

YAESU
The radio

HF/50 MHz TRANSCEIVER

FT-450D

OPERATION MANUAL



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Congratulations on the purchase of your Yaesu amateur transceiver! Whether this is your first rig, or if Yaesu equipment is already the backbone of your station, rest assured that your transceiver will provide many hours of operating pleasure for years to come.

GENERAL FEATURES

Super Compact HF Transceiver with IF-DSP

Built-in ATU (automatic antenna tuner)

Great HF radio performance, with uncomplicated operation, is realized with the very small **FT-450D** HF transceiver.

- HF + 50 MHz with 100 Watts output all mode operation
- Small, compact and light-weight HF radio, 9" (W) x 3.3" (H) x 8.5" (D) (229 x 84 x 217 mm), 8.8 lb (4.0 kg)
- Large 9-segment LCD display characters, provide easily read frequency indication
- Black-Nega type LCD
- Illumination Button
- Built-in IF DSP unit that performs all of the following functions:
 - Modulation and Demodulation
 - CONTOUR
 - MANUAL NOTCH
 - DNR
 - WIDTH (CW narrow 300 Hz operation available without any optional filters)
 - Microphone equalizer built in
 - Speech Processor
 - DSP VOX operation
 - Two Voice memory channels included
 - Frequency read out function
- TCXO built-in
- 500 memory channels
- IF SHIFT
- IPO
- 20 dB ATT built-in
- Clarifier
- Electronic keyer built-in
- Microphone and phone jacks on the front panel
- FSK-RTTY TX operation
- Long wire antenna can be used by the optional **FC-40**

FRONT PANEL BUTTONS AND KNOBS

IPO/ATT Button

This button selects the IPO or ATT feature. Available selections are:

ATT:OFF/IPO:OFF → ATT:OFF/IPO:ON
→ ATT:ON/IPO:OFF → ATT:ON/IPO:ON
→ ATT:OFF/IPO:OFF

IPO: OFF, ATT: OFF

Attenuator is OFF, and the RF preamplifier amplifies the incoming signal.

IPO: ON, ATT: OFF

Attenuator is OFF, and the received signal bypasses the RF preamplifier, yielding a direct feed to the first mixer.

IPO: OFF, ATT: ON

The received signal is reduced by 20 dB, and the RF preamplifier amplifies the incoming signal.

IPO: ON, ATT: ON

The received signal is reduced by 20 dB, and the incoming signal bypasses the RF preamplifier, yielding a direct feed to the first mixer.

The selection will be indicated in the Block Diagram on the display.

DSP Button

This button selects the DSP functions. Available selections are CONTOUR, NOTCH, DNR, and WIDTH.

ON/OFF Button

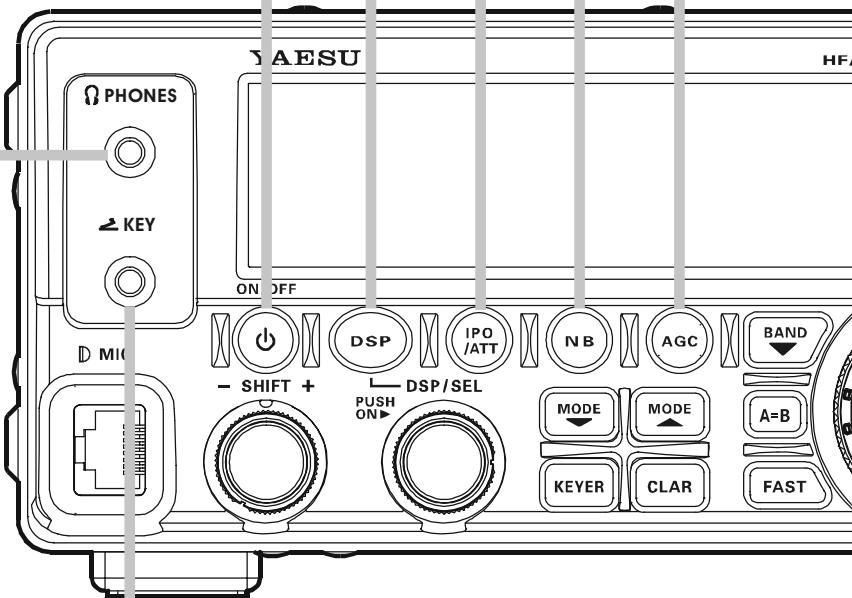
Press and hold in this button for one second to turn the transceiver on or off.

PHONE Jack

A 3.5 mm, 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.



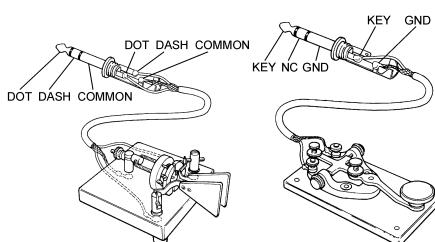
KEY Jack

This 3.5 mm, 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 below. Key up is 5 volts, and key down current is 0.5 mA.

Do not use the plug except the 3.5-mm 3-pin type plug. If the plug in correct size is not used the radio may be harmed or damaged.

If the Keyer plug is removed from the jack while the FT-450D is in operation, the FT-450D may be switched to the transmit mode.

Turn off the power of the FT-450D before connecting or disconnecting the Keyer.



FRONT PANEL BUTTONS AND KNOBS

C.S/VOICE Button

Press this button to activate one of the 52 functions, which can be assigned via Menu Item "PNL-C.S." Press the [F] button followed by this button to announce the current operating frequency (with resolution to the displayed 100 Hz digit) and operating mode.

V/M/MW Button

This button toggles frequency control between the VFO and the memory system. Press the [F] button followed by this button to copy the current operating data from the VFO into the currently selected memory channel.

RCL/HOME Button

Press this button to recall the Quick Memory Bank memory for operation. Press this button again to return to the VFO or Memory mode. Press the [F] button followed by this button to recall the "Home" (favorite frequency) channel.

SPLIT/STEP Button

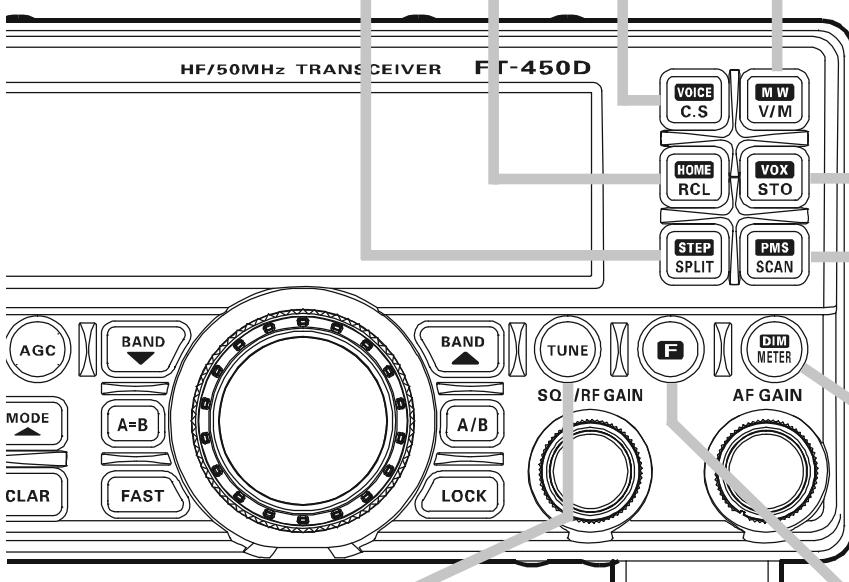
Press this button to activate split frequency operation between VFO-A, used for reception and VFO-B, used for transmission (or vice versa). Press the [F] button followed by this button to enable setting of the frequency step with the [DSP/SEL] knob. When the selection is complete, press this key again.

STO/VOX Button

Press this button to copy the operating information (frequency, mode, bandwidth, and also repeater direction/shift frequency and CTCSS functions on the FM mode) into the Quick Memory Bank. Press the [F] button followed by this button to activate the VOX (voice-actuated transmitter switching) feature in the SSB, AM, and FM modes.

SCAN/PMS Button

Press this button to initiate the upward scanning of VFO frequencies or memory channels. Press the [F] button followed by this button to engage the Programmable Memory Scan, (PMS) which limits scanning within a particular frequency range.

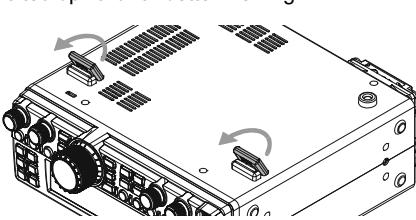


TUNE Button

Press this button momentarily to toggle the Internal Automatic Antenna Tuner on/off. Press and hold in this button to begin the automatic Tuning.

Front Feet

The two front feet allow the transceiver to be tilted upward for better viewing.



METER/DIM Button

Press this button to change the meter function in the transmit mode as follows.

PO → ALC → SWR → PO

PO: Indicates the average power output level.

ALC: Indicates the relative ALC voltage.

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

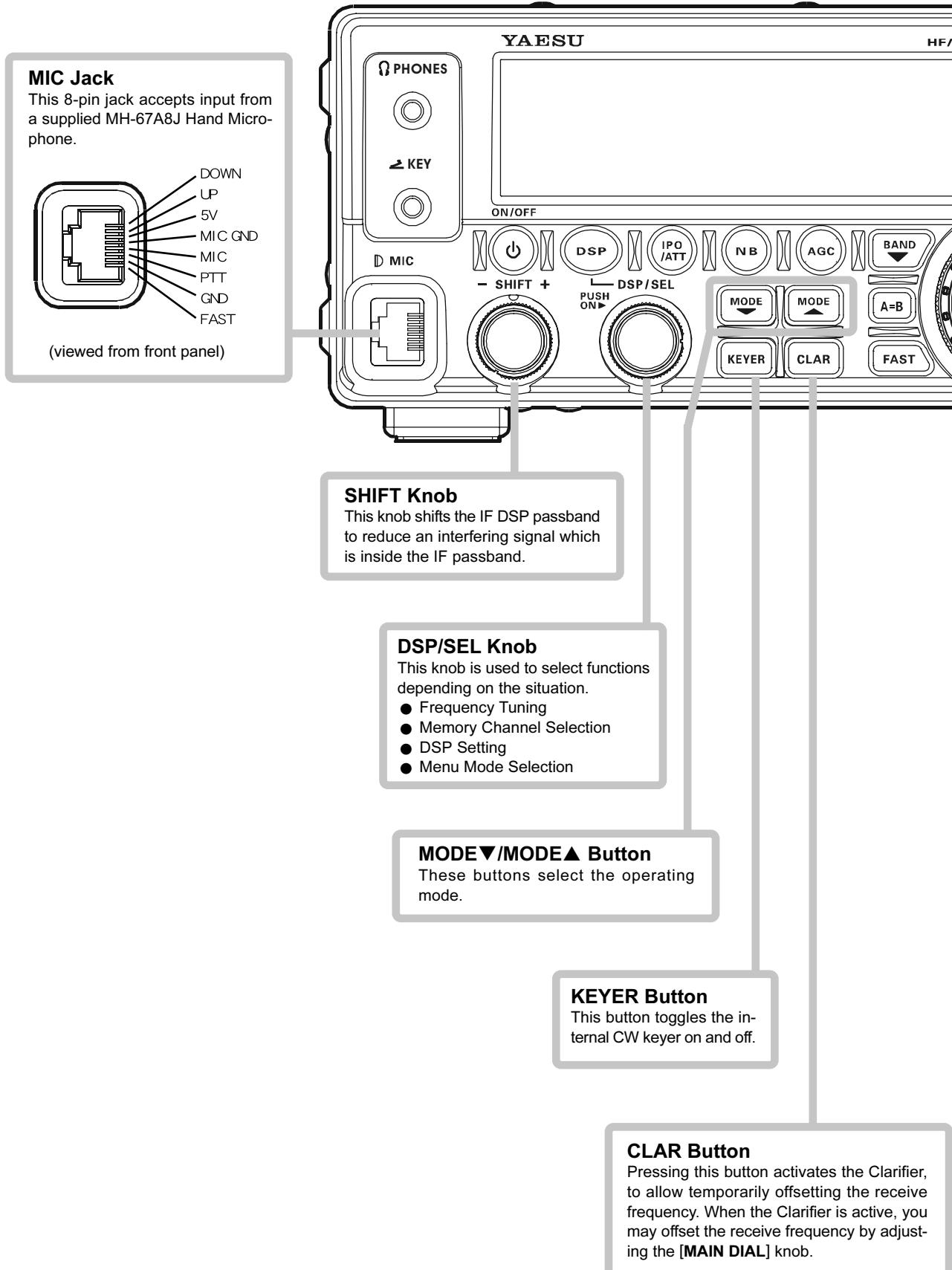
Press the [F] button followed by this button to enable adjustment of the display dimmer level by the [DSP/SEL] knob. When the adjustment is complete, press this key again.

F Button

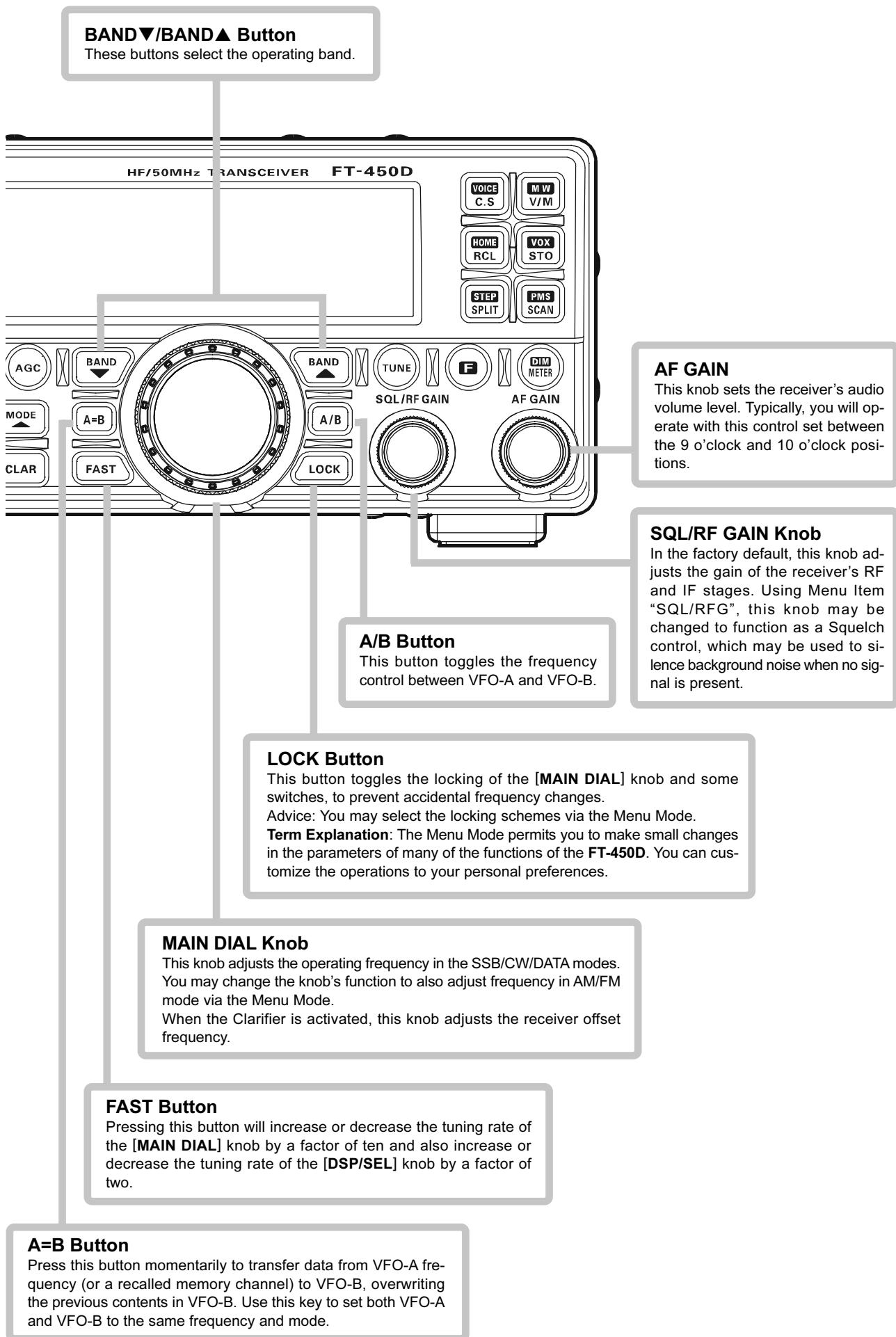
Press this button to activate the alternate key functions of the six command buttons located on the upper right corner of the front panel.

Press and hold this button for one second to engage the "Menu" mode.

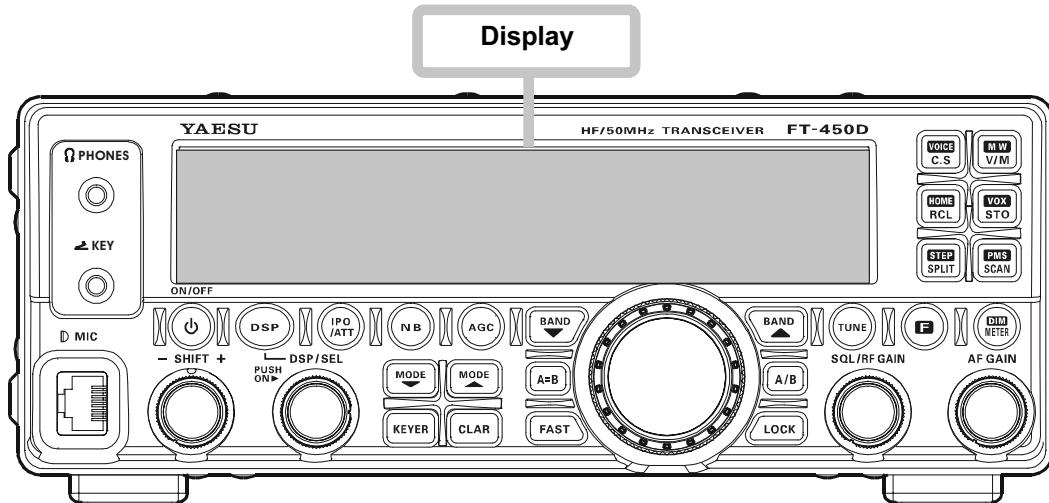
FRONT PANEL BUTTONS AND KNOBS



FRONT PANEL BUTTONS AND KNOBS



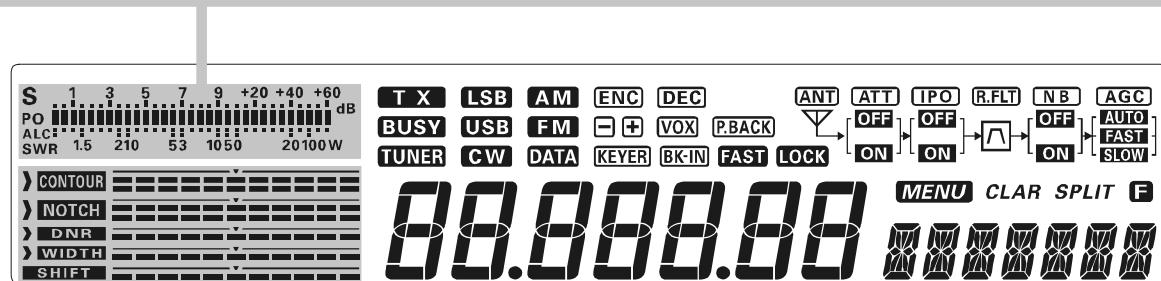
DISPLAY INDICATIONS



Meter

While receiving, the received signal strength is displayed.

While transmitting, the meter displays PO, ALC, or SWR (determined by the [METER/DIM] button).



DSP Graphic Display

- CONTOUR**: The peak position of the CONTOUR Filter is depicted graphically here when the CONTOUR Filter is activated.
- NOTCH**: The null position of the IF Notch Filter is depicted graphically here when the IF Notch Filter is activated.
- DNR**: Indicates the Noise Reduction level of the Digital Noise Reducer.
- WIDTH**: Indicates the bandwidth of the DSP IF filter.
- SHIFT**: Indicates the peak position of the DSP IF filter.

DISPLAY INDICATIONS

Block Diagram Display

- [ANT]**: Indicates the antenna status. When the antenna system became abnormality, this indicator will blink.
- [ATT]**: Indicates the RF attenuator status ("ON" or "OFF") selected for operation by the [IPO/ATT] button.
- [IPO]**: Indicates that the front-end RF pre-amplifier is removed from the receiver circuit. The incoming signal is fed direct to the first mixer.
- [R.FLT]**: Indicates the 10 kHz Roofing Filter status. This is always turned on.
- [NB]**: Indicates the Noise Blanker status ("ON" or "OFF").
- [AGC]**: Indicates the AGC decay time.



Frequency Display

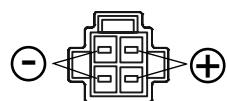
The operating frequency is displayed.

- T X**: This indicator appears during transmission.
- BUSY**: This indicator appears whenever the receiver squelch is open.
- TUNER**: This indicator appears when the Internal Automatic Antenna Tuner is activated.
- LSB / USB / CW / AM / FM / DATA**: Displays the currently selected operating mode.
- ENC / DEC**: Displays the current CTCSS operation while in FM mode.
- /+**: Displays the Repeater Shift Direction while in FM mode.
- VOX**: This indicator appears whenever the VOX (automatic voice-actuated transmitter switching) circuit is activated.
- P.BACK**: This indicator appears while the voice recorder is recording the receiver audio. This indicator blinks while the voice recorder is playing back the recorded audio.
- KEYER**: This indicator appears whenever the internal CW keyer is activated.
- BK-IN**: This indicator appears whenever the CW break-in operation is activated.
- FAST**: This indicator appears when the [MAIN DIAL] knob's tuning rate is set to fast.
- LOCK**: This indicator appears when the [MAIN DIAL] knob is locked.
- MENU**: This indicator appears whenever the Menu Mode is engaged.
- CLAR**: This indicator appears whenever the Clarifier function is activated.
- SPLIT**: This indicator appears whenever Split-frequency operation is activated.
- F**: This indicator appears when the alternate key functions of the six command buttons located on the upper right corner of the front panel is activated.

REAR PANEL JACKS

DC IN Jack

This is the DC power supply connection for the transceiver. Use the supplied DC cable to connect directly to the car battery or to a DC power supply, which must be capable of supplying at least 22 A @13.8 VDC.



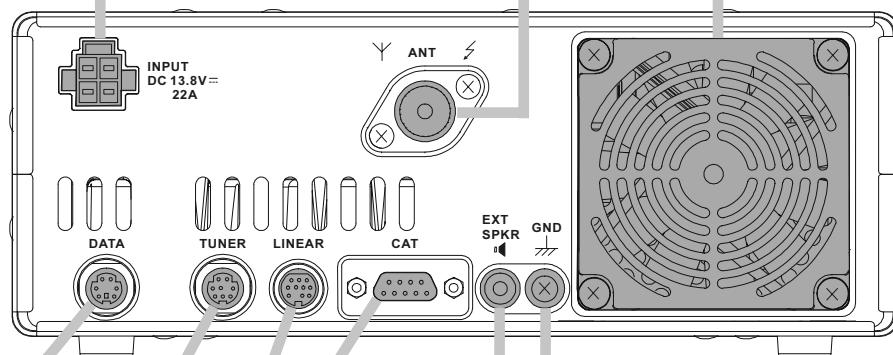
(viewed from rear panel)

ANT Jack

Connect your antenna here, using a type-M (PL-259) coaxial connector and 50 Ohm coaxial feedline. Warning!: High Power RF voltage is present at the TX RF section of the transceiver while transmitting. Absolutely! Do not touch the TX RF section while transmitting.

COOLING FAN

Turns at low speed in receive mode. Turns at high speed when the temperature begins to rise or in transmit mode.



GND Terminal

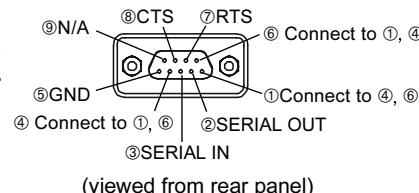
For safety and optimum performance, use this terminal to connect the transceiver to a good earth ground. Use a large diameter, short braided cable for making ground connections. Refer to page 12 for other notes about proper grounding.

EXT SPKR Jack

This 3.5-mm, 2-pin jack provides variable audio output for an external speaker. The audio output impedance at this jack is 4 - 16 Ohms and the level varies according to the setting of the front panel's [AF GAIN] knob. Inserting a plug into this jack disables the internal loudspeaker.

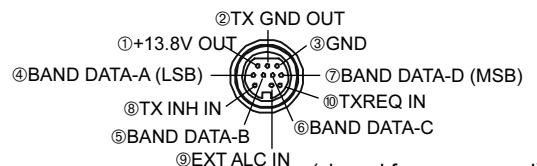
CAT Jack

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



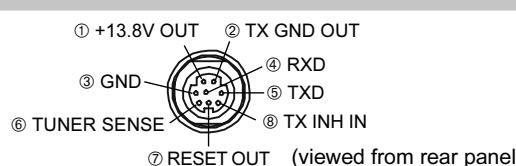
LINEAR Jack

This 10-pin output jack provides band selection data, which may be used for control of the optional **VL-1000** Solid-State Linear Amplifier.



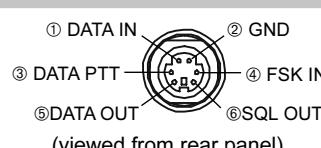
TUNER Jack

This 8-pin jack is used for Connection to the **FC-40** External Automatic Antenna Tuner.

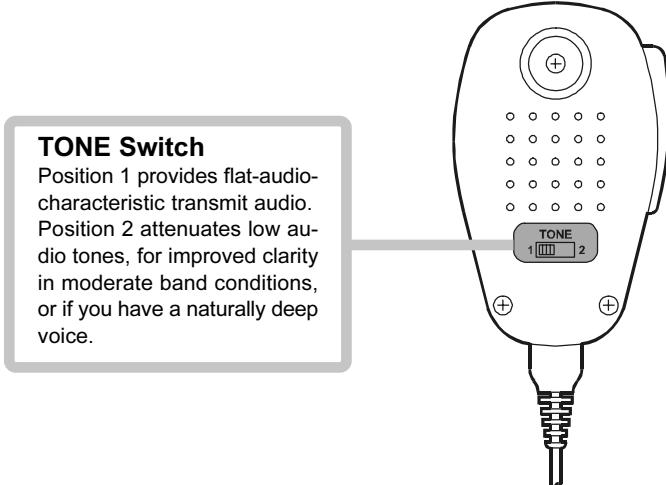
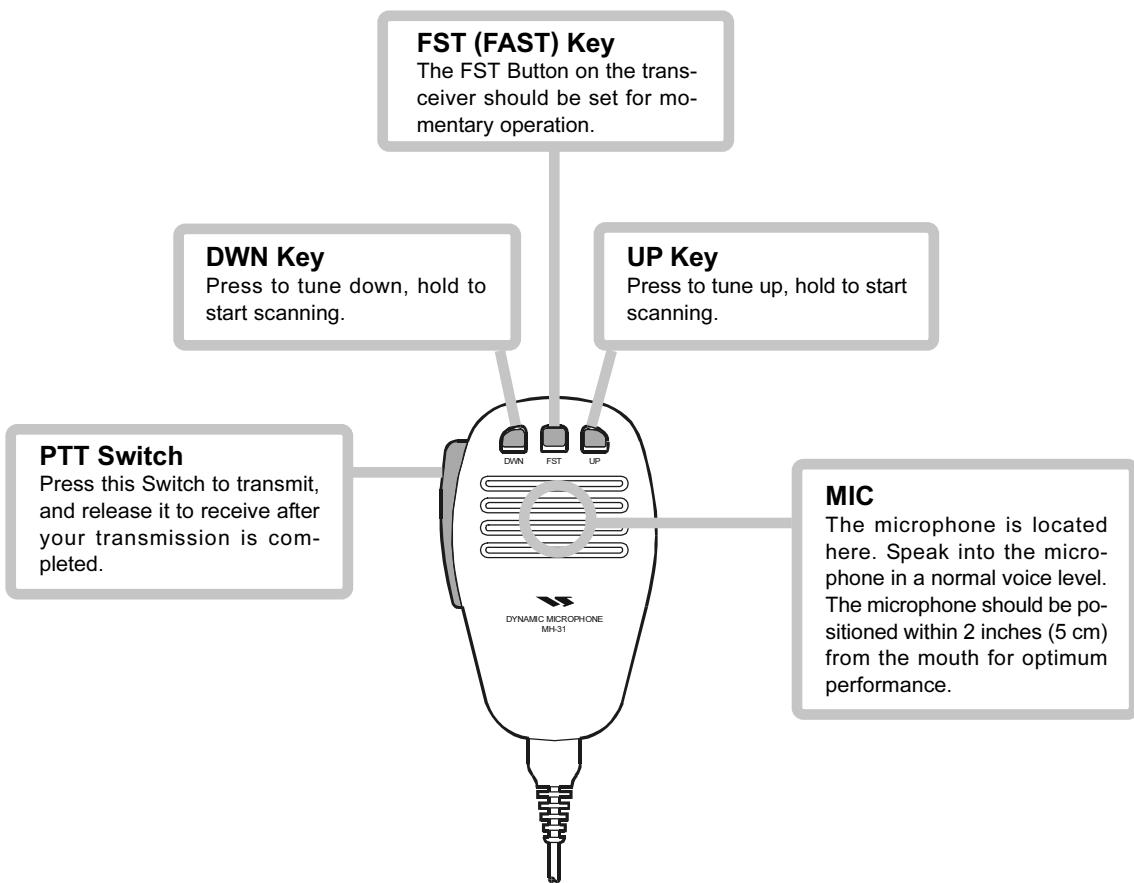


DATA Jack

This 6-pin input/output jack provides receiver audio and squelch signals, and accepts transmit (AFSK) audio and PTT control, from an external packet TNC.



SUPPLIED MH-31A8J MICROPHONE



ACCESSORIES & OPTIONS

SUPPLIED ACCESSORIES

Hand Microphone (MH-31A8J)	1 pc	P/N: M3090086A
DC Power Cord with Fuse	1 pc	P/N: T9025225
Fuse	1 pc	P/N: Q0000074
Operation Manual	1 pc	
Warranty Card	1 pc	

AVAILABLE OPTIONS

External Automatic Antenna Tuner (for Wire Antenna)	FC-40
Active-Tuning Antenna System	ATAS-25
Active-Tuning Antenna System	ATAS-120A
Solid-State Linear Amplifier/AC Power Supply	VL-1000 / VP-1000
Band Data Cable (for VL-1000)	CT-118
Desktop Microphone	MD-100
DTMF Hand Microphone	MH-36E8J
Hand Microphone	MH-31A8J
Lightweight Stereo Headphone	YH-77STA
Mobile Mounting Bracket	MMB-90
Carrying Handle	MHG-1
Linear Amplifier Connection Cable	SCU-28

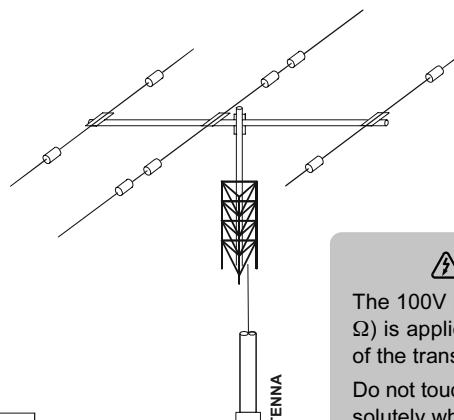
CONNECTION OF ANTENNA AND POWER SUPPLY

The **FT-450D** is designed for use with any antenna system providing a 50 Ohm resistive impedance at the desired operating frequency. Every effort should be made to ensure the impedance of the antenna system is as close as possible to the specified 50-Ohm value. Note that the "G5RV" type antenna does not provide 50-Ohm impedance on all HF Amateur bands, and an external wide-range antenna coupler must be used with this antenna type.

Any antenna to be used with the **FT-450D** must, ultimately, be fed with 50 Ohm coaxial cable. Therefore, when using a "balanced" antenna such as a dipole, remember that a balun or other matching/balancing device must be used to ensure proper antenna performance.

CAUTION

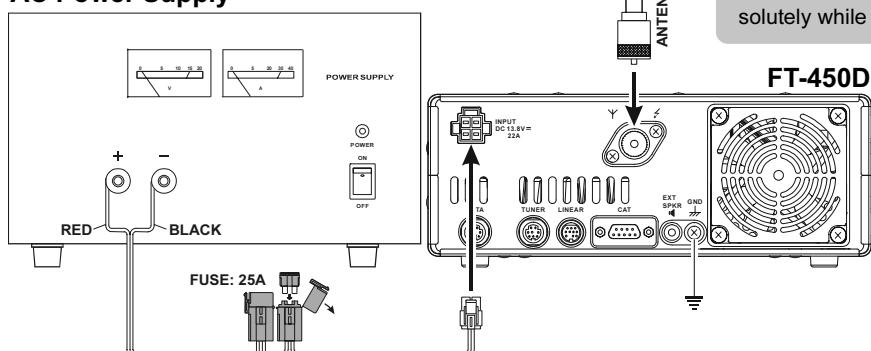
Permanent damage can result if improper supply voltage, or reverse-polarity voltage, is applied to the **FT-450D**. The Limited Warranty on this transceiver does not cover damage caused by application of AC voltage, reversed polarity DC, or DC voltage outside the specified range of 13.8V $\pm 10\%$. When replacing fuses, be certain to use a fuse of the proper rating. The **FT-450D** requires a 25A fast-blow fuse.



⚠ Warning!

The 100V RF voltage (@100 W/50 Ω) is applied to the TX RF section of the transceiver while transmitting. Do not touch the TX RF section absolutely while transmitting.

AC Power Supply



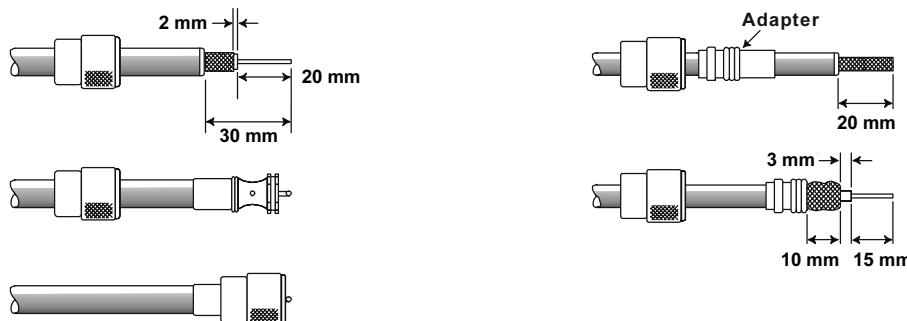
⚠ CAUTION ⚠

- Do not position this apparatus in a location with direct exposure to sunshine.
- Do not position this apparatus in a location exposed to dust and/or high humidity.
- Do not expose the apparatus to dripping or splashing. Do not put objects with liquids on the apparatus.
- Ensure adequate ventilation around this apparatus, so as to prevent heat build-up and possible reduction of performance due to high heat.
- Do not install this apparatus in a mechanically-unstable location, or where objects may fall onto this product from above.
- To minimize the possibility of interference to home entertainment devices, take all precautionary steps including separation of TV/FM antennas from Amateur transmitting antennas to the greatest extent possible, and keep transmitting coaxial cables separated from cables connected to home entertainment devices.
- Be absolutely certain to install your transmitting antenna(s) such that they cannot possibly come in contact with TV/FM radio or other antennas, nor with outside power or telephone lines.

INSTALLATION

ABOUT COAXIAL CABLE

Use high-quality 50-Ohm coaxial cable for the lead-in to your **FT-450D** transceiver. All efforts at providing an efficient antenna system will be wasted if poor quality, lossy coaxial cable is used. This transceiver utilizes standard "M" ("PL-259") type connector.



TYPICAL PL-259 INSTALLATION

GROUNDING

The **FT-450D** transceiver, like any other HF communications apparatus, requires an effective ground system for maximum electrical safety and best communications effectiveness. A good ground system can contribute to station efficiency in a number of ways:

- It can minimize the possibility of electrical shock to the operator.
- It can minimize RF currents flowing on the shield of the coaxial cable and the chassis of the transceiver. Such currents may lead to radiation, which can cause interference to home entertainment devices or laboratory test equipment.
- It can minimize the possibility of erratic transceiver/accessory operation caused by RF feedback and/or improper current flow through logic devices.

An effective earth ground system may take several forms. For a more complete discussion, see an appropriate RF engineering text. The information below is intended only as a guideline.

