

Introduction

The FT-450 is a rugged, innovative multiband, multimode portable transceiver for the amateur radio HF/VHF bands. Providing coverage of the 160-10 meter bands plus the 6 m, the FT-450 includes operation on the SSB, CW, AM, FM, and Digital modes, yielding the most comprehensive performance package available for field operation.

Designed for use from an external DC power source, the FT-450 provides 100 watts of power output from a 13.8-Volt external power supply.

The multi-function Liquid-Crystal Display includes various backlighting, which may be disabled for battery conservation. The display includes bar-graph indication of power output, ALC voltage, SWR, and modulation level.

Among the advanced features of the FT-450 are many incorporated only in large base-station transceivers. These include Dual VFOs; Split-Frequency operation; Digital Signal Processing (Bandpass Filtering, Noise Reduction, Notch, and Microphone Equalizer); IF Shift; Clarifier ("R.I.T."); IF Noise Blanker; AGC Fast/Slow/Auto/Off selection; RF Gain and Squelch control; IPO (Intercept Point Optimization) and a receiver front-end Attenuator; VOX; Built-in Electronic Keyer; Adjustable CW Pitch; Built-in CTCSS Encoder/Decoders; and Time-Out Timer (TOT) functions; Computer Interface capability; and Cloning capability.

We urge you to read this manual in its entirety, so as to gain a full understanding of the amazing capability of the exciting FT-450 Transceiver.

Specifications

General

Frequency Range:	Receive: 30 kHz - 56 MHz Transmit: 160 - 6 Meters
Emission Modes:	A1 (CW), A3 (AM), A3J (LSB/USB), F3 (FM)
Synthesizer Steps (Min.):	10 Hz (CW/SSB), 100 Hz (AM/FM)
Antenna Impedance:	50 Ohms, Unbalanced (M)
Operating Temp. Range:	-10 °C to +50 °C
Frequency Stability:	± 4 ppm from 1 min. to 60 min after power on. @25 °C: 1 ppm/hour
Supply Voltage:	Normal: 13.8 VDC ±10 %, Negative Ground
Current Consumption:	Squelched: 1 A (Approx.) Receive: 1.5 A Transmit: 22 A
Case Size:	229 (W) x 84 (H) x 217 (D) mm
Weight (Approx.):	3.6 kg

Transmitter

RF Power Output:	100 W @13.8 V DC
Modulation Types:	SSB: Balanced Modulator AM: Early Stage (Low Level) FM: Variable Reactance
FM Maximum Deviation:	±5 kHz (FM-N: ±2.5 kHz)
Spurious Radiation:	-50 dB (1.8-29.7 MHz) -70 dB (50 MHz)
Carrier Suppression:	>40 dB
Opp. Sideband Suppression:	>50 dB
SSB Frequency Response:	400 Hz-2600 Hz (-6 dB)
Microphone Impedance:	200-10k Ohms (Nominal: 600 Ohms)

Receiver

Circuit Type:	Double-Conversion Superheterodyne			
Intermediate Frequencies:	1 st : 67.899 MHz 2 nd : 24 kHz			
Sensitivity:		<u>SSB/CW</u>	<u>AM</u>	<u>FM</u>
	1.8 MHz-28 MHz	0.2 μ V	2 μ V	-
	28 MHz-30 MHz	0.2 μ V	2 μ V	0.5 μ V
	50 MHz-56 MHz	0.16 μ V	1 μ V	0.25 μ V
	(SSB/CW/AM = 10 dB S/N, FM = 12 dB SINAD)			
Image Rejection:	70 dB			
IF Rejection:	60 dB			
Selectivity (-6/-60 dB):	SSB/CW: 2.2 kHz/4.5 kHz AM: 6 kHz/20 kHz FM-N: 9 kHz/25 kHz CW-N: 500 Hz/2.0 kHz			
AF Output:	2.2 W (@4 Ohms, 10% THD or less)			
AF Output Impedance:	4-16 Ohms			

ACCESSORIES & OPTIONS

Supplied Accessories

MH-67A8J Microphone

Available Options

YH-77STA Stereo Headphone
MH-31A8J Microphone
MD-200A8X Microphone
MLS-100 External Speaker
SP-2000 External Speaker
FP-1030A DC Power Supply
MHG-1 Carrying Handle
ATU-450 Antenna Tuner

Installation

Power Connections

The **FT-450** is designed use from an external DC power source.

External DC power source operation

The DC power connector for the **FT-450** must only be connected to a DC source providing 13.8 Volts DC ($\pm 10\%$), and capable of at least 22 Amperes of current. Always observe proper polarity when making DC connections:

The Red DC power lead connects to the Positive (+) DC terminal; and

The Black DC power lead connects to the Negative (–) DC terminal.

