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International Crystal 100D Owner's Manual

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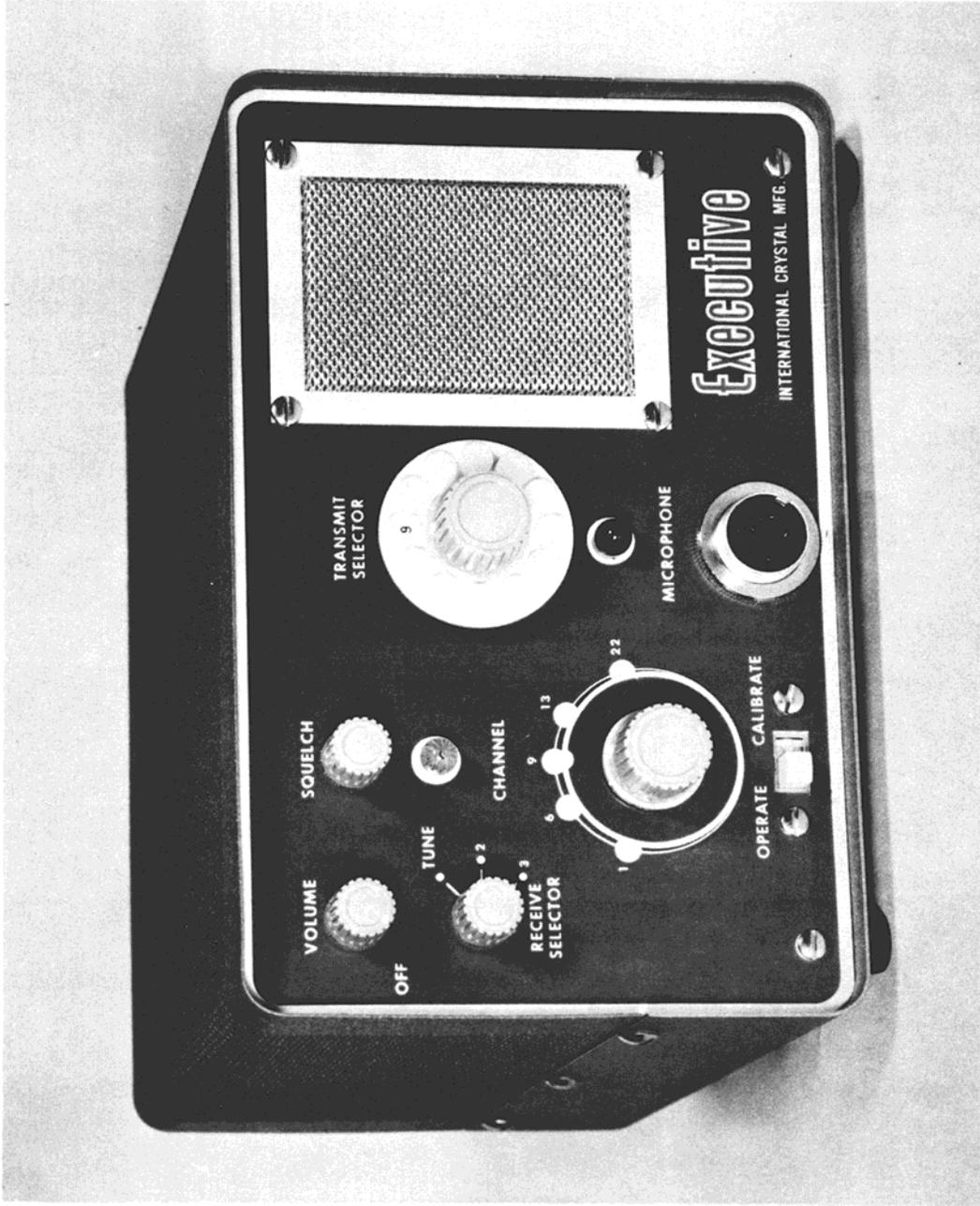
Manual 170-229
Issued 4/23/63
Revised 7/15/63

**EXECUTIVE
MODEL 100D
OPERATION and MAINTENANCE
MANUAL**

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INTERNATIONAL
Crystal Mfg. Co., Inc.
18 N. Lee
Oklahoma City, Oklahoma



ADDENDUM #1 Model 100-D
 Issued 7/15/63

Effective on units with Serial #98800XE and later.

Wiring of the Transmit Selector pilot lamp has been changed as follows:

* OLD CIRCUIT

** NEW CIRCUIT

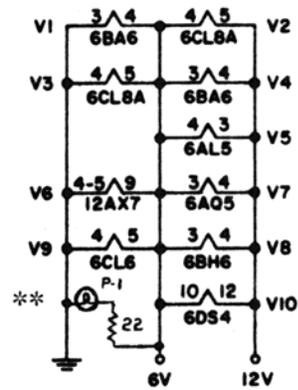
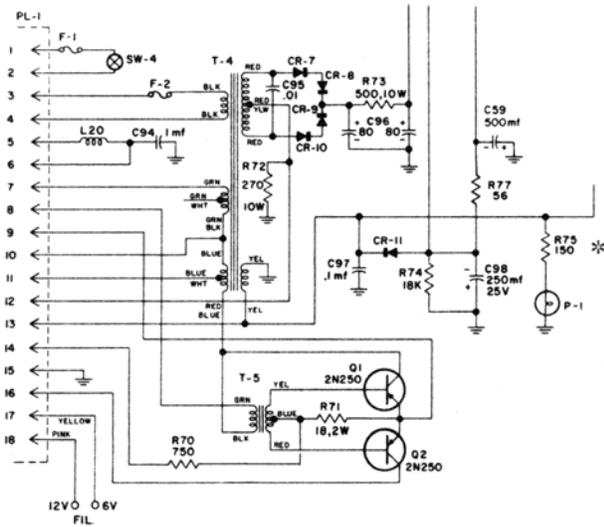


