

# IC-120

## 1200MHz FM TRANSCEIVER

### INSTRUCTION MANUAL



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## SECTION I SPECIFICATIONS

### GENERAL

|                             |              |   |   |
|-----------------------------|--------------|---|---|
| Numbers of semiconductors   | Transistor   | 55  |   |
|                             | FET          | 7   |   |
|                             | IC           | 26  |   |
|                             | Diode        | 101   | (European Version : 104)                          |
| Frequency coverage          |              | 1260 ~ 1300MHz  |   |
| Frequency resolution        |              | 10KHz/20KHz steps   | (European Version : 25KHz/75KHz)                  |
| Frequency control           |              | Microcomputer based Digital PLL synthesizer<br>Independent Dual VFO Capability. |   |
| Frequency stability         |              | Within $\pm 0.0005\%$   |   |
| Memory channels             |              | 6 channels with any in-band frequency programmable                              |   |
| Usable conditions           |              | Temperature: $-10^{\circ}\text{C} \sim 60^{\circ}\text{C}$                      | ( $14^{\circ}\text{F} \sim 140^{\circ}\text{F}$ ) |
| Antenna impedance           |              | 50 ohms unbalanced with N (UG-21/U) connector                                   |   |
| Power supply requirement    |              | 13.8V DC $\pm 15\%$ (negative ground)   | 2.5A Max.   |
| Current drain (at 13.8V DC) | Transmitting |   | Approx. 2.0A                                      |
|                             | Receiving    | At max audio output   | Approx. 0.8A                                      |
|                             |              | Squelched   | Approx. 0.6A                                      |
| Dimensions                  |              | 50mm(H) x 140mm(W) x 207mm(D)   |   |
| Weight                      |              | Approx. 1.9kg   |   |

### TRANSMITTER

|                          |  |   |   |
|--------------------------|--|---|---|
| Output power             |  | 1W  |   |
| Emission mode            |  | 16F <sub>3</sub> (F3E)  |   |
| Modulation system        |  | Variable reactance frequency modulation   |   |
| Max. frequency deviation |  | $\pm 5\text{KHz}$   |   |
| Spurious emission        |  | More than 40dB below carrier  |   |
| Microphone               |  | 600 ohm electret condenser microphone with push-to-talk<br>and frequency UP/DOWN switches.<br>(USA version : with 16 key dual-tone pad.)<br>(European version : with 1750Hz tone-burst unit.) |   |
| Operating mode           |  | Simplex, Duplex   | (Any offset in band in 100KHz increments) |

### RECEIVER

|                                   |  |                                   |                         |
|-----------------------------------|--|-----------------------------------|-------------------------|
| Receiving system                  |  | Triple-conversion superheterodyne |                         |
| RIT frequency coverage            |  | $\pm 5\text{KHz}$                 |                         |
| Modulation acceptance             |  | 16F <sub>3</sub> (F3E)            |                         |
| Intermediate frequency            |  | 1st:                              | 141MHz                  |
|                                   |  | 2nd:                              | 10.75MHz                |
|                                   |  | 3rd:                              | 455KHz                  |
| Sensitivity                       |  | Less than $0.3\mu\text{V}$        | for 12dB SINAD          |
|                                   |  | Less than $0.5\mu\text{V}$        | for 20dB Noise quieting |
| Squelch sensitivity               |  | Less than $0.25\mu\text{V}$       |                         |
| Spurious response rejection ratio |  | More than 60dB                    |                         |
| Selectivity                       |  | More than $\pm 7.5\text{KHz}$     | at $-6\text{dB}$ point  |
|                                   |  | Less than $\pm 15\text{KHz}$      | at $-60\text{dB}$ point |
| Audio output power                |  | More than 2.0W                    |                         |
| Audio output impedance            |  | 4 ~ 8 ohms                        |                         |

## **SECTION II DESCRIPTION**

### **1200MHz FM TRANSCEIVER INCORPORATING A MICROCOMPUTER**

CPU control with ICOM's original programs provide various operating capabilities. No-backlash dial controlled by ICOM's unique rotary encoder circuit. The band-edge detector and Endless System provides out-of-band protection. There are no variable capacitors or dial gears, ensuring problem-free use. The IC-120 can accommodate FM, coverage in the 1260 ~ 1300MHz frequency range.

### **MULTI-PURPOSE SCANNING**

The Memory Scan allows you to monitor six different memory channels and the Program Scan provides scanning between two programmed frequencies. The scanning speed is adjustable, and the auto-stop terminates scanning when a signal is received or a channel is empty.

### **DUAL VFO'S AND 6 MEMORY CHANNELS**

The IC-120 provides two VFO's. The both VFO's cover 40MHz range, 1260MHz to 1300MHz, with 10KHz (European version: 25KHz) increments by VFO "A", and 20KHz (European version: 75KHz) increments by VFO "B", and they can be used both for simplex and duplex modes.

The IC-120 has 6 memory channels which memorize any in-band frequencies as well as simplex/duplex modes and their offset frequencies, if desired.

In addition, when recalling the memorized frequency, it can be changed by turning the TUNING CONTROL the same as the VFO.

### **NEWLY DEVELOPED PLL CIRCUIT COVERS ENTIRE BAND**

The PLL circuit newly developed by ICOM covers 40MHz of entire band between 1260MHz and 1300MHz. The circuit is composed of three VCO's and mixing down system, and gives accurate frequency reading and high stability.

### **MICROWAVE TECHNOLOGY**

The front end and transmitter circuits employ the latest microwave devices:

The antenna switching circuit employs a low-loss switching module consisting of a quarter wave strip line and switching diodes.

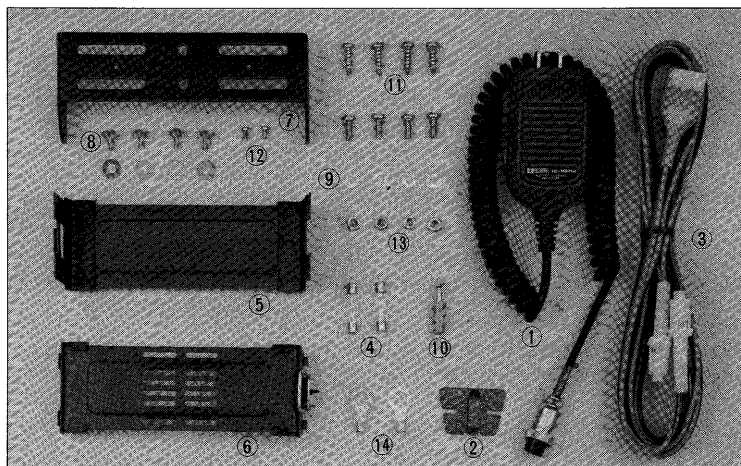
The RF amplifiers employ low noise figure, high gain disk type transistors for microwave purpose. Also the power amplifiers employ microwave purpose high gain, high power transistors.

In the band-pass filters, the ICOM original strip-line-like pressed coils are employed and they give stable reception and distortion-free signals with a minimum spurious radiation level.

## SECTION III INSTALLATION

### UNPACKING

Carefully remove your transceiver from the packing carton and examine it for signs of shipping damage. Should any be apparent, notify the delivering carrier or dealer immediately, stating the full extent of the damage. It is recommended you to keep the shipping cartons. In the event storage, moving, or reshipment becomes necessary, they come in handy. Accessory hardware, cables, etc., are packed with the transceiver. Make sure you have not overlooked anything.

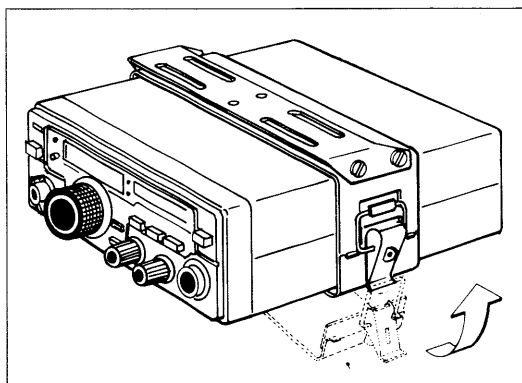
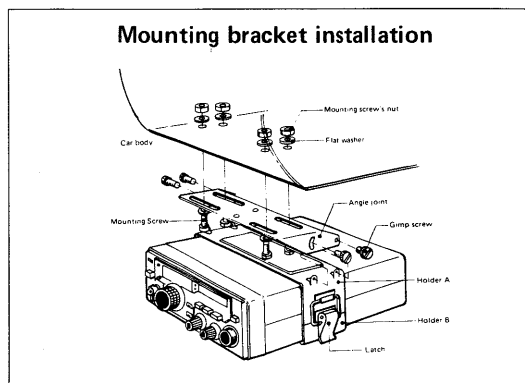


- |                                     |   |   |   |
|-------------------------------------|---|---|---|
| 1. Microphone (IC-HM12) . . . . .   | 1 | 8. Gimp screws . . . . .                    | 4 |
| 2. Microphone hook . . . . .        | 1 | 9. Flat washers . . . . .                   | 8 |
| 3. Power cord . . . . .             | 1 | 10. Plug for speaker . . . . .              | 1 |
| 4. Spare fuses (3A) . . . . .       | 2 | 11. Mounting screws . . . . .               | 8 |
| 5. Installing holder A . . . . .    | 1 | 12. Screws for additional bracket . . . . . | 2 |
| 6. Installing holder B . . . . .    | 1 | 13. Mounting screws' nuts . . . . .         | 4 |
| 7. Installing angle joint . . . . . | 1 | 14. Battery terminal lugs . . . . .         | 2 |

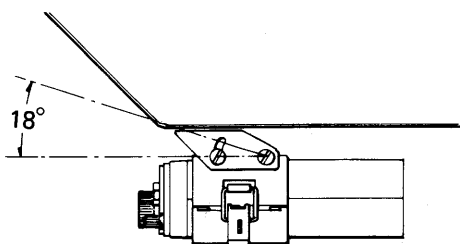
**Note:** USA version supplies with IC-HM14 (dual-tone encoder mic), European version supplies with IC-HM15 (with 1750Hz tone-burst unit).

