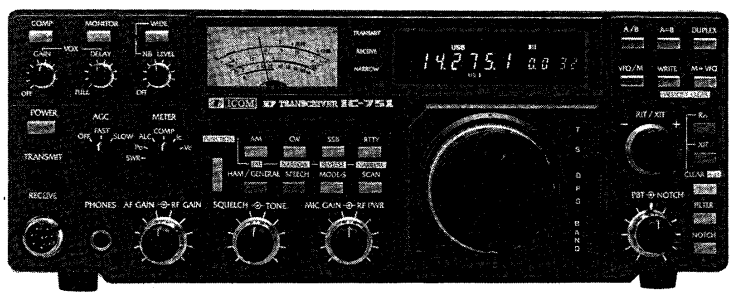
IC-751

HF ALL BAND TRANSCEIVER
GENERAL COVERAGE RECEIVER

INSTRUCTION MANUAL



ICOM

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SECTION 1 SPECIFICATIONS

GENERAL

Number of Semiconductors:
- Transistors 105
- FET 16
- IC (Includes CPU) 51
- Diodes 219

Frequency Coverage:
- Ham Band 1.8 MHz ~ 2.0MHz
  3.45MHz ~ 4.1MHz
  6.95MHz ~ 7.5MHz
  9.95MHz ~ 10.5MHz
  13.95MHz ~ 14.5MHz
  17.95MHz ~ 18.5MHz
  20.95MHz ~ 21.5MHz
  24.45MHz ~ 25.1MHz
  27.95MHz ~ 30.0MHz
- General Cover (Receive Only)
  0.1MHz ~ 30.0MHz
  Thirty 1MHz Segments (or Continuous)
- RIT/XIT Coverage ±9.9KHz

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 ±200Hz after switch on 1 min to 60 mins, and less than ±30Hz after 1 hour. Less than ±500Hz in the range of 0°C ~ +50°C.

Power Supply Requirements:
DC 13.8V ±15% Negative ground Current drain 20A max. (at 200W input)
AC power supply is available for AC operation.

Antenna Impedance:
50 ohms Unbalanced

Weight:
8.5Kg

Dimensions:
115mm(H) x 306mm(W) x 355mm(D)

TRANSMITTER

RF Power:
- SSB (A_3J) 200 Watts PEP input
- CW (A_1), RTTY (F_1) 200 Watts input
- FM (F_3) 200 Watts input
- AM (A_3) 40 Watts output

Continuously Adjustable Output power 10 Watts ~ Max.

Emission Mode:
- A_3J SSB (Upper sideband and Lower sideband)
- A_1 CW
- F_1 RTTY (Frequency Shift Keying)
- A_3 AM
- F_3 FM

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 55dB down at 1000Hz AF input

Microphone:
Impedance 600 ohms
Input Level 12 millivolts typical
Dynamic or Electret Condenser Microphone
(Optional desk mic IC-SM6 can be used.)

RECEIVER

Receiving System:
- SSB, CW, RTTY, AM
  Quadruple Conversion Superheterodyne with continuous Bandwidth Control.
- FM Triple Conversion Superheterodyne

Receiving Mode:
A_1, A_3J (USB, LSB) F_1 (Output FSK audio signal), A_3, F_3

Intermediate Frequencies:
- 1st 70.4515MHz
- 2nd 9.0115MHz (SSB), 9.0106MHz (CW, RTTY)
  9.0100MHz (AM, FM)
- 3rd 455KHz
- 4th 350KHz (except FM)

with continuous Bandwidth Control

Sensitivity:
- SSB, CW, RTTY
  0.1 ~ 0.5MHz Less than 0.5μV for 10dB S/N
  0.5 ~ 1.6MHz Less than 1.0μV for 10dB S/N
  1.6 ~ 30MHz Less than 0.15μV for 10dB S/N
- AM 0.1 ~ 0.5MHz Less than 3μV for 10dB S/N
  0.5 ~ 1.6MHz Less than 6μV for 10dB S/N
  1.6 ~ 30MHz Less than 1μV for 10dB S/N
- FM 1.6 ~ 30MHz Less than 3μV for 12dB SINAD.

