YAESU

FT-8500/MH-39

Dual Band FM
Paging Transceiver

K B2LJJ

Contents

Searching for station activity is easy with VFO, memory and programmed-limit (sub band) scanning and the new Spectra-Analyzer feature. Select all memories or only those you want to be scanned. Two scan modes are now available: Busy Scan searches for activity then pauses, while Clear Scan looks for an inactive channel to operate on - great for urban areas with crowded bands. Scan speed can be set to normal or slow, and when activity is found, scanning pauses, then resume after 5-seconds, or only when the station stops transmitting. Each band has one priority memory which can be monitored every few seconds while operating from the VFO or memories.

The built-in CTCSS (Continuous Tone-Coded Squelch System) provides 39 subaudible tones which can be stored in each memory independently. The CTCSS Bell feature can be set to ring when the tone squelch opens.

DTMF calling and paging quietly monitor until calls to you (or only stations in groups you select) are received. The station's ID code is then displayed so you know who is calling you. With answer-back paging, the FT-8500 can even acknowledge or relay (forward) DTMF paging calls when you are absent. A fully configurable paging ringer beeps, plays a melody you compose, or plays back paging ID codes in CW! The Trigger Paging function switches from paging to code squelch operation after receiving a page by pressing the PTT so you can talk immediately.

The DTMF paging ringer can be disabled, or set to ring 1, 3, 5 or 8 times, and even cycle every minute until you respond. With the one-touch paging feature, selecting and displaying paging codes is simplified.

DTMF text messages up to eight characters long can be sent to other stations. A message ID of eight characters can also be sent and displayed with the text. Received messages are displayed and automatically stored for later retrieval. A tri-mode ringer alerts you to calls or messages by sounding a preset or user-programmed melody, or else have the built-in CW monitor playback the message in Morse code!

For autopatch operation, a 10-memory, 16-digit DTMF autodialer stores nine frequently-called numbers and one memory reserved for a user-programmed DTMF melody ringer for playback. The DTMF autodial memories can also be tagged with six-character alphanumeric names.

The Tx time-out timer (TOT) limits key-down time and the selectable-period APO (Automatic Power Off) timer turns off the radio after a period of inactivity. A convenient rear-panel data jack is provided for packet TNC connection. Data rate (1200/9600 BPS) and VHF/UHF port selection can be configured via menu programming. PCC (Personal Computer Control) and transceiver cloning is also accomplished using this jack. Please take some time to carefully review this manual thoroughly before operation.

FT-8500 Dual-Band FM Mobile Paging Transceiver with MH-39 DTMF Microphone

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. Along with the philosophy that each Yaesu transceiver should serve you well into the future. Yaesu stands behind our products with a worldwide network of dealers and service centers. Feel free to contact us if you need technical advice or assistance.

The FT-8500 is a deluxe compact FM mobile transceiver for both 2-m and 70-cm amateur band operation. A few of the new features in this dual-band rig include the following:

- DTMF Remote Control Microphone – the MH-39 permits controlling most transceiver functions from the palm of your hand.
- Spectra-Analyzer – view station activity above and below a selected channel: simply turn the dial to center a signal of interest on the scope and press the PTT to operate! You can also view activity among programmed memory banks. Adjustable signal width, spacing and span markers allow fine-tuning the spectrum view as you like.
- Configurable Memory Banks – fifty general-purpose memories are arranged into five banks on each band, and you can transfer memory banks from one band to the other as needed. Free unused memories and move them where they are needed! Five special-purpose memories (including an instant-recall Home channel) are also available on each band. Memories can be tagged with an 6-character alphanumeric name and this name can be displayed instead of the frequency.
- Two user-programmed function keys - makes multi-keystroke functions as simple as the push of a button.
- DTMF and Message Paging with CW Monitor – decodes incoming DTMF Paging codes and messages with selectable CW playback speed.
- Dual In-Band Receive (V&V and U&U) with Auto Receiver Muting for improved cross-band operation. Receiver muting has selectable levels and duration.

The upper LCD shows channel data and most programmable settings, you can even display the DC supply voltage. The lower dot matrix display shows programming menus and also double as a Spectra-Analyzer display for viewing channel activity. The LCD has selectable contrast and illumination levels for maximum visibility under varying lighting.

Specifications

General

Frequency range: (Rx) 110~174 MHz 410~500 MHz
(Tx) 144~148 MHz 430~450 MHz

Channel steps: 5, 10, 12.5, 15, 20, 25 & 50 kHz

Frequency stability: ±10 ppm from -20 to +60° C (VHF)
±5 ppm from -5 to +50° C (UHF)

Repeater shift: ±600 kHz , ±5 MHz (programmable)

Emission type: F3 (G3E), F2

Supply voltage: 11.7 ~ 15.9 VDC

Current consumption:

Receive: less than 1 A

	VHF	UHF
Transmit (Max.) (high)	11.5 A	9.0 A
(mid)	6.0 A	5.0 A
(low)	4.5 A	4.0 A

Operating temp. range: -20 to +60° C

Case size (WHD): 140 × 40 × 160 w/o knobs

Weight (approx.): 1.1 kg (2.4 lb)

Transmitter

RF output:	VHF	UHF
(high)	50 W	35 W
(mid)	10 W	10 W
(low)	5 W	5 W

Modulation system: variable reactance

Maximum deviation: ± 5 kHz

FM Noise (@ 1kHz): better than -40dB

Spurious emissions: > 60 dB below carrier

Microphone type: 2-kΩ condenser

Receiver

Circuit type: double-conversion superheterodyne

IFs: 45.05 MHz & 455 kHz (VHF)
58.525 MHz & 455 kHz (UHF)

12-dB SINAD Sensitivity: < 0.18 µV (main)
< 0.25 µV (sub)

Selectivity (-6/-60 dB): 12/24 kHz

Image Rejection: better than 70 dB

Squelch Sensitivity: better than 0.13 µV

AF Output: 2 W @ 8Ω for 5% THD

AF Output Impedance: 4~16 Ω (8-Ω internal speaker)

Specifications subject to change without notice or obligation.

Specifications guaranteed within amateur bands only.

Frequency ranges and repeater shift vary according to transceiver version, check with your dealer.

Accessories & Options

Accessories

MH-39$_{A6J}$ DTMF Microphone

MMB-36 Mobile Mounting Bracket

DC Power Cord w/fuse

Spare 15-A Fuse

Options

FS-10 Smart Controller

YSK-8500 Separation Kit

FTS-22 Tone Squelch Unit

SP-7 External Loudspeaker

FP-800 AC Power Supply w/Loudspeaker

MMB-60 Quick-Release Mobile Bracket

Availability of accessories may vary. Some accessories are supplied as standard per local requirements, others may be unavailable in some regions. Check with your local Yaesu dealer for changes to the above list.

Controls & Connectors

Front Panel

(1) LCD (Liquid Crystal Display)

The upper half of the display consists of segmented digits for frequency readout and various icons representing enabled transceiver features. The lower half contains a dot-matrix display for Spectra-Analyzer viewing, menu programming and alphanumeric name display. See the graphics on page 10 for descriptions of the display icons and indications.

(2) DIAL Rotary Selector

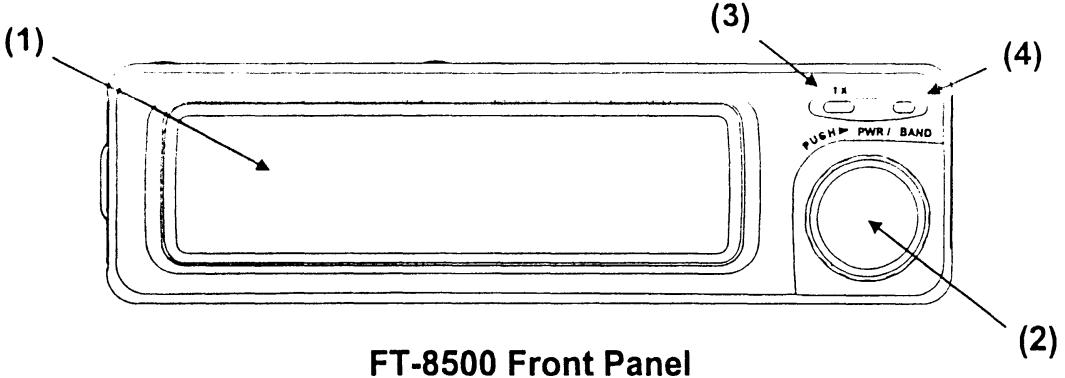
Rotate this to tune, or select memories and other settings, according to the function selected by the keys. This knob duplicates some functions of the MH-39 (PWR) and (DWN)/(UP) keys for convenience.

(3) TX Indicator

This LED indicator glows red when transmitting.

(4) Auto Dimmer Photo Sensor

This senses ambient lighting and adjusts LCD backlighting for optimum visibility.



FT-8500 Front Panel

Rear Panel

(1) ANT Jack

This Type-"M" jack (SO-239) accepts an antenna designed to provide 50-Ω impedance on 2-m & 70-cm. An external duplexer is not required. Note: European versions use a Type- "N" connector.

(2) UHF -SP- EXT Jacks

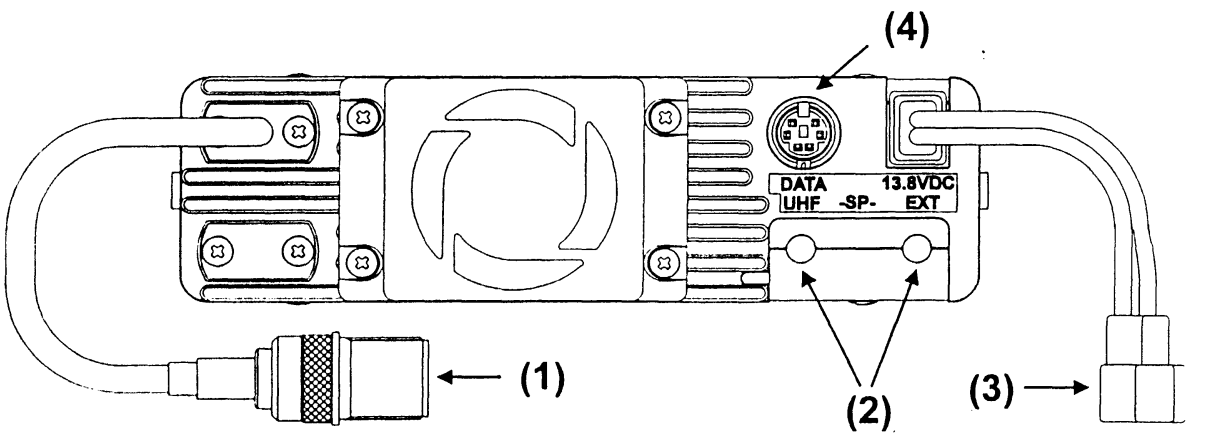
These 2-conductor, 3.5-mm mini phone jacks provide separate VHF & UHF audio output for an optional speaker (impedance is 8Ω). Inserting a plug into the **UHF -SP-** jack disables UHF audio from the internal speaker. Both VHF & UHF audio is disabled when a plug is inserted in to the **-SP-EXT** jack.

(3) +13.8 VDC Cable Pigtail w/Fuse

This is the power supply connection for the transceiver. Use the supplied DC cable to connect this pigtail to the car battery or other DC power supply capable of at least 15 amperes (continuous duty). Make certain that the red lead connects to the positive side of the supply.

(4) DATA Jack

This provides interface connections for packet TNC operation, transceiver memory cloning and (with the optional FIF-232C Interface Box) for PCC (Personal Computer Control) operation of the transceiver.



MH-39 Keypad Functions

Below are short descriptions of the various controls and button functions on the MH-39 microphone. The print on the keyfaces or orange labels indicate their primary function, while white labeling above or around the button indicates an alternate function (accessed by pressing D*, followed by the desired button. A quick reference table is also provided on pages 15-16. Detailed descriptions and operation are covered later in the *Operation* chapter.

MIC

Beneath this grill is the condenser microphone element. Speak across this opening in a normal tone of voice while pressing the PTT.

P1

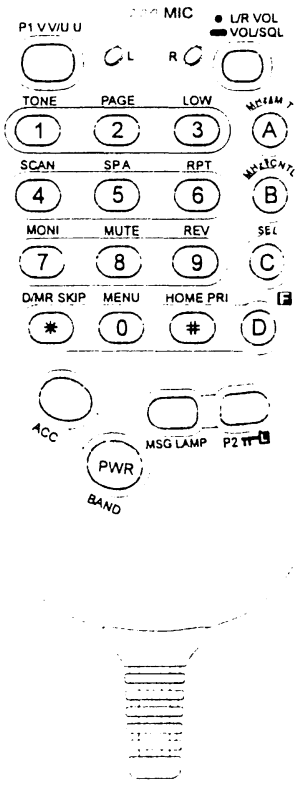
This activates a user-programmed function, or else enables dual in-band receive (V&V, U&U).

L R LEDs

These glow or blink to indicate an alternate function is selected (after pressing D*), or which channel (left/right) the active setting applies.

VOL

To adjust the receiver volume, first press this momentarily to select the left/right channel (indicated by the L or R LED), then rotate the **VOL** control for a comfortable level. The squelch is adjusted in a similar manner by first holding the button longer for ½ sec. (L or R LED blinks).



Keypad

MH-39 keys have primary functions, (labeled in orange and take effect when pressed directly), and *alternate* functions, (labeled in white and take effect when preceded by Ⓓ→ [*desired key*]). The 0~9, #, ✻, and A~D keys generate DTMF tones during transmit. See page 15~16 for a key function list.

Ⓐ

Tunes channels up in 1-MHz steps, selects memories, and also enables memory tuning of a displayed memory.

Ⓑ

Tunes channels down in 1-MHz steps, selects memories, and also temporarily toggles operating control from one band to the other.

Ⓒ

Pressing this displays and saves default or selected settings for menu programming functions.

Ⓓ

Enables alternate function of following key pressed within 5 seconds (while ◯L or R◯ blink).

①

Selects CTCSS encode, decode or encode & decode operation (***ENC***, ***DEC***, ***ENC DEC***).

②

Selects DTMF Paging, Trigger Paging, Code Squelch, and CTCSS Bell operation.

③

Selects high, medium, or low transmitter RF output power.

④

Activates VFO or memory channel scanning.

⑤

Enable/disable the receiver Spectra-Analyzer. Press *momentarily* to start manual "one-shot" sweep, or *hold it* to start continuous sweeping.

⑥

Press to select the desired Tx offset (+/-) needed for repeater operation.

⑦

Momentarily disables receiver squelch to monitor weak stations.

⑧

Toggles the sub receiver audio muting feature on/off.

⑨

Reverse Tx/Rx frequencies momentarily during duplex or repeater operation.