In mobile installations, noise pickup may be minimized by connecting the DC cable directly to your vehicle's battery, rather than to the ignition switch or "accessory" circuitry. Direct connection to the battery also provides the best voltage stability.

Tips for Successful Mobile Installations:

- Before connecting the DC cable to the battery, measure the voltage across the battery terminals with the engine running fast enough to show a charge. If the voltage is above 15 Volts, the vehicle's voltage regulator should be adjusted to reduce the charging voltage to 14 Volts or lower.
- Route the DC cable as far away from the ignition cables as possible.
- If the DC cable is not long enough, use #12 AWG (minimum) stranded, insulated wire to extend it. Be certain to solder the connections at the splice securely, and provide ample insulation for the soldered splice (heat shrink tubing plus black electrical tape work well).
- Check the battery terminal connections frequently to be sure they are tight and not corroded.

Caution

Permanent damage can result if improper supply voltage, or reverse-polarity voltage, is applied to the **FT-450**. The Limited Warranty on this transceiver does not cover damage caused by application of AC voltage, reversed polarity DC, or DC voltage outside the specified range of 13.8V $\pm 10\%$. Never attempt to connect the **FT-450** to a 24 Volt battery system.

When replacing fuses, be certain to use a fuse of the proper rating. The **FT-450** requires a 25A fast-blow fuse.

Antenna Considerations

The antenna systems connected to your **FT-450** transceiver are, of course, critically important in ensuring successful communications. The **FT-450** is designed for use with any antenna system providing 50 resistive impedance at the desired operating frequency. While minor excursions from the 50 specification are of no consequence, the power amplifier's protection circuitry will begin to reduce the power output of there is more than a 50% divergence from the specified impedance (less than 33 or greater than 75, corresponding to a Standing Wave Ratio (SWR) of 1.5:1).

Antenna Installations

When installing a "balanced" antenna such as a Yagi or dipole, remember that the **FT-450** is designed for use with an (unbalanced) coaxial feedline. Always use a balun or other balancing device so as to ensure proper antenna system performance.

Use high-quality 50 Ω coaxial cable for the lead-in to your **FT-450** transceiver. All efforts at providing an efficient antenna system will be wasted if poor quality, lossy coaxial cable is used. Losses in coaxial lines increase as the frequency increases, so a coaxial line with 0.5 dB of loss at 7 MHz may have 6 dB of loss at 432 MHz (thereby consuming 75% of your transceiver's power output!). As a general rule, smaller-diameter coaxial cables tend to have higher losses than larger-diameter cables, although the precise differences depend on the cable construction, materials, and the quality of the connectors used with the cable. See the cable manufacturers' specifications for details.

For reference, the chart below shows approximate loss figures for typically- available coaxial cables frequently used in HF installations.

Always locate antennas such that they can **never** come in contact with outdoor power lines in the event of a catastrophic support or power-pole structural failure. Ground your antennas' support structure(s) adequately, so as to dissipate energy absorbed during a lightning strike. Install appropriate lightning arrestors in the antenna coaxial cables (and rotator cables, if rotary antennas are used).

In the event of an approaching electrical storm, disconnect all antenna lead-in, rotator cables, and power cables completely from your station **if the storm is not immediately in your area**. Do not allow disconnected cables to touch the case of your **FT-450** transceiver or accessories, as lightning can easily jump from the cable to the circuitry of your transceiver via

the case, causing irreparable damage. If a lightning storm is in progress in your immediate area, do not attempt to disconnect the cables, as you could be killed instantly if lightning should strike your antenna structure or a nearby power line.

If a vertical antenna is utilized, be certain that humans and/or pets and farm animals are kept away both from the radiating element (to prevent electrical shock and RF exposure danger) *and* the ground system (in the event of an electrical storm). The buried radials of a ground-mounted vertical antenna can carry lethal voltages outward from the center of the antenna in the event of a direct lightning strike.

RF Field Exposure

This transceiver is capable of power output in excess of 50 Watts, so customers in the United States *may* be required to demonstrate compliance with Federal Communications Commission (FCC) regulations concerning maximum permissible exposure to radio frequency energy. Compliance is based on the actual power output used, feedline loss, antenna type and height, and other factors which can only be evaluated as a system.

Information regarding these regulations may be available from your Dealer, your local radio club, from the FCC directly (press releases and other information can be found on the FCC's site on the World Wide Web at <<http://www.fcc.gov>>), or from the American Radio Relay League, Inc. (225 Main St., Newington CT 06111 or <<http://www.arrl.org>>).

Although there is negligible radio frequency (RF) leakage from the **FT-450** transceiver itself, its antenna system should be located as far away from humans and animals as practicable, so as to avoid the possibility of shock due to accidental contact with the antenna or excessive long-term exposure to RF energy. During mobile operation, do not transmit if someone is standing adjacent to your antenna, and use the lowest power possible.

