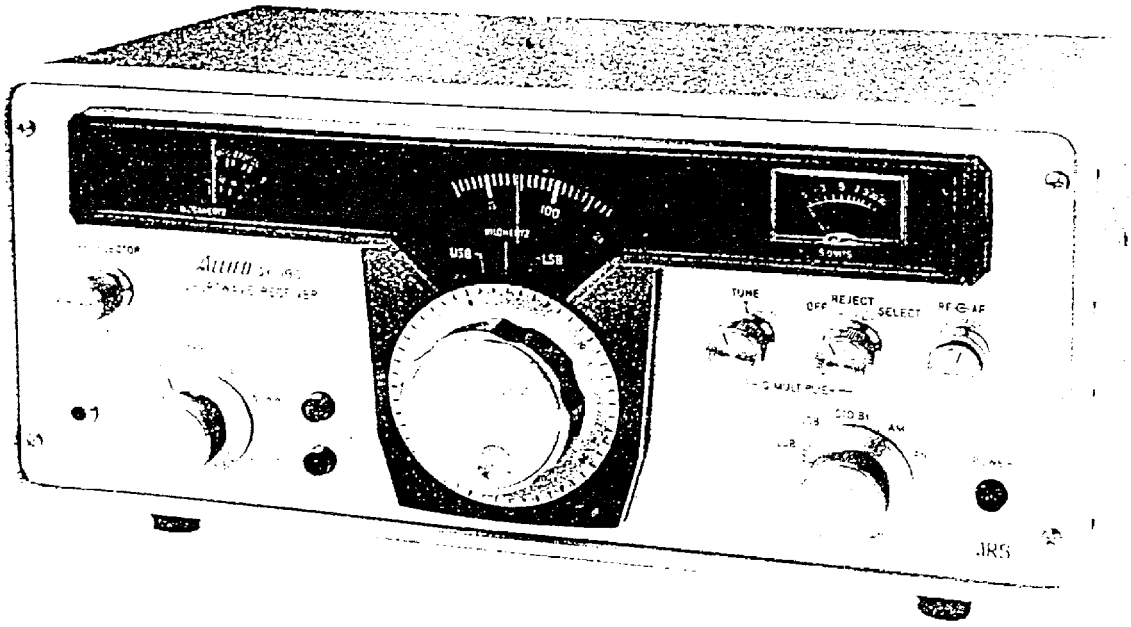
INSTRUCTION MANUAL

ALLIED®

SX-190

SOLID STATE

11 BAND SHORTWAVE RECEIVER



CATALOG

CUSTOM MANUFACTURED FOR
ALLIED RADIO SHACK A TANDY CORPORATION COMPANY

TECHNICAL SPECIFICATION

Basic Frequency Coverage	
*Additional Band	500 KHz band width
*Crystal not supplied	3.5 to 10 MHz
80 meter Band	3.5 to 4.0 MHz
49 meter Band	5.7 to 6.2 MHz
40 meter Band (HAM)	7.0 to 7.5 MHz
31 meter Band (WWV@ 10 MHz)	9.5 to 10.0 MHz
25 meter Band	11.5 to 12.0 MHz
20 meter Band (HAM)	14.0 to 14.5 MHz
19 meter Band (WWV@15 MHz)	15.0 to 15.5 MHz
16 meter Band	17.5 to 18.0 MHz
11 meter Band (CB)	27.0 to 27.5 MHz
*Crystal not supplied	10.0 to 30.0 MHz
Number of semiconductors	4 FET, 22 TR, 13 diodes, 2 zeners and 2 thermisters
IF. Frequencies	2.420 MHz to 2.920 MHz (Variable) and 455 KHz
Reception	AM, CW, and Single sideband (SSB)
Sensitivity - AM	Less than 1 microvolt for 10 db S/N ratio
Sensitivity SSB/CW	Less than 0.5 microvolt for 10 db S/N ratio
Selectivity	4 KHz at 6 db down
Visual dial accuracy	±200 Hz
Calibration accuracy	Better than ±500 Hz adjacent 25 KHz calibration points after indexing
Stability	Better than 500 Hz after warm-up
Image rejection	More than 60 db
Spurious rejection	More than 50 db
Rejection tuning	More than 40 db
Selection tuning	500 Hz at -3db
Audio output power	Maximum 1 watt at 8-ohm load
Audio output impedance	8 ohm and 600 ohm
Headphone output	8 ohm, panel-mounted jack accepts standard 1/4-inch plug
Antenna input impedance	50 ohm to 75 ohm unbalanced: rear mounted type SO-239 coaxial receptacle accepts PL-259 connector
Power source	120 volt AC 60 Hz and 12V DC negative ground only
Power consumption	10 watts
Remote stdby control	Rear-mounted; 2 pin connector
Dimensions	7" high, 15" wide and 10" deep

GENERAL DESCRIPTION

The SX-190 SHORTWAVE RECEIVER is fully transistorized and offers a new high in reliability, selectivity, and drift free operation. It covers the 49 thru 16-meter international broadcasting bands plus the 11-meter CB band and WWV at 10 and 15 MHz. Two blank positions are left for the owner who may by the addition of the proper crystal, cover any 500 KHz wide segment of frequency between 3.5 thru 10 MHz and 10.0 thru 30.0 MHz. These bands are selectable with the front panel band selector switch.

Its circuitry uses 4 FETS, 22 transistors, 13 diodes, 2 thermistors and 2 zener regulators. Dual conversion and mechanical filters enhance the excellent image and spurious rejection plus sharp selectivity of this receiver.

The suppression of unwanted heterodynes and interfering carriers is enhanced by the Q-MULTIPLIER, which provides better than 40 dB of attenuation.

The use of a PRESELECTOR assures maximum sensitivity and a high signal to noise ratio for outstanding reception of weak signals. The tuning dial features anti-backlash construction. It is direct reading to 1 KHz. Precise tuning of all signals including SSB is assured by the large easy to read dial. Superior stability is obtained by the use of a crystal controlled 1st local oscillator and a VFO 2nd oscillator. A dual frequency calibrator (25 and 100 KHz), crystal controlled, is used for calibrating the dial readout to an accuracy of better than ±200Hz.

The SX-190 is equipped with a crystal controlled Beat Frequency Oscillator (BFO) for the reception of USB, LSB and CW signals.

Incorporated in its circuitry are AGC, ANL and S-meter functions. The AGC (Automatic Gain Control) has been tailored to produce minimum audio output changes even with large variations of input signal levels. ANL (Automatic Noise Limiter) operation is achieved through the use of a diode. When pulse type interference accompanies an incoming signal, the diode in the ANL circuit operates in a cutoff mode for very brief time intervals, thus it effectively acts as a gate to shut out undesirable noise peaks. The S-METER indicates incoming signal strength and also acts as a tuning aid by indicating peak signal.

A dual power supply operates from a source of 110-120 volts 60 Hz AC or 12 volts DC. On AC, a 1-ampere fuse in the secondary of the power transformer is used for protection of the equipment. The B+ power supply uses a full wave rectifier and a stabilized regulator.

The antenna input is designed to operate with a wide variety of 50-75 ohm antennas. Both speaker and headphone jacks are provided (8 ohm). For use with a companion transmitter, muting connections are available at the rear panel along with both HFO and VFO outputs.

Rugged mechanical construction plus modularized design provide for maximum mechanical stability and ready access to either the top or bottom of the SX-190. This allows for maximum ease of maintenance or alignment should either become necessary.

SECTION 1: INSTALLATION

1.1 UNPACKING

Immediately after receipt of the receiver it should be removed from the shipping carton and visually inspected to insure that it has not been damaged in shipment. If it is determined that the receiver has been damaged in transit the shipping carton and packing material should be saved and the transportation company notified immediately.

As part of the initial inspection, all of the front panel controls should be checked to insure their proper mechanical operation. It is advisable to generally, look the receiver over and verify that nothing has been shaken loose and that everything appears to be normal.

The following items are supplied with each receiver:

1. Instruction manual, ALLIED MODEL SX-190.

2. DC power cable assembly.

3. 1/4" phone plug connector.

4. Additional feet.

1.2 RECEIVER CONNECTIONS

If the SX-190 Receiver is to be used for receiving only and not as part of a system with interconnections to an associated transmitter there are only a few required connections. These connections are easily accessible at the rear of the receiver and their design permits permanent connections to be made in a neat manner. Figure 1-2 (page 5) illustrates the connections points at the rear of the receiver.

1.2.1 ANTENNA CONNECTION

The SX-190 Receiver has been designed to operate from a 50-75 ohm unbalanced antenna input. To obtain the best results from the receiver the antenna that most nearly suits your needs should be selected. The illustrations shown in Figure 1-5 (page 7) are typical antenna installations. All that is required is to install a PL-259 connector on the feed line and connect it to the antenna input.

1.2.2 SPEAKER CONNECTIONS

Instructions for installing the phones plug on the speaker cable are illustrated in Figure 1-3 (page 6). After wiring the connector, insert in Phones/SPK jack.

1.2.3 GROUND CONNECTIONS and/or LIGHTNING ARRESTOR INSTALLATION

A good external earth ground connection to the chassis is a must to eliminate a potential shock hazard. It is possible that a voltage may exist between the chassis and ground as a result of the power line bypass capacitor that is connected between chassis and the power line. A method of connecting a ground is illustrated in Figure 1-4 (page 6).

As added protection it is also desirable to install a lightning arrestor. This would provide protection for the receiver as well as the operator. Figure 1-5 (page 7) illustrates the method of installing lightning arrestors.