⓪

Momentarily displays the programmed menu settings for review, or to make changes. Holding it longer than ½ second writes current channel data to an allocated memory.

Toggles operation between the DIAL and programmed memory channels, or selects scan skip for selected memories.

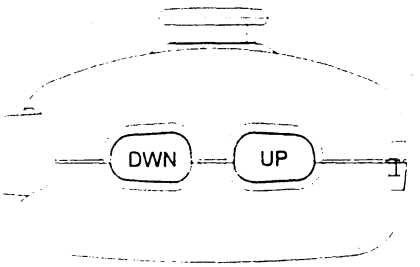
Momentarily pressing this recalls the Home channel for the selected band. Holding it longer activates priority memory monitoring.

Selects prestored message slots for transmission during DTMF Message operation. Also activate the keypad backlighting for better viewing in darkness.

Momentarily pressing this activates a second user-programmed function. Holding it longer locks MH-39 buttons, PTT or the transceiver DIAL knob (various locking schemes are menu-selectable).

Hold this to turn the transceiver on/off, or press momentarily to toggle main/sub channel operation.

Press to activate the accessory function. In European versions, this keys the transmitter and sends a 1750-Hz tone burst to access repeaters requiring it. In other transceiver versions this key is not used.



MH-39 Top Controls

DWN/UP

Press or hold to tune up/down in the default channel step size. During Menu Programming, these move from displayed headings to available entries. With an entry selected, pressing DWN or UP moves between available fields for data entry.

Note! - P1 & P2 keys

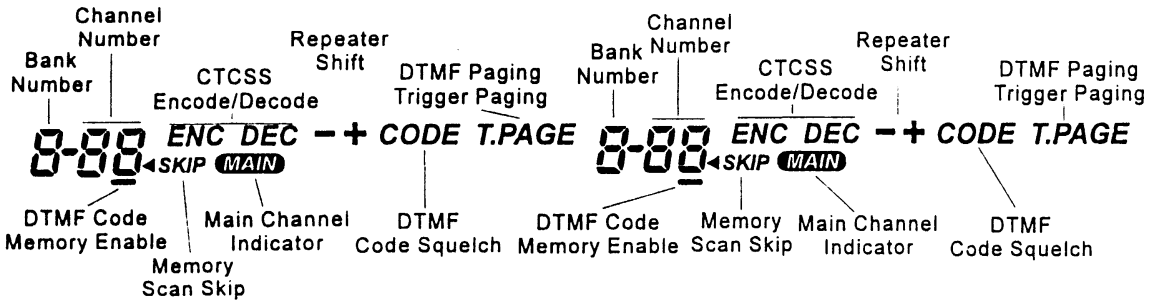
From the factory, the user-programmable function keys are preset to the following:

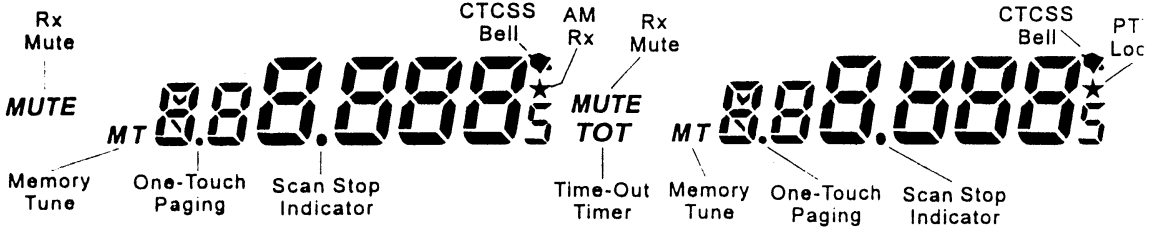
P1 - Reverse Tx/Rx frequencies momentarily during duplex or repeater operation (replaces D → 9).

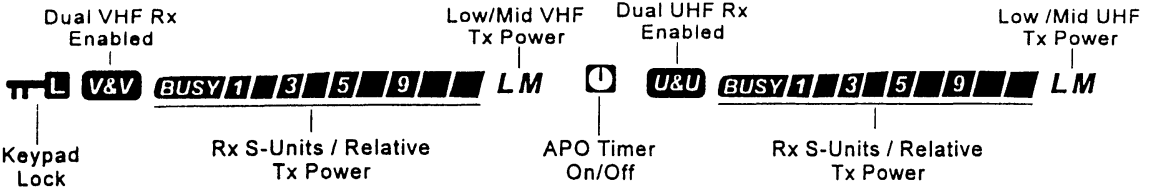
P2 - Selects high, medium, or low transmitter RF output power (replaces D → 3).

These default settings can be changed by a simple power-on key sequence. Refer to the box on page 17, and the explanation on page 22 for further details.

LCD Indications







Installation

This chapter describes installation of the FT-8500 with typical supplied accessories. Installation of the optional FTS-22 Tone Squelch Unit should be done *before installing the transceiver* and is described in the *Installation of Options* chapter at the back of this manual.

Preliminary Inspection

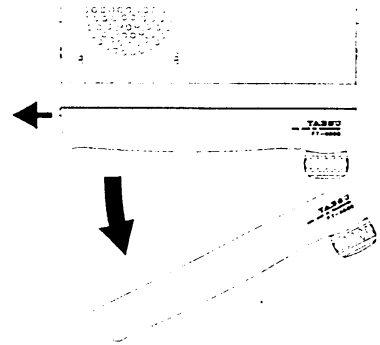
Inspect the transceiver thoroughly immediately upon opening the packing carton. Confirm that all controls and switches work freely, and inspect the case for any damage. Make sure the accessory fuse is included. If any damage is found, document it completely, and contact the shipping company (or dealer, if you purchased it over the counter) right away. Save the packing materials in case you need to return the set for service.

If you purchased the optional FTS-22 Tone Squelch Unit, install it now as described on page 59. This chapter describes base station installation first, followed by mobile installation and then interconnections with external accessories.

Installing the MH-39 Microphone

From the factory, the MH-39 is packaged separately from the transceiver body. It is installed by removing the front panel from the transceiver, then plugging the MH-39 cable into the transceiver body, then reinstalling the front panel.

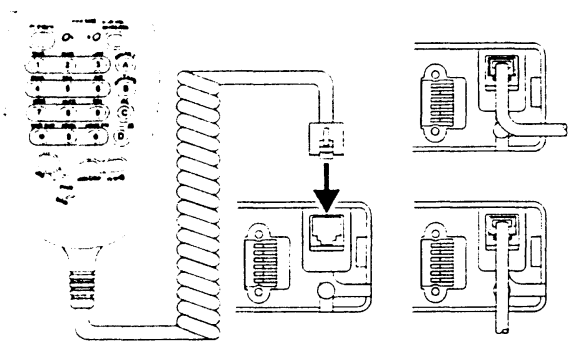
❒ To remove the front panel, use your left thumb nail to *slightly* pry open the latch on the left side of the transceiver. Next, using your right hand to slide the panel outward and away from the transceiver.



❒ Plug the microphone cable into the recessed jack on the transceiver, as shown in the drawing.

❒ Before reinstalling the front panel, decide if you want the control cable to exit from the side or bottom of the transceiver, then route the cable into

the appropriate channel provided (see drawing) Reinstall the front panel by hinging it into place, you will hear a click when the panel locks into place.



Important! Ensure the power is first switched off before removing the front sub-panel. The transceiver will turn off automatically after two seconds if the front panel is removed with power applied.

Antenna Considerations

The FT-8500 is designed for use with antennas ha ing an impedance near 50 Ω at all operating freque cies. For optimum performance use a high qualit carefully-designed antenna. The antenna should b connected whenever power is on, to avoid damag that could otherwise result if transmission occur accidentally without an antenna.

Ensure your antenna is designed to handle 50 Watt continuous transmitter power. For best performanc and safety in mobile installations, mount the antenn in the center of a flat surface, out of reach of huma hands: 50 Watts can cause an RF burn *to anyon touching the antenna during transmission!*

For best performance use the shortest possibl length of quality coaxial cable. Use a matching type M plug (SO-239) for the jack on the transceiver pigta (European versions use Type-N).

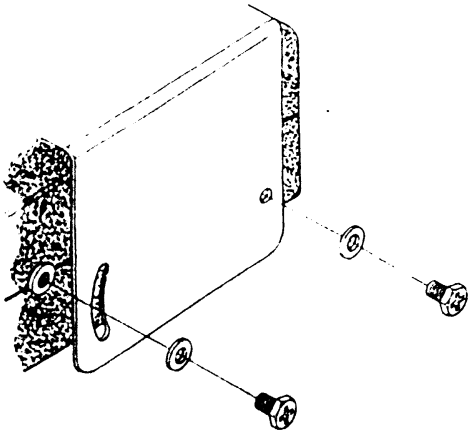
Mobile Installation

The FT-8500 must only be installed in cars having *negative ground* electrical system. The transceive can be installed in one piece using the supplie MMB-36 mobile mounting bracket, or in two piece using the optional YSK-8500 separation kit an MMB-60 quick release mounting bracket. Mount th transceiver where the display, controls and micro phone are easily accessible. The transceiver may b installed in any position, but should not be near

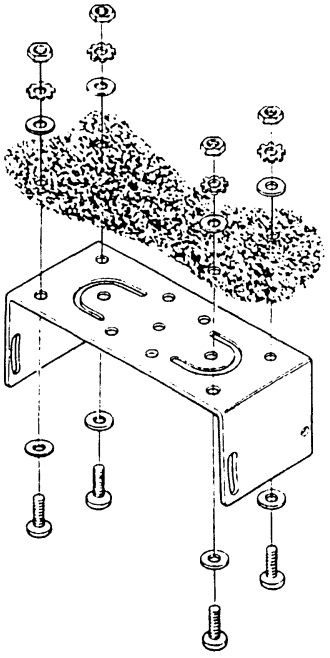
heater vent or where it could interfere with driving. Make sure to provide plenty of space at the rear so that air can flow freely through the heatsink. Refer to the diagrams showing installation.

Transceiver Installation

❒ Decide the mounting location with sufficient clearance for the transceiver, plus space for ventilation around the cooling fan and above and below the set. Use the mounting bracket as a template to locate the mounting holes. Use a 4.8-mm (3/16") bit to drill the holes, and secure the bracket with the supplied screws, washers and nuts (see diagram).



❒ Position the transceiver in the bracket so that the holes in the side are aligned with those in the bracket, and bolt the transceiver into place using the supplied short screws and flat washers. The MH-39 hanger may be installed wherever convenient.



Mobile Power Connections

To minimize voltage drop and avoid blowing the car fuses, connect the supplied DC cable directly to the battery terminals. *Do not attempt to defeat or bypass the fuse — it is there to protect you and the equipment!*

> ***Warning!***
>
> *Never apply AC power to the power cable of the transceiver, nor DC voltage greater than 15 volts.* When replacing the fuse, only use a 15-A fast-blow type. Failure to observe these safety precautions will void the warranty.

- ❒ Before connecting the transceiver, check the voltage at the battery terminals while revving the engine. If it exceeds 15 volts, adjust the car regulator before proceeding.
- ❒ Connect the RED power cable lead to the POSITIVE (+) battery terminal, and the BLACK lead to the NEGATIVE (–) terminal. If you need to extend the power cable use #14 AWG or larger insulated, stranded copper wire. Connect the cable to the transceiver only after connecting to the battery.

FP-800 AC Power Supply

Operation from the AC line requires a power supply capable of providing at least 15A continuously at 13.8 VDC. The FP-800 AC power supply/loudspeaker is available from your Yaesu dealer to meet these needs. Use the DC power cable supplied with the transceiver for making power connections, and connect the external speaker cable to either speaker jack on the rear panel.

External Speakers

The optional SP-7 External Speaker includes its own swivel-type mounting bracket, and is available from your Yaesu dealer. Of course the SP-3, SP-4 or SP-55 External Speakers may also be used. Plugging in an external speaker disables the speaker in the transceiver.

MH-39 Keypad Button Functions				
Button	**Normal Function** (Rx/Tx)	**Alternate Function** (after pressing [D])	**Hold >0.5 sec.**	**Press button & Power On**
1	Enter digit 1 / DTMF 1	Toggles CTCSS encode, decode, encode &decode on/off.	-	Keypad direct-access mode.
2	Enter digit 2 / DTMF 2	Selects Paging, Trigger Paging, Code Squelch, or CTCSS Bell.	-	
3	Enter digit 3 / DTMF 3	Toggles high, mid, or low Tx output power.	-	Keypad alt-function direct-access mode.
4	Enter digit 4 / DTMF 4	Activates VFO or memory channel scanning.	PMS	-
5	Enter digit 5 / DTMF 5	Activates *single*-sweep spectra analyzer.	Activates *continuous* spectra analyzer sweep.	-
6	Enter digit 6 / DTMF 6	Selects repeater shift (Tx offset) direction: + / - / simplex.	-	Activate cross-band repeat.
7	Enter digit 7 / DTMF 7	Momentarily disables receiver squelch.	-	-
8	Enter digit 8 / DTMF 8	Toggles receiver audio mute feature on / off.	-	-
9	Enter digit 9 / DTMF 9	Reverses Tx & Rx frequencies.	-	-
0	Enter digit 0 / DTMF 0	Recalls menu programming routine.	One-touch memory write.	Direct Menu-Access Mode.
*	Toggle DIAL & MR mode / DTMF *.	Memory channel scan-skip on/off.	-	Memory Bank transfer mode.
#	Transfers operation to the Home channel/DTMF #.	Priority channel monitoring	-	-

MH-39 Keypad Button Functions				
Button	**Normal Function** (Rx/Tx)	**Alternate Function** (after pressing D)	**Hold >0.5 sec.**	**Press button & Power On**
A	Tune up in 1 MHz steps / DTMF A.	Enables Memory Tuning of the displayed memory.	-	-
B	Tune down in 1 MHz steps / DTMF B.	Temporarily transfers main control to the other band	-	-
C	Menu setting selection / DTMF C	N/A (no function).	-	-
D	Activate alternate function of following key / DTMF D	N/A (no function).	-	Transceiver Clone Mode.
P2	Activates user-programmed function #2.	Locks the microphone controls and buttons.	-	P2 key user-set mode*.
LAMP	Recall received message bank for display & checking.	Turns keypad lamp on/off.	-	-
	Toggles main and sub channel operation.	N/A (no function).	Turns radio on / off.	-
P1	Activates user-programmed function #1.	Enables dual in-band receive (V&V, U&U).	-	P1 key user-set mode*.
	Select L/R channel for volume control.	N/A (no function).	Squelch set for L/R channel.	-
	Jumper-selectable function*.	Same as normal function.	Same as normal function.	-

*Note - for more information on applications and programming of P1 and LAMP, see the box on the next page, and also on page 22.