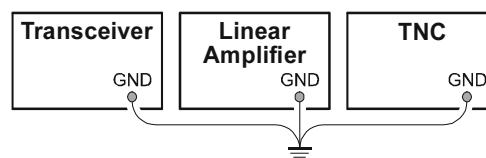
Typically, the ground connection consists of one or more copper-clad steel rods, driven into the ground. If multiple ground rods are used, they should be positioned in a "V" configuration, and bonded together at the apex of the "V" which is nearest the station location. Use a heavy, braided cable (such as the discarded shield from type RG-213 coaxial cable) and strong cable clamps to secure the braided cable(s) to the ground rods. Be sure to weatherproof the connections to ensure many years of reliable service. Use the same type of heavy, braided cable for the connections to the station ground bus (described below).

Inside of the station, a common ground bus consisting of a copper pipe of at least 25 mm (1") diameter should be used. An alternative station ground bus may consist of a wide copper plate (single-sided circuit board material is ideal) secured to the bottom of the operating desk. Grounding connections from individual devices such as transceivers, power supplies, and data communications devices (TNCs, etc.) should be made directly to the ground bus using a heavy, braided cable.

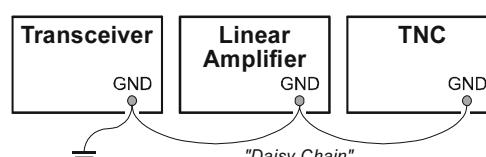
Do not make ground connections from one electrical device to another, and thence to the ground bus. This so-called "Daisy-Chain" grounding technique may nullify any attempt at effective radio frequency grounding. See the drawing at the right for examples of proper grounding techniques.

Inspect the ground system - inside the station as well as outside - on a regular basis so as to ensure maximum performance and safety.

Besides following the above guidelines carefully, note that household or industrial gas lines must never be used in an attempt to establish an electrical ground. Cold water pipes may, in some instances, help in the grounding effort, but gas lines represent a significant explosion hazard, and must never be used.



PROPER GROUND CONNECTION



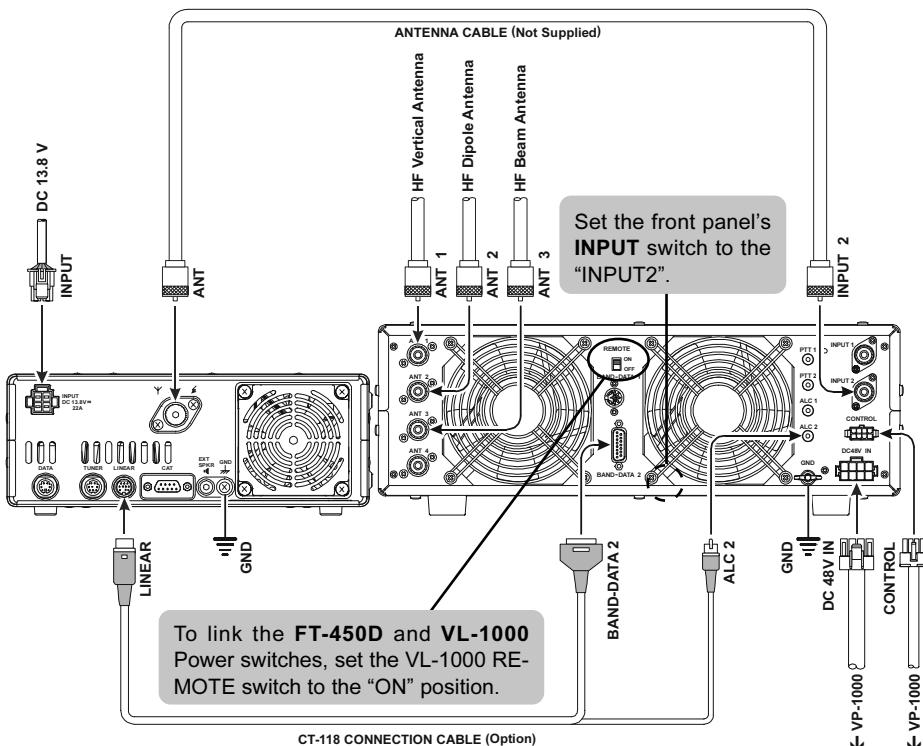
IMPROPER GROUND CONNECTION

VL-1000 LINEAR AMPLIFIER INTERCONNECTION

Be sure that both the **FT-450D** and **VL-1000** are turned off, then follow the installation recommendations contained in the illustration.

Note

- Please refer to the **VL-1000** Operating Manual for details regarding amplifier operation.
- Please do not attempt to connect or disconnect coaxial cables when your hands are wet.



INTERFACING TO OTHER LINEAR AMPLIFIER

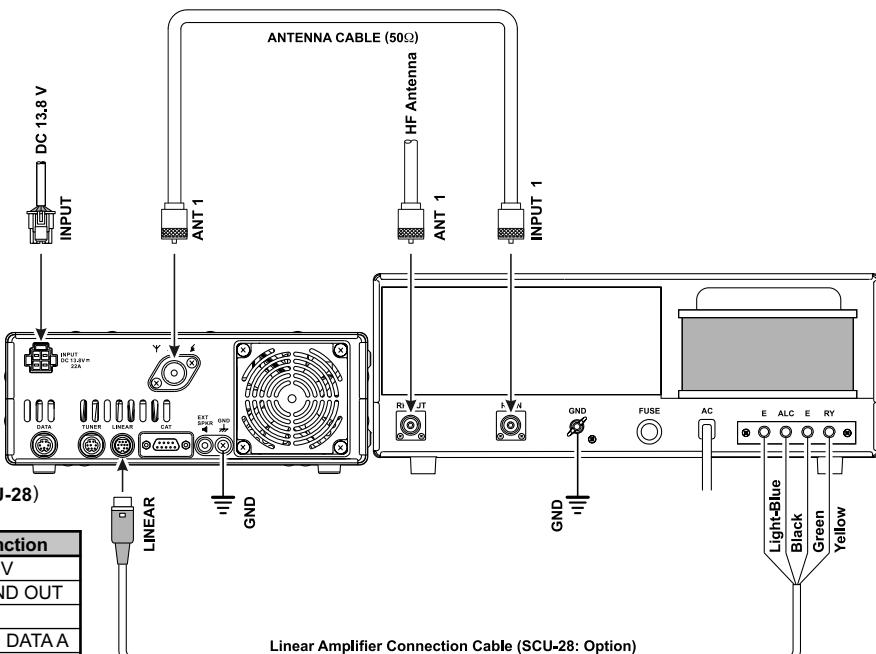
The T/R control line is a transistor “open collector” circuit, capable of handling positive amplifier relay coil voltages of up to +50V DC and current of up to 400 mA. If you plan on using multiple linear amplifiers for different bands, you must provide external band-switching of the “Lin Tx” relay control line from the “**TX GND OUT**” line at the **LINEAR** jack.

Important Note!

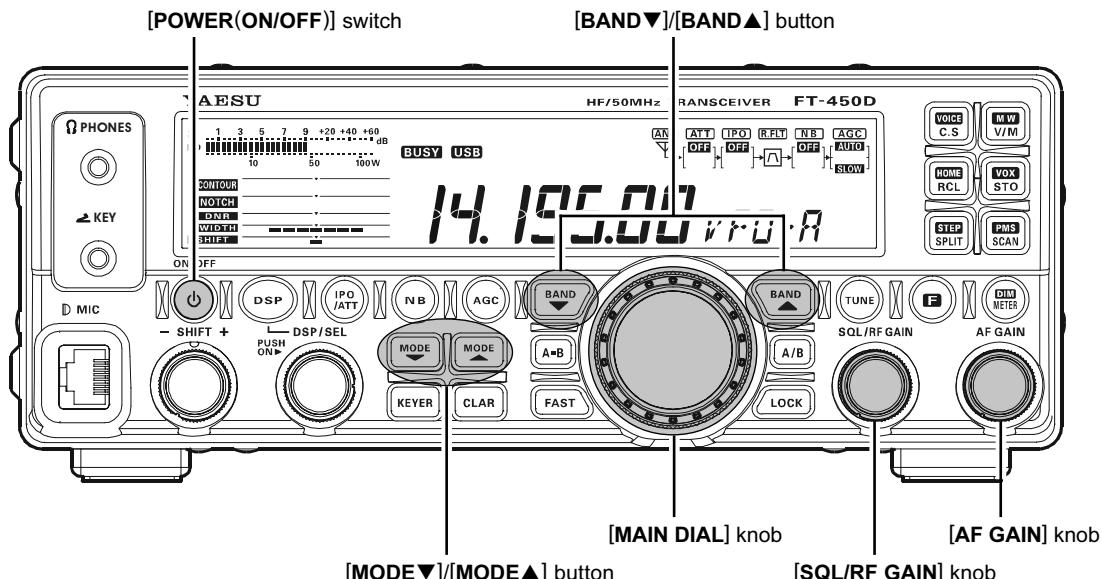
Do not exceed the maximum voltage or current ratings for the “**TX GND OUT**” line at the **LINEAR** jack. This line is not compatible with negative DC voltages, nor AC voltages of any magnitude. Most amplifier control relay systems require only low DC voltage/current switching capability (typically, +12V DC at 25 ~ 75 mA), and the switching transistor in the **FT-450D** will easily accommodate such amplifiers.

Linear Amplifier Connection Cable (SCU-28)
Color Code Information

Wire Color	LINEA Jack (Pin Number)	Function
Orange	1	+13.8 V
Yellow	2	TX GND OUT
Green	3	GND
Red	4	BAND DATA A
White	5	BAND DATA B
Blue	6	BAND DATA C
Violet	7	BAND DATA D
Brown	8	TX INH
Black	9	EXT ALC IN
Gray	10	TX REQ IN
Light Blue	Case	Shield



EASY OPERATION



RECEIVING

1. Connect your antenna to the ANT jack on the rear panel.
 2. Connect the after-market DC power supply (or car battery) using the supplied DC power cable, and set the **POWER** switch of the DC power supply to on.
 3. Press and hold in the **[POWER(ON/OFF)]** switch for one second to turn the transceiver on.
 4. Rotate the **[SQL/RF GAIN]** knob to the fully counter-clockwise position.
 5. Rotate the **[AF GAIN]** knob to set a comfortable audio level on incoming signals or noise. Clockwise rotation of the **[AF GAIN]** knob increases the volume level.
 6. Press the **[BAND▼]/[BAND▲]** button to select the amateur band which you wish to begin operating.
 7. Press the **[MODE▼]/[MODE▲]** button to select the desired operating mode.
 8. Rotate the **[MAIN DIAL]** knob to set the desired frequency.

TRANSMIT

1. Connect the supplied **MH-31A8J** to the **MIC** jack on the front panel.
 2. To transmit, press the microphone's **PTT** (Push To Talk) switch, speak into the microphone in a normal voice level.
 3. Release the **PTT** switch to return to the receive mode.

Regarding of the [DSP/SEL] knob

The [DSP/SEL] knob is used for operating various functions depending on the situation.

If you can not change the frequency/memory channel by tuning the [DSP/SEL] knob, the [DSP/SEL] knob is selected to operate one of the DSP functions.

In this case, press the [DSP] button several times until the “>” icon disappears from the DSP Graphic Display.

Operation on 60-Meter (5 MHz) Band (U.S. and U.K. versions only)

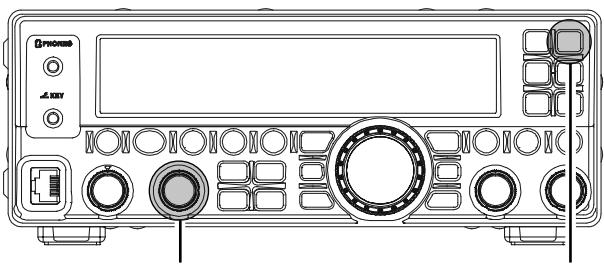
The 60-meter frequencies have been incorporated into the **FT-450D**, by fixed memory channels. These channels are set to USB and CW (U.S. version only), and they appear between the “last” PMS channel (MEM-P2U) and the first “regular” memory channel (MEM-001).

To operate on the 60-meter (5 MHz) band:

1. Press the [**V/M/MW**] button once, if necessary, to enter the “Memory” mode.
 2. Rotate the [**DSP/SEL**] knob to select the desired channel (“US5-001” through “US5-005”: U.S. version or “UK5-FA” through “UK5-FM”: U.K. version), at the factory, with the permitted frequencies in the 5 MHz band.
 3. Pressing the [**MODE▼**] or [**MODE▲**] button momentarily, switches the operating mode between SSB and CW.
 4. To exit from 60-meter operation and return to the VFO mode, just press the [**V/M/MW**] button.

NOTE:

The operating frequencies and modes for 5 MHz band operation are both fixed, and may not be changed.



[DSP/SEL] knob

[V/M/MW] button

U.S.VERSION		U.K.VERSION	
CH No.	FREQUENCY	CH No.	FREQUENCY
US5-001	5.332000 MHz	UK5-FA	5.260000 MHz
US5-002	5.348000 MHz	UK5-FB	5.280000 MHz
US5-003	5.358500 MHz	UK5-FC	5.290000 MHz
US5-004	5.373000 MHz	UK5-FK	5.368000 MHz
US5-005	5.405000 MHz	UK5-FL	5.373000 MHz
	—	UK5-FE	5.400000 MHz
	—	UK5-FM	5.405000 MHz

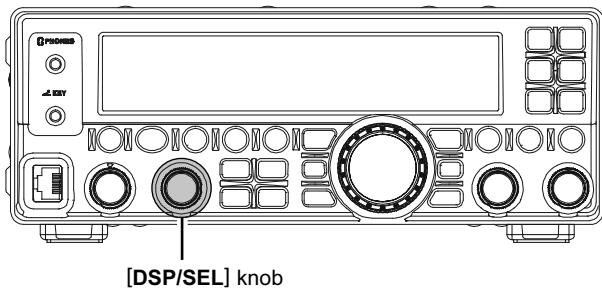
HOW TO USE THE [DSP/SEL] KNOB

When a DSP function is not selected and no “>” icon is shown in the LCD Graphic Display, then turning the [DSP/SEL] knob controls the frequency in VFO mode, or selects the memory channel in memory mode, or selects the menu item in memory mode. In the VFO Mode, briefly depressing the [DSP/SEL] knob will permit frequency adjustment in 100 kHz steps (Default setting). (The 100 kHz operation may be changed with the “SELDIAL” menu function.)

When a DSP function is selected, the “>” icon will appear next to the function in the LCD Graphic Display. Then pressing the [DSP/SEL] knob will switch the DSP function on or off. When the DSP function is on, turning the [DSP/SEL] knob will change the function parameters.

ADVICE:

You may change the function of the [DSP/SEL] knob via menu item “SELDIAL”.

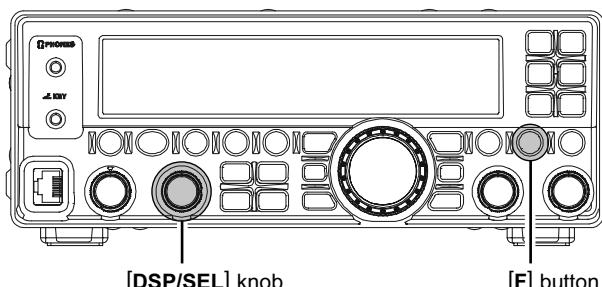


[DSP/SEL] knob

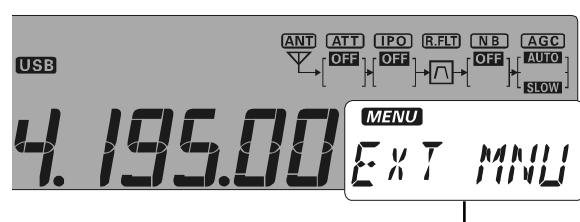
MENU OPERATION

The Menu System allows you to customize a wide variety of transceiver performance aspects and operating characteristics. After you have initially customized the various Menu procedures, you will find that you will not have to resort to them frequently during everyday operation.

1. Press and hold the [F] button for one second to enter the Menu Mode. The “**MENU**” icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select the Menu Item to be adjusted.
3. Press the [DSP/SEL] knob to enable adjustment of the selected Menu Item. The “**MENU**” icon will blink.
4. Rotate the [DSP/SEL] knob to adjust or select the parameter to be changed.
5. Press the [DSP/SEL] knob to save the selection. The icon appears continuously.
6. Press and hold the [F] button for one second to return to normal operation.



[F] button



Menu Item or Menu Setting

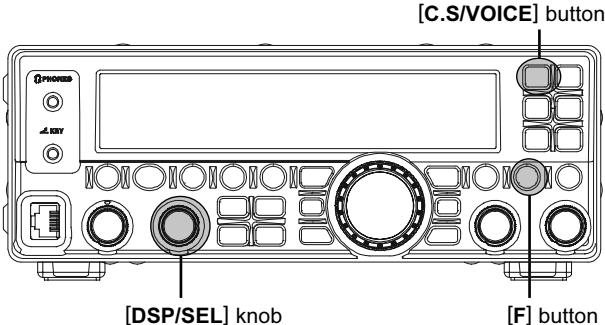
EASY OPERATION

HOW TO USE THE [C.S/VOICE] SWITCH

You may set the [C.S/VOICE] button function to one of 52 functions via Menu Item "PNL-C.S".

To assign a function to the [C.S/VOICE] button:

1. Press and hold the [F] button for one second to enter the Menu Mode. The "MENU" icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select Menu Item "PNL-C.S".
3. Press the [DSP/SEL] knob to enable adjustment of this Menu Item. The "MENU" icon will be blinking.
4. Rotate the [DSP/SEL] knob to select the desired function.
5. Press the [DSP/SEL] knob. The "MENU" icon returns to appear continuously.
6. Press and hold the [F] button for one second to return to normal operation.



Item	Function
MONI	Activates the Monitor function.
N/A	No Function.
P/B	Activates the Digital Voice Recorder.
PLAY1	Send the CW message, which is memorized in BEACON TEXT 1.
PLAY2	Send the CW message, which is memorized in BEACON TEXT 2.
PLAY3	Send the CW message, which is memorized in BEACON TEXT 3.
QSPL	Activates Quick Split Operation
SPOT	Generates a CW Spot Tone while pressing the [C.S/VOICE] button when using CW mode.
SQLOFF	Opens the noise squelch while pressing the [C.S/VOICE] button.
SWR	Transmits a 10 watts carrier (CW mode) to measure the SWR ratio while pressing the [C.S/VOICE] button.
TXW	Monitor the transmit frequency while pressing the [C.S/VOICE] button when Split Frequency operation is engaged.
VCC	Display the DC supply voltage while pressing the [C.S/VOICE] button.
VOICE2	Announces the current S-meter reading, operating frequency (with resolution to the displayed 100 Hz digit), and operating mode.
VM1MONI	Play back the voice message, which is memorized in Voice Memory 1.
VM1REC	Store the voice message into Voice Memory 1.
VM1TX	Send the voice message, which is memorized in Voice Memory 1.
VM2MONI	Play back the voice message, which is memorized in Voice Memory 2.
VM2REC	Store the voice message into Voice Memory 2.
VM2TX	Send the voice message, which is memorized in Voice Memory 2.
DOWN	Decreases the VFO frequency by one step or moves the memory channel to the next-lowest channel while pressing the [C.S/VOICE] button.
FAST	Set to the same function as the front panel's [FAST] button.
UP	Increases the VFO frequency by one step or moves the memory channel to the next-highest channel while pressing the [C.S/VOICE] button
DSP	Set to the same function as the front panel's [DSP] button.
IPO/ATT	Set to the same function as the front panel's [IPO/ATT] button.
NB	Set to the same function as the front panel's [NB] button.
AGC	Set to the same function as the front panel's [AGC] button.
MODEDN	Set to the same function as the front panel's [MODE▼] button.
MODEUP	Set to the same function as the front panel's [MODE▲] button.
DSP/SEL	Set to the same function as the front panel's [DSP/SEL] button.
KEYER	Set to the same function as the front panel's [KEYER] button.
CLAR	Set to the same function as the front panel's [CLAR] button.
BANDDN	Set to the same function as the front panel's [BAND▼] button.
BANDUP	Set to the same function as the front panel's [BAND▲] button.
A=B	Set to the same function as the front panel's [A=B] button.
A/B	Set to the same function as the front panel's [A/B] button.
LOCK	Set to the same function as the front panel's [LOCK] button.
TUNE	Set to the same function as the front panel's [TUNE] button.
VOICE	Announce the current operating frequency (with resolution to the displayed 100 Hz digit) and operating mode.
MW	Copies the current operating data from the VFO into the currently selected memory channel.
V/M	Toggles frequency control between VFO and memory system.
HOME	Recall the "Home" (favorite frequency) channel.
RCL	Recall the QMB (Quick Memory Bank) memory.
VOX	Activate the VOX (automatic voice-actuated transmitter switching) feature.
STO	Copies operating data into QMB (Quick Memory Bank) Memory.
STEP	Enables the setting of the frequency step of the [DSP/SEL] knob by the [DSP/SEL] knob.
SPLIT	Activates split frequency operation between VFO-A and VFO-B.
PMS	Engages Programmable Memory Scan (PMS).
SCAN	Initiates the upward scanning of VFO frequencies or memory channels.
MENU	Engage the "Menu" mode.
DIMMER	Enables adjustment of the display dimmer level by the [DSP/SEL] knob.
MTR	Change the meter function in the transmit mode.
USER	This parameter is for future expansion of the transceiver's capabilities. Do not select this parameter.

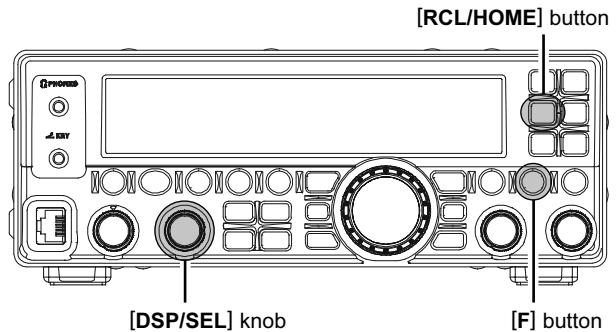
KEY DURATION SETTING

The duration that buttons are held determines the function they activate. Factory default is one second. Pressing a button for less than one second activates one function. Pressing and holding the button in for longer than one second activates another function.

The default one second release time can be changed to a shorter or longer duration, if desired.

To do this:

1. Press and hold the [F] button for one second to enter the Menu mode again. The “**MENU**” icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select menu item “KEYHOLD”.
3. Press the [DSP/SEL] knob to enable adjustment of this menu item. The “**MENU**” icon will be blinking.
4. Rotate the [DSP/SEL] knob to set the desired duration time. Available selections are 0.5/1.0/1.5/2.0 sec. (default value: 1.0 sec). You may Press the [RCL/HOME] button to reset the duration time to the factory default.
5. Press the [DSP/SEL] knob. The “**MENU**” icon returns to appear continuously.
6. Press and hold the [F] button for one second to save the new setting and return to normal operation.



EASY OPERATION

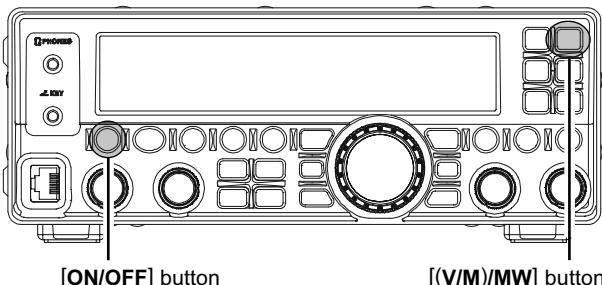
RESETTING THE MICROPROCESSOR

The FT-450D has three reset methods.

VFO/MEMORY RESET

Use this procedure to reset (clear out) the Memory channels (Except the QMB channel) previously stored and VFO data, without affecting any configuration changes you may have made to the Menu settings.

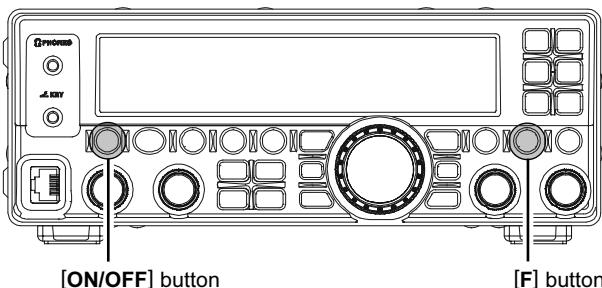
1. Press and hold in the [POWER(ON/OFF)] button for one second to turn the transceiver off.
2. Press and hold the [(V/M)/MW] button. While holding it in, press and hold in the [POWER(ON/OFF)] switch for one second to turn the transceiver on. Once the transceiver comes on, you may release the [(V/M)/MW] button.



MENU MODE RESET

Use this procedure to restore the Menu settings to their factory defaults, without affecting the memories you have programmed.

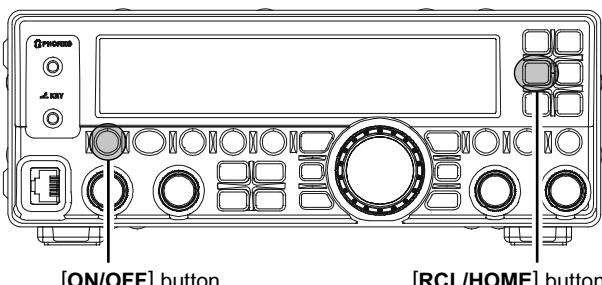
1. Press and hold in the [POWER(ON/OFF)] button for one second to turn the transceiver off.
2. Press and hold the [F] button. While holding it in, press and hold in the [POWER(ON/OFF)] button for one second to turn the transceiver on. Once the transceiver comes on, you may release the [F] button.



FULL RESET

Use this procedure to restore all Menu and Memory settings to their original factory defaults. All Memories will be cleared by this procedure.

1. Press and hold in the [POWER(ON/OFF)] button for one second to turn the transceiver off.
2. Press and hold the [RCL/HOME] button. While holding it in, press and hold in the [POWER(ON/OFF)] button for one second to turn the transceiver on. Once the transceiver comes on, you may release the [RCL/HOME] button.



TUNING STEPS

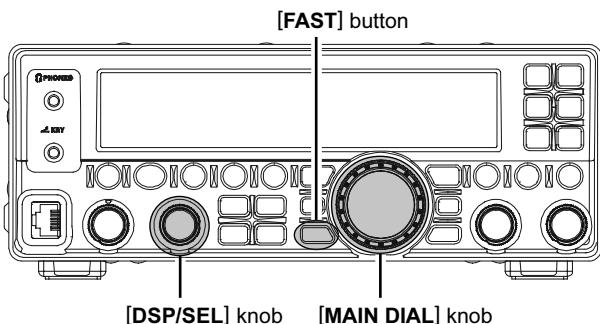
The tuning step of the [MAIN DIAL] knob and the [DSP/SEL] knob is different depending on the operating mode.

OPERATING MODE	KNOB	
	[MAIN DIAL]	[DSP/SEL] ^{×1}
LSB/USB	1/10/20 Hz	1.0/2.5/5.0 kHz
CW	1/10/20 Hz	1.0/2.5/5.0 kHz
AM	100/200 Hz ^{×2}	2.5/5.0/9.0/10/12.5/25 kHz
FM	100/200 Hz ^{×2}	5.0/6.25/10/12.5/15/20/25/50 kHz
DATA	1/10/20 Hz	1.0/2.5/5.0 kHz

×1: When you press the [DSP/SEL] knob, the tuning step of the [DSP/SEL] knob changes to 100 kHz in all modes.

×2: In the factory default, the [MAIN DIAL] knob does not tune the AM and FM modes. However, you may activate the [MAIN DIAL] knob on the AM and FM mode via Menu Item "A&FDIAL".

- Pressing the [FAST] button will increase or decrease the tuning rate of the [MAIN DIAL] knob by a factor of ten and also increase or decrease the tuning rate of the [DSP/SEL] knob by a factor of two.



NOTICE Regarding of the [DSP/SEL] knob

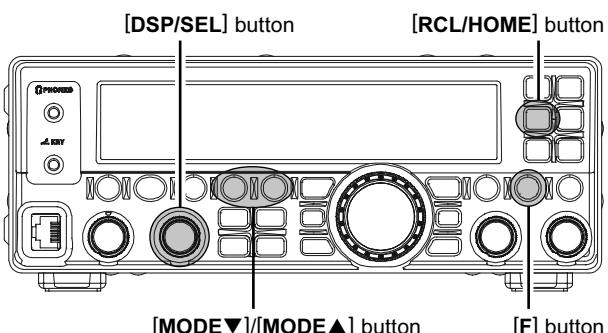
The [DSP/SEL] knob is used for operating various functions depending on the situation.

If you can not change the frequency/memory channel by tuning the [DSP/SEL] knob, the [DSP/SEL] knob is selected to operate one of the DSP functions.

In this case, press the [DSP] button several times until the "greater than" icon disappears from the DSP Graphic Display.

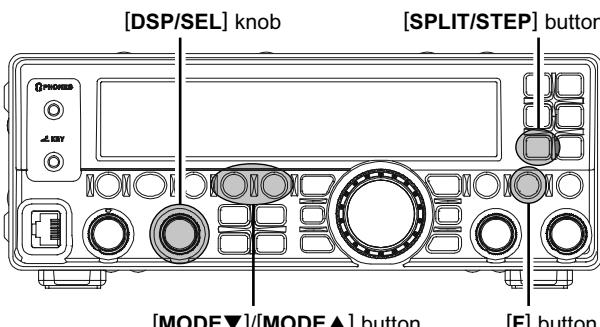
CHANGE THE TUNING STEP OF THE [MAIN DIAL] KNOB

1. Set the operating mode by pressing the [MODE▼]/[MODE▲] button.
2. Press and hold the [F] button for one second to enter the Menu mode. The "MENU" icon will appear on the display.
3. Rotate the [DSP/SEL] knob to select the menu item "DIALSTP".
4. Press the [DSP/SEL] knob to enable adjustment of this menu item. The "MENU" icon will be blinking.
5. Rotate the [DSP/SEL] knob to select the desired tuning step described above.
(You may Press the [RCL/HOME] button to reset the tuning step to the factory default.)
6. Press the [DSP/SEL] knob. The "MENU" icon is displayed continuously.
7. Press and hold the [F] button for one second to save the new setting and return to normal operation.



CHANGE THE TUNING STEP OF THE [DSP/SEL] KNOB

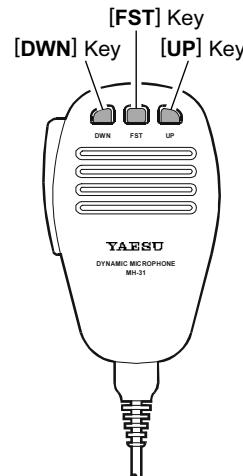
1. Set the operating mode by pressing the [MODE▼]/[MODE▲] button.
2. Press the [F] button momentarily.
3. Press the [SPLIT/STEP] button.
4. Rotate the [DSP/SEL] knob to select the desired tuning step described above.
5. Press the [DSP/SEL] knob to save the new setting and return to normal operation.



RECEIVING

ABOUT THE [UP]/[DWN] BUTTONS OF THE MH-31A8J

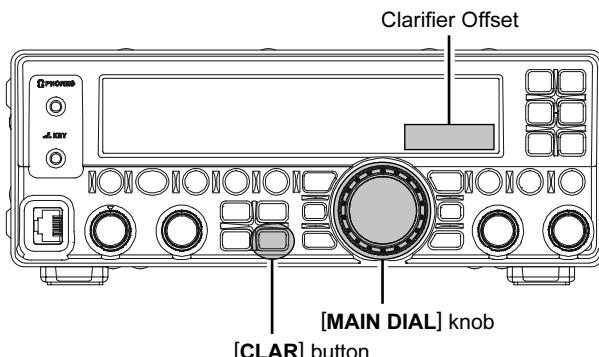
- The microphone [UP]/[DWN] keys utilize the tuning steps of the [MAIN DIAL] knob on the SSB/CW/DATA mode, and utilize the tuning steps of the [DSP/SEL] knob on the AM/FM mode.
- When the microphone [FST] key is pressed, the tuning rate increases by a factor of ten, in a manner similar to the effect of the transceiver front-panel [FAST] button.



CLARIFIER

You may change the receiving frequency only without changing the transmit frequency.

1. Press the [CLAR] button to activate the clarifier. The “CLAR” icon will appear on the display.
2. Rotate the [MAIN DIAL] knob to tune the desired receive frequency. (Offset of up to ± 9.99 kHz may be set using the clarifier.)
The offset frequency will appear at the bottom right corner of the display.
3. Press the [CLAR] button again to disable the clarifier. The “CLAR” icon will disappear from the display.



NOTE:

- Even when the clarifier is disabled, the variance of the clarifier remains (both TX and RX frequencies).
- Press and hold in the [CLAR] button for one second to clear the clarifier offset, meaning the receiving frequency is equal to the transmit frequency.
- When the [MAIN DIAL] knob is rotated to change the frequency after disabling the clarifier, the clarifier offset becomes “zero”, meaning the receiving frequency is equal to the transmit frequency.

- When the receiving frequency is higher than transmit frequency, “+” will be appended to the offset frequency.
When the receiving frequency is lower than transmit frequency, “-” will be appended to the offset frequency.
- You may assign the CLAR function to the [DSP/SEL] knob via the Menu Item “CLAR”.

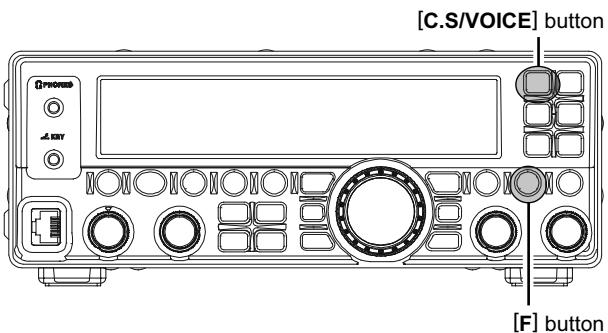


DIGITAL VOICE ANNOUNCEMENT

Press the [F] button followed by the [C.S/VOICE] button to announce the current operating frequency (with resolution to the displayed 100 Hz digit) and operating mode.

ADVICE:

If you assign the “VOICE2” function to the [C.S/VOICE] button via the menu item “PNL-C.S”, you may confirm the current operating frequency (with resolution to the displayed 100 Hz digit), operating mode, and **S-meter reading** through the voice message announcement system by pressing the [C.S/VOICE] button. See page 16 for details of the [C.S/VOICE] button assignment.

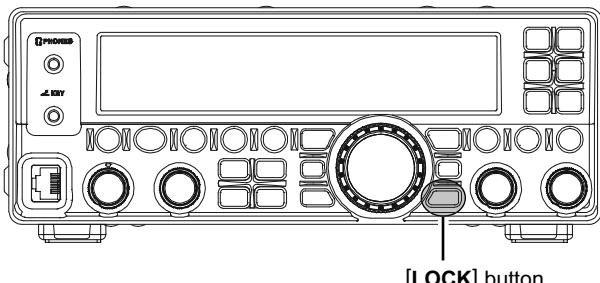


DIAL Lock

Pressing the [LOCK] button toggles the locking of the [MAIN DIAL] knob and some switches, to prevent accidental frequency changes.

ADVICE:

You may select the locking schemes via the menu item “LOCKMOD”. See page 83 for details.



RECEIVING

MY BANDS OPERATION

The "My Bands" feature allows you to select several Amateur bands, and make *only* those bands available for selection via the [BAND▼]/[BAND▲] buttons.

This feature can be *very* useful in a contest, where the 10/18/24 MHz band are not used, or if you do not have antennas for some bands.

MY BANDS SETUP

1. Press and hold the [F] button for one second to enter the Menu mode again. The "MENU" icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select the menu item "MY BAND".
3. Press the [DSP/SEL] knob to enable adjustment of this menu item. The "MENU" icon will be blinking.
4. Press the [BAND▼]/[BAND▲] buttons to choose a band you wish to skip (omit) from the band selection loop.
5. Rotate the [DSP/SEL] knob to select "OFF", and then press the [DSP/SEL] knob.

NOTE

The "OFF" selection sets the selected band to be *skipped*, while the "ON" selection sets the selected band to be *included* in the band-selection list.

6. Press the [DSP/SEL] knob. The "MENU" icon returns to appear continuously.
7. Repeat steps 4 through 6 to select/deselect as many bands as you like.

NOTE

The GEN (General Band) and the current band cannot be skipped.

