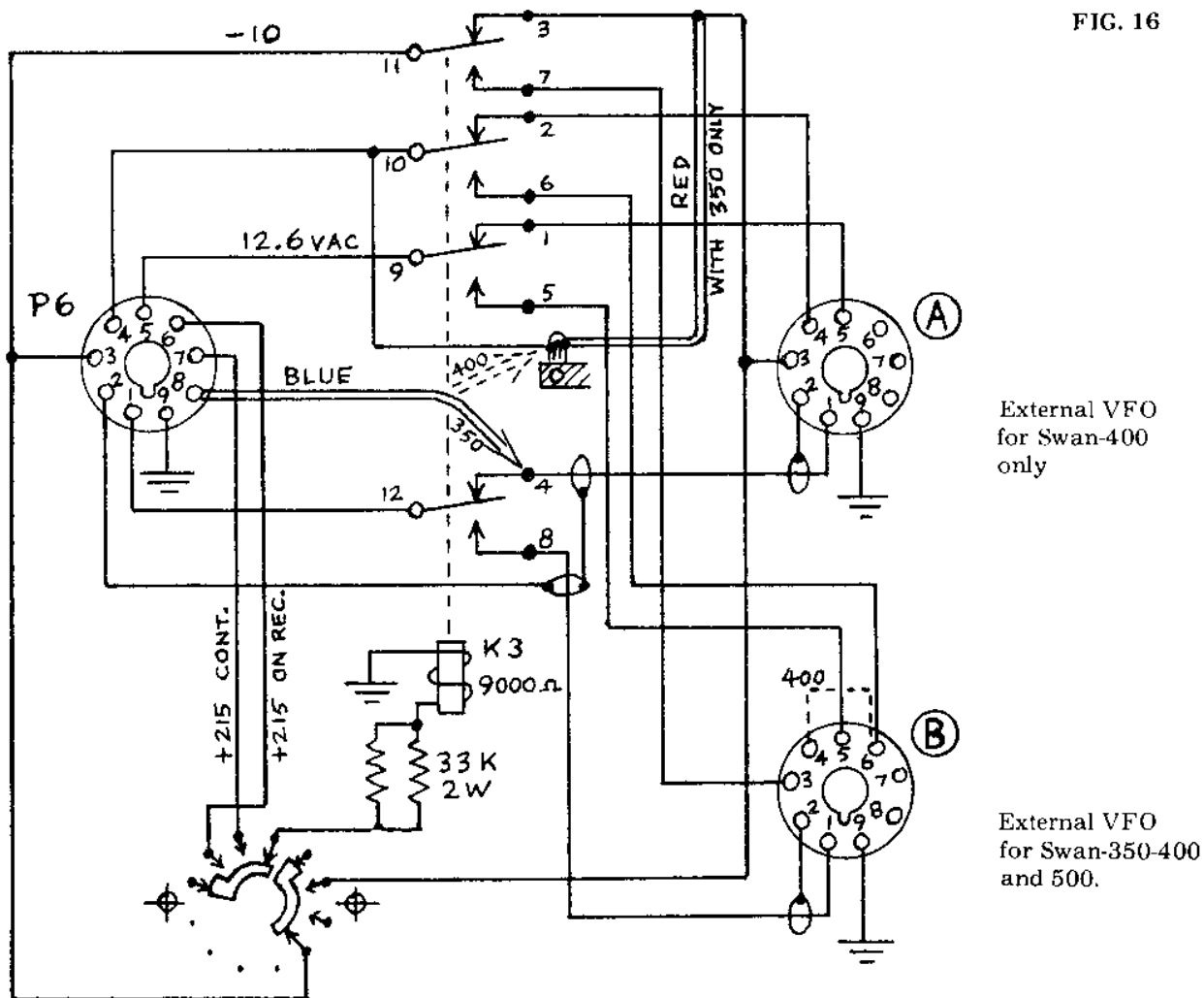


FIG. 16



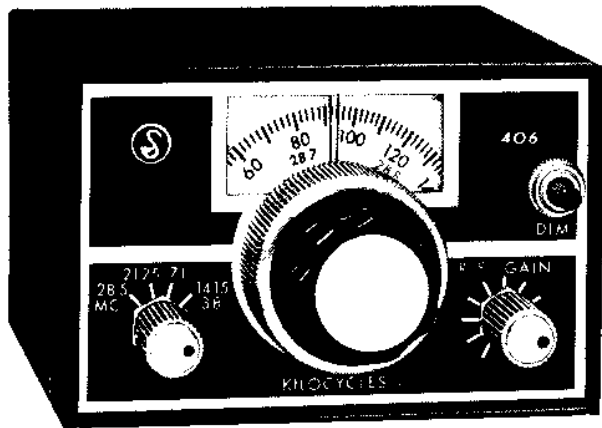
VFO Selector Switch

- Pos. 1 - Transceive on VFO "A".
- Pos. 2 - Transmit on VFO "A", Receive on VFO "B".
- Pos. 3 - Transceive on VFO "B".

NOTE: When used with the Swan-350 or 500, VFO "A" is the internal and VFO "B" is the external VFO. Socket "A" on the adaptor is not used with the 350 or 500.

<p>There are presently 3 models of Swan external VFO's. Any one of them may be used with the 350, or 500, and any combination of two of them may be used with the 400 transceiver.</p> <p>Model-410, full coverage: \$95 Model-406B, phone band, miniature size: \$75 Model-405X, fixed channel: \$45 (less crystals)</p>	<p style="text-align: center;">SWAN MODEL -22 DUAL VFO ADAPTOR</p> <p>Provides for addition of an external VFO to the Swan-350 and 500 single sideband transceiver or for use of two VFO's with the Swan-400.</p> <p style="text-align: right;">SWAN ELECTRONICS CORP. Oceanside, California</p>
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NOTE: Model-22 comes wired for use with the Swan-350 and 500. For use with the 400, see page 3.



**SWAN MODEL 406B
FREQUENCY CONTROL UNIT**

Model 406B Frequency Control Unit is designed for full phone band coverage of 80, 40, 20 and 15 meters, and one 500 kc segment of the 10-meter band. The unit is specifically intended for mobile operation, and provisions for mobile mounting have been incorporated.

CIRCUIT THEORY

Q1, the 2N706 Oscillator operates in the common base configuration, as a Colpitts oscillator. See Figure 6. Capacitors C1801, C2001, and C2003 effectively tap the oscillator across only about 10 percent of the tank circuit. This results in exceptional stability. Q2, the Emitter Follower, is