Electromagnetic Compatibility

If this transceiver is used with, or in the vicinity of, a computer or computer-driven accessories, you may need to experiment with grounding and/or **Radio Frequency Interference (RFI)** suppression devices (such as ferrite cores) to minimize interference to *your* communications caused by energy from the computer. Computer-generated RFI is usually a result of inadequate shielding of the computer's cabinet or I/O and peripheral connections. While computer equipment may "comply" with RF emission standards, this does *not* ensure that sensitive Amateur Radio receivers like the **FT-450** will not experience

interference from the device!

Be certain to use only shielded cables for TNC-to-Transceiver connections. You may need to install AC line filters on the power cord(s) of the suspected equipment, and decoupling ferrite toroidal chokes may be required on interconnecting patch/data cables. As a last resort, you can try installing additional shielding within the computer's case, using appropriate conductive mesh or conductive shielding tape. Especially check "RF holes" where plastic is used for cabinet front panels.

For further information, consult amateur radio reference guides and publications relating to RFI suppression techniques.

Heat and Ventilation

To ensure long life of the components, be certain to provide adequate ventilation around the cabinet of the **FT-450**. The cooling system of the transceiver must be free to draw cool air in from the side of the transceiver and expel warm air from the rear of the transceiver.

Do not install the transceiver on top of another heat-generating device (such as a linear amplifier), and do not place equipment, books, or papers on top of the transceiver. Place the transceiver on a hard, flat, stable surface. Avoid heating vents and window locations that could expose the transceiver to excessive direct sunlight, especially in hot climates.

CW Key/Keyer Connections

All commonly-available keyer paddles should work perfectly with the built-in Electronic Keyer. The wiring configuration for the paddle is shown below.

For straight-key operation, only the tip and shaft connections are used.

Note: *Even when using a straight key, you must use a three-conductor ("stereo") plug. If a two-conductor plug is used, the key line will be constantly shorted to ground.*

When using an external electronic keyer, be absolutely certain that it is configured for "positive" keying, not "negative" or "grid block" keying. The "key-up" voltage of the **FT-450** is +5V, and the "key-down" current is only about 1 mA.

For CW automated keying using a personal computer, with an external memory keyer

providing for manual sending, it usually is possible to connect the keyed lines together via a “Y” connector. Check with the documentation accompanying your keyer and your contest/DX software for any cautions which need to be observed.

Receiver Accessories (Tape Recorder etc.)

Connection of a tape recorder or other such receiver accessory is easily accomplished by using the **DATA** jack’s Data Out (1200 bps) terminal (Pin 5) and Ground (Pin 2). The audio output is fixed at 100 mV, with an impedance of 600 Ω .

Front Panel Control & Switches

(1) Liquid Crystal Display

The Liquid Crystal Display (LCD) provides indication of the operating frequency and other aspects of transceiver status.

Front Panel Control & Switches

1. POWER Switch

Press and hold in this switch for one second to turn the transceiver on. Press and hold in this switch for one second, similarly, to turn the transceiver off.

2. METER/DIM Switch

This control switch determines the function of the meter during transmission.

ALC: Indicates the relative ALC voltage.

PO: Indicates the power output level.

SWR: Indicates the Standing Wave Ratio (Forward: Reflected).

Press [F] button and this button to lower the illumination intensity of the frequency display.

3. VOX/STO Switch

This button enables automatic voice-actuated transmitter switching in the SSB, AM, and FM modes. While activated, appear [VOX] on the display.

4. TUNE Switch

This is the on/off switch for the FT-450’s Antenna Tuner.

Pressing this button momentarily places the antenna tuner in line between the transmitter final amplifier and the antenna jack (“TUNER” icon will appear in the display). Reception is not affected.

Pressing and holding in this button for 1/2 second, while receiving in an amateur band,

activates the transmitter for a few seconds while the automatic antenna tuner rematches the antenna system impedance for minimum SWR. The resulting setting is automatically stored in one of the antenna tuner's 100 memories, for instant automatic recall later when the receiver is tuned near the same frequency.

Pressing this button momentarily, while the Tuner is engaged, will take the Automatic Antenna tuner out of the transmit line.

5. PHONES Jack

A 1/8-inch 3-contact jack accepts either monaural or stereo headphones with 2- or 3-contact plugs. When a plug is inserted, the loudspeaker is disabled.

Note: When wearing headphones, we recommend that you turn the AF Gain levels down to their lowest settings before turning power on, to minimize the impact on your hearing caused by audio "pops" during switch-on.

6. KEY Jack

This 1/8-inch, 3-contact jack accepts a CW key or keyer paddles (for the built-in electronic keyer), or output from an external electronic keyer. Pinout is shown on page xx. Key up voltage is 5 V, and key down current is 1 mA. This jack may be configured for keyer, "straight key," or computer keying interface operation via [KEYER] key.