1.2.4 POWER CONNECTIONS

Before inserting the power cable it should first be determined that the power source is of the proper voltage and frequency. For use on 12 VDC insert the plug which is part of the DC power cable into DC jack and connect the red cable to positive side, the black to negative. It is important to observe the polarity when using the receiver on 12 VDC.

1.2.5 STD BY CONNECTIONS

The STD BY jack is jumpered in factory to operate the receiver.

1.3 INTERCONNECTIONS FOR USE WITH TRANSMITTER

Figure 1-1 (page 5) illustrates the interconnections required for using SX-190 Receiver with a transmitter.

The following paragraphs describe the required interconnections to use the receiver in this manner. The receiver and transmitter require a common ground and the antenna input to the receiver may be controlled by an internal antenna changeover relay in the transmitter or an external antenna changeover relay. Consult your transmitter manual for interconnection instructions.

1.3.1 STB BY CONNECTIONS

In order to mute the receiver internally, the function switch should be placed in STD BY. All other positions of the function switch allow the transmitter to control the muting of the receiver when interconnected properly. Remove the jumper wire from STD BY plug and connect to the relay in the transmitter. Consult your transmitter manual for interconnection instructions.

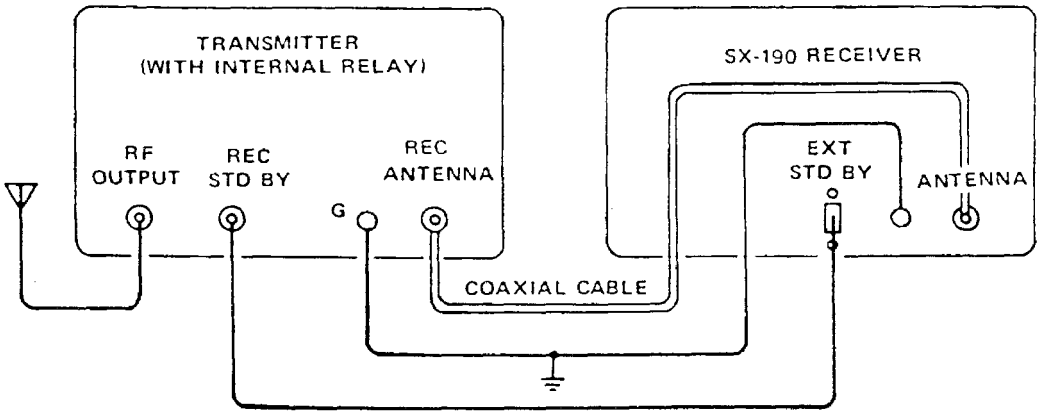
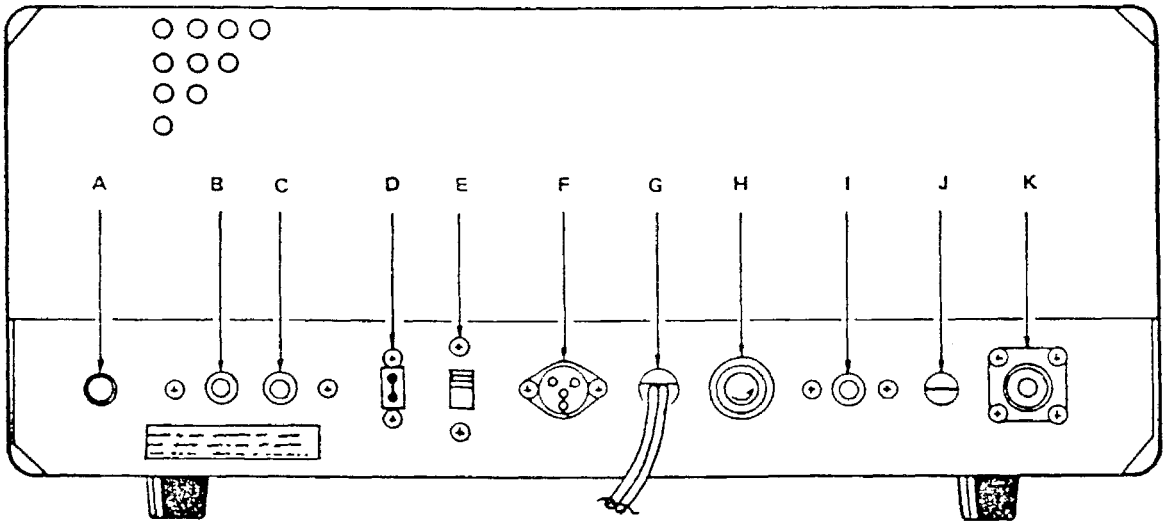


FIGURE 1-1 INTERCONNECTIONS



A - Speaker jack
B - Line/Tape output
C - VFO output
D - Ext std-by
E - AC/DC switch
F - DC input jack
G - AC line cord
H - Fuse
I - HFO output
J - GND terminal
K - 80-239 antenna jack

FIGURE 1-2 REAR VIEW OF SX-190

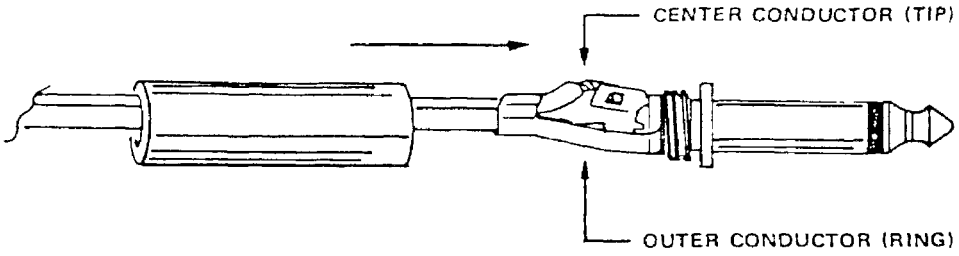


FIGURE 1-3 ATTACHING CABLE TO PHONE PLUG CONNECTOR

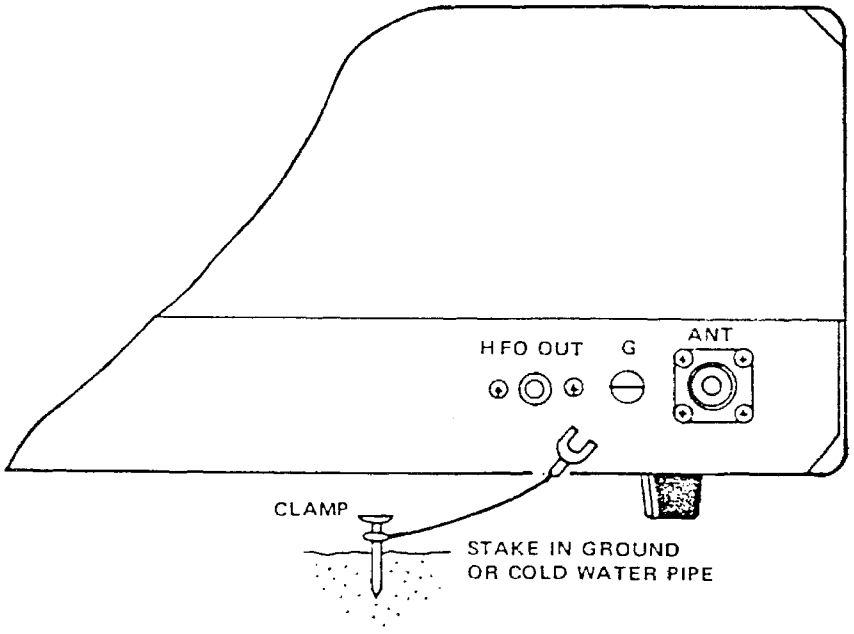


FIGURE 1-4 INSTALLATION OF GROUND

ANTENNAS

(a) Single Wire Antenna

The single wire or inverted "L" type of antenna will provide satisfactory performance over the entire tuning range. Simply connect one end of the antenna wire to center pin of a PL-259 Connector and attach to Antenna Jack. For good reception the antenna wire should he 30 to 100 feet long and placed as high as possible (see Fig. 1-5-1). Generally, this type of antenna provides maximum pick-up at right angles to its entire length. This should be borne in mind when installing the antenna. In some locations, reception may be improved by connecting a ground wire from the GND terminal to a cold water-pipe or outside ground rod. For protection against lightning, a lightning arrestor should be included in any outdoor antenna system.

(b) Doublet Antenna

A doublet antenna will give excellent results, especially on amateur bands. A 75 ohms balanced transmission line should be used (as shown in Fig. 1-5-2). Since the doublet antenna provides optimum performance only at a given frequency, it should be cut to the length for the most often used band of frequencies. The overall length of a doublet antenna can be determined by using the following formula:

$$L \text{ (Length in feet)} = \frac{468}{\text{Frequency MHz}}$$

Since the doublet antenna displays directional properties broadside to its length, it should be oriented in such a manner that maximum signal pickup can be realized.

(c) Other Antenna Systems

More elaborate antenna systems may be installed to provide better performance. Information on a number of different types can be obtained by referring to the Radio Amateur's Handbook or the A.R.R.L. Antenna Book, both published by the American Radio Relay League, West Hartford, Conn.

