

IC-720A

HF ALLBAND TRANSCEIVER GENERAL COVERAGE RECEIVER

INSTRUCTION MANUAL



CAUTION

This set employs a microcomputer to control frequencies, operating mode and display.

The microcomputer has a program to initialize the operating condition of the set. However, sometimes an abnormal figure may be displayed on the display, or the display fails to illuminate.

This may be caused by an intermittent connection of the power plug or the power switch being turned OFF and ON too quickly.

This is not an equipment malfunction. When this occurs, it may be solved with the following simple procedure:

1. Turn OFF the set's power switch.
2. If the set has a memory switch, turn OFF this switch also.
3. If you use a memory backup power supply, unplug its power connector.
4. Unplug the power plug of the set.
5. Wait at least 45 seconds and reconnect the power plug to the set.
6. Turn ON the power switch.
7. Make sure the set has the correct startup readout.
(If not, repeat the above procedure.)
8. Turn ON the memory switch (when the set has one), connect the memory backup power connector (when used).

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SECTION 1 SPECIFICATIONS

GENERAL

Number of Semi-Conductors:

Transistors	105
FET	16
IC (Includes CPU)	51
Diodes	219

Frequency Coverage:

Ham Band	1.8MHz ~ 2.0MHz
	3.5MHz ~ 4.1MHz
	6.9MHz ~ 7.5MHz
	9.9MHz ~ 10.5MHz
	13.9MHz ~ 14.5MHz
	17.9MHz ~ 18.5MHz
	20.9MHz ~ 21.5MHz
	24.5MHz ~ 25.1MHz
	28.0MHz ~ 30.0MHz

General Cover (Receive Only)

0.1MHz ~ 30.0MHz
Thirty 1MHz Segments

Frequency Control:

CPU based 10Hz step Digital PLL synthesizer.
Independent Transmit-Receive Frequency Available on same band.

Frequency Readout:

6 digit 100Hz readout.

Frequency Stability:

Less than 500Hz after switch on 1 min to 60 mins, and less than 100Hz after 1 hour. Less than 1KHz in the range of -10°C to $+60^{\circ}\text{C}$.

Power Supply Requirements:

DC 13.8V $\pm 15\%$ Negative ground Current drain 20A max. (at 200W input)
AC power supply is available for AC operation.

Antenna Impedance:

50 ohms Unbalanced

Weight:

7.5Kg

Dimensions:

111mm(H) x 241mm(W) x 311mm(D)

TRANSMITTER

RF Power:

SSB (A ₃ J)	200 Watts PEP input
CW (A ₁), RTTY (F ₁)	200 Watts input
Continuously Adjustable Output power 10 Watts ~ Max.	
AM (A ₃)	40 Watts output

Emission Mode:

A ₃ J	SSB (Upper sideband and Lower sideband)
A ₁	CW
F ₁	RTTY (Frequency Shift Keying)
A ₃	AM

Harmonic Output:

More than 40dB below peak power output

Spurious Output:

More than 60dB below peak power output

Carrier Suppression:

More than 40dB below peak power output

Unwanted Sideband:

More than 40dB down at 1000Hz AF input

Microphone:

Impedance 1300 ohms
Input Level 120 millivolts typical
Dynamic or Electret Condenser Microphone with Preampfier

RECEIVER

Receiving System:

Quadruple Conversion Superheterodyne with continuous Bandwidth Control.