Note: You cannot use a 2-contact plug in this jack (to do so produces a constant "key down" condition).

7. Microphone Connector

This 8-pin jack accepts input from a microphone utilizing a traditional YAESU HF-transceiver pin assignment.

8. KEYER Switch

This button toggles the internal CW keyer on and off. While activated, [KEYER] icon appears in the display.

9. ATT/IPO Switch

This button selects the degree of attenuation and IPO (Intercept Point Optimization), if any, to be applied to the receiver input.

Available selections are (ATT: ON)/(IPO: OFF), (ATT: OFF)/(IPO: ON), (ATT: ON)/(IPO: ON), or (ATT: OFF)/(IPO: OFF), and [ATT] or [IPO] icon will change according to the attenuation level selected.

10. AGC Switch

This button selects the AGC characteristics for the receiver. Available selections are FAST, MID, Slow, or Auto, and the “AGC” icon will change according to the AGC characteristics selected.

11. NB Switch

This button turns the IF Noise Blanker on and off.

Press this button momentarily to reduce a short pulse noise, and “NB” icon appears in the display.

12. SQL/RF GAIN Knobs

SQL Knob

The outer [SQL] knob sets the signal level threshold at which receiver audio is muted, in all modes. It is very useful during local rag-chews, to eliminate noise between incoming transmissions. This control is normally kept fully counter-clockwise (off), except when scanning and during FM operation.

RF GAIN Knob

The outer [RF GAIN] knob is the receiver’s RF gain control, which adjusts the gain of the receiver’s RF and IF amplifier stages. This control is normally left in the fully clockwise position.

13. AF GAIN Knob

The inner [AF GAIN] knob sets the receiver’s audio volume level. Typically, you will operate with this control set past the 9 o’clock to 10 o’clock position.

14. MODE Switches

Pressing [MODE UP] or [MODE DOWN] button will select the operating mode.

15. SPLIT Switch

Pressing this button to activates split frequency operation between the Main band (VFO-A), used for transmission and Sub band (VFO-B), used for reception. If you press and hold in the [SPLIT] button for two seconds, the “Quick Split” feature will be engaged, whereby the Sub band VFO (VFO-B) will automatically be set to a frequency 5 kHz higher than the Main band (VFO-A) frequency with same operating mode, and the transceiver will be placed in the Split mode.

17. Main Tuning Dial Knob

This large knob adjusts the operating frequency of the Main band (VFO-A) or a recalled memory. Clockwise rotation of this knob increases the frequency. Default tuning increments

are 10 Hz (100 Hz in AM and FM modes); when the [FAST] button is pressed, the tuning steps increase. The available steps are:

<u>Operating Mode</u>	<u>1 Step*</u>	<u>1 Dial Rotation</u>
LSB/USB/CW	10 Hz (100 Hz)	10 kHz (100 kHz)
AM/FM	100 Hz (1 kHz)	100 kHz (1 MHz)

* Numbers in parentheses indicate steps when the [FAST] button is On.

Advice: The tuning steps for the Main Tuning Dial knob are set, at the factory, to 10 Hz per step. Via Menu item "DIALSTP," however, you may change this setting from 10 Hz to 1 Hz instead. When 1 Hz basic steps are selected, the action of the [FAST] button will be changed to 1/10 of the values listed above.

18. FAST Switch

Pressing this button will increase or decrease the tuning rate of the Main Tuning Dial knob by a factor of ten, as mentioned in the previous section.

When this function is activated, "FAST" icon appears in the display.

19. LOCK Switch

This button toggles locking of the Main Tuning Dial knob, to prevent accidental frequency changes. When the button is active, the Main Tuning Dial knob can still be turned, but the frequency will not change, and "LOCK" icon appears in the display.

20. A=B Switch

Press this button momentarily to transfer data from the Main band (VFO-A) frequency (or a recalled memory channel) to the Sub band (VFO-B), overwriting any previous contents in the Sub band (VFO-B). Use this key to set both Main band (VFO-A) and Sub band (VFO-B) receivers to the same frequency and mode.

21. A/B Switch

Pressing this button momentarily exchanges the contents of the Main band (VFO-A) (or a recalled memory channel) and the Sub band (VFO-B).

22. V/M Switch

This button toggles Main band (VFO-A) receiver operation between the memory system and the VFO. Either "MR" or "MT" will be displayed to the under the main frequency display field to indicate the current selection. If you have tuned off of a Memory channel frequency (MT), pressing this button returns the display to the original memory contents (MR), and pressing it

once more returns operation to the Main VFO (no icon).

23. BAND Keys

These keys allow one-touch selection of the desired Amateur band (1.8 ~ 50 MHz).