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SECTION I

GENERAL

The INTERNATIONAL EXECUTIVE, Model 100-D is the latest of the Executive series. This Citizens Band unit combines a sensitive and selective dual conversion receiver with a highly stable and efficient crystal controlled transmitter. The complete transmitter, receiver and power supply are housed in an attractive brown cabinet to blend favorably in the home, office, car or truck.

The EXECUTIVE Model 100-D makes use of a high-frequency crystal filter. Use of this filter between the first and second mixers greatly reduces adjacent channel interference.

The new delayed AVC system enables the receiver to handle very high input signal levels without overload.

The receiver manually tunes all 23 Class "D" Citizens Band channels. In addition two receiving crystal sockets are provided in the unit for the selection of any two desired channels. The selection of either crystal controlled channel, or manual tuning is accomplished with a three position switch on the front panel. A squelch circuit is built-in to provide receiver quieting during periods when no signal is being received.

The transmitter oscillator uses fundamental crystals operating at one-half the desired operating frequency. The crystals supplied have a frequency tolerance of .005% when used in the EXECUTIVE. A twelve position crystal switch assembly allows the operator to choose anyone of twelve channels at the flick of a switch.

The illuminated TRANSMIT SELECTOR allows the operator to instantly select the desired channel for which crystals have been installed in the selector switch assembly. Illuminated from behind the panel, the translucent channel buttons in the switch dial assembly make channel switching easy even in the darkest mobile installation.

A new speech clipper-filter circuit utilizing an audio bandpass filter and 6DS4 nuvistor has been incorporated in the Model 100-D. This new circuit allows the operator to maintain a higher average level of modulation without exceeding the 100% limit.

The EXECUTIVE has been designed with flexibility of installation in mind. It may be used in the home or office with power secured from the AC line. It may also be used in a car, boat, plane or other mobile and portable applications, wherever there is 6 or 12 VDC available. It may be used with a base loaded whip antenna, regular whip, long wire, ground plane, beam and other types of antennas. The attractive case design lends itself to use in the home or office without appearing unsightly or out of place.

Though the unit is very versatile, it is not to be expected that either receiving or transmitting results will be the same in every installation. As in all radio communications and particularly in VHF applications, the type of antenna, its location above ground, the noise present in the area and other factors are bound to affect the results obtained.

SPECIFICATIONS

Receiver:

Tuning Range (Manual tuning)	26.955 to 27.265 mc (Class "D" Citizens Band, Channels 1 through 23).
Tuning Range (Selector Pos. 2)	Crystal Controlled - Any Channel, 1 through 23.
Tuning Range (Selector Pos. 3)	Crystal Controlled - Any Channel, 1 through 23.
Sensitivity	Usable to .1 microvolts
Selectivity	50 db down at 10 kc better than 60 db down at 20 kc
Image Rejection	Better than 50 db down
Audio Output	2.5 watts into 4-6 ohms
Speaker Impedance	4-6 ohms
Squelch Range	.5 to 20,000 microvolts. On-off differential is approximately 1 microvolt, at 5 microvolt input.
Noise Limiter	Automatic, series-gate

TRANSMITTER

Frequency Stability	± .005% @ 0° to 125° F, when used with INTERNATIONAL high stability fundamental crystals.
RF Power Input	5 watts maximum (FCC rules)

Modulation

Capability - 100% with built in modulation limiter.

Crystals Required

Transmitter - INTERNATIONAL "T" (T-9 for Channel 9, etc.), high stability, fundamental type, at one-half the desired frequency. Receiver INTERNATIONAL "R" (R-9 for Channel 9, etc.)

Microphone

High impedance crystals, ceramic or high output dynamic type. (Push-to-talk switch required.)