used for matching the impedance of the coaxial cable to the transceiver, as well as for isolation. The band-switch selects the appropriate coil and trimmer for each range. Dial tracking is adjusted with the core and trimmer. With proper adjustment of coils and trimmers, the Model 406B may be used to cover any 200-kc segment in the 80- through 15-meter amateur bands, and any 500 kc segment of the 10 meter band.

INSTALLATION

A universal mounting bracket and mounting screws are supplied with the Model 406B. This bracket may be either top mounted, or bottom mounted, depending on where the 406B is to be mounted in the car. Many of the newer cars have a padded overhang. In other cases, attaching the mounting bracket to the bottom of the 406B will allow installation on a top surface. A row of small holes are provided along the sides of the 406B cabinet for top mounting of the bracket. You will find that the bracket will also allow tilting of the 406B. For bottom mounting, it will be necessary to drill additional holes along the bottom of the cabinet. Remove the cabinet first, and you will find chassis holes already provided for this purpose. Simply add these same holes to the cabinet.

ALIGNMENT

Alignment of the Model 406B requires only the use of a general coverage receiver tuning the frequency ranges between 8 mc and 24 mc. Calibration of the receiver is not critical since the crystal calibrator in the transceiver is used for final adjustment but the receiver must be accurate within 50 kc to permit selection of the proper 100 kc harmonic.

FOR MINOR FREQUENCY ADJUSTMENTS, which may be required after the initial aging period, simply remove the cabinet cover and very carefully adjust the trimmer capacitor marked for the specific range.