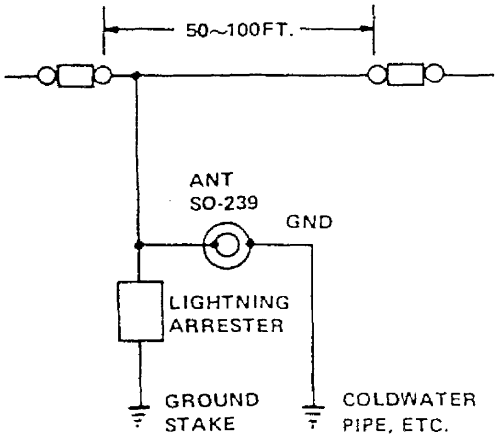


Figure 1-5-1

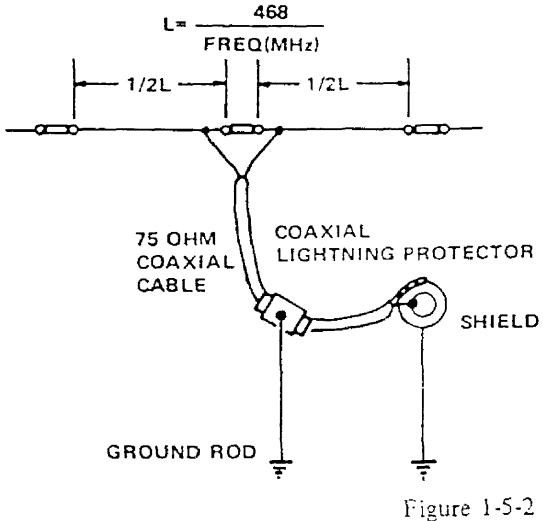
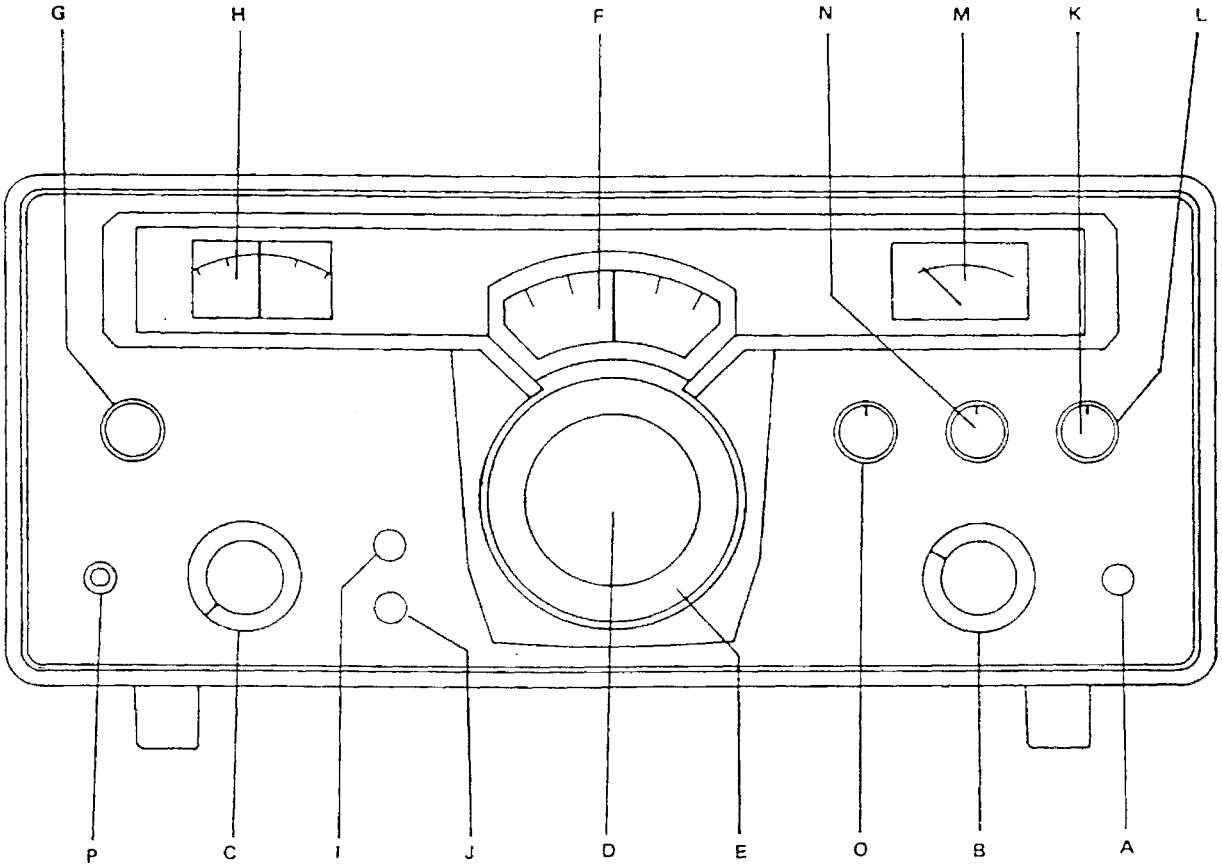


Figure 1-5-2

FIGURE 1-5 TYPICAL ANTENNA INSTALLATION



A - Power switch
B - Function switch
C - Band switch
D - Main tuning knob
E - Dial skirt
F - Main dial
G - Preselector
H - Preselector dial
I - 25 kHz Calibrator switch
J - 100 kHz Calibrator switch
K - AF gain control
L - RF gain control
M - "S" meter
N - Q-multiplier switch
O - Rejection tuning
P - Phones jack

FIGURE 2-1 FRONT VIEW OF SX-190

SECTION 2: CONTROLS AND THEIR FUNCTIONS

Power Switch (A)

Turns the set power on and off.

Function Switch (B)

This switch selects the mode of operation for the receiver. Each position selects the following mode:

USB This position is used for CW (continuous wave or code) and upper SSB (Single side-band) operation.

LSB This is the position to use for lower SSB and CW reception.

Stand by

This position cuts off the B supply voltage, making the receiver temporarily inoperative during transmission periods.

AM

This position provides for normal reception of amplitude-modulated signals using diode detection.

AM ANL

This position provides for reception of amplitude-modulated signals under conditions of excessive external interference. ANL stands for Automatic Noise Limiter.

Band (C)

This an 11-position Band Change Switch to cover the international broadcasting bands from 3.5 to 18.0 MHz, the 15 MHz standard frequency signal (WWV) and the 27 MHz CB band.

Tuning (D) (E) (F)

This is the Main Tuning Knob. One revolution controls a 50 KHz linear dial reading. Each indication line on the knob indicates 1 KHz, for frequencies between 3.5 and 30.0 MHz. The dial skirt is held in place by a fiction clutch, which allows easy adjustment for calibration.

Preselector (G) (H)

The Preselector is a three-section air variable capacitor that tunes the input to the RF amplifier, output from the RF amplifier, and the input to the 1st mixer simultaneously. This control can be set approximately to the desired frequency by using the marking on the Preselector dial. After setting to the correct frequency and tuning in the desired signal with the frequency tuning knob, this control must be "peaked" in order for the receiver to provide the optimum in sensitivity.

CAL (I) (J)

The calibrator circuit is crystal controlled and supplies 2 calibration frequencies. By pushing knob (I) to it's "in" position you activate the 25 kHz calibrator, which will provide marker signals every 25 KHz from 3.5 to 30.0 MHz. By pushing knob (J) to it's "in" position you activate the 100 KHz calibrator, which will provide marker signals every 100 KHz from 3.5 to 30.00 MHz.

RF Gain (L) AF Gain (K)

These are concentric controls.

(L) This is the receiver sensitivity control. For ordinary reception it should be set at maximum (extreme clockwise position). It should be adjusted only in such cases where an extremely strong signal from a local station may overload the receiver, causing distortion and a resultant decrease in sound level.

(K) This is the volume control. Turn to the right in a clockwise direction to increase volume, and to the left to decrease volume.

S-Meter Readings (M)

The S-Meter provides a means of measuring the relative strength of incoming signals. Relative readings are only correct when the RF-GAIN control is fully clockwise. Measurements are read in "S" units from 1 to 9 and in decibels above S-9 from 0 to 40 dB.

Q Multiplier (N) (O)

(N) Q multiplier selector switch, determines rejection or selection mode.

(O) Tune control, moves the notch or peak thru the passband.

Phones (P)

The Phones jack (J7) provides audio output from the final audio stage. The Phones Jack has an output impedance of 8 ohms. When using the Phones Jack the speaker jack is disabled.

TABLE 1

CONTROL	AM SETTING	CW SETTING	SSB SETTING
Function	AM or ANL	USB or LSB	USB or LSB
AF Gain	Adjust for desired audio level	Adjust for desired audio level	Adjust for desired audio level
Band Sel	Set for desired range	Set for desired range	Set for desired range
RF Gain	Maximum	Maximum	Maximum
Preselector	Set for desired frequency	Set for desired range	Set for desired range
Main Tuning	Set to desired frequency	Set to desired frequency	Set to desired frequency

TABLE 1 indicates the initial settings of the various controls for each type of operation. Therefore, the degree of strength and clarity with which signal will be received will depend upon proper readjustment of the various controls.

Function

Switch to SSB upper or lower for reception of SSB and CW. and to AM for AM reception. When pulse type interference hampers AM reception, switch FUNCTION to AM-ANL.

Band

Set this switch to the desired band.

RF Gain

Set this control for maximum sensitivity (Full clock-wise position).

AF Gain

Adjust this control for desired volume level.

Pre Selector

Turn this control and set the indicator near the desired band. Adjust for maximum receiver sensitivity.

Tuning

Set the dial indicator to zero. Then push the outer dial lightly and turn it so that it also is set at zero. Now the indications on the outer dial can be directly read down to 1 KHz. The 15 MHz standard signal WWV can be received when the dial reading is at 0 mark.