### LOCATION

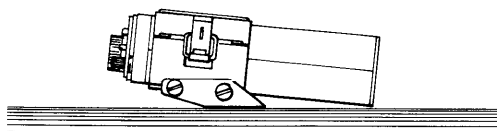
Where you place the transceiver in your automobile is not critical and should be governed by convenience and accessibility. Since the unit is so compact, many mobile possibilities present themselves. In general, the mobile mounting bracket will provide you with some guide as to placement. Any place where it can be mounted with metal screws, bolts, or pop-rivets will work. For fixed station use, a power supply should be designed to produce 3 amps for the transceiver.



### Angle adjustment



### Optional installation



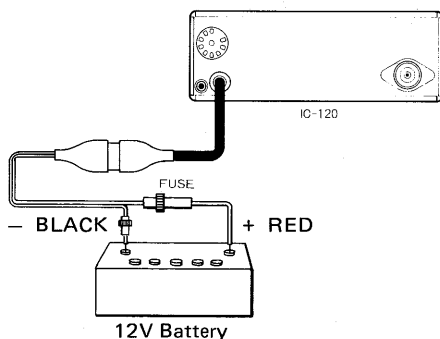
## POWER REQUIREMENTS

The transceiver is supplied ready to operate from any regulated 13.8V DC, 3 ampere negative ground source. An automobile 12 volt, negative ground, system is usually more than adequate. Some note must be taken, however, of the condition of the vehicle's electrical system. Items such as low battery, worn generator/alternator, poor voltage regulator, etc., will impair operation of your transceiver as well as the vehicle. High noise generation or low voltage delivery can be traced to these deficiencies. If an AC power supply is used with your transceiver, make certain it is adequately regulated for both voltage and current. Low voltage while under load will not produce satisfactory results from your transceiver. Receiver gain and transmitter output will be greatly impaired. Caution against catastrophic failure of the power supply should be observed.

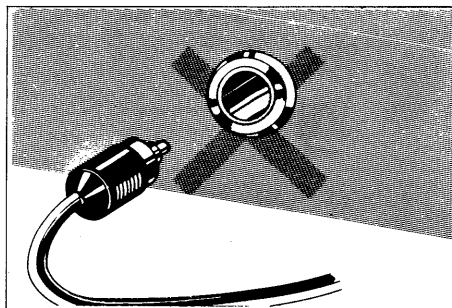
**CAUTION:** Excessive Voltage (above 15V DC) will cause damage to your transceiver. Be sure to check source voltage before plugging in the power cord.

Included with your transceiver is a DC power cable with plug attached. The Red Wire is positive (+), the Black, negative (—). If your mobile installation permits, it is best to connect these directly to the battery terminals. This arrangement eliminates random noise and transient spikes sometimes found in automotive accessory wiring. If such an arrangement is not possible, then any convenient B+ lead in the interior of the vehicle and the negative frame can be utilized. Remember, the unit operates on a negative ground system only; it cannot be used in a positive ground automobile. After making your connections, simply insert the plug into your transceiver.

### DC power cable connection



**Do not use a cigarette lighter socket.**



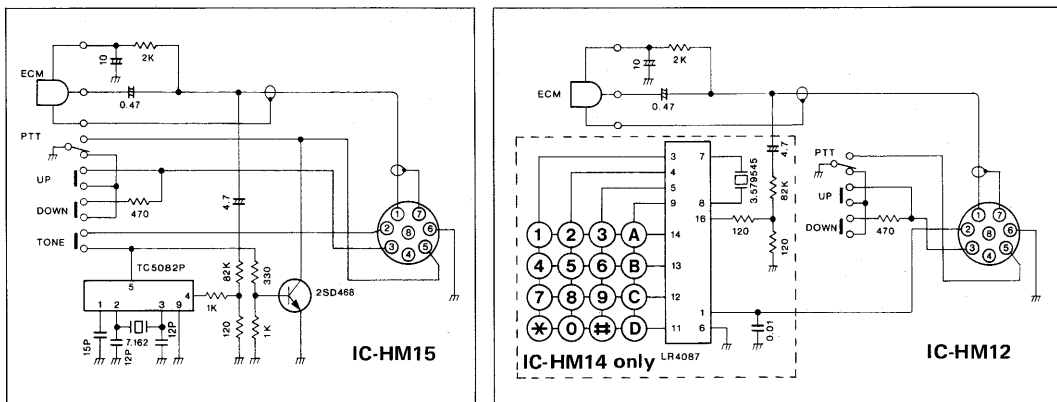
## ANTENNA

The single most important item that will influence the performance of any communication system is the antenna. For that reason, a good, high-quality, gain antenna of 50 ohms impedance is recommended, fixed or mobile. In UHF as well as the low bands, every watt of ERP makes some difference. Therefore, 1 watt average output plus 10dB of gain antenna equals 10 watts ERP, presuming low VSWR of course. The few extra dollars invested in a gain type antenna is well worth it. When adjusting your antenna, whether mobile or fixed, by all means follow the manufacturer's instructions. There are however some pitfalls to be aware of. For example, do not attempt to adjust an antenna for lowest VSWR when using a VSWR meter not engineered for UHF (1200MHz range) applications. Such readings will invariably have an error of 40% or more. Instead, use an in-line watt meter similar to the Bird Model 43 or Sierra Model 164B with UHF (1200MHz) cartridge. Further, when adjusting a mobile antenna, do so with the engine running preferably above normal idling speed. This will insure proper voltage level to the transceiver.

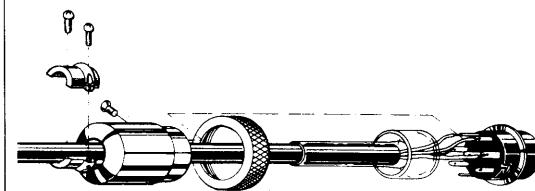
The RF coaxial connector on the rear chassis mates with a standard N (UG-21/U) connector.

## MICROPHONE

A high quality electret condenser microphone is supplied with your transceiver. Merely plug it into the proper receptacle on the front panel. Should you wish to use a different microphone, make certain it has a proper output level. Particular care should be exercised in wiring also, as the internal electrical switching system is dependent upon it. See the schematic for the proper hookup.



Microphone plug exploded view

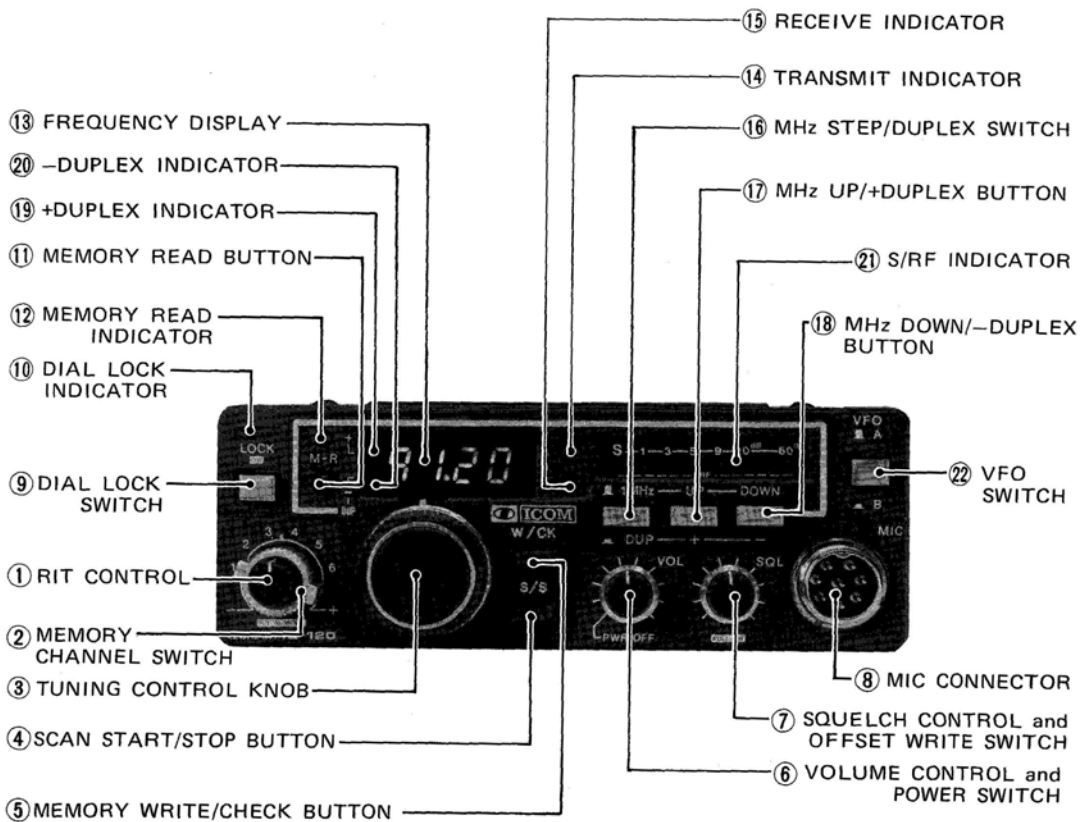


## EXTERNAL SPEAKER

An external speaker jack and plug is supplied with your unit in the event another speaker is desirable. The external speaker impedance should be 4 ~ 8 ohms, and when used, will disable the internal speaker. A 4 ~ 16 ohm headset can be utilized as well.