FOR MAJOR FREQUENCY ADJUSTMENTS Tune Frequency Control Unit to low end of frequency range, and locate heterodyne with general coverage receiver at frequency indicated in the following table. Adjust vernier coil to bring heterodyne within a few kc of the receiver frequency, then switch on calibrator and adjust vernier coil for zero beat with calibrator at 100 kc increment of dial. Move tuning to high end of tuning range and adjust trimmer capacitor for zero beat. Repeat high and low end adjustments until calibration is correct at both ends. Coil and capacitor locations are marked in the unit.

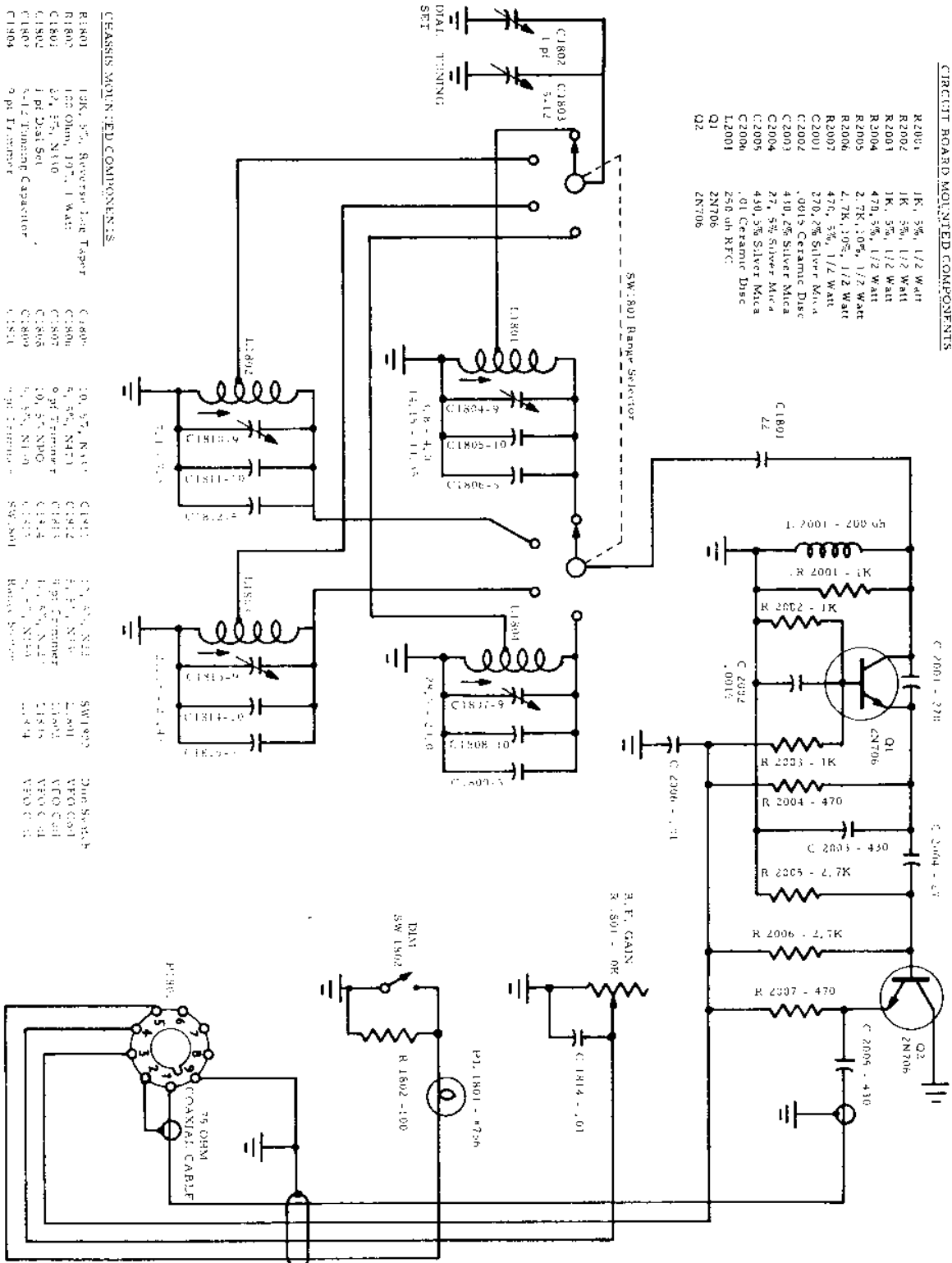
DIAL SET

A dial-set has been provided located at rear of chassis so that dial adjustment can be made at any 100 kc point of the dial. With calibrator on, set the dial to any 100 kc point closest to the