NOTE - User-Programmed Keys

All transceiver functions and settings are accessible via keypad sequences from the MH-39. As explained earlier and shown in the tables on the preceding pages, most buttons have multiple functions, depending on the duration they are held depressed (less or more than ½ sec.), or if they are preceded by [D] → (to enable their alternate function).

Two special keys, [P1] and [P2], can each be assigned a function (of the users selection) to simplify operation. This is especially convenient for functions that require two-keystroke activation, as they can now be accessed with a single push of a button. Examples are: scanning, power output, spectra analyzer - any of the ivory-labeled functions on the keypad.

The box on page 22 gives provides an explanation on programming [P1] and [P2], and performs two examples of useful function assignments to these keys.

Notes:

Notes:

Basic Operation

This chapter is prefaced with a short tutorial to get users on the air quickly. The remainder of the manual covers the more complex transceiver settings and various programming routines.

For now, we recommend reading these first few pages in detail, then, after you have become more familiar with the basic operation of the FT-8500, you can move on to customize transceiver settings to your taste and take advantage of all of the features of this transceiver.

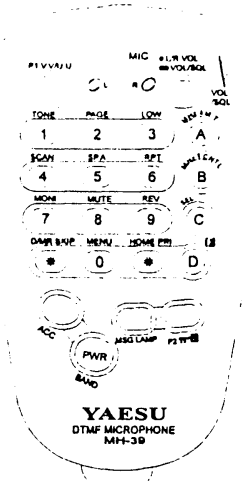
Preliminary Steps

Before operating the FT-8500 the first time:

- ❒ Connect an appropriate antenna to the antenna jack at the rear of the transceiver. *Never operate the transceiver without an antenna connected.*
- ❒ Ensure a 13.8-volt regulated DC power supply capable of providing 15 amps continuous current is used. Never connect this transceiver to 24-volt or positive-ground automotive electrical systems.
- ❒ Never connect AC to the power lead of this transceiver, irreparable damage may result and this will void you warranty!

MH-39 DTMF Microphone

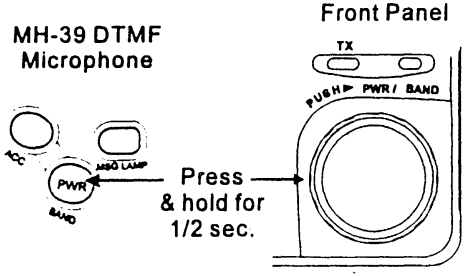
All transceiver functions can be accomplished with this microphone. To lock-out functions of the DIAL knob or MH-39 buttons, press Ⓓ→▭, so that 🔑 appears at the left of the display. The PTT lock is enabled via the programming menu and ★ appears when activated. The locking scheme (PTT, DIAL, keypad, etc.) can be configured later, as explained on page 73.



MH-39 DTMF Microphone

Turning the Power On/Off

Turn the power on by pressing in the DIAL knob or [PWR]. The transceiver is turned off in the same manner - only this time press and hold either the DIAL knob or [PWR] for ½ second.



Transceiver Power-on

Adjusting the Volume & Squelch

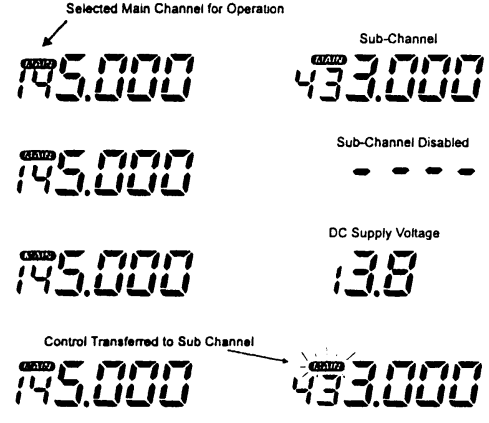
Volume and squelch are set independently for VHF and UHF. Rotate the side control for a comfortable volume level after selecting the desired band by pressing [VOL] once or twice (the ◯L/R◯ indicators glow to indicate the selected band).

The squelch threshold is set in a similar manner, except in this case [VOL] *is held for ½-second* so that ◯L or R◯ *blink*. The squelch control sets the signal threshold for each band at which stations will open the squelch and be heard. Press and hold [VOL] again for ½-second to cancel volume or squelch adjustment (◯L or R◯ LED will stop blinking).

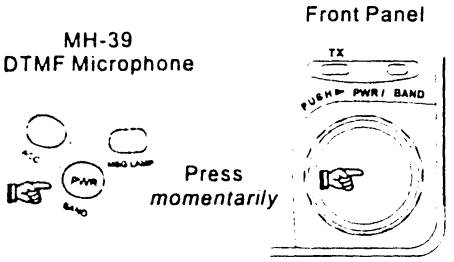
Generally, you will want to set the squelch level jus past the point where channel noise is muted. Adjus ing the squelch too "tight" results in only strong relatively nearby stations being heard. With th squelch too "loose", stations too weak to operate, c falsing on channel noise will open the squelch.

Selecting VHF or UHF Operation

The frequency with MAIN appearing next to it is calle the *main* channel, while the other displayed fre quency is known as the *sub* channel. The sub chan nel can be disabled for monoband operation or yo can have the DC supply voltage displayed in place o the frequency (see the graphic below and menu function 35, on page 71).



There are two ways to select or toggle the main channel of operation. You can momentarily press either [PTT], or the DIAL knob to toggle the desired channel. Remember to only press these for less than ½ sec, as holding them longer will turn the transceiver off.



Selecting Main Channel

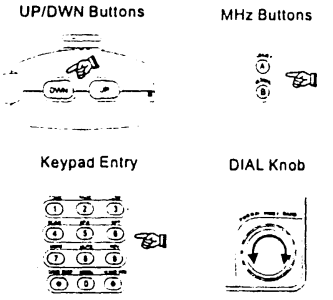
Normally, the MH-39 and DIAL knob only affect the main channel. However by pressing [D]→[B] so that [MAIN] blinks next to the sub channel, the controls now act on the sub channel. After making adjustments to the sub channel, press [D]→[B] again to return to the main channel.

Intelligent Band Display

IBD (Intelligent Band Display) is active by default and the channel display blinks to let you know which band is receiving a station. IBD can be enabled or disabled with menu function 36, as described on page 71.

Tuning

There are several ways to tune the transceiver. Pressing [A] or [B] jumps in 1-MHz segments, while pressing the [DWN] or [UP] keys, or rotating the DIAL knob tunes in the default channel steps only.



Tuning Methods

Frequencies can also be entered directly* from the MH-39 keypad using the following procedure:

ex. to enter 446.520 MHz, press:

[PTT] [SCAN 4]→[SCAN 4]→[RPT 6]→[SPA 5]→[PAGE 2]→[MENU 0]

Remember to match the 1-kHz and 10-kHz digits -place entry of the frequency to the default channel step size. While some entries are valid, other will be rounded to the nearest 12.5-kHz or 25-kHz channel, or else rejected.

***Note** - direct entry can be disabled by menu function 33 (see page 71), if desired.

If you enter an incorrect digit at any time, simply press the PTT and start over again (this does not key the transmitter).

Mixed Receive (V & V,U & U) Operation

You can simultaneously receive on two VHF or two UHF channels, and select either channel as the main channel for operation. During mixed receive, the sub-channel receiver is disabled during transmit.

Pressing D→ F1 toggles transceiver operation between normal and mixed receive, with VOL selecting either V&V (R lit) or U&U (L lit).

For example, to activate V&V receive, first press VOL as necessary so that L is lit. Next, press D→F1 (U&U or V&V appear in the display indicating which combination is selected).

Afterwards, the DIAL knob, DWN/UP, and A/B keys are used as before for tuning or scanning operation on either receiver.

Note - During mixed receive, sensitivity and IMD of the alternate receiver is degraded slightly, however this should not greatly affect performance, except in highly RF-congested areas.

User-Programmed Keys

All transceiver functions and settings are accessible via keypad sequences from the MH-39. As explained before, most buttons have multiple functions, *depending on the duration they are held depressed* (less or more than ½ sec.), or if they are preceded by the key entry D→ (to enable their alternate function).

Two special keys, F1 and F2 MHz, can each be assigned a function (of the users selection) to simplify routine transceiver operation. This is especially convenient for functions that require two-keystroke activation, as they can now be accessed with a single push of a button. Examples are: scanning, power output, spectra analyzer - any of the ivory-labeled functions on the keypad.

To program F1 or F2 MHz, hold either key while turning on the power (L/R LEDs blink). Next, press the button with the ivory label corresponding to the function you wish to assign...that's it. Let's try two examples:

ex. assign Programming Menu recall to F1.

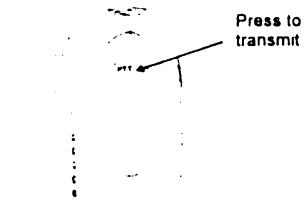
- ☐ Hold F1 while turning on the power, then press MENU 0. From now on, pressing F1 replaces D→MENU 0!

ex. assign Spectra Analyzer activation to F2 MHz.

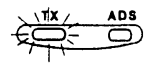
- ☐ Hold F2 MHz while turning on the power, then press APA 5. From now on, *momentarily* pressing F2 MHz activates *one-sweep* spectrum analyzer operation, *holding it longer* (>½ sec.) starts *continuous* sweeping.

Transmitting

Select the desired transmit power by pressing [D]→[3], then [3] as necessary to select high, mid, or low output. A three-pitch beep sounds along with each level, and ***L*** or ***M*** appear when low or mid-power levels are selected, respectively.



To transmit, press and hold the PTT while speaking across the microphone element grill in a normal voice. Release the PTT to receive again. During transmission, LCD bargraph segments appear and the red **TX** lamp just above the DIAL knob turns on (as shown in the graphic).

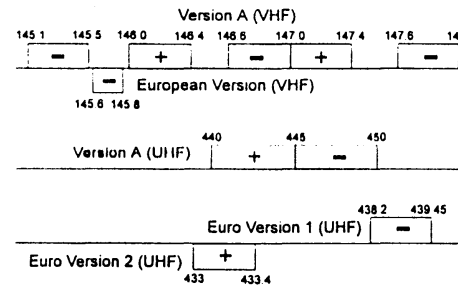


		VHF	UHF
▮▮	*L*	5 W	5W
▮▮▮▮	*M*	10 W	10 W
▮▮▮▮▮▮		50 W	35 W

Repeater Operation

The ARS (Auto Repeater Shift) feature allows easy repeater operation by automatically selecting the standard shift (–/+) used in the VHF/UHF repeater sub bands of the country the unit is shipped to.

ARS-Repeater Subbands



Pressing the PTT is all that is normally needed to operate on standard "open" repeaters. If the repeater uses a reverse shift, you can select this manually by toggling the [D]→[RPT 6] button until the required shift

appears. To listen on the repeater input (to see if you can work a station direct, for example), you can reverse Rx/Tx frequencies by pressing [D]→[9].

For repeaters requiring a CTCSS tone for access, press [D]→[1] to activate the CTCSS tone encoder (*ENC* appears). CTCSS tones are selected from menu function 6 (page 64) and operation is covered later on page 36.

Note: European versions can access repeaters requiring a 1750 Hz tone burst by pressing [PTT] (this activates the transmitter and sends the 1750 Hz tone). In other versions this switch has no function.

Selecting DIAL or Memory Operation

DIAL Mode - This is for tuning or scanning a band when looking for a clear channel to operate on. In this mode, the DIAL knob and [DWN]/[UP] keys each tune the band in the selected step size, (or in 1-MHz steps using [A]/[B]), and the scanning function tunes in the selected step size.

Memory (MR) Mode - This is for operating on channels usually stored in memories. For example, after storing the frequencies of your local repeaters, you can confine operation to those channels by selecting the memory mode. The DIAL, [DWN]/[UP], and [A]/[B] keys and scanning function select stored memories.

Each band has 50 general-purpose memories arranged into five banks with ten memory channels per bank. These banks can be transferred from one band to another as needed (explained later). Six additional special-purpose memories store band scanning and tuning limits, a priority channel and a home channel.

Memory Structure

General Purpose Memories					Special Use
1-01	2-01	3-01	4-01	5-01	L1
1-02	2-02	3-02	4-02	5-02	U2
↓	↓		↓	↓	L2
1-09	2-09	3-09	4-09	5-09	U2
1-10	2-10	3-10	4-10	5-10	PR1

Each memory has a Memory Tune mode which allows tuning similar to the DIAL mode, and storing the resulting re-tuned memory into the same or another memory slot. This and other special MR functions are described later, but keep these terms in mind.

You can tell at a glance which mode is active for each band by looking above and to the left of the first frequency digit. If you see a number or name (such as 1-01 or PR1), you are in the MR mode. The numbered annotation denotes bank and channel. For example 1-01 indicates bank 1, channel 1.

The [V/M] key toggles between DIAL and the last-used memory. While in the MR mode, your previous DIAL settings are preserved.

Advanced Operation

In the Basic Operation chapter, essential transceiver functions were briefly covered to get you on the air quickly. In this chapter, the remainder of the more advanced operating features and programming are covered. The FT-8500 has a wealth of features to allow you to derive the most operating pleasure whether you are mobile, base or away from your rig.

The more advanced transceiver function have various settings and parameters associated with them that are usually configured according to operating requirements or personal taste. The FT-8500 uses a menu display system which allows using the microphone keys to navigate among the various menu entries, then select and configure settings as needed. Afterwards, most of these settings take effect when the transceiver is turned on, or when manually enabled with the press of a button. Menu programming is covered in the last chapter, which begins on page 61.

Throughout this chapter, various page references are made to the Menu chapter. In this chapter we cover more advanced operational features and settings. After understanding how each feature works, you can proceed to the Menu chapter and customize each setting as we go along - or after all the descriptions are covered first.

Spectra-Analyzer Operation

The Spectra-Analyzer displays station activity above and below the current operating channel in the DIAL (VFO) mode. In MR (Memory Recall) mode, all programmed memories within a selected memory bank (up to 10 channels) are displayed for activity. In both modes, the display shows the relative signal strength of any stations on each channel.

You can use the analyzer to search out signal activity, and then QSY directly to a signal of interest for a QSO.

The Spectra-Analyzer is operated using the (SPA 5) button. Two types of sweep activity are possible:

Single Sweep - press [D] → (SPA 5). Each press thereafter gives a "one-shot" sweep for activity.

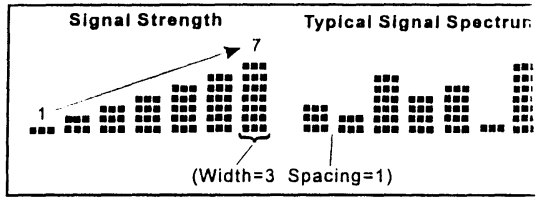
Continuous Sweep - press [D] → (SPA 5), and this time *hold* (SPA 5) (longer than ½ sec.) for continuous sweeping. During continuous sweep, S PR *blinks* above and to the left of the Main Channel (similar to that shown on the next page).