AM Operation

For the reception of stations place all controls in the positions indicated in the Initial Control Settings chart. Tune in a station, using Main tuning controls as indicated in the section under "TUNING". Adjust Preselector for highest "S" meter reading. This control setting is satisfactory while operating over a limited frequency range. If excessive spurious noises such as those caused by auto ignition make reception difficult, place the FUNCTION switch in the AM ANL position. The automatic noise limiter should be used only when necessary, since it tends to reduce the overall efficiency of the receiver.

CW Operation

The control setting required for the reception of code signals are indicated in the chart. Tune signal to zero beat. The main tuning dial control should then be adjusted on either side of the center for desired pitch.

Signal Sideband Operation

For SSB reception, the dial should be turned very slowly. Excessive signal strength during SSB reception may make demodulation difficult. In such cases decrease the RF GAIN by turning this control to the left. Smooth demodulation will then be possible.

Control settings for sideband reception are virtually the same as for CW. Note, however, that two positions of the function control are provided to permit selection of either the upper or lower sideband, as necessary. The sideband that must be selected will depend upon the band in use. As indicated in the sideband selection chart (TABLE 2), the lower sideband is usually required for SSB reception on 80 and 40 meters, the upper sideband for SSB reception on 20, 15 and 10 meters.

TABLE 2

METERS	FREQUENCY	SIDEBAND USED
80	3.5 to 4.0 MHz	Lower
40	7.0 to 7.5 MHz	Lower
20	14.0 to 14.5 MHz	Upper
15	21.0 to 2l.5 MHz	Upper
10	28.0 to 29.7 MHz	Upper

TABLE 3

SHORTWAVE BROADCAST BAND*	FREQUENCY (MHz)	LISTENING TIME
49 meter band	5.95 to 6.20	Winter nights
41 meter band	7.10 to 7.30	Winter nights
31 meter band	9.50 to 9.775	Nights, all year
25 meter band	11.70 to 11.975	Nights, all year
19 meter band	15.10 to 15.45	Days, all year and Summer nights
16 meter band	17.70 to 17.90	Days, all year and Summer nights
11 meter band	26.95 to 27.50	Days, all year

*These are separate and distinct from the Amateur Shortwave bands, which operate over different groups of frequencies.

On the short wave frequencies there will be found radio stations transmitting from all over the world. Many of these stations provide English-language broadcasts. The frequencies on which most shortwave broadcast stations operate are found in the two upper bands of your receiver. The majority of shortwave broadcast stations operate within certain internationally assigned groups of frequencies, or "bands". For your convenience, a list of the shortwave bands which offer best reception has been provided (TABLE 3). Since shortwave reception varies with the time of day, season of the year and with weather conditions, recommended listening times have also been shown along with each shortwave band.

CALIBRATION AM/CW/SSB

In order for the receiver to be used properly it is important that the dial calibration be checked and set for each band of the receiver. The controls should be set as follows for calibration:

1. Preselector - to marking for desired band
2. Band switch - to desired band
3. Rejection - "OFF"
4. Tuning - Rotate until dial scale "0" appears on pointer.
5. RF - maximum clockwise
6. AF - to suit operator
7. Mode - LSB
8. CAL - 100 KHz.

AM

This control is used to set the dial skirt to exact center frequency of calibration signal. For first setting rotate tuning knob nearest to the 100 KHz maker signal until the tone is in the zero beat. Hold the tuning knob firmly at this point and rotate the dial skirt to zero position. The skirt dial is just behind the tuning knob and is held in position by a friction-locking device. This dial is easily moved by hand but will remain in position after adjustment. In the AM position no calibration tone can be heard, however, accurate frequency location can be determined by observing the "S" meter for maximum indication when tuning thru the calibration signals.

CW/SSB

With the controls set as described above, a marker signal should be heard from the speaker. Rotate the main tuning knob until the tone reaches zero beat. When the tone is at zero beat, turn the “0” marking on the dial skirt to the line marked LSB. This zero beat signal can be heard every 100 KHz. If 25KHz knob is pushed, signal can be heard every 25 KHz. When the function switch is set to USB, tune the “0” marking on the dial skirt to the line marked USB in the same manner. The dial is now calibrated. This same procedure must be followed for dial accuracy when switching to other bands.

Q-MULTIPLIER

The Q-multiplier operates in all modes, CW, AM and SSB, to null unwanted signals with a deep 40 dB notch, or peak the desired signal while sharpening receiver selectivity to help you pick the signal you want out of the noise. The selector switch has off, reject and select positions. A tune control allows you to move the "peak" or "null" throughout the receiver bandpass. When centered, the notch or peak will be in the middle of the bandpass, and moving the control to either side will shift the notch or peak towards either side of the bandpass.

ADDITIONAL FREQUENCY COVERAGE

For coverage other than the International Broadcasting Band, two extra crystal sockets are provided on the RF printed circuit board. Their receiving range is any 500 KHz bandwidth between 3.5-10 MHz and 10.0-30 MHz.

The extra crystal frequency is calculated as follow.

Extra crystal frequency = Low-end frequency of receiving band +2.920 MHz.
For example, if you want to receive 15 Meter Amateur band range from 21.0 to 21.5 MHz.

Extra crystal frequency = 2l.0 MHz +2.920 MHz = 23.920 MHz.
Insert this crystal to the extra crystal socket X11 for receiving range between 10-30 MHz, or X1 for 3.5-10 MHz, and an extra capacitor must be added in parallel with TC-4 for 3.5-10 MHz or TC-l I for 10-30 MHz. The trimmer capacity should be adjusted for correct frequency and also maximum output. The extra capacitor value is shown in Fig. 2-3 and Fig. 2-4.