frequency you wish to work. Now adjust dial-set control to zero-beat the VFO with the 100 kc Calibrator. This provides greater accuracy of dial readout.

406B FREQ RANGE	OSC. FREQ. (kc)	ADJUST COIL (Low end)	ADJUST CAP. (Hi end)
3.8-4.0 14.15-14.35	Low-High 8973-9173	L1801	C1804
7.1-7.3	12,273-12,473	L1802	C1810
21.25-21.45	16,077-16,277	L1803	C1813
28.5-29.0	23,327-23,827	L1804	C1807

CIRCUIT BOARD MOUNTED COMPONENTS

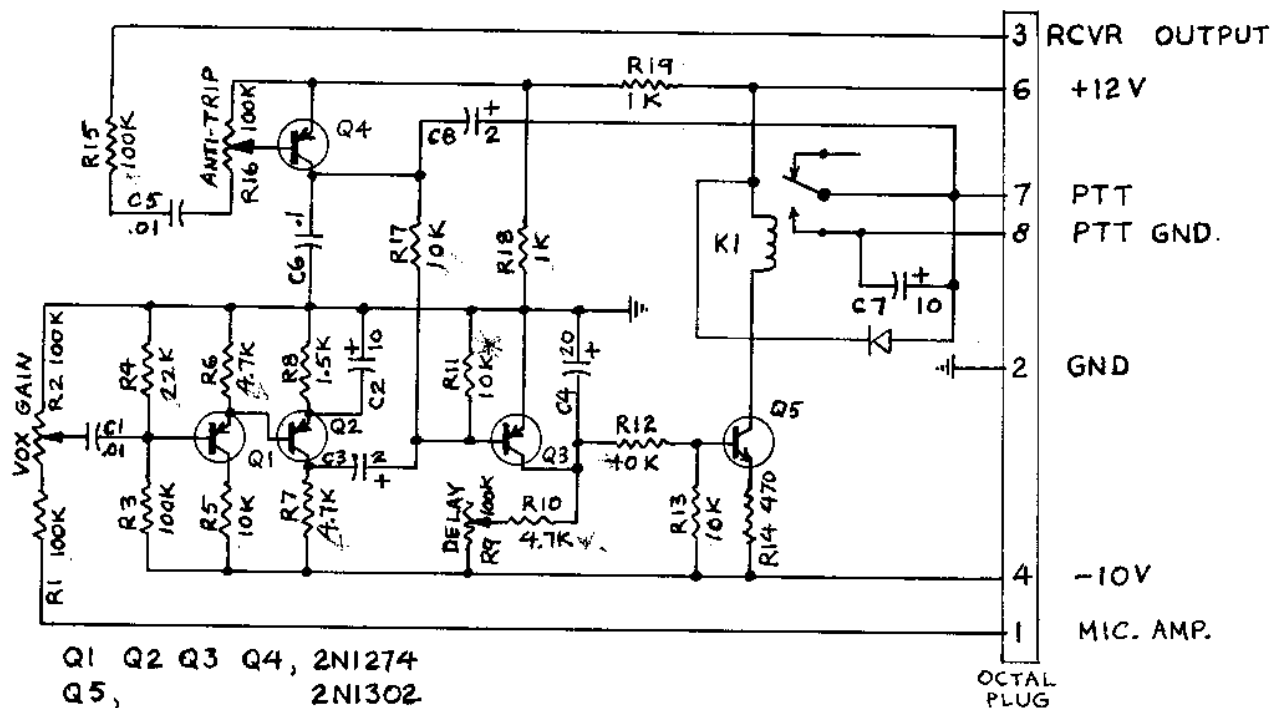
- R 2001 1K, 5%, 1/2 Watt
- R 2002 1K, 5%, 1/2 Watt
- R 2003 1K, 5%, 1/2 Watt
- R 2004 470, 5%, 1/2 Watt
- R 2005 2.7K, 10%, 1/2 Watt
- R 2006 4.7K, 10%, 1/2 Watt
- R 2007 470, 5%, 1/2 Watt
- C 2001 370, 2% Silver Mica
- C 2002 .0015 Ceramic Disc
- C 2003 430, 2% Silver Mica
- C 2004 27, 5% Silver Mica
- C 2005 430, 5% Silver Mica
- C 2006 .01 Ceramic Disc
- Q 1 2N706
- Q 2 2N706