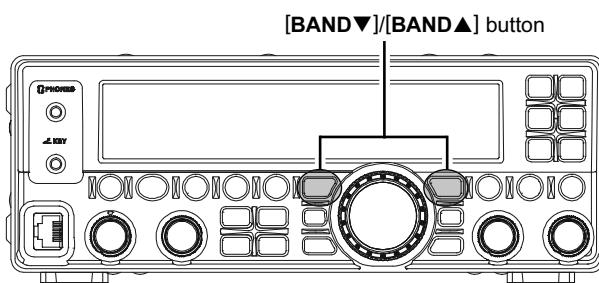
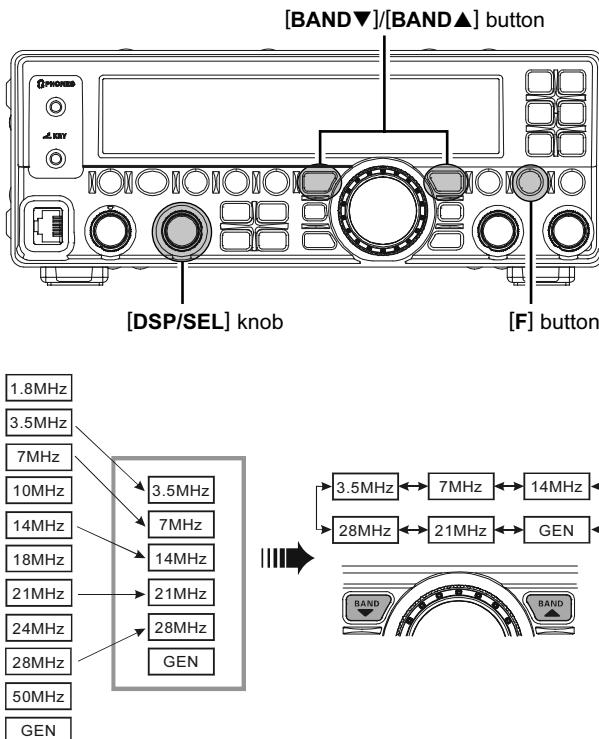
8. Press and hold the [F] button for one second to save the new setting and return to normal operation.

MY BANDS OPERATION

Press the [BAND▼]/[BAND▲] buttons to choose the Amateur band on which you wish to operate. Only those Amateur bands that have *not* been skipped will appear as you scroll through the bands.

NOTE

If you want to recall an operating band which has been set to my band "OFF", Press the [F] button, then press the [BAND▼]/[BAND▲] button until the desired band appears.



MY MODES OPERATION

The "My Modes" feature allows you to select the operating modes you wish to have available for selection via the [MODE▼]/[MODE▲] buttons. Only the desired modes will be displayed in the loop.

This feature can be very useful in an HF operation, where the AM/FM/DATA modes are not used.

MY MODES SETUP

1. Press and hold the [F] button for one second to enter the Menu mode again. The "**MENU**" icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select the menu item "MY MODE".
3. Press the [DSP/SEL] knob to enable adjustment of this menu item. The "**MENU**" icon will be blinking.
4. Press the [MODE▼]/[MODE▲] buttons to choose a mode you wish to skip (omit) from the mode selection loop.
5. Rotate the [DSP/SEL] knob to select "OFF", and then press the [DSP/SEL] knob.

NOTE

The "OFF" selection sets the selected mode to be **skipped**, while the "ON" selection sets the selected mode to be **included** in the mode-selection list.

6. Press the [DSP/SEL] knob. The "**MENU**" icon returns to appear continuously.
7. Repeat steps 4 through 6 to select/deselect as many modes as you like.

NOTE

The mode currently in use cannot be turned off.

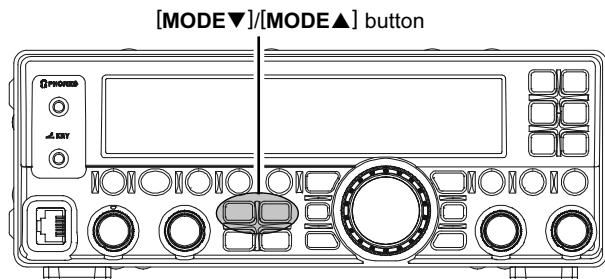
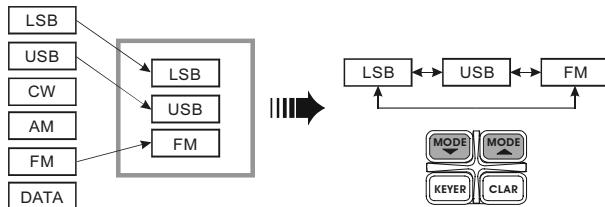
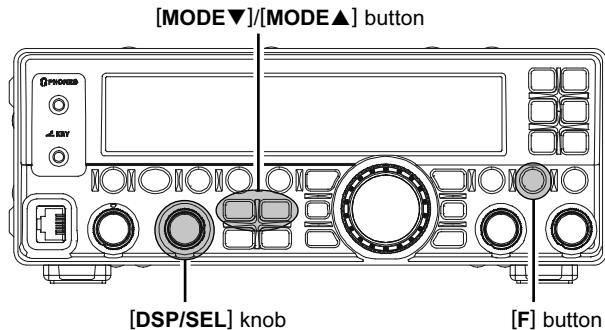
8. Press and hold the [F] button for one second to save the new setting and return to normal operation.

MY MODES OPERATION

Press the [MODE▼]/[MODE▲] buttons to choose the operating mode on which you wish to operate. Only those operating modes that have *not* been skipped will appear as you scroll through the modes.

NOTE

If you want to recall an operating Mode which has been set to my band "OFF", Press the [F] button, then press the [MODE▼]/[MODE▲] button until the desired Mode appears.



RECEIVING

DIGITAL VOICE RECORDER

PREPARATIONS

1. Press and hold the [F] button for one second to enter the Menu mode. The “**MENU**” icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select the menu item “PNL-C.S.”.
3. Press the [DSP/SEL] knob to enable adjustment of this menu item. The “**MENU**” icon will be blinking.
4. Rotate the [DSP/SEL] knob to select “P/B” to assign the Play Back feature to the [C.S/VOICE] button.
5. Press the [DSP/SEL] knob. The “**MENU**” icon returns to appear continuously.
6. Press and hold the [F] button for one second to save the new setting and return to normal operation.

RECORDING

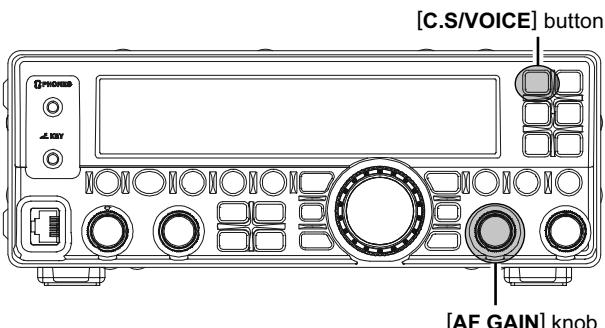
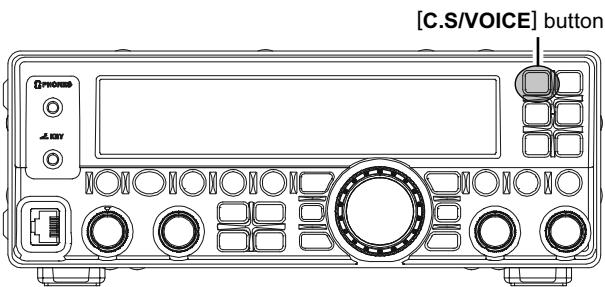
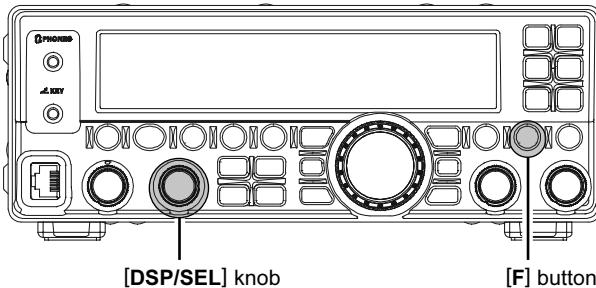
1. Press and hold in the [C.S/VOICE] button for one second to initiate recording. The “**P.BACK**” icon will appear in the display to confirm that recording is in progress. The recorder will store up to 20 seconds of the received audio and then halt the recording. The “**P.BACK**” icon will go out.
2. You may halt the recording in progress, by pressing and holding the [C.S/VOICE] button for one second.

PLAYBACK

Press the [C.S/VOICE] button *momentarily* to begin playback of the recorded audio. The “**P.BACK**” icon will blink in the display to confirm that playback is in progress.

ADVICE:

You may adjust the playback level of the recording with the [AF GAIN] knob



CONVENIENCE FEATURES

RECEIVER OPERATION (FRONT END BLOCK DIAGRAM)

The **FT-450D** includes a wide range of special features to suppress the many types of interference that may be encountered on the HF bands. However, real world interference conditions are constantly changing, so optimum setting of the controls is somewhat of an art, requiring familiarity with the types of interference and the subtle effects of some of the controls. Therefore, the following information is provided as a general guideline for typical situations, and a starting point for your own experimentation.

The **FT-450D**'s interference-fighting circuitry begins in its "RF" stages, and continues throughout the entire receiver section. **FT-450D** allows configuration of the features described below.

R. FLT (IF Roofing Filters)

The Roofing filter, with a bandwidth of 10 kHz is provided in the 68 MHz First IF, right after the first mixer. This filter provides narrow-band selectivity to protect the following IF and DSP stages, for special operating circumstances.

CONTOUR Filter (SEE PAGE 28)

The DSP Contour filter provides a unique capability on the receiver, providing either nulling or peaking of tunable segments of the receiver passband, so as to suppress interference or excessive frequency components on an incoming signal, or to peak those tunable frequency segments. The amount of nulling/peaking, and the bandwidth over which it is applied, are adjustable via the Menu.

IF SHIFT (SEE PAGE 29)

The passband center frequency response of the IF DSP filtering may be adjusted using this control.

IF WIDTH (SEE PAGE 30)

The width of the IF DSP filtering may be adjusted using this control.

IF NOTCH (SEE PAGE 31)

The IF Notch filter is a high-Q notch filter that can significantly reduce, if not eliminate, an interfering carrier.

DNR (DIGITAL NOISE REDUCTION) (SEE PAGE 32)

The DSP's Digital Noise Reduction (DNR) feature utilizes eleven different mathematical algorithms to analyze and suppress different noise profiles encountered on the HF/50 MHz bands. Choose the selection that provides the best noise suppression, which concurrently will allow the signal to rise up out of the noise.

AGC (SEE PAGE 27)

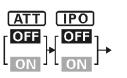
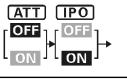
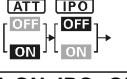
The AGC system is highly adaptable to changing signal and fading characteristics, making reception possible under the most difficult conditions.

CONVENIENCE FEATURES

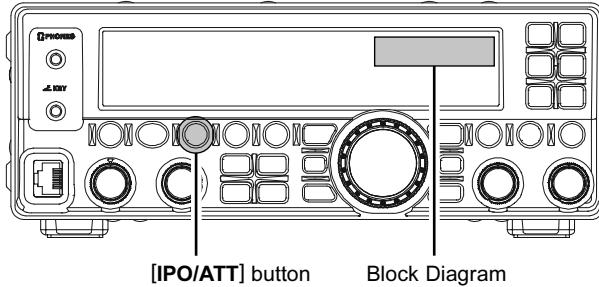
IPO/ATT (ADJUST THE RECEIVING SENSITIVITY)

You may reduce the receiving signal strength to 20 dB when extremely strong local signals or high noise degrade reception. You may optimize the characteristics of the receiver front-end, for best reception, depending on the noise levels and the signal strengths.

Press the [IPO/ATT] button several times to set the desired selection, per the chart below.

ATT: OFF, IPO: OFF 	Attenuator is OFF, and the incoming signal is amplified by the RF preamplifier.
ATT: OFF, IPO: ON 	Attenuator is OFF, and the incoming signal bypasses the RF preamplifier, yielding direct feed to the first mixer.
ATT: ON, IPO: OFF 	Attenuator is ON, (the incoming signal is reduced by 20 dB) and the incoming signal is amplified by the RF preamplifier.
ATT: ON, IPO: ON 	Attenuator is ON, (the incoming signal power is reduced by 20 dB) and the incoming signal bypasses the RF preamplifier, yielding direct feed to the first mixer.

The selection will be indicated in the Block Diagram on the display.



NOTE

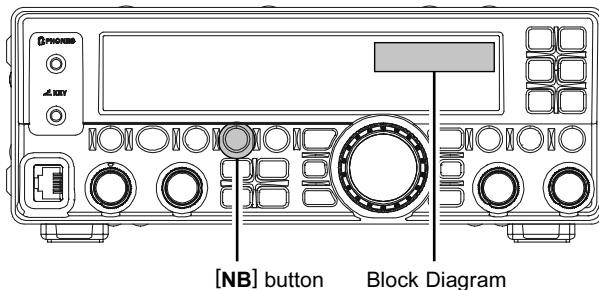
An attenuator is always "ON" between 30kHz and 1.7MHz.

NOISE BLANKER (INTERFERENCE REJECTION "SIGNALS WITHIN 3 kHz")

The **FT-450D** includes an effective Noise Blanker, which can significantly reduce noise caused by automotive ignition systems.

1. Press the [NB] button to activate the Noise Blanker.
2. Press the [NB] button again to disable the Noise Blanker.

The selection will be indicated in the Block Diagram on the display.



CONVENIENCE FEATURES

AGC (TOOL FOR COMFORTABLE AND EFFECTIVE RECEPTION)

The AGC system is designed to help compensate for fading and other propagation effects, with characteristics that can be of particular value on each operating mode. The basic objective of AGC is to maintain a constant audio output level once a certain minimum threshold of signal strength is achieved.

Press the [AGC] button repeatedly to select the desired receiver-recovery time constant. The AGC status is indicated in the Block Diagram displayed on the display. For most operations, we recommend the "AUTO" mode. You may disable the AGC by pressing and holding in the [AGC] button for one second.

AUTO	[AGC] [AUTO] [FAST] [SLOW]	Sets the receiver-recovery time automatically depending on the operating mode.
FAST	[AGC] [AUTO] [FAST] [SLOW]	Sets the receiver-recovery time to fast. This mode is suitable for CW/DATA reception.
SLOW	[AGC] [AUTO] [FAST] [SLOW]	Sets the receiver-recovery time to slow. This mode is suitable for SSB/AM reception.



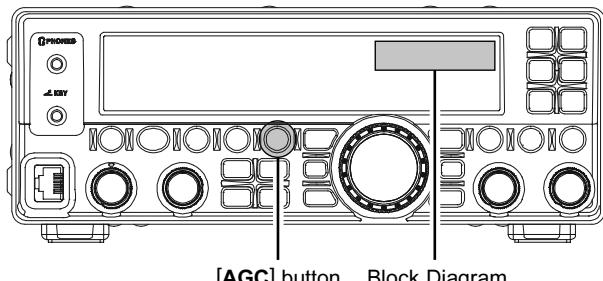
NOTE:

Normally, the "AUTO" selection is satisfactory for most situations, but in the event of operation on a crowded band where you wish to receive a weak signal, you may wish to change the setting (to FAST, for example). The "AUTO" mode selections are:

OPERATING MODE	AUTO AGC SELECTION
LSB	SLOW
USB	SLOW
CW	FAST
AM	SLOW
FM	FAST (Fixed)
DATA	FAST

ADVICE:

If the AGC receiver-recovery time is set to "Off" [AGC] by pressing and holding in the [AGC] button, [AGC] the S-meter will no longer deflect. Additionally, you will likely encounter distortion on stronger signals, as the IF amplifiers and the following stages are probably being overloaded.



[AGC] button Block Diagram

CONVENIENCE FEATURES

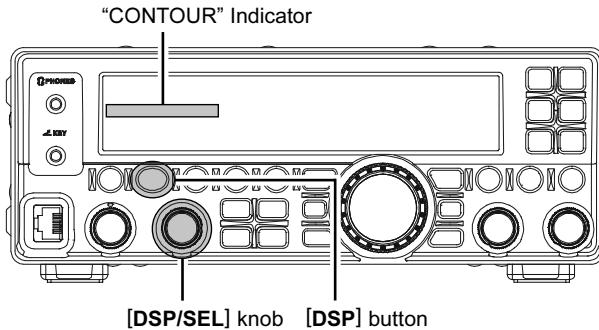
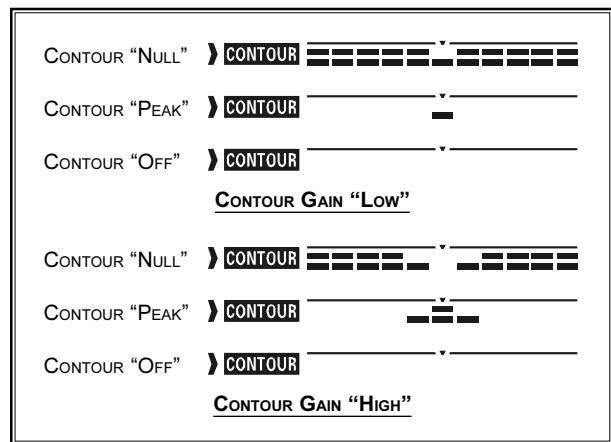
CONTOUR (INTERFERENCE REJECTION “SIGNALS WITHIN 3 KHZ”)

The Contour filtering system provides a gentle perturbation of the DSP filter pass band, so as to suppress or enhance particular frequency components in five steps, thus improving the sound and/or readability of a received signal.

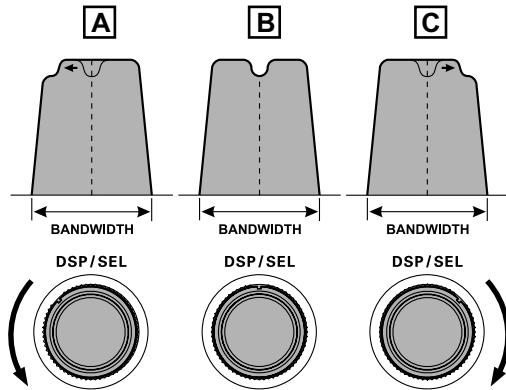
1. Press the [DSP] button several times to set the “>” icon to the “CONTOUR” indicator of the DSP Graphic Display on the display.
2. Press the [DSP/SEL] knob to engage the contour filter.
3. Press and hold the [DSP/SEL] knob for one second to toggle the contour filter’s level between “null” and “peak”.
4. Rotate the [DSP/SEL] knob to achieve the most natural-sounding audio reproduction on the incoming signal.

The peak position of the contour filter is graphically-depicted in the “CONTOUR” indicator of the DSP Graphic Display on the LCD.

5. Press the [DSP/SEL] knob again to increase the contour filter’s level (“null” or “peak”).
6. To disable the contour filter, press the [DSP/SEL] button again. The graphic disappears from the “CONTOUR” indicator of the LCD Display, confirming that the contour filter is no longer operating.



Refer to Figure “B”, this shows a “indentation” of the contour filter is center of a passband. Counter-clockwise rotation (to the left) of the [DSP/SEL] knob causes the indentation to move toward a lower frequency within the passband, while clockwise rotation (to the right) causes the indentation to move toward a higher frequency within the passband. By removing interference or unwanted frequency components on the incoming signal, it is possible to make the desired signal rise out of the background noise/interference, enhancing intelligibility.



QUICK POINT:

The steep slopes of the DSP filtering can, when adjusted aggressively, impart an unnatural sound to an incoming signal. Often, a narrow bandwidth is not the key to improving copy. The incoming signal itself may have undesirable or excessive frequency components. By judicious use of the Contour filter, the “shoulder” of the passband response may be altered, or components removed from within the passband, allowing the desired signal to rise above the background noise and interference in a manner not obtainable with other filtering systems.

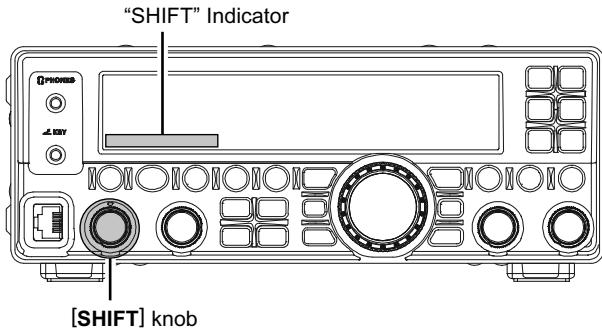
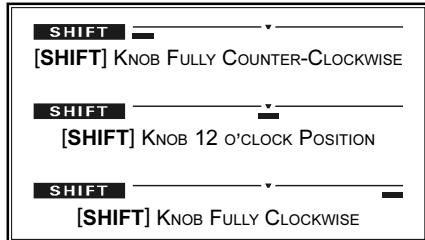
CONVENIENCE FEATURES

SHIFT (INTERFERENCE REJECTION "SIGNALS WITHIN 3 kHz")

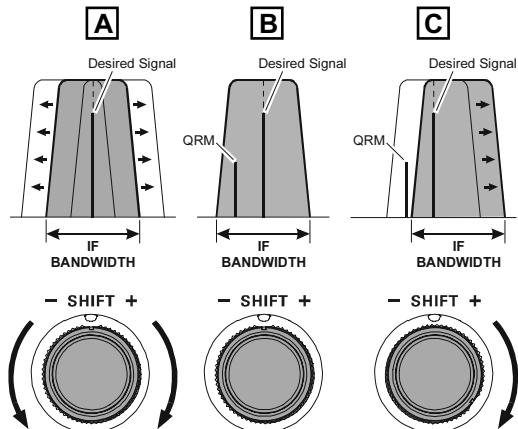
IF Shift allows you to vary the DSP filter passband higher or lower, without changing the pitch of the incoming signal, so as to reduce or eliminate interference. Because the carrier tuning frequency is not varied, there is no need to re-tune the operating frequency when eliminating the interference. The total passband tuning range for the IF Shift system is ± 1 kHz.

Rotate the [SHIFT] knob to the left or right to reduce the interference.

You may observe the position of the passband in the "SHIFT" indicator of the DSP Graphic Display on the display.



Referring to Figure "A", note the depiction of the IF DSP filter as the thick line, with the [SHIFT] knob in the 12 o'clock position. In Figure "B", an interfering signal has appeared inside the original passband. In Figure "C", you can see the effect of rotating the [SHIFT] knob to reduce the interference level by moving the filter passband so that the interference is outside of the passband.

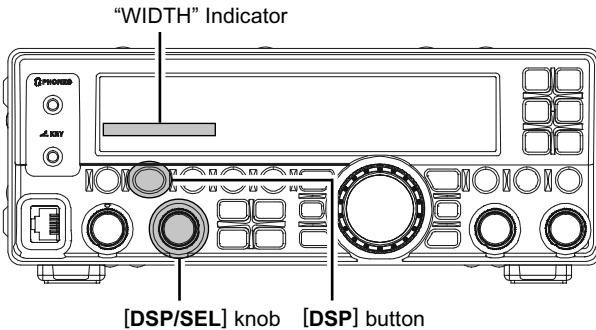


CONVENIENCE FEATURES

WIDTH (INTERFERENCE REJECTION "SIGNALS WITHIN 3 kHz")

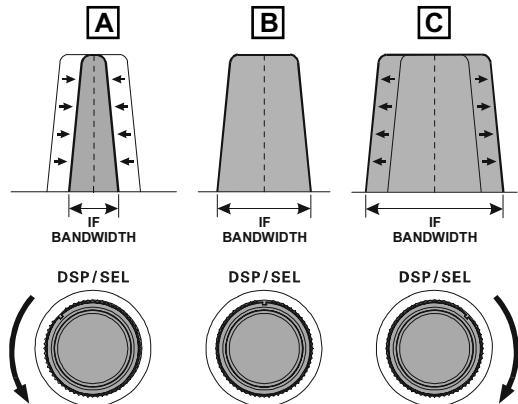
The IF Width tuning system allows you to vary the width of the DSP IF passband with three steps (FM: two steps), so as to eliminate interference. Moreover, the bandwidth may actually be expanded from its default setting, should you wish to enhance incoming signal fidelity when interference on the band is low.

1. Press the [DSP] button several times to set the ">>" icon to the "WIDTH" indicator of the DSP Graphic Display on the display, to enable adjustment of the bandwidth by the [DSP/SEL] knob.
2. Rotate the [DSP/SEL] knob to adjust the bandwidth. Counter-clockwise rotation reduces the bandwidth, while clockwise rotation increases the bandwidth.



Referring to Figure "B", this is default bandwidth.

By rotating the [DSP/SEL] knob to the left, the bandwidth will narrow (see Figure "A"), while rotation of the [DSP/SEL] knob to the right, as depicted in Figure "C", will widen the bandwidth.



The default bandwidths, and total bandwidth adjustment range, will vary according to the operating mode:

SSB Mode: 1.8 kHz / 2.4 kHz / 3.0 kHz
(Nominal: 2.4 kHz).

CW Mode: 300 Hz / 500 Hz / 2.4 kHz
(Nominal: 2.4 kHz).

DATA Mode: 300 Hz / 2.4 kHz / 3.0 kHz
(Nominal: 2.4 kHz).

AM Mode: 3.0 kHz / 6.0 kHz / 9.0 kHz
(Nominal: 6.0 kHz).

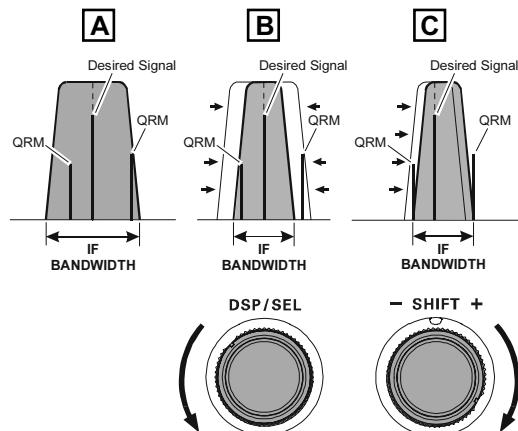
FM Mode: 2.5 kHz / 5.0 kHz
(Nominal: 5.0 kHz).

Using IF Shift and Width Together

The IF Shift and Variable IF Width features together form a very effective interference-fighting filtering system.

For example, in Figure "A" you can see how interference has appeared both on the high and low sides of the desired signal. By rotating the [DSP/SEL](WIDTH) knob, as shown in Figure "B", the interference from one side can be eliminated, and by re-positioning the [SHIFT] knob (Figure "C"), the interference on the opposite side can be removed, without re-introducing the interference previously eliminated in Figure "B".

Advice: For best interference reduction, the Width and Shift features are the primary tools you should use. After narrowing the bandwidth (Width) and/or adjusting the center of the passband (Shift), the Contour control may also yield additional signal-enhancement benefits on the net residual bandwidth. What's more, the IF Notch Filter (see the next section) may also be utilized, in conjunction with the three other filter systems, to significant advantage.

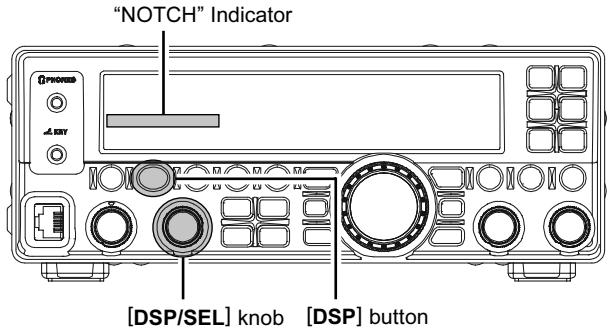


CONVENIENCE FEATURES

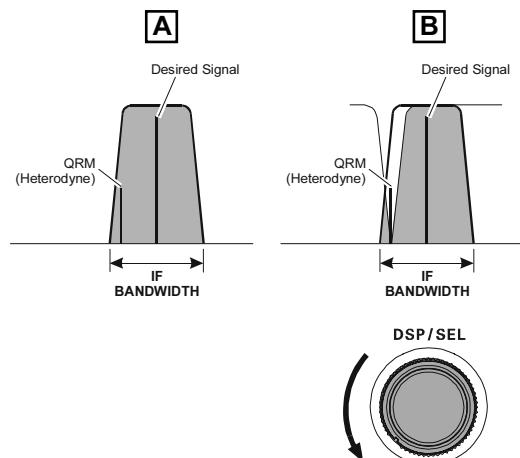
NOTCH (INTERFERENCE REJECTION "SIGNALS WITHIN 3 KHZ")

The IF Notch filter is a highly effective system that allows you to slice out an interfering beat note or other carrier signal from inside the receiver passband.

1. Press the [DSP] button several times to set the “>” icon to the “NOTCH” indicator of the DSP Graphic Display on the display.
2. Press the [DSP/SEL] knob to engage the IF Notch filter.
3. Rotate the [DSP/SEL] knob to adjust the center frequency of the IF Notch Filter.
You may observe the graphically depicted peak position of the IF Notch filter in the “NOTCH” indicator of the DSP Graphic Display on the display.
4. To disable the IF Notch filter, press the [DSP/SEL] button again. The graphically depicted peak position disappears from the “NOTCH” indicator of the DSP Graphic Display on the display confirming that the IF Notch filter is no longer operating.



The performance of the IF Notch filter is shown in Figure “A”, where the effect of rotation of the [DSP/SEL] knob is depicted. In Figure “B”, you can see the notching effect of the IF Notch filter as you rotate the [DSP/SEL] knob to eliminate the incoming interference.

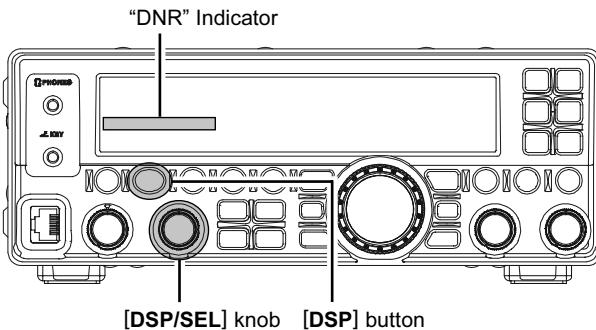


CONVENIENCE FEATURES

DNR (INTERFERENCE REJECTION “SIGNALS WITHIN 3 KHZ”)

The Digital Noise Reduction (DNR) system is designed to reduce the level of random noise found on the HF and 50 MHz bands, and it is especially effective during SSB operation. Any of eleven different noise-reduction parameters can be selected. Each of these algorithms was created for dealing with a different noise profile, and you will want to experiment with the DNR system to find the best setting according to the noise currently being experienced.

1. Press the [DSP] button several times to set the “>” icon to the “DNR” indicator of the DSP Graphic Display on the display.
2. Press the [DSP/SEL] knob to engage the Digital Noise Reduction system.
3. Rotate the [DSP/SEL] knob to select the setting that most effectively reduces the noise level. You may observe the effectiveness of the Digital Noise Reduction system in the “DNR” indicator of the DSP Graphic Display on the display.
4. To disable the Digital Noise Reduction system, press the [DSP/SEL] button again. The graph effectively disappears from the “DNR” indicator of the DSP Graphic Display on the display confirming that the Digital Noise Reduction system is no longer operating.



CONVENIENCE FEATURES

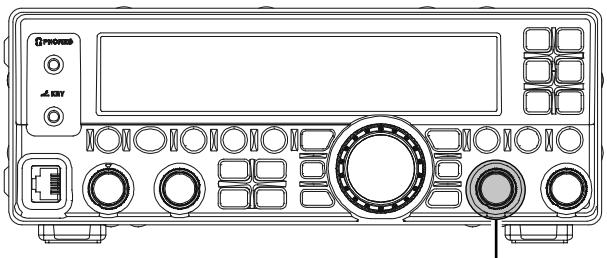
RF GAIN

The RF Gain controls provide manual adjustment of the gain levels for the receiver RF and IF stages, to compensate for noise and/or signal strength conditions at the moment.

The [SQL/RF GAIN] knob should, initially, be rotated to the fully clockwise position. This is the point of maximum sensitivity, and counter-clockwise rotation will gradually reduce the system gain.

ADVICE:

- As the [SQL/RF GAIN] knob is rotated counter-clockwise to reduce the gain, the S-meter reading will rise. This indicates that the AGC voltage being applied to the receiver is increasing (which causes a *reduction* in receiver gain).
- Rotating the [SQL/RF GAIN] knob control to the fully counter-clockwise position will essentially disable the receiver, as the gain will be greatly reduced. In this case, the S-meter will appear to be "pegged". (That is a full-scale reading).



[SQL/RF GAIN] knob

USING THE AUTOMATIC ANTENNA TUNER

The Automatic Antenna Tuner (hereinafter referred to as the “ATU”) built into each **FT-450D** is designed to ensure a 50-Ohm load for the final amplifier stage of the transmitter.

ADVICE:

- Because the ATU of the **FT-450D** is located inside the station, it only adjusts the impedance presented to the transceiver at the station end of your coaxial cable feedline. It does not “tune” the SWR at the antenna feed point itself. When designing and building your antenna system, we recommend that every effort be made to ensure a low SWR at the antenna feed point.
- The ATU of the **FT-450D** includes 100 memories for tuning data. Eleven of these memories are allocated, one per Amateur band, so that each band has at least one setting preset for use on that band. The remaining 89 memories are reserved for the 89 most-recent tuning points, for quick frequency change without the need to retune the ATU.
- The ATU in the **FT-450D** is designed to match impedances within the range of 16.7 Ohms to 150 Ohms, corresponding to an SWR of 3:1 or less on the 160 through 6 meter amateur bands. Accordingly, simple non-resonant whip antennas, along with random-length wires and the “G5RV” antenna (on most bands) may not be within the impedance matching range of the ATU.

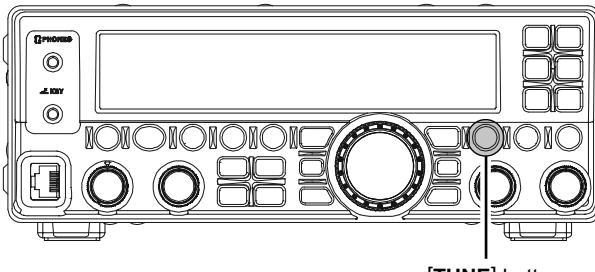
ATU OPERATION

1. Use the Main Tuning Dial knob to set the radio to the desired operating frequency within the Amateur band.
2. Press the [TUNE] button momentarily to place the ATU in the transmit line (no adjustment/tuning will occur yet). The “**TUNER**” icon will appear in the display.

QUICK POINT:

The momentary press of the [TUNE] button will turn the tuner on, and the microprocessor will automatically select the tuning point closest to the current operating frequency.

3. Press and hold in the [TUNE] button for one second to begin automatic tuning. The transmitter will be engaged, and the “**TUNER**” icon will blink while tuning is in progress. When the optimum tuning point has been reached, the radio will return to receive, and the “**TUNER**” icon will again glow steadily (instead of blinking).
4. To disconnect the ATU from the transmit line, press the [TUNE] button momentarily. The “**TUNER**” icon will turn off, confirming that the ATU has been turned off. In the “Off” mode, the transceiver will be directly connected to the coaxial cable connected to your antenna, and will operate based on whatever impedance is present at the station end of the coax.



[TUNE] button

ADVICE:

The ATU circuit is located between the final amplifier and the rear-panel antenna jack; reception is not affected by the ATU.

QUICK POINTS:

As shipped from the factory, only one ATU alignment point is saved on each Amateur band. This was memorized during the final alignment and performance verification stages on the production line.

NOTE:

Please check the operating frequency before beginning the tuning process, to be sure you are not interfering with others who may already be using the frequency.

TERMINOLOGY:

Antenna Tuner Memories: The microprocessor of the ATU makes a note of the positions of the tuning capacitors and the selected inductors, and stores the data for each 10 kHz window in which tuning has occurred. This eliminates the need to re-tune every time you return to a frequency on which you have already completed the tuning process.

USING THE AUTOMATIC ANTENNA TUNER

ABOUT ATU OPERATION

Figure 1 depicts a situation where normal tuning via the ATU has been successfully completed, and the tuning data has been stored in the ATU memory. The antenna system as seen by the transmitter is shown.

In Figure 2, the operator has changed frequency, and the "☒" icon has appeared. The operator presses and holds in the [TUNE] button for two seconds to begin impedance matching using the ATU.

If a high SWR condition exists (above 3:1), corrective action must be taken in the antenna system to bring the impedance closer to 50 Ohms. The ATU will refuse to memorize settings on frequencies where the SWR exceeds 3:1. A High SWR may indicate a mechanical failure in the feed system, and can lead to the generation of spurious signals causing TVI, etc.