Squelch Sensitivity:
1.6 ~ 30MHz Less than 0.3μV

Selectivity:
- SSB, CW, RTTY
  2.3KHz (Adjustable to 0.8KHz Min) at −6dB
  4.0KHz at −60dB
- AM 2.4KHz at −6dB, 4.2KHz at −60dB
  (When Filter switch ON)
  4.0KHz at −6dB, 15KHz at −50dB
- FM 15KHz at −6dB, 30KHz at −60dB

Notch Filter Attenuation:
More than 45dB

Spurious Response Rejection Ratio:
More than 60dB

Audio Output:
More than 3 Watts

Audio Output Impedance:
8 ohms

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

SECTION 2 FEATURES

ALL BAND, ALL MODE, ALL SOLID-STATE

The IC-751 covers all the Amateur HF frequencies from 1.8MHz to 29.7MHz, including the new three bands of 10MHz, 18MHz and 24MHz. It offers not only SSB, but also CW, AM, FM and RTTY. All of the circuits in the IC-751, including the driver and final power stages are completely solid-state, and provide about 100 watts output.

GENERAL COVERAGE RECEIVER CAPABILITY

The IC-751 has capabilities for an all amateur band transceiver as well as a general coverage receiver between 100KHz and 30MHz with continuous tuning. 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 and the band-pass filters are selected by an electric signal from the CPU and it makes a no tune-up system.

DUAL VFO

Dual VFO's controlled by a large tuning knob provide easy access to split frequencies used in DX operation. Normal tuning rate is in 10Hz increments and increasing the speed of rotation of the main tuning knob shifts the tuning to 100Hz increments automatically. Pushing the tuning speed button gives 1KHz tuning. Digital outputs are available for computer control of the transceiver frequency and functions, and for a synthesized voice frequency readout.

32 MEMORIES

Thirty two tunable memories are provided to store mode, HAM/GENERAL COVERAGE mode, and frequency, and the RAM is backed up by an internal lithium memory backup battery to maintain the memories for up to seven years. Scanning of frequencies, memories and bands are possible from the unit, or from the IC-HM12 scanning microphone. In the Mode-S mode, only those memories with a particular mode are scanned; others are bypassed. Data may be transferred between VFO's, from VFO to memories, or from memories to VFO.

OUTSTANDING RECEIVER PERFORMANCE

Utilizing an ICOM developed J-FET DBM, the IC-751 has a 105dB dynamic range. The 70.4515MHz first IF virtually eliminates spurious responses, and a high gain 9.0115MHz second IF, with ICOM's PBT selectivity. A deep IF notch filter, adjustable AGC and noise blanker (can be adjusted to eliminate the woodpecker), audio tone control, plus RIT with separate readout provides easy-to-adjust, clear reception even in the presence of strong QRM or high noise levels. A low noise receiver preamp provides exceptional reception sensitivity as required.

TRANSMITTER

The transmitter features high reliability transistors in a low IMD (–38dB @ 100W), full 100% duty cycle (internal cooling fan standard), 12 volt DC design. Quiet relay selection of transmitter LPF's, transmit audio tone control, monitor circuit (to monitor your own CW or SSB signal), XIT, and a high performance speech processor enhance the IC-751 transmitter's operation. For the CW operator, semi break-in or full QSK is provided for smooth, fast break-in keying.

OTHER FEATURES

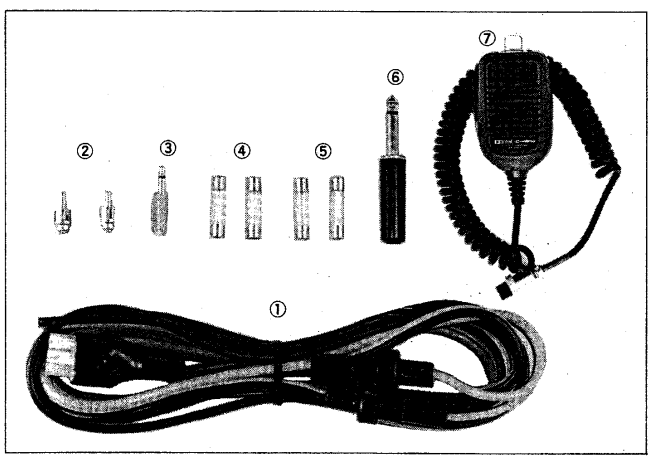
All of the above features plus full function metering, SSB and FM squelch, convenient large controls, a large selection of plug-in filters, and a new high visibility multi-color flourescent display that shows frequency in white, and other functions in white or red, make the IC-751 your best choice for a superior grade HF base transceiver.