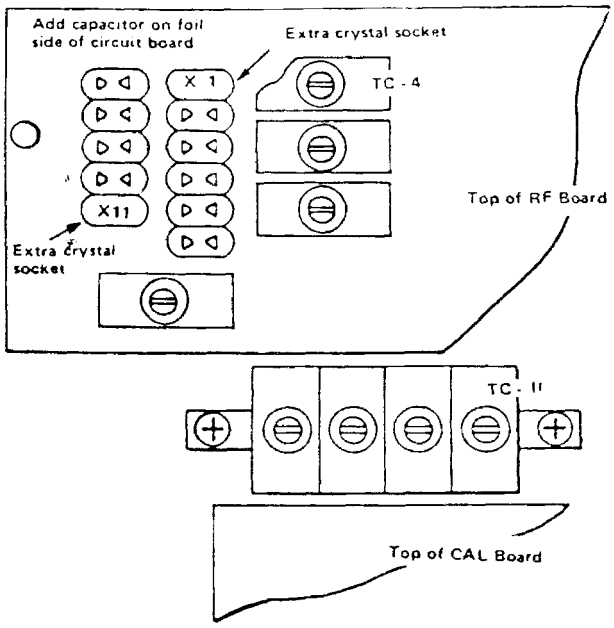


FIGURE 2-2 LOCATIONS OF EXTRA CRYSTAL AND CAPACITOR

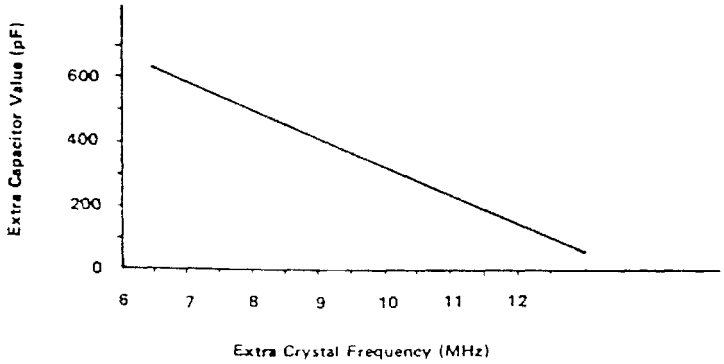


FIGURE 2-3 CHART OF EXTRA CRYSTAL FREQUENCY VS. CAPACITOR VALUE FOR 3.5 - 10 MHz RANGE

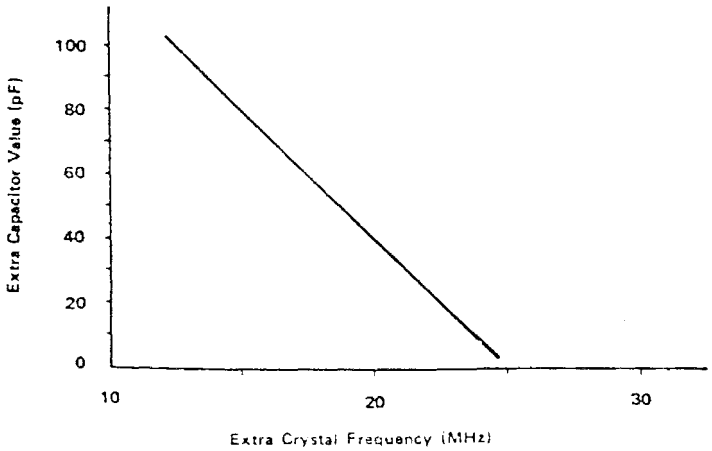
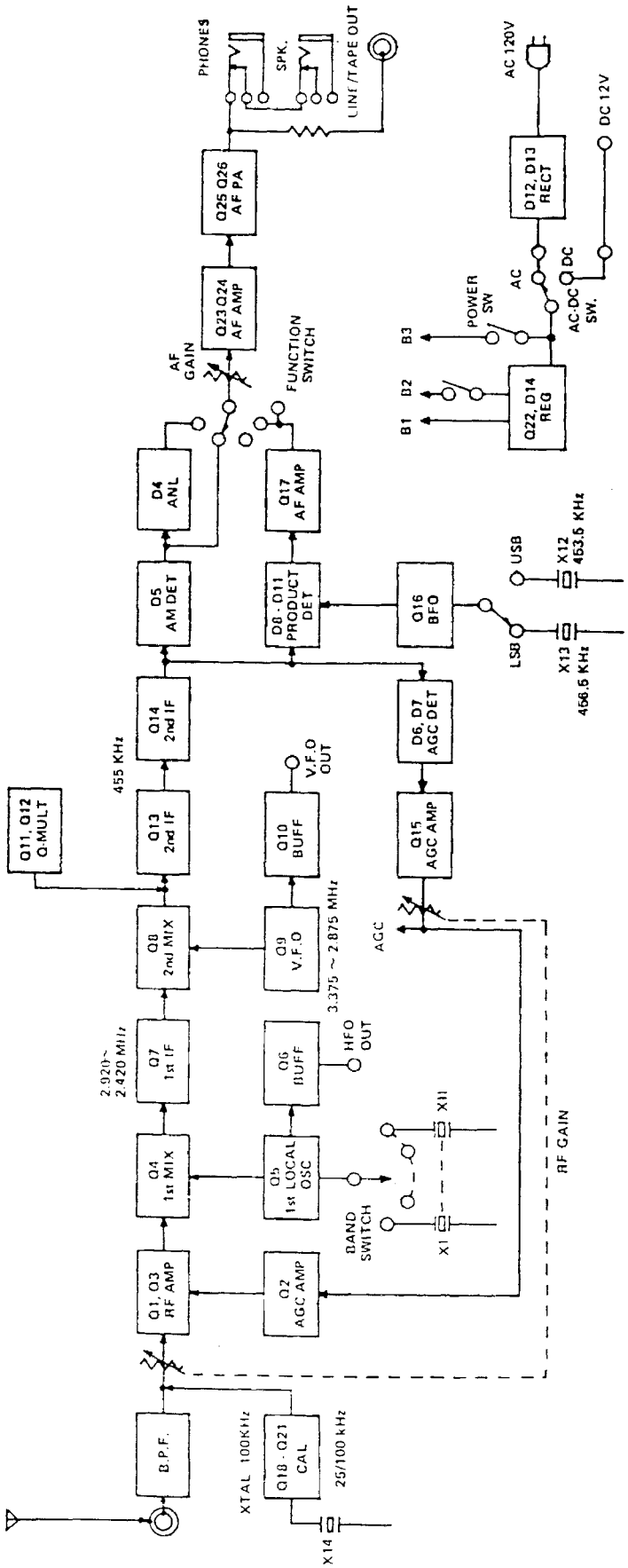


FIGURE 2-4 CHART OF EXTRA CRYSTAL FREQUENCY VS. CAPACITOR VALUE FOR 10.0 - 30 MHz



BLOCK DIAGRAM OF THE SX-190

SECTION 3: THEORY OF OPERATION

3.1 GENERAL

This section will aid in understanding the operation of the various circuits in this receiver as well as an aid in servicing and diagnosing troubles. The SX-190 is a dual conversion receiver using a crystal-controlled oscillator to provide the first mixing. The first and second mixers are coupled by a band-pass IF circuit 500 kHz wide. The second conversion occurs with the mixing of the 1st IF and the VFO. The low or 2nd IF is amplified and then detected by three different detectors The first detector provides the necessary AGC voltages, the second detector is used for AM reception and the third detector is used for CW and SSB reception. The detected signal is then amplified and applied to the audio output.

The complete circuit of the SX- 190 is shown in the schematic diagram at the rear of the manual. A block diagram is also provided to aid in understanding this receiver. While reading the text it is suggested that both diagrams be followed. The block diagram will reveal the overall scheme, whereas the schematic diagram will provide the detailed circuitry.

3.2 RF AMPLIFIERS AND HIGH FREQUENCY OSCILLATOR

The RF signal received at the antenna is applied to the gate of Q1 (cascode RF Amplifier) thru the antenna input connector J1. The PRESELECTOR control is a 3-section air variable capacitor that tunes the gate and drain of the RF amplifier as well as the gate of the first mixer (Q4). The required tuning range of these circuits is obtained by switching an appropriate value of inductance in parallel with the PRESELECTOR tuning capacitor and its associated coils (T1, T2, & T3). The complete range of 3.5 - 30 MHz is covered by 2 tuning ranges of the PRESELECTOR and by 11 ranges of the crystal controlled high frequency oscillator (Q5). The output of the high frequency oscillator (HFO) is coupled to the source of the 1st mixer as well as the base of an emitter follower (Q6), which is coupled to J2 on the rear panel of the receiver. The emitter follower allows the output of the HFO to be used without any loading effect being placed on the HFO. The RF GAIN control (VR1, 2) varies the AGC voltage fed to the base of the AGC Amplifier Q2, and also attenuates the coupling between T1 and T2. As the setting is changed in a counterclockwise direction, the bias decreases causing a reduction in gain of the RF amplifier stage. The same condition exists when the strength of the incoming signal increases. The output of the RF Amplifier is coupled by T2 and tuned by the PRESELECTOR tuning capacitor to the gate of Q4, the first mixer.

The output of the HFO is always 2.920 MHz higher than the lower edge of the selected band. On frequencies below 17.920 MHz the oscillator collector circuit is tuned to the fundamental crystal frequency; at frequencies above 20.420 MHz the collector circuit is tuned to the third overtone of the crystal.

3.3 FIRST MIXER AND BANDPASS IF

The output of the RF Amplifier is applied to the gate of the first mixer Q4. At the same time the output of the HFO coupled thru T4 is applied to the source of the first mixer. The two signals are mixed and their products are selected in the drain circuit of Q4. The circuit in the drain of Q3 is tuned as a bandpass circuit passing all frequencies between 2.920 MHz and 2.420 MHz. This is the frequency range of the 500 KHz bandpass IF. The transformers L8, 9 and Ll0 and their associated components comprise the bandpass IF. The output of this IF is applied to the base of Q8, the second mixer.

3.4 SECOND MIXER AND VARIABLE FREQUENCY OSCILLATOR

The second mixer combines the output of the bandpass IF with the output of the variable frequency oscillator (VFO) to produce the 455 KHz IF.

The VFO produces the required frequencies for tuning LSB, USB, CW and AM signals. Inductor T7 parallels capacitor VC6, in the frequency-determining network. The output frequency is lowered causing the VFO to tune from 3.375-2.875 MHz.

The mixing products of the bandpass IF and VFO are selected in the collector circuit of Q8 (second mixer). The output of the VFO is provided at the rear panel at J4. Here the VFO is isolated by emitter follower (Q10).

3.5 455 KHz IF DETECTOR CIRCUITS AND NOISE LIMITER

Immediately following the 2nd mixer (Q8) are the mechanical Filters (MF1, MF2). Output from the MF1 is amplified by Q13 and connects to MF2 and is tuned by the three transformers T9, T10 and T11. The signal is taken from the secondary of T11 to be detected and used as the AGC voltage.

The AM detector, diode D5, also gets its signal from the secondary of T11 and is coupled to the noise limiter (D4). This noise limiter only functions in the AM mode when its output is delivered through the function switch, on to the AF GAIN and to the 1st audio amplifier.

The detection of CW & SSB signals is accomplished by D8, D9. Dl0 and D11. These four diodes comprise a balanced demodulator circuit. The audio is developed from the product detection of the incoming 455 KHz signal and the output of the BFO, which may come from the crystal controlled SSB oscillator, and its output is delivered to AM preamplifier (Q17). The output of the AM preamplifier is coupled thru C79 to Function switch (SW3-d) to the AF gain control, VR3, and on to the 1st audio amplifier.

3.6 AUDIO CIRCUITS

As stated earlier the audio voltage developed by a particular detector is coupled through the Function switch (SW3-d) to the AF Gain control (VR3). The audio voltage is amplified in three separate stages. The first audio amplifier Q23 feeds the second audio amplifier Q24 that drives the final audio output stage, which is operating push-pull, and consists of transistors Q25 and Q26.

The audio system has been designed to provide three different audio outputs. J6 is an 8-ohm phone output for a head-phone. Jack J7 is also an 8-ohm speaker jack. The third audio output J8 is a 600-ohm output jack, which can be used for tape out and/or line out operation.

3.7 BFO AND CW OSCILLATOR CIRCUITS

BFO circuitry consists of the transistor Q16 and it associated circuitry. In the reception of LSB and USB signals the Function switch will place either X12 or X13 (USB or LSB) in the base circuit of Q16. Q16 now functions as an oscillator providing the necessary frequency to the balanced demodulator for the beat between the 455 KHz IF signal. In the LSB position of the Function switch X13 is in the circuit producing a frequency of 456.5 KHz. In the USB position, X12 produces a frequency of 453.5 KHz.
(X: Crystal)

3.8 AGC AND "S" METER CIRCUITRY

Signal voltage is coupled from the primary of T11 to AGC detector D6 and D7. The AGC amplifier Q15 amplifies the rectified signal voltage.

The collector voltage of Q15 is divided by R65 and VR2, and it is applied to the IF and RF amplifier stages. Emitter voltage of Q15 is used for "S" meter circuit.

The AGC time constant is controlled by C65 and thru C64. In the USB and LSB position the parallel combination of C64 present a larger time constant resulting in a slower AGC discharge rate.

The RF GAIN control VR2 provides a manual control of the gain in the RF, 1st, 2nd mixer and IF stages. The RF Gain control is in series with the bases and controls static bias to these stages As the control is rotated counter-clockwise the bias voltage decreases, reducing the bias and therefore the gain of the stages.