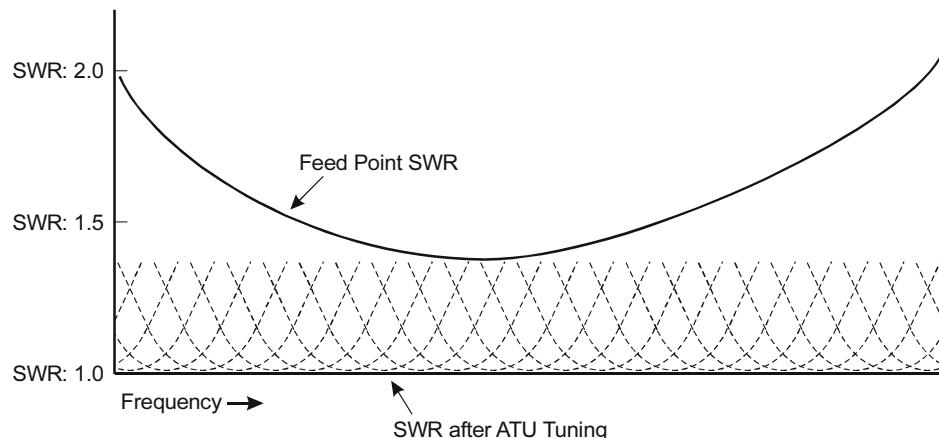


FIGURE 1

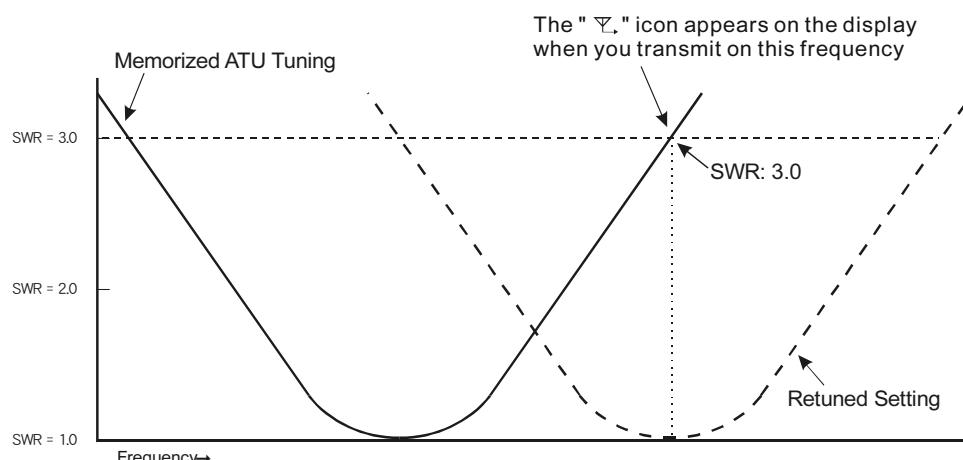


FIGURE 2

About ATU Memories

SWR (After tuning) Less than 2:1

The tuner settings are stored in the ATU memory.

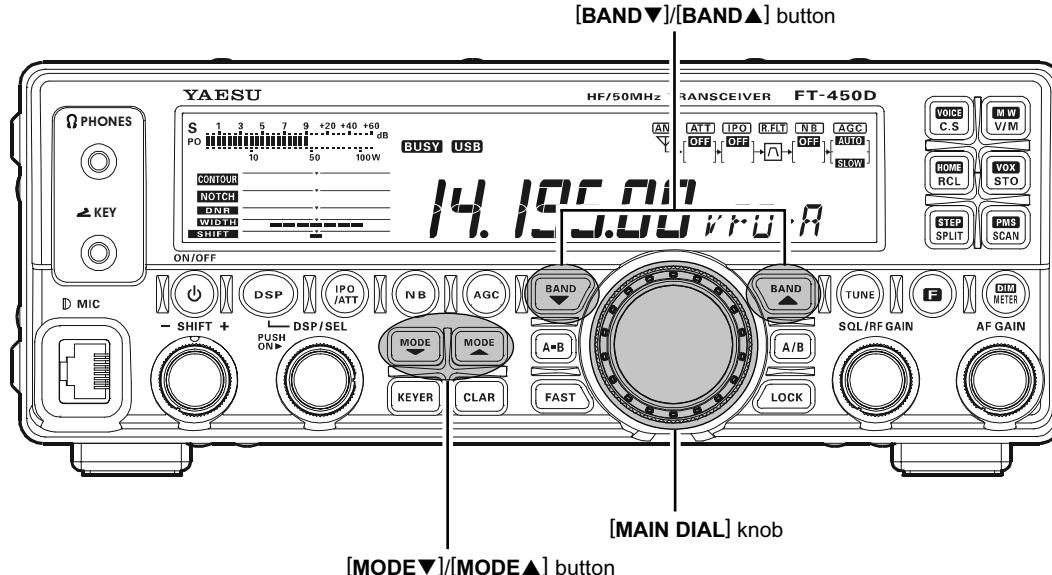
SWR (After tuning) Greater than 2:1

Tuning data will not be retained in memory. If you return to the same frequency, the tuning process must be repeated.

SWR (After tuning) Greater than 3:1

The "☒" icon does not blink, and the tuner settings, if achieved, will not be memorized. Please investigate the high SWR condition and resolve the problem, before attempting further operation using this antenna.

SSB/AM Mode Transmission



- Press the [BAND▼]/[BAND▲] buttons to select the operating band.

By pressing the [BAND▼]/[BAND▲] buttons, the operating band will change as follows.

7 ⇌ 10 ⇌ 14 ⇌ 15 ⇌ 18 ⇌ 21 ⇌ 24.5 ⇌
28 ⇌ 50 ⇌ 1.8 ⇌ 3.5 ⇌ 7

- Press the [MODE▼]/[MODE▲] buttons to select the LSB, USB or AM mode.

By convention, LSB is used in the 7 MHz and lower Amateur bands for SSB communication, and USB is used on the 14 MHz and higher bands (the 10 MHz band is used for CW and data modes only).

- Rotate the [MAIN DIAL] knob to adjust the operating frequency.

If you use the **MH-31A8J** (or **MD-100A8X**: option), you may adjust the operating frequency by the [**UP**]/[**DWN**] buttons on the microphone.

- Press the [BAND▼]/[BAND▲] buttons to select the operating band.
- Press the microphone's **PTT** (Push To Talk) switch to begin transmission. Speak into the microphone in a normal voice level.

The "**T X**" icon will appear in the display, confirming that transmission is in progress.

The Speech Processor is automatically activated while transmitting. The Speech Processor increases "talk power" by increasing the average power output.

- Release the **PTT** switch at the end of your transmission. The transceiver will return to the receive mode.

IMPORTANT NOTE:

When performing tests, be sure to check the frequency before transmitting, to avoid interfering with others who may already be using the frequency.

NOTICE

Regarding of the [DSP/SEL] knob

The [DSP/SEL] knob is used for operating various functions depending on the situation.

If you can not change the frequency/memory channel by tuning the [DSP/SEL] knob, the [DSP/SEL] knob is selected to operate of one of the DSP functions.

In this case, press the [DSP] button several times until the ">" icon disappears from the DSP Graphic Display.

SSB/IAM Mode TRANSMISSION

TX METER SELECTION

You may change the PO meter function to ALC meter or SWR meter in the transmit mode.

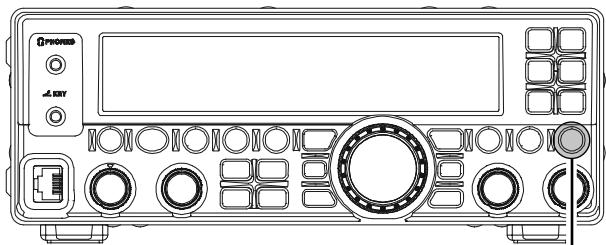
By pressing the [METER/DIM] button, the meter function will change as follows.

PO → ALC → SWR → PO

PO: Indicates the average power output level.

ALC: Indicates the relative ALC voltage.

SWR: Indicates the Standing Wave Ratio.



[METER/DIM] button

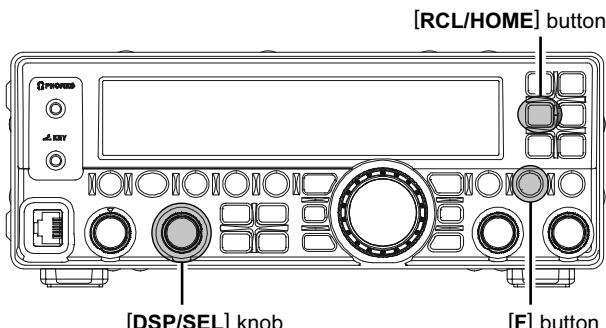
TX POWER ADJUSTMENT

Adjusting the TX output power:

1. Press and hold the [F] button for one second to enter the Menu mode. The “**MENU**” icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select the menu item “RFPOWER”.
3. Press the [DSP/SEL] knob to enable adjustment of this menu item. The “**MENU**” icon will be blinking.
4. Rotate the [DSP/SEL] knob to select the desired power output.

You may press the [RCL/HOME] button to reset the power output to the factory default.

5. Press the [DSP/SEL] knob. The “**MENU**” icon returns to appear continuously.
6. Press and hold the [F] button for one second to save the new setting and return to normal operation.



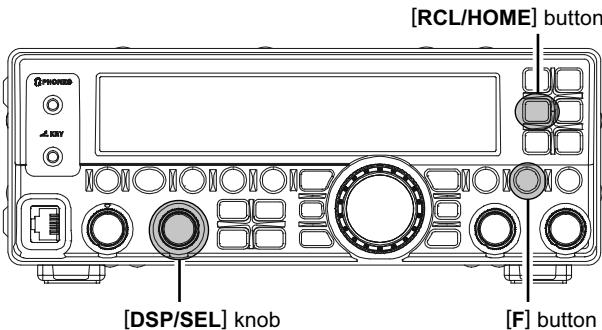
[F] button

SSB/IAM Mode Transmission

Transmitter Time-Out Timer (TOT)

The “Time-Out Timer” (TOT) feature that is designed to force the transceiver into the “receive” mode after a preset time period of continuous transmission (the default is “OFF”). This feature prevents your transceiver from transmitting a “dead carrier” for a long period of time if the microphone **PTT** switch is accidentally locked in the “TX” condition. The Time-Out Timer “switch-to-receive” time may be adjusted from 1 to 20 minutes, or Off via Menu Item “TOT”.

1. Press and hold the **[F]** button for one second to enter the Menu mode again. The “**MENU**” icon will appear on the display.
2. Rotate the **[DSP/SEL]** knob to select the menu item “TOT”.
3. Press the **[DSP/SEL]** knob to enable adjustment of this menu item. The “**MENU**” icon will be blinking.
4. Rotate the **[DSP/SEL]** knob to select the desired “Maximum TX” time. Available selections are 1 minute through 20 minutes or off.
Press the **[RCL/HOME]** button to reset the TOT time to the factory default.
5. Press the **[DSP/SEL]** knob. The “**MENU**” icon returns to appear continuously.
6. Press and hold the **[F]** button for one second to save the new setting and return to normal operation.



SSB/AM MODE TRANSMISSION

MICROPHONE GAIN LEVEL ADJUSTMENT

At the factory, a microphone gain has been programmed that should be satisfactory for the supplied **MH-31A8J** Hand Microphone. If you use an after-market microphone, you may wish to set a different Microphone Gain Level.

1. Press and hold the [**F**] button for one second to enter the Menu mode again. The “**MENU**” icon will appear on the display.
2. Rotate the [**DSP/SEL**] knob to select the menu item “**MICGAIN**”.
3. Press the [**DSP/SEL**] knob to enable adjustment of this menu item. The “**MENU**” icon will be blinking.
4. Rotate the [**DSP/SEL**] knob to select the desired microphone gain (**LOW**, **NOR**, or **HIGH**, factory default: **NOR**).

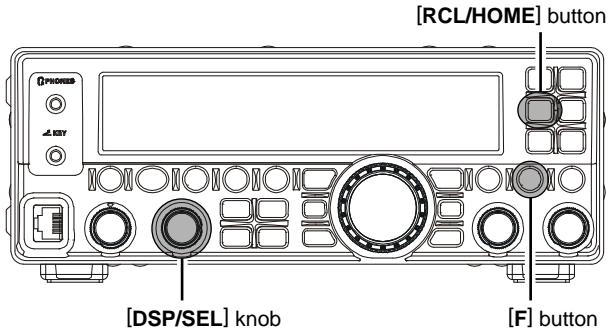
LOW: Set to “LOW” when using a microphone with a high output level (the speech processor is turned OFF).

NOR For normal voice the speech processor is turned on automatically.

HIGH: Set to “HIGH” when using a microphone with a low output level (the speech processor is turned ON).

Press the [**RCL/HOME**] button to reset the microphone gain to the factory default.

5. Press the [**DSP/SEL**] knob. The “**MENU**” icon returns to appear continuously.
6. Press and hold the [**F**] button for one second to save the new setting and return to normal operation.



SSB/IAM Mode Transmission

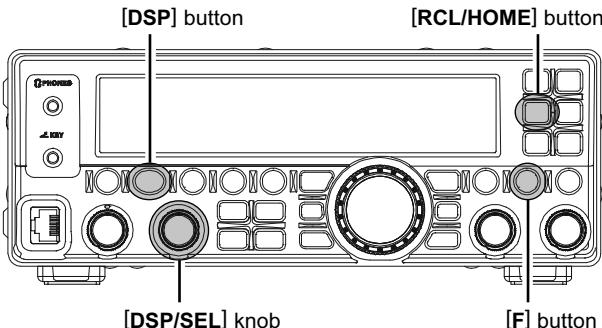
DSP MICROPHONE EQUALIZER

You may select one of ten available DSP equalization techniques for transmitted microphone audio.

1. Press and hold the [DSP] button for one second. This instantly activates menu item "MIC EQ". The "**MENU**" icon will appear on the display.
2. Press the [DSP/SEL] knob to enable adjustment of this menu item. The "**MENU**" icon will be blinking.
3. Rotate the [DSP/SEL] knob to select the desired equalizer pattern. Observe the relative equalizer pattern on the display.
(You may press the [RCL/HOME] button to reset the equalizer pattern to the factory default.)
4. Press the [DSP/SEL] knob. The "**MENU**" icon returns to appear continuously.
5. Press and hold the [F] button for one second to save the new setting and return to normal operation.

The available selections are:

- 0: Flat
- 1: Low-frequency components are reduced.
- 2: Mid-frequency components are reduced.
- 3: High-frequency components are reduced.
- 4: High-frequency components are enhanced.
- 5: Mid-frequency components are enhanced.
- 6: Low-frequency components are enhanced.
- 7: Low-frequency components are enhanced and High-frequency components are reduced.
- 8: Low-frequency components are reduced and Mid-frequency components are enhanced.
- 9: Low-frequency components are reduced and High-frequency components are enhanced

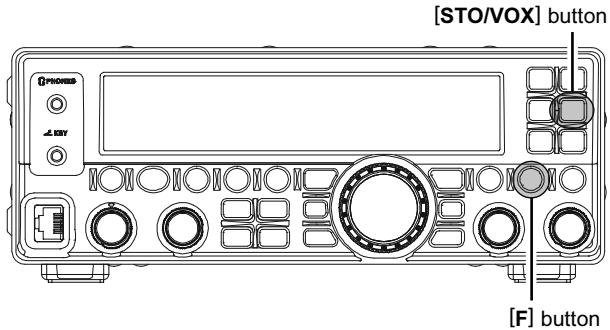


SSB/IAM Mode Transmission

AUTOMATIC TX/RX SWITCHING USING VOICE CONTROL (VOX)

Instead of using the microphone's PTT switch to activate the transmitter, the VOX (Voice Operated TX/RX Control) system provides hands-free, automatic activation of the transmitter, based on voice input into the microphone. Setup of the VOX system takes only a few seconds.

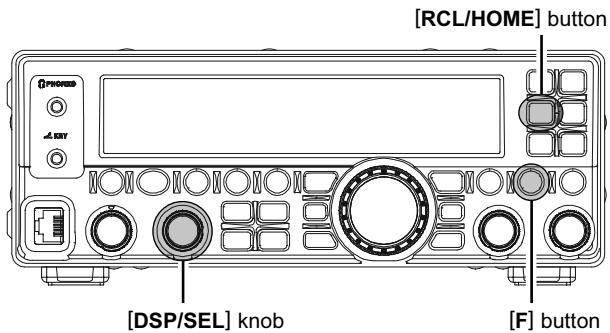
1. Press the [F] button followed by the [STO/VOX] button to engage the VOX operation. The “**VOX**” icon will appear in the display.
2. Without pressing the PTT switch, speak into the microphone in a normal voice level. When you start speaking, the transmitter should be activated automatically. When you finish speaking, the transceiver should return to the receive mode (after a short delay).
3. To exit from VOX operation, press the [F] button followed by the [STO/VOX] button again.



VOX GAIN ADJUSTMENT

Adjust the VOX gain level to prevent accidental transmitter activation in a noisy environment.

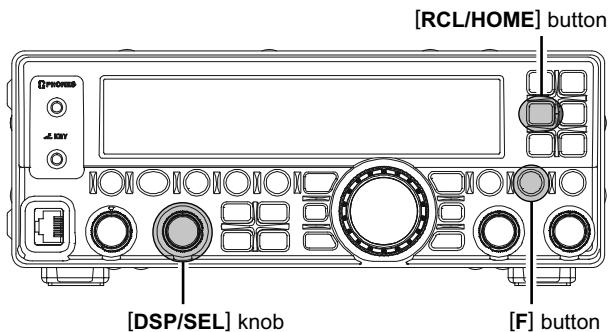
1. Press and hold the [F] button for one second to enter the Menu mode. The “**MENU**” icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select the menu item “VOXGAIN”.
3. Press the [DSP/SEL] knob to enable adjustment of this menu item. The “**MENU**” icon will be blinking.
4. Rotate the [DSP/SEL] knob to set to the point where the transmitter is quickly activated by your voice, without causing background noise to activate the transmitter. Available selections are 1 through 100 (factory default: 50). Press the [RCL/HOME] button to reset the VOX gain level to the factory default.



5. Press the [DSP/SEL] knob. The “**MENU**” icon returns to appear continuously.
6. Press and hold the [F] button for one second to save the new setting and return to normal operation.

VOX DELAY ADJUSTMENT (THE TRANSMIT-RECEIVE DELAY AFTER THE CESSION OF SPEECH)

1. Press and hold the [F] button for one second to enter the Menu mode again. The “**MENU**” icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select the menu item “VOX DLY”.
3. Press the [DSP/SEL] knob to enable adjustment of this menu item. The “**MENU**” icon will be blinking.
4. Rotate the [DSP/SEL] knob while saying a brief syllable like “Ah” and listening to the hang time, so as to set the desired delay. Available selections are 100 through 3000 msec (factory default: 500 msec). Press the [RCL/HOME] button to reset the VOX delay time to the factory default.
5. Press the [DSP/SEL] knob. The “**MENU**” icon returns to appear continuously.
6. Press and hold the [F] button for one second to save the new setting and return to normal operation.



SSB/CW Mode TRANSMISSION

MONITOR

You may listen to the quality of your transmitted signal using the Monitor feature.

PREPARATIONS

Assign the Monitor feature to the [C.S/VOICE] button.

1. Press and hold the [F] button for one second to enter the Menu mode. The “**MENU**” icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select the menu item “PNL-C.S”.
3. Press the [DSP/SEL] knob to enable adjustment of this menu item. The “**MENU**” icon will be blinking.
4. Rotate the [DSP/SEL] knob to select “MONI” to assign the Monitor feature to the [C.S/VOICE] button.
5. Press the [DSP/SEL] knob. The “**MENU**” icon returns to appear continuously.
6. Press and hold the [F] button for one second to save the new setting and return to normal operation.

ADVICE:

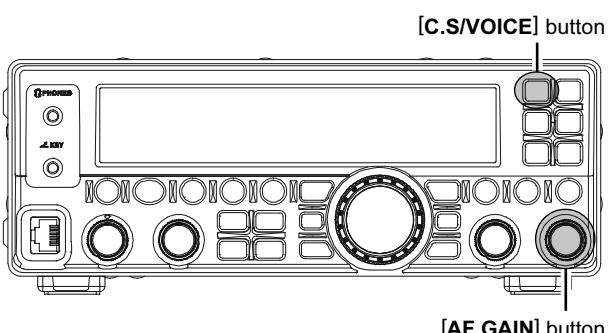
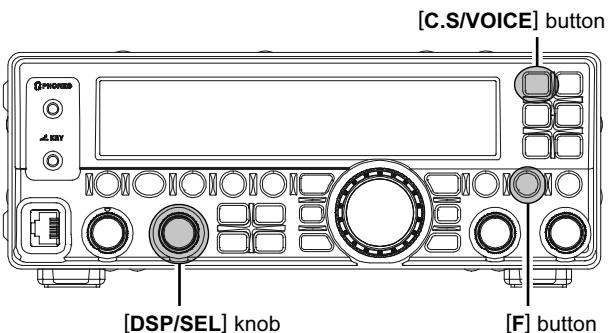
You may assign the MONITOR feature to the MH-31A8J (or optional microphone's) [DWN]/[FST]/[UP] button via the Menu Item “P M-DWN”, “P M-FST” or “P M-UP”.

MONITORING

1. Press the [C.S/VOICE](MONITOR) button to activate the Monitor feature.
During transmission, your transmitted voice is output from the speaker.
2. Rotate the [AF GAIN] knob to adjust the audio level from the monitor.
3. To disable the Monitor feature, press the [C.S/VOICE](MONITOR) button again.

ADVICE:

- If you are using the speaker for monitoring, instead of headphones, excessive advancement of the [AF GAIN] knob can cause feedback to occur. Additionally, this feedback can cause the VOX system to hang up in a loop, making it impossible to return to receive. Therefore, we recommend the use of headphones, if at all possible, or the minimum usable setting of the [AF GAIN] knob, if the speaker must be used.
- Because the Monitor feature utilizes a sampling of the transmitter's DSP signal, it can be very useful for checking the adjustment of the Speech Processor or Microphone Equalizer on SSB, and for checking the general signal quality on AM and FM.



SSB/IAM Mode TRANSMISSION

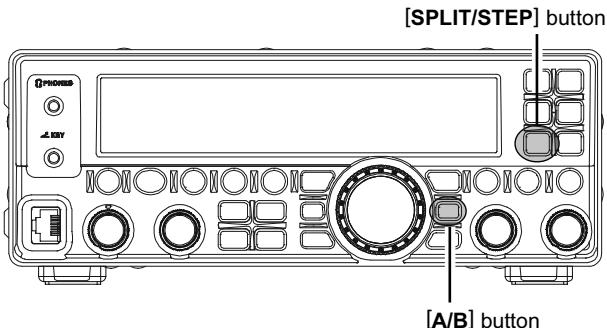
SPLIT-FREQUENCY OPERATION

A powerful capability of the **FT-450D** is its flexibility in Split Frequency operation, using VFO-A and VFO-B frequency registers. This makes the **FT-450D** especially useful for high-level DX-pedition use, as the Split operation capability is very advanced and easy to use.

1. Press the **[A/B]** button to switch the VFO register to VFO-B, then set the transmit frequency.
2. Press the **[A/B]** button again to switch the VFO register to VFO-A, then set the receive frequency.
3. Now press the **[SPLIT/STEP]** button to activate Split-Frequency Operation.
4. The “*SPLIT*” icon will appear in the display.
5. To quit Split-Frequency Operation, press the **[SPLIT/STEP]** button again.

ADVICE:

- It is possible to set different operating modes (for example, LSB and USB) on the two VFOs used during Split operation.
- It is possible to set different amateur bands (for example, 14 MHz and 21 MHz) on the two VFOs used during Split operation, if you use the multi band antenna.



[SPLIT/STEP] button

[A/B] button

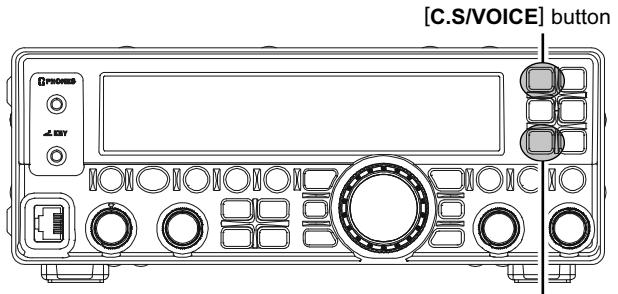
QUICK SPLIT OPERATION

The Quick Split feature allows you to set a one-touch offset of +5 kHz to be applied to your radio's transmit frequency compared to the receiving frequency. Furthermore, the transmit mode sets to the same mode as the receiving frequency register.

1. Press and hold in the **[SPLIT/STEP]** button for one second to engage the Quick Split feature. The transmit mode is set to the same mode as the receiver frequency register and applies a frequency 5 kHz above the receiving frequency register to the transmit frequency register.
The “*SPLIT*” icon will appear in the display.
2. Press and hold in the **[SPLIT/STEP]** button for one second to increment the transmit frequency +5 kHz.
3. To quit the Quick Split Operation, press the **[SPLIT/STEP]** button again.

ADVICE:

If you assign the “TXW” feature into the **[C.S/VOICE]** button, you may also listen to the TX frequency temporarily while pressing the **[C.S/VOICE]** button during Split operation.



[C.S/VOICE] button

[SPLIT/STEP] button

SSB/AM MODE TRANSMISSION

VOICE MEMORY (SSB/AM/FM MODES)

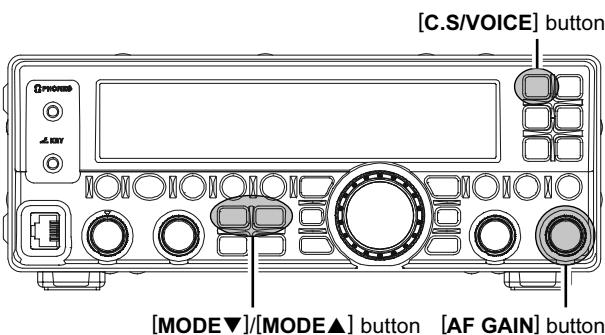
You may utilize the Voice Memory capability of the **FT-450D** for repetitive messages. The Voice Memory system includes two memories (VM1 and VM2) capable of storing up to 10 seconds of voice audio each. The maximum that both memories can hold is 10 seconds.

Recording Your Own Voice in Memory

1. Assign the "VM1REC" (Voice Recording) function to the [**C.S/VOICE**] button using the procedure in the box below.
2. Select the LSB, USB, AM, or FM mode using the [**MODE▼**]/[**MODE▲**] buttons.
3. Press the [**C.S/VOICE**] button. A "VM1 REC" notation will appear in the display.
4. Press and hold the microphone's **PTT** switch, the radio display will count down.
("VM1 -3" → "VM1 -2" → "VM1 -1" → "VM1 10")
5. When the display Shows "VM1 10", speak into the microphone in a normal voice level to record the message (such as "CQ DX, CQ DX, this is W 6 Delta X-Ray Charlie, W 6 Delta X-Ray Charlie, Over"). Remember that the time limit for recording is 10 seconds.
6. Release the **PTT** switch to terminate the message storage process.

Checking Your Recording

1. Assign the "VM1MONI" (Voice Monitoring) function to the [**C.S/VOICE**] button using the procedure in the box below.
2. Select the LSB, USB, AM, or FM mode using the [**MODE▼**]/[**MODE▲**] buttons.
3. Press the [**C.S/VOICE**] button, and you will hear the contents of the voice memory you just recorded.
4. You may adjust the playback level of the recording by the [**AF GAIN**] knob.



ADVICE

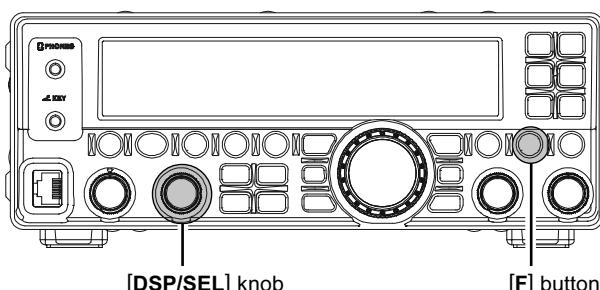
You may perform the Voice Memory operation with the memory slot "VM2 (VM2REC, VM2MONI, and VM2TX)" instead of memory slot "VM1 (VM1REC, VM1MONI, and VM1TX)".

Transmitting the Recorded Message

1. Assign the "VM1TX" (Voice Transmitting) function to the [**C.S/VOICE**] button using the procedure in the box below.
2. Select the LSB, USB, AM, or FM mode using the [**MODE▼**]/[**MODE▲**] buttons.
3. Press the [**C.S/VOICE**] button to transmit the contents of the voice memory you just recorded.
4. You may adjust the playback level of the recording by the [**AF GAIN**] knob.

How to assign a function to the [**C.S/VOICE**] button

1. Press and hold the [**F**] button for one second to enter the Menu Mode. The "**MENU**" icon will appear on the display.
2. Rotate the [**DSP/SEL**] knob to select Menu Item "PNL-C.S".
3. Press the [**DSP/SEL**] knob to enable adjustment of this Menu Item. The "**MENU**" icon will be blinking.
4. Rotate the [**DSP/SEL**] knob to select the desired function.
5. Press the [**DSP/SEL**] knob. The "**MENU**" icon returns to appear continuously.
6. Press and hold the [**F**] button for one second to return to normal operation.



SSB/IAM Mode TRANSMISSION

NOTE

CW MODE OPERATION

The powerful CW operating capabilities of the FT-450D include operation using both an electronic keyer paddle and a "straight key" or emulation thereof, as is provided by a computer-based keying device.

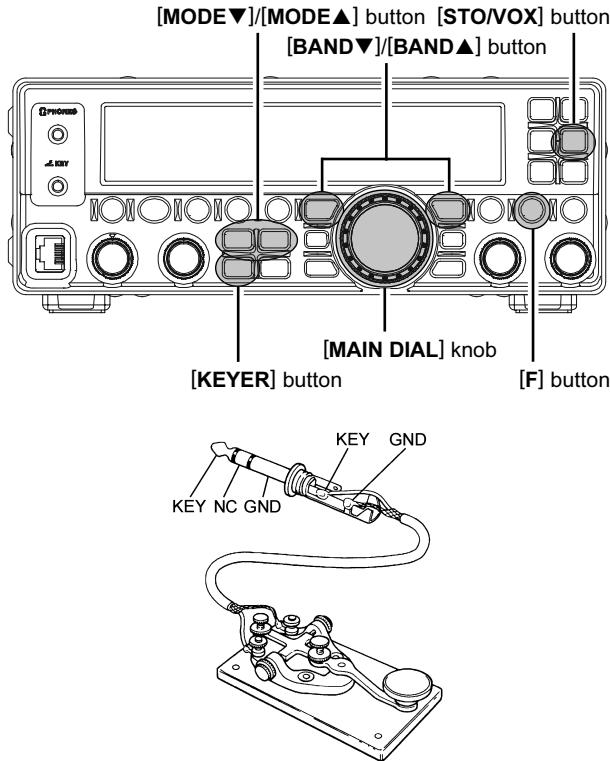
SETUP FOR STRAIGHT KEY (AND STRAIGHT KEY EMULATION) OPERATION

Before starting, connect your key to the front panel **KEY** jack in the status that turned off the **[POWER(ON/OFF)]** switch, and be sure the **[KEYER]** button is turned off (the "**KEYER**" icon is not displayed) for now.

1. Press the **[BAND▼]/[BAND▲]** buttons to select the operating band.
By pressing the **[BAND▼]/[BAND▲]** buttons, the operating band will change as follows.
 $7 \leftrightarrow 10 \leftrightarrow 14 \leftrightarrow 15 \leftrightarrow 18 \leftrightarrow 21 \leftrightarrow 24.5 \leftrightarrow 28 \leftrightarrow 50 \leftrightarrow 1.8 \leftrightarrow 3.5 \leftrightarrow 7 \dots$
2. Press the **[MODE▼]/[MODE▲]** buttons to select the CW mode.
3. Rotate the **[MAIN DIAL]** knob to adjust the operating frequency.
If you use the **MH-31A8J** (or **MD-100A8X**: option), you may adjust the operating frequency by the **[UP]/[DWN]** buttons on the microphone.
4. Press the **[F]** button followed by the **[STO/VOX]** button to engage automatic activation of the transmitter when you close the CW key. The "**BK-IN**" icon will appear in the display.
5. When you close your CW key, the transmitter will automatically be activated, and the CW carrier will be transmitted. When you release the key, transmission will cease after a brief delay. The delay time is user-programmable, per the discussion on page 48.

NOTE:

Do not use the plug except the 3.5-mm 3-pin type plug. If the plug in correct size is not used the radio may be harmed or damaged.



NOTICE

Regarding of the **[DSP/SEL]** knob

The **[DSP/SEL]** knob is used for operating various functions depending on the situation.

If you can not change the frequency/memory channel by tuning the **[DSP/SEL]** knob, the **[DSP/SEL]** knob is selected to operate of one of the DSP functions.

In this case, press the **[DSP]** button several times until the "**>**" icon disappears from the DSP Graphic Display.

CW MODE OPERATION

USING THE BUILT-IN ELECTRONIC KEYER

Before starting, connect your keyer paddle to the front panel **KEY** jack in the status that turned off the **[POWER(ON/OFF)]** switch.

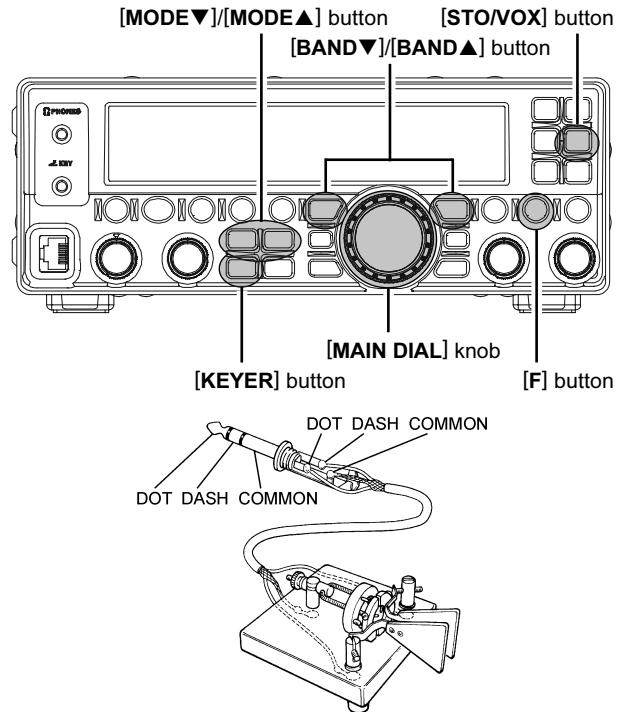
1. Press the **[BAND▼]/[BAND▲]** buttons to select the operating band.
By pressing the **[BAND▼]/[BAND▲]** buttons, the operating band will change as follows.
 $7 \leftrightarrow 10 \leftrightarrow 14 \leftrightarrow 15 \leftrightarrow 18 \leftrightarrow 21 \leftrightarrow 24.5 \leftrightarrow 28 \leftrightarrow 50 \leftrightarrow 1.8 \leftrightarrow 3.5 \leftrightarrow 7 \dots$
2. Press the **[MODE▼]/[MODE▲]** buttons to select the CW mode.
3. Rotate the **[MAIN DIAL]** knob to adjust the operating frequency.
If you use the **MH-31A8J** (or **MD-100A8X**: option), you may adjust the operating frequency by the **[UP]/[DWN]** buttons on the microphone.
4. Press the **[F]** button followed by the **[STO/VOX]** button to engage automatic activation of the transmitter when you close the CW key. The “**BK-IN**” icon will appear in the display.
5. Press the **[KEYER]** button to activate the built-in Electronic Keyer. The “**KEYER**” icon will appear in the display.
6. When you press either the “Dot” or “Dash” side of your paddle, the transmitter will automatically be activated and the CW carrier will be transmitted. When you release the paddle, transmission will cease after a brief delay. The delay time is user-programmable, per the discussion on page 48.

NOTE:

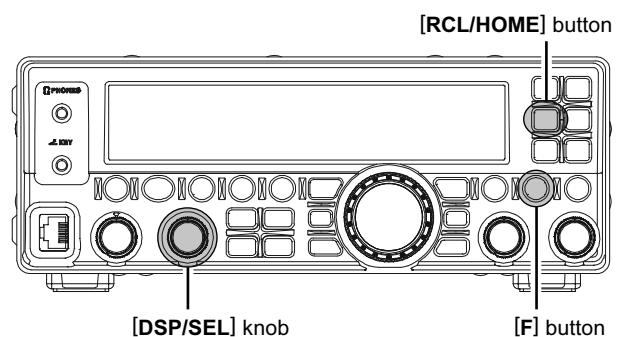
Do not use the plug except the 3.5-mm 3-pin type plug. If the plug in correct size is not used the radio may be harmed or damaged.