POWER CONSUMPTION

Transmitting

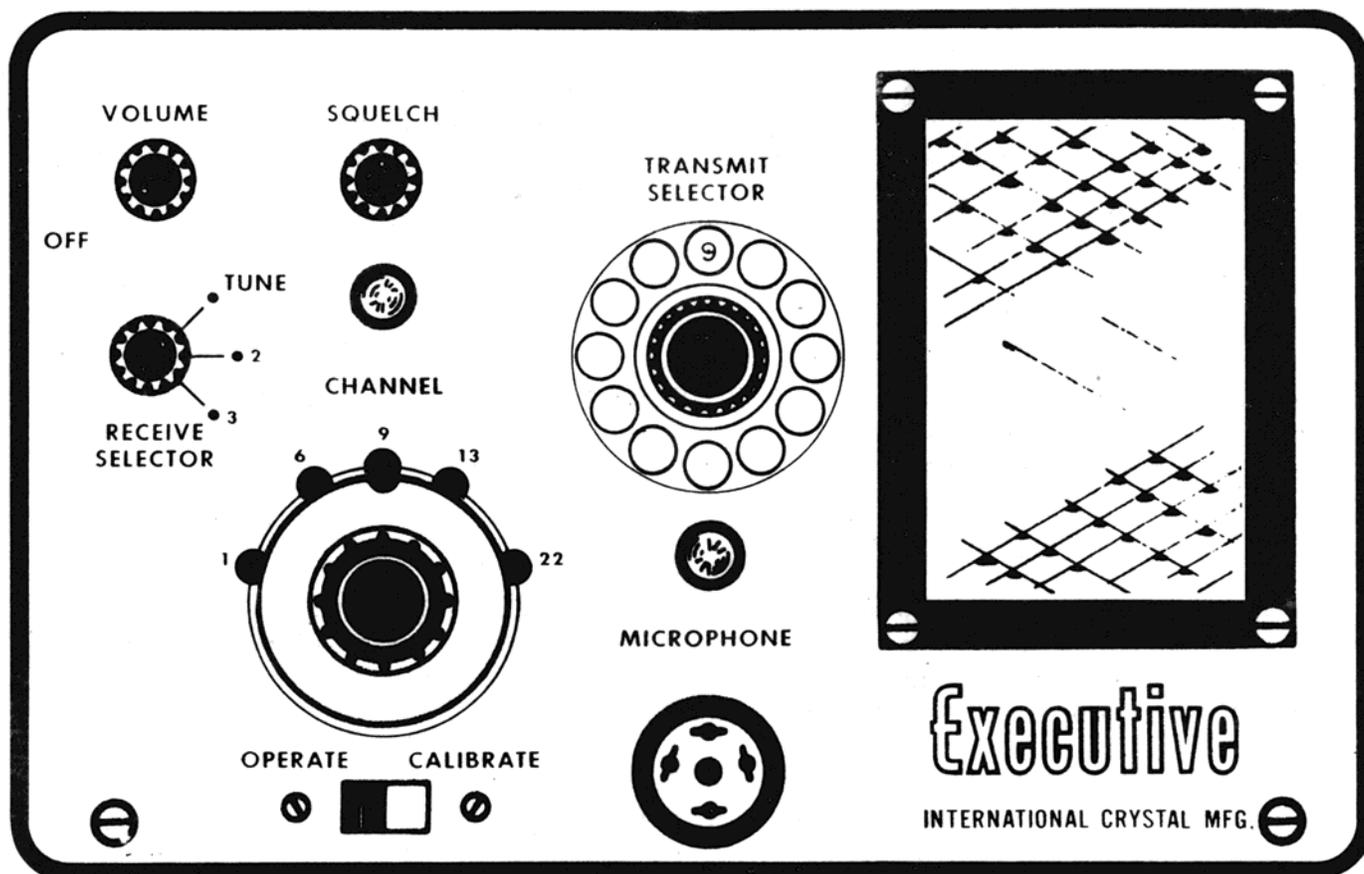
65 watts (approximate)

Receiving

60 watts (approximate)

Weight

12 pounds (approximate)



FRONT PANEL CONTROLS

VOLUME

On-off switch, volume control. To turn receiver on, turn the knob clockwise. Clockwise rotation of the knob also increases the volume level. Allow the set to warm up for about one minute before you wish to use it.

SQUELCH

This control is used to eliminate background noise when no signal is being received. Upon initial warmup, turn this control fully counter clockwise until a click is heard. The switch in the squelch control is OFF in this position. To operate, turn squelch control on and fully clockwise. Then slowly turn the control counterclockwise until the background noise just disappears. Leave the control set at this point. Do not turn the control too far counterclockwise as this will reduce the receiver performance and weak signals will not be heard.

RECEIVE SELECTOR

Set this control to TUNE unless receiver crystals have been installed in positions #2 and #3, in which case set the switch to the desired crystal position for crystal controlled reception.

TRANSMIT SELECTOR

A channel 9 crystal has been installed at the factory in switch position #2. A channel 9 indicator button has been installed in the indicator dial assembly. Channel number indicator buttons are furnished with each INTERNATIONAL transmit crystal and may be installed in the desired position of the indicator dial assembly. Place the switch in this position unless you have had other crystals installed, in which case select the channel on which you desire to transmit.

CHANNEL (Tuning)

With the RECEIVE SELECTOR set in TUNE position this control tunes the receiver through the range of all 23 channels. The approximate locations of channels 1, 6, 9, 13 and 22 are indicated on the panel. Other channels fall in between these points.

OPERATE-CALIBRATE (Switch)

During normal operation this switch is left in the OPERATE position. When it is desired to pretune the receiver to a specific channel (you must have a transmit crystal for this channel installed in the TRANSMIT SELECTOR crystal socket) set the controls as follows:

TRANSMIT SELECTOR to the desired channel
OPERATE-CALIBRATE switch to CALIBRATE
RECEIVE SELECTOR to Tune

Rotate tuning dial until the loudest part of the tone signal is received.

Rock the tuning dial back and forth to locate the center of the signal.

Leave tuning dial at this point and the receiver is pretuned to transmit channel you have selected. Return OPERATE-CALIBRATE switch to operate position.

MICROPHONE (Receptacle)

This connector requires a four prong lock-on plug which is furnished with the unit. High impedance crystal or ceramic type microphones may be used with this transceiver.

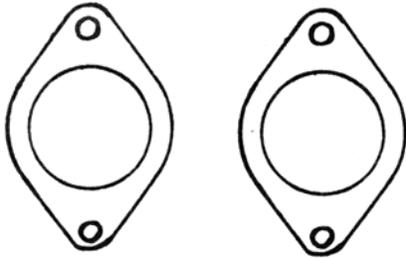
RECEIVE (Indicator)

This indicator located directly below the squelch control, functions as an ON-OFF (plate voltage) indicator for the receiver section of the transceiver. When the transceiver is operating in RECEIVE position, the lamp will glow steadily and go out when the transceiver is placed in TRANSMIT position.