CHASSIS MOUNTED COMPONENTS

- R 1801 10K, 5%, Reverse Bias Taper
- R 1802 75 OHM, 10%, 1 Watt
- C 1801 27, 5%, N140
- C 1802 1 pf Dist Sct
- C 1803 5-17 Tuning Capacitor
- C 1804 10, 5%, N471
- C 1805 0 pf Trimmer
- C 1806 10, 5%, N100
- C 1807 5, 5%, N140
- C 1808 5, 5%, N140
- C 1809 4 pf Trimmer
- C 1810 4 pf Trimmer
- C 1811 4 pf Trimmer
- C 1812 4 pf Trimmer
- C 1813 4 pf Trimmer
- C 1814 4 pf Trimmer
- C 1815 4 pf Trimmer
- C 1816 4 pf Trimmer
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- C 1826 4 pf Trimmer
- C 1827 4 pf Trimmer
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- C 1830 4 pf Trimmer
- C 1831 4 pf Trimmer
- C 1832 4 pf Trimmer
- C 1833 4 pf Trimmer
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- C 1847 4 pf Trimmer
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- C 1867 4 pf Trimmer
- C 1868 4 pf Trimmer
- C 1869 4 pf Trimmer
- C 1870 4 pf Trimmer
- C 1871 4 pf Trimmer
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- C 1892 4 pf Trimmer
- C 1893 4 pf Trimmer
- C 1894 4 pf Trimmer
- C 1895 4 pf Trimmer
- C 1896 4 pf Trimmer
- C 1897 4 pf Trimmer
- C 1898 4 pf Trimmer
- C 1899 4 pf Trimmer
- C 1900 4 pf Trimmer

FIG.18 SCHEMATIC DIAGRAM, MODEL 406B FREQUENCY CONTROL UNIT



SWAN ELECTRONICS, Oceanside Calif.

VX-1 SCHEMATIC
Voice Control Accessory
For Swan 250-350-400-500

8-3-65

FIG. 15 PLUG IN VOX ACCESSORY, MODEL VX-1

OPERATING INSTRUCTIONS

1. Place the VOX-PTT switch in the PTT position and adjust the transceiver for normal push-to-talk operation.
2. Plug in the VX-1 and rotate the VOX GAIN, ANTI-VOX, and DELAY controls fully counter-clockwise. Attach the top of the VX-1 to the 350 back with a G-32 screw.
3. Rotate the transceiver MIC. GAIN fully counter-clockwise. This will prevent audio from being transmitted but will not affect VX-1 during initial adjustments.
5. Place the VOX-PTT switch in the VOX position.
6. While speaking into the microphone in a normal manner, slowly rotate the VOX GAIN control clockwise until the VX-1 keys the transmitter. Do not use more VOX GAIN than necessary to assure positive operation at normal voice levels.
7. Increase the receiver gain until received signals are at a normal volume level. These

signals will trip the Vox when picked up by the microphone.

8. With the microphone held in the normal operating position, very slowly increase the ANTI-VOX until received signals do not trip the Vox.

NOTE: Excessive ANTI-VOX gain will cause received signals to gate the VX-1 off so that no amount of sound at the microphone will key the transmitter. Satisfactory balance between the VOX GAIN and ANTI-VOX is easily obtained when the microphone is at least a foot from the speaker.