ADJUSTING THE KEYER SPEED

1. Press and hold the **[F]** button for one second to enter the Menu mode. The “**MENU**” icon will appear on the display.
2. Rotate the **[DSP/SEL]** knob to select the menu item “**CWSPEED**”.
3. Press the **[DSP/SEL]** knob to enable adjustment of this menu item. The “**MENU**” icon will be blinking.
4. Rotate the **[DSP/SEL]** knob while pressing either the “Dot” or “Dash” side of your paddle, so as to set the desired keyer speed (4 - 60 wpm).
Press the **[F]** button if you wish to select display of “cpm” (characters per minute) instead of “wpm” (words per minute). The “cpm” selection is based on the international “PARIS” standard, which stipulates five characters per word.
(You may Press the **[RCL/HOME]** button to reset the keyer speed to the factory default.)
5. Press the **[DSP/SEL]** knob. The “**MENU**” icon returns to appear continuously.



You may enable the CW keying by the **[UP]/[DWN]** keys of the **MH-31A8J** (while the built-in electronic keyer is engaged) via menu item “**CW PADDLE**”. See page 81 for details.



6. Press and hold the **[F]** button for one second to save the new setting and return to normal operation.

TERMINOLOGY:

PARIS Word Length: By convention in the Amateur industry (utilized by ARRL and others), the length of one “word” of CW is defined as the length of the Morse Code characters spelling the word “PARIS.” This character (dot/dash/space) length is used for the standard definition of code speed in “words per minute”.

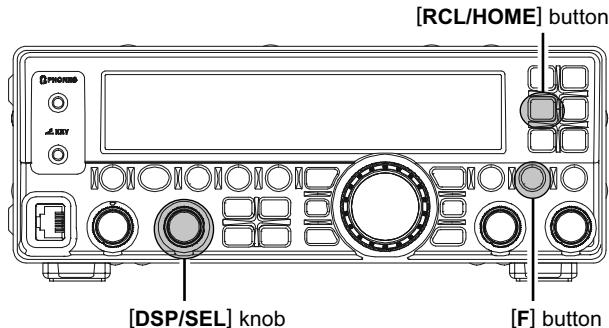
CW MODE OPERATION

USING THE BUILT-IN ELECTRONIC KEYER

SETTING THE KEYER WEIGHT (DOT/SPACE:DASH) RATIO

The Menu Item "CWWEIGHT" may be used to adjust the Weight for the built-in Electronic Keyer. The default weighting is 3:1 (a dash is three times longer than a dot or space).

1. Press and hold the [F] button for one second to enter the Menu mode again. The "MENU" icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select the menu item "CWWEIGHT".
3. Press the [DSP/SEL] knob to enable adjustment of this menu item. The "MENU" icon will change to blink.
4. Rotate the [DSP/SEL] knob to set the desired keyer weight value. Available adjustment range is for a Dot/Space:Dash ratio of "2.5" - "4.5" (default value: "3.0").
(You may press the [RCL/HOME] button to reset the keyer weight value to the factory default.)
5. Press the [DSP/SEL] knob. The "MENU" icon returns to appear continuously.
6. Press and hold the [F] button for one second to save the new setting and return to normal operation.

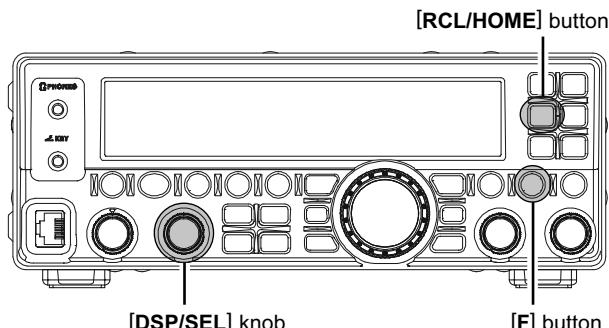


SELECTING THE KEYER PADDLE'S WIRING CONFIGURATION

You may select "normal" or "reverse" paddle polarity via Menu Item "CW KEY". The default setting is "normal", whereby the "Tip" connection on the key plug is "Dot" and the "Ring" connection is "Dash".

To change the paddle polarity:

1. Press and hold the [F] button for one second to enter the Menu mode again. The "MENU" icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select the menu item "CW KEY".
3. Press the [DSP/SEL] knob to enable adjustment of this menu item. The "MENU" icon will be blinking.
4. Rotate the [DSP/SEL] knob to set the "REV" (default: "NOR").
(You may Press the [RCL/HOME] button to reset the paddle polarity to the factory default.)
5. Press the [DSP/SEL] knob. The "MENU" icon returns to appear continuously.
6. Press and hold the [F] button for one second to save the new setting and return to normal operation.



CW MODE OPERATION

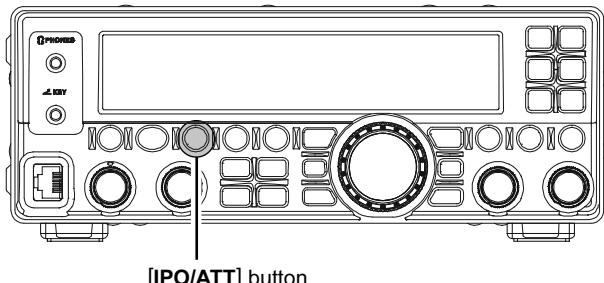
CW SPOTTING (ZERO-BEATING)

"Spotting" (zeroing in on another CW station) is a handy technique for ensuring that you and the other station are precisely on the same frequency.

To Use CW SPOTTING:

In CW mode, while pressing and holding the [IPO/ATT] button, the Spot tone will be heard and Spot tone frequency will show in the display. This tone corresponds to the pitch of your transmitted signal, and if you adjust the receiver frequency to match the pitch of the received CW signal to that of the Spot tone, your transmitted signal will be precisely matched to that of the other station.

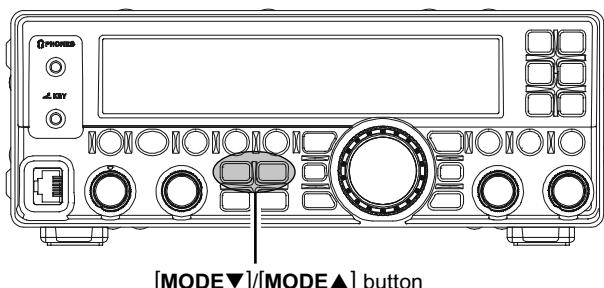
Release the [IPO/ATT] button to turn the Spot tone off.



USING CW REVERSE

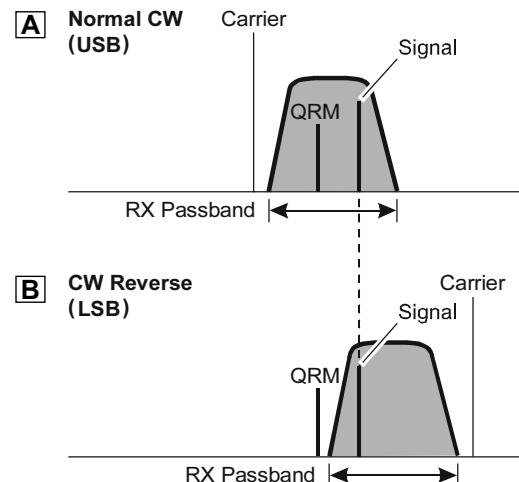
If you experience a difficult interference situation, where an interfering station cannot readily be eliminated, you may wish to try receiving using the opposite sideband. This may throw the interfering station's frequency in a direction that may lend itself more readily to rejection.

1. To start, let's use a typical example where you have set the CW mode (using the default "USB" injection: the "CW" and "USB" icon appear).
2. Press and hold in the [MODE▼] or [MODE▲] button for one second. The "LSB" icon appears instead of "USB", indicating that the "LSB" injection side has now been selected.
3. Press and hold in the [MODE▼] or [MODE▲] button, once again, for one second to return to the normal (USB) injection side and cancel CW Reverse operation (the "CW" and "USB" icons appear).



In the illustration, Figure A demonstrates the normal CW injection setup, using the USB side. In Figure B, CW Reverse has been engaged, so as to receive using LSB-side injection to eliminate interference.

The beneficial effect of switching sidebands can clearly be seen in this example.



CW MODE OPERATION

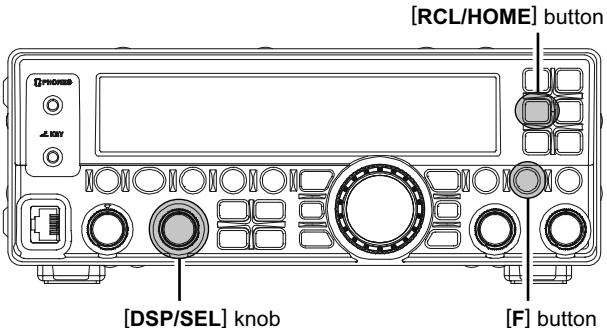
CW DELAY TIME SETTING

During semi-break-in (not QSK) operation, the hang time of the transmitter, after you have finished sending, may be adjusted to a comfortable value consistent with your sending speed. This is the functional equivalent to the "VOX Delay" adjustment used on voice modes, and the delay may be varied anywhere between 30 - 3000 millisecond (10 millisecond step) and FULL (Full Break-in operation).

1. Press and hold the [F] button for one second to enter the Menu mode. The "**MENU**" icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select the menu item "CW DLY".
3. Press the [DSP/SEL] knob to enable adjustment of this menu item. The "**MENU**" icon will be blinking.
4. Rotate the [DSP/SEL] knob to set the desired delay time.

If the delay selection is set to "FULL", the transceiver operates in the full break-in mode (allowing you to hear between the characters that are being sent).

(You may press the [RCL/HOME] button to reset the delay time to the factory default.)



5. Press the [DSP/SEL] knob. The "**MENU**" icon returns to appear continuously.
6. Press and hold the [F] button for one second to save the new setting and return to normal operation.

CW SIDETONE VOLUME LEVEL SETTING

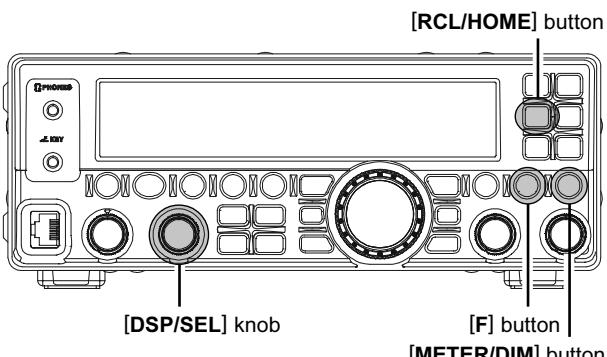
You may adjust the CW sidetone volume level via the Menu Item "CWSTONE".

1. Press and hold the [F] button for one second to enter the Menu mode. The "**MENU**" icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select the menu item "CWSTONE".
3. Press the [DSP/SEL] knob to enable adjustment of this menu item. The "**MENU**" icon will be blinking.
4. While pressing and holding the [METER/DIM] button, rotate the [DSP/SEL] knob to set the desired sidetone volume level (FIX 0 - FIX 100).

If you wish to adjust the CW sidetone level with the [AF GAIN] knob, press the [F] key to change the display to "LNK-xx" then rotate the [DSP/SEL] knob to set the volume ratio of the CW sidetone volume level for the receiving audio volume level. Available selections are LNK-50 ~ LNK 0 ~ LNK+50. When the LNK 0 is selected, the CW sidetone volume level becomes the same as receiving audio volume level.

(You may press the [RCL/HOME] button to reset the CW sidetone level to the factory default.)

5. Press the [DSP/SEL] knob. The "**MENU**" icon returns to appear continuously.
6. Press and hold the [F] button for one second to save the new setting and return to normal operation.

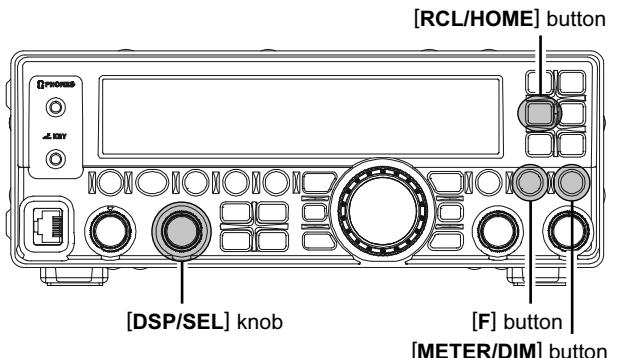


CW MODE OPERATION

CW PITCH ADJUSTMENT

You may adjust the center frequency of the receiver passband, as well as the pitch of your offset CW carrier via the Menu Item "CWPITCH". Available tone selections are 400 Hz through 800 Hz, in 100 Hz step.

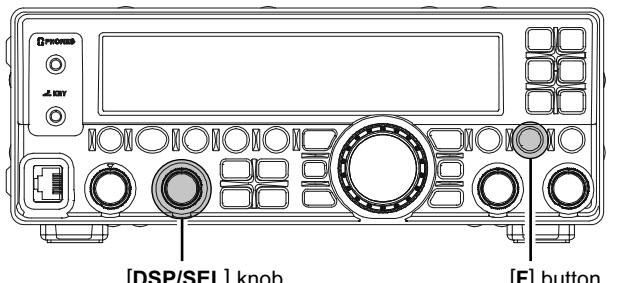
1. Press and hold the [F] button for one second to enter the Menu mode. The "MENU" icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select the menu item "CWPITCH".
3. Press the [DSP/SEL] knob to enable adjustment of this menu item. The "MENU" icon will be blinking.
4. While pressing and holding the [METER/DIM] button, rotate the [DSP/SEL] knob to set the desired pitch frequency.
(You may press the [RCL/HOME] button to reset the pitch frequency to the factory default.)
5. Press the [DSP/SEL] knob. The "MENU" icon returns to appear continuously.
6. Press and hold the [F] button for one second to save the new setting and return to normal operation.



CW TRAINING FEATURE

The **FT-450D** provides a unique CW Training feature, which sends random Morse Code five-character groups via the sidetone (heard in the speaker), so you can improve your CW proficiency whether or not the bands are open.

1. Press and hold the [F] button for one second to enter the Menu mode. The "MENU" icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select the menu item "CWTRAIN".
3. Press the [DSP/SEL] knob to enable adjustment of this menu item. The "MENU" icon will be blinking.
4. Rotate the [DSP/SEL] knob to select the training mode:
N: Numeric character only
A: Alphabet character only
M: Numeric and Alphabet characters (Mixed)
5. Press the [F] button to begin generation of the five character code groups (CW sidetone only, does not key the transmitter).
6. When the code group is completed, the "Answer" will appear on the display.
7. Press the [DSP/SEL] knob. The "MENU" icon returns to appear continuously.
8. Press the [F] button to generate another code group, as above.
9. To disable the CW Training feature, press and hold the [F] button for one second to return to normal operation.



NOTE:

- You may adjust the Morse Speed via Menu Item "CWSPEED".
- You may adjust the sidetone volume level via Menu Item "CWSTONE".

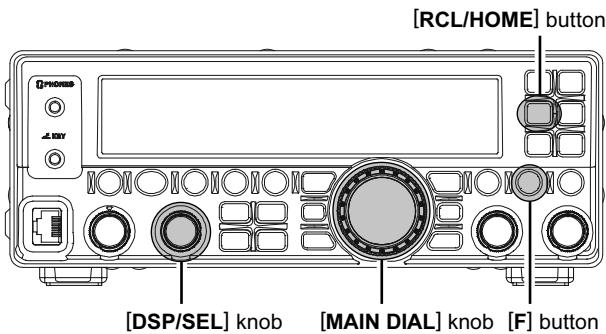
CW MODE OPERATION

BEACON FEATURE

The **FT-450D**'s unique "Beacon" feature allows you to set up the transceiver to send a repetitive message. For example, on a DX-pedition, the **FT-450D** beacon might be activated on a 50 MHz frequency, to alert DXers to possible band openings.

BEACON TEXT STORAGE

1. Press and hold the [**F**] button for one second to enter the Menu mode again. The "**MENU**" icon will appear on the display.
2. Rotate the [**DSP/SEL**] knob to select the menu item "BCN TXT".
3. Press the [**DSP/SEL**] knob to enable adjustment of this menu item. The "**MENU**" icon will be blinking.
4. Rotate the [**MAIN DIAL**] knob to select "1:1---".
5. Rotate the [**DSP/SEL**] knob one click clockwise to enable storage of the Beacon Text.
6. Rotate the [**MAIN DIAL**] knob to select the first character (number or letter) in the Beacon Text you wish to store. Then rotate the [**DSP/SEL**] knob one click clockwise to move to the next character. Available characters are A - Z, 0 - 9, /, →, space and @ character.
7. Repeat step 6 as many times as necessary to complete the Beacon Text.
 - If the Beacon Text is more than 40 characters long, but less than 79, set the last (40th) character to be "→," press the [**DSP/SEL**] knob twice, then rotate the [**MAIN DIAL**] knob to select "2:2---". Now repeat step 6.
 - If the Beacon Text is more than 79 characters long, but less than 118 characters may be stored. In this case, set the final character slot in "2:" to be "→", press the [**DSP/SEL**] knob twice, and then rotate the [**MAIN DIAL**] knob to select "3:3---". Now repeat step 6.
8. Press and hold the [**F**] button for one second to save the new setting and return to normal operation.



SET THE BEACON INTERVAL TIME

1. Press and hold the [**F**] button for one second to enter the Menu mode again. The "**MENU**" icon will appear on the display.
2. Rotate the [**DSP/SEL**] knob to select the menu item "BCN TIM".
3. Press the [**DSP/SEL**] knob to enable adjustment of this menu item. The "**MENU**" icon will be blinking.
4. Rotate the [**DSP/SEL**] knob to select the interval time (between message and message) Available selections are 1 - 255 second or off.
5. Press the [**DSP/SEL**] knob. The "**MENU**" icon returns to appear continuously.
6. Press and hold the [**F**] button for one second to save the new setting and return to normal operation.

CW MODE OPERATION

BEACON FEATURE

BEACON TRANSMISSION (ON THE AIR)

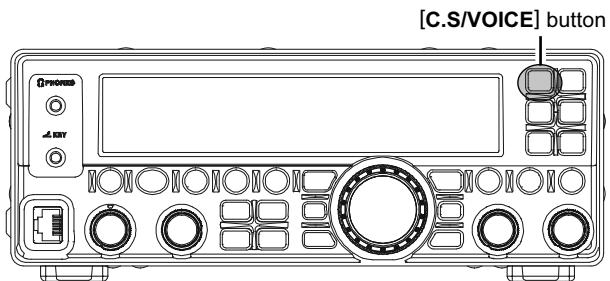
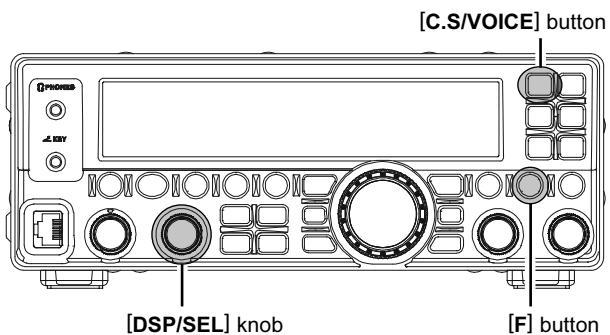
1. Press and hold the [F] button for one second to enter the Menu mode. The “**MENU**” icon will appear on the display.
 2. Rotate the [DSP/SEL] knob to select menu item “PNL-C.S.”.
 3. Press the [DSP/SEL] knob to enable adjustment of this menu item. The “**MENU**” icon will be blinking.
 4. Rotate the [DSP/SEL] knob to select “PLAY1”.
 5. Press the [DSP/SEL] knob. The “**MENU**” icon returns to appear continuously.
 6. Press and hold the [F] button for one second to save the new setting and return to normal operation.
 7. Set the operating mode to CW.
 8. Press the [C.S/VOICE] button to activate the Beacon Feature (transmit the CW Beacon).
- The “PLAY1” notation appears on the display while sending the beacon, and the “BEACON” notation appears on the display between transmissions.

To disable the transmission from the Beacon, press the [C.S/VOICE] button again.

MANUAL BEACON TRANSMISSION

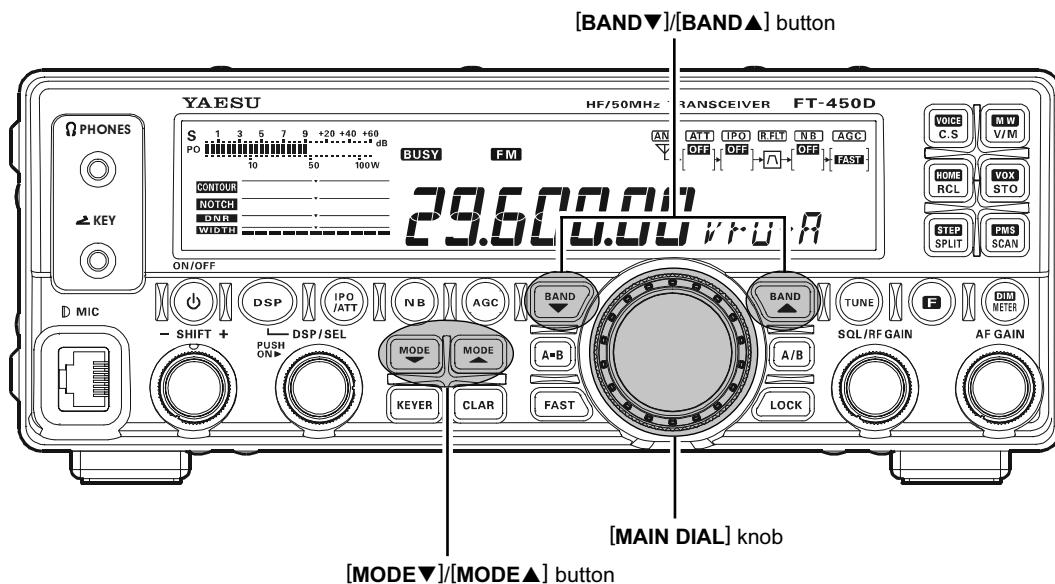
You may also send the Beacon text manually. If this is done, all three “Beacon” messages may be used as a traditional CW message keyer. To do this:

1. Repeat the “Set the Beacon Interval Time” procedure described previously, rotating the [DSP/SEL] knob to select “off” in step 4.
2. Repeat the “Beacon Transmission (On the Air)” procedure, rotating the [DSP/SEL] knob to select “PLAY2” if you wish to send the message manually which is stored in bank “1”, “2”, or “PLAY3” if you wish to send the message manually which is stored in bank “3” in step 4.
3. Press the [C.S/VOICE] button to activate the Beacon Feature (transmit the CW Beacon).



FM MODE OPERATION

BASIC OPERATION



1. Press the [BAND▼]/[BAND▲] buttons to select the 28 MHz or 50 MHz.
Note: FM is only used in the 28 MHz and 50 MHz Amateur bands covered in the **FT-450D**. Please do not use FM on any other bands.
2. Press the [MODE▼]/[MODE▲] buttons to select the FM mode.
3. Rotate the [MAIN DIAL] knob to adjust the operating frequency.
If you use the **MH-31A8J** (or **MD-100A8X**: option), you may adjust the operating frequency by the [UP]/[DWN] buttons on the microphone.
4. Press the microphone's **PTT** (Push To Talk) switch to begin transmission. Speak into the microphone in a normal voice level.
The “**T X**” icon will appear in the display, confirming that transmission is in progress.
5. Release the **PTT** switch at the end of your transmission. The transceiver will return to the receive mode.

NOTE:

- In the FM mode, the squelch circuit is set to the threshold point automatically. However, when turn the [SQL/RF GAIN] knob counter-clockwise, the squelch circuit is turned off. Keep the [SQL/RF GAIN] knob always clockwise position. You may change the [SQL/RF GAIN] knob from the RF GAIN function to the squelch function via Menu item SQL/RFG.
- At the factory, a microphone gain has been programmed that should be satisfactory for the supplied **MH-31A8J** Hand Microphone. If you use an after-market microphone, you may wish to set a different Microphone Gain Level, described previously (Microphone Gain Level Adjustment: see page 39)

NOTICE

Regarding of the [DSP/SEL] knob

The [DSP/SEL] knob is used for operating various functions depending on the situation.

If you can not change the frequency/memory channel by tuning the [DSP/SEL] knob, the [DSP/SEL] knob is selected to operate of one of the DSP functions.

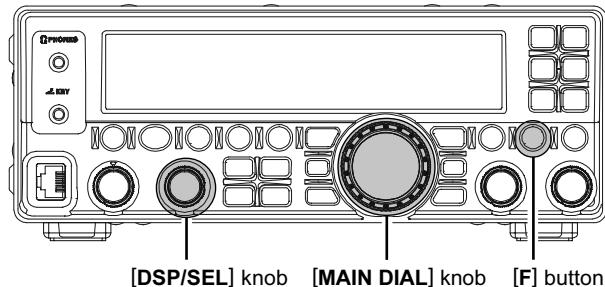
In this case, press the [DSP] button several times until the “>” icon disappears from the DSP Graphic Display.

FM MODE OPERATION

REPEATER OPERATION

The FT-450D may be operated on 29 MHz and 50 MHz repeaters. Use this procedure to set the repeater shift direction, and the CTCSS squelch mode & tone.

1. Press and hold the [F] button for one second to enter the Menu mode again. The “**MENU**” icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select the menu item “RPT”.
3. Press the [DSP/SEL] knob to enable adjustment of this menu item. The “**MENU**” icon will change to blink.
4. Rotate the [DSP/SEL] knob to select the desired repeater shift direction. Available selections are -SHIFT, SIMPLEX, and +SHIFT.
5. Press the [DSP/SEL] knob. The “**MENU**” icon returns to appear continuously.
6. Rotate the [DSP/SEL] knob to select the menu item “SQL TYP”.
7. Press the [DSP/SEL] knob to enable adjustment of this menu item. The “**MENU**” icon will be blinking.
8. Rotate the [DSP/SEL] knob to select the desired CTCSS mode. If you just need to send the uplink encoding tone, select “ENC”. For encode/decode operation, choose “ENC DEC” instead.
9. Press the [DSP/SEL] knob. The “**MENU**” icon returns to appear continuously.
10. Rotate the [DSP/SEL] knob to select the menu item “TONE F”.
11. Press the [DSP/SEL] knob to enable adjustment of this menu item. The “**MENU**” icon will be blinking.
12. Rotate the [DSP/SEL] knob to select the desired CTCSS tone to be used. A total of 50 standard CTCSS tones are provided.
13. Press the [DSP/SEL] knob. The “**MENU**” icon returns to appear continuously.
14. Press and hold the [F] button for one second to save the new setting and return to normal operation.
15. Rotate the [MAIN DIAL] to the output frequency (downlink) from the repeater.
16. Close the microphone's PTT switch to begin transmission. You will observe that the frequency has shifted to correspond to the programming you set up in the previous steps. Speak into the microphone in a normal voice level, and release the PTT switch to return to the receive mode.



CTCSS TONE FREQUENCY (Hz)							
67.0	69.3	71.9	74.4	77.0	79.7	82.5	85.4
88.5	91.5	94.8	97.4	100.0	103.5	107.2	110.9
114.8	118.8	123.0	127.3	131.8	136.5	141.3	146.2
151.4	156.7	159.8	162.2	165.5	167.9	171.3	173.8
177.3	179.9	183.5	186.2	189.9	192.8	196.6	199.5
203.5	206.5	210.7	218.1	225.7	229.1	233.6	241.8
250.3	251.4	-	-	-	-	-	-

ADVICE:

The conventional repeater shift used on 29 MHz is 100 kHz, while on the 50 MHz band the shift may vary between 500 kHz and 1.7 MHz (or more). To program the proper repeater shift, use Menu Item “RPT SFT”.

FM MODE OPERATION

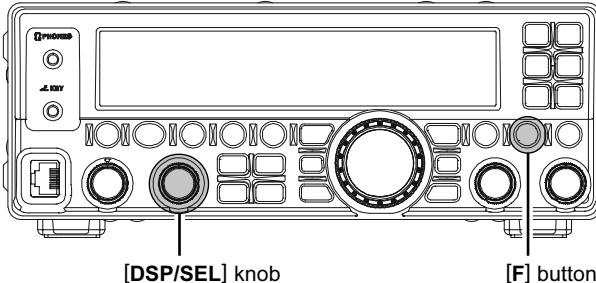
TONE SQUELCH OPERATION

You may also use "Tone Squelch" whereby your receiver will be kept silent until an incoming signal bearing a matching CTCSS tone is received. Your receiver's squelch will then open in response to the reception of the required tone.

1. Press and hold the [F] button for one second to enter the Menu mode again. The "**MENU**" icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select menu item "SQL TYP".
3. Press the [DSP/SEL] knob to enable adjustment of this menu item. The "**MENU**" icon will be blinking.
4. Rotate the [DSP/SEL] knob to select the "ENC DEC".
5. Press the [DSP/SEL] knob. The "**MENU**" icon returns to appear continuously.
6. Rotate the [DSP/SEL] knob to select menu item "TONE F", then press the [DSP/SEL] knob to enable adjustment of this menu item.
7. Rotate the [DSP/SEL] knob to select the desired CTCSS tone to be used. A total of 50 standard CTCSS tones are provided.
8. Press the [DSP/SEL] knob. The "**MENU**" icon returns to appear continuously.
9. Press and hold the [F] button for one second to save the new setting and return to normal operation.

When Tone Squelch is activated, the "**ENC DEC**" icon appears in the display.

CTCSS TONE FREQUENCY (Hz)							
67.0	69.3	71.9	74.4	77.0	79.7	82.5	85.4
88.5	91.5	94.8	97.4	100.0	103.5	107.2	110.9
114.8	118.8	123.0	127.3	131.8	136.5	141.3	146.2
151.4	156.7	159.8	162.2	165.5	167.9	171.3	173.8
177.3	179.9	183.5	186.2	189.9	192.8	196.6	199.5
203.5	206.5	210.7	218.1	225.7	229.1	233.6	241.8
250.3	251.4	-	-	-	-	-	-



FM MODE OPERATION

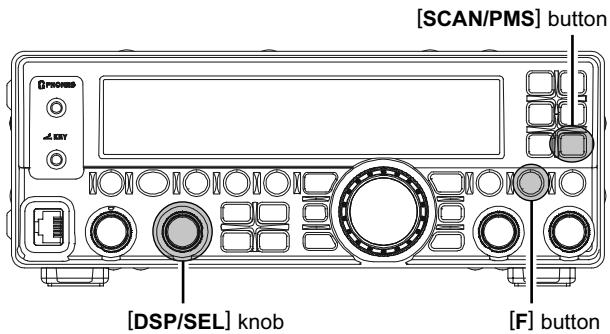
TONE SEARCH SCANNING

In operating situations where you don't know the CTCSS tone being used by another station or stations, you can command the radio to listen to the incoming signal and scan in search of the tone being used. Two things must be remembered in this regard:

- You must be sure that your repeater uses the same tone type (CTCSS).
- Some repeaters do not pass the CTCSS tone; you may have to listen to the station(s) transmitting on the repeater uplink (input) frequency in order to allow Tone Search Scanning to work.

To scan for the tone in use:

1. Set the radio up for CTCSS operation (see the previous discussion). The “**ENC DEC**” icon will appear on the display.
2. Press and hold the **[F]** button for one second to enter the Menu mode. The “**MENU**” icon will appear on the display.
3. Rotate the **[DSP/SEL]** knob to select the menu item “TONE F”.
4. Press the **[DSP/SEL]** knob to enable adjustment of the selected Menu Item. The “**MENU**” icon will be blinking.
5. Press the **[SCAN/PMS]** button to start scanning for the incoming CTCSS tone.
6. When the radio detects the correct tone, it will halt on that tone, and audio will be allowed to pass.
7. Press the **[DSP/SEL]** knob to lock in that tone.
8. Press and hold the **[F]** button for one second to return to normal operation.



NOTE:

If the Tone Scan feature does not detect a tone, it will continue to scan indefinitely. When this happens, it may be that the other station is not sending any tone. You can press the **[SCAN/PMS]** button to halt the scan at any time.

MEMORY OPERATION

CONVENIENT MEMORY FUNCTIONS

The FT-450D contains 500 regular memories, labeled "MEM-001" through "MEM-500", two Home channels, one for the HF band and another for the 50 MHz band, two special programmed limit memory pairs, labeled "MEM-P1L/MEM-P1U" and "MEM-P2L/MEM-P2U", one QMB (Quick Memory Bank) memory, one Alaska Emergency Frequency Channel (5167.5 kHz), and five 60-meter (5 MHz) band channels (US version only). and seven 60-meter (5 MHz) band channels (UK version only). Each (except the Alaska Emergency Frequency Channel and 60-meter Band channels, which are fixed.) stores various settings, in addition to the frequency and mode (See below). By default, the 500 regular memories are contained in one group; however, they can be arranged in up to 10 separate groups, if desired.

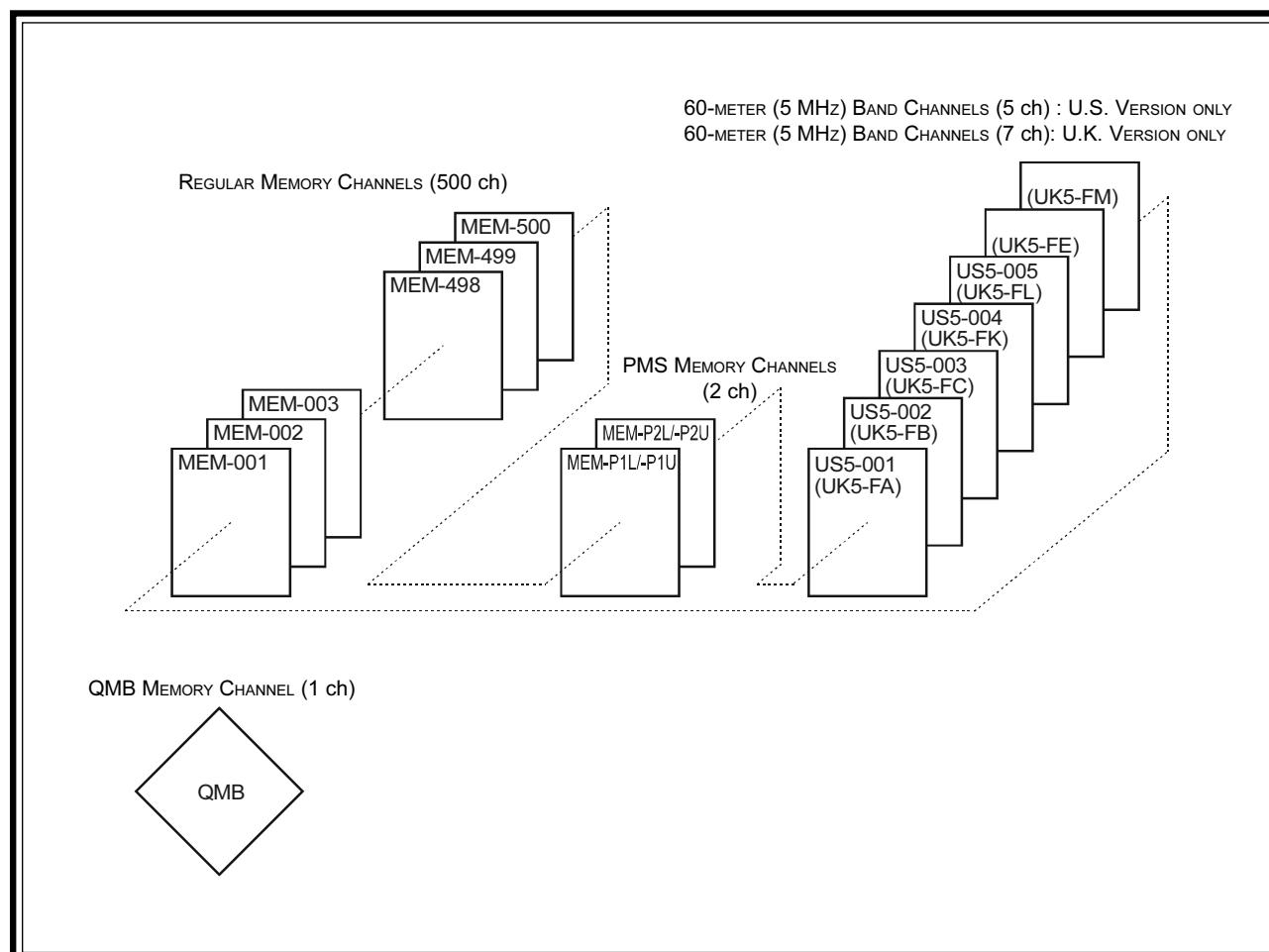
Quick Point:

The FT-450D's memory channels store the following data:

- Operating Frequency
- Operating Mode
- NARROW / WIDE FM bandwidth status
- ATT status
- IPO status
- CONTOUR status and its Peak Frequency
- DSP Noise Reduction (DNR) status and its Reduction algorithm selection.
- DSP Notch filter (NOTCH) status
- Repeater Shift Direction
- CTCSS Tone Frequency

IMPORTANT NOTE:

On a rare occasion the memory data may be lost or corrupted due to static electricity, electrical noise or erroneous operation. Parts changes or repairs may cause memory loss. Be sure to write down or record your data so you will be able to restore it.