TRANSMIT (Indicator)

This indicator functions as an audio level monitor. Depress the microphone keying button and speak directly into microphone. The indicator light will flicker intermittently as you speak in a normal voice level. With indicator operating on voice peaks, modulation will be about 95%. When talking too close to microphone the indicator lamp will glow almost constantly. This can result in over-modulation and cause adjacent channel interference. This indicator will flicker when the transceiver is in RECEIVE position also, showing proper operation of the receiver audio section.

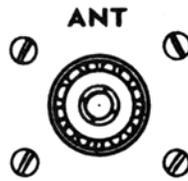
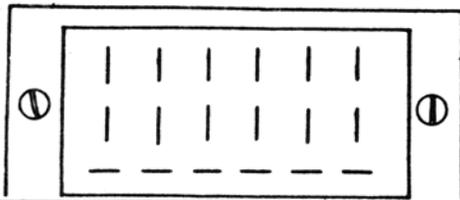
MODEL CTZ-100D SERIAL



**INTERNATIONAL
CRYSTAL MFG. CO., INC.
OKLAHOMA CITY, OKLA.**

THIS UNIT COMPLIES WITH F.C.C. RULES AND REGULATIONS, PART 19, FOR CLASS D OPERATION.

POWER REQUIREMENTS 60 WATTS. 115 VAC, 50-60 CYCLES; 6 VDC, 10 AMPS; 12 VDC, 5 AMPS.



FUSE SIZE
15 AMP, 6 VDC
7.5 AMP, 12 VDC

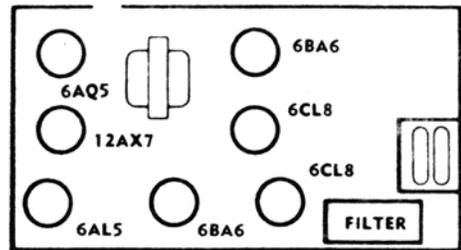
PUSH TO RESET



FUSE



RECEIVER AUDIO

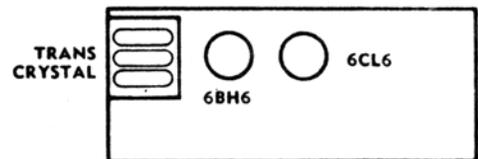


**FRONT
REC
CRYSTAL**

MIC. GAIN



ACC



TRANS/PWR SUPPLY

141-134

REAR PANEL CONTROLS

ANT (Antenna Receptacle)

This receptacle is used to connect the transmission line to the transmit-receive relay, TR-1. The receptacle is a standard low-loss, VHF type designed for 50- to 72- ohm coaxial cable.

ACC (Accessory Receptacle)

This connector requires a five prong plug which is furnished with the unit. This plug contains a jumper for internal speaker operation and must be in place for the set to function. An external speaker and Signal Strength ("S") Meter may be connected to the set with this connector.

FUSE

A 15 ampere fuse is installed in the fuseholder and may be changed or replaced, if necessary, by unscrewing the red insert in the center of the holder. If the transceiver is to be operated on 12 volts dc the fuse should be replaced with one having a rating of 7.5 amperes.

MIC. GAIN (Microphone Level)

This control adjusts microphone amplifier gain. The level has been set at the factory in conjunction with the speech clipper level control to maintain close to 100% modulation with a wide variation of input signal level from the microphone. In view of this, adjustment of this control will not normally be required. The red transmit indicator lamp will begin to flicker on voice peaks indicating approximately 95% modulation. CAUTION: Excessive gain will cause overmodulation.

PUSH TO RESET

This is a thermal cut-out. It protects the unit when it is being operated on 115 volts ac. If overload causes it to cut out, it can be reset by pressing in on the plunger and holding it in for about two seconds.

POWER

An 18-contact plug is used as a power connector. This allows various input voltages to be used without requiring changes within the unit. All necessary connection changes are made on the external plug. Five different cord assemblies are used; 115 VAC, 6VDC negative ground, 6VDC positive ground, 12 VDC negative ground, and 12VDC positive ground.

SECTION II

RECEIVER CIRCUIT DESCRIPTION

The receiver section of this transceiver is a double conversion unit employing the superheterodyne principle of frequency conversion. The first converter is composed of three basic sections; an rf amplifier, mixer, and oscillator which is either tunable or crystal controlled.

A received signal from the antenna is coupled to the control grid of the rf amplifier through a double tuned circuit consisting of coils L1 and L2, their respective shunting capacitors, and coupling capacitor C3. This double tuned circuit aids greatly in the elimination of unwanted signals outside the passband to which it has been tuned. The gain of the rf amplifier is controlled automatically by the receiver's delayed AVC system coupled to the control grid of V1 through a 1 megohm resistor.

After reaching the control grid of V1 (6BA6) the signal is amplified and coupled to the control grid of the mixer, V2A (triode section of 6CL8A). Here the signal is heterodyned with a signal in the 17 mc region coupled from the oscillator, V2B (tetrode section of 6CL8A). A difference frequency signal at 10 mc is selected by coil L6 in the plate circuit of the mixer, V2A and coupled to the grid of the second mixer in the I. F. strip through the 10 mc crystal filter-amplifier assembly.