## SECTION IV CONTROL FUNCTIONS

### FRONT PANEL



#### 1. RIT CONTROL

Shifts the receive frequency  $\pm 5\text{KHz}$  either side of the transmit frequency. Rotating the control to the (+) side raises the receive frequency, and rotating to the (-) side lowers the receive frequency. The frequency shift by turning the RIT Control is not indicated on the frequency display.

If the OFF position is desired, place the RIT control at the center (12 o'clock) position. Then the transmit and receive frequencies are the same.

By changing the internal plug connection, the RIT function will change to FINE TUNING which can shift the operating frequency both in the receive mode and transmit mode.

#### 2. MEMORY CHANNEL SWITCH

When the MEMORY READ switch is pushed and the MEMORY READ INDICATOR is illuminated, this switch selects a memory channel, channels 1 - 6.

#### 3. TUNING CONTROL KNOB

Rotating the TUNING CONTROL KNOB clockwise increases the frequency, while rotating it counterclockwise decreases the frequency. The frequency is changed in 10KHz (European version: 25KHz) steps with the VFO "A", and 20KHz (European version: 75KHz) steps with

the VFO "B", when tuning up past 1300MHz, the frequency will automatically revert to 1260MHz. Likewise, when tuning down past 1260MHz, the frequency will automatically revert to 1300MHz.

When the set is in the MEMORY CHANNEL mode, the operating frequency also can be changed by turning the TUNING CONTROL. The frequency increment is dependent on the VFO switch setting as in the VFO operation.

#### **4. SCAN START/STOP BUTTON**

Starts and stops any of the scan functions. When depressing it again to restart the scan, it will start from the stopped memory channel or frequency.

#### **5. MEMORY WRITE/CHECK BUTTON**

By pushing this button, a frequency of the selected VFO is written into a memory channel in the SIMPLEX mode, or the receive frequency is changed to the respective transmit frequency in the DUPLEX mode.

#### **6. VOLUME CONTROL and POWER SWITCH**

When the control is turned completely counterclockwise, the power is OFF. By turning the control clockwise beyond the "click", the unit is turned ON and the audio level increases by further rotating it clockwise.

#### **7. SQUELCH CONTROL and OFFSET WRITE SWITCH**

Turning this control clockwise sets the squelch threshold higher. To turn OFF the squelch function, turn this control completely counterclockwise.

By pulling the SQUELCH control knob while the DIAL LOCK is engaged, the OFFSET frequency is displayed on the frequency display. The OFFSET frequency can be changed by pushing the MHz UP or DOWN button while the MHz STEP/DUPLEX switch is pushed in. Each push of the MHz UP button increases the OFFSET frequency in 100KHz increments, and the MHz DOWN button decreases it in like manner.

#### **8. MIC CONNECTOR**

Connect the supplied microphone to this jack. If you wish to use a different microphone, refer to the drawings on page 5.

#### **9. DIAL LOCK SWITCH**

After the IC-120 is set to a certain frequency for rag chewing, mobile operation, etc., by pushing this switch, the DIAL LOCK INDICATOR is illuminated and the VFO is electronically locked at the displayed frequency, thus inactivating the operation of the TUNING CONTROL. To change the frequency, the DIAL LOCK must first be disengaged by pushing and releasing this switch again.

#### **10. DIAL LOCK INDICATOR**

Illuminates when the DIAL LOCK switch is pressed to lock the dial.

#### **11. MEMORY READ BUTTON**

Each push selects the VFO mode and MEMORY CHANNEL mode alternately. When the MEMORY CHANNEL mode is selected, the MEMORY READ INDICATOR will be illuminated.

**12. MEMORY READ INDICATOR**

When the MEMORY READ button is pushed to select the MEMORY CHANNEL mode, this indicator is illuminated.

**13. FREQUENCY DISPLAY**

The four large 7 segment LED's represent the digits between 10MHz and 10KHz, and an LED for 5KHz (European version only) of the operating frequency. The frequency indicated is the carrier frequency.

**14. TRANSMIT INDICATOR**

Illuminates in the transmit mode.

**15. RECEIVE INDICATOR**

Illuminates when the squelch is opened in the receive mode.

**16. MHz STEP/DUPLEX SWITCH**

Selects the function of the MHz UP/+DUPLEX and MHz DOWN/-DUPLEX buttons.

When the switch is in the out position, each push of the MHz UP/+DUPLEX button increases the displayed frequency in 1MHz increments and the MHz DOWN/-DUPLEX button decreases the displayed frequency in 1MHz increments. In addition, by pushing both the MHz UP/+DUPLEX and MHz DOWN/-DUPLEX buttons simultaneously, the displayed frequency is decreased in 10MHz increments.

When the switch is depressed, by pushing the MHz UP/+DUPLEX button, the set is in the DUPLEX mode and the transmit frequency will be set 10MHz (European version; 33MHz) (This can be changed to any 100KHz steps in-band frequency.) above the displayed (receive) frequency. If the expecting transmit frequency goes out of band, the transmit frequency will remain at the displayed receive frequency and the DUPLEX mode will be cleared.

By pushing the MHz DOWN/-DUPLEX button, the set is in the DUPLEX mode and the transmit frequency will be set 10MHz (European version; 33MHz) (This can be changed to any 100KHz steps in-band frequency.) below the displayed (receive) frequency. Other functions are the same as the MHz UP/+DUPLEX button.

**17. MHz UP/+DUPLEX BUTTON**

This button has dual functions; to set into the "+" DUPLEX mode, and to increase the operating frequency in 1MHz increments and the OFFSET frequency in 100KHz increments.

**18. MHz DOWN/-DUPLEX BUTTON**

This button has dual functions; to set into the "-" DUPLEX mode, and to decrease the operating frequency in 1MHz increments and the OFFSET frequency in 100KHz increments.

**19. +DUPLEX INDICATOR**

Illuminates when the +DUPLEX mode is selected.

**20. -DUPLEX INDICATOR**

Illuminates when the -DUPLEX mode is selected.

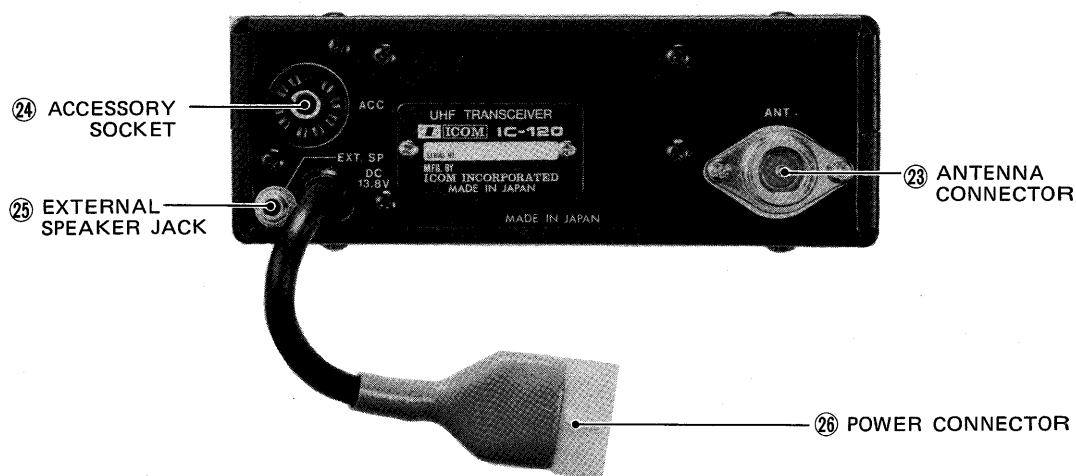
## 21. S/RF INDICATOR

Indicates S-units and RF output level with seven LED's in line. The numbers on the S-meter represent S1 through S9 and 20 and 60dB over S9. The RF output level meter functions only as a relative output meter and does not indicate the wattage. These functions are switched automatically when T/R switching is made.

## 22. VFO SWITCH

Selects either VFO, "A" or "B", for tuning. In the "A" (out) position, the displayed frequency changes 10KHz steps (European version; 25KHz steps) by turning the TUNING CONTROL. In the "B" (locked in) position, the frequency changes 20KHz steps (European version; 75KHz steps). This switch also decides the tuning rate in the MEMORY CHANNEL mode in like manner of the VFO mode.

## REAR PANEL



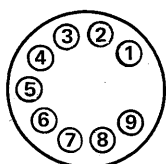
## 23. ANTENNA CONNECTOR

This is used to connect an antenna to the set. Its impedance is 50 ohms and connects with an N (UG-21/U) connector.

## 24. ACCESSORY SOCKET

The table below shows terminal connections of this connector.