MEMORY GROUPS

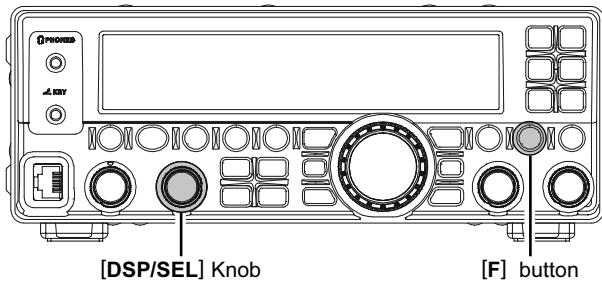
Memory channels may be organized into as many as 10 convenient groups, for easy identification and selection. For example, you might want to set aside memory groups for AM BC stations, shortwave broadcast stations, contest frequencies, repeater frequencies, and PMS limits, or any other groupings you like.

Each memory group is capable of holding up to 50 memory channels (the Group size is fixed). When a memory channel is grouped, the channel numbers change to correspond to the chart below:

Memory Group Assignment:

1. Press and hold the [F] button for one second to enter the Menu mode again. The “**MENU**” icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select the menu item “MEM GRP”.
3. Press the [DSP/SEL] knob to enable adjustment of this menu item. The “**MENU**” icon will be blinking.
4. Rotate the [DSP/SEL] knob to select “ON”.
5. Press the [DSP/SEL] knob. The “**MENU**” icon returns to appear continuously.
6. Press and hold the [F] button for one second to save the new setting and return to normal operation.

To cancel Memory Group operation, repeat above steps, choosing “OFF” in step 4.



Memory Channel Number	
Group Memory "OFF"	Group Memory "ON"
MEM-001 ~ MEM-050	M-01-01 ~ M-01-50
MEM-051 ~ MEM-100	M-02-01 ~ M-02-50
MEM-101 ~ MEM-150	M-03-01 ~ M-03-50
MEM-151 ~ MEM-200	M-04-01 ~ M-04-50
MEM-201 ~ MEM-250	M-05-01 ~ M-05-50
MEM-251 ~ MEM-300	M-06-01 ~ M-06-50
MEM-301 ~ MEM-350	M-07-01 ~ M-07-50
MEM-351 ~ MEM-400	M-08-01 ~ M-08-50
MEM-401 ~ MEM-450	M-09-01 ~ M-09-50
MEM-450 ~ MEM-500	M-10-01 ~ M-10-50
MEM-P1L ~ MEM-P2U	M-11-1L ~ M-11-2U
MEM-EMG	M-12-EM
US5-001 ~ US5-005 (UK5-FA ~ UK5-FM)*	M-13-01 ~ M-13-05 (M-13-FA ~ M-13-FM)*

*: UK version only.

MEMORY OPERATION

REGULAR MEMORY OPERATION

The Regular Memory of the **FT-450D** allows storage and recall of up to 500 memories, each storing frequency, mode, and a wide variety of status information detailed previously. Memories may be organized into as many as ten Memory Groups, and additionally you get two pairs of band-limit (PMS) memories along with one QMB (Quick Memory Bank) memory and two Home channels.

Memory Storage

1. In the VFO mode, select the desired frequency, mode, and status the way you want to have it stored.
2. Press the **[F]** button followed by the **[V/M/MW]** button.

The blinking current memory channel number will be shown on the display, and the contents of the current memory channel will be shown on the display.

If there is no action by you within 90 second from releasing the **[V/M/MW]** button the Memory Storage procedure is canceled.

The memory storage procedure is canceled unless you operate it within 90 seconds.

3. Rotate the **[DSP/SEL]** knob to select the memory channel in which you wish to store the data. If you have selected a channel on which data is already stored, that frequency will appear on the display.
4. Press the **[V/M/MW]** button momentarily to store the frequency and other data into the selected memory channel. A beep will confirm that you have held the **[V/M/MW]** button.

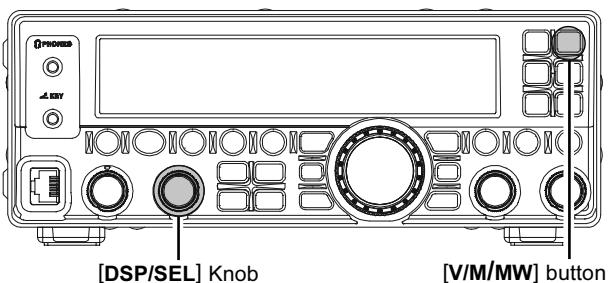
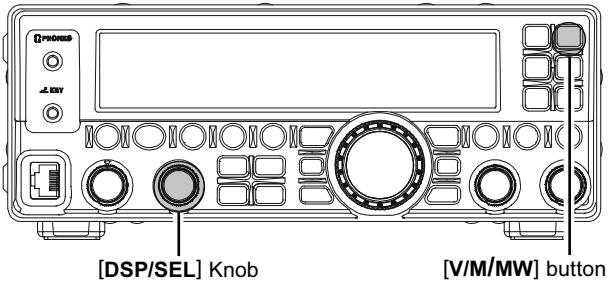
You may over write new data into a channel on which data is already stored.

Memory Channel Recall

1. Press the **[V/M/MW]** button, if necessary, to enter the Memory mode. A memory channel number will appear in the display.
2. Rotate the **[DSP/SEL]** knob to select the desired memory channel.

Advice:

To work within a particular Memory Group, press the **[DSP/SEL]** button. Then rotate the **[DSP/SEL]** knob to select the desired Memory Group. Now press the **[DSP/SEL]** button again. You may now choose the memory channel within the selected Memory Group.



REGULAR MEMORY OPERATION

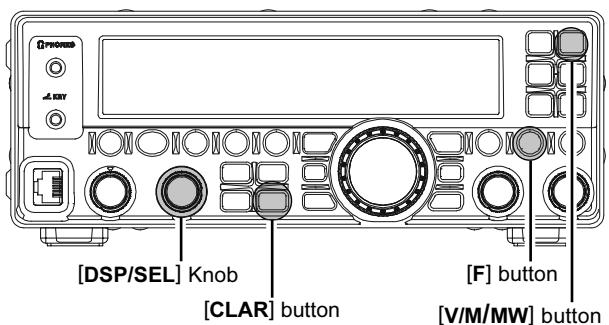
Erasing Memory Channel Data

1. Press the [V/M/MW] button, if necessary, to enter the Memory mode.
2. Press the [F] button followed by the [V/M/MW] button.
The blinking current memory channel number will be shown on the display, and the contents of the current memory channel will be shown on the display.
3. Rotate the [DSP/SEL] knob to select the memory channel that you would like to erase.
4. Press the [CLAR] button to erase the contents of the selected memory channel.
5. Press the [V/M/MW] button momentarily to erase the selected memory channel. The display will revert to memory channel 1.

ADVICE:

After erasure, only the memory channel number will remain. The frequency data will disappear from the display.

If you make a mistake and wish to restore the memory's contents, just repeat above steps.



Memory Tune Operation

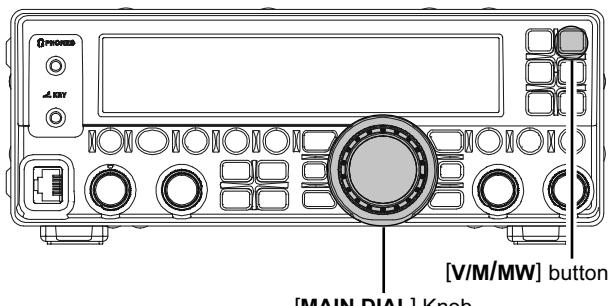
You may freely tune off of any memory channel in the "Memory Tune" mode, this is similar to VFO operation. So long as you do not over-write the contents of the current memory, Memory Tune operation will not alter the contents of the memory channel.

1. Press the [V/M/MW] button, if necessary, to enter the Memory mode.
2. Rotate the [MAIN DIAL] knob. You will now observe that the memory channel's frequency is changing.

The "M-TUNE" notation will replace the Memory Channel Number, indicating you are in the "Memory Tune" mode.

During Memory Tune operation, you may change operating modes, and engage and offset the Clarifier, if desired.

3. Press the [V/M/MW] button momentarily to return to the originally-memorized frequency of the current memory channel. One more press of the [V/M/MW] button will return you to VFO operation.



MEMORY OPERATION

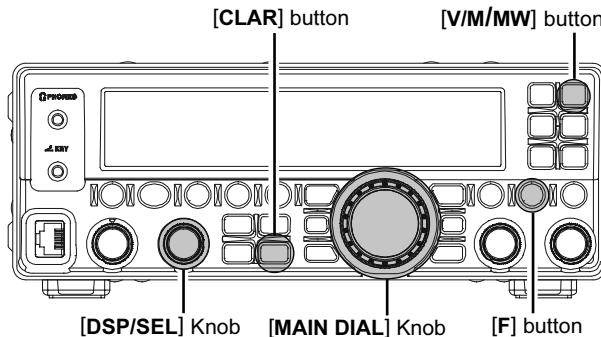
REGULAR MEMORY OPERATION

Labeling Memories

You may wish to append an Alphanumeric "Tag" (label) to a memory or memories, to aid in recollection of the channel's use (such as a club name, etc.). This is easily accomplished using the Menu mode.

1. Recall the memory channel that you wish to append a label.
2. Press and hold the [F] button for one second to enter the Menu mode again. The "**MENU**" icon will appear on the display.
3. Rotate the [DSP/SEL] knob to select the menu item "MEM TAG".
4. Press the [DSP/SEL] knob to enable adjustment of this menu item. The "**MENU**" icon will blink, and "MEM TAG" will be replaced with "TAG-OFF"
5. Press the [F] button to display the previously stored label (in the factory default, all memory channels are stored with the memory channel number as the label).
6. Rotate the [MAIN DIAL] knob to select the first digit of the desired label.
7. Rotate the [DSP/SEL] knob one step clockwise to move to the next character.
8. Repeat steps 6 and 7 to program the remaining letters, numbers, or symbols of the desired label. Seven characters may be used in the creation of a label.
9. If you make a mistake, rotate the [DSP/SEL] knob counter-clockwise to move back the cursor, then re-enter the correct letter, number, or symbol. You may press the [CLAR] button to clear the current digit label.
10. When you have completed the creation of the label, press the [DSP/SEL] knob. The "**MENU**" icon returns to appear continuously.
11. Press and hold the [F] button for one second to save the new setting and return to normal operation.

In Memory mode operation, the display indicates the channel numbers while selecting the memory channels, then the display will switch to the Alphanumeric "Tag" (label) after two seconds.

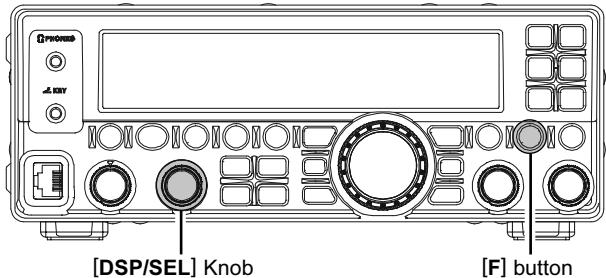


MEMORY OPERATION

REGULAR MEMORY OPERATION

To disable the Alphanumeric "Tag" (label) display.

1. Recall the memory channel that you wish to disable the Alphanumeric "Tag" (label).
2. Press and hold the [F] button for one second to enter the Menu mode again. The "**MENU**" icon will appear on the display.
3. Rotate the [DSP/SEL] knob to select the menu item "MEM TAG".
4. Press the [DSP/SEL] knob to enable adjustment of this menu item. The "**MENU**" icon will blink and the "MEM TAG" notation will be replaced with the Alphanumeric "Tag" (label).
5. Press the [F] button. The "**MENU**" icon returns to appear continuously and the Alphanumeric "Tag" (label) will be replaced with the "TAG-OFF" notation.
6. Press and hold the [F] button for one second to save the new setting and return to normal operation.



MEMORY OPERATION

HOME CHANNEL MEMORIES

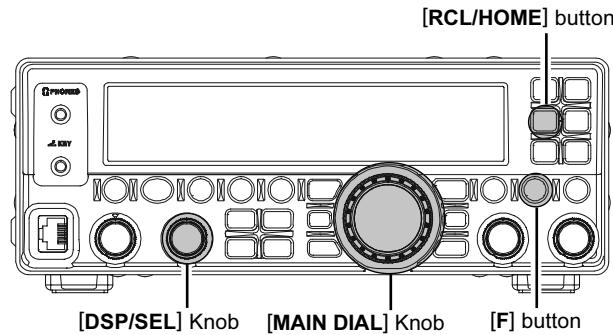
Two one-touch "Home" channels are available, for special frequencies you use often.

The HF band Special "Home" channel default is 29.300 MHz or 29.600 MHz, FM. The 50 MHz band "Home" channel default is 50.100 MHz, 51.000 MHz, or 52.525 MHz, FM (depends on the transceiver's version).

Home Channel Recall

1. Press the [F] button, followed by the [RCL/HOME] button to recall the Home Channel on the band group where you currently are operating (HF or 50 MHz). The "HOME" notation appears in the display.
2. Press the [F] button, followed by the [RCL/HOME] button to return to the previous-used frequency (either a VFO or a memory channel).

The transceiver switches to VFO mode if either the [DSP/SEL] knob or [MAIN DIAL] knob is turned. (In AM/FM modes the menu item "A&FDIAL" should be set to "ON" for the [MAIN DIAL] to be active).



Home Channel Frequency Change

The factory default for the Home Channel is 29.300 MHz, FM for HF band and 51.000 MHz, FM for 50 MHz band. You can re-program the Home Channel in a manner identical to that used for the regular memories:

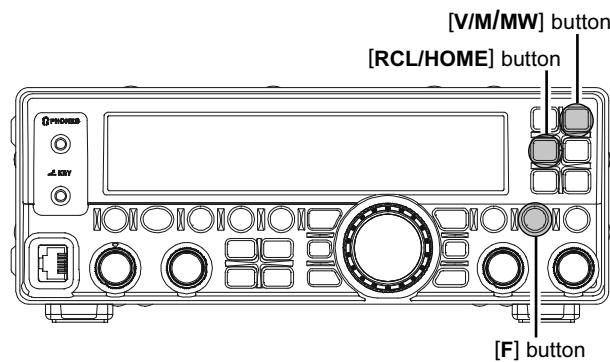
1. In the VFO mode, select the desired frequency, mode, and status the way you want to have it stored.
2. Press the [F] button followed by the [V/M/MW] button.

The blinking current memory channel number will be shown on the display, and the contents of the current memory channel will be shown on the display.

If there is no action by you within 10 second from releasing the [V/M/MW] button the Memory Storage procedure is canceled.

The memory storage procedure is canceled unless you operate it within 10 seconds

3. Press the [RCL/HOME] button momentarily to store the frequency and other data into the Home Channel. A double beep will confirm that you have held the [RCL/HOME] button in long enough.



QMB (QUICK MEMORY BANK)

The Quick Memory Bank is independent from the regular and PMS memories. You can quickly store operating parameters for later recall.

Storage

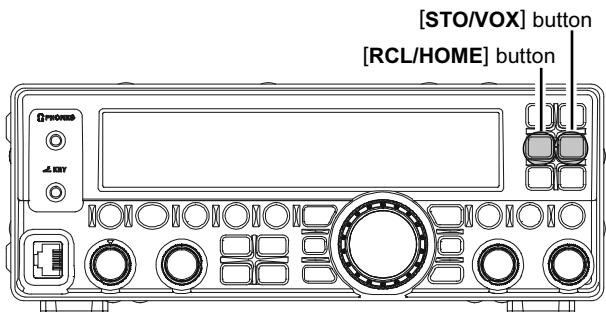
1. Tune to the desired frequency on the VFO mode.
2. Press the [STO/VOX] button momentarily. The “beep” will confirm that the contents of the VFO have been written to the QMB memory.

Recall

1. Press the [RCL/HOME] button. The QMB channel's data will be shown on the display.
2. Press the [RCL/HOME] button to return to the previous-used frequency (either a VFO or a memory channel).

Advice:

Rotating the [MAIN DIAL] knob, or changing the operating mode, will place the transceiver in the “Memory Tune” mode (The “QMB” notation will replace the “MT-QMB” in the display), which is a temporary “pseudo-VFO” method of tuning off of a stored memory channel. If you do not over-write the contents of the current memory channel, the original contents will not be disturbed by the initiation of Memory Tune operation. Press the [RCL/HOME] button to return original QMB frequency and/or operating mode.



SCANNING OPERATION

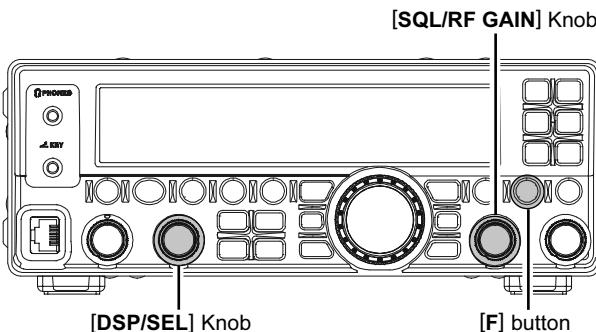
You may scan either the VFO or the memories of the **FT-450D**, and the radio will halt the scan on any station with a signal strong enough to open the receiver's squelch.

VFO AND MEMORY SCANNING

Preparation

When operating the Scanning feature, set the configuration of the **[SQL/RF GAIN]** knob to "Squelch" via the Menu Item "SQL/RFG".

1. Press and hold the **[F]** button for one second to enter the Menu mode again. The "**MENU**" icon will appear on the display.
2. Rotate the **[DSP/SEL]** knob to select the menu item "SQL/RFG".
3. Press the **[DSP/SEL]** knob to enable adjustment of this menu item. The "**MENU**" icon will be blinking.
4. Rotate the **[DSP/SEL]** knob to select "SQL" to assign the Squelch feature to the **[SQL/RF GAIN]** knob.
5. Press the **[DSP/SEL]** knob. The "**MENU**" icon returns to appear continuously.
6. Press and hold the **[F]** button for one second to save the new setting and return to normal operation.



VFO AND MEMORY SCANNING

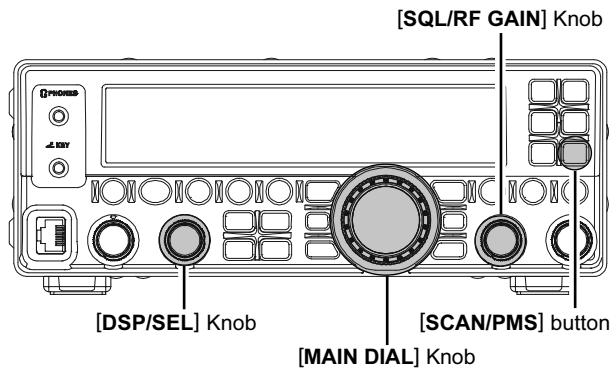
VFO/Memory Scan

1. Rotate the [SQL/RF GAIN] knob just to the point where the noise is silenced and the “**BUSY**” indicator on the display turns off.
2. Press the [SCAN/PMS] key to initiate upward scanning (toward higher frequencies or higher memory channel numbers).
3. If you want to change direction of the scan while it is underway, rotate the [MAIN DIAL] knob one click in the opposite direction (in this case, one click counter-clockwise). You will see the scanner reverse direction and scan down in frequency.
You may change the direction of the scanner by pressing and holding the microphone’s [UP]/[DWN] key for one second, if you are using the **MH-31A8J** Hand Microphone or optional **MD-100A8X** Desktop Microphone.
4. In FM/AM mode, when the scanner encounters a signal strong enough to open the squelch, the scanner will halt for five seconds, after which scanning will resume.
In the SSB/CW and SSB-based Data modes, when the scanner encounters a signal strong enough to open the squelch, the scanner will step across the signal very slowly, giving you time to stop the scan, if you like.
5. To stop the scanner, press the [SCAN/PMS] button or **PTT** switch.

ADVICE:

You may select the manner in which the scanner resumes while it has paused on a signal, using Menu Item “SCN RES”. The default “5Sec” setting will cause the scanner to resume scanning after five seconds; you may change it, however, to resume only after the carrier has dropped out, if you like. See page 85.

During Memory Group operation, only the channels within the current Memory Group will be scanned.



PROGRAMMABLE MEMORY SCANNING (PMS)

To limit scanning (and manual tuning) within a particular frequency range, you can use the Programmable Memory Scanning (PMS) feature, which utilizes two special-purpose memory pairs ("MEM-P1L/MEM-P1U" and "MEM-P2L/MEM-P2U"). The PMS feature is especially useful in helping you to observe any operating sub-band limits, which apply to your Amateur license class.

1. Store the Lower and Upper tuning/scanning limit frequencies into the memory pair "MEM-P1L" and "MEM-P1U", respectively, or "MEM-P2L" and "MEM-P2U". See page 58 for details regarding memory storage.
2. Press the [F] button, followed by the [SCAN/PMS] button.
3. Rotate the [DSP/SEL] knob to select "PMS-1" "PMS2" or "PMS1+2".

PMS-1: The scanner will be limited within the frequency range programmed in the memory pair "MEM-P1L/MEM-P1U".

PMS-2: The scanner will be limited within the frequency range programmed in the memory pair "MEM-P2L/MEM-P2U".

PMS-1+2: The scanner will be limited within the frequency ranges programmed by both memory pairs ("MEM-P1L/MEM-P1U" and "MEM-P2L/MEM-P2U").

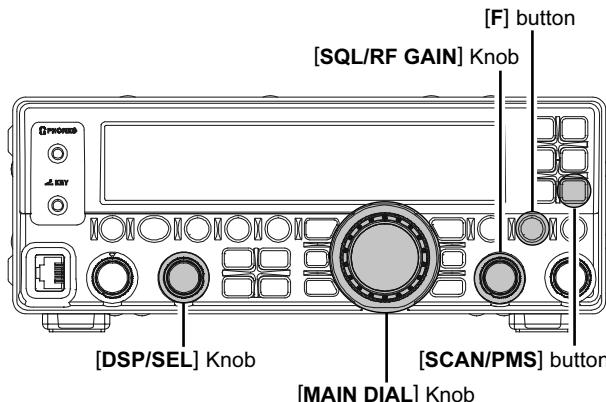
If a memory pair is vacant, the PMS-1+2 selection is not available.

4. Press the [SCAN/PMS] button.
5. Rotate the [SQL/RF GAIN] knob just to the point where the noise is silenced and the "**BUSY**" indicator on the display turns off.
6. Press the [SCAN/PMS] key to initiate upward scanning (toward higher frequencies or higher memory channel numbers).
7. If you want to change direction of the scan while it is underway, rotate the [MAIN DIAL] knob one click in the opposite direction (in this case, one click counter-clockwise). You will see the scanner reverse direction and scan down in frequency.

You may change the direction of the scanner by pressing and holding the microphone's [UP]/[DWN] key for one second, if you are using the **MH-31A8J** Hand Microphone or optional **MD-100A8x** Desktop Microphone.

8. In FM/AM mode, when the scanner encounters a signal strong enough to open the squelch, the scanner will halt for five seconds, after which scanning will resume.

In the SSB/CW and SSB-based Data modes, when the scanner encounters a signal strong enough to open the squelch, the scanner will step across the signal very slowly, giving you time to stop the scan, if you like.



ADVICE:

You may select the manner in which the scanner resumes while it has paused on a signal, using Menu Item "SCN RES". The default "5Sec" setting will cause the scanner to resume scanning after five seconds; you may change it, however, to resume only after the carrier has dropped out, if you like. See page 85.

OPERATION ON ALASKA EMERGENCY FREQUENCY: 5167.5 kHz (U.S. VERSION ONLY)

Section 97.401(d) of the regulations governing amateur radio in the United States permit emergency amateur communications on the spot frequency of 5167.5 kHz by stations in (or within 92.6 km of) the state of Alaska. This frequency is only to be used when the immediate safety of human life and/or property are threatened, and is never to be used for routine communications.

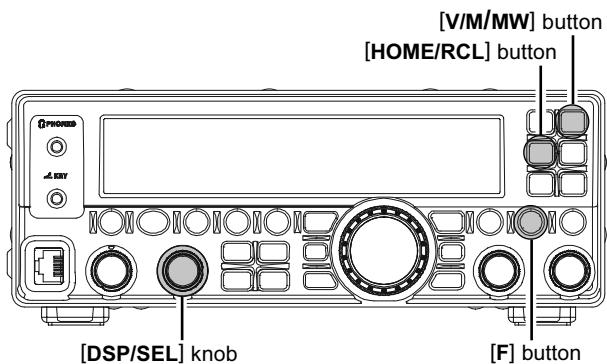
The **FT-450D** includes the capability for transmission and reception on 5167.5 kHz under such emergency conditions.

Preparation

1. Press and hold the [F] button for one second to enter the Menu mode again. The “**MENU**” icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select the menu item “EMERGEN”.
3. Press the [DSP/SEL] knob to enable adjustment of this menu item. The “**MENU**” icon will be blinking.
4. Rotate the [DSP/SEL] knob to select “ON”.
5. Press the [DSP/SEL] knob. The “**MENU**” icon returns to appear continuously.
6. Press and hold the [F] button for one second to save the new setting and return to normal operation.

Operation

1. Press the [**V/M/MW**] button, if necessary, to enter the Memory mode. A memory channel number will appear in display.
2. Rotate the [DSP/SEL] knob to select the emergency channel (“MEM-EMG”), which is found between channels “MEM-P2U” and “US5-001.” If you partitioned your memory channels into Memory Groups via Menu Item “MEM GRP”, then select the memory channel group “M-12-EM” which is the emergency channel.
3. To exit from emergency channel and return to the VFO mode, just press the [**V/M/MW**] button.



Note:

- The receive-mode CLARIFIER functions normally while using this frequency, but variation of the transmit frequency is not possible. Activation of “MEM-EMG” or “M-12-EM” does not enable any other out-of-amateur-band capability on the transceiver. The full specifications of the **FT-450D** are not necessarily guaranteed on this frequency, but power output and receiver sensitivity should be fully satisfactory for the purpose of emergency communication.
- In an emergency, note that a half-wave dipole cut for this frequency should be approximately 45'3" on each leg (90'6" total length). Emergency operation on 5167.5 kHz is shared with the Alaska-Fixed Service. This transceiver is not authorized for operation, under the FCC's Part 87, for aeronautical communications.

MISCELLANEOUS SETTINGS

DISPLAY SETTINGS

Display Dimmer

You may adjust the brightness level with the five steps.

1. Press the [F] button, followed by the [METER/DIM] button to enable adjustment of display dimmer.
2. Rotate the [DSP/SEL] knob to select a comfortable brightness level (1 - 8).
3. Press the [METER/DIM] button to save the new setting and return to normal operation.

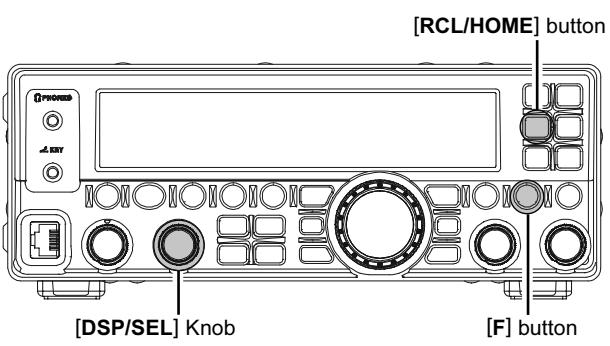
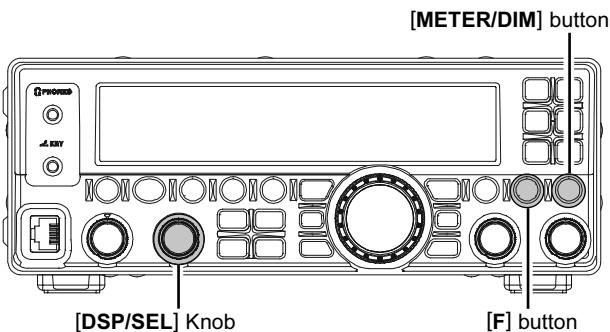
Display Contrast Level

You may also adjust the contrast level with the 24 steps.

1. Press and hold the [F] button for one second to enter the Menu mode. The “**MENU**” icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select the menu item “CONT”.
3. Press the [DSP/SEL] knob to enable adjustment of this menu item. The “**MENU**” icon will be blinking.
4. Rotate the [DSP/SEL] knob to select a desired contrast level (1 - 24).

You may press the [RCL/HOME] button to reset the contrast level to the factory default.

5. Press the [DSP/SEL] knob. The “**MENU**” icon returns to appear continuously.
6. Press and hold the [F] button for one second to save the new setting and return to normal operation.



MISCELLANEOUS SETTINGS

BEEPER SETTING

Beep Volume

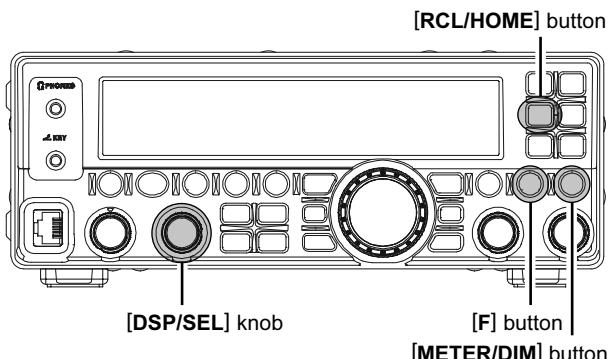
You may adjust the beep volume level via the Menu Item "BEEPVOL".

1. Press and hold the [F] button for one second to enter the Menu mode. The "**MENU**" icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select the menu item "BEEPVOL".
3. Press the [DSP/SEL] knob to enable adjustment of this menu item. The "**MENU**" icon will be blinking.
4. Rotate the [DSP/SEL] knob to set the desired beep volume level (FIX 0 - FIX 100).

WARNING! Do not adjust the beep volume too high. You may press the [METER/DIM] button to sound a beep as you adjust the [DSP/SEL] knob. If you wish to adjust the beep volume level in accordance with the [AF GAIN] knob, press the [F] key to change the display to "LNK-XX" then rotate the [DSP/SEL] knob to set the volume ratio of the beep volume level for the receiving audio volume level. Available selections are "LNK-50" ~ "LNK 0" ~ "LNK+50". When the "LNK 0" is selected, the beep volume level is the same as receiving audio volume level.

You may press the [RCL/HOME] button to reset the beep volume level to the factory default.

5. Press the [DSP/SEL] knob. The "**MENU**" icon returns to appear continuously.
6. Press and hold the [F] button for one second to save the new setting and return to normal operation.



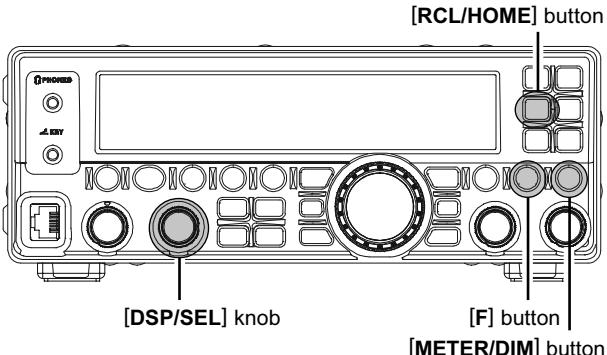
MISCELLANEOUS SETTINGS

BEEPER SETTING

Beep Tone

You may adjust the beep tone to your desired tone via the Menu Item "BEEPTON".

1. Press and hold the [F] button for one second to enter the Menu mode again. The "MENU" icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select the menu item "BEEPTON".
3. Press the [DSP/SEL] knob to enable adjustment of this menu item. The "MENU" icon will be blinking.
4. Rotate the [DSP/SEL] knob to select the desired tone. Available selections are 440/880/1760 Hz, factory default: 880 Hz). You may press the [METER/DIM] button to sound a beep as you adjust the [DSP/SEL] knob.
You may press the [RCL/HOME] button to reset the beep tone level to the factory default.
5. Press the [DSP/SEL] knob. The "MENU" icon returns to appear continuously.
6. Press and hold the [F] button for one second to save the new setting and return to normal operation.



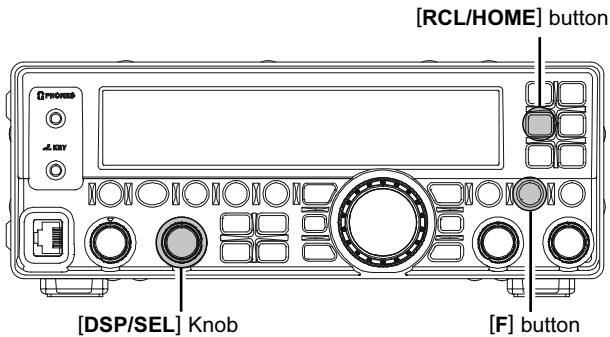
MISCELLANEOUS SETTINGS

AUTOMATIC POWER-OFF (APO)

The “Automatic Power-Off” (APO) feature will turn the radio completely off after a user-defined period of PTT or key/button inactivity. If you do not press any front panel keys or buttons, rotate the [MAIN DIAL] knob, use the microphone’s keys and buttons, or transmit, and so long as the transceiver is not scanning or engaged in priority monitoring, the radio will shut itself off after the specified time period. The available selections for the time before power-off are 1 - 12 hours (1 hour step), as well as APO Off. This feature is useful in minimizing battery drain in a mobile installation if you forget to turn the transceiver off.

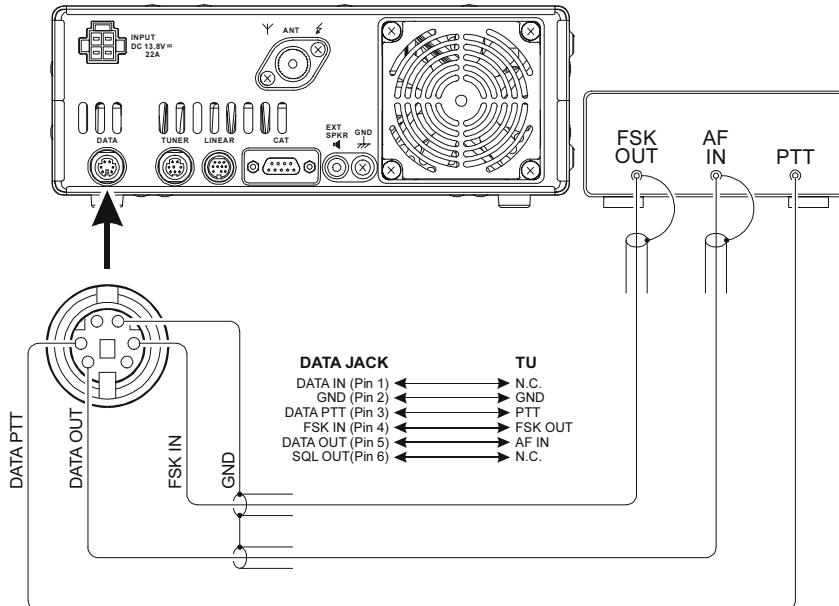
1. Press and hold the [F] button for one second to enter the Menu mode again. The “**MENU**” icon will appear on the display.
2. Rotate the [DSP/SEL] knob to select the menu item “APO”.
3. Press the [DSP/SEL] knob to enable adjustment of this menu item. The “**MENU**” icon will be blinking.
4. Rotate the [DSP/SEL] knob to select desired “Switch-off” time or “off.”
You may press [RCL/HOME] button to reset the APO to the factory default.
5. Press the [DSP/SEL] knob. The “**MENU**” icon returns to appear continuously.
6. Press and hold the [F] button for one second to save the new setting and return to normal operation.

If there is no action by you within the time interval programmed, the “APO” notation will blink on the display and an alert bell will provide an audible warning from the speaker within one minute of the APO timer expiration, then the microprocessor will shut down the radio automatically.