The oscillator is a conventional Colpitts circuit which may be either crystal controlled or tuned over a limited frequency range when the RECEIVE SELECTOR switch is in TUNE position.

The second section of the receiver consists of a mixer and crystal controlled oscillator, intermediate frequency amplifier, second detector and noise limiter, a special squelch circuit, and delayed AVC system.

The 10 mc signal received at the grid of the second mixer, V3A, is heterodyned with a 10455 kc signal from the crystal controlled oscillator, V3B. The difference frequency of 455 kc is selected in the plate circuit of V3A and transformer coupled to the control grid of the intermediate frequency amplifier, V4. The gain of this amplifier is also automatically controlled by the AVC system connected to the grid of V4 through the secondary of transformer T1 and 220 K ohm resistor.

The signal is further amplified in V4 and coupled from the plate through transformer T2 to the plate of the detector, V5A, where the audio component is detected. V5A is also used to produce the normal AVC voltage for receiver I. F. section. The AVC voltage for V1 the rf amplifier is obtained from the delayed AVC system. This circuit is assembled on a small terminal board and mounted as a subassembly on the bottom side of the I. F. board. With no signal input to the receiver the voltage at pin #7 on the converter board is from .2 to .5 volts positive. This voltage is prevented from going further positive by clamping diode CR-1. As the level of the 455 kc signal from the plate of I. F. amplifier V4 increases the voltage applied to the control grid of V-1 gradually becomes more and more negative. When the input signal received by the antenna reaches approximately 5 microvolts, V1 is cut off as the negative voltage

being applied to the control grid is about -20 volts. The detected signal is coupled to V5B which acts as a series-type noise limiter removing noise pulses which may ride through on the signal. The squelch circuit consisting of a neon lamp, NE-1, silicon diode, CR-4, and associated components is connected so that the audio section of the receiver is cut off and background noise eliminated when no signal is being received. The cut-off level may be varied by use of the squelch control.

The third section of the receiver is a conventional audio amplifier consisting of a twin triode audio voltage amplifier, 12AX7, V6A-V6B followed by a 6AQ5, V7 tetrode power amplifier. When the transceiver is in RECEIVE position only one-half of the 12AX7 is used. The second triode section, V6B, receives the audio signal from the center tap of the volume control. The audio signal is amplified in V6B whose output is RC coupled to the control grid of the power amplifier, V7, through a bandpass circuit consisting of choke L13 and capacitors C70 & C75. The audio signal is further amplified in V7. The plate of V7 is connected to transformer T-3, which performs a dual function. In RECEIVE position this transformer acts as a normal output transformer with its secondary connected to the speaker. In TRANSMIT position, its function is that of a modulation transformer.

In TRANSMIT position, V6A is utilized as a straight voltage amplifier. This stage is preceded by a level clipping circuit consisting of a 6DS4, V10, diodes CR5 & CR6 and associated components. This clipping circuit allows a higher average level of modulation without the danger of exceeding the 100% limit.

TRANSMITTER CIRCUIT DESCRIPTION

The transmitter is a two-stage unit consisting of a crystal controlled oscillator and neutralized tetrode final amplifier. The crystal oscillator is an electron-coupled Colpitts circuit with the crystal oscillating in the grid cathode circuit. The oscillator uses INTERNATIONAL high stability, fundamental type crystals operating at one-half the desired transmitter output frequency. A twelve position switch, TRANSMIT SELECTOR, is provided to select any one of twelve crystals, which may be installed within the unit. A channel 9 crystal is furnished with the unit and installed in one of the twelve crystal sockets.

The plate circuit of the oscillator is tuned to the second harmonic of the crystal frequency by coil L19. The oscillator output is inductively coupled to the grid coil L17 of final amplifier, V9. The plate circuit of V9 is a shunt-fed, pi matching network. Neutralization is accomplished by capacitor C85, and link coil L16, coupled to the cold end of coil L17.

POWER SUPPLY CIRCUIT DESCRIPTION

A three-way supply is used in this transceiver. It operates as a conventional, full-wave rectifier circuit on all voltage inputs followed by a capacitor input RC filter network. On 6 or 12 volt battery operation, a transistor oscillator circuit is used to provide the necessary AC voltage for the primary circuit of the power transformer.

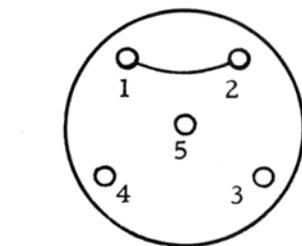
The transceiver is supplied with a power cord for operation from 115 volts AC, 60 cycles. The unit may be operated either from 6 volt positive ground, 6 volt negative ground, 12 volt positive ground, or 12 volt negative ground by use of the proper power cord assembly which may be purchased from your dealer. The power supply is equipped with a thermal circuit breaker for protection on AC operation. For protection on 12 volt DC operation a 7.5 ampere fuse is used with the transceiver. Protection on 6 volt DC operation is provided by a 15 ampere fuse which is supplied with the unit. When 12 volt DC operation is desired the 7.5 ampere fuse must be substituted for the 15 ampere fuse.

ACCESSORY RECEPTACLE

This connector, located on the rear panel of the unit, requires a five prong plug which is furnished with the unit. This plug contains a jumper for internal speaker operation and must be in place for the set to function. For external speaker (4 to 6 ohms) operation, remove the jumper and connect the external speaker between terminals 1 and 5 of the plug.