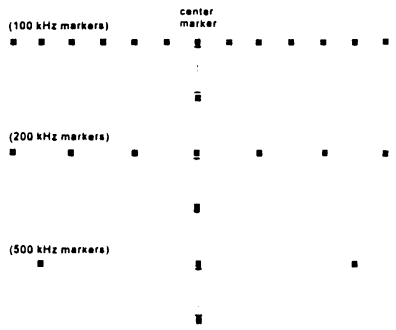
When activated, the lower dot-matrix display sweeps from left to right searching for activity on the main channel. The centered pixel group (top & bottom) of the lower display is the *center marker*, and a single blinking group is the *tuning marker* (representing the displayed receive frequency).

When Spectra-Analyzer operation starts, the center marker is at the receive (displayed) frequency. In fact, the lower center marker and tuning markers overlay and appear as one. As you turn the DIAL or press on the DWN/UP or A/B buttons, the tuning marker shifts left or right, while the center marker remains fixed, to give a relative position of your retuned frequency.

The vertical (stacked) pixels indicate the relative strength of received stations and ranges from 1~7 pixels. The sweeping circuit of the Spectra-Analyzer combined with vertical representation of signal activity form a characteristic "silhouette" of band activity.

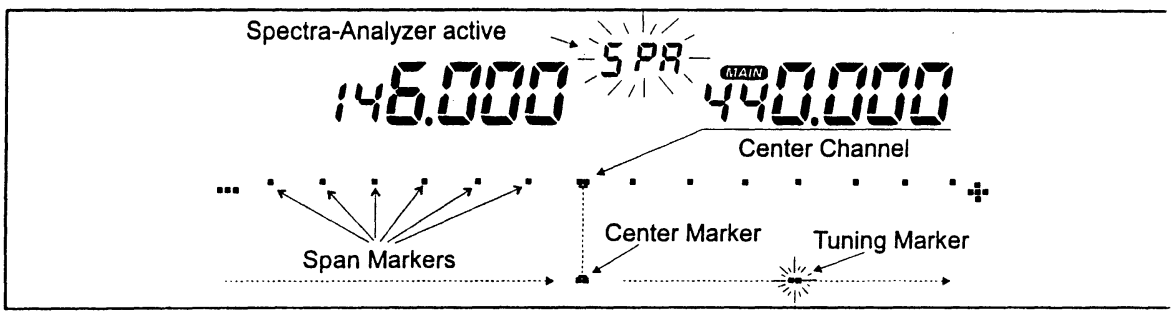
Span markers are provided to give visual reference during frequency excursions and signal "location". They can be calibrated to appear in 100-kHz, 200-kHz, 500-kHz, or 1-MHz increments.





Span Marker Comparison

(@25-kHz channel steps)



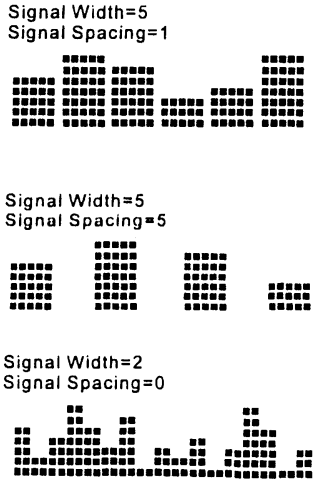
It is important to realize that the total spectrum you can view depends on the configuration of three (3) following settings:

Channel Step Size – basically, the larger the steps size, the greater the total spectral view, but at the expense of channel resolution. For general operation, we recommend keeping the default step size to the standard size used for the amateur band you operate on.

Signal Width – the number of horizontal pixels assigned to represent a signal. Received signals can be displayed using 1 to 10 pixels in width.

Space Width – similarly, this is how many horizontal pixels are turned off to represent "spaces" between visible channel activity. This can be varied from 0~5 pixel widths. Both this and the signal width setting determine how the spectrum "silhouette" appears.

With seven channel steps sizes, ten signal widths and six space widths, there are a variety of combinations that each present a unique spectrum view. With experimentation, you can select the combinations that are most effective for your operating needs and configure these settings from menu functions 50, 51 & 52 on page 74. The illustration shows examples of the effect of these settings.



Using the Spectra-Analyzer

For DIAL (VFO) operation press (D)→(5) to start continuous or single sweeping. When you see activity or a signal of interest, use the DIAL, (DWN)/(UP), or (A)/(B) buttons to shift the tuning marker over so that it is centered on the visible segment (or the tallest segment of a group). When properly centered on an active channel, the frequency display blinks (unless IBD is disabled, see page 71). Please remember the following points when using the Spectra-Analyzer:

- If *single-sweep* mode was used (pressing (D)→(5) for less than ½ sec), the station will be heard when

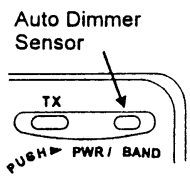
properly tuned (the marker is centered). You can press the PTT at any time to operate.

- With *continuous-sweeping*, after centering (tuning) a signal of interest, you must first *press in on* (C) *once* to monitor and/or transmit, *and again* to resume sweeping.
- When viewing main channel activity, you can toggle operation to the sub channel at any time, however, *Spectra-Analyzer operation remains on the previous band.* To change spectrum views, you must first turn the scope off by pressing (*), then toggle bands and press D→(5) again.

☞ ***Hint*** - to eliminate the need for a two-keystroke input to activate the Spectra-Analyzer, this feature can be assigned to either F1 or F2 for faster access and operating convenience (see page 22).

Display Dimmer and Contrast

The LCD backlighting adjusts automatically to ambient lighting from the front panel photo sensor. However, there are six auto-dimmer levels and six manual levels that can be selected, and backlighting can also be turned off if desired.



The display contrast can be manually adjusted through 16 levels for best visibility at different viewing angles. Please refer to menu functions 30 and 31, on page 71 for dimmer and contrast settings.

Auto Receiver Mute

With dual receive capability, stations can occasio ally be heard from both receivers simultaneous Aside from causing confusion, important informatic such as a QTH or callsign from the desired static might be missed. This feature mutes or disable audio while receiving a station from a selected bar while receiving a station on the other band. You s have S-meter indications of activity on the sub-cha nel, but audio will not be heard while the main-cha nel is busy. Audio from both channels can also b muted together, if desired.

The mute feature can activate automatically manually by pressing D→(8). In addition, selec able muting levels and time duration are availabl The settings explained below are configured b menu functions 47, 48 & 49 on page 73.

Mute Time - during manual muting, audio is contin ously muted by selecting Off, otherwise a mute dur tion of 1 ~ 60 mins can be selected. After the tim expires, audio is unmuted until D→(8) is presse again. Timer settings do not apply if Auto Mute i enabled.

Mute Level – Audio is either partially or completel muted according to selected mute level.

- Mute Level 1 (*preset* muting) – reduces audio to *preset level*–regardless of the original volume (th preset level is also factory default).

- Mute Level 2 (*full* mute) – audio is disabled so that received audio from the selected band is not heard.

Auto Mute - this selects which band's audio is to be muted if two stations are received simultaneously (see the note below). The ***MUTE*** icon appears above the selected band. The mute function is completely disabled by selecting OFF.

Mute Function Comparison	
Manual Mute	**Auto Mute**
Enabled by pressing [D]→[8] *momentarily* (<1/2 second).	Enabled/disabled in the auto mute menu, activates when the transceiver is turned on.
Mutes *both* channels / bands according to the selected mute *level* (1, 2) and *duration* (1-60 mins) set by menu	Mutes a selected channel / band (***MUTE*** icon displayed) according to the selected mute level
Comments	***Comments***
Ensure mute time is set between 1-60 mins - setting this to 0 *disables* the manual mute feature completely.	Mute time duration (1-60 mins) does not apply to this function.
Do not hold the [8] button longer than 1/2 sec, this activates the unrelated skip function.	Pressing [D]→[8] will momentarily mute *both* the left and right receiver channels.

Note - during mixed V&V or U&U receive, the ***MUTE*** icon identifies which channel's audio will be muted.

With Auto Mute enabled from the menu, the function activates whenever the radio is turned on, and ***MUTE*** appears to the left of the selected band. Refer to the table for a comparison of manual and auto mute.

Extended Receive & AM Reception

Receive range (only) can be extended from 110~174 MHz (VHF) and 410~500 MHz (UHF) by performing a power-on routine. Press and hold [4]&[#] while turning on the power.

If you want to receive aeronautical transmissions, AM mode can be set to automatically activate for frequencies between 110~137 MHz or else be disabled via menu function 53 (see page 74). For best tuning, use 25-kHz channel steps in the aeronautical band.

The ★ symbol *blinks* next to the left frequency display to remind you that AM reception in enabled. Note: do not confuse this with the PTT lock indication (which appears as a *steady* ★ next to the right frequency display.

To return to amateur band-only reception, repeat the power-on sequence.

Memory Storage

There are 112 programmable memories. These consist of 100 regular memories divided into 10 banks, along with 6 special-purpose memories (L1, L2, U1, U2, PRI and HOME) for each band. Normally, the ten memory banks are divided evenly, providing 5 banks (50 memory channels) each for VHF and UHF. If you need more memories on a particular band, you can transfer banks as needed (see the box to the right).

Each memory can store separate receive and transmit frequencies or repeater shift, and CTCSS tone data. The Home channel memory is recalled instantly by pressing [#]. The L1 & U1 and L2 & U2 memories can be used in pairs to store the programmable tuning and scanning limit as described later, in addition to general purpose operation. The PRI memory can be used for priority channel monitoring.

You can assign alphanumeric (A/N) names up to 6 characters long to each memory, and have it displayed by name rather than frequency. Memories that have not been named are still displayed in the usual 3-01,L1 format, so you can mix and select the way memories are displayed.

A choice of 60 different characters is available, with 24 special-purpose symbols to customize your name tags (see the table on page 48). While programming frequency and operating settings into a memory, you can assign it a name. Refer to menu function 1, on page 62.

Transferring Memory Banks

The ratio between VHF and UHF memory banks can be changed as needed. Hold the [*] button while turning the transceiver on. The display appears as below showing the present memory bank ratio:

UHF 5 BANKS VHF 5 BANKS

Press [A]/[B] to select the ratio you need, then press the PTT to save and exit. ***Note!*** *previously-stored channel data is lost when performing this procedure!*

Notice that pressing [*] from the VFO mode alway recalls the *last stored or used* memory. When storin memories, <VACANT> appears on the display fc memories that have not been previously prc grammed, while <AVAILABLE> appears whe memories presently storing data are selected.

Recalling Memories

Previously, we used [*] to change from the VFC mode to the memories after they were stored. The group and channel number appears at the displa top whenever operating on a memory.

After at least one memory has been stored, you car select memories for operation by pressing [*] ther using the DIAL or [DWN]/[UP] keys. Only pre-storec memories are displayed: empty memories are skipped. To exit the memories and return to the last-used VFO, press [*].

Home Channel Memory

The Home channel is an instant-recall memory (one per band) that can be used to give quick access to any commonly used frequency (such as a simplex calling channel or club repeater). It is instantly recalled from DIAL or MR modes by pressing [#].

When [#] is pressed, H appears in the channel box for the respective band while the Home channel is selected. The Home channel memory is set to bottom edge of the band by default, but you can reprogram it with any frequency and repeater state, or even a separate transmit frequency.

To program the Home channel memory, select 03:HOME CHANNEL WRITE under the <MEMORY FUNCTIONS> menu (page 63) and use the same procedure as for storing regular memories.

Split Memory Operation

All memories can store an independent transmit frequency, for operation on repeaters with non-standard shift.

Note! - this operation requires at least one of the user-programmed keys to be configured for menu recall.

- ❒ Store the receive frequency in the desired memory using the method already described (it does not matter if a repeater offset is active).
- ❒ Tune the VFO to the desired transmit frequency. Press [D]→[0], then [DWN]/[UP] to again bring up the 01:MEMORY WRITE entry.
- ❒ Press [C], then hold the PTT switch while pressing [F] or [PTT] (whichever is set for menu recall) once more momentarily (this does not key the transmitter).

Whenever you recall a separate transmit frequency memory, "– +" appear together above the appropriate frequency display. Again, you can press [D]→[9] to display the transmit frequency, and the shift symbols will blink. You can also press [D]→[6] to cancel repeater shift (temporarily, until you change channels).

After storing a memory with a separate transmit frequency, rewriting the receive frequency *also* deletes the separate transmit frequency.

Tuning Memories

While receiving on a recalled memory, you can retune it and change other memorized settings (such as repeater shift) by pressing [D]→[A]. The ***MT*** icon appears to the left of the channel display, and you can tune in the same way as described before (including 1-MHz steps).

- ❒ To store the retuned frequency or setting in the current (or other) memory: press [D]→[0], bring up the 01:MEMORY WRITE entry, select a new memory (if desired). Press [D]→[0] again to save

the retuned memory, then (*) to exit memory tuning.

❒ Once you have retuned a memory, if you don't want to save your changes, just press (*) to return to the original memory data.

Clearing Memories

If you regularly move from one area to another, you may want to use certain memories at specific locations or times. You can temporarily clear undesired memories (except memory channel 1-01) and restore them any time later when needed. Refer to menu function 2 on page 63 for details on memory clearing. The status of each memory appears on the menu display.

The following are a few terms to be familiar with:

- <VACANT> indicates the memory has not been previously programmed.
- <RESTORE> appears for previously written memories which have been erased.
- <ERASE> indicates memories stored with data but not yet erased.
- <PERMANENT> only appears on memory 1-01, this memory cannot be erased.

One-Touch Memory

To store channel data quickly, press (D), then hc (0) for 1 second to write the current channel setti into the *first vacant memory of the last availat bank.* For example, if five banks were made availat for VHF (see the box on page 30), and all memori in bank 5 were vacant, channel data would be e tered into 5-01. You can later recall this memc and assign it a name or move it to another memc channel, as desired.

Memory-Only Mode

If you would like to only operate on memory cha nels, you can use this feature for very simple oper tion: only stored memories can be selected ar displayed (along with their alphanumeric names, if s tagged). Indicators for settings like repeater shift ar tone squelch are still displayed, although they cann be changed. Only TX power, volume/squelch, cha nel selection and paging operation can still be s lected.

❒ After programming memories, you can togg memory-only operation by holding (*) & (2) whi turning on the power.

Scanning

Before scanning, make sure the squelch is set to silence background noise. In the DIAL (VFO) mode scanning starts *upward* by pressing D → 4 momentarily. To toggle scanning direction *downward*, press ⊶, or rotate the DIAL ccw. If the transceiver is in the VFO or MT (memory tune) mode, band scanning will result. Otherwise, in normal memory mode, only the memories are scanned.