SECTION 3 INSTALLATION

BE SURE TO READ THE FOLLOWING INSTRUCTIONS CAREFULLY BEFORE OPERATION

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. DC Power Cord 1
2. Pin Plugs 2
3. External Speaker Plug 1
4. Spare Fuses (20 Amp) 2
5. Spare Fuses (3 Amp) 2
6. Key Plug 1
7. Microphone (IC-HM12) 1

3 - 2 RECOMMENDATIONS FOR INSTALLATION

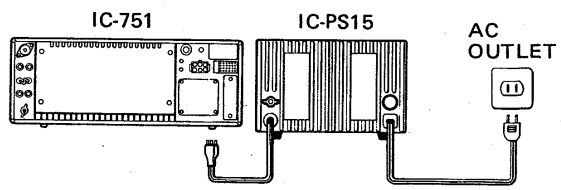
1. Avoid placing the IC-751 in direct sunlight, high temperature, dusty or humid places.
2. The temperature of the set will usually become relatively warm during transmission. Any equipment should be at least 1 inch (3cm) away from the unit so as to provide good ventilation. Be sure that nothing is on 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

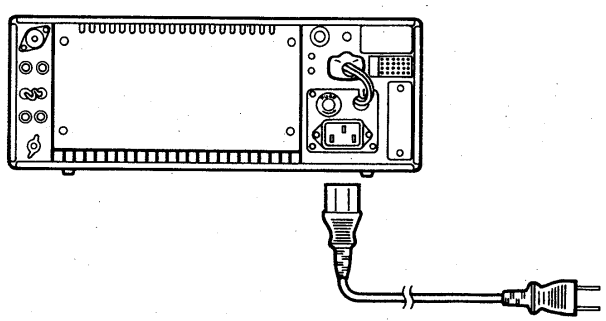
For AC operation, use the special power supply IC-PS15, or optional built-in power supply IC-PS35. If you would like to use your car battery or any other DC power supply, be sure that its output voltage is 12-15 Volts and the current capacity is at least 20 Amps. The maximum power consumption of the 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-751 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-751. Refer to the drawing below.

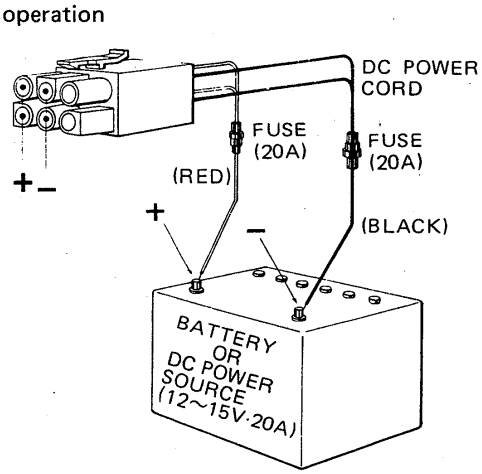
For AC operation (with IC-PS15)



For AC operation (when optional IC-PS35 is installed).



For DC operation



3 - 4 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-751 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, however it will be good enough for strong Broad Casting stations.

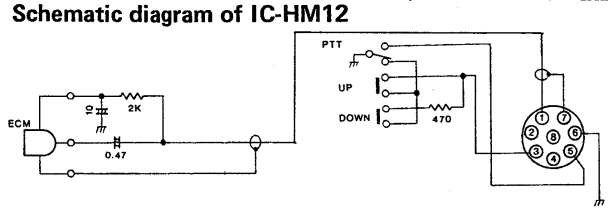
3 - 5 GROUND

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.

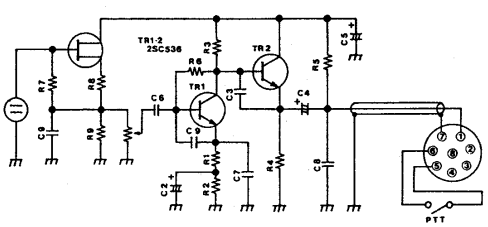
3 - 6 MICROPHONE

The supplied electret condenser type hand microphone IC-HM12 or optional desk mic IC-SM6 can be used. Merely plug it into the proper receptacle on the front panel. Should you wish to use a different microphone, make certain it has proper output level. Particular care should be excercised in wiring also, as the internal electrical switching system is dependent upon it. Refer the schematics for the proper hookup.