Receiving Mode:

A₁, A₃J (USB, LSB) F₁ (Output FSK audio signal), A₃

IF Frequencies:

1st	39.7315MHz
2nd	9.0115MHz
3rd	10.75MHz
4th	9.0115MHz

with continuous Bandwidth Control

Sensitivity:

Less than 0.25 microvolts for 10dB S+N/N

Selectivity:

SSB, CW, RTTY $\pm 1.15\text{KHz}$ at -6dB
(Adjustable to $\pm 0.4\text{KHz}$ Min)
 $\pm 2.1\text{KHz}$ at -60dB

CW-N

(when optional filter installed)

$\pm 250\text{Hz}$ at -6dB

$\pm 750\text{Hz}$ at -60dB

AM

$\pm 3.0\text{KHz}$ at -6dB

$\pm 9.0\text{KHz}$ at -60dB

(when optional filter installed)

$\pm 2.6\text{KHz}$ at -6dB

$\pm 6.0\text{KHz}$ at -60dB

Spurious Response Rejection Ratio:

More than 60dB

Audio Output:

More than 2 Watts

Audio Output Impedance:

8 ohms

Specifications are approximate and are subject to change without notice or obligation.

SECTION 2 FEATURES

REAL ALL BAND, ALL MODE, ALL SOLID STATE

The IC-720A covers all the Amateur HF frequencies from 1.8MHz to 29.999.9MHz, including the new three bands. It offers not only SSB, but also AM, CW and RTTY. All of the circuits in the IC-720A, including the driver and final power stages are completely solid state, and provide about 100 Watts output.

GENERAL COVERAGE RECEIVER CAPABILITY.

The IC-720A has capabilities for an all amateur band transceiver as well as a general coverage receiver between 100KHz and 30MHz with thirty 1MHz segments. The Up-conversion system using a high side IF and Microcomputer Control System make these capabilities possible.

In addition to these, the low-pass filters switched by rotary relay and the band-pass filters selected by an electric signal from the BAND UP/DOWN button, make a no tune-up system.

DUAL 10Hz STEP DIGITAL VFO

The dual digital VFO consists of the PLL unit, which has a triple looped Phase-Locked-Loop, and the LOGIC unit, used to control the PLL, has the Microcomputer Control System.

Three tuning frequency resolutions of 10Hz, 100Hz and 1KHz steps are selectable with the TS button and the TUNING RATE SELECT switch. Two separate VFO's can be used independently in the SIMPLEX operation, and any desired in band frequency split transmit/receive in the DUPLEX operation.

OUTSTANDING RECEIVER PERFORMANCE

The IC-720A employs a dual conversion superheterodyne system which has the first IF at 39.7315MHz and the second IF at 9.0115MHz.

The RF amplifier circuit is a wide band push-pull amplifier using low-noise and wide dynamic range junction FET's, and the mixer is a high level Double Balanced Mixer developed by ICOM.

These advanced devices and system give higher spurious response rejection ratio, higher sensitivity and wider dynamic range.

PASS-BAND TUNING AND SPEECH PROCESSOR

The IC-720A has a built-in Pass-Band Tuning system developed by ICOM that allows you to continuously adjust the pass band of the IF. By turning the control, you can eliminate interference from a nearby signal, thus providing clear reception. It can also be used as a tone control. During transmit, the Pass-Band Tuning circuit can be used as a Speech Processor providing increased "talk power" for outstanding DXing.

ADDITIONAL CIRCUITS

The IC-720A has a built-in Noise Blanker, VOX, CW Monitor, APC, SWR detector, and many other circuits for your convenience.

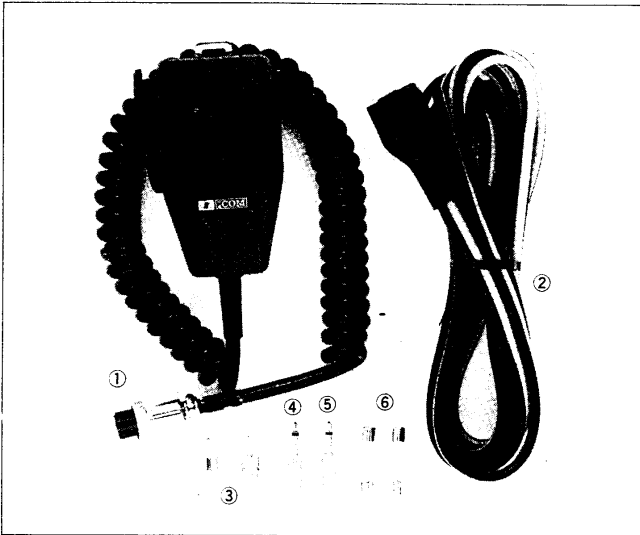
The IC-720A has everything you need to really enjoy HF operation, in an extremely compact, rugged transceiver.