What's more, these keys may be used for direct entry of a desired operating frequency during VFO operation.

24. CLAR Switch

Pressing this button activates the RX Clarifier, to allow offsetting the Main (VFO-A) receiving frequency temporarily. Press this button once more to return the Main receiver to the frequency shown on the main frequency display field; the Clarifier offset will still be present, though, in case you want to use it again. To cancel the Clarifier offset, press the [CLEAR] button.

24. SHIFT Knobs (except on FM and AM mode)

The inner [SHIFT] knob provides adjustment of the IF DSP passband, using 10 Hz steps for precise adjustment and easy reduction of interference on either side of your operating frequency. The total adjustment range is ± 1 kHz. The normal operating setting for this knob is straight up, in the 12 o'clock position.

Display Indications

1. Receiver Configuration Indicator

ATT and IPO (ATT: ON)/(IPO: OFF), (ATT: OFF)/(IPO: ON), (ATT: ON)/(IPO: ON), or (ATT: OFF)/(IPO: OFF)

Indicates the attenuation and IPO status selected for operation by the front panel [AGC/IPO] button.

AGC (AUTO, FAST, SLOW):

Indicates the AGC decay time selected for operation by the front panel [AGC/IPO] switch.

NB

This indicator appears when the receiver's (short duration) Noise Blanker is activated.

Further more, this indicator will blink for three second then appears continuously when the receiver's the (longer duration) Noise Blanker is activated.

DNR

This indicator appears whenever the Digital Noise Reduction is activated.

NOTCH

Appears the graphically depict the peak position of the IF Notch Filter when the IF Notch Filter is activated.

6. WIDTH

Indicates the bandwidth of the DSP IF filter.

SHIFT

Indicates the peak position of the DSP IF filter.

KEYER

This indicator appears whenever the internal CW keyer is activated.

TX

This indicator appears during transmission on the (VFO-A) frequency.

Frequency Display

This is the frequency display.

LOCK

This indicator appears when the Main Tuning Dial knob is locked.

FAST

This indicator appears when the Main Tuning Dial knob's tuning rate is selected to fast.

Rear Panel

25. ANT Jacks

Connect your antenna here, using a type-M (PL-259) plug and coaxial feedline for each. These antenna ports are always used for transmission, and also are used for reception unless a separate receive antenna is also used for the receiver. The internal antenna tuner affects only the antenna(s) connected here, and only during transmission. These connectors utilize Teflon[®] insulation for extreme durability and to ensure stable impedance over the entire frequency range.

26. GND

Use this terminal to connect the transceiver to a good earth ground, for safety and optimum

performance. Use a large diameter, short braided cable for making ground connections, and please refer to page xx for other notes about proper grounding.

27. DATA Jack

This 8-pin output jack provides band selection data, which may be used for control such as the TNC.

28. TUNER Jack

This 8-pin output jack provides band selection data, which may be used for control such as the Antenna Tuner.

29. LINER Jack

This 8-pin output jack provides band selection data, which may be used for control such as the Linear Amplifier.

30. EXT SPKR

This gold-plated two-contact output jacks provides receiving audio from the receivers for an external loudspeaker or speakers, such as the SP-2000. Inserting a plug into one of these jacks disables the corresponding internal loudspeaker. Impedance is 4 - 16 Ohms.

31. CAT Jack

This 9-pin serial DB-9 jack allows external computer control of the FT-450. Connect a serial cable here and to the RS-232C COM port on your personal computer (no external interface is required).

32. DC IN Jack

This 4-pin connector requires a 13.8-volt supply capable of 22 amperes continuous duty. Usually, connect the DC OUT plug to this jack. For DC operation, use the xx DC Cable with 25 A fuse.

Operation

RF Says: Hi! I'm R.F. Radio, and I'm here to guide you through the fine points of the setup and use of your new FT-450. I know your anxious to get on the air, but I encourage you to read the "Operation" section of this manual as thoroughly as possible, so you'll get the most out of this fantastic new rig. Now. . .let's get operating!

Turning the Transceiver On and Off

1. To turn the transceiver on, press and hold in the **PWR** switch for one second.
2. To turn the transceiver off, again press and hold in the **PWR** switch for one second.

Operating Band Selection

This transceiver covers an incredibly wide frequency range, over which a number of different operating modes are used. Therefore, this transceiver's frequency coverage has been divided into different operating bands, each of which has its own pre-set channel steps and operating modes. You can change the channel steps and operating mode once you get started, of course, per the next section.

To change the frequency band, press either the **BAND(DWN)** or **BAND(UP)** key to move to the next lower or higher operating band, respectively.