Also available at terminal #3 of this connector is the negative AVC voltage produced by the second detector of the I.F. unit. This voltage may be used to operate an "S" Meter provided the input impedance of the external meter is one megohm or more.

ACCESSORY PLUG WIRING



- 1 } Jumper
- 2 }
- 3 -AVC Voltage
- 4 12 VAC
- 5 Ground

WIRING POWER PLUG FOR MODEL 100 D

The 3-way power supply may be operated from any one of 5 different power systems; 115 VAC; 6 VDC positive ground, 6 VDC negative ground, 12 VDC positive ground, 12 VDC negative ground. Depending upon voltage to be used, connect the jumper wires to the plug as indicated below. A power cord is included with the kit. If it is desired to connect the plug for battery use, two pieces of #12 or larger battery wire, no longer than three feet, should be used between the plug and battery. DO NOT USE SMALL SIZE WIRE OR LONGER LENGTHS WHEN OPERATING FROM BATTERY AS THIS CAUSES EXCESSIVE VOLTAGE LOSS.

Remove the cover from the power plug by removing the two retainer pins and then separating cover and base. The sketches below are of the connection side of the plug base. Use the #18 buss wire supplied to make jumpers. Where jumpers cross and there is danger of a short, use a length of the insulating sleeving over the wire.

Part #150-174

115 VAC

115 VAC to pins 1 and 4
Jumper pins 2 and 3
Jumper pins 13 and 18

Part # 150-212

6 VDC Neg. Gnd.

+6 VDC Hot to pin 1 red
-6 VDC Gnd. to pin 15 brown
Jumper pins 11 to 12 to 14 to 15 to 18
Jumper pins 2 to 5 to 17
Jumper pins 7 to 8
Jumper pins 6 to 9
Jumper pins 10 to 16

Part # 150-214

12 VDC Neg. Gnd.

+12 VDC Hot to pin 1 red
-12 VDC Gnd. to pin 15 brown
Jumper pins 10 to 14 to 15
Jumper pins 7 to 8 to 16
Jumper pins 2 to 5 to 18
Jumper pins 6 to 9

Part #150-213

6 VDC Pos. Gnd.

-6 VDC Hot to pin 1 brown
+6 VDC Gnd. to pin 15 red
Jumper pins 9 to 12 to 15 to 18
Jumper pins 6 to 11 to 14
Jumper pins 2 to 5 to 17
Jumper pins 7 to 8
Jumper pins 10 to 16

Part #150-215

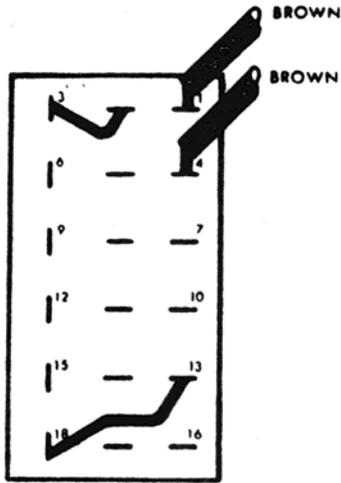
12 VDC Pos. Gnd.

-12 VDC Hot to pin 1 brown
+12 VDC Gnd. to pin 15 red
Jumper pins 6 to 10 to 14
Jumper pins 7 to 8 to 16
Jumper pins 2 to 5 to 18
Jumper pins 9 to 15

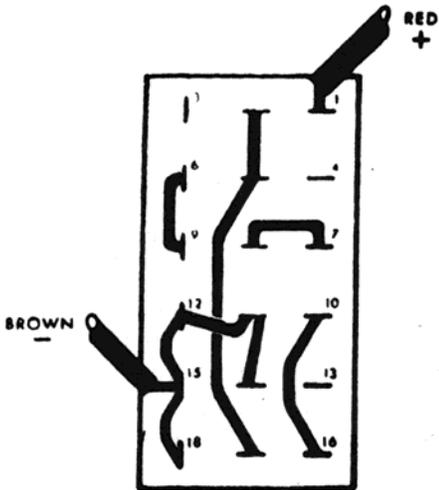
POWER PLUG WIRING

(ALL VIEWS FROM BACK OF PLUG)