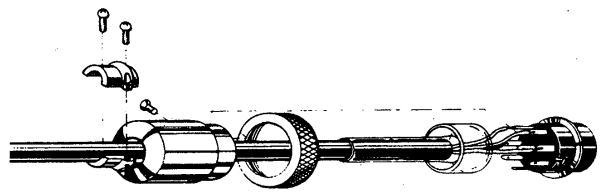
Schematic diagram of IC-HM12



Schematic diagram of IC-SM6



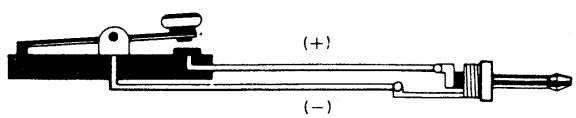
Microphone plug exploded view



3 - 8 CW KEY

When operating CW, connect a key to the KEY jack on the rear panel with the key plug supplied (1/4 inches standard plug). 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 - 8 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 300mVp-p for S-9 signal. For details, refer to 5 - 7 RTTY OPERATION on page 24.

3 - 9 EXTERNAL SPEAKER

The IC-751 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 - 10 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 - 11 COOLING FAN

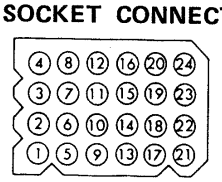
The rear of the PA unit is designed to provide for adequate cooling, but with 200 Watts input the final stage produces quite a bit of heat, and its temperature may rise during prolonged transmissions. The fan is connected to a temperature monitoring circuit which monitors the temperature of the final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

1. The fan does not operate both in the receive and thansmit modes.
2. When the temperature rises to a point (50°C) 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 (90°C) the fan will run much more rapidly. Investigate the cause of overheating i.e. antenna mismatch, etc. and correct the cause of the overheating before starting to transmit again.

3 - 12 ACCESSORY (ACC) SOCKET

Various functions are available through the accessory socket such as modulation output, receiver output, T/R change-over, and so forth. The table below shows those terminals.

ACC SOCKET CONNECTIONS



Outside view

PIN No.	FUNCTION
1.	Output from the squelch control stage. (+8V when the squelch is ON)
2.	13.8 Volts DC in conjunction with the power switch operation.
3.	Connected to Push-to-talk, T/R change-over switch. When grounded, the set operates in the transmit mode.
4.	Output from the receive detector stage. Fixed output regardless of AF output or AF gain.
5.	Output from Transmitter MIC amplifier stage. (Input for MIC gain control stage.)
6.	8 Volts DC available when transmitting. (relay can not be directly actuated. Max. 5mA).
7.	Input for external ALC voltage.
8.	Ground
9.	Input for RTTY keying (MARK: HIGH level, SPACE: LOW level: This can be reversed by the internal switch.).
10.	NC (No Connection)
11.	Input for TRANSVERTER control. When 8 Volts DC is applied, the set can operate with a transverter.
12.	Output reference voltage for band switching.
13.	Output for external band switching.
14.~24.	NC