... 1.8 MHz □ 3.5 MHz □ 7.0 MHz □ 10 MHz □ 14 MHz □ 15 MHz □ 18 MHz □ 24 MHz
□ 28 MHz □ 50 MHz □ 1.8 MHz ...

R.F. Says: VFOa and VFOb are independent VFOs, so they may be set to different bands. See the “Stacked VFO System” discussion on page <<??> for details.

Mode Selection

Press the **MODE** key to move among the eight settings for the operating modes, respectively.

... LSB ... USB ... CW ... AM ... FM ... DATA ... LSB ...

R.F. Says: You can also set VFOa and VFOb to different modes in the same band, allowing you to have a “Phone” VFO and a “CW” VFO, for example.

Adjusting the Audio Volume Level

Rotate the **AF GAIN** knob to set a comfortable listening level.

R.F. Says: Start with the **AF** knob set fully counter-clockwise, especially when using FM (the background noise on FM can be surprisingly loud)!

Adjusting the RF Gain and Squelch

The **SQL/RF** Gain control is configured differently, depending on the country to which the **FT-450** has been exported. In the U.S. version, the default function of this control is “RF Gain.” The configuration of the **SQL/RF** Gain control is set via Menu Mode **No-***** [**SQL RF**

GAIN]; see page <<??>> for details.

If your transceiver is configured for “RF Gain” use, rotating this control fully clockwise in the SSB/CW/Digital modes will provide best sensitivity. To reduce the receiver’s RF Gain somewhat, rotate this control counter-clockwise slightly. You will observe an increasing number of bars on the S-meter as you rotate the RF Gain control counter-clockwise; this indicates increasing AGC voltage, which is causing the front-end gain to be reduced. In the FM and Packet modes, this control will automatically be set to “Squelch,” even though the setting of Menu No-*** is set to “RF Gain.”

If this control is configured for “SQL” operation, the FT-450’s RF Gain will be set for maximum sensitivity in all modes, and the **SQL/RF** Gain control will function solely as a Squelch control. In this case, rotate the **SQL/RF** Gain control to the point where the background noise is just silenced; this will provide the best sensitivity to weak signals, while keeping the receiver quiet when no signal is received.

Setting the Operating Frequency

1. In the “**SSB/CW/DATA**” modes, rotate the **DIAL** knob to set the frequency. Clockwise rotation of the **DIAL** increases the operating frequency.
2. In the “**AM/FM**” modes, rotate the DSP/SEL knob to set the frequency. Clockwise rotation of the DSP/SEL increases the operating frequency.
3. You may also use the DSP/SEL knob to adjust the operating frequency in the “**SSB/CW/DATA**” modes. The DSP/SEL knob provides faster tuning, ideal for making quick changes in frequency when you want to move across the band in a hurry. You can then use the **DIAL** to make fine frequency adjustments.
4. If you press the DSP/SEL knob momentarily, then rotate the DSP/SEL knob, you can now change the operating frequency in 1 MHz steps, allowing very quick frequency excursions. This can be particularly helpful on the VHF and UHF bands.
5. In step 2 above, it was mentioned that tuning in the “**AM/FM**” modes is accomplished using the DSP/SEL knob. By default, the **DIAL** is disabled in these modes; if you wish to enable the **DIAL** in these modes, use Menu Mode [**A&F DIAL**]; see page <<??>>.

Receiver Accessories

Locking Front Panel Controls

The front panel **LOCK** button allows you to disable the **DIAL** and/or the front panel controls.

In the transceiver's default configuration, pressing the **LOCK** button disables just the **DIAL**, while the other keys and switches are unaffected.

To lock out the remainder of the controls and the DSP/SEL knob, use Menu Mode [**LOCK MODE**];

1. Press and hold in the [**F**] key for one second to enter the Menu mode.
2. Rotate the DSP/SEL knob so as to recall [**LOCK MODE**].
3. Rotate the **DIAL** to select the desired.
FREQ.: Locks front panel keys and knobs related to frequency control (such as **BAND (UP)** and **BAND (DWN)** key, etc.)
PANEL: Locks all front panel keys and knobs (except **POWER** and **LOCK** keys)
ALL: Locks all front panel keys and knobs (except **POWER** and **LOCK** keys) and microphone keys.
4. When you have made your selection, Press and hold in the [**F**] key for one second to save the new setting and exit to normal operation.

When the controls are locked out, press the **LOCK** button once more to release them to normal operation.

Clarifier (Receiver Incremental Tuning)

The Clarifier (RIT) allows you to set an offset of up to ± 9.99 kHz of the receive frequency relative to your transmit frequency. To achieve a wider offset than this, you may use the "Split" operating mode, described later.