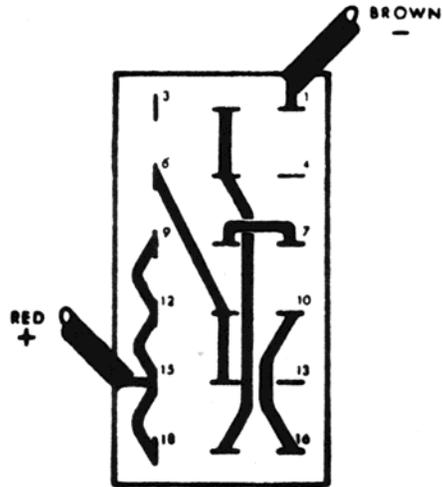
115 VAC 150-174



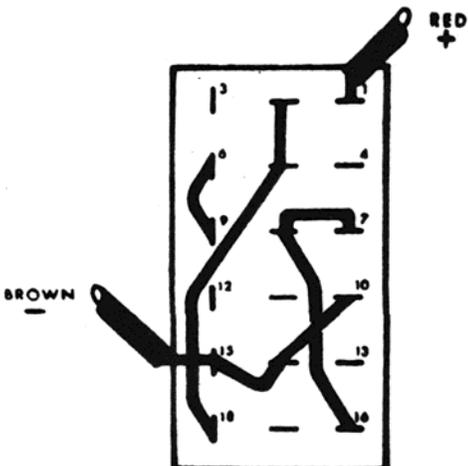
6 VDC Neg Gnd 150-212



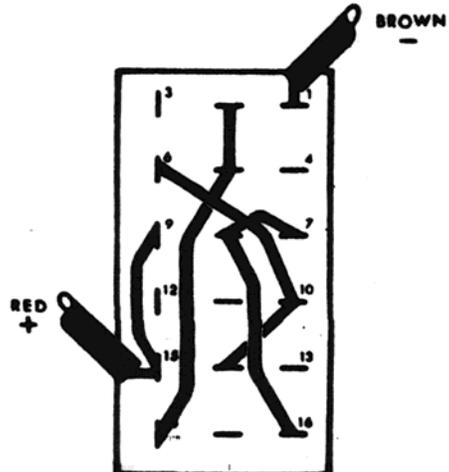
6 VDC Pos Gnd 150-213

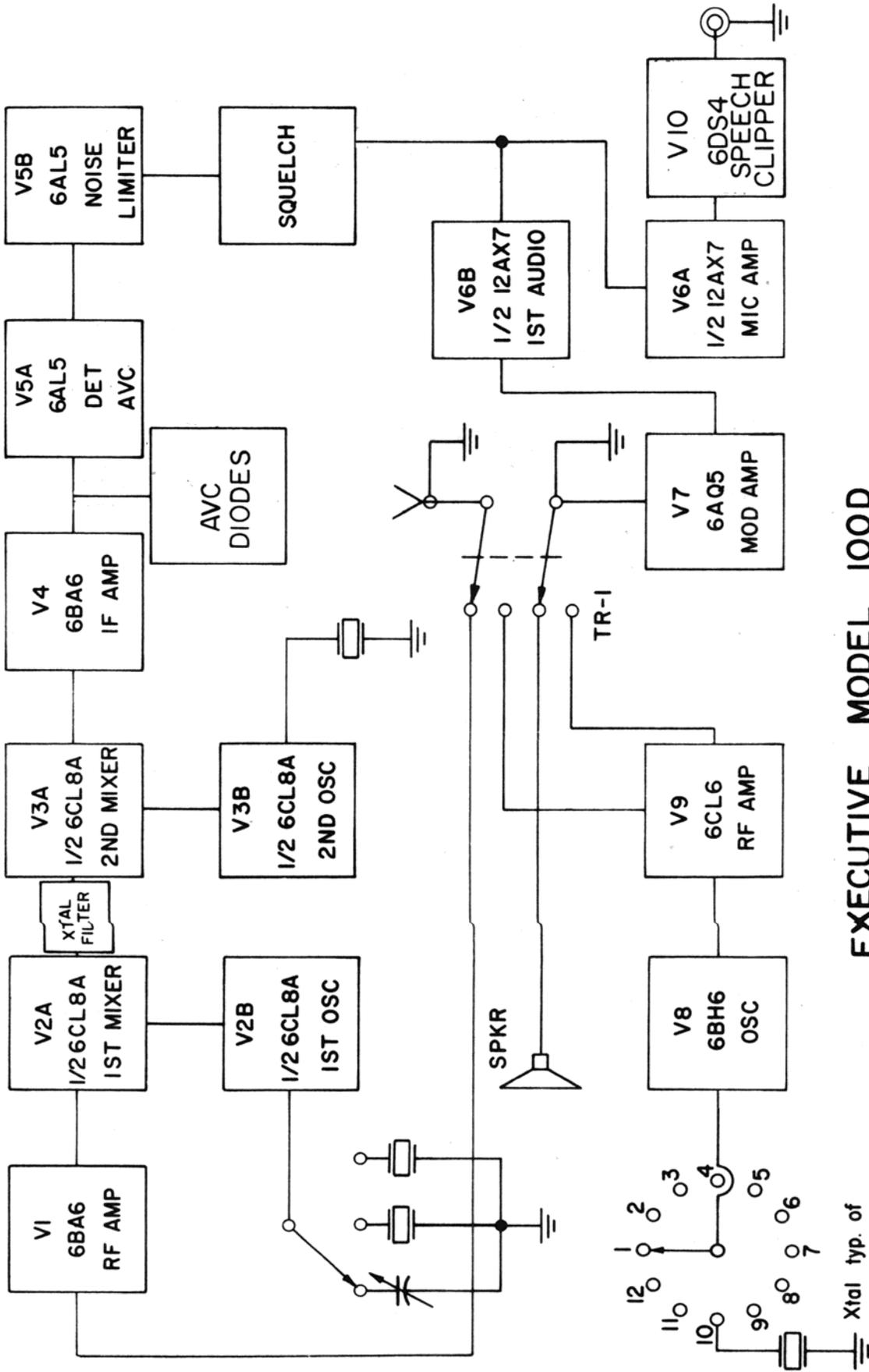


12 VDC Neg Gnd 150-214



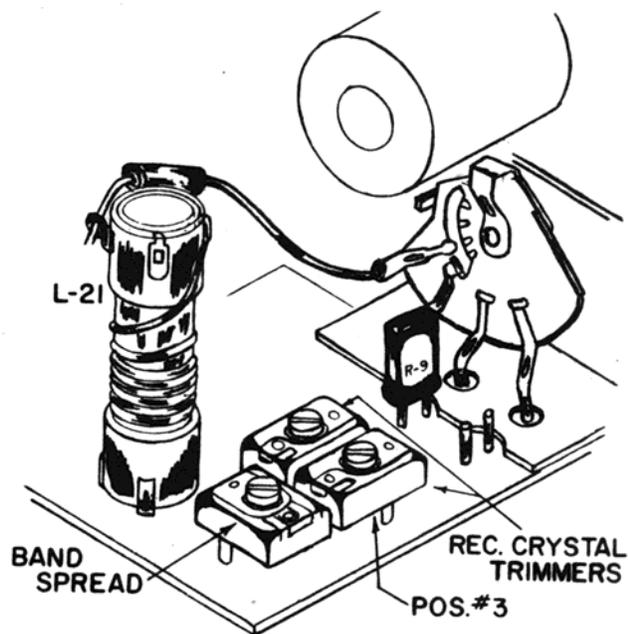
12 VDC Pos Gnd 150-215



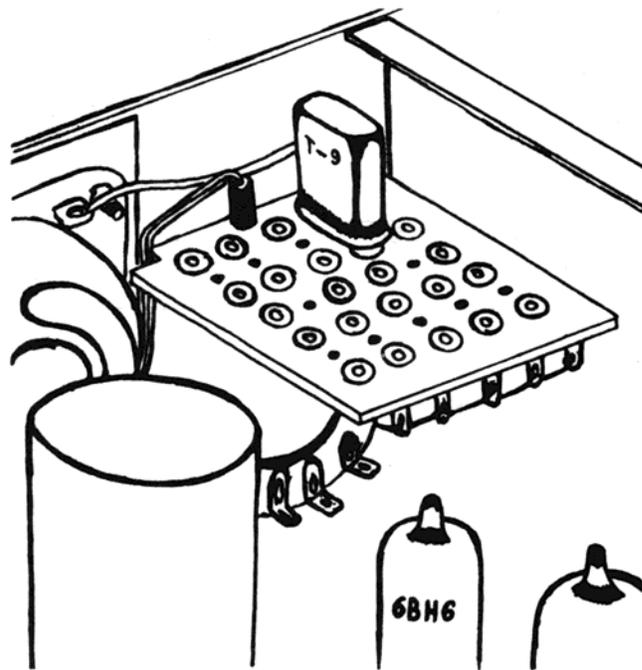


**EXECUTIVE MODEL 100D
BLOCK DIAGRAM**

12 2 3 4 5
11 10 9 8 7 6
Xtal typ. of
all 12 positions.



RECEIVER OSCILLATOR



TRANSMITTER OSCILLATOR

RECEIVER OSCILLATOR

The EXECUTIVE is delivered with a channel 9 receiver oscillator crystal in position #2 and may be operated to tune all 23 channels of the citizens band with the RECEIVE SELECTOR switch in TUNE position. For fixed tuning in either one or two channels install INTERNATIONAL type "R" miniature crystals for specific channels. The two crystals from left to right are controlled by positions #2 and #3 respectively on the RECEIVE SELECTOR switch. Type "R" crystals are listed in Section IV of this manual.

TRANSMITTER OSCILLATOR

The EXECUTIVE is equipped with one channel 9 transmit crystal. Additional crystals may be installed to permit transmission on either one or more channels. From left to right, the twelve crystals are controlled by positions #1, #2, #3, etc. respectively on the TRANSMIT SELECTOR switch. Transmit crystals are listed in section IV of this manual.

SECTION III INSTALLATION

The actual placement of the EXECUTIVE unit makes very little if any difference, in its performance. In planning an installation the transceiver should be placed where it will save the most steps. For instance, if the unit is installed in a home to provide communications between the wife at home and her husband in the car, the basement would be a poor location. A more desirable location would be at or near the portion of the house where she spends most of her time, such as in the kitchen, den, or possibly the living room.