SECTION 3 INSTALLATION

BE SURE TO READ THE FOLLOWING INSTRUCTIONS BEFORE USE.

3-1 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 keep the shipping cartons. In the event storage, moving, or reshipment becomes necessary they will be handy. Accessory cables, plugs, etc., are packed with the transceiver. Make sure you have not overlooked anything. -



- | | |
|--|---|
| 1. Microphone (IC-HM7) | 1 |
| 2. DC Power Cord | 1 |
| 3. Pin Plugs (Low Band ANT Terminal Plug, Transverter Terminal Plug) | 2 |
| 4. External Speaker Plug | 1 |
| 5. Key Plug | 1 |
| 6. Spare Fuses (20 Amp) | 2 |

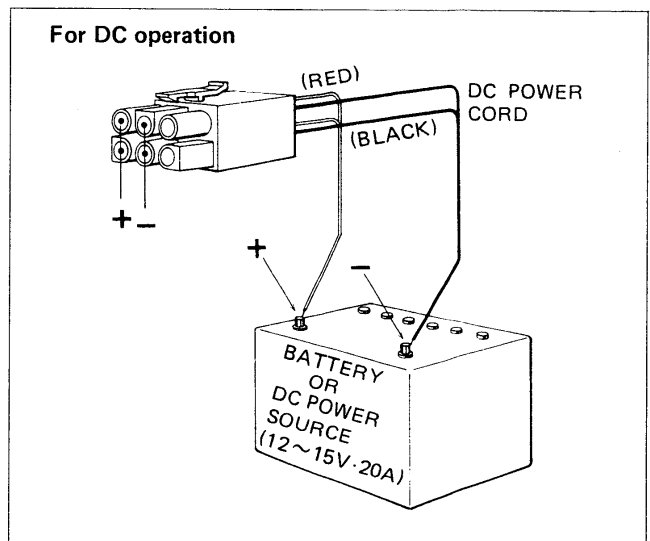
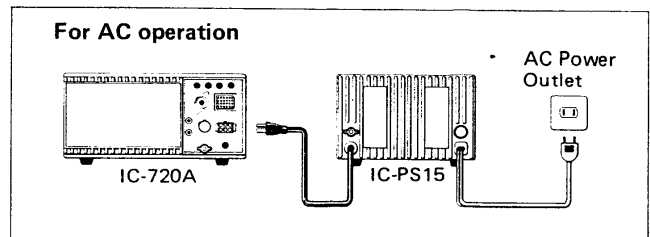
3-2 RECOMMENDATIONS FOR INSTALLATION

1. Avoid placing the IC-720A in direct sunlight, high temperature, dusty or humid places.
2. The sides of the unit, when facing it, function also as heatsinks. The temperature there will usually become relatively warm during transmission. Any equipment should be at least 1 inch (3cm) away from the unit, so as to provide good ventilation. Be sure that nothing is on and just behind the rear PA heatsink to ensure good ventilation. Also avoid places near outlets of heaters, air conditioners, etc.
3. Place the unit so that the controls and switches can easily be handled and the frequency indication and meter can easily be read.
4. For mobile installation, an optional mounting bracket is available. Select the best location that can stand the weight of the unit and that does not interfere with your driving in any way.
5. Use the Ground Lug!

3-3 POWER SUPPLY

For AC operation, use the special power supply IC-PS15. If you would like to use your car battery or any other DC power supply; be sure that its output voltage is 12-15 Volts and the current capacity is at least 20 Amps. The maximum power consumption of the set during transmission runs from 16-20 Amps, so keep that in mind if the unit is installed in your automobile, and turn it on after you have started the engine. Attention should also be paid to the condition of the battery and electrical system.