1. Press the **CLAR** button momentarily to activate the Clarifier function.
2. Turn the **DSP/SEL** knob, which allows the receiver frequency to be varied over a range of 9.99 kHz.
3. When the receiving frequency is higher or lower than transmit frequency, shift frequencies will appear at the right side of the frequency display.
4. To turn the Clarifier off, again press the **CLAR** button momentarily. When you turn the Clarifier back on, the offset previously stored will still be applied.
5. To reset the Clarifier offset to zero, turn the Clarifier off, then turn the **DIAL** by any amount. The Clarifier will reset to zero after the first "step" of the **DIAL**.

IF SHIFT

The receiver's IF SHIFT feature is an effective interference-reduction tool, which allows you to shift the passband response higher or lower without changing the pitch of the incoming

signal.

Rotate the **SHIFT** knob, as needed, to reduce or eliminate the interference.

AGC (Automatic Gain Control)

The receiver recovery time constant of the AGC system may be modified to match your operating needs.

Press the **[AGC]** key toggle the AGC recovery time constant among the following selections:

AGCauto → AGCfast → AGCslow → AGCauto ...

where “AUTO” represents “FAST” on CW and DATA(AFSK), and “SLOW” on the voice modes.

Noise Blanker

The IF Noise Blanker may be useful in reducing or eliminating some types of impulse noise, especially noise generated by automotive ignition systems.

1. Press the **[NB]** key to activate the Noise Blanker. The “parenthesis” will appear at the both side of the “**NB**” indication.
2. Press the **[NB]** key again to turn the Noise Blanker off.

IPO (Intercept Point Optimization)

The IPO feature bypasses the receiver RF preamplifier, thereby eliminating the preamp’s gain.

This button selects the degree of attenuation and IPO (Intercept Point Optimization), if any, to be applied to the receiver input.

Available selections are (ATT: ON)/(IPO: OFF), (ATT: OFF)/(IPO: ON), (ATT: ON)/(IPO: ON), or (ATT: OFF)/(IPO: OFF), and **[ATT]** or **[IPO]** icon will change according to the attenuation level selected.

DSP Noise Reduction (NR)

The **NOISE REDUCTION** feature of the DSP system may be used to enhance signal-to-noise ratio on weak signals.

1. Press the **[DSP]** key, which selects **DNR meter** on the display, then the “parenthesis” will appear at the both side of the “**DNR**” indication.
2. Press the **[DSP/SEL]** key to activate the **DSP NOISE REDUCTION** feature. Rotate the **DIAL** to find the point where best signal-to-noise ratio is obtained under the current noise conditions.
3. Press the **[DSP]** key to save the new setting and exit to normal operation.
4. To turn off the **DSP NOISE REDUCTION** feature, press the **[DSP/SEL]** key again.

DSP Notch Filter

The DSP system's Notch Filter may be helpful in removing one or more offending carrier or heterodyne signals from the audio passband.

1. Press the [**DSP**] key, which selects **NOTCH meter** on the display, then the "parenthesis" will appear at the both side of the "**NOTCH**" indication.
2. Press the [**DSP/SEL**] key to activate the notch filter feature. Rotate the **DIAL** to find the point where best signal-to-noise ratio is obtained under the current noise conditions.
3. Press the [**DSP**] key to save the new setting and exit to normal operation.
4. To turn off the notch filter feature, press the [**DSP/SEL**] key again.

Transmitter Operation

SSB/AM Transmission

Basic Setup/Operation

1. Press the **MODE** key so as to select either SSB (LSB/USB) or AM mode. In the SSB mode, if you are operating on the 7 MHz or lower bands, select the LSB mode. If you are operating on the 14 MHz or higher bands, select the USB mode.
2. Press the [**METER/DIM**] key momentarily, to select the "ALC" meter function ("**ALC**" will appear on the display).
3. Press the microphone's **PTT** switch, and speak into the microphone in a normal voice while watching the meter. The ideal audio input level to the transmitter from the microphone will cause a few "segments" of indication on the ALC meter. Release the **PTT** switch to return to receive mode.
4. If the ALC meter is too high, or too low, you may need to reset the Microphone Gain:
 - 1 Press and hold in the [**F**] key for one second to enter the Menu mode.
 - 2 Rotate the DSP/SEL knob to recall Menu Mode [**MIC GAIN**].
 - 3 Close the **PTT** switch, and while speaking into the microphone rotate the **DIAL** until the proper ALC indication is achieved on voice peaks.
 - 4 When done, press and hold in the [**F**] key for one second to save the new setting for the Microphone Gain.

CW Transmission

Operation using Straight Key/External Keying Device

When using a straight key, an external electronic keyer, or a computer-generated keying device, please follow the instructions in this section.