In the MR (memory recall) mode, *momentarily* (less than ½ sec.) pressing D → 4 only scans those programmed memories *in the currently selected bank* (1-01 ~ 1-10, for example). Pressing *and holding* D → 4 scans all memories (except L1, U1, L2, U2 & PRI).

Scanning pauses when a signal opens the squelch, the decimal point in the display blinks (with IBD enabled, the frequency also blinks - see page 71).

When band scanning, a double beep sounds each time the scanner reaches the band edge, unless the beeper is disabled (menu function 34 on page 71). Scanning resumes according to how you set the scan resume mode in from menu function 38 on page 72. There are two types of scanning, each with two modes of resume operation:

BUSY SCAN - searches for the next active channel, then pauses. With *Carrier Resume*, scanning continues after the station stops transmitting. *Time Resume* pauses on activity for 5 seconds then scanning continues (if the station is still transmitting or not).

CLEAR SCAN - searches for the next open (clear) channel, then pauses. With *Carrier Resume*, scanning continues if a station transmits. *Time Resume* pauses on open channels for 5 seconds then scanning continues (if a station is transmitting or not). You can use Clear Scan in metropolitan areas with crowded bands to find a free channel to operate.

Normal or slow scan speed can also be selected in the #37: SCAN SPEED SELECT menu on page 72.

❑ To manually stop scanning, press the PTT, A / B, ✱ or #. This leaves operation on the current frequency (or the home channel with #).

Memory Skip Scanning

With very active channels stored in memories, you may wish to skip them when scanning, but still have them available for manual selection. You can mark a memory to be *skipped* by pressing D → ✱ while receiving on the memory. The ◀*SKIP* icon appears just above the 100's of MHz digits, indicating that this memory will be skipped during scanning (although you can still recall it manually).

To cancel scan-skip and allow the memory to be scanned, repeat the steps used to disable it; select the memory manually, and press D → ✱.

PMS (Programmed Memory Scanning & Tuning)

Besides band and memory scanning, you can also scan only between two frequencies of your choice (in the selected channel steps). The limits are stored in two pairs of special memories labeled L1 & U1 and L2 & U2 as follows:

❒ Store the lower edge of the desired scanning range in memory L1, and the upper edge in memory U1 (or L2 & U2).

❒ With either of the memories recalled, press D→A to enable memory tuning (***MT*** appears *blinking*).

You can now tune and scan as before, however the range is now limited to the resulting subband. If ARS or manual repeater shift is activated, the offset is applied automatically when you transmit (even if the resulting transmit frequency is outside the subband limits). Memories L2 & U2 work together the same way.

Note: The frequency resolution of subband limits is 100 kHz, although the channel resolution of the L & U memories is the selected channel step size. Therefore, the actual limits are the frequencies stored in these memories *rounded down* to the nearest 100 kHz. Since the memories themselves are not limited to a specific frequency, you can still use them for other purposes within the 100-kHz range above the intended limit.

Note that with PMS, as with regular band scanning a double beep sounds each time the scanne reaches the sub band edge, unless you have dis abled the beeper (page 71).

❒ To release subband limits press DIMR SKIP * once to returr to memory operation, again to return to a VFO, o. HOME PM # to switch to the Home channel.

Once the L & U memory pairs are stored, you car reactivate subband scanning and tuning just by re calling either memory of the pair and pressing D→A again. However, you cannot activate the subband if either memory of either PMS memory-pai is marked for skip-scanning, or cleared (menu function 2 on page 63).

One-Touch PMS

A faster way to start PMS scanning is to press D→4 and keep 4 depressed for ½-second or longer. The display reverts to the last-used PMS memory with memory tuning automatically enabled (***MT*** blinking). If this memory is in the pair (subband) you wish to scan, press D→4 to start scanning. Otherwise, select a memory in the other pair and press D→4 to begin.

☞ ***Hint*** - to eliminate the need for a two-keystroke input to activate One-Touch PMS, this feature can be assigned to either P1 or P2 for faster access and operating convenience (see page 22).

Priority Memory Monitoring

The priority function automatically checks for activity on the priority memory every five seconds while operating on the VFO or other memories. When the receiver detects a signal on the priority memory, operation automatically shifts there while the signal is present (plus a few seconds). If you transmit while paused on the priority memory, monitoring ceases and operation stays on the priority memory.

To set up priority monitoring:

- ❒ Program a channel you wish to use as the priority channel in memory PR 1 (found between U2 and 1-0 1).
- ❒ Press (*) to operate in the VFO mode or select the memory you want to operate on, and then press D → (#). P appears in the display, and about every five seconds the displayed frequency and channel number shift to the priority memory (PR 1) briefly while the receiver checks for a signal.

As long as no signal appears on the priority memory to open the squelch, you can tune, transmit and receive on the VFO, or select other memories (memory labels are displayed only while changing). If you hear a station you wish to talk with on the priority memory, press the PTT momentarily while receiving their signal to stop priority checking, otherwise, operation reverts and checking continues. Priority monitoring will resume according to how you set the scan-resume mode (see menu function 38 on page 72). To cancel priority monitoring manually, press (*).

Note that you programmed memory PR 1 as the priority memory in the above procedure when operating from a VFO. You cannot, however, switch between memory and VFO operation (because pressing (*) cancels priority monitoring).

Locking the Controls

The PTT, MH-39 buttons, and DIAL can each be locked (disabled) to prevent inadvertent transmissions or adjustments. You will find 🔒 (dial and/or buttons)or possibly ★ (PTT lock) displayed singly, or in combination near the frequency display when any of these are locked. Configuring the locking scheme is configured from menu functions 45 & 46, as explained on page 73. The DIAL and buttons are locked by pressing D → (MW), while the PTT lock is menu-enabled.

CTCSS Operation

You can access repeaters requiring a CTCSS (continuous, subaudible) tone, and silently monitor for calls on busy channels. The encode "***ENC***" function superimposes a subaudible tone on the transmitted carrier. The decode "***DEC***" (tone squelch) function monitors receiver audio through a narrow filter at the same subaudible frequency, keeping the squelch closed until you receive a matching tone (with optional FTS-22 tone squelch unit installed). To check or set the current CTCSS tone frequency, refer to menu function 6 on page 64.

To activate CTCSS functions, press [D]→[TONE 1] when the operating frequency is displayed. With one press, ***ENC*** (encode) appears above the display and the tone generator is activated for transmission. Press [TONE 1] again and ***ENC DEC*** are displayed together as the tone squelch system is activated for both transmit and receive (only incoming signals "encoded" with the matching tone open the squelch). To turn off the tone squelch features, press [TONE 1] once more.

You can store CTCSS tones (and encode/decode states) in each memory in the same manner and at the same time as storing channel frequencies. To change the tone or state stored in a memory, just recall it, reset the tone frequency or function, and store the memory again. If you activate CTCSS on a subband limit memory, it will be active when *that* memory is used to start subband operation.

CTCSS Bell Paging

CTCSS Bell operation is an extension of the CTCSS encode/decode function previously described: incoming subaudible tones open the squelch. However, it adds two features to make this semi-private operation more convenient:

(1) The CTCSS Bell mode displays 🔔 above the respective band's frequency display. When you receive a matching CTCSS tone, this bell blinks for a few moments to indicate you received a call. So, by looking at the display you can tell if a call came. You cannot tell, however, who called. That requires DTMF Paging, described later.

(2) If you are waiting for a call, it is sometimes convenient to have the transceiver "ring" to get your attention. The alert ringer can be set to ring once, several times or can be disabled completely (see menu functions 24~27 on page 69 & 70 for CTCSS Bell ringer configuration).

To activate the CTCSS Bell:

- ❒ Tune to the desired frequency, then select a CTCSS tone frequency as described on page 64. Note: ***ENC DEC*** does not have to be selected and/or appear in this case.
- ❒ Press [D]→[PAGE 2], then [PAGE 2] repeatedly to select the CTCSS Bell mode. This cycles through the following paging mode/displays:

- DTMF paging – ***PAGE*** is displayed below the center of the respective frequency display.
- DTMF "Trigger" Pager – ***T.PAGE*** is displayed, as above;
- DTMF tone-coded squelch – ***CODE*** is displayed;
- CTCSS Bell Paging – 🔔 is displayed at the upper left, and;
- No paging (none of the above symbols).

Now all incoming calls without a matching CTCSS tone will be ignored by your receiver. Any call received with the matching CTCSS tone will cause 🔔 to blink and the transceiver to ring (if the ringer is enabled) as the squelch opens while the caller transmits. Note that other stations do not need to be using the CTCSS Bell function to call you: they can use normal CTCSS functions of their transceiver.

When you reply to a CTCSS Bell call, you may want to turn off the CTCSS Bell function, since otherwise the transceiver will ring every time your squelch opens (unless you have disabled the ringer). Just press [F]→[2] once to turn it off. If you have set up normal tone squelch operation beforehand, you can continue your QSO.

You can store the CTCSS Bell mode selection in a memory, just as you can store different CTCSS tones and encode/decode states.

DTMF Code Squelch & Paging

The FT-8500 includes a DTMF (Dual-Tone, Multi-Frequency) tone encoder/decoder for paging and selective calling features. This allows calling specific stations or groups, and receiving calls directed only to you or to groups of your choice.

The paging and code squelch systems use 3-digit numeric codes (000 ~ 999), transmitted as DTMF number sequences. There are eight Code Memories (independent of channel memories and the VFO) numbered 1 ~ 6, C and P, which all store 3-digit DTMF paging codes.

3-Digit DTMF Code Memories	
CH	**USE**
1 ~ 6	Individual ID code of stations you wish to call or monitor stored here.
C*	Automatically shows ID code of paging station — Rx-only, cannot be written to.
P*	Your personal ID code is stored here.
*memory cannot be selected for page-code inhibit	

Your receiver remains silent until it receives three DTMF digits that match those stored in one of its code memories. The squelch then opens so the caller is heard, and the paging ringer sounds (see page 68~69). When you press the PTT, the same three pre-stored DTMF code digits are transmitted

automatically. In the paging mode, *three more DTMF digits are sent*, representing the 3-digit identification code of the transmitting station.

Like the CTCSS Bell system described previously, the DTMF Paging and Code Squelch systems are selected by pressing [D]→[PAGE 2], then repeatedly pressing [PAGE 2]. Either ***PAGE***, ***T.PAGE*** or ***CODE*** appear when DTMF paging, trigger paging or code squelch is activated, respectively. The following descriptions begin with an overview of the various DTMF selective calling features, followed by details of actual operation.

DTMF Code Squelch

The code squelch mode is very simple: both you and the other station communicate using the same 3-digit DTMF sequence, sent automatically at the start of every transmission. Your receiver remains silent to all signals that are not prefixed by your selected 3-digit code. When you receive the matching tone sequence, your squelch opens and stays open until a few seconds after the end of their transmission.

In the code squelch mode, you must first store and then manually select the one Code Memory holding the 3-digit DTMF code required to open your squelch (menu function 16 on page 67). Also, in the code squelch mode, Code Memories 1 ~ 6 always function the same — the distinctions and special settings described next for the paging mode do not apply.

DTMF Paging

Standard DTMF Paging uses a specially formatte string of 7 DTMF digits (see below). With DTMI paging, you can receive signals that are prefixed witl your personal 3-digit code, or any of up to six othe 3-digit codes.

DTMF PAGING FORMAT

Code of Called Station			Flag	Code of Calling Station		
1	2	3	*	4	5	6
DTMF String (7 digits in length)						

When you receive a paging call, the selected Code Memory changes automatically, and the way the display responds depends on which paging code was received. The key to using DTMF paging in the FT-8500 is first understanding how the Code Memo ries are used.

Code Memory P (Personal Code Memory)

You must choose a 3-digit code to identify your sta tion, and store it in this Code Memory. You can share this code with your friends, club members or anyone you want to be able to reach you by paging.

When a station transmits your personal 3-digit code the receiver squelch opens, the ringer responds (see page 68), and the 3-digit code of the station calling is stored in Code Memory C. At the same time the

frequency display changes to show the contents of Code Memory C - which always contains the identity of *the calling station*.

Code Memories 1 ~ 6

Codes of up to six other stations can be stored in these memories. These are stations you expect to frequently contact, and whose page calls you also want to receive. Members of a common group or club usually share a common 3-digit paging code so that they can be paged simultaneously.

If the paging code received is *not your personal code*, but matches one of those stored in Code Memories 1~6, the transceiver still responds as before, but the display now shows the code memory of the *station that was paged* (rather than the calling station's ID).

Code Memory C

This is reserved for only one purpose - to store the calling station's 3-digit ID code for later display. This code memory is *read-only* and cannot be used to manually store codes like memories 1~6 & P.

If a station pages your personal 3-digit code (stored in code memory P), the transceiver *automatically* reverts to code memory C and displays the caller's ID. If the paging code matches one of the other codes stored in code memories 1~6, the calling station's ID is *still* entered in code memory C, however, you have to *manually* recall it for viewing.

Note that Code Memories 1~6 are used to store codes for calling purposes only, or for both calling and receiving, as you desire.

Remember, with Code Squelch operation (but not with DTMF Paging), you can only receive a call on the currently selected code memory, and the display does not change when a call is received. So for code squelch, as mentioned before, the code memory distinction does not apply (although you must still store the 3-digit Code Memories).

In either code squelch or paging modes, any DTMF-equipped station can call you. They can use a DTMF keypad to send the three digits if you are in code squelch mode, or seven digits (actually, three digits—"star"—three digits, e.g. 1 2 3 ✻ 4 5 6) if you are in paging mode.

DTMF Code Monitoring

When a 3-digit DTMF code is received during Code Squelch or DTMF Paging operation, it is automatically written into code memory C. By selecting this code memory as described next, you can view what DTMF code was last heard, whether or not it opened your squelch.

Configuring Code Memories

The first thing to do before using DTMF Paging or Code Squelch is to store your personal 3-digit code in Code Memory P. Although up to six other code memories can be stored, you might only need a few of them to call your friends or a specific group. Likewise, you'll probably only want your radio to respond to pages directed to you (or maybe your group or club's code). When storing code memories using the procedure on page 67 (menu function 16), you choose whether your transceiver should respond to paging calls for the codes in memories 1~6 (code memories P & C, however cannot be modified). Remember that the field entry at the far right determines whether DTMF Code Squelch or Paging operation will respond to the 3-digit code stored in this memory.

After entering the 3-digit code, press [UP] to move to the right and press [*A]/[*B] to toggle the field selection to either ENABLE or DISABLE. You can also have a small underbar appear in the display for code memories enabled to receive paging calls with the One-Touch paging feature (covered later).