3 - 13 CAUTIONS

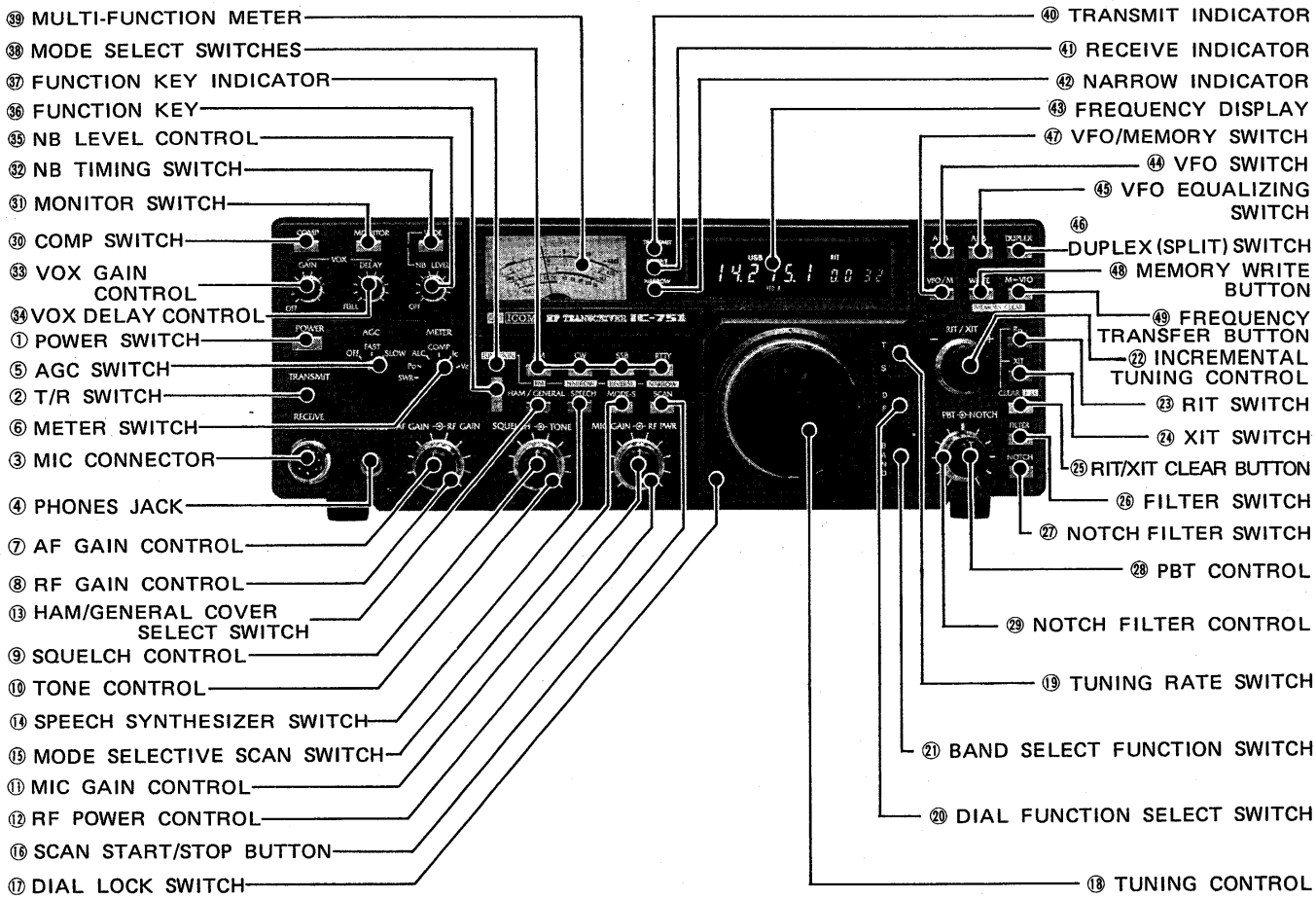
As the unit has already been closely adjusted with highly sophisticated measuring instruments, never tamper with the turnable resistors, coils, trimmers, etc.

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



1. POWER SWITCH

The POWER SWITCH is a push-lock type switch which controls the input DC power to the IC-751. When the external AC power supply (IC-PS15) or optional built-in AC power supply (IC-PS35) is used, the switch also acts as the AC power supply switch. When the switch is pushed in and locked, power is supplied to the set. When the switch is pushed again and released, power is cut to all circuits (except the PA unit when using an external DC power supply).

2. T/R (TRANSMIT/RECEIVE) SWITCH

This switch is for manually switching from transmit to receive and vice versa. Set the switch to RECEIVE (down) and the IC-751 is in the receive mode. Set the switch to TRANSMIT (up) and it switches to transmit. When switching with the PTT switch on the microphone or with the VOX switch set to ON, the T/R switch must be in the RECEIVE position.

3. MIC CONNECTOR

Connect a suitable microphone to this jack. The supplied hand microphone IC-HM12 or optional desk mic IC-SM6 can be used. If you wish to use a different microphone, refer to the drawings on page 4.

4. PHONES JACK

Accepts a standard 1/4 inch headphone plug for headphones of 4 ~ 16 ohms. Stereo phones can be used without modification.

5. AGC (AUTOMATIC GAIN CONTROL) SWITCH

For changing the time-constant of the AGC circuit. With the switch in the SLOW position the AGC voltage is released slowly, and thus is suitable for SSB reception. With the switch in the FAST position, the AGC voltage is released faster, and the AGC is suitable for stations suffering from fast fading or when operating in the CW mode.