1. Insert your key's (three-conductor) plug into the rear-panel **KEY** jack.

2. Press the **MODE** (UP)/**MODE** (DOWN) key, as needed, to select one of the CW modes.
R. F. Says: The “CW” mode utilizes USB-side carrier injection, while the CWR (Reverse) mode utilizes LSB-side injection.
3. Press and hold the **[KEYER]** key for one second, then appears [CWSPEED] on the display.
4. The CW hang time can be adjusted using the Menu Mode. To adjust the CW hang time:
 - 1) Rotate the [DSP/SEL] knob until appears [CW DLY] on the display, then press the [DSP/SEL] knob, then select the delay time.
 - 2) When done, press the [DSP/SEL] knob, then press and hold in the **[F]** key for one second to save the new setting and exit to normal operation.
5. You can adjust the CW sidetone volume level using the Menu Mode. To adjust the CW sidetone volume level:
 - 1) Rotate the [DSP/SEL] knob until appears [CWSTONE] on the display, then press the [DSP/SEL] knob, then select the delay time.
 - 2) When done, press the [DSP/SEL] knob, then press and hold in the **[F]** key for one second to save the new setting and exit to normal operation.
6. You also can adjust the CW sidetone pitch using the Menu Mode. To adjust the CW sidetone volume level:
 - 1) Rotate the [DSP/SEL] knob until appears [CWPITCH] on the display, then press the [DSP/SEL] knob, then select the delay time.
 - 2) When done, press the [DSP/SEL] knob, then press and hold in the **[F]** key for one second to save the new setting and exit to normal operation.

R. F. Says: Because the CW Pitch corresponds to the actual pitch of your transmitted signal, the sidetone may be used in a “CW Spot” capacity. Just tune the pitch of the received signal to the same pitch as that of your transceiver’s sidetone, and you will be perfectly “zero beat” with the other station.

FM Transmission

Basic Setup/Operation

1. Press the **MODE** (UP)/**MODE** (DOWN) key so as to select the FM mode.
2. Press the microphone’s **PTT** switch, and speak into the microphone in a normal voice.
3. Release the **PTT** switch to return to the receive mode.

Scanning Operation

This transceiver contains a wide variety of scanning capabilities. Whether you are in the VFO mode or one of the memory modes, scanning operation is fundamentally identical in all

configurations, but with the following differences:

- In the VFO mode, scanning causes the transceiver to sweep up or down the band, pausing or halting on any signal encountered;
- In the Memory mode, the scanner will scan the programmed memories, and can be instructed to skip certain memories during scanning;
- In the Programmable Memory Scan (PMS) mode, the scanner will scan the band within user-programmed frequency limits.

Scanning Operation

1. Set the **SQL** knob to the point where background noise is silenced. A typical setting, for effective scanning operation, will be at 12 o'clock or slightly clockwise from this position.
2. Set the transceiver into the operating configuration in which you wish to scan (VFO or Memory; PMS will be described later).
3. Press the [PMS/SCAN] key momentarily to start upward scan (toward higher frequencies or higher memory channel numbers).
4. Rotate the **DIAL** knob or **MEM/VFO CH** knob counterclockwise to toggle the scanning direction downward.
5. The scanner will now cause the transceiver to increment in the chosen direction until a signal is detected. When a signal is encountered which opens the Squelch, In the FM/AM modes, the scanner will pause until the signal disappears (at the end of the other station's transmission), at which point scanning will resume. While the transceiver is in the "Pause" condition, the decimal points in the frequency display area will blink. See "Scan-Resume Choices" on page <<??>> for details of how to customize the resumption of scanning. In the SSB/CW modes, the scanner will slow down (but doesn't stop).
6. Press the **PTT** switch on the microphone to cancel scanning.

Scan-Resume Choices

Scanning operation requires that you have the **FT-450's** audio squelched. The transceiver then "assumes" that the opening of the squelch corresponds to the discovery of a signal you may wish to listen to.

Once the scan has been halted, one of three things may happen:

TIME (default action): In this mode, the transceiver pauses on the signal and stays locked on its frequency for five seconds. Thereafter, scanning will resume whether or not the other station's transmission has ended. The pause time is adjustable from 0 to 10 seconds via Menu Mode [**RESUME**].

BUSY: In this mode, the scanner will halt until the other station's transmission ceases (at which point the squelch will close). One second after the squelch closes, scanning resumes automatically.

To choose the Scan-Resume mode;

1. Press and hold in the **[F]** button for one second to activate the Menu mode.
2. Rotate the DSP/SEL knob to select Menu Mode **[SCAN MODE]**.
3. Press and rotate the DSP/SEL knob to select the Scan-Resume mode
4. Press and hold in the **[F]** button for one second to exit the Menu mode.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Part 15.21: Changes or modifications to this device not expressly approved by Vertex Standard could void the user's authorization to operate this device.

DECLARATION BY MANUFACTURER

The scanner receiver is not a digital scanner and is incapable of being converted or modified to a digital scanner receiver by any user.