As mentioned above, code memory P cannot be disabled, since this is your own ID (that you will always want to receive when paging is activated). Likewise, code memory C cannot be enabled, since this is reserved for displaying incoming codes only.

Once you have stored your 3-digit ID in code memory P, you can activate the paging or code squelch functions from the normal frequency display by pressi [D]→[PAGE 2]. As mentioned earlier in the CTCSS E procedure, repeatedly pressing this key cycl through DTMF paging (***PAGE*** displayed), trigg paging (***T.PAGE***), code squelch (***CODE***), CTCS Bell paging (🔔), and no paging (none of these syr bols).

DTMF Code Squelch Operation

As described earlier, with DTMF code squelch ac vated (***CODE*** displayed), your squelch will not ope until you receive the proper 3-digit DTMF code a cording to the selected code memory. Likewise, eac time you press the PTT, the same 3-digit code i automatically sent to open the other station's DTM coded squelch.

DTMF Paging Operation

Any DTMF-equipped station can call you by sendin your 3-digit code, followed by their 3-digit ID Code When a valid paging tone sequence is received several things happen:

- The ringer sounds (unless you disabled it, usin menu function 21 on page 69).
- The ***PAGE*** icon blinks, and the 3-digit ID code of *the calling station* appears in the frequency display. This code in now stored in code memory C.

If you press your PTT switch after receiving a page, the transceiver sends the other station's ID code, a DTMF "star" (*) followed by your own 3-digit per-

sonal ID code (code memory P) all automatically, and then resets the radio to receive another call.

Unless you are using the Trigger Paging function (covered next), you may want to switch from paging to code squelch mode once contact is established. Just press [D]→[2] once, so that ***CODE*** appears. Either you or the other station will also have to select code memory C, so that you will both be using the same DTMF code (either, but not both, must reselect their Code Memory).

With the Code Squelch activated in this manner, you will hear three DTMF code digits transmitted when you press your PTT switch. These are the digits stored in the currently selected code memory (and displayed in place of the 100's-of-MHz digit if One Touch Paging option is enabled), and that open the squelch of the other station.

Therefore, at the start of each transmission, you must wait a second or two after pressing the PTT switch for the DTMF code to be sent (you will hear it in your speaker).

When you finish your conversation, if you need to reactivate DTMF Code Paging, press [D]→[2] until ***PAGE*** is again displayed.

Trigger Paging

This feature overcomes the inconvenience of manually switching to and from Code Squelch operation when responding to a page. It can only be used between transceivers equipped with this feature: such as the Yaesu FT-11R/41R and FT-51R.

To activate Trigger Paging, press [D]→[2], then [2] repeatedly, until ***T.PAGE*** is displayed. When a call is received, ***T.PAGE*** blinks, and the alert ringer sounds. If the other station is also using Trigger Paging, communications can begin just by acknowledging the page: press the PTT and talk within 3 seconds after the DTMF code sequence is sent. The pager resets to receive a new call as soon as either station fails to respond to the other within 3 seconds.

Paging "Answer Back"

When you press the PTT to respond to a page call, the caller's ID code, followed by a DTMF "✻" and your personal ID code, are transmitted. This informs the calling station that their page was received. If you prefer, you can have the FT-8500 respond *automatically* (transpond) to received calls using the answer-back feature.

There are two choices for automatic response - *Answer-Back* and *Page Forwarding*. As mentioned before, the answer-back mode acknowledges a received page by "paging back" the calling station (just as if you manually selected their 3-digit code

and pressed the PTT). Page Forwarding takes a received DTMF paging string and re-transmits the *original* sequence (rather than reversing the ID code pair as in answer-back format), relaying the call to extend your paging range. The graphics on page 47 illustrates the difference between these modes.

You can leave your FT-8500 with this mode enabled in your vehicle, office or other vantage point when you are temporarily away, but will be using another transceiver and don't want to miss any paging calls.

To enable this feature, see menu function 18, on page 68.

Paging Tx Delay

When calling other stations using DTMF Paging c DTMF Code Squelch, particularly through repeater you may find that some stations are unable to receiv your calls. This can be caused by their squelch nc opening fast enough (after receiving your transmitte carrier) to allow all of the DTMF digits to be receive and decoded.

To correct this problem, you can set a longer dela between the time your transmitter is keyed and th first DTMF digit is sent. Refer to menu function 17 o page 68 to change the default delay of 450 msecs t a longer delay (750 or 1000 msecs).

Sending DTMF Messages

This feature uses DTMF signaling to send messages to stations with transceivers equipped for message reception, such as the Yaesu FT-11/41R & FT-51R. This feature is *independent* of DTMF Paging described previously and you aren't required to first page a station in order to send them a message.

Message Format

The FT-8500 contains a bank of ten Tx message memory "slots" labeled 1~9 and 0 (which is reserved for holding your personal ID, etc.). Any of the numbers, letters or symbols from the sixty alphanumeric-character set (page 48) can be used in message and ID text.

Tx Message Bank	
Slot No.	**Messages**
0	YAESU (ID slot)
1	QSY U
2	QSY U
3	QSY
4	SIMPLX
5	GO2RPT
6	IN CAR
7	AT HOME
8	CALLME
9	EMERG

A separate 9-slot memory bank is used for *incoming* (received) message storage. Once received, these messages are automatically stored to be recalled and viewed later.

Message are sent using a simple format: the message text is composed of up to eight DTMF characters, always preceded by and ending with a DTMF "#" character, as shown below.

Flag	TX Message TEXT & ID Format (up to 8 characters)	Flag
#	CALLHOME	#

The DTMF # flags used at the beginning and end are significant because they identify the DTMF string contained within as a message when decoded. The FT-8500 automatically formats your message with # flags, so you only have to enter text as you would like it to appear.

The reserved ID slot uses the same format, and is basically just another message slot. However, when the receiving station is set up for message and ID reception, it will be handled (and displayed) separately.

There are ten factory-programmed Tx messages (including the ID slot), as shown in the table. You can store your own personal ID in slot 0 and customize slots 1~9 with messages of your choice from menu function 13, outlined on page 66~67.

DTMF Message Operation

When sending messages, you can have your ID included along with the message, and have their ID displayed when you receive a message (if they include it). Also, "MSG" or else "MSG ID" appears at the lower left of the display, indicating if one or both are to be sent (and displayed). Message or message+ID format is selected and enabled from menu selection 12 on page 66.

With message mode activated, you operate as before (there is no requirement to have DTMF paging or CTCSS turned on). Message operation remains transparent until a properly formatted DTMF sequence is received. When this occurs:

- The message is stored into an open slot in the receive message bank. Up to nine messages are stored in the order received, and can be recalled later.
- A display header appears, showing the message (and ID if enabled), which band it was received on, and the slot it is now stored in (1~9). If the CW Monitor (menu function 15 on page 67) is enabled, the message is decoded and played back in Morse.
- In either case, the message header remains until MSG LAMP is pressed *twice*.

Vacant slots can be filled with up to nine messages, subsequent messages are queued and *overwrite* filled slots on a *first-in, first-out* order. If you do not want stored messages overwritten, this can be disabled and MSG FULL appears after the ninth message (menu function 14 on page 67). To view messages, press MSG LAMP and recall message slots using the DIAL knob or A/B keys. Empty message slots are indicated by <BLANK>.

Sending Messages

Before sending a message, inform the other station to switch their transceiver into its message reception mode. With that done, any stored messages can be sent using the following procedure:

- ❒ Hold the PTT and press MSG LAMP, the display changes to show the currently selected message slot.
- ❒ Use the numbered keys or the A/B button to select the desired message slot to send, then press MSG LAMP and release the PTT. You will hear the DTMF message string (and ID if selected) as it is being sent.

Sending Messages Manually

If you do not have a particular message in memory (or the time to store it), you can send it manually by using keypad button combinations. As explained before, message format consists of a DTMF # followed by up to eight message characters, ending with a

additional #. When sending a pre-stored message, the #'s are automatically inserted. When sending messages manually, however, *remember to include these.*

Unlike DTMF numerals, which are entered with a single key, letters of the alphabet and other symbols each require a *two-button key sequence*. For example, generating the letter P requires manually entering 7 → A. The table on page 49 shows the key sequences required to generate each of the available characters.

- Press and hold the PTT during the message string; press #, followed by your message (up to eight characters), then # again before releasing the PTT. If sending an ID string immediately follow with an additional #, the ID text (up to eight characters), then # to finish.

Customizing Ringer Settings

The transceiver's ringer responds CTCSS Bell, DTMF Paging or DTMF Message calls according to how it is configured via menu programming. Three types of ringer melodies are available:

- Beeper Melody (factory-programmed)
- User-programmed Melody
- CW Monitor

The CTCSS Bell & DTMF Paging Ringer can be enabled to repeat the selected melody (or Morse announcement) 1, 3, 5 or 8 times when a call is received, or disabled.

The DTMF Message ringer can be enabled or disabled. The User-Melody is stored in DTMF Auto-Dial Memory USR (reserved for this purpose), and is explained in detail shortly. The CW monitor decodes incoming DTMF tones and replays them via the internal speaker to alert you to incoming calls and their message. The CW playback speed is selectable from approximately 5~25 wpm (menu function 39 on page 72). The chart below shows possible ringer settings.

Ringer Function	Repetition (on/off)	Melody Selection
CTCSS Bell →	Off 1, 3, 5, 8 →	CW Monitor Internal User
Paging Ringer →	Off 1, 3, 5, 8 →	CW Monitor Internal User
Message Ringer →	Off On →	CW Monitor

To configure the CTCSS Bell, Paging/Message Ringer and CW Monitor, refer to menu functions 19~27, on pages 68~70.

DTMF Autodialer Operation

Ten autodial memories, labeled 1 ~ 9, and USr, store DTMF tone sequences of up to 16 digits. Memory USr is reserved for storing a user-composed ringer melody, and is covered shortly. You may assign a name up to 6 characters to each DTMF auto-dial memory, to be displayed when the memory is recalled. This can help you to identify whose numbers you have stored. The same character set and procedure is used for autodialer memory naming. Autodialer memories can be used for remote DTMF control sequences or telephone numbers for repeater or personal autopatch systems.

The DTMF autodial memory feature is toggled on or off via menu programming and ▣ is displayed at the center of the lower display when autodialing is activated. To store DTMF Autodialer Memories and enable the function, refer to menu functions 9 & 10, on page 65.

Using the Autodialer

❒ To play back DTMF auto-dial memories on the air, first ensure the DTMF memory mode is activated (▣ displayed). Then close the PTT switch and press the number of the auto-dial memory to transmit. Once the DTMF sequence begins, you may release the PTT (the transmitter stays keyed until the entire auto-dial string has been sent).

Note!

With the DTMF Auto-Dialer active, the keypad cannot be used to transmit individual DTMF codes. If you do not have the required DTMF sequence stored in memory, turn the Auto-Dial mode off, then manually enter the desired DTMF codes.

Composing the Ringer User-Melody

The default ringer for CTCSS Bell or DTMF Paging operation is factory set. You may compose your own melody if desired, and and store it in a special DTMF Autodial memory reserved for this purpose (memory USR EP). When enabled, the user-melody plays instead of the factory melody. Refer to menu function 10 on page 65 to enter your own melody.

APO (Automatic Power-Off)

This turns the transceiver off after 1~12 hours of key or PTT inactivity*. APO is activated using menu function 28 on page 70. Afterwards, ⏻ appears in the display, and a timer starts every time you press a key. If you don't press any keys for the selected time-out period, and as long as you are not scanning or priority monitoring, the transceiver turns off. After that, you must switch the transceiver back on for use. You can deactivate the APO feature via menu programming, so the display shows OFF. ***Note:** Tx during Packet and X-Band Repeater operation will not reset the APO (but pressing a key will).*

Transmit Time-Out Timer (TOT)

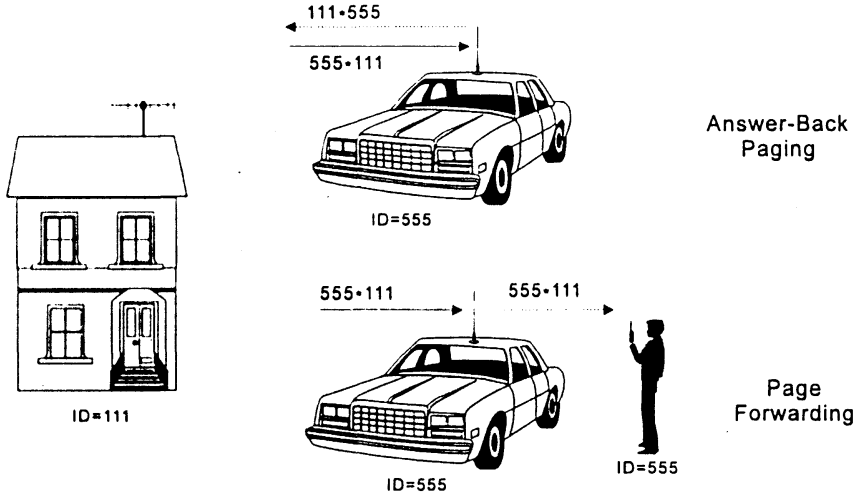
This limits Tx time after the PTT is held (1~60 mins), after which the transmitter automatically un-keys (even if the PTT is still held). To reset the timer and transmit again, the PTT must first be released. This feature is useful to limit long key-down periods when the cross-band repeater feature is enabled, or in the event of a stuck microphone (wedged between the car seats, for example). The TOT is enabled via menu function 29 on page 70; select a timer duration of 1~60 mins or OFF. When active, ***TOT*** appears between the channel displays.

Checking the Battery or DC Supply Voltage

The battery or DC supply voltage can be displayed in place of the sub channel frequency, or else momentarily checked. Refer to menu functions 32 & 35 on page 71.

Disabling the Keypad Beeper

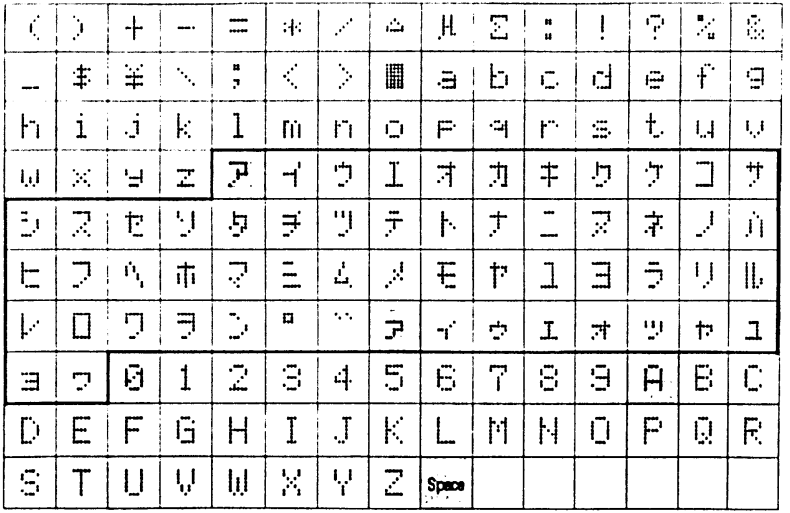
You can turn off the keypad beeper that sounds whenever a key or button is pressed on the MH-39 Mic Controller unit. If you lock the keypad, each key will sound a different musical note for as long as it is held. Refer to menu function 34 on page 71 to enable/disable the beeper.