9. Adjust the DELAY control to hold the transmitter keyed for the desired interval after you stop talking.

NOTE: A little experimenting on the air will reveal that only a small portion of the first spoken syllable is lost when the VX-1 is actuated. Short DELAY settings will result in most efficient operation.



SWAN MODEL 410 FREQUENCY CONTROL UNIT

Model 410 Frequency Control Unit is designed for full coverage of 80, 40, 20, 15 and 10 meters. The unit is specifically intended for fixed station operating and matches the 500 in height, depth, and styling.

CIRCUIT THEORY

Q1, the 2N706 Oscillator operates in the common base configuration, as a Colpitts oscillator. See Figure 6. Capacitors C1801, C2001, and C2003 effectively tap the oscillator across only about 10 percent of the tank circuit. This results in exceptional stability. Q2, the Emitter Follower, is used for matching the impedance of the coaxial cable to the transceiver, as well as for isolation. The band-switch selects the appropriate coil and trimmer for each range. Dial tracking is adjusted with the coil and trimmer.

ALIGNMENT

Alignment of the Model 410 requires only the use of a general coverage receiver tuning the frequency ranges between 8 mc and 24 mc. Calibration of the receiver is not critical since the crystal calibrator in the transceiver is used for final adjustment but the receiver must be accurate within 50kc to permit selection of the proper 100 kc harmonic.

FOR MINOR FREQUENCY ADJUSTMENTS, which may be required after the initial aging period, simply remove the cabinet cover and very carefully adjust the trimmer capacitor marked for the specific range.

FOR MAJOR FREQUENCY ADJUSTMENTS Tune Frequency Control Unit to low end of frequency range, and locate heterodyne with general coverage receiver at frequency indicated in the following table. Adjust vernier coil to bring heterodyne within a few kc of the receiver frequency, then switch on calibrator and adjust vernier coil for zero beat with calibrator at 100 kc increment of dial. Move tuning to high end of tuning range and adjust trimmer capacitor for zero beat. Repeat high and low end adjustments until calibration is correct at both ends. Coil and capacitor locations are marked in the unit.