3.9 REJECTION FILTER

The Rejection Filter consists of transistors Q11, Q12 and their associated components. The frequency of the notch is controlled by VC7, REJECTION TUNING. This control allows the notch to be moved across the passband of the 455 KHz IF. Resistor, VR15, is used to adjust the depth of the notch.

This notch circuit is an inverted "Q" multiplier. The circuitry around Q12 multiplies the "Q" of coil T7. By multiplying its "Q", the circuit provides a narrower notch. This circuit shapes the notch and VR15 sets the depth. The output of this circuit is actually a peak rather than a notch until it is inverted by Q11, then it appears as a notch when tuned through the IF passband.

3.10 CALIBRATION CIRCUIT

Calibration circuitry consists of transistors Ql8 thru Q21. 100 KHz signal is produced by Q21 and connected to buffer amplifier transistor Q18. And every 100 KHz harmonic is supplied thru C80. Q19 and Q20 are multivibrators to oscillate at 25 kHz. It is also connected to buffer amplifier and to C80.

3.11 POWER SUPPLY

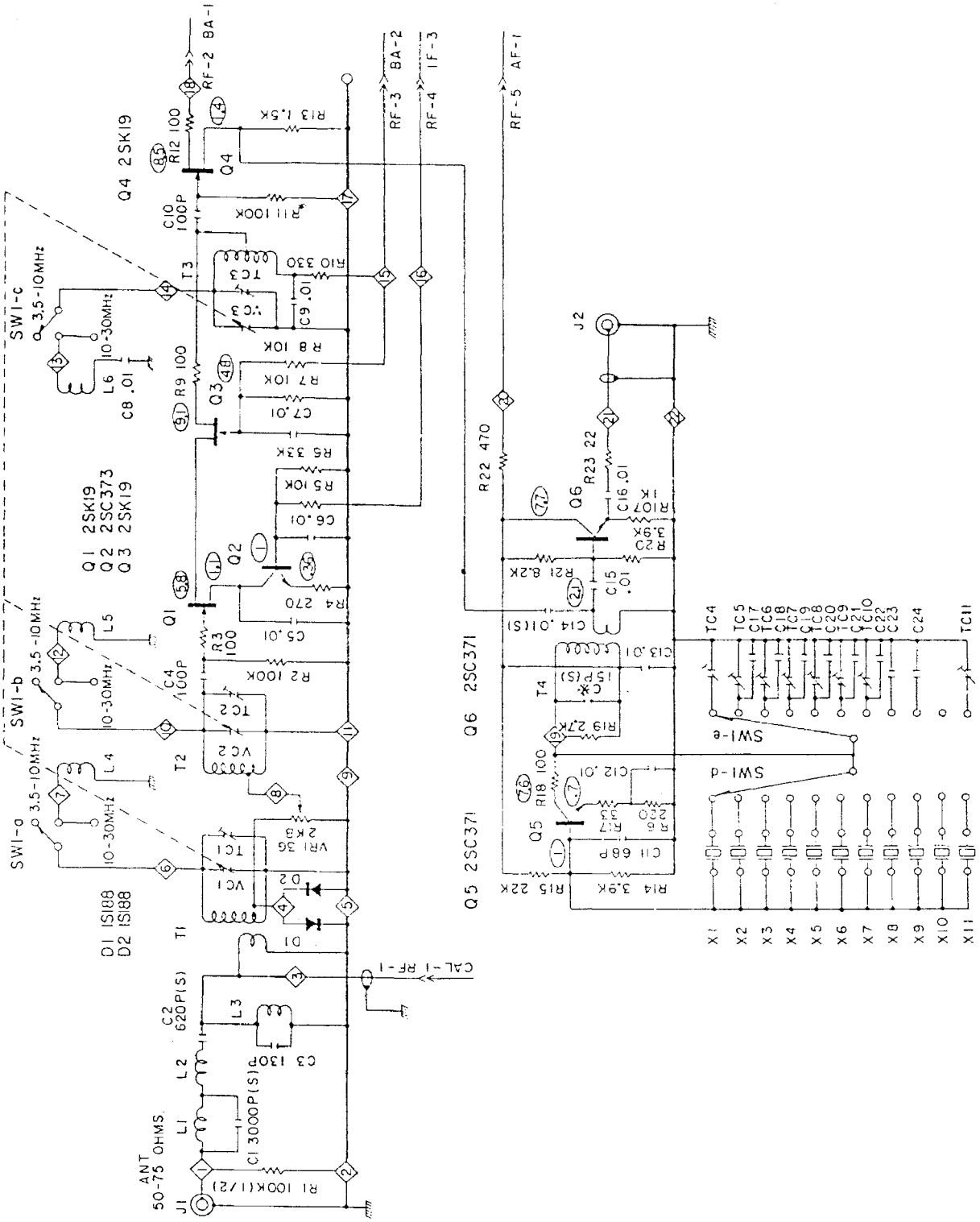
The power supply of the SX-190 has the advantage of operating from 120 VAC 60 Hertz or 12 VDC without any internal wiring changes.

3.11.1 AC POWER SUPPLY

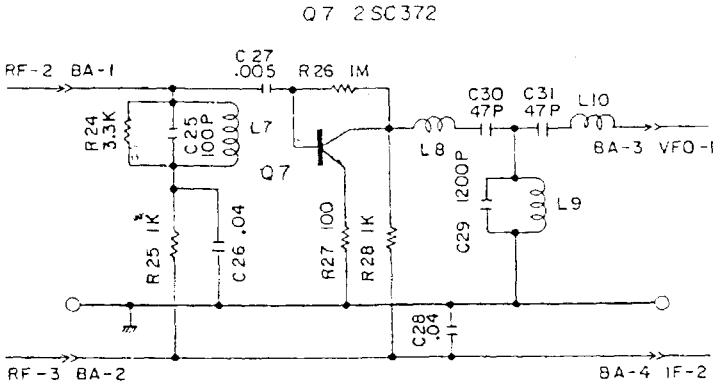
Transformer T13 steps down the voltage from the source to a nominal voltage of approximately 10 Volts. This voltage is then rectified by the diode consisting of diodes D12 and Dl3. This rectified voltage is then fed to the collector Q22. In the base circuit of Q22, a 10V Zener regulator is used to regulate the base potential. Transistor Q22 is used as an emitter follower regulator. From here the 9.5V supply line is taken, and also the 7V supply line originates thru a dropping resistor R82. The 7V supply line is regulated by a 7V Zener Diode D3.

3.11.2 DC POWER SUPPLY

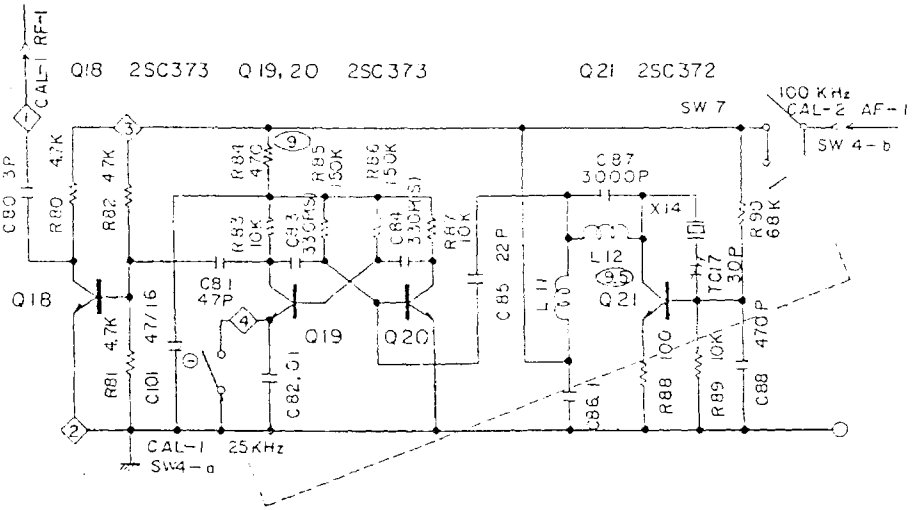
There is no DC power supply as such. The receiver merely regulates and fuses the 12 VDC source.