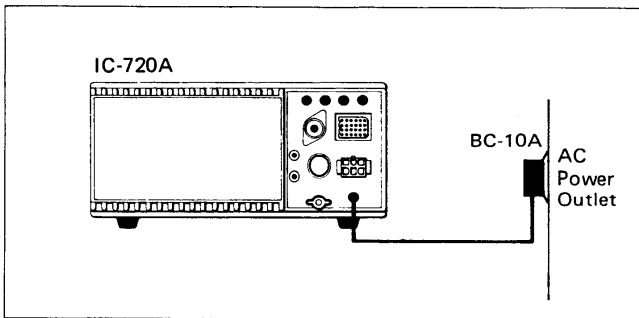
The connection of the DC power cord supplied with the IC-720A is done in the following way: First make sure that the power switch of the unit is in the OFF position and the T/R switch is in the receive position. Connect the cord to the DC power supply with the RED lead to the positive terminal and the BLACK lead to the negative terminal. (Reverse connection will cause the protection circuit to operate and blow the fuse.) Connect the DC plug to the socket on the rear panel of the IC-720A. Refer to the drawing below.



3-4 MEMORY BACK-UP

To retain the memory in the CPU, keeping the operating frequencies of the VFOs even when the main Power Switch is turned OFF, connect a power source of 9 to 12 Volts DC to the Memory Back-Up terminal on the rear panel. For mobile installation this can be accomplished by direct connection to the car battery, since the current drain is low.

For AC operation it is recommended that the optional BC-10A be used.



3-5 ANTENNA

Antennas play a very important role in radio communication. If the antenna is inferior, your transceiver cannot give you the best performance. With a good antenna and feeder cable having 50 ohms impedance, you should easily get the desired matching and performance. Carefully install a high performance antenna that suits the frequency band(s) you wish to operate on and place it as high as possible. Be especially careful of the condition of the connectors as loose connections will deteriorate the performance. Be sure to connect the ground terminal of a whip antenna, if used, to the body of your car.

As the output is quite high, avoid connecting the antenna connector to open lines and do not transmit under mismatched conditions. Otherwise the final stage could be overloaded and cause a malfunction of the unit.

Since the IC-720A has a General Coverage receiver it is recommended that a long-wire general coverage antenna and an antenna coupler be used. The antenna's impedance should be 50 ohms. To attempt to use the Ham band antenna for general coverage reception could result in mismatching, and attendant poor reception.

When receiving lower than 1600KHz, connect the antenna to the "LOW BAND ANT" terminal. (Refer to page 21.)

3-6 GROUND

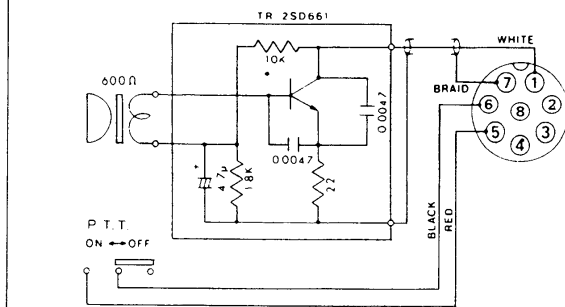
In order to prevent electrical shocks, TVI, BCI and other problems, be sure to connect a heavy wire ground, as short as possible, from a good earth point to the ground terminal on the rear panel.

3-7 MICROPHONE

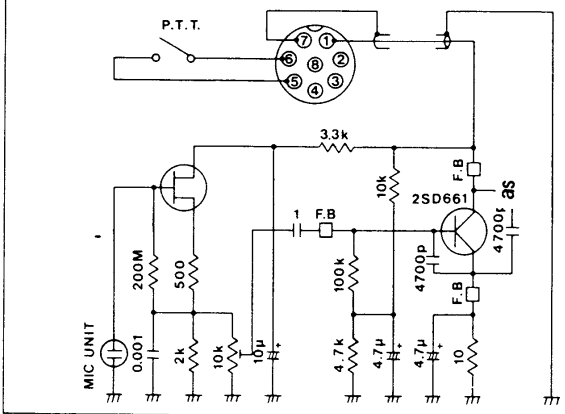
The microphone supplied with the IC-720A is the IC-HM7 which contains a pre-amplifier. The optional electret condenser type stand microphone IC-SM5 can be used. Their circuit diagrams are shown.