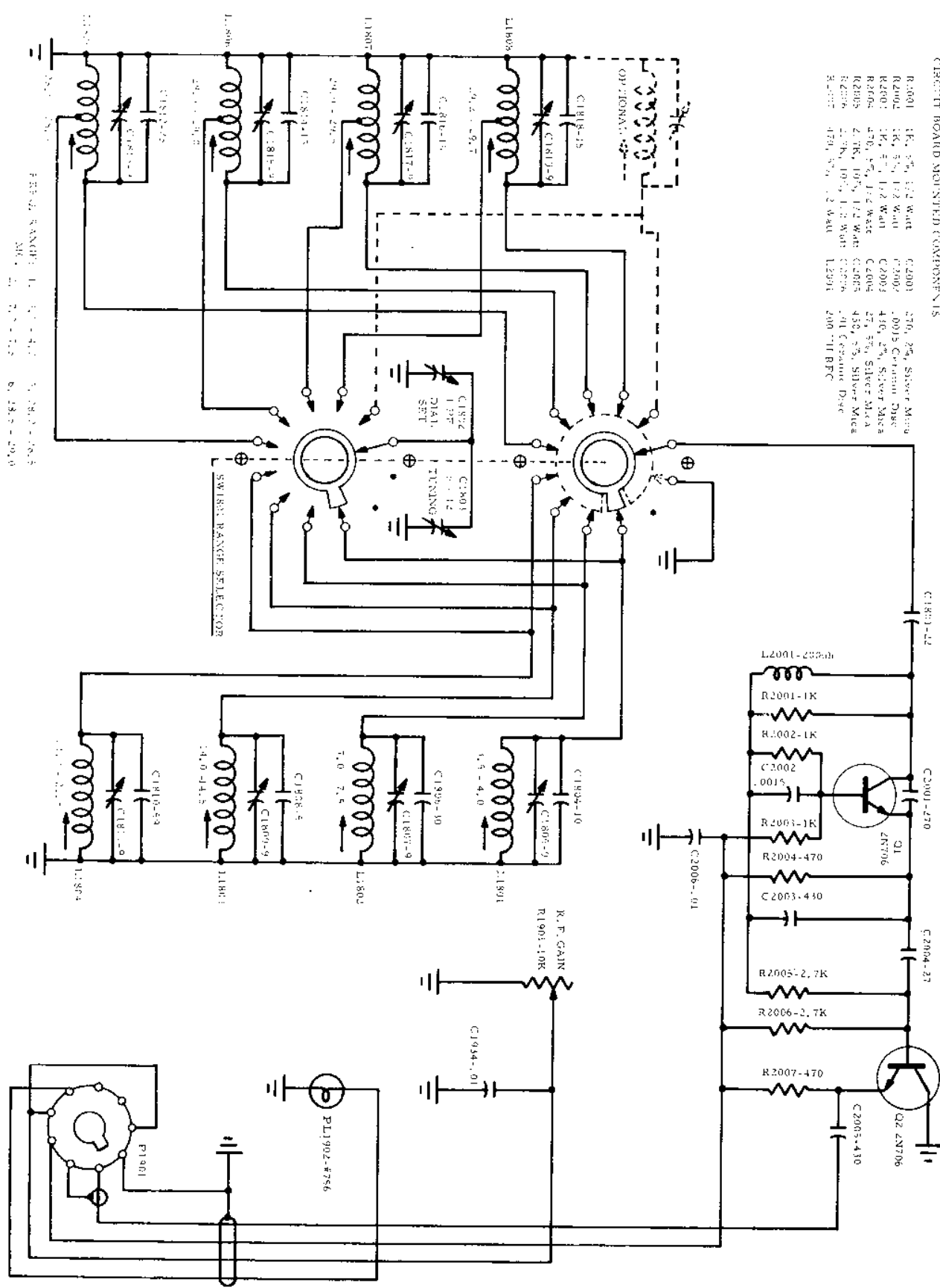
DIAL SET

A dial-set has been provided so that dial adjustment can be made at any 100 kc point of the dial. With calibrator on, set the dial to any 100kc point closest to the frequency you wish to work. Now adjust dial-set control to zero-beat the VFO with the 100 kc Calibrator. This provides greater accuracy of dial readout.

410 FREQ. RANGE	OSC. FREQ. (kc)	ADJUST COIL (Low end)	ADJUST CAP. (High end)
3.5— 4.0	8,673— 9,173	L1801	C1805
7.0— 7.5	12,173— 12,673	L1802	C1807
14.0— 14.5	8,827— 9,327	L1803	C1809
21.0— 21.5	15,827— 16,327	L1804	C1811
28.0— 28.5	22,827— 23,327	L1805	C1813
28.5— 29.0	23,327— 23,827	L1806	C1815
29.0— 29.5	23,827— 24,327	L1807	C1817
29.2— 29.7	24,027— 24,527	L1808	C1819

CIRCUIT BOARD MOUNTED COMPONENTS

R2001	1K, 5%, 1/2 Watt	C2001	.270, 25% Silver Mica
R2002	1K, 5%, 1/2 Watt	C2002	.0015 Capacitor Disc
R2003	1K, 5%, 1/2 Watt	C2003	470, 25% Silver Mica
R2004	470, 5%, 1/2 Watt	C2004	25, 5% Silver Mica
R2005	2.7K, 10%, 1/2 Watt	C2005	450, 5% Silver Mica
R2006	2.7K, 10%, 1/2 Watt	C2006	.01 Capacitor Disc
R2007	470, 5%, 1/2 Watt	L2001	200 TIT DFC