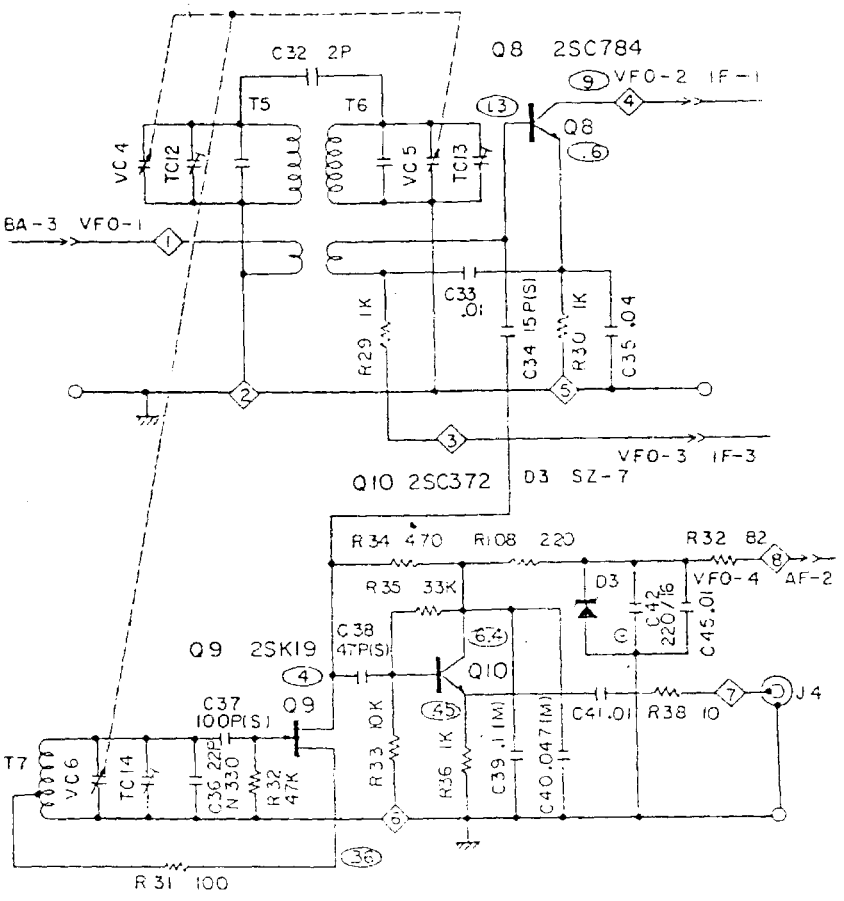
SCHEMATIC DIAGRAM OF RF AMP



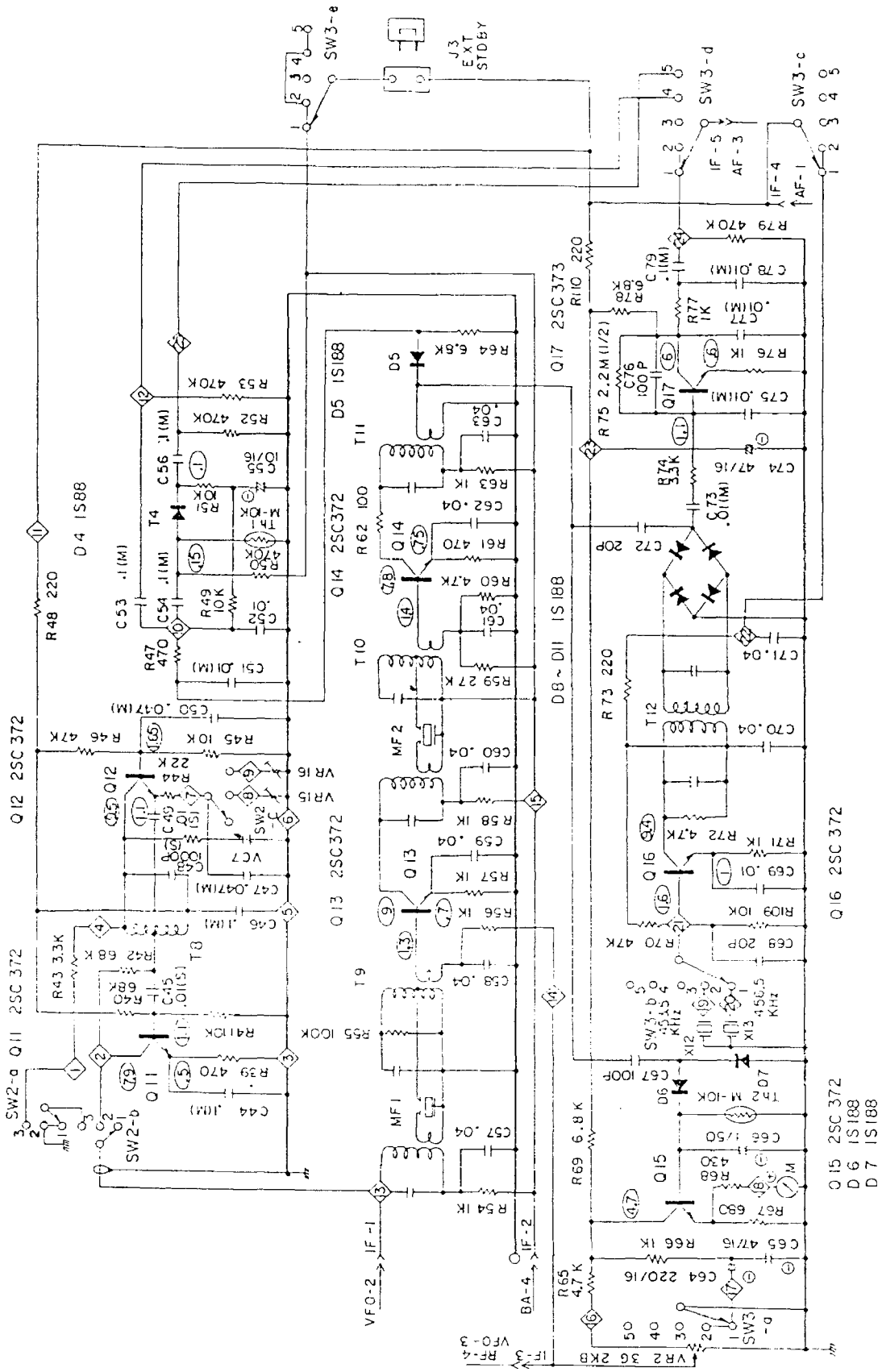
SCHEMATIC DIAGRAM OF BUFFER AMP



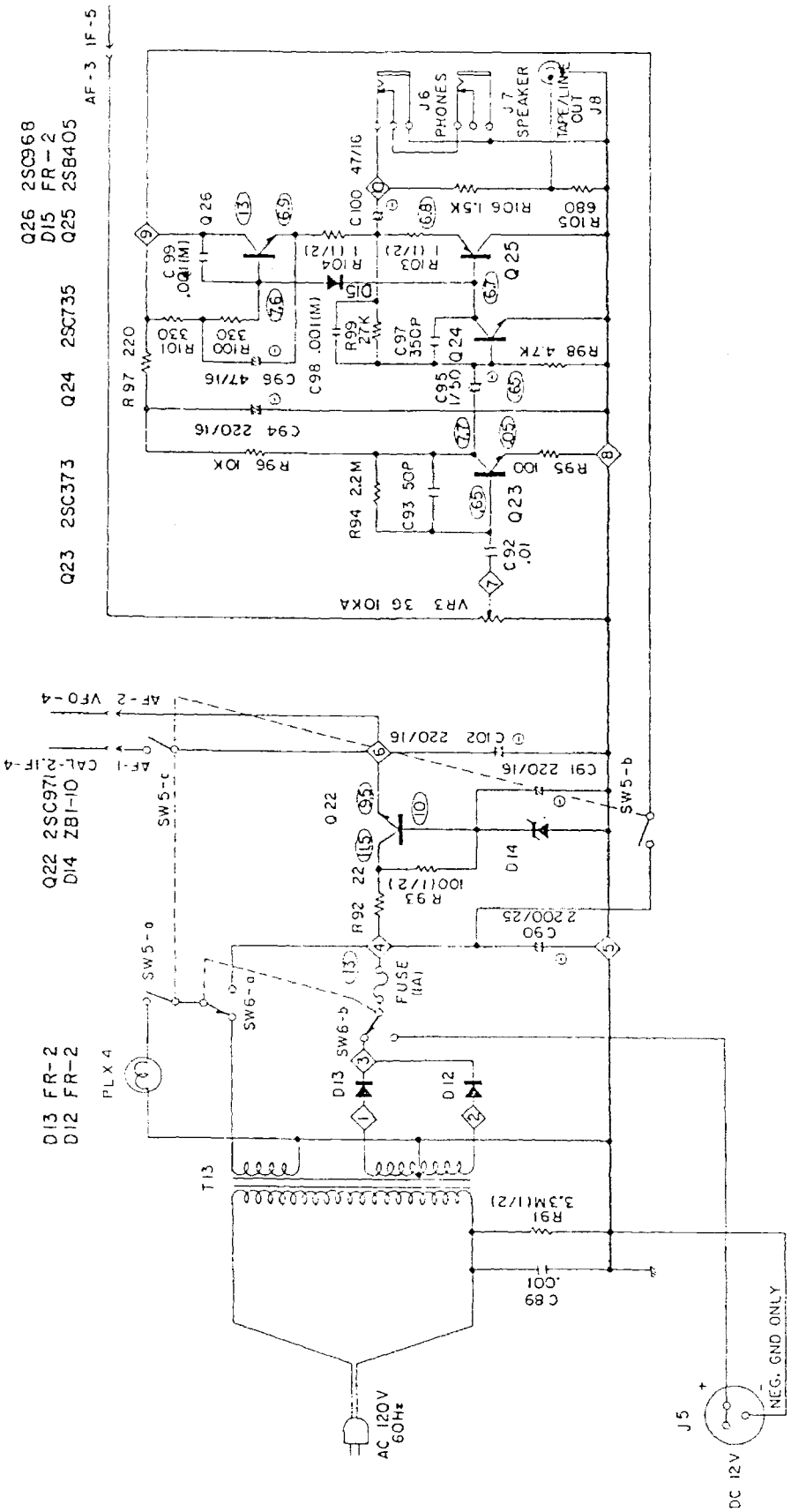
SCHEMATIC DIAGRAM OF CALIBRATOR



SCHEMATIC DIAGRAM OF VFO SECTION



SCHEMATIC DIAGRAM OF I.F. AMP SECTION

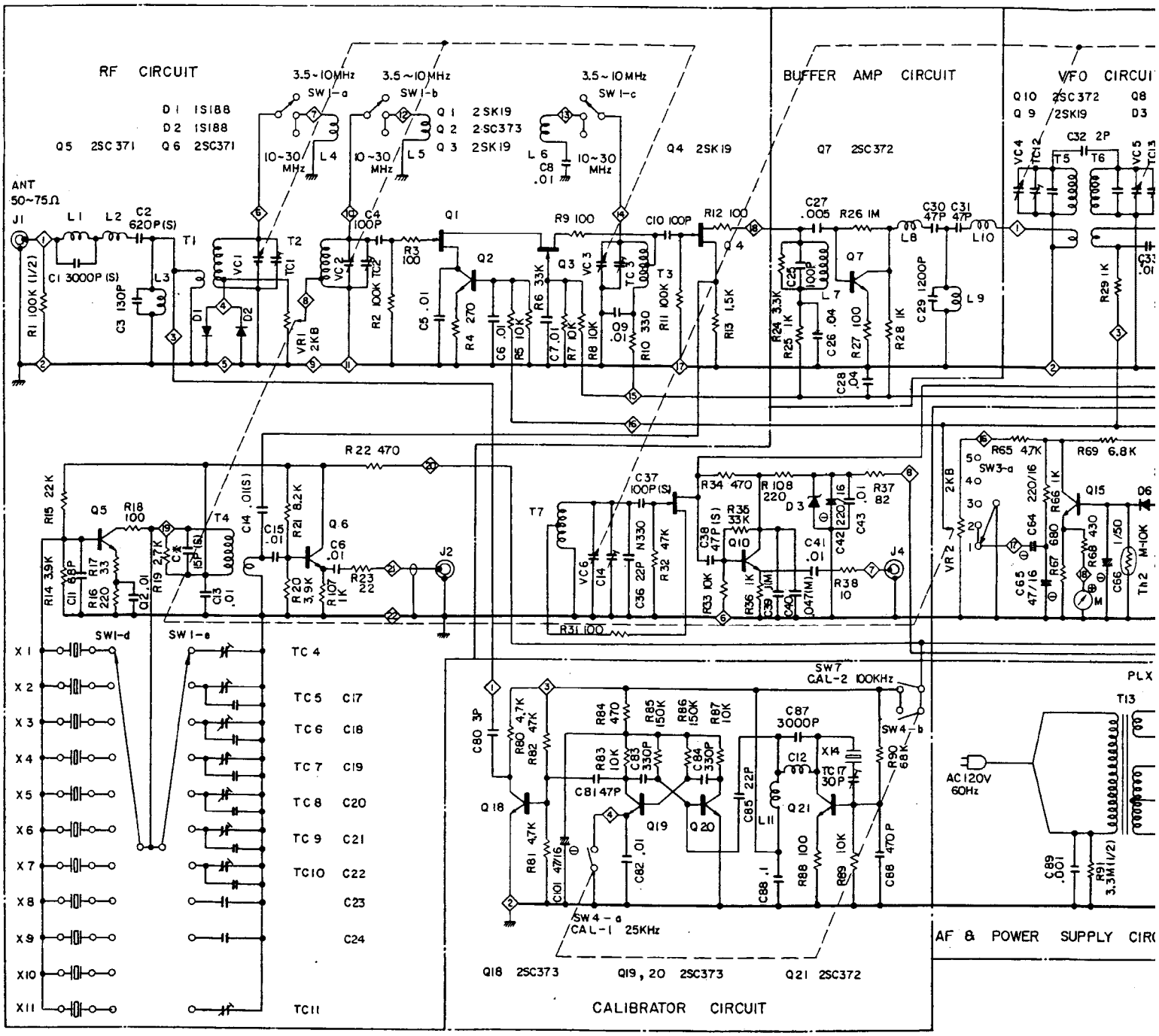


SCHEMATIC DIAGRAM OF POWER SUPPLY

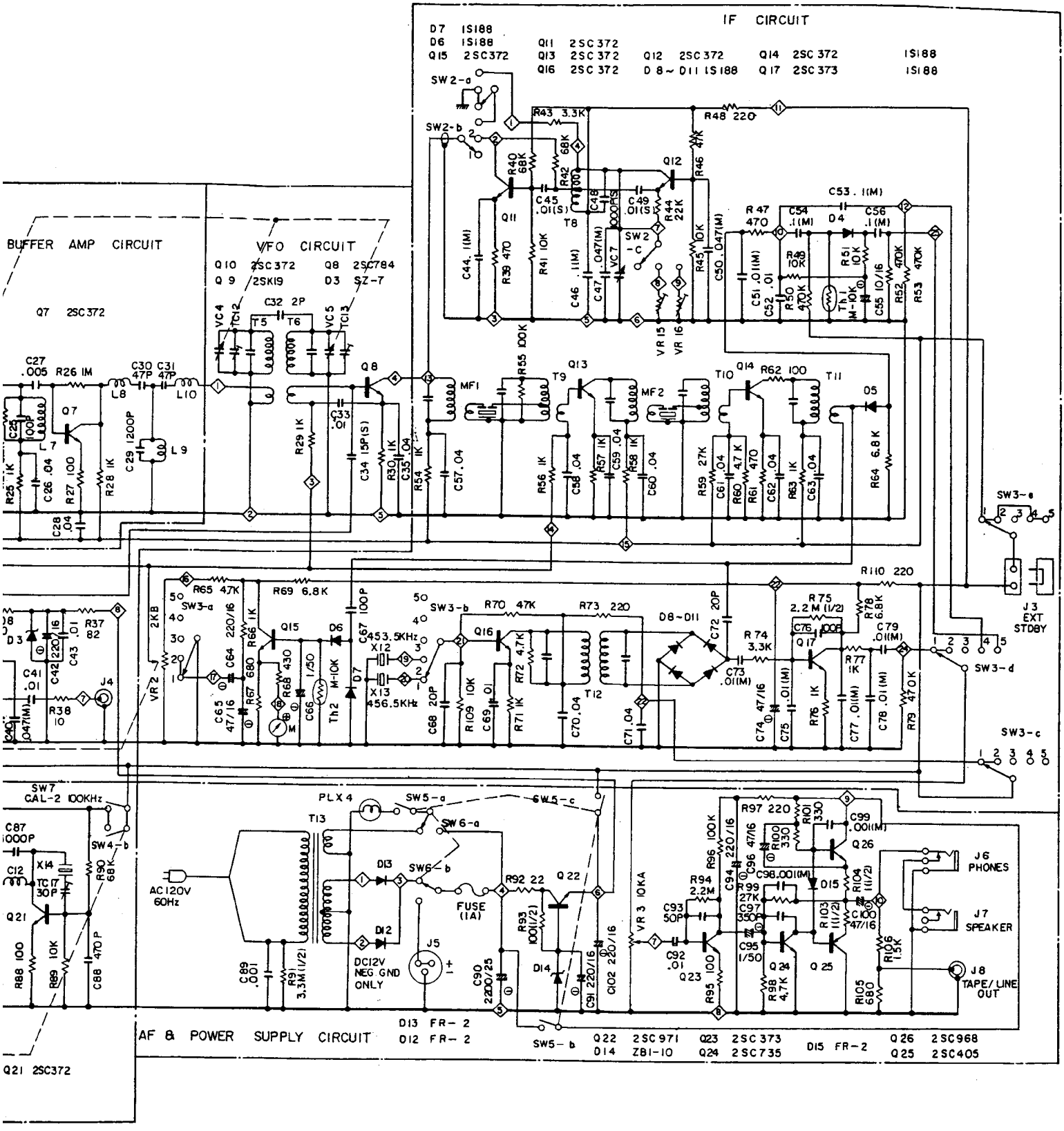
TRANSISTOR AND DIODE COMPLEMENT

Q 1	2SK19	Cascode RE Stage
Q 2	2SC373	AGC Amp.
Q 3	2SK19	Cascode RF Stage
Q 4	2SK19	1st Mixer
Q 5	2SC371	1st Local Osc.
Q 6	2SC371	1st Local Osc. Emitter Follower
Q 7	2SC372	1St IF Band Pass Amp.
Q 8	2SC784	2nd Mixer
Q 9	2SK19	Variable Frequency Osc.
Q10	2SC372	Variable Frequency Osc. Emitter Follower
Q11	2SC372	"Q" Multiplier Inverter
Q12	2SC372	"Q" Multiplier
Q13	2SC372	2nd IFAmp.
Q14	2SC372	2nd IF Amp.
Q15	2SC373	AGC Amp.
Q16	2SC372	BFO
Q17	2SC373	AF Amp.
Q18	2SC373	CAL. Buffer Amp.
Q19	2SC373	25khz Multivibrator