RTTY (RADIO TELETYPE) OPERATION

Most RTTY operation today is accomplished using a TNC or other computer-based system that utilizes AFSK tones. For RTTY operation using a Terminal Unit (TU) or the "FSK" output from a TNC, please see the discussion below. See also the illustration for details regarding connection to your TU.



SETTING UP FOR RTTY OPERATION

Before commencing RTTY operation, please direct your attention to the setup steps shown in the chart to the right.

MENU ITEM	AVAILABLE VALUES
RTY SFT (RTTY SHIFT)	170 / 200 / 425 / 850 Hz
RTY TON (RTTY TONE)	1275 / 2125 Hz
RTYRPOL (RTTY RX POLARITY)	NOR / REV
RTYTPOL (RTTY TX POLARITY)	NOR / REV

BASIC SETUP

1. Press the [MODE▼]/[MODE▲] buttons several times to indicate both the "DATA" and "LSB" icons on the display. Engage the RTTY operation using "LSB" injection, which is generally used in the Amateur service.
2. When you begin typing on your TU or computer keyboard, the command to transmit should automatically be sent to the transceiver, causing it to enter the transmit mode.

NOTE:

If you anticipate making data transmissions of longer than a few minutes, we recommend that you reduce the transmitter power to 1/2 ~ 1/3 of its normal maximum via Menu Item "RFPOWER".

QUICK POINT:

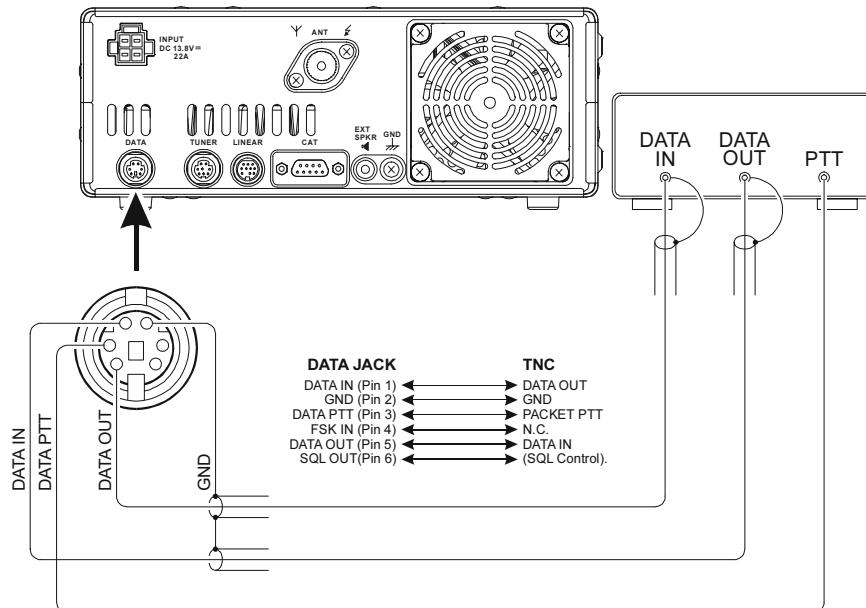
In the **FT-450D**, "RTTY" is a mode defined as being an "FSK" mode, whereby the closing and opening of a keying line (to ground) causes the Mark/Space tones to alternate. The RTTY mode is not an AFSK based mode in this transceiver, and the AFSK output tones from a TNC will not cause Mark/Space shifting to occur. Use the "Packet" mode for AFSK-based Baudot and other data modes.

ADVICE:

- There is no adjustment of the FSK input level (FSK IN of the **DATA** jack) on the rear panel; please make any needed level adjustments at the TU side.
- The Mark/Space Shift utilized in most Amateur RTTY operation is 170 Hz. Other shifts may be configured, however, using Menu Item "RTY SFT". The **FT-450D** is set up for "high tone" operation (centered on 2125 Hz) by default, but you may configure it for low tone (1275 Hz) operation using Menu Item "RTY TON".
- You may find that you are unable to decode some RTTY stations, even if they are of sufficient signal strength. If this is observed, there may be a Mark/Space polarity problem between your station and the other station. If so, try setting Menu Item "RTYRPOL" to "REV" ("Reverse") to see if that permits copy. A separate Menu Item permits reversal of your transmitter's Mark/Space polarity: "RTYTPOL".

PACKET OPERATION

Packet operation is easily accomplished on the **FT-450D** by connecting your TNC (Terminal Node Controller) to the transceiver, per the illustration.



PACKET SETUP (INCLUDING SUBCARRIER FREQUENCY)

Before operation can commence, change Menu Item "D TYPE" setting to "USER-L" (for LSB-Based Packet Operation) or "USER-U" (for USB-Based Packet Op-

eration), to configure your radio for the data mode to be used.

BASIC SETUP

1. Press the [MODE▼]/[MODE▲] buttons several times to indicate both the "DATA" and "LSB" icons (for LSB-Based Packet) or the "DATA" and "USB" icons (for USB-Based Packet) on the display. Engage the Packet operation.
2. When the "transmit" command is received from the TNC, the transmitter of the **FT-450D** will automatically be engaged. Likewise, the command to return to receive will cause the radio to revert to the receive mode.

ADVICE:

- There is no adjustment of the DATA input level and DATA output level of the **DATA** jack on the rear panel; please make any needed level adjustments at the TU side.
- During Packet operation via the rear panel's **DATA** jack, the front panel **MIC** jack is cut off, so you won't have a "live microphone" problem during data operation.

NOTE:

If you anticipate making data transmissions of longer than a few minutes, we recommend that you reduce the transmitter power to 1/2 ~ 1/3 of its normal maximum via Menu Item "RFPOWER".

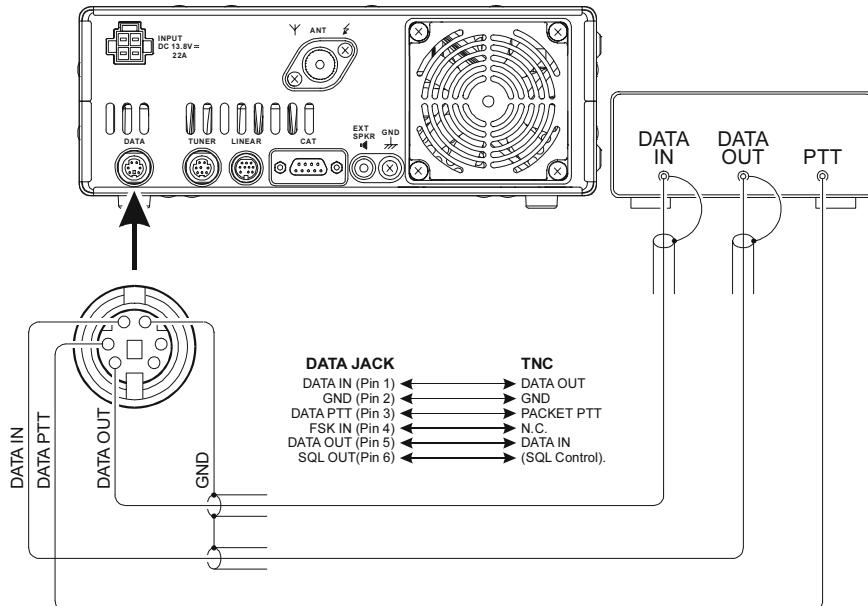
QUICK POINT:

DATA Jack Specifications

- DATA IN**
 - Input Level: 60 mVp-p
 - Input Impedance: 600 Ohms
- DATA OUT**
 - Fixed level, does not respond to setting of **[AF GAIN]** or **[SQL/RF GAIN]** knob.
 - Output Level: 500 mVp-p
 - Output Impedance: 600 Ohms

PSK OPERATION

PSK operation is easily accomplished on the **FT-450D** by connecting your TNC (Terminal Node Controller) to the transceiver, as in the illustration.



BASIC SETUP

1. Press the [**MODE▼**] or [**MODE▲**] button to select the SSB mode.
2. When the “transmit” command is received from the TNC, the **FT-450D** transmitter will be engaged. The microphone input is disabled automatically when transmitting the PSK signal. Likewise, the TNC “receive” command will cause the radio to revert to the receive mode.

ADVICE:

- There is no adjustment of the DATA input level and DATA output level of the **DATA** jack on the rear panel; please make any needed level adjustments at the TU side.
- During PSK operation via the rear panel **DATA** jack, the front panel **MIC** jack is cut off, so you won't have a “live microphone” problem during data operation.
- Set the PSK sub carrier frequency of the TNC to 1.5 kHz.

NOTE:

If you anticipate making data transmissions of longer than a few minutes, we recommend that you reduce the transmitter power to 1/2 ~ 1/3 of its normal maximum via Menu Item “RFPOWER”.

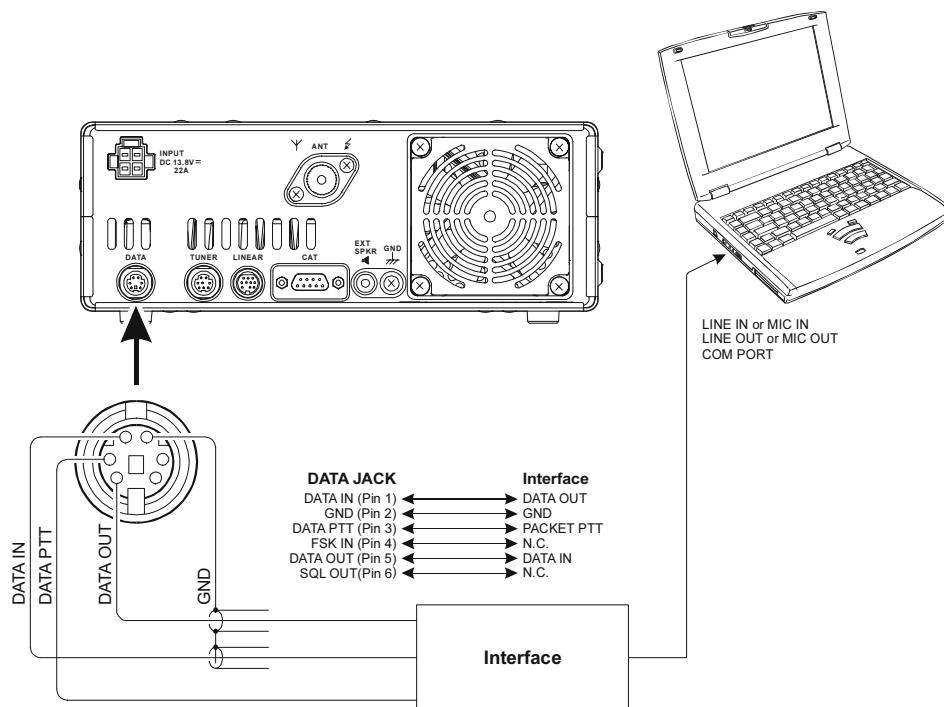
QUICK POINT:

DATA Jack Specifications

- DATA IN
 - Input Level: 60 mVp-p
 - Input Impedance: 600 Ohms
- DATA OUT
 - Fixed level, does not respond to setting of [**AF GAIN**] or [**SQL/RF GAIN**] knob.
 - Output Level: 500 mVp-p
 - Output Impedance: 600 Ohms

MISCELLANEOUS AFSK-BASED DATA MODES

The **FT-450D** may also be used for a host of other SSB-based Data modes. Please set up your system using the illustration as a guideline.



QUICK POINT:

When you have configured Menu Item “DIG VOX” to select the desired VOX Gain level (1 - 100), the transceiver will operate in a “VOX” mode, and it is not necessary to connect a **PTT** line. This makes for very convenient interfacing to computer Sound Cards, etc.

MENU MODE

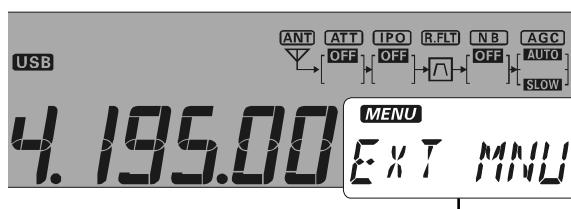
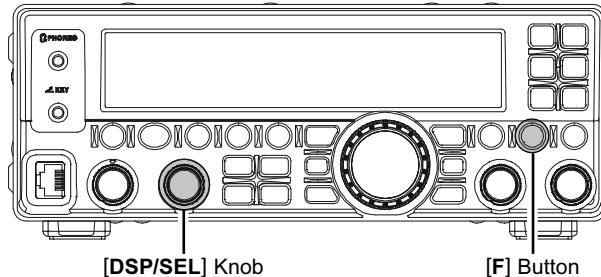
The Menu system permits extensive customization of the FT-450D.

You can set up your transceiver to operate just the way you want.

The Menu's 62 items are grouped into generally used categories from "EXT MNU" to "VOXGAIN". The Menu Mode may be set to display all 62 items or the abbreviated set of 16 most often used items.

USING THE MENU

1. Press and hold in the [F] button for one second. The Menu Item and a title for the Menu Mode will appear in the display.
2. Rotate the [DSP/SEL] knob to select the desired Menu Item.
3. Press the [DSP/SEL] knob. The "MENU" icon will appear in the display.
4. Rotate the [DSP/SEL] knob to change the value or condition for the Menu Item. The "MENU" icon will blink in the display.
5. Press the [DSP/SEL] knob. The "MENU" icon will appear in the display
6. Now, hold in the [F] button for one second to save the new setting and exit to normal operation.

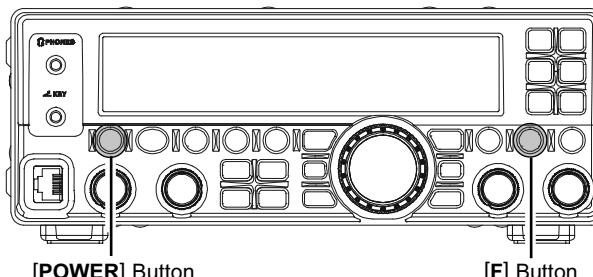


Menu Item or Menu Setting

Menu Mode Reset

You may reset all the Menu settings to their original factory defaults.

1. Turn the front panel [POWER] Button off.
2. While holding in [F] button, press the [POWER] Button to turn the transceiver on.



MENU FUNCTION	AVAILABLE VALUES	DEFAULT SETTING
EXT MNU (EXTENSION MENU)	ON / OFF	ON
A&FDIAL (AM&FM DIAL)	DISABLE / ENABLE	DISABLE
APO (APO TIME)	OFF / 1 ~ 12 (h)	OFF
BCN TIM (BEACON TIME)	OFF / 1 ~ 255 (sec)	OFF
BCN TXT (BEACON TEXT)	-	-
BEEPTON (BEEP TONE)	440 / 880 / 1760 (Hz)	880Hz
BEEPVOL	FIX0 ~ FIX100 or LNK-50 ~ LNK0 ~ LNK+50	FIX10 or LNK-8
CAT RTS	DISABLE / ENABLE	ENABLE
CAT TOT (CAT TIME OUT TIME)	10 / 100 / 1000 / 3000 (mSec)	10
CATRATE	4800 / 9600 / 19200 / 38400 (bps)/DATA	4800
CLAR (CLAR DIAL / SEL)	DIAL / SEL	DIAL
CLK SFT (CLOCK SHIFT)	ON / OFF	OFF
CONT (DISP CONTRAST)	1 ~ 24	10
CW AUTO (CW AUTO MODE)	ON / OFF	OFF
CW BFO	USB / LSB / AUTO	USB
CW DLY (CW DELAY)	FULL / 30 ~ 3000 (mSec)	250
CW KEY (CW KEY REV)	NOR / REV	NOR
CW QSK	15 / 20 / 25 / 30 (mSec)	15
CWPADDL (CW PADDLE)	KEY / MIC	KEY
CWPITCH	400 / 500 / 600 / 700 / 800 (Hz)	700

MENU MODE

MENU FUNCTION	AVAILABLE VALUES	DEFAULT SETTING
CWSPEED	4 wpm (20cpm) ~ 60 wpm (300cpm)	12wpm (60cpm)
CWSTONE (CW SIDE TONE)	FIX0 ~ FIX100 or LNK-50 ~ LNK0 ~ LNK+50	FIX10 or LNK-8
CWTRAIN (CW TRAINING)	N: / A: / M:	N:
CWWEIGT (CW WEIGHT)	1/2.5 ~ 1/4.5	1/3.0
D DISP (DATA DISP)	-3000 ~ 0 ~ +3000 (Hz)	0
D TYPE (DTAT MODE)	RTTY / USER-L / USER-U	RTTY
DIALSTP (DIAL STEP)	SSB/CW:1/10/20 (Hz), AM/FM:100/200 (Hz)	SSB/CW:10,AM/FM:100
DIG VOX	OFF / 1 ~ 100	OFF
EMERGEN (EMERGENCY)	ON / OFF	OFF
KEYHOLD (KEY HOLD TIME)	0.5 / 1.0 / 1.5 / 2.0	1.0
LOCKMOD (LOCK MODE)	FREQ / PANEL / ALL	FREQ
M-TUNE	ON / OFF	ON
MEM GRP (MEMORY GROUP)	ON / OFF	OFF
MEM TAG	TAG-OFF / TAGNAME	TAG-OFF
MIC EQ	0 ~ 9	0
MICGAIN	LOW / NOR / HIGH	NOR
MICSCAN (MIC AUTO SCAN)	ON / OFF	ON
MY BAND	ON / OFF	ON
MY MODE	ON / OFF	ON
P M-DWN (MIC-DWN PG)	One of 52 functions (See page 16)	DWN
P M-FST (MIC-FAST PG)	One of 52 functions (See page 16)	FAST
P M-UP (MIC-UP PG)	One of 52 functions (See page 16)	UP
PEAKHLD (METER PEAK HOLD)	ON / OFF	ON
PNL-C.S (PANEL'S CUSTOM SWITCH)	One of 52 functions (See page 16)	VCC
QSPL F (QUICK SPLIT FREQ)	-20 ~ 0 ~ +20(KHz)	+5
RFPOWER (RF PWR SET)	5 ~ 100	100
RPT (REPEATER SHIFT DIRECTION)	- SHIFT / SIMPLEX / +SHIFT	SIMPLEX
RPT SFT (REPEATER SHIFT OFFSET)	0 ~ 9.99	※
RTY SFT (RTTY-SHIFT)	170 / 200 / 425 / 850	170
RTY TON (RTTY-TONE)	1275 / 2125 (Hz)	2125
RTYRPOL (RTTY-RX-POLARITY)	NOR / REV	NOR
RTYTPOL (RTTY-TX-POLARITY)	NOR / REV	NOR
SCN RES (SCAN RESUME)	BUSY / TIME 1 ~ 10	TIME5
SELDIAL (SEL DIAL MODE)	CWSTONE / CWSPEED / 100KHz /1MHz / MICGAIN / RFPOWER	100KHZ
SQL TYP (SQL TYPE)	OFF / ENC / ENC DEC	OFF
SQL/RFG (SQL/RF GAIN)	SQL / RF GAIN	RF GAIN
STBY BP (STBY BEEP)	ON / OFF	OFF
TONE F (TONE FREQ)	67 ~ 254.1 (Hz)	88.5 (Hz)
TOT (TOT TIME)	OFF/1 ~ 20 (Min)	OFF
TUNER (TUNER/ATAS)	ATAS / EXT ATU / INT ATU / INTRATU / F TRANS	INT ATU
VOX DLY (VOX DELAY)	100 ~ 3000 (ms)	500 (ms)
VOXGAIN	1 ~ 100	50

※: Depends on the transceiver's version

MENU MODE

EXT MNU (EXTENSION MENU)

Function: Enables / Disables the extended Menu Mode
Available Values: ON / OFF
Default: ON
OFF: The menu will only display the 16 most often used items.
ON: All 62 menu mode items will be displayed.

A&FDIAL (AM&FM DIAL)

Function: Enables or disables the [MAIN DIAL] knob in the AMand FM modes.
Available Values: ENABLE / DISABLE
Default: DISABLE
ENABLE: The frequency can be set with the [MAIN DIAL] knob even in the AM/FM mode.
DISABLE: The [MAIN DIAL] knob does not change the frequency in the AM / FM mode.

APO (APO TIME)

Function: OFF / 1~12 (h)
Available Values: ON / OFF
Default: OFF
Selects the Auto Power Off time (time before power goes off).

BCN TIM (BEACON TIME)

Function: Selects the interval time (between message and message)
Available Values: OFF/1~255 (sec)
Default: OFF

BCN TXT (BEACON TEXT)

Function: Stores the message for the Beacon. Up to 118 characters may be stored.
Please refer to page 52 for storage procedure.

BEEPTON (BEEP TONE)

Function: Selects the beep frequency.
Available Values: 440 / 880 / 1760 (Hz)
Default: 880 (Hz)

BEEPVOL

Function: Selects the beep volume level.
Available Values: FIX0 ~ FIX100 or LNK-50 ~ LNK 0 ~ LNK+50
Default: FIX10 or LNK-8

CAT RTS

Function: Enables / Disables the RTS port of the CAT jack.
Available Values: DISABLE/ENABLE
Default: ENABLE

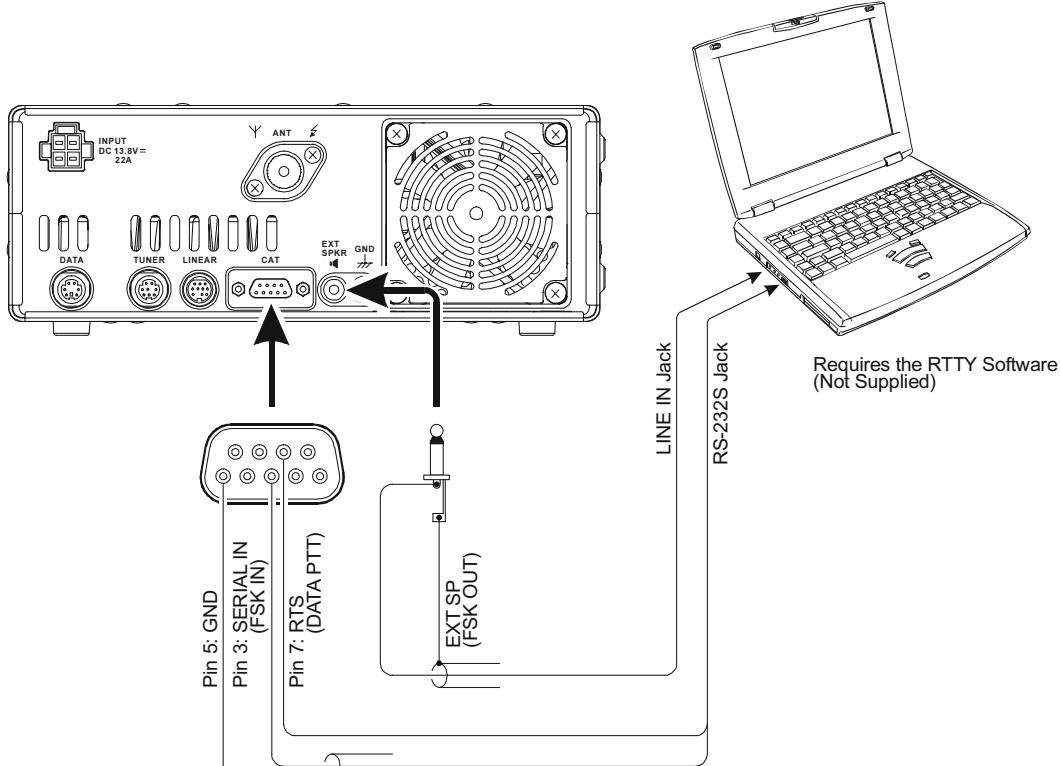
CAT TOT (CAT TIME OUT TIME)

Function: Sets the Time-Out Timer countdown time for a CAT command input.
Available Values: 10 / 100 /1000 / 3000 (ms)
Default: 10
The Time-Out Timer shuts off the CAT data input after a continuous transmission of the programmed time.

CATRATE

Function: Sets the transceiver circuitry for the CAT baud rate to be used.
Available Values: 4800/9600/19200/38400 (bps)/ DATA
Default: 4800

The CAT baud rate is set for the transceiver.
Setting "CATRATE" to "DATA" will enable RTTY operation from the CAT jack. The interconnection for RTTY operation is shown below.



CLAR (CLAR DIAL/SEL)

Function: Setting of CLAR button

Available Values: DIAL / SEL

Default: DIAL

Defines which Control knob is used for setting the clarifier-offset frequency.

CLK SFT (CLOCK SHIFT)

Function: Shifting of CPU clock frequency

Available Values: ON / OFF

Default: OFF

This function is only used to move a spurious response "birdie," should it fall on a desired frequency.

CONT (DISP CONTRAST)

Function: Display contrast adjustment

Available Values: 1~24

Default: 10

The display contrast level is set 1~24

CW AUTO (CW AUTO MODE)

Function: Enables the **KEY** jack, to permit CW operation while in SSB modes.

Available Values: OFF / ON

Default: OFF

OFF: The **KEY** jack is enabled in CW mode only.

ON: The **KEY** jack is enabled on all modes (SSB mode: A1A). Thus, on SSB, you can ask a station for a CW QSO without having to change your **FT-450**'s Mode selection, if Menu "CW AUTO" is set to "ON."

CW BFO

Function: Sets the CW carrier oscillator injection side in CW mode

Available Values: USB / LSB / AUTO

Default: USB

USB: Injects the CW carrier oscillator on the USB side

LSB: Injects the CW carrier oscillator on the LSB side

AUTO: Injects the CW carrier oscillator on the LSB side while operating on the 7 MHz band and below, USB side while operating on the 10 MHz band and up.

CW DLY (CW DELAY)

Function: Sets the receiver recovery time during pseudo-VOX CW semi-break-in operation.

Available Values: FULL / 30~3000ms

Default: 250

The recovery time may be adjusted in steps of 10 msec. A longer delay may be preferable if you pause frequently while sending.

CW KEY (CW KEY REV)

Function: Sets the keyer paddle's wiring configuration.

Available Values: NOR / REV

Default: NOR

The polarity can be reversed in the menu without changing the connection of the keyer when there is a left-handed operator or, two or more people.

NOR(NORMAL): Keyer paddle polarity is normal.

The plug "Tip" connection produces dots, and the plug "ring" connection produces dashes.

REV(VERSE): Keyer paddle polarity is inverted.

The plug "Tip" connection produces dashes, and the "Ring" connection produces dots.

CW QSK

Function: Selects the time delay between when the key is closed and the carrier is transmitted during QSK operation when using the internal keyer.

Available Values: 15 / 20 / 25 / 30 (ms)

Default: 15 (ms)

Note:

If you select "25 ms" or "30 ms," please do not attempt to set Menu "CW SPEED" to a speed faster than 50 wpm (250 cpm), as the delay will make it impossible to transmit.

CWPADDL (CW PADDLE)

Function: When enabled, the microphone's (MH-31A8J) [UP]/[DWN] keys may be used for CW keying.

Available Values: KEY / MIC

Default: KEY

KEY: The key connected to **KEY** Jack is selected.

MIC: When this Menu Item is set to "MIC," the microphone's (MH-31A8J) [UP]/[DWN] keys may be used for CW keying. (while the built-in electronic keyer is engaged).

CWPITCH

Function: Sets the pitch of the CW sidetone, (BFO offset) and the CW filter center frequencies.

Available Values: 400 / 500 / 600 / 700 / 800 (Hz)

Default: 700

The CW pitch may be adjusted in steps of 100 Hz.

MENU MODE

CWSPEED

Function: Sets the sending speed for the built-in Electronic keyer.

Available Values: 4 wpm(20cpm)~60wpm(300cpm)

Default: 12wpm (60cpm)

You can set the sending speed in either: wpm (words per minute), or cpm (characters per minute).

To button between "Wpm" and "cpm", just press the [F] button.

Note:

If the CW QSK is set to 25ms, the setting of CW SPEED must not exceed 50wpm (250cpm); And if the CW QSK is set to 30ms, the setting of CW SPEED must not exceed 42wpm (210cpm). The delay will make it impossible to transmit.

CWSTONE (CW SIDE TONE)

Function: Sets the CW sidetone volume level.

Available Values: FIX0 ~ FIX100 or
LNK-50 ~ LNK 0 ~ LNK+50

Default: FIX10 or LNK-8

CWTRAIN (CW TRAINING)

Function: Setting of CW training function

Available Values: N: / A: / M:

Default: N:

Sends random Morse Code five-character groups via the sidetone.

N: Numeric characters only

A: Alphabet characters only

M: Numeric and Alphabet characters (Mixed)

CWWEIGT (CW WEIGHT)

Function: Sets the CW weight level.

Available Values: 1/2.5~1/4.5

Default: 1/3.0

Sets the Dot/Dash ratio for the built-in electronic keyer.

D DISP (DATA DISP)

Function: DIG (USER-L or USER-U) mode operation.

Available Values: -3000Hz ~ 0 ~ +3000Hz

Default: 0

Defines the displayed frequency offset during DATA (USER-L or USER-U) mode operation.

D TYPE (DTAT MODE)

Function: Selects the mode and sideband (if applicable) in the DATA mode.

Available Values: RTTY/USR-L/USR-U

Default: RTTY

RTTY: FSK RTTY operation

USR-L: User-programmed custom operation based on LSB mode

USR-U: User-programmed custom operation based on USB mode

DIALSTP (DIAL STEP)

Function: Sets the DIAL knob's tuning speed.

Available Values: SSB/CW: 1 / 10 / 20 (Hz)
AM/FM: 100 / 200 (Hz)

Default: SSB/CW: 10 (Hz), AM/FM: 100 (Hz)

The width of the step of the [MAIN DIAL] knob can be set for each mode.

DIG VOX

Function: Sets the gain of the VOX circuitry input level for the DIG mode.

Available Values: OFF / 1~100

Default: OFF

EMERGEN (EMERGENCY)

Function: Enables Tx/Rx operation on the Alaska Emergency Channel, 5167.5 kHz.

Available Values: ON/OFF

Default: OFF

When this Menu Item is set to "ON," the spot frequency of 5167.5 kHz will be enabled. To get to this frequency, use the [DSP/SEL] knob to navigate. The Alaska Emergency Channel will be found between the Memory channel "US5-001" and "MEM-500."

Note:

Use of this frequency is restricted to amateurs operating in (or within 92.6 km of) the U.S. State of Alaska, and it is to be used for emergency communications only (involving the immediate protection of life or property).

KEYHOLD (KEY HOLD TIME)

Function: Sets the hold time for a push button to activate.

Available Values: 0.5 / 1.0 / 1.5 / 2.0

Default: 1.0

LOCKMOD (LOCK MODE)

Function: Sets the keylock for the panel buttons and dial

Available Values: FREQ / PANEL / ALL

Default: FREQ

Selects the operation of the front panel's [LOCK] key.

FREQ: Locks the front panel keys and knobs related to frequency control.

Front Panel:

[A=B] button, [FAST] button, [BAND] button, [A/B] button, [MW] button [V/M] button, [HOME] button, [RCL] button, [STO] button, [SPLIT] button, [PMS] button, [SCN] button, [MAIN DIAL] knob, [DSP/SEL] knob (Turns or Pushes).

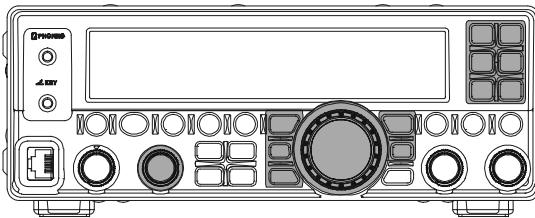
[C.S] button:

QSPL, DWN, FAST, UP

Microphone:

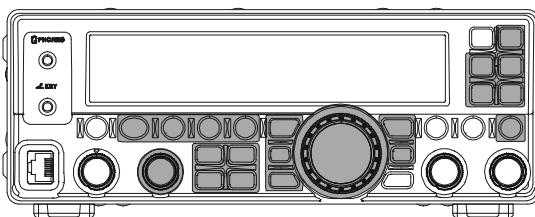
MH-31A8J (or optional MH-36E8J, MD-100A8X and MD-200A8X):

[UP] key, [DWN] key, [FAST] key



PANEL: Locks all front panel keys and knobs.

[DSP] button, [PROC/KEYER] button, [IPO/ATT] button, [AGC] button, [MODE] button, [NB] button, [CLAR] button, [A=B] button, [FAST] button, [BAND] button, [A/B] button, [HOME] button, [RCL] button, [VOX] button, [STO] button, [STEP] button, [SPLIT] button, [MW] button, [V/M] button, [PMS] button, [SCAN] button, [MAIN DIAL] knob, [DSP/SEL] knob (Turns or Pushes), [METER] button



ALL: Locks all front panel keys and knobs (except POWER and LOCK keys) and microphone keys.

Front Panel:

[DSP] button, [PROC/KEYER] button, [IPO/ATT] button, [AGC] button, [MODE] button, [NB] button, [CLAR] button, [A=B] button, [FAST] button, [BAND] button, [A/B] button, [HOME] button, [RCL] button, [VOX] button, [STO] button, [STEP] button, [SPLIT] button, [MW] button, [V/M] button, [PMS] button, [SCAN] button, [MAIN DIAL] knob, [DSP/SEL] knob (Turns or Pushes) ([CLAR] knob)

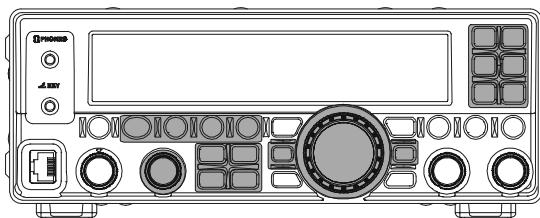
[C/S] button:

MONI, N/A, P/B, PLAY1, PLAY2, PLAY3, QSPL, SWR, VCC, DWN, FAST, UP

Microphone:

MH-31A8J (or optional MH-36E8J, MD-100A8X and MD-200A8X):

[UP] key, [DWN] key, [FAST] key



M-TUNE

Function: Permission/non-permission of Memory tune

Available Values: ON / OFF

Default: ON

ON: Forwarding from the memory channel and the home channel to VFO is permitted.

OFF: Forwarding from the memory channel and the home channel to VFO is not permitted.

In the "Memory Tune" mode, you may freely tune off of the memory channel. This is similar to VFO operation. Memory Tune operation will not alter the contents of the memory channel, so long as you do not over-write the contents of the current memory.

MEM GRP (MEMORY GROUP)

Function: Enables/disables the memory grouping feature.

Available Values: ON / OFF

Default: OFF

When this Menu Item is set to "ON," the 500 "standard" memory channels are partitioned into ten Memory Groups, each holding up to 50 memory channels.

MEM TAG

Function: Stores Alpha-Numeric "Tags" for the memory channels.

See page 62 for information on setting the "Memory Tags".

MENU MODE

MIC EQ

Function: Setting of the DSP microphone equalizer

Available Values: 0 ~ 9

Default: 0

You may select one of ten available DSP equalization techniques for transmitted microphone audio.

0: Flat

1: Low-frequency component is decreased.

2: Mid-frequency component is decreased.

3: High-frequency component is decreased.

4: High-frequency component is enhanced.

5: Mid-frequency component is enhanced.

6: Low-frequency component is enhanced.

7: Low-frequency component is enhanced and High-frequency component is decreased.

8: Low-frequency component is decreased and Mid-frequency component is enhanced.

9: Low-frequency component is decreased and High-frequency component is enhanced.

MICGAIN

Function: Setting of the MIC gain

Available Values: LOW / NOR / HIGH

Default: NOR

Adjusts the microphone gain level for SSB/AM/FM.

LOW: When the microphone input is high the speech processor is turned off automatically.

NOR: For normal voice the speech processor is turned on automatically.

HIGH: When the microphone input is low the speech processor is turned on automatically.

MICSCAN (MIC AUTO SCAN)

Function: “ON/OFF” of microphone scanning function

Available Values: ON/OFF

Default: ON

Enables/disables scanning access via the microphone's [UP]/[DWN] keys.

OFF: The frequency or the memory channel is scanned only while [UP]/[DWN] button is being pushed. The scanning stops when [UP]/[DWN] button is released.

ON: When [UP]/[DWN] button is held for about 1.0 second, the scanning continues even after the button is released.

MY BAND

Function: Setting of the my band

Available Values: ON/OFF

Default: ON

The “My Bands” feature allows you to select several Amateur bands, and make only those bands available for selection via the [BAND▼]/[BAND▲] buttons.

ON: Only the bands that are turned on will be shown when pushing the [BAND▼]/[BAND▲] button.

OFF: A Band that is turned off will not appear when the [BAND▼]/[BAND▲] button is pushed.

NOTE:

The band presently in use and the General band cannot be turned off.