Should you wish to use a different microphone, make certain it has a proper pre-amplifier.

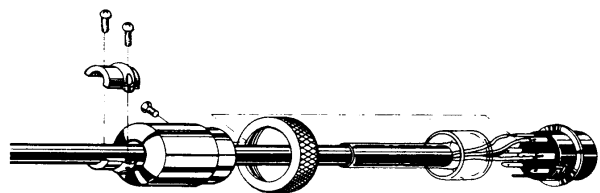
Schematic diagram of IC-HM7



Schematic diagram of IC-SM5



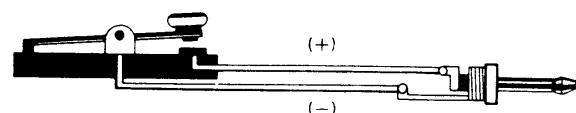
Microphone plug exploded View



3-8 CW KEY

When operating CW, connect the Key to the Key Jack with the plug supplied. The connection of the plug is shown below.

Key Wiring Diagram



If the terminals have polarity, be sure to make the correct connection. Note that the keyed voltage when switching with semiconductors or relays with resistors in the circuit, should be adjusted to be below 0.4 Volts!

3 - 9 RTTY

When operating RTTY, connect the ACC socket pins 8 (ground) and 9 to your tele-typewriter through a high speed relay or a level converter to TTL level, and the tones for your terminal unit will be available from pin 4. The AF output level is about 300mV P-P for S-9 signal. For details, refer to 5 - 4 RTTY OPERATION on page 18.

3 - 10 EXTERNAL SPEAKER

The IC-720A contains an internal speaker, and is also designed so that it can drive an external speaker from the external (EXT) speaker jack on the rear panel. Be sure the impedance of the external speaker is 8 ohms, and remember that with the external speaker connected, the internal speaker is disabled.

3 - 11 HEADPHONES

Any good headphone set, including stereo type, that have 4-16 ohms impedance can be used. With the plug inserted halfway into the PHONES jack, both the headphone and speaker will operate. This is convenient when others wish to listen in on the station, or you wish to record contacts using a tape recorder connected to the headphone jack. With a stereo headphone set inserted this way, however, the headphone will lose the sound on one side. With the plug inserted completely, only the headphone works.

3 - 12 COOLING FAN

The rear of the PA unit is designed to provide for adequate cooling, but with 200 Watts input the final stage produces quite a bit of heat, and its temperature may rise during prolonged transmissions. The fan is connected to a temperature monitoring circuit which monitors the temperature of the final stage. The fan operates as follows:

1. The fan does not operate in the receive mode, but will run all the time in transmit.
2. When the temperature rises to a point detected by the monitor circuit the fan will operate during both transmit and receive to provide additional cooling.
3. If the temperature rises to a danger limit the fan will run much more rapidly. At this time stop transmitting and investigate the cause of overheating i.e. antenna mismatch, etc. Correct the cause of the overheating before starting to transmit again.

3 - 13 POWER SUPPLY

It is recommended that you use the IC-PS15 as a power supply for base operation. If you wish to use another type power supply make sure that it meets the voltage, current

requirements. Note carefully the overvoltage protection, for a runaway regulator can destroy the IC-720A; be especially careful that more than 16 Volts cannot be supplied to the transceiver. Do not connect the power supply, antenna, accessory plug, or microphone with the Power Switch in the ON position. Be especially careful not to transmit without an antenna or dummy load hooked up. If the fuse blows replace it with a 20 Amp fuse, only after fixing the cause. Do not turn the Power Switch ON and OFF repeatedly for this way cause the readout to mis-display. Should this occur, turn the set OFF and wait for approximately 30 seconds before turning it back ON.