### ACC SOCKET CONNECTIONS



Outside view

| PIN No. | FUNCTION   |
|---------|--|
| 1.      | Output of the applied voltage to the S/RF indicator driver IC.   |
| 2.      | Connected to Push-to-talk, T/R change-over switch. When grounded, the set operates in the transmit mode. |
| 3.      | 13.8 Volts DC in conjunction with the power switch operation. (0.3A Max.)                                |
| 4.      | Ground.  |
| 5. ~ 8. | NC (no connection).  |
| 9.      | Output of the discriminator circuit for a discriminator meter.   |

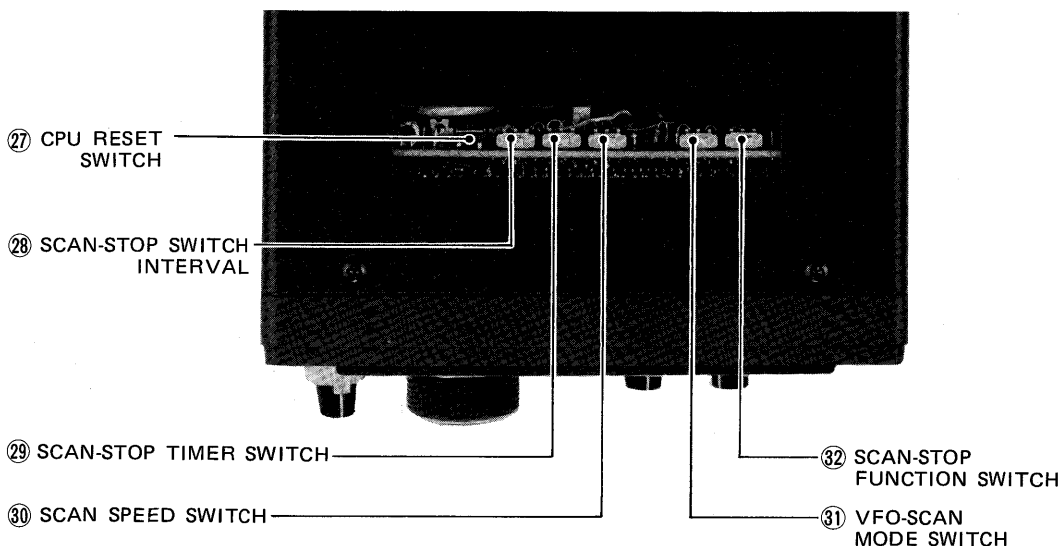
## 25. EXTERNAL SPEAKER JACK

When an external speaker is used, connect it to this jack. Use a speaker with an impedance of 4 ~ 8 ohms. When the external speaker is connected the built-in speaker does not function.

## 26. POWER CONNECTOR

Connect the supplied power cord to this connector.

## UNDER THE TOP COVER



## 27. CPU RESET SWITCH

Resets the CPU into the initial condition. If the CPU seems abnormal, push this switch when the power is ON, and the CPU will be initialized.

## 28. SCAN-STOP INTERVAL SWITCH

Switches the interval of the scan auto-stopping time. Place the switch to the desired interval; "L" for about 8 seconds or "S" for about 4 seconds.

## 29. SCAN-STOP TIMER SWITCH

Switches the scan-stop interval function ON and OFF.

## 30. SCAN SPEED SWITCH

Switches the scanning speed in any scan mode. Place the switch to the desired speed; "F" for fast or "S" for slow.

## 31. VFO-SCAN MODE SWITCH

Switches the VFO-scan function to either the programmed scan or the full range scan.

## 32. SCAN-STOP FUNCTION SWITCH

Switches the scan-stop function to either stop on a busy channel or stop on an empty channel.

## SECTION V OPERATION

### HOW TO TUNE

The following instructions are for tuning in any mode. Please read carefully and understand fully before turning ON your unit. Proper tuning is necessary for optimum operation.

### TUNING CONTROL

Rotating the Tuning Knob clockwise increase the frequency; turning it counterclockwise decreases the frequency in 10KHz (European version: 25KHz) steps when VFO "A" is used, or in 20KHz (European version: 75KHz) steps when VFO "B" is used.

When you reach 1299.99MHz, turning the Tuning Control knob clockwise will bring the operating frequency to 1260.00MHz, the lowest edge, and you can continue increasing the frequency from there by continuing to rotate the knob clockwise. The VFO endless system functions in the same way when decreasing the frequency from 1260.00MHz, and will prevent you from inadvertently operating out of the amateur radio band.

### MEMORY READ SWITCH and VFO SWITCH

The CPU in the IC-120 contains two "VFO's" for both receiving and transmitting. The VFO's are labeled VFO "A" and VFO "B" and are selectable with the VFO Switch, when the MEMORY READ INDICATOR is not illuminated. The dual VFO system gives the IC-120 many very convenient features. Please read this section very carefully and perform the operation several times until you are comfortable with the system. Try the example for practice!

1. VFO "A" is for both transmitting and receiving and is selected by placing the VFO Switch in the "A" (out) position. The transmit and receive frequency will be controlled by VFO "A", displayed on the frequency display and stored in "A" memory.
2. VFO "B" is for both transmitting and receiving and is selected by placing the VFO Switch in the "B" (in) position. The transmit and receive frequency will be controlled by VFO "B", displayed on the frequency display, and stored in "B" memory.

**NOTE:** The memory channel positions are described in the "MEMORY CHANNEL OPERATION" on page 14.

- When the IC-120 is first turned ON or initialized, 1260.00MHz is preset into the VFO "A" and VFO "B".

### FOR EXAMPLE:

When the VFO Switch is set in the "A" position and the set is turned ON or the CPU RESET switch is pushed, "60.00" will be displayed on the readout representing 1260.00MHz. This will occur whether the VFO switch is in either the "A" or "B" position. Rotating the tuning control knob clockwise will increase the frequency, and rotating the tuning knob counterclockwise will decrease the frequency in 10KHz (European version; 25KHz) steps with VFO "A", or in 20KHz (European version; 75KHz) steps with VFO "B".

- Switching from one VFO to the other VFO does not clear the first VFO. The frequency is retained in the VFO's memory.

### FOR EXAMPLE:

If 1260.150MHz is set with VFO "A", and the VFO switch is set to VFO "B", the frequency

readout will show VFO B's frequency, but 1260.150MHz is still stored in VFO A's memory. Return the VFO Switch to VFO "A" position, and "60.15" will be displayed on the readout. Accordingly, if the switch is placed in the VFO "B" position, the frequency that was set with the VFO "B" will appear. This allows you to set a certain frequency with one VFO, work up and down the band with the other VFO, and periodically check the set frequency simply by switching between VFO "A" and "B". It also allows you to search for a clear frequency with one VFO, while keeping your operating frequency on the other VFO. When you have found a clear frequency, switch back to your operating frequency, inform the station you are in contact with of the new frequency, and switch back. It's that simple!

### **MHz UP/DOWN BUTTONS**

When the MHz STEP/DUPLEX switch is in the MHz (OUT) position, each push of the MHz UP button increases the displayed frequency in 1MHz increments. At this time its lower digits will remain as it had in the previous one. If the displayed frequency reaches the highest MHz range (1299MHz), the next increment will cause the display to revert to the low limit (1260MHz).

Each push of the MHz DOWN button decreases the displayed frequency in like manner when the MHz UP button is pushed. If the displayed frequency reaches to the lowest MHz range (1260MHz), the next increment will advance the display to high limit (1299MHz).

By pushing both the MHz UP and MHz DOWN buttons simultaneously, the displayed frequency is decreased in 10MHz increments. If the displayed frequency reaches to lowest 10MHz range (1260MHz), the next is the high limit (1290MHz).

### **DUPLEX (REPEATER) OPERATION**

The MHz STEP/DUPLEX switch and +DUPLEX or -DUPLEX button allow DUPLEX (repeater) operation. The OFFSET frequency is preset for standard separation; 10MHz (European version: 33MHz), but this frequency can be reset for any 100KHz step in-band frequency. So, you can access any repeater.

1. When the "+" or "-" DUPLEX INDICATOR is not illuminated, the set is in SIMPLEX mode; the receive frequency and transmit frequency are the displayed frequency which is set by VFO A or B, or MEMORY CHANNELS 1 - 6.
2. When the MHz STEP/DUPLEX switch is in DUP (pushed in) position and the -DUPLEX button is pushed (-DUPLEX INDICATOR is illuminated), the set is in -DUPLEX mode, and the transmit frequency is set 10MHz (European version; 33MHz) or reset OFFSET frequency below the receive frequency.
3. When the +DUPLEX button is pushed (+DUPLEX INDICATOR is illuminated), the set is in +DUPLEX mode, and the transmit frequency is set 10MHz (European version; 33MHz) or reset OFFSET frequency above the receive frequency.
4. When the "+" or "-" DUPLEX INDICATOR is illuminated, while the MEMORY WRITE/CHECK button is pushed, the receive frequency becomes the expecting transmit frequency, so you can receive the repeater's input frequency. However, if the expecting transmit frequency is out of band, the DUPLEX mode will be cancelled by pushing the MEMORY WRITE/CHECK button and the displayed frequency will remain on the previous receive frequency. Thus the MEMORY WRITE/CHECK button functions as the MEMORY WRITE button, so don't depress this button continuously in this case.

- +DUPLEX or –DUPLEX mode will allow you to access a repeater that has a 10MHz input/output frequency separation.

#### **FOR EXAMPLE:**

Set the operating frequency to 1293.150MHz with VFO A. Then push the MHz STEP/DUPLEX switch in and the –DUPLEX button, and the –DUPLEX INDICATOR will be illuminated.

“93.15” will be shown on the display during receive and “83.15” during transmit. You are now receiving on 1293.150MHz and transmitting on 1283.150MHz, so you can access a 1283.150/1293.150 repeater.

If you push the MEMORY WRITE/CHECK button, “83.15” will be shown on the display and you can receive on 1283.150MHz, i.e., repeater input frequency, while the button is depressed.