Automatic "Answer-Back" Paging (see page 41).

Alphanumeric Character Set

Note! Characters within the thick boundary line are Japanese kana, and are used in domestic Japanese transceiver versions. While selecting and entering characters for memory names, you can instantly return tc the first character of a set (shown in the shaded boxes) by simply pressing (#), instead of pressing ✱Ⓐ/✱Ⓑ. Also, you can move among first characters between sets by pressing HOME/PM (#).



Alphanumeric Character Key Code Table

0	MENU 0	A	PAGE 2 → A	N	RPT 6 → B	space	TONE 1 → C	?	MENU 0 → D
1	TONE 1	B	PAGE 2 → B	O	RPT 6 → C	(	MENU 0 → A	%	TONE 1 → *
2	PAGE 2	C	PAGE 2 → C	P	MON 7 → A	)	MENU 0 → B	&	PAGE 2 → *
3	LOW 3	D	LOW 3 → A	Q	TONE 1 → B	+	MENU 0 → C	–	LOW 3 → *
4	SCAN 4	E	LOW 3 → B	R	MON 7 → B	-	TONE 1 → D	$	SCAN 4 → *
5	SPA 5	F	LOW 3 → C	S	MON 7 → C	=	PAGE 2 → D	¥	SPA 5 → *
6	RPT 6	G	SCAN 4 → A	T	MUTE 8 → A	*	LOW 3 → D	\	RPT 6 → *
7	MON 7	H	SCAN 4 → B	U	MUTE 8 → B	/	SCAN 4 → D	;	MON 7 → *
8	MUTE 8	I	SCAN 4 → C	V	MUTE 8 → C	Δ	SPA 5 → D	<	MUTE 8 → *
9	REV 9	J	SPA 5 → A	W	REV 9 → A	μ	RPT 6 → D	>	REV 9 → *
		K	SPA 5 → B	X	REV 9 → B	Σ	MON 7 → D	■	MENU 0 → *
		L	SPA 5 → C	Y	REV 9 → C	:	MUTE 8 → D		
		M	RPT 6 → A	Z	TONE 1 → B	!	REV 9 → D		

Power-On Settings

Some transceiver default operational settings can be enabled/disabled, changed or reset using a power-on procedure. This requires holding a particular key (or key combination) depressed while turning the transceiver on, as outline in the table below. For detailed explanations on how these affect transceiver operation refer to the page(s) listed in the far right column.

Power-On Settings and Functions

Press and hold the following key(s) while turning the transceiver on.	**Operational Effect or Setting Enabled**	**Ref. Page**
1	Enable keypad direct-access mode (primary key function).	15
3	Enable keypad direct-access mode (alternate key function).	16
5	Enables Cross-Band Repeat Mode (bi-directional repeat).	52
0	Toggle Direct Key Entry (menu 33) capability on/off.	21, 71
*	Adjust Memory Bank Ratio for VHF and UHF.	30
D	Enables Transceiver Cloning Mode.	53
4 & #	Enable Extended Receive (110~174 MHz & 410~500 MHz).	29
* & 2	Activate Memory-Only mode.	32
) &	Reset User-Programmed Function Keys (MH-39 Mic Controller CPU)	54
* & D & 9	Reset Transceiver CPU and all operational settings to factory-default.	54

APPENDIX

Packet Radio Operation

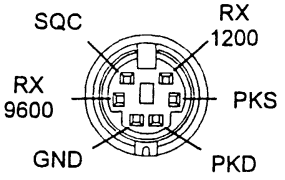
The FT-8500 provides a convenient rear-panel DATA jack for easy TNC interconnections. Refer to the graphic for pin-out connections.

When the **DATA** jack PKS line is grounded, data transmission is enabled and the microphone circuit *is disabled during transmit.* However, keying the MH-39 PTT at the same time defeats this and a "live mic" will occur, so be careful. Band selection and data rate (1200/9600 BPS) can be selected via the programming menu on page 72.

Note: Tx and Rx audio via the DATA jack is determined by menu programming (✻40: DATA JACK SELECT), even if the main channel indicated by MAIN is the other band.

To use the FT-8500 for packet, first select the desired band and data rate for operation. Construct or purchase a patch cable for connection between the FT-8500 and your TNC and refer to the table at the right for complete level and switching information. If your TNC uses a PLL-type DCD (Data Carrier Detect) circuit, you may not require the squelch status input from pin 6 (SQC).

DATA JACK PIN CONNECTIONS		
PIN	**LABEL**	**NOTES**
1	PKD	*Packet Data Input:* Impedance: 10 kΩ Max. Input Level: 40 mVpp @ 1200 bps 2.0 Vpp @ 9600 bps
2	GND	*Signal Ground*
3	PKS	Packet Send: *PTT switching: ground to transmit-MH-39 mic circuit disabled* during data transmission.
4	RX9600	*9600 bps Packet Data Output:* Impedance: 10 kΩ Max. Output: 500 mVpp @ 9600 bps
5	RX1200	*1200 bps Packet Data Output:* Impedance: 10 kΩ Max. Output: 300 mVpp @ 1200 bps
6	SQC	*Squelch Control* Squelch Open: +5V (TTL) Squelch Closed: 0V (TTL)



(as viewed from the rear panel)

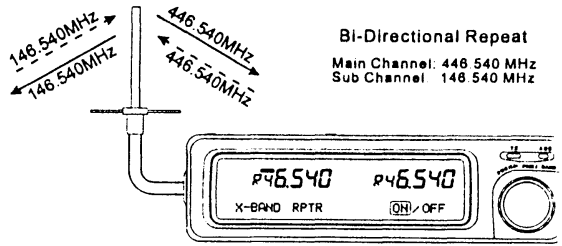
Cross-Band Repeater Operation

The FT-8500 can be set up to operate as a full-featured cross-band repeater with a simple power-on procedure. This feature is useful for field-day, club station or emergency operation in remote areas, and for cross-band linking. However, remember these few points before using the cross-band repeater function.

- Check with amateur rules and regulations to ensure this type of operation is permitted in your country.
- Pick your frequency pair carefully, so as to not interfere with existing repeaters in operation, cross linking two repeaters on two separate bands may cause a lot of havoc, and may be illegal! If you are not sure of active repeater frequencies, a safe rule is to stay off of the repeater sub bands and use the simplex portion of each band. *Contact the frequency coordinator for your area for guidance.*
- Remember that the Tx duty cycle will probably be much greater than before, so use a low Tx power output setting for cooler operation.

Transceiver CTCSS settings (encode/decode) can still be selected for each band, so you can make your repeater "closed" if desired.

❒ Before enabling cross-band repeat, configure both channel settings as desired. Then, hold (SET 6) while turning on the power. The display shows X-BAND RPTR ON/OFF.



❒ Press (DWN) or (UP) to select ON, turn the transceiver off, then on again.

❒ For cross-band repeat you do not need to select the main channel, as this changes depending on which channel the input signal is received on. The (MAIN) icon automatically switches to show which channel the FT-8500 is transmitting, or you can glance at the meter to see which side is transmitting and receiving.

To exit the cross-band repeater mode, turn the transceiver off, hold (SET 6) while turning on the power, then select OFF.

Transceiver Cloning

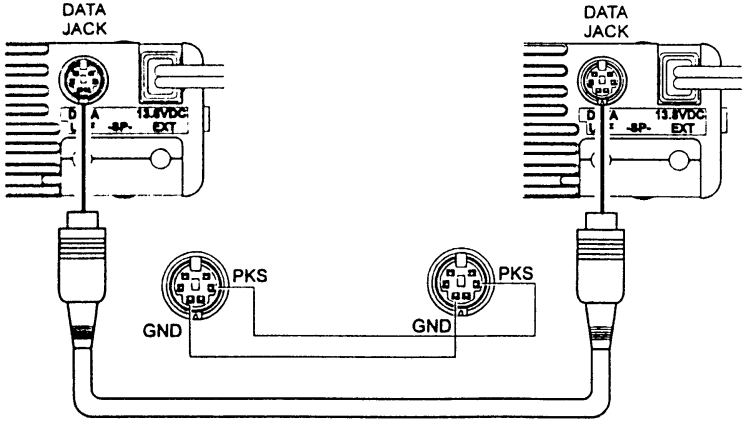
You can transfer all data stored in one FT-8500 to another set automatically by a cloning procedure. This requires a user-constructed cable to connect the **DATA** jacks on the two transceivers as shown below.

❒ Insert the clone cable into the **DATA** jack of each transceiver.

❒ Turn both units off, then press and hold the [D] key of each radio while turning the power on again. CLONE MODE appears on the display.

❒ On the destination transceiver, press [D]→[9 REV], the display shows <WAITING DATA>. Next press [D]→[6 APT] on the source transceiver so the display shows <SENDING DATA>. After successful data transfer, <CLONE DATA> appears again on both transceiver displays. If there was a problem, <ERROR> appears on the display, recheck your cable and then turn both transceivers off and try again.

❒ Remove the cloning cable. Channel and operating data for both transceivers are now identical.



In Case of Problems

Don't worry if you find transceiver operation somewhat complicated at first. You might find yourself temporarily lost, at least until you have had the chance to learn the various functions of the display and keys. This section provides some tips to help you navigate the various display and key modes if you get stuck.

If the display shows nothing at all, check the power switch, and power supply, fuses and cables. If two beeps sound unexpectedly when you transmit, check for a small "+" or "–" near the top center of the display, indicating that the operating frequency, with the selected repeater shift, is resulting in an out-of-band Tx frequency.

Invalid key entries usually do nothing, and no beep sounds. However, if the keys are locked, nothing happens when you press a key for even valid commands. Check for 🔒 (keypad or DIAL lock) or ★ (PTT lock) in the display. If you see one of these, slide the LOCK switch, or check the lock configuration in menu programming.

If you still cannot enter data, check to see if the TX LED is red, indicating the transmitter is activated. Releasing the PTT switch should return the set to receive. If not, switch the transceiver off, and then back on.

Resetting User-Programmed Function Keys

To reset (clear) any functions assigned to the user programmed [P1] & [P2 WFM] keys, press and hold [P1] & [P2 WFM] together while turning the transceiver on.

Resetting the CPU

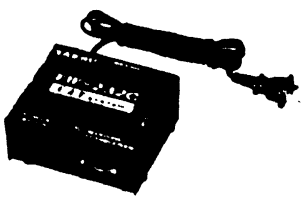
❒ As a last resort, if you are unable to gain control of the transceiver, the FT-8500 can be reset from the keypad to clear all settings, memories, channel step and repeater shifts to their factory defaults. Just press and hold [D], [REV 9] and [DW/MR *] together while turning the transceiver on.

Personal Computer Control Operation

Introduction

The PCC (Personal Computer control) System in the FT-8500 provides control of frequency, VFO, memory, and other settings using an external personal computer. This allows multiple control operations to be fully automated as single mouse click or keystroke operations on the computer keyboard.

You will need the optional FIF-232C Interface Box for PCC operation. This device connects between the transceiver **DATA** jack and computer, and converts the digital signal levels for proper data transfer. When the command instruction activating PCC operation is sent from the computer via the FIF-232C, <PCC ON> appears in the display.



FIF-232C

You will need to construct a cable to connect the transceiver to the FIF-232C (see the diagram on the next page). You will also need a serial cable for connection to the RS-232C (serial or COM port) connector on your computer. Purchase a standard serial cable (not the so-called "null modem" type), ensuring it has the correct gender and number of pins (some serial COM port connectors use a 9-pin rather than 25-pin configuration).

Yaesu Musen does not produce PCC System operating software due to the wide variety of personal computers and operating systems now in use. However, the information provided in this chapter explains the serial data structure and opcodes used by the PCC system. This is intended to help you start writing programs on your own. As you become more familiar with PCC operation, you can customize programs later on for your operating needs.

There are commercially produced software packages available, and various shareware and freeware programs. To find out more information, contact your dealer or check advertisements in current amateur radio journals and publications. Other valuable information sources include amateur radio and PC users-groups, packet radio and PC bulletin boards (BBS), and amateur radio swap-meets (hamfests).

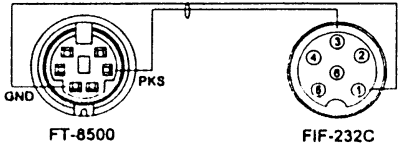
PCC Data Protocol

Serial TTL data (0/+5V) at 9600 bps is sent via the DATA IN & DATA GND pins of the **DATA** jack. Each byte consists of one start bit, 8 data bits, no parity and two stop bits. All transceiver settings can be configured by sending commands in hexadecimal code to the transceiver CPU via the FIF-232C interface. The coding table on the next page lists all functions with the corresponding hexadecimal code.

Using the PCC Command Coding Table

First choose which function you wish to emulate. Next, note its corresponding hexadecimal code. For example, to activate the Spectra-Analyzer, a hex code of 19h must be sent. Before starting, PCC operation must first be enabled by sending the PCC ON command (AAh); afterwards, following PCC commands take effect. Note that up/dwn commands (22h~25h) can also be entered, as well as press & hold (F0h) for buttons that have dual functions, depending on the duration they are held. In this way, you can use a specially-written program or the computer keyboard to control the FT-8500.

There are 60 instruction opcodes listed in the table on the next page. The PCC control program mus construct the appropriate instruction opcode, organ izing the parameters, then send them to the SI seria input pin of the DATA jack on the transceiver.



Example: Tune to 145.520 MHz; this assumes direc frequency entry (menu function 33) i*s enabled.* Firs think how this would be entered using the keypac The sequence would be:

TONE 1 → SCAN 4 → SPA 5 → SPA 5 → PAGE 2 → MENU 0

- Determine the opcode for the desired instructior using the PCC Commands Code table. These opcodes should be stored in the program so they can be looked up when the user requests the corresponding command. In this case the instruction is:

01h 04h 05h 05h 02h 00h "h"=hex

ADMS-2 Programming Software

The ADMS-2 is a MS Windows® menu-driven PC-compatible software that enables transceiver programming with simple "point-and-click" operation. This allows sending transceiver settings to and from your PC, creating memory files for customized settings, and for cloning information to another FT-8500 instantly. You can add and edit frequencies, including alphanumeric names, CTCSS tones, and repeater settings, then load and operate. For more information on pricing and availability, contact your Yaesu dealer.