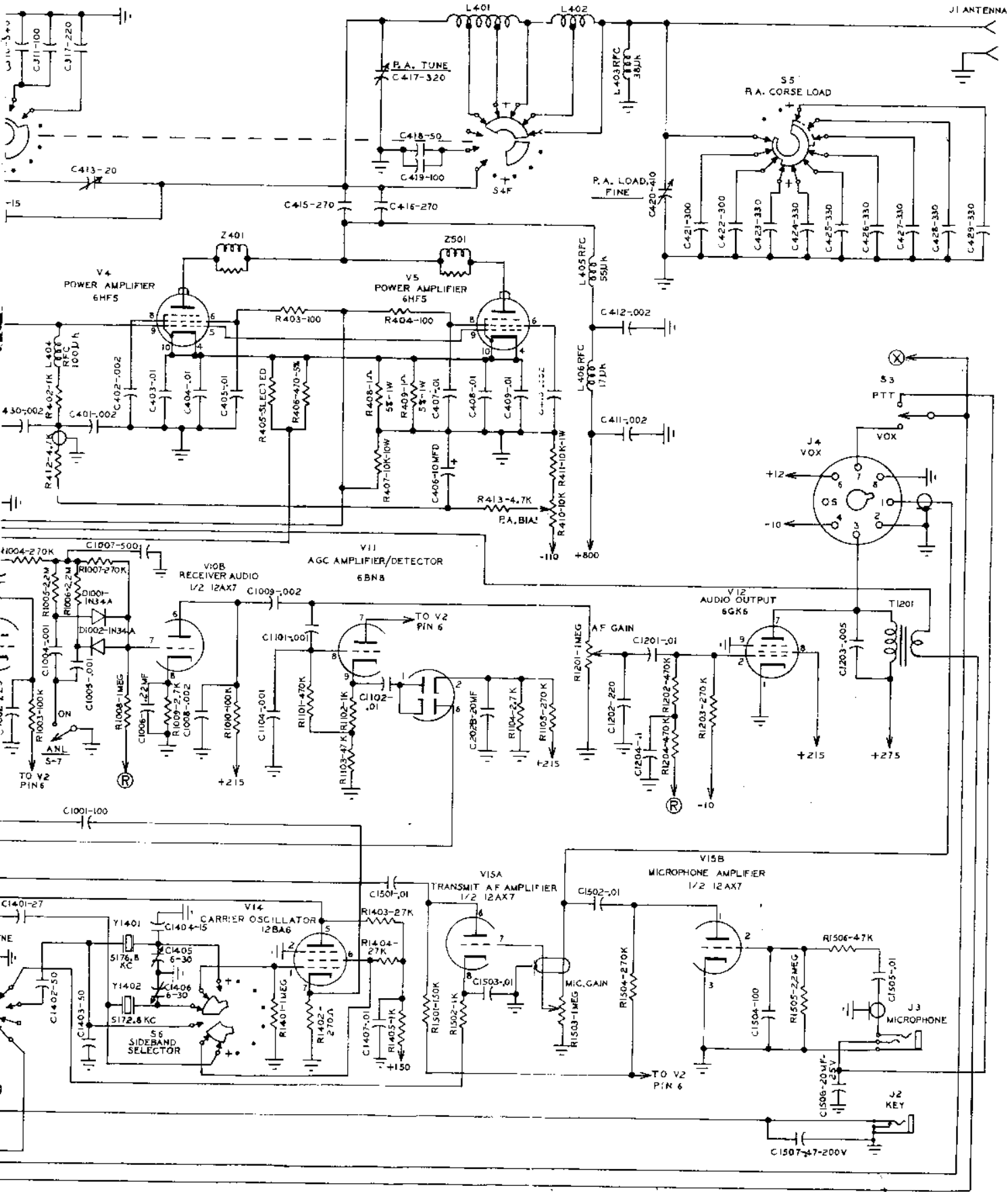


FREQUENCY RANGE

1	1.7 - 4.1	5	28.2 - 32.5
2	2.1 - 4.9	6	33.5 - 39.0
3	2.7 - 6.1	7	39.0 - 44.5
4	3.3 - 7.5	8	44.5 - 50.0

15. Assembly Range: Oscillator

FIG. 19 MODEL 410 VARIABLE FREQUENCY OSCILLATOR



SCHEMATIC DIAGRAM - SWAN MODEL 500 SINGLE SIDEBAND TRANSCEIVER.