If you change the receive (VFO A) frequency from 1293.150MHz to 1293.250MHz, the transmit frequency will change from 1283.150MHz to 1283.250MHz, so now you can access a 1283.250/1293.250 repeater.

By pushing the +DUPLEX button, the set is in the +DUPLEX mode and the transmit frequency will be 10MHz above the receive frequency.

If you set the receive frequency to 1283.750MHz, the transmit frequency will be 1293.750MHz.

These functions will be available also with VFO B and MEMORY CHANNELS 1 – 6.

#### **RESETTING THE OFFSET FREQUENCY**

The OFFSET frequency can be reset to any 100KHz steps in-band frequency other than 10MHz (European version: 33MHz).

By pulling the SQUELCH CONTROL AND OFFSET WRITE switch knob while the DIAL LOCK switch is pushed in, the FREQUENCY DISPLAY shows the OFFSET frequency. If no OFFSET frequency has been reset since first turning the power of the set ON, “10.00” (European version: “33.00”) will be shown on the display.

When the MHz STEP/DUPLEX switch is in 1MHz (out) position, each push of the MHz UP/+DUPLEX button increases the displayed OFFSET frequency in 100KHz increments. In the like manner, each push of the MHz DOWN/–DUPLEX button decreases the displayed OFFSET frequency. Push the MHz UP or MHz DOWN button to obtain desired OFFSET frequency, and the reset OFFSET frequency is written into the CPU and maintained as long as a new OFFSET frequency is reset.

This reset OFFSET frequency can be memorized into a memory channel, so this is very convenient for memorizing a frequency for a repeater that has a non-standard offset frequency separation.

- What to do if you want to access a repeater that has a frequency separation other than 10MHz (for example: 15MHz).

#### **FOR EXAMPLE:**

Push the DIAL LOCK switch in (the DIAL LOCK INDICATOR will be illuminated) and pull the SQUELCH CONTROL and OFFSET WRITE switch knob, and the FREQUENCY DISPLAY shows "10.00". Set the MHz STEP/DUPLEX switch in 1MHz (OUT) position, then push the MHz UP/+DUPLEX button many times to show "15.00" on the display. Then push the SQUELCH CONTROL knob to normal position and the DIAL LOCK switch to release it.

Set the receive frequency to a desired repeater's output frequency; for example 1291.200MHz. Then push the MHz STEP/DUPLEX switch in and the -DUPLEX button.

"91.20" will be shown on the display during receive and "76.20" during transmit. You are now receiving on 1291.200MHz and transmitting on 1276.200MHz, so you can access a 1276.200/1291.200 repeater.

If you change the receive frequency from 1291.200MHz to 1291.250MHz, the transmit frequency will change from 1276.200MHz to 1276.250MHz, so you can access a 1276.250/1291.250 repeater.

These operating frequencies, OFFSET frequency and DUPLEX mode can be memorized into a memory channel, and you can recall this memory channel and access that repeater, even if the OFFSET frequency is reset to the standard separation.

### **MEMORY CHANNEL OPERATION**

#### **MEMORY WRITING (PROGRAMMING THE MEMORY CHANNELS)**

Select a VFO, then set the operating frequency to the desired one with the TUNING CONTROL and/or MHz UP/DOWN buttons. For example, set it for 1295.250MHz, the display shows "95.25".

Set the MEMORY CHANNEL switch to the channel to be programmed (1 — 6). As an example, set it at MEMORY CHANNEL 3. To check the contents of the memory channel, push the MEMORY READ button, and the MEMORY READ INDICATOR is illuminated and a frequency programmed in the channel is shown on the FREQUENCY DISPLAY. (If no frequency has been programmed since first turning the power ON, the FREQUENCY DISPLAY does not show any frequency, but MHz decimal only.) If you don't like to rewrite the frequency programmed previously in the channel, select another memory channel by turning the MEMORY CHANNEL switch.

Make sure the set is in the VFO mode and SIMPLEX mode, then push the MEMORY WRITE/CHECK button, and the previous programmed frequency is erased and the new frequency (1295.250MHz) is programmed into the MEMORY CHANNEL 3.

When you want to memorize the DUPLEX mode and its OFFSET frequency, first, push the MEMORY READ button to call the memory channel, then set the radio in the desired DUPLEX mode and reset its OFFSET frequency if desired. After this, the DUPLEX mode and its OFFSET frequency can be recalled when this memory channel is selected.

Program other desired frequencies (and DUPLEX mode) into other memory channels in the same manner. MEMORY CHANNELS 1 and 2 are used for the PROGRAMMED SCAN. For programmed scan operation, refer to "SCAN OPERATION" on page 15.

## MEMORY READING

By pushing the MEMORY READ button, the MEMORY READ INDICATOR is illuminated and the set becomes in the MEMORY CHANNEL mode. The desired memory channel can be selected by turning the MEMORY CHANNEL switch. Set the MEMORY CHANNEL switch to the desired memory channel, and the previously programmed frequency will be recalled. This recalled frequency can be changed by turning the TUNING CONTROL and/or MHz UP/DOWN button the same as the VFO. Also this frequency can be memorized into the selected memory channel by pushing the MEMORY WRITE button in like manner.

When the MEMORY READ button is pushed again, the set returns to the VFO mode and the previous operating frequency of that VFO will again be shown on the display.

The programmed frequencies in the six memory channels are maintained as long as new frequencies are not reprogrammed.

## SCANNING OPERATION

### MEMORY SCAN

This is used to scan the six memory channels continuously.

1. Program six desired frequencies into MEMORY CHANNELS 1 – 6. If there are blank channels, they will be scanned faster.
2. Push the MEMORY READ button to illuminate the MEMORY READ INDICATOR and set the MEMORY CHANNEL switch to any channel position.
3. Depress the S/S (Scan Start/Stop) button, and the frequency starts scanning the programmed frequencies in the Memory Channels 1, 2, 3, 4, 5, 6, 1, 2, 3, 4, 5, 6, . . . . .
4. If the SQUELCH is engaged, the scan stops when the squelch is opened and receives a signal. To stop scanning without opening the squelch, depress the S/S Button. Depress it again to restart the scanning.

This function can be changed to stop when the squelch is closed, i.e., an empty channel, by setting the SCAN-STOP FUNCTION SWITCH located under the top cover to the EMPTY position.

5. The SCAN SPEED can be changed by the SCAN SPEED switch under the top cover. Place the switch to desired speed; "F" for fast or "S" for slow.

### PROGRAMMED SCAN

This is used to scan between two desired frequencies, which are programmed in Memory Channels 1 and 2, by setting the VFO-SCAN MODE Switch located under the top cover to "P" position.

1. Program the frequencies of the high and low edges of the desired scanning range into the memory channels 1 and 2. Regardless of which channel the higher frequency is programmed in the scan starts from the high edge of the range.

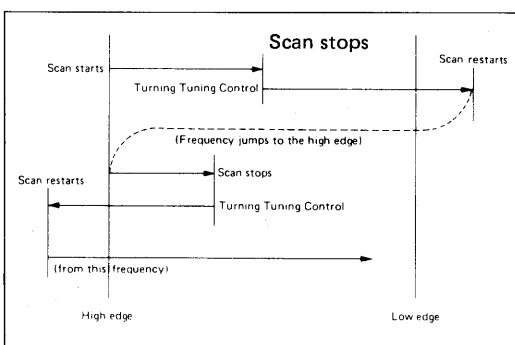
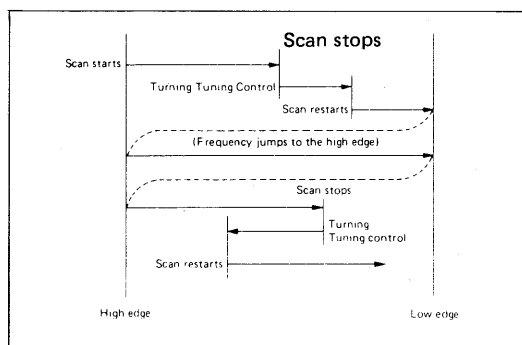
For example, 1294.00MHz is in the memory channel 1 and 1295.50MHz in the channel 2.

2. If the set is in the MEMORY CHANNEL mode, push the MEMORY READ button to set to the VFO mode. Pushing the SCAN START/STOP button starts the scan from the VFO frequency or the high edge (1295.50MHz) to the low edge.

If the VFO frequency is below the low edge frequency, the frequency jumps to the high edge (1295.50MHz) and the scan starts from the frequency. If the VFO frequency is higher than the high edge, the scan starts from the VFO frequency and scans down to the low edge but it will return to the programmed high edge frequency.

The scanning frequency increments depend on the VFO switch setting (VFO A: 10KHz/25KHz, VFO B: 20KHz/75KHz).

3. When the scanning frequency reaches the low edge (1294.00MHz), it automatically returns to the high edge (exact frequency is programmed frequency plus 90KHz with VFO A, or plus 80KHz with VFO B, except European version) and continues scanning down to provide endless scanning operation.
4. While the SQUELCH is engaged, the squelch opening as a signal is received will stop the scanning automatically on the frequency. If the RECEIVE indicator LED is lit because the SQUELCH is not engaged, the scan does not stop at any signal.
5. To stop the scan operation, depress the S/S Button. Depressing the S/S Button again restarts the scan from the frequency at which it stopped.
6. When the scanning has automatically stopped on a frequency, the frequency can not be changed by turning the TUNING CONTROL. If you wish to change the frequency, first, push the SCAN START/STOP button to clear the scan function.