FIXED LOCATION INSTALLATION

Operation of the EXECUTIVE from any fixed location such as the home or office will always be best with an outside antenna. A full discussion of antenna selection is given at the end of this section.

MOBILE INSTALLATION

It is possible that the EXECUTIVE, when used in a car or other mobile application, may use a short, base loaded whip, mounted on the rear of the unit. It will not however, prove to be very satisfactory. For best results, a whip, mounted outside the vehicle is required. It may be mounted with a bumper mount on the rear bumper, or may be mounted on a rear fender or cowl, using a ball mount.

The EXECUTIVE itself should be mounted under the dash or in some other practical place in the vehicle. A special mobile mount, designed for the EXECUTIVE is available from INTERNATIONAL which allows the unit to be securely mounted to the car, yet be very easily and quickly removed. Information on this mount is given in the ACCESSORIES section of this manual. Various types of antenna mounts and microphones are also available from INTERNATIONAL.

Installations in cars, planes, boats or other locations near gasoline engines present special problems of their own due to noise created by spark plugs, distributor, voltage regulator and generator. A typical mobile installation is shown below. Measures which help reduce this noise are discussed at the end of this section.

When making a mobile installation the automobile voltage regulator must be adjusted for a maximum generator charging rate of 7.3 volts on 6 volt systems and 14.7 volts on 12 volt systems. Equipment installed in vehicles having the regulator out of adjustment where the generator charging voltage exceeds 7.5 VDC on 6 volt systems or 15VDC on 12 volt systems shall be considered out-of-warranty.