Q20	2SC373	25kHz Multivibrator
Q21	2SC372	100kHz Calibrator
Q22	2SC971	Regulator
Q23	2SC373	AF Amp.
Q24	2SC735	AF Driver Amp.
Q25	2SB405	AF Power Amp.
Q26	2SC968	AF Power Amp.

D l	1S188	Overload Protector
D 2	1S188	Overload Protector
D 3	SZ7	7V Voltage Regulator
D 4	1S188	ANL
D 5	1S188	AM Detector
D 6	1S188	AGC Detector
D 7	1S188	AGC Detector
D 8	18188	Product Detector
D 9	18188	Product Detector
D10	1S188	Product Detector
D11	1S188	Product Detector
D12	FR-2	Rectifier
D13	FR-2	Rectifier
D14	ZB1-10	10V Voltage Regulator
D15	FR-2	Temperature Compensator
TH 1	M-10K	Temperature Compensator
TH 2	M-10K	Temperature Compensator



REMARKS:
RESISTANCE VALUES IN OHMS. K=1000 M=1000000
CAPASITANCE VALUES IN MF. P= MMF



VALUES IN OHMS. K = 1000 M = 1000000
E VALUES IN MF. P = MMF

COMPLETE SCHEMATIC DIAGRAM OF RECEIVER

ALLIED RADIO SHACK A TANDY CORPORATION COMPANY
FORT WORTH, TEXAS 76107

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