### VFO FULL RANGE SCAN

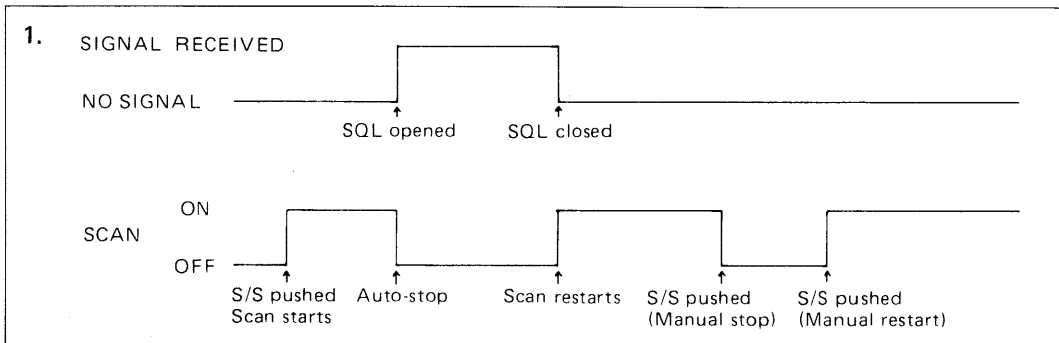
This is used to scan the entire band between 1260.00MHz and 1299.99MHz.

1. Push the MEMORY READ button to set to the VFO mode, if different, and set the internal VFO-SCAN MODE Switch to "F" position. Depressing the S/S button starts the scan from the VFO frequency to the low edge. The scanning frequency increments depend on the VFO Switch setting.
2. When the scanning frequency reaches the low edge, it automatically returns to the high edge and continues scanning down to provide endless scanning operation.
3. Other operations are the same as the PROGRAMMED SCAN and MEMORY SCAN.

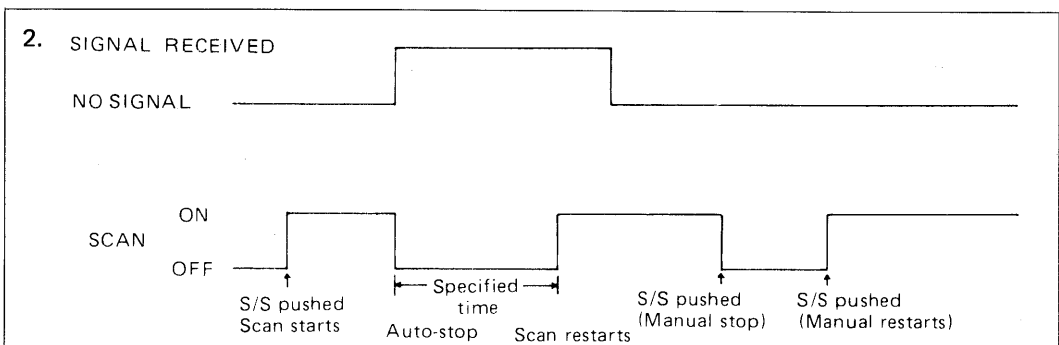
While the SCAN is operating even if the SCAN stops on a frequency, the decimal point of the frequency display will blink according to the scanning speed.

## RESUMING SCAN

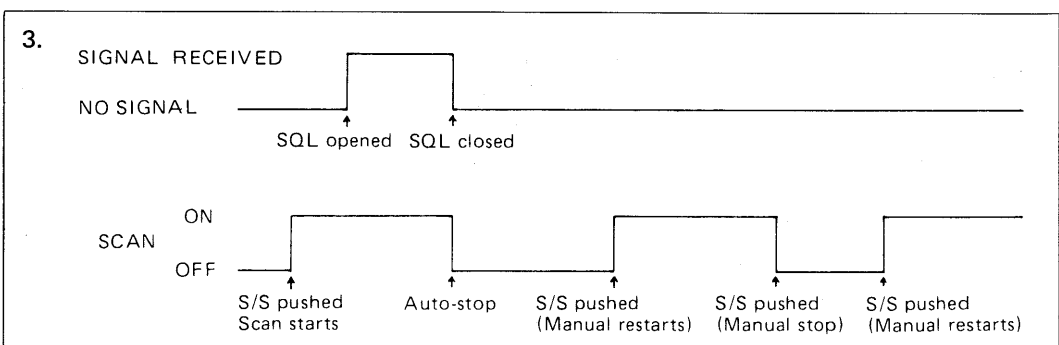
All scan modes are provided with the resume scan function. When the scan has been stopped by the auto-stop function, the scan will restart after the cause goes away, or after passing a specified time.



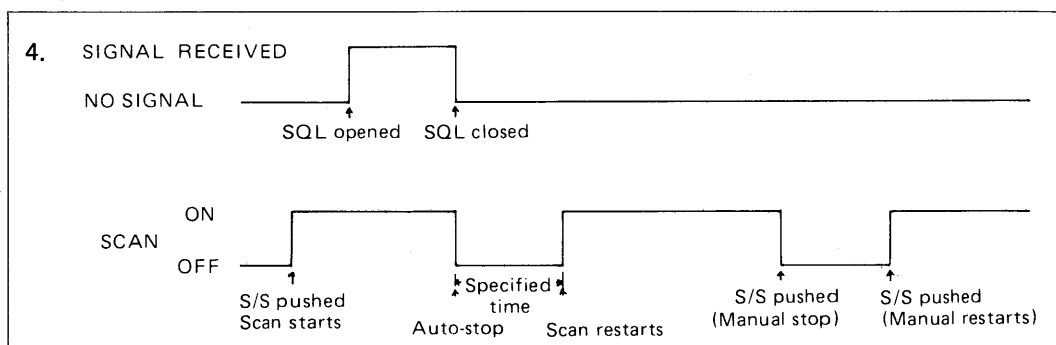
1. By setting the SCAN-STOP TIMER Switch in OFF position and the SCAN-STOP FUNCTION SWITCH in BUSY position (both located under the top cover), the scan will stop on a signal (by opening the squelch), then the scan will restart with disappearing the signal.



2. By setting the SCAN-STOP TIMER Switch in ON position and the SCAN-STOP FUNCTION SWITCH in BUSY position, the scan will stop on a signal, and will restart after specified time is passed, whether a signal has been received or not. This scan stopping time is selectable "L" (about 8 seconds) and "S" (about 4 seconds) with the SCAN-STOP INTERVAL Switch located under the top cover.



3. By setting the **SCAN-STOP FUNCTION SWITCH** in **EMPTY** position and the **SCAN-STOP TIMER Switch** in **OFF** position, the scan will stop on an empty channel (by the closing of the squelch), then the scan will restart when a signal appears.



4. By setting the **SCAN-STOP FUNCTION SWITCH** in **EMPTY** position and the **SCAN-STOP TIMER Switch** in **ON** position, the scan will stop on an empty channel, then will restart after specified time is passed, whether a signal has been received or not.

Set the **SCAN-STOP TIMER Switch**, **SCAN-STOP TIME Control**, and **SCAN-STOP FUNCTION SWITCH** to the desired positions before the set is installed.

## OPERATION

### 1. RECEIVING

After connecting an antenna, microphone, etc., set knobs and switches as follows.

|   |  |
|---|--|
| RIT CONTROL                             | : Center (12 o'clock) position                                     |
| MEMORY CHANNEL SWITCH                   | : Any position   |
| DIAL LOCK SWITCH                        | : OFF (out)  |
| MHz STEP/DUPLEX SWITCH                  | : 1MHz (out)   |
| VFO SWITCH                              | : "A" (out)  |
| VOLUME CONTROL and POWER SWITCH         | : Completely counterclockwise (OFF position)                       |
| SQUELCH CONTROL and OFFSET WRITE SWITCH | : Completely counterclockwise (Pull switch is in normal position). |

Now turn the **VOLUME CONTROL AND POWER SWITCH** clockwise to click on. The **RECEIVE INDICATOR** will be illuminated and a frequency will be shown on the **FREQUENCY DISPLAY**. If the decimal point is blinking and the displayed frequency is scanning, the set is in a scan mode, so push the **SCAN START/STOP** button to clear the **SCAN** mode. If the **MEMORY READ INDICATOR** is illuminated, the set is in the **MEMORY CHANNEL** mode and a memory channel can be selected by the **MEMORY CHANNEL** switch. If you want to set to the **VFO** mode, push the **MEMORY READ** button, and the **MEMORY READ INDICATOR** will go **OFF** and the set will be in the **VFO** mode. By turning the **TUNING CONTROL**, the displayed frequency can be changed. Slowly turn the **VOLUME** Control clockwise to a comfortable level. Rotate the tuning knob until a signal is received. The **S/RF** indicator will light according to the signal strength, so tune for the highest possible indicator reading and the clearest audio.

If no signal can be heard, turn the Squelch Control clockwise until the noise from the speaker stops and set it just below this threshold. (When adjusting the Squelch control setting, if some communication signals can be heard, turn the tuning control either direction and set it where only noise can be heard.) The transceiver will now remain silent until an incoming signal is received which opens the squelch and lights the RECEIVE indicator. If the squelch is unstable due to the reception of weak signals or mobile stations, adjust the squelch control further until the proper threshold is obtained.

For tuning, Memory Channel operation and Scanning operation refer to "HOW TO TUNE" on page 11, "MEMORY CHANNEL OPERATION" on page 14, and "SCANNING OPERATION" on page 15.

## **2. TRANSMITTING**

For simplex operation, push the MHz STOP/DUPLEX Switch in and "--DUP" or "+DUP" button to do not illuminate any DUPLEX INDICATOR, if illuminated.