MY MODE

Function: Setting of my mode

Available Values: ON/OFF

Default: ON

The “My Mode” feature allows you to select an operating mode, and set whether or not the mode will be displayed or skipped when the [MODE▼]/ [MODE▲] buttons are pressed.

This feature can be very useful in HF operation, when the AM/FM/DATA modes are not used.

ON: Only the mode registered by turning on can be selected by pushing [MODE▼]/ [MODE▲] button.

OFF: A mode that is turned off will not be appear when pressing the [MODE▼]/ [MODE▲] button.

NOTE:

The mode displayed on the display while setting “My mode” cannot be turned off.

P M-DWN (MIC-DWN PG)

Function: One of 52 functions can be preset and assigned to the [DWN] key of the microphone.

Available Values: Please see page 16.

Default: DOWN

Presets of various functions can be assigned to the [DWN] key of the microphone using this option.

P M-FST (MIC-FAST PG)

Function: One of 52 functions can be preset and assigned to the [FST] key of the microphone.

Available Values: Please see page 16.

Default: FAST

Presets of various functions can be assigned to the [FAST] key of the microphone using this option.

P M-UP (MIC-UP PG)

Function: One of 52 functions can be preset and assigned to the [UP] key of the microphone.

Available Values: Please see page 16.

Default: UP

Presets of various functions can be assigned to the [UP] key of the microphone using this option.

PEAKHLD (METER PEAK HOLD)

Function: Peak hold setting of S meter.

Available Values: ON/OFF

Default: ON

When this function is set to on the peak S meter reading is held for one second to improve readability.

PNL-C.S

Function: One of 52 functions can be preset and assigned to the [VOICE/C.S] key.

Available Values: Please see page 16.

Default: VCC

Presets of various functions can be assigned to the [VOICE/C.S] key using this option.

Please see page 16 for a detailed explanation.

QSPL F (QUICK SPLIT FREQ)

Function: offsets the transmit frequency.

Available Values: -20 ~ 0 ~ +20 (kHz)
in 1kHz increments

Default: +5

The Quick Split feature allows you to set a one-touch offset to be applied to your radio's transmit frequency compared to the receiving frequency. Also, the transmit mode is set to the same mode as the receive frequency (See page 43).

RFPOWER (RF PWR SET)

Function: Sets the maximums transmit power level for the current band.

Available Values: 5 ~ 100 (W)

Default: 100 (W)

RPT (REPEATER SHIFT DIRECTION)

Function: Sets the Repeater shift Direction

Available Values: -SHIFT / SIMPLEX / +SHIFT

Default: SIMPLEX

RPT SFT (REPEATER SHIFT OFFSET)

Function: Sets the magnitude of the repeater shift on the 28/50MHz band.

Available Values: 0.00 ~ 99.99 (MHz)

Default: Depends on the transceiver's version.

The FT-450D may be utilized on 29 MHz and 50 MHz repeaters.

ADVICE:

The conventional repeater shift used on 29 MHz is 100 kHz, while on the 50 MHz band the shift may vary between 500 kHz and 1.7 MHz (or more). To program the proper repeater shift, use Menu Item "RPT SFT" (see page 55).

RTY SFT (RTTY-SHIFT)

Function: Selects the frequency shift for FSK RTTY operation.

Available Values: 170 / 200 / 425 / 850 (Hz)

Default: 170

RTY TON (RTTY-TONE)

Function: Selects the Mark tone for RTTY operation.

Available Values: 1275 / 2125 (Hz)

Default: 2125

RTYRPOL (RTTY-RX-POLARITY)

Function: Selects normal or reverse Mark / Space polarity for RTTY receive operation.

Available Values: NOR/REV

Default: NOR

RTYTPOL (RTTY-TX-POLARITY)

Function: Selects normal or reverse Mark / Space polarity for RTTY transmit operation.

Available Values: NOR /REV

Default: NOR

SCN RES (SCAN RESUME)

Function: Sets the delay time for scan resume.

Available Values: BUSY / TIME1 ~ 10 (sec)

Default: TIME5 (sec)

SELDIAL (SEL DIAL MODE)

Function: Assigns a second function to DSP/SEL knob that is activated when the DSP/SEL knob is momentarily depressed.

Available Values: CWSTONE / CWSPEED
/ 100KHZ /1MHZ/MICGAIN
/ RFPOWER

Default: 100KHZ (100 kHz)

CWSTONE: CW SIDETONE LEVEL

CWSPEED: CW KEYER SPEED

100KHZ: 100Khz Step

1MHZ: 1MHz Step

MICGAIN: MIC GAIN SET

RFPOWER: RF POWER SET

SQL TYP (SQL TYPE)

Function: Selects the Tone Encoder and/or Decoder mode.

Available Values: OFF / ENC / ENC/DEC

Default: OFF

OFF: The function of "SQL knob" that exists in the front panel is selected.

ENC: CTCSS Encoder

ENC/DEC: CTCSS Encoder/Decoder(Tone Squelch)

SQL/RFG (SQL/RF GAIN)

Function: Selects the configuration of the front panel's SQL/RF knob.

Function: SQL/RF-GAIN

Default: SQL

MENU MODE

STBY BP (STBY BEEP)

Function: Setting of standby beep

Available Values: OFF / ON

Default: OFF

OFF: No beep sound is transmitted.

ON: A beep is transmitted before returning to receive.

The beep, transmitted when the **PTT** is released, will inform the other operators that your transmission has ended.

TONE F (TONE FREQ)

Function: Sets the CTCSS Tone Frequency.

Available Values: 67.0 ~ 254.1 (Hz)

50 Standard CTCSS tones

Default: 88.5 (Hz)

TOT (TOT TIME)

Function: Selects the time of the Time-Out-Timer.

Available Values: OFF/1 ~ 20 (min)

Default: OFF

TUNER (TUNER/ATAS)

Function: Setting of the Auto Antenna and Antenna Tuner

Available Values: ATAS / EXT ATU / INT ATU / INTRATU / F RANS

Default: INT ATU

Selects the device (**FC-40** or **ATAS-100/-120/-120A**) controlled by the front panel's [**TUNE**] button.

ATAS: The [**TUNE**] button will activate the optional **ATAS-100/-120/-120A** on the HF amateur bands and 50 MHz amateur band.

EXT ATU: The [**TUNE**] button will activate the optional **FC-40**.

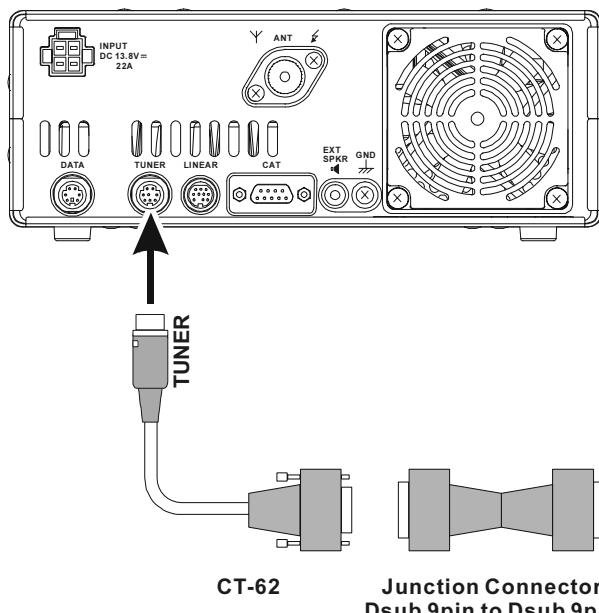
INT ATU: The [**TUNE**] button will activate the Antenna Tuner. The tuner passes only the Transmitter RF.

INTRATU: The [**TUNE**] button will activate the Antenna Tuner. The tuner passes both the Transmitter RF and the Receiver signal.

F TRANS: The frequency data of the radio is sent to another **FT-450D**. This feature is very useful for the "SO2R" (Single Operator, Two Radio) operation. In this case, the interconnection is as follows.

MASTER SETTING

Set menu item "TUNER" to "F TRANS".



SLAVE TRANSCIEVER SETTING

Set menu item "CAT RTS" to "DISABLE".

Set menu item "CATRATE" to "4800 bps".

OPERATION

When the [**TUNE**] button on the Master Transceiver is pressed, the Slave Transceiver frequency becomes the same as the Master Transceiver.

IMPORTANT NOTICE

Please install an antenna protection circuit so the Master (RX) Transceiver is not damaged when the Slave (TX) Transceiver is transmitting.

VOX DLY (VOX DELAY)

Function: Sets the “hang time” for the VOX circuitry.

Available Values: 100 ~ 3000 (ms) (100 ms/step)

Default: 500 (ms)

In VOX operation, sets the delay time when the transmitter will return to receive after a voice pause.

The Delay time can be set while transmitting.

VOXGAIN

Function: Sets the gain of the VOX circuitry's input audio detector.

Available Values: 1 ~ 100

Default: 50

The sensitivity is least at “1”, and maximum at “100”.

The VOX operation sensitivity can be set while transmitting.

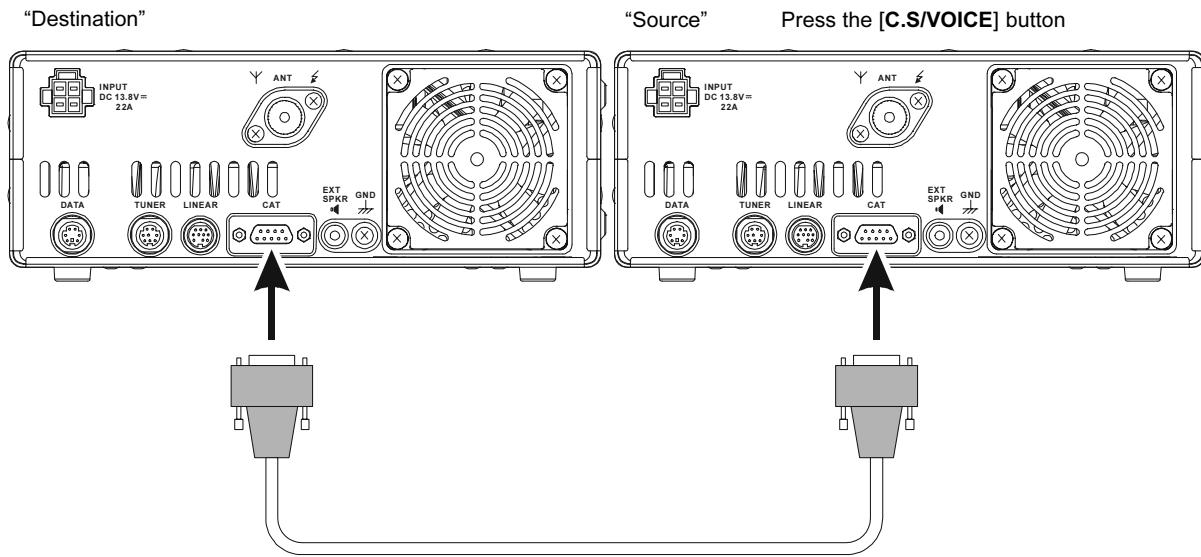
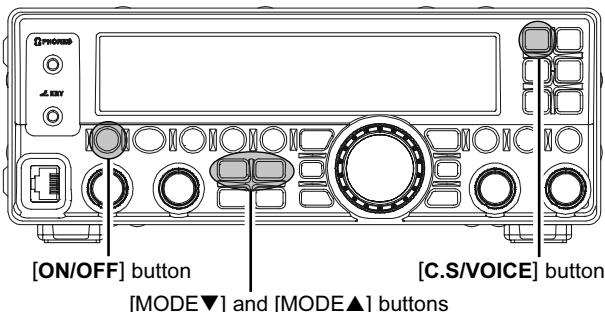
CLONING

You can transfer all data stored in one transceiver to another set by utilizing the handy "Cloning" feature. This requires a user supplied cloning cable, which connects the **CAT** jacks on the two transceivers, as shown below. To clone from one transceiver to another, use the following procedure:

1. Insert the D-SUB 9pin cross cable (User Supplied) into the **CAT** jack of each transceiver.
2. Turn both transceivers off, then press and hold in the **[MODE▼]** and **[MODE▲]** buttons on each radio while turning the power on again. The "cLonE C.S-SND" notation will appear on the display.
3. On the "Source" radio, press the **[C.S/VOICE]** button.
4. Data will now be transferred to the "Destination" radio from the "Source" radio.
When the clone completes successfully, "CLonE SENDING" is displayed on the display.
If there is a problem during the cloning process, "Error" will be displayed. Check your cable connections and try again.
5. If cloning is successful, turn the "Destination" radio off, and "cLonE C.S-SND" notation will reappear on the "Source" radio.
6. Turn the "Source" radio off.
7. Remove the clone cable. The channel and operating data for both radios are now identical. Both radios may be turned on now for normal operation.

NOTE:

The cloning operation cannot be performed between the FT-450D and FT-450.



INSTALLATION OF OPTIONAL ACCESSORIES

AUTOMATIC-MATCHING 200-MEMORY ANTENNA TUNER FC-40 OPERATION

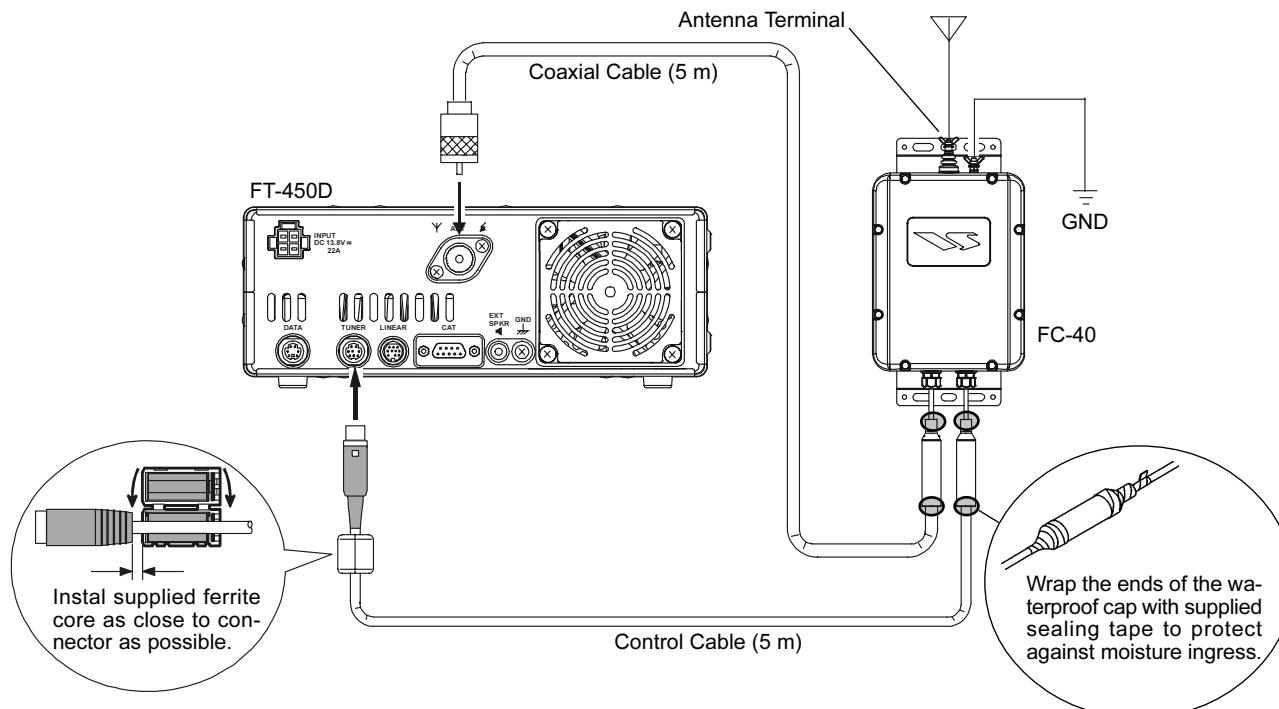
The **FC-40** makes use of the control circuitry built into the transceiver, which allows the operator to control and monitor automatic operation of the **FC-40**, which mounts near the antenna feedpoint. The **FC-40** uses specially selected, thermally-stable components, and is housed in a waterproof case to withstand severe environmental conditions with high reliability.

A carefully-chosen combination of solid-state switching components and high-speed relays allows the **FC-40** to match a wide variety of antennas to within a 2:1 SWR on any amateur band frequency (160 through 6 meters), typically in less than eight seconds. Transmitter power required for matching may be as little as 4 - 60 Watts, and matching settings are automatically stored in memory for instant recall when the same frequency range is selected later.

Please see the manual of FC-40 for detailed information.

Interconnections to FT-450D

After mounting the **FC-40**, connect the cables from the tuner to the **ANT** and **TUNER** jacks on the rear panel of the **FT-450D** Transceiver.

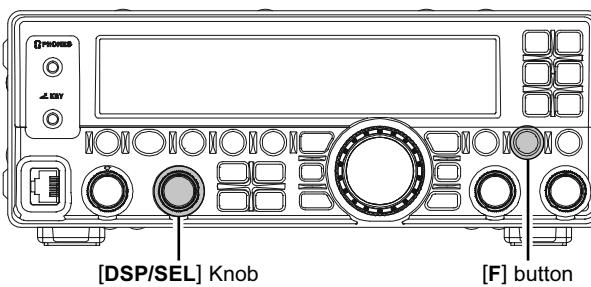


Installation

The optional **FC-40** Automatic Antenna Tuner provides automatic tuning of a coaxial line so as to present a nominal 50-ohm impedance to the **FT-450D**'s, HF/50 MHz antenna port.

Before operation can begin, you must instruct the **FT-450D**'s microprocessor that the **FC-40** is being used. This is done using the Menu Mode:

1. Press and hold the **[F]** button for one second to enter the Menu Mode.
The **"MENU"** icon will appear in the display.
2. Rotate the **[DSP/SEL]** knob to select the Menu Item "TUNER."
3. Press the **[DSP/SEL]** knob to enable this selected Menu Item.
4. Rotate the **[DSP/SEL]** knob to change the setting to "EXT ATU."
5. Press and hold the **[F]** button for one second to return to normal operation.



INSTALLATION OF OPTIONAL ACCESSORIES

AUTOMATIC-MATCHING 200-MEMORY ANTENNA TUNER FC-40 OPERATION

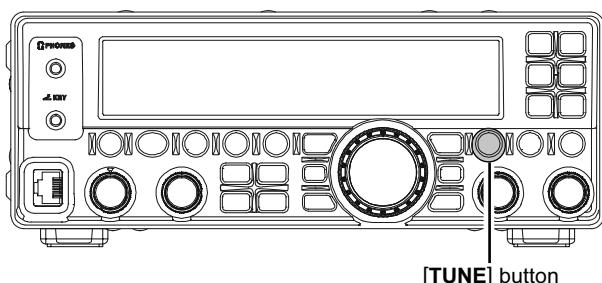
Operation

1. Press the [TUNE] button briefly to activate the Automatic Antenna Tuner.

The “**TUNER**” icon will appear in the display.

If the transceiver frequency is out of the amateur band, the “**TUNER**” icon will not appear.

2. Press and hold the [TUNE] button for one second to begin automatic tuning. The transmitter will be engaged, and the “**TUNER**” icon will blink while tuning is in progress.
3. Tuning will stop automatically when a low SWR is achieved. You may Press and hold the [TUNE] button for one second while tuning is in progress, to cancel the automatic tuning.
4. To disable the Automatic Antenna Tuner, press the [TUNE] button briefly again.



Note

- Please connect a good earth ground to the **GND** terminal of **FC-40**.
- The carrier signal transmits continuously while tuning is in progress. Please monitor the operating frequency before beginning the tuning process. Be sure you are not interfering with others who may already be using the frequency.
- It is normal to hear the sound of the relays while tuning is in progress.
- If the impedance cannot be matched by the **FC-40** better than 2:1, and the “ ∇ ” icon will blink, the microprocessor will not retain the tuning data for that frequency, as the **FC-40** presumes that you will want to adjust or repair your antenna system to correct the high SWR condition.

INSTALLATION OF OPTIONAL ACCESSORIES

ACTIVE-TUNING ANTENNA SYSTEM (ATAS-100/-120/120A) OPERATION

The optional **ATAS-100**, **ATAS-120**, or **ATAS-120A** Active-Tuning Antenna System permits operation on a number of HF bands (7/14/21/28 MHz) plus 50 MHz.

The **FT-450D** provides microprocessor control of the tuning mechanism in the ATAS antenna for convenient automatic tuning.

Interconnections to FT-450D

"ATAS-120A" is connected referring to the figure below.

ADVICE:

Always turn off the power switch on the **FT-450D** and the external power supply before you connect any cables.

ATTENTION:

- Do not touch the cables or connectors with wet hands.
- Do not touch the cables or connectors when you transmit. There is danger of electric shock or other serious injury.

Installation

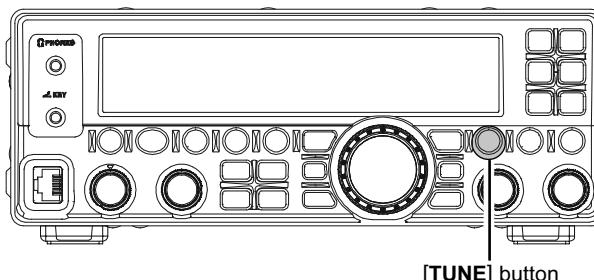
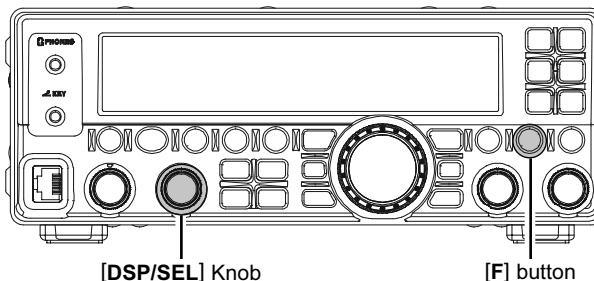
Before operation can begin, you must instruct the **FT-450D**'s microprocessor that the ATAS-100/-120/-120A is being used. This is done using the Menu Mode:

1. Press and hold the **[F]** button for one second to enter the Menu Mode.
The "**MENU**" icon will appear in the display.
2. Rotate the **[DSP/SEL]** knob to select the Menu Item "TUNER".
3. Press the **[DSP/SEL]** knob to enable this selected Menu Item.
4. Rotate the **[DSP/SEL]** knob to change the setting to "ATAS".
5. Press and hold the **[F]** button for one second to return to normal operation.

Operation

AUTOMATIC TUNING

1. Press the **[TUNE]** button briefly to activate the Automatic Antenna Tuner.
The "**TUNER**" icon will appear in the display.
If the transceiver frequency is out of the amateur band, the "**TUNER**" icon will not appear.
If the antenna SWR is High (more than 1:2.0), the "" icon will blink.
2. Press and hold the **[TUNE]** button for one second to begin automatic tuning. The transmitter will be engaged, and the "**TUNER**" icon will blink while tuning is in progress.
3. Tuning will stop automatically when a low SWR is achieved. You may Press and hold the **[TUNE]** button for one second while tuning is in progress, to cancel the automatic tuning.

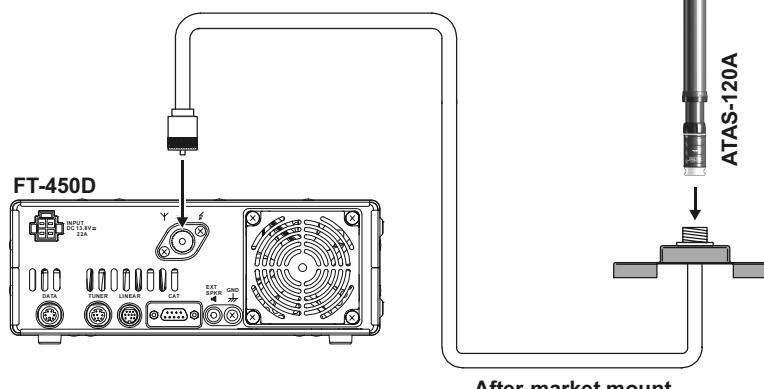
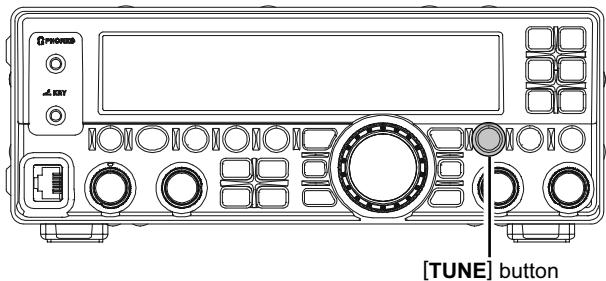


INSTALLATION OF OPTIONAL ACCESSORIES

ACTIVE-TUNING ANTENNA SYSTEM (ATAS-100/120/120A) OPERATION

MANUAL TUNING

1. Press the [TUNE] button briefly to activate the Automatic Antenna Tuner.
The “**TUNER**” icon will appear in the display.
If the transceiver frequency is out of the amateur band, the “**TUNER**” icon will not appear.
If the antenna SWR is High (more than 1:2.0), the “” icon will blink.
2. Press and hold in the microphone **PTT** switch.
With the transceiver in the “transmit” mode, press and hold in the [**BAND▲**] button (to raise the antenna) or the [**BAND▼**] button (to lower the antenna). While you hold in one of these keys, the **FT-450D** will generate a carrier, and you may watch the SWR meter of the **FT-450D**, looking for the meter indication to reach its minimum value.
When this is reached, release the [**BAND▲**] or [**BAND▼**] button, then release the **PTT** switch to return to the “receive” mode.



INSTALLATION OF OPTIONAL ACCESSORIES

CARRYING HANDLE MHG-1 INSTALLATION

The **MHG-1** is a Carrying Handle designed to match **FT-450D** transceiver.

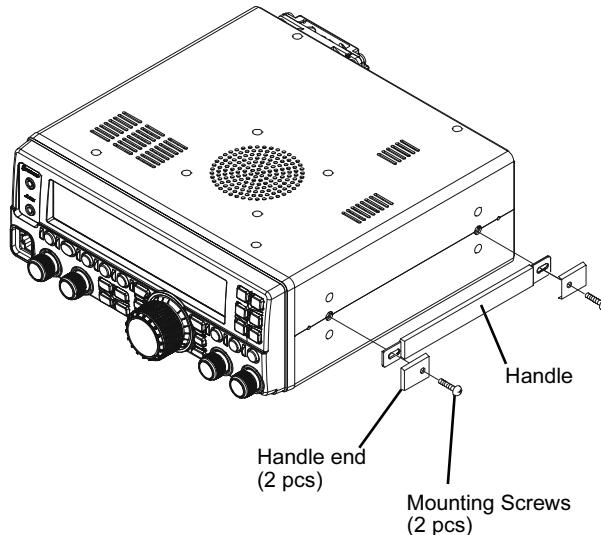
Parts List

Handle	1pc
Handle end	2pcs
Mounting Screws (M4x15B)	2pcs

Installation

Screw the Carrying Handle to the **FT-450D** using the supplied screws.

! Do not install the supplied **MHG-1** Mounting Screws if you are not installing the **MHG-1**! Also, do not use an improper screw for mounting the **MHG-1**! An improper screw may cause a “short circuit” to the internal circuitry, causing serious damage!



INSTALLATION OF OPTIONAL ACCESSORIES

MOUNTING BRACKET MMB-90 INSTALLATION

The **MMB-90** is a mounting bracket designed to match the YAESU **FT-450D** transceiver.

Parts List

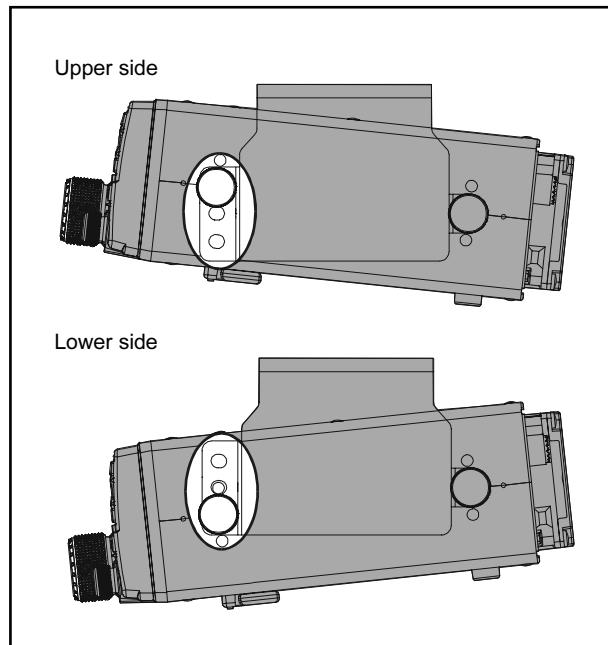
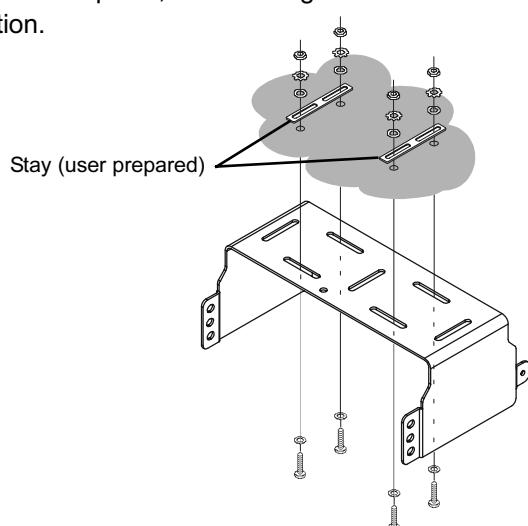
Mounting Bracket	1 pc
Double Face Adhesives	2 pcs
Screws, Washers & Nuts for Mounting Bracket	
M4 Knob-screws	4 pcs
M5X20 Screws	4 pcs
M5X20 Tapping screws	4 pcs
Washers	8 pcs
Washers	4 pcs
N5 Nut	4 pcs

Installation Procedure

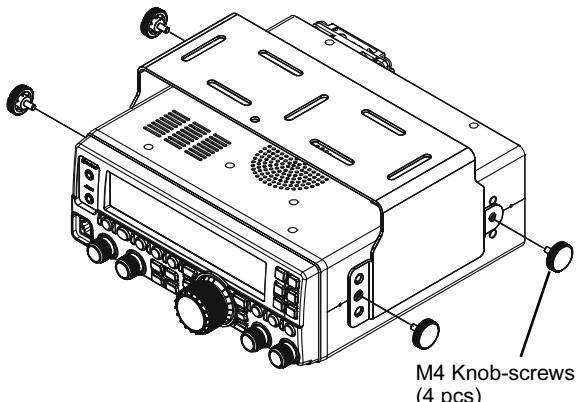
1. Determine a convenient mounting location with sufficient clearance and ventilation. Use the bracket as a template and locate the mounting holes. Use a 4.8-mm (3/16") bit to drill the holes. Secure the bracket with the supplied screws, washers and nuts.

NOTE:

The supplied double-sided adhesive tape may be used to temporarily hold the mobile mounting bracket in place, while drilling the holes for installation.



2. Position the transceiver in the bracket so the holes in the side are aligned with those in the bracket. Fasten the transceiver into place using the supplied Knob-screws (M4).



SPECIFICATIONS

General

Rx Frequency Range:	30 kHz - 56 MHz (operating) 160 - 6 m (specified performance, Amateur bands only)
Tx Frequency Ranges:	160 - 6 m (Amateur bands only)
Frequency Stability:	±1 ppm/hour (@+25 °C, after warmup)
Operating Temperature Range:	14 °F ~ 122 °F (-10 °C ~ +50 °C)
Emission Modes:	A1A (CW), A3E (AM), J3E (LSB, USB), F3E (FM)
Frequency Steps:	10 Hz (SSB & CW), 100 Hz (AM & FM)
Antenna Impedance:	50 Ohms, unbalanced
Power Consumption:	Rx (signal present) 1.5 A Tx (100 W) 22 A
Supply Voltage:	DC 13.8 V ± 10%
Dimensions (WxHxD):	9' x 3.3" x 8.5" (229 x 84 x 217 mm)
Weight (approx.):	8.8 lb (4.0 kg)

Transmitter

Power Output:	100 watts (25 watts AM carrier)
Modulation Types:	J3E (SSB): Balanced, A3E (AM): Low-Level (Early Stage), F3E (FM): Variable Reactance
Maximum FM Deviation:	±5.0 kHz / ±2.5 kHz
Harmonic Radiation:	Better than -60 dB (160 - 10m Amateur bands) Better than -70 dB (6m Amateur band)
SSB Carrier Suppression:	At least 60 dB below peak output
Undesired Sideband Suppression:	At least 60 dB below peak output
Audio Response (SSB):	Not more than -6 dB from 300 to 2400 Hz
Microphone Impedance:	600 Ohms (200 to 10 kOhms)

SPECIFICATIONS

Receiver

Circuit Type: Double-conversion superheterodyne

Intermediate Frequencies: 67.899 MHz / 24 kHz

Sensitivity (IPO "OFF", ATT: OFF):

SSB (2.4 kHz, 10 dB S+N/N)	0.25 µV (1.8 - 2.0 MHz)
	0.25 µV (3.5 - 30 MHz)
	0.20 µV (50 - 54 MHz)
AM (6 kHz, 10 dB S+N/N, 30 % modulation @400 Hz)	2.00 µV (1.8 - 2.0 MHz)
	2.00 µV (3.5 - 30 MHz)
	1.00 µV (50 - 54 MHz)
FM (BW: 15 kHz, 12 dB SINAD)	0.50 µV (28 - 30 MHz)
	0.30 µV (50 - 54 MHz)

There is no specification in frequency ranges not listed.

Squelch Sensitivity:

(IPO "OFF", ATT: "OFF")

SSB/CW/AM	2.50 µV (1.8 - 30 MHz)
	1.00 µV (50 - 54 MHz)

FM

0.32 µV (28 - 30 MHz)
0.16 µV (50 - 54 MHz)

There is no specification in frequency ranges not listed.

Selectivity (-6/-60 dB):

Mode	-6 dB	-60 dB
CW	250 Hz or better	700 Hz or less
SSB	2.2 kHz or better	4.5 kHz or less
AM	6 kHz or better	20 kHz or less
FM	15 kHz or better	30 kHz or less
FM-N	9 kHz or better	25 kHz or less

Image Rejection:

80 dB or better

IF Rejection:

80 dB or better (160 - 10m Amateur bands)

65 dB or better (6m Amateur band)

Maximum Audio Output:

2.2 W into 4 Ohms with 10% THD

Audio Output Impedance:

4 to 16 Ohms (8 Ohms: nominal)

Conducted Radiation:

-47 dBm ≤ 1000 MHz, -57 dBm > 1000 MHz

Specifications are subject to change, in the interest of technical improvement, without notice or obligation, and are guaranteed only within the amateur bands.

FCC NOTICE

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.

1. Changes or modifications to this device not expressly approved by YAESU MUSEN could void the user's authorization to operate this device.
2. 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 including interference that may cause undesired operation.
3. The scanning receiver in this equipment is incapable of tuning, or readily being altered, by the User to operate within the frequency bands allocated to the Domestic public Cellular Telecommunications Service in Part 22.

DECLARATION BY MANUFACTURER

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

WARNING: MODIFICATION OF THIS DEVICE TO RECEIVE CELLULAR RADIOTELEPHONE SERVICE SIGNALS IS PROHIBITED UNDER FCC RULES AND FEDERAL LAW.

THIS CLASS B DIGITAL APPARATUS COMPLIES WITH CANADIAN ICES-003.

EU Declaration of Conformity

We, Yaesu Musen Co. Ltd of Tokyo, Japan, hereby declare that this radio equipment FT-450D is in full compliance with EU Radio Equipment Directive 2014/53/EU. The full text of the Declaration of Conformity for this product is available to view at <http://www.yaesu.com/jp/red>

ATTENTION – Conditions of usage

This transceiver works on frequencies that are regulated and not permitted to be used without authorisation in the EU countries shown in this table. Users of this equipment should check with their local spectrum management authority for licensing conditions applicable for this equipment.

					
AT	BE	BG	CY	CZ	DE
DK	ES	EE	FI	FR	UK
GR	HR	HU	IE	IT	LT
LU	LV	MT	NL	PL	PT
RO	SK	SI	SE	CH	IS
LI	NO	–	–	–	–

Disposal of Electronic and Electrical Equipment

Products with the symbol (crossed-out wheeled bin) cannot be disposed as household waste.

Electronic and Electrical Equipment should be recycled at a facility capable of handling these items and their waste by-products.

Please contact a local equipment supplier representative or service center for information about the waste collection system in your country.





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1901L-LS-1
Printed in Japan