When the control is in the OFF position, the AGC function is turned OFF and the S-meter does not swing even if a signal has being received. (The AGC does not actuate in the FM mode.)

6. METER SWITCH

In the transmit mode, the meter has six functions.

1. Vc — Indicates the collector voltage of the final transistors.
2. Ic — Indicates the collector current of the final transistors.
3. COMP — Indicates the compression level when the speech processer is in use.
4. ALC — Indicates the ALC level. The meter begins to function when the RF output power reaches a certain level.
5. Po — Indicates an approximate RF output power.
6. SWR — SWR can be measured by setting this switch to the Po position and calibrating the meter needle to the "SET" position with the RF POWER control, then setting this switch to the SWR position.

7. AF GAIN CONTROL
Controls the audio output level in the receive mode. Clockwise rotation increases the level.

8. RF GAIN CONTROL
Controls the gain of the RF section in the receive mode. Clockwise rotation gives the maximum gain. As the control is rotated counterclockwise, the needle of the MULTI-FUNCTION METER rises, and only signals stronger than the level indicated by the needle will be heard. (In the FM mode, regardless of the control setting, the RF gain is fixed at the maximum.)

9. SQUELCH CONTROL
Sets the squelch threshold level. To turn OFF the squelch function, rotate this control completely counterclockwise. To set the threshold level higher, rotate the control clockwise.

10. TONE CONTROL
Controls the receiver audio tone. Adjust the control to provide comfortable reception.

11. MIC GAIN CONTROL
Adjusts the level of modulation according to the input of the microphone. Clockwise rotation increases the microphone gain. As the input will vary with different microphone and different voices, the knob should be turned until the Meter needle, in the ALC mode, begins to move slightly within the ALC zone. In the SSB mode when the speech processor is in use, the MIC GAIN CONTROL sets a clipping limit, while the RF POWER CONTROL sets the RF drive level to the maximum power level, where ALC starts at the saturation point of the amplifiers.

12. RF POWER CONTROL
Controls the RF output power 10 Watts to maximum (SSB: 100 Watts PEP, CW, RTTY, FM: 100 Watts, AM: 40 Watts). Clockwise rotation increases the output power.

13. HAM BAND/GENERAL COVER SELECT SWITCH
Each push selects the function of the set alternately. In the HAM BAND mode, the transceiver functions in any of nine HAM bands between 1.8MHz and 28MHz. In the GENERAL COVERAGE mode the set functions as a general coverage receiver between 0.1MHz and 30MHz. (The set will not transmit in this mode.)

14. SPEECH SYNTHESIZER SWITCH
When the optional speech synthesizer unit is installed, this switch turns on the unit which announces the displayed frequency in English.

15. MODE SELECTIVE SCAN SWITCH
When this switch is pushed, only memory channels stored with the operating mode which is displayed on the frequency display just prior to pushing this switch, are selected by turning the tuning control or scanning.

16. 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 frequency in the programmed scan, or from the highest memory channel in the other memory scans.

17. DIAL LOCK SWITCH
After the IC-751 is set to a certain frequency for rag chewing, mobile operation, etc., by pushing this switch, the VFO is electronically locked at the display frequency, thus inactivating the operation of the tuning control. To change frequency, the dial lock must first be disengaged by pushing and releasing this switch again.

18. TUNING CONTROL
Rotating this control clockwise increases the frequency or the memory channel number, while rotating it counterclockwise decreases it. The frequency changes by 10Hz in any mode. In 10Hz step tuning rate, by turning the tuning control faster, the 50Hz step tuning rate is automatically selected. This makes it very convenient to make a QSY over a wide frequency range.

This control is also used to select the operating band while the BAND SELECT FUNCTION switch is depressed.

19. TUNING RATE SWITCH
By pushing in this switch, the operating frequency is changed to correspond to 1KHz increments in any mode.

At the same time, the 100Hz digit on the display is cleared to show "0". When this switch is pushed again and released, the frequency is changed normally. This switch allows you to quickly QSY over a great frequency range.

20. DIAL FUNCTION SELECT SWITCH
In the VFO operation, by pushing in this switch, the operating frequency (displayed VFO frequency) is locked and the memory channel number (displayed on the frequency display) can be changed by turning the tuning control.

In the MEMORY CHANNEL mode, by pushing in this

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