3 - 14 CAUTIONS

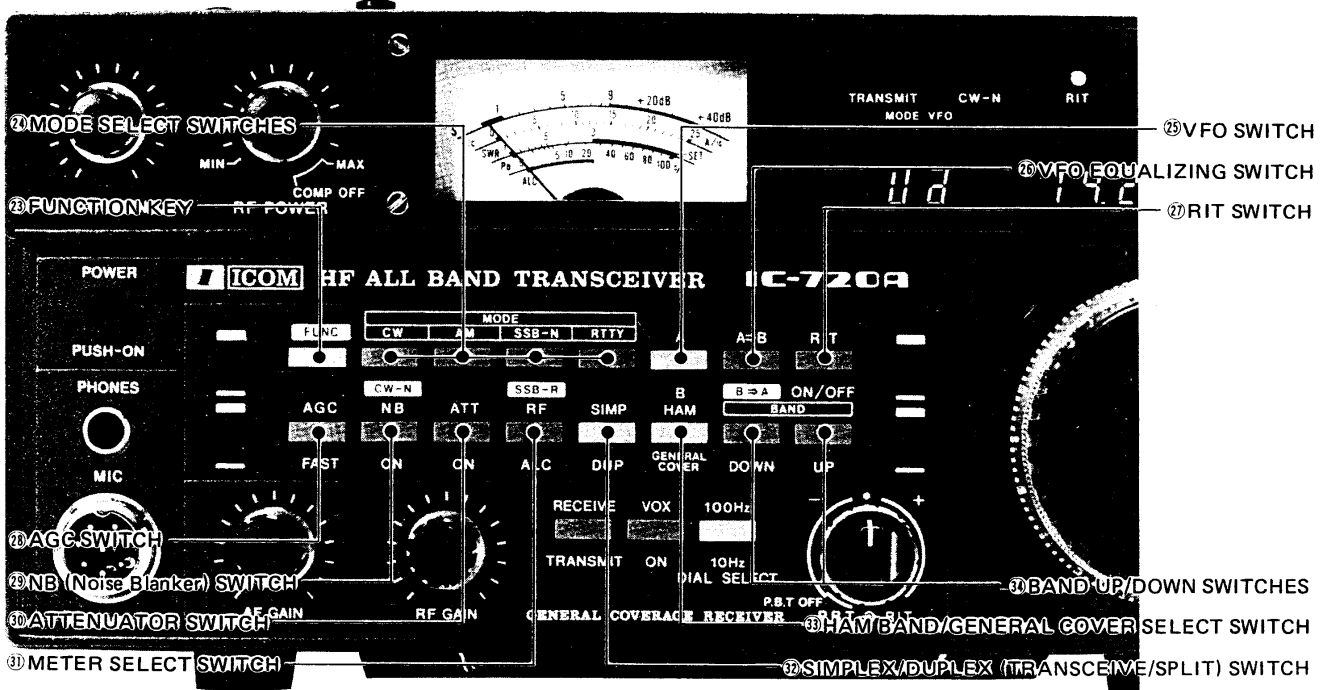
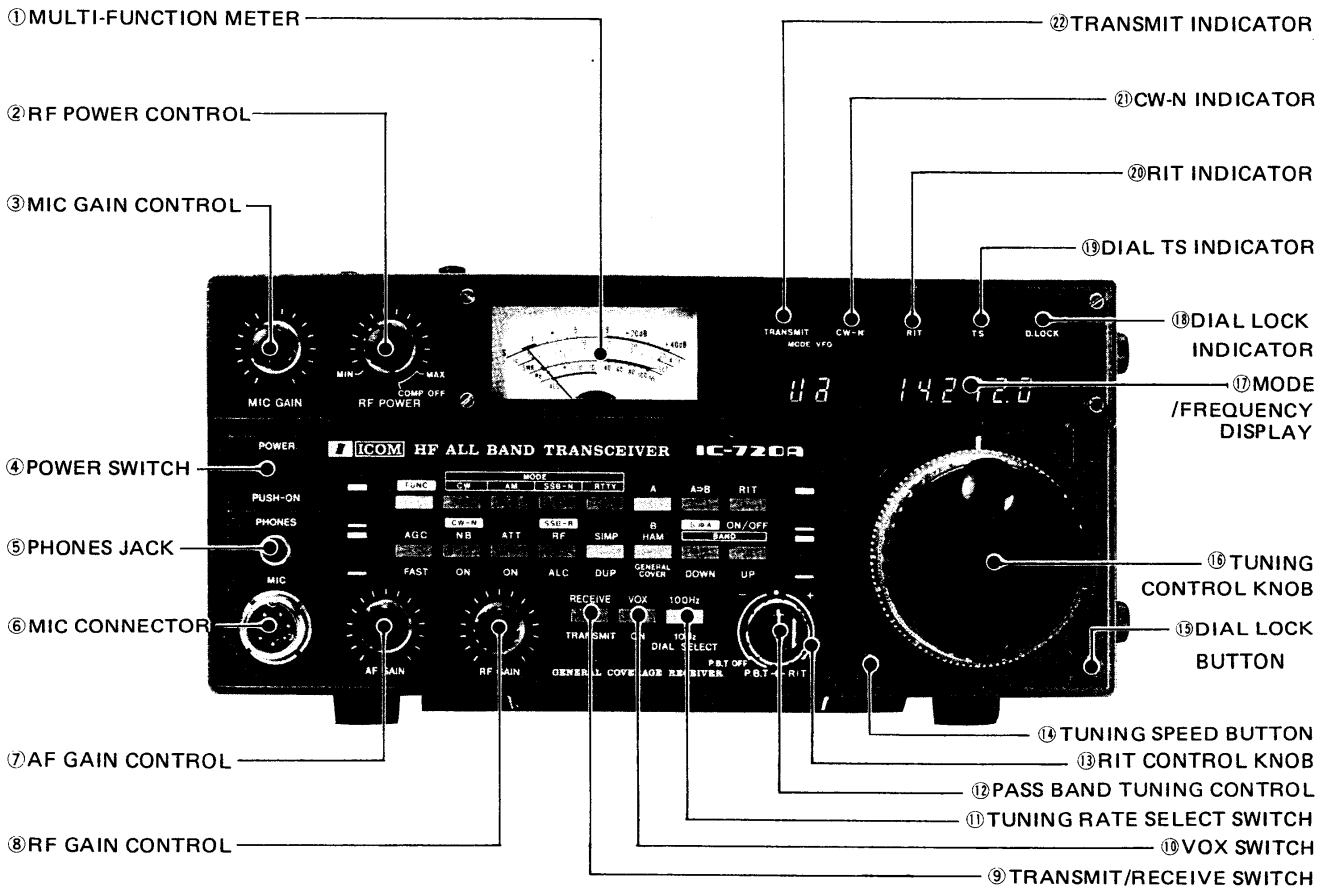
As the unit has already been closely adjusted with highly sophisticated measuring instruments, never tamper with the turnable resistors, coils, trimmers, etc.

C-MOS is used in the Logic unit as well as the PLL. C-MOS ICs are very susceptible to excessive static charges and over-current and care must be used when handling them. Therefore, avoid touching the Logic unit and the nearby circuitry unless absolutely necessary. When it is necessary to check the circuitry, observe the following points.

Ground all measuring instruments, the soldering iron, and other tools. Do not connect or disconnect the C-MOS IC from its socket, or solder it when the power is on. Do not apply voltage of less than -0.5 or more than +5 Volts to the input terminals of the IC. DO NOT MEASURE WITH AN OHMMETER.

SECTION 4 OPERATING CONTROLS

4-1 FRONT PANEL





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