For duplex operation push the MHz STOP/DUPLEX Switch in and the "--DUP" or "+DUP" button to illuminate the desired duplex indicator.

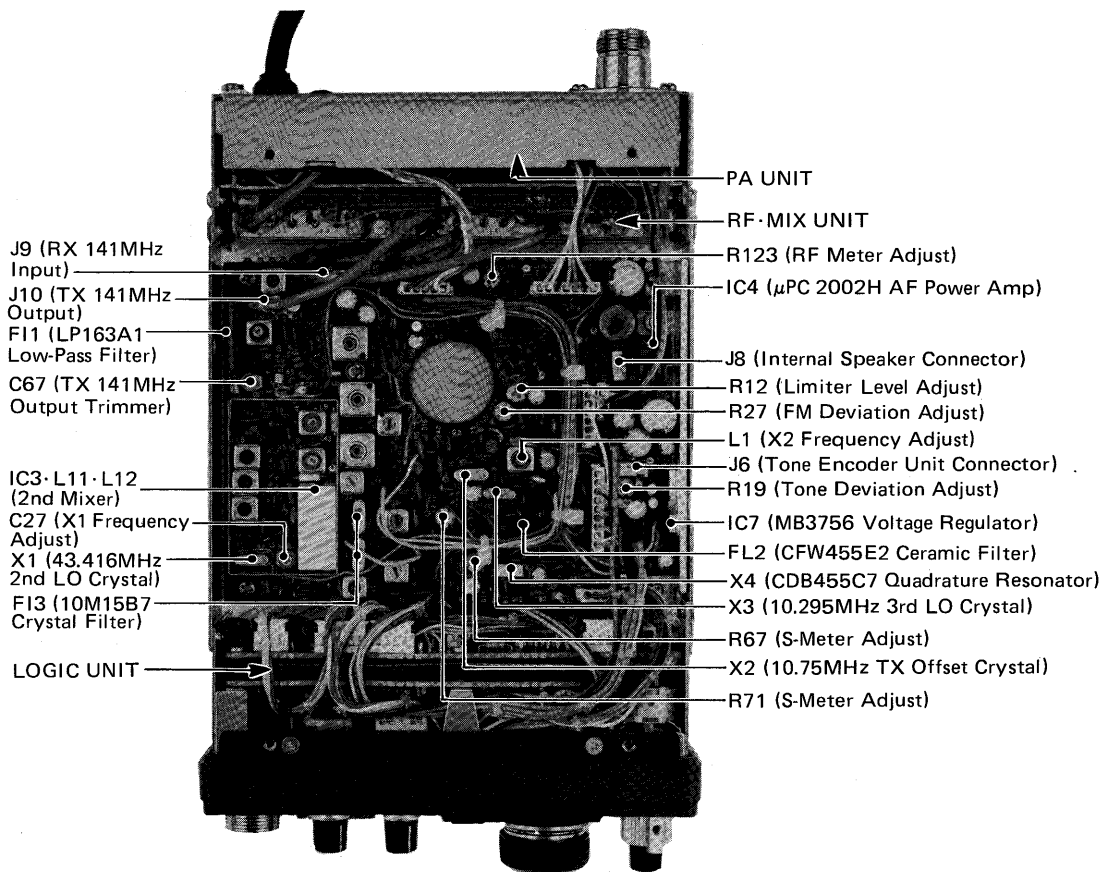
When the IC-120 is first turned ON, the OFFSET frequency will be preset 10MHz (European version: 33MHz). This OFFSET frequency is standard repeater input/output frequency separation. If you desire to operate a repeater that has a frequency difference other than  $\pm 10$ MHz (or 33MHz), reset the OFFSET frequency to desired frequency. Refer to "RESETTING THE OFFSET FREQUENCY" on page 13.

Depress the PTT (push-to-talk) Switch on the microphone and the transceiver will transmit. At the same time the TRANSMIT indicator will illuminate red and the S/Rf indicator will provide an indication of relative power output of the transmitter.

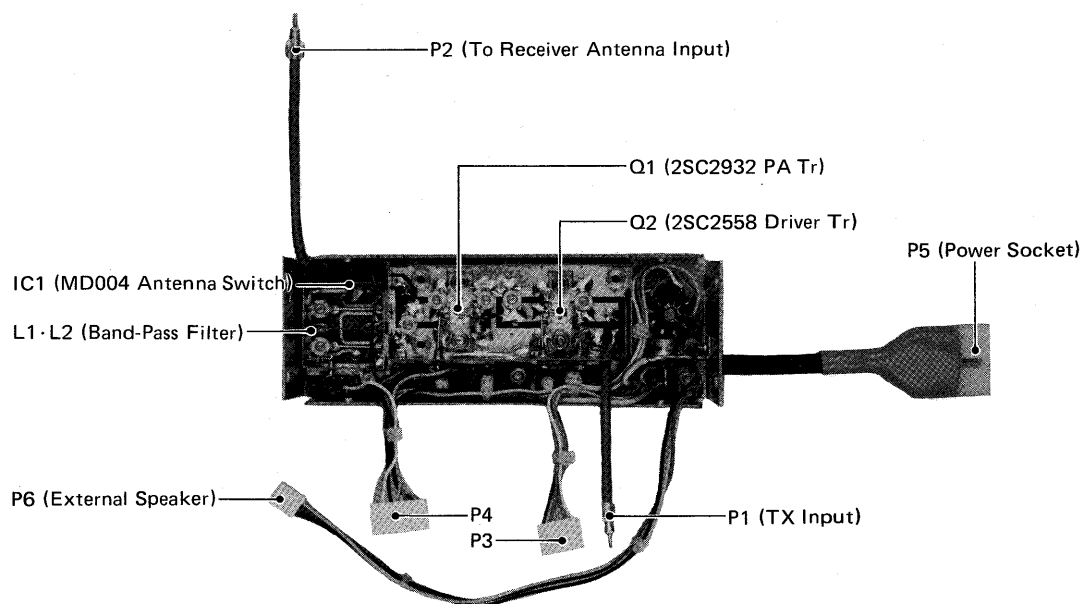
If you need a tone-burst for initial access of the repeater, depress the Tone Call Switch on the microphone for the required period (European version only). (Tone-burst periods vary individually from 100 milli-seconds to 2 seconds.) (USA version: The 16 key Dual-Tone pad is provided on the microphone, and the optional subaudible tone encoder can be installed in the set.)

## SECTION VI INSIDE VIEWS

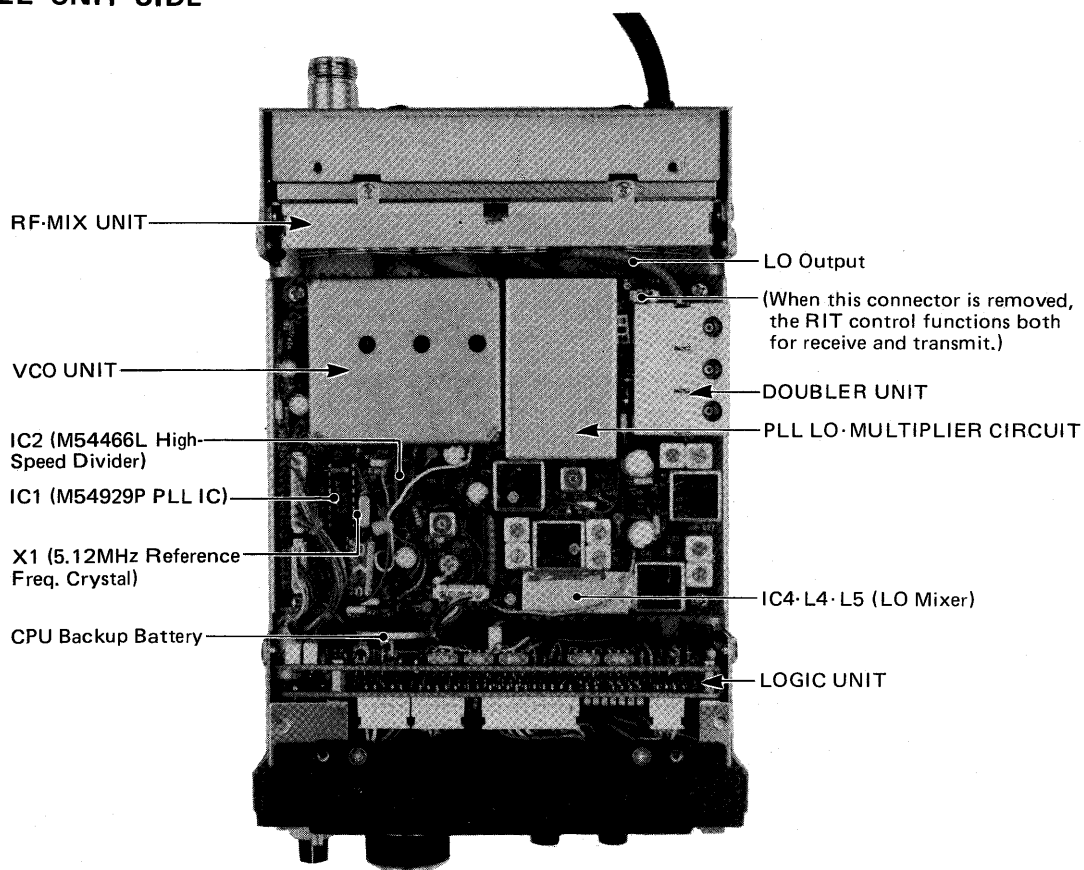
### MAIN UNIT SIDE



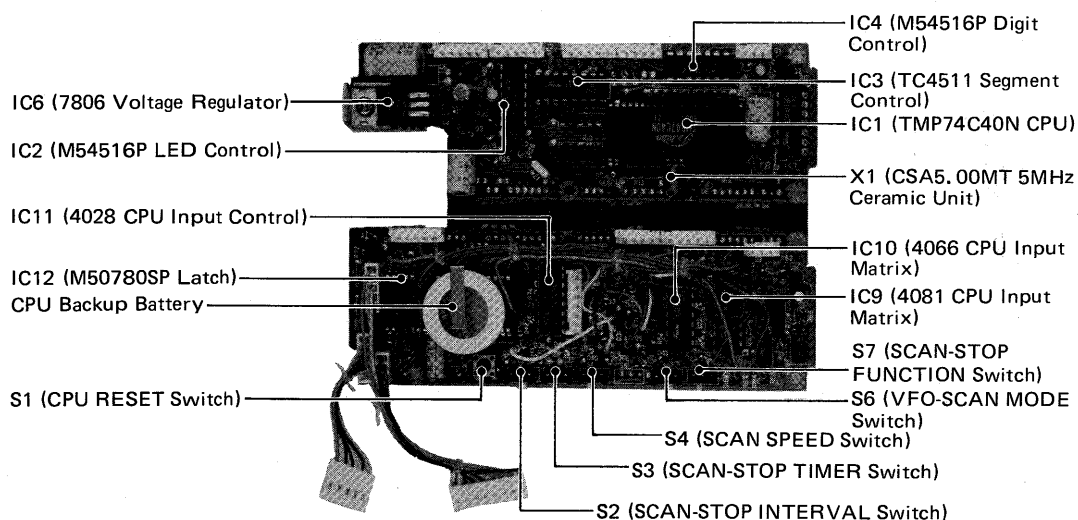
### PA UNIT



## PLL UNIT SIDE



## LOGIC UNIT



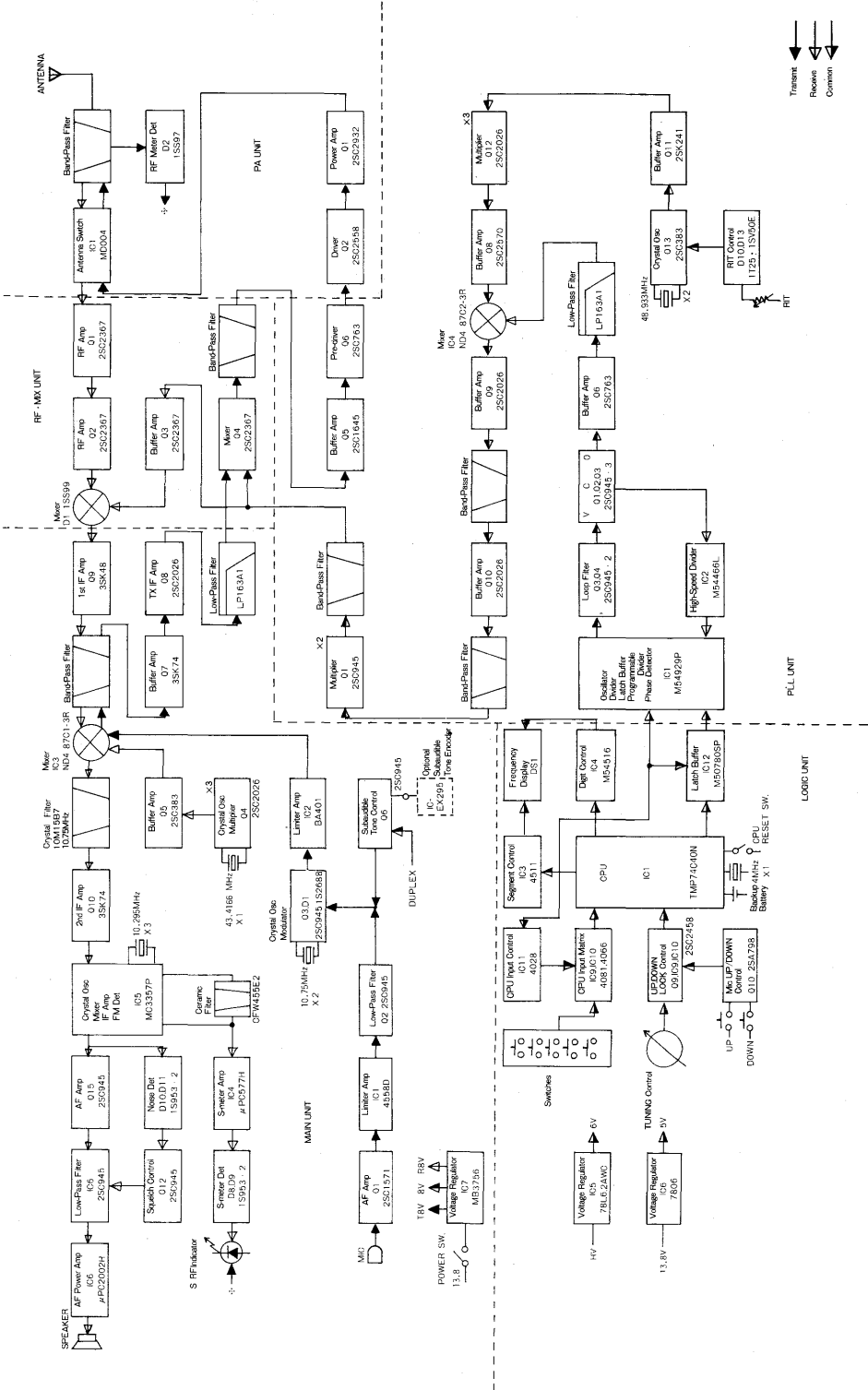
## SECTION VII TROUBLESHOOTING

Your IC-120 has been tested very carefully at the factory before shipping. The chart below has been designed to help you correct any problems which are not equipment malfunctions. If you are not able to locate the problem and/or solve it through use of this chart, please contact your dealer or the nearest ICOM service center for assistance.

| Problem  | Possible Cause  | Solution  |
|--|---|---|
| 1. Power does not come ON when the switch is turned.       | Power cord is improperly connected.<br><br>Power cord is connected with the polarity reversed.<br><br>Blown fuse.   | Carefully reconnect power cord.<br><br>Disconnect the power cord, replace the blown fuse, then reconnect the power cord observing proper polarity.<br><br>Check for the cause, then replace the fuse with a new one.  |
| 2. No sound comes from the speaker.                        | VOLUME Control knob is completely counterclockwise, but not "clicked OFF".<br><br>The unit is in the transmit mode, by the PTT Switch on the microphone.<br><br>SQUELCH setting is turned too far clockwise.<br><br>External speaker is in use.<br><br>The internal speaker cable is not connected. | Turn the knob clockwise to a suitable level.<br><br>Put the unit in the receive mode.<br><br>Turn the SQUELCH control counterclockwise until noise can be heard and reset it just below the threshold.<br><br>Check if the external speaker plug is inserted properly or if the external speaker cable is cut.<br><br>Connect the speaker connection. |
| 3. Sensitivity is low and only strong signals are audible. | The antenna feed line is cut or shorted.  | Check the feed line and correct any improper condition.   |
| 4. No or low RF output.                                    | PTT Switch is not functioning due to bad connection of the MIC connector.<br><br>The antenna feeder is cut or shorted.  | Check the connection of the MIC connector and correct any problems.<br><br>Check the antenna feeder and correct any problems.   |
| 5. No modulation.  | Bad connection of the MIC connector.<br><br>The MIC cable is cut.   | Check the connection of the MIC connector and correct any problems.<br><br>Repair the disconnected or cut wire.   |

| <b>Problem</b>  | <b>Possible Cause</b>  | <b>Solution</b>  |
|---|--|--|
| 6. The receive mode functions properly and your signals are transmitted, but you are unable to make a contact with another station. | <p>The set is in DUPLEX mode. (When desiring SIMPLEX mode.)</p> <p>The set is in SIMPLEX mode. (When desiring DUPLEX mode.)</p> <p>Improper frequency split or input/output frequency of the repeater.</p> | <p>Push the MHz STEP/DUPLEX Switch in and "+DUP" or "-DUP" button to go off both DUPLEX indicators.</p> <p>Push the MHz STEP/DUPLEX Switch in and push "+DUP" "-DUP" button according to repeater input/output frequency.</p> <p>Set the proper frequency split and push the "+DUP" or "-DUP" button according to the repeater input/output frequency.</p> |
| 7. The memory scan operation does not function when the S/S Switch is pushed.   | <p>No frequency is programmed in the memory channels or the same frequency is programmed in all the memory channels.</p> <p>The set is not in the Memory Channel mode.</p>                                 | <p>Program the desired frequencies in the memory channels following the instructions for "MEMORY CHANNEL OPERATION" on page 14.</p> <p>Push the MEMORY READ button and the MEMORY CHANNEL Switch at the desired Memory Channel.</p>  |
| 8. The programmed scan operation does not function when the S/S Switch is pushed.   | The set is not in the VFO mode.  | Push the MEMORY READ button for the VFO mode.  |
| 9. The scan does not stop even if a signal is received.   | The squelch has opened when the scan started.  | Engage the squelch on a no signal frequency, then start the scan by pushing the S/S Switch.  |

## SECTION VIII BLOCK DIAGRAM







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