PCC Command Coding Table

Hex	Function	Hex	Function	Hex	Function
00H	0 digit/DTMF entry	16H	Reverse Tx/Rx frequencies	36H	LOCK & T.CALL *on*
01H	1 digit/DTMF entry	17H	Start DIAL/MR scanning	37H	LOCK, PTT & T.CALL *on*
02H	2 digit/DTMF entry	18H	Toggle Rx audio mute on/off	38H	MONI *on*
03H	3 digit/DTMF entry	19H	Turn Spectra Anaylzer on/off	39H	MONI & PTT *on*
04H	4 digit/DTMF entry	1AH	Spect. Analyzer center	3AH	MONI & T.CALL *on*
05H	5 digit/DTMF entry	1BH	VHF main channel	3BH	MONI, PTT & T.CALL *on*
06H	6 digit/DTMF entry	1CH	UHF main channel	3CH	MONI & LOCK *on*
07H	7 digit/DTMF entry	1DH	select paging mode	3DH	MONI, LOCK & PTT *on*
08H	8 digit/DTMF entry	1EH	display/select MSG slot	3EH	MONI, LOCK & T.CALL *on*
09H	9 digit/DTMF entry	1FH	- not used -	3FH	MONI, LOCK, T.CALL & PTT *on*
0AH	A digit/DTMF entry	20H	recall menu programming	40H	VHF SQL adjust
0BH	B digit/DTMF entry	21H	entry	41H	VHF VOL adjust
0CH	C digit/DTMF entry	22H	step/mem. bank up or menu select.	42H	UHF SQL adjust
0DH	D digit/DTMF entry	23H	step/mem bank dwn or menu select	43H	UHF VOL adjust
0EH	# digit/DTMF entry/PRI ch. recall	24H	1 step/ch. up or menu selection	AAH	PCC *on*
0FH	* digit/DTMF entry/mem. tuning	25H	1 step/ch. down or menu selection	ABH	PCC *off*
10H	Home channel recall	30H	PTT, T.CALL, LOCK & MONI *off*	F0H	Press & hold
11H	Toggle DIAL/MR operation	31H	PTT *on*		
12H	Main channel transfer to sub ch.	32H	T.CALL *on*		
13H	Toggle CTCSS encode/decode	33H	PTT & T.CALL *on*		
14H	Toggle TX power level (hi/mid/low)	34H	LOCK *on*		
15H	Toggle repeater shift (+/-)	35H	LOCK & PTT *on*		

Example: Change the CTCSS encode/decode tone from 88.5 Hz (default) to 100.0 Hz;

- First, the menu programming loop needs to be recalled, next, tone select must be selected and then the default tone changed using Ⓐ/Ⓑ:

  Ⓓ→Ⓞ enables menu programming (20h).

  Ⓞ→⑥ recalls the tone select entry (00h, 06h).

  Ⓒ views the default tone (21h).

  Ⓐ→Ⓐ→Ⓐ→Ⓐ moves up four consecutive times to select 100.0 Hz (22h, 22h, 22h, 22h).

  Ⓒ saves the new tone (21h).

  Ⓓ→Ⓞ exits menu programming (20h).

- The opcode for this instruction is :

20h 00h 06h 21h 22h 22h 22h 22h 21h 20h

Commands for dual-function buttons require a special flag (**FFh**) when constructing the opcode:

Example: Activate continuous-sweep Spectra-Analyzer operation.

- Normally, Ⓓ→⑤ must be pressed, with ⑤ *held* longer than ½ sec. to enable *continuous* sweeping, (single sweep activates if it is only momentarily pressed). Preceding a button code with FFh (press & hold) simulates holding that button for 1 second. In this case the command to activate continuous-sweep Spectra-Analyzer operation is:

FOh 19h

Writing Programs

Coding Examples

Although Yaesu Musen does not offer PCC contrc programs (due to the variety of incompatible compui ers used by our customers), the following is an ex ample of a PCC command, in BASIC programmin language. Note that all variations of BASIC may nc support some of the commands, in which case alter nate algorithms may need to be developed to dupli cate the functions of those shown.

Sending a Command

After "opening" the computer's serial port for 9600 baud, 8 data bits and 2 stop bits with no parity, as i/c device #2, any PCC command may be sent.

Notice that the instruction opcode is sent in the same order in which they appear in the PCC Commands table.

For example, the following command could be usec to set the frequency of the display to 145.520 MHz:

```
PRINT #2,
CHR$(&H1B);  CHR$(&H01);
CHR$(&H04);  CHR$(&H05);
CHR$(&H05);  CHR$(&H02);
```

Sending a parameter that is out of range for the intended function, or not among the specified legal values for that function should do nothing.

FTS-22 Tone Squelch Unit Installation

The FTS-22 includes dual decoders for 39 user-selectable EIA standard subaudible CTCSS tones. It provides silent monitoring of busy channels when activated (***ENC/DEC***). See the explanations on page 36 & 64 for operation and tone selection.

❒ Disconnect the power cable, and turn the set upside-down. Referring to Figure 1, remove the six screws affixing the bottom cover.

❒ Referring to Figure 2, locate the unused 12-pin connector inside the front panel. Plug the FTS-22 cable into the connector.

❒ Peel the covering from one side of the double-sided tape provided with the FTS-22, and stick it in the bare area on the printed circuit board.

❒ The factory adjusts the output tone level (VR1 on the FTS-22) for the proper deviation, so it should require no further adjustment. Replace the bottom cover and six screws.

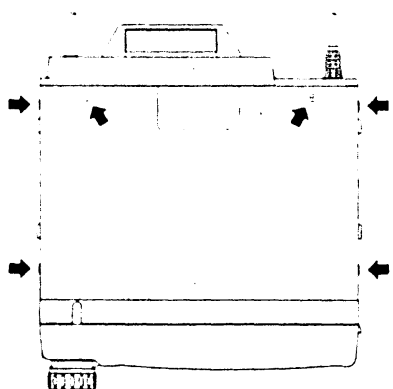


Figure 1

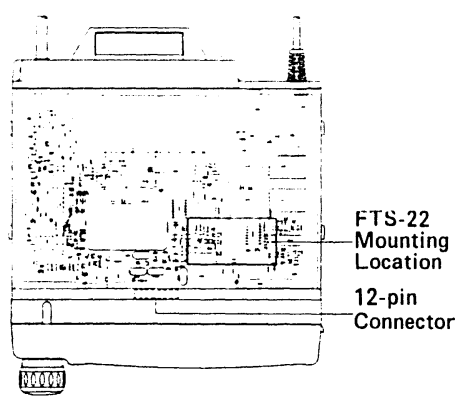
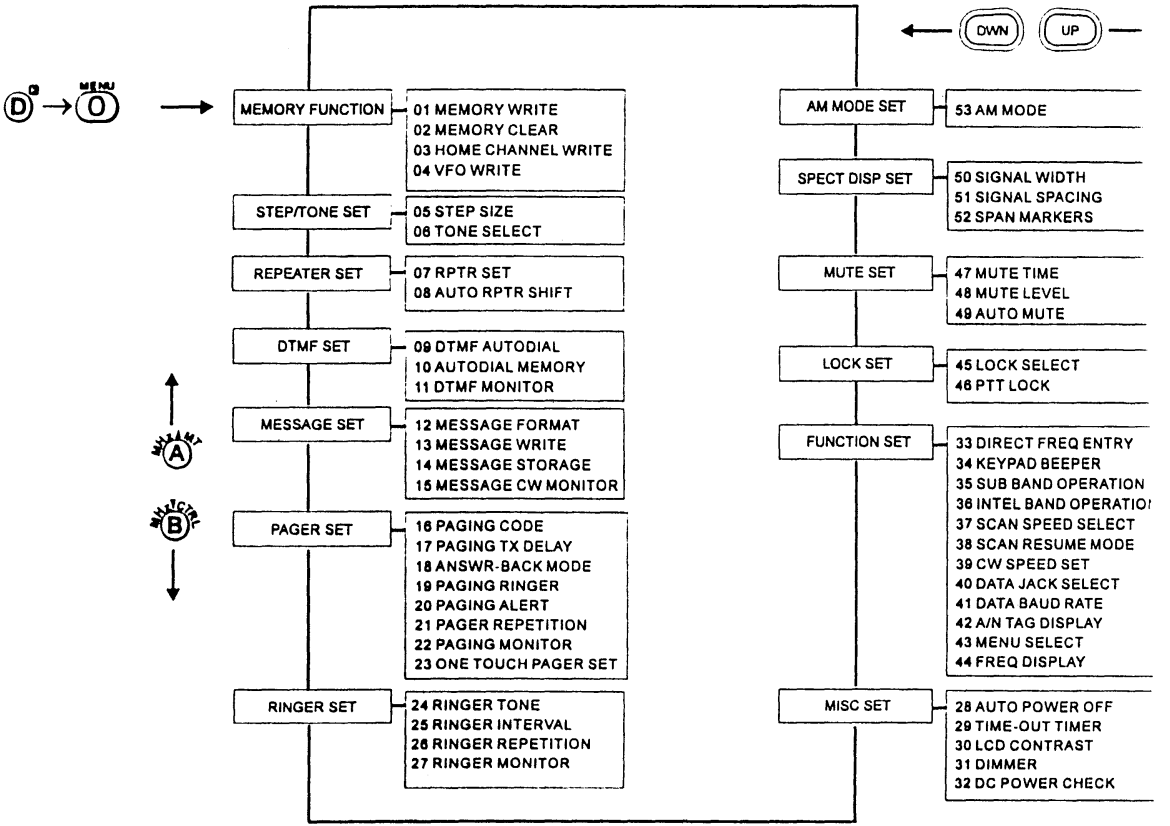


Figure 2


D
MENU
O
DWN
UP
MEMORY FUNCTION
01 MEMORY WRITE
02 MEMORY CLEAR
03 HOME CHANNEL WRITE
04 VFO WRITE
STEP/TONE SET
05 STEP SIZE
06 TONE SELECT
REPEATER SET
07 RPTR SET
08 AUTO RPTR SHIFT
DTMF SET
09 DTMF AUTODIAL
10 AUTODIAL MEMORY
11 DTMF MONITOR
MESSAGE SET
12 MESSAGE FORMAT
13 MESSAGE WRITE
14 MESSAGE STORAGE
15 MESSAGE CW MONITOR
PAGER SET
16 PAGING CODE
17 PAGING TX DELAY
18 ANSWR-BACK MODE
19 PAGING RINGER
20 PAGING ALERT
21 PAGER REPETITION
22 PAGING MONITOR
23 ONE TOUCH PAGER SET
RINGER SET
24 RINGER TONE
25 RINGER INTERVAL
26 RINGER REPETITION
27 RINGER MONITOR
AM MODE SET
53 AM MODE
SPECT DISP SET
50 SIGNAL WIDTH
51 SIGNAL SPACING
52 SPAN MARKERS
MUTE SET
47 MUTE TIME
48 MUTE LEVEL
49 AUTO MUTE
LOCK SET
45 LOCK SELECT
46 PTT LOCK
FUNCTION SET
33 DIRECT FREQ ENTRY
34 KEYPAD BEEPER
35 SUB BAND OPERATION
36 INTEL BAND OPERATIO
37 SCAN SPEED SELECT
38 SCAN RESUME MODE
39 CW SPEED SET
40 DATA JACK SELECT
41 DATA BAUD RATE
42 A/N TAG DISPLAY
43 MENU SELECT
44 FREQ DISPLAY
MISC SET
28 AUTO POWER OFF
29 TIME-OUT TIMER
30 LCD CONTRAST
31 DIMMER
32 DC POWER CHECK

Menu Programming and Custom Settings

This chapter covers all of the menu entries and selection settings used by the transceiver. These functions were described previously, but must be configured as desired using menu programming. Menu and entry headings are shown as they appear in the display to assist you as you go along.

Menu Organization

Fifty three transceiver settings are contained in one of thirteen menus (refer to the menu loop shown on the opposite page). To enable menu selection and programming, press [D]→[MENU 0] momentarily.

☞ ***Hint*** - to eliminate the need for a two-keystroke input to activate Menu Programming, this feature can be assigned to either [F1] or [F2] for faster access and operating convenience (see page 22).

The lower display heading contained within the < > brackets is the *menu title*, and the number inside of the [ ] list how many entries are available for the selected menu. Setting for menu entries preceded by a "✱" symbol take effect *for both bands*, otherwise **the setting must be configured *twice*** (once for VHF then again for UHF).

Turning the DIAL knob, or pressing [A]/[B] maneuvers inside the menu loop. When the desired menu appears, press [DWN] or [UP] to display its first entry (some menus have only one entry, while others have as many as twelve). Use [A]/[B] or the DIAL again to view the other menu entries.

☞ ***Hint:*** If you know the *number of the entry* you want, you can go directly to it using the keypad.

ex. to recall 46:PTT LOCK, simply press [SCAN 4]→[RPT 6].

With an entry appearing, you must press [MW C] to display its default setting, then once again use [DWN]/[UP] to select or change a setting. Pressing [MW C] saves the entry setting and exits.

Let's begin by doing an example that demonstrates the basic procedure used throughout this chapter.

ex. change the default CTCSS tone to 103.5 Hz.

❒ First press [D]→[MENU 0] to bring up the menu display.

<MEMORY FUNCTIONS> [4]

❒ Press [A] once so that the STEP/TONE SET menu appears. Press [DWN] or [UP] so menu entries appear, then press [A]/[B] or turn the DIAL until 08:TONE SELECT is displayed. ***Note:*** tone select could also have been recalled directly by pressing [MENU 0]→[RPT 6].

❒ Press [MW C] so the default setting - TONE 88.5 Hz- - blinks, then use the DIAL or press [A]/[B] until 103.5 Hz appears. Press [MW C] again to save the entry and return to the original menu or [D]→[MENU 0] to exit.

This demonstrates the basic method used for most transceiver menu-based settings. The remainder of this chapter covers each menu in order with a brief description of entries and their settings. A menu flowchart is provided for your reference on page 60, refer to this as necessary.

Menu Headings

As mentioned before, the menu "loop" contains 13 headings and a total of 53 entries encompassing most transceiver functions and settings. Entries are numbered and grouped under appropriate headings. A brief explanation of each menu heading, its various entries and their settings follows:

<MEMORY FUNCTIONS> [4]

There are 55 programmable memory channels for each band. These consist of 50 regular memories arranged into 5 banks, along with 5 special-purpose memories. Memories can be tagged with alphanumeric names (up to six characters in length) if desired. Each memory can store separate receive and transmit frequencies or repeater shift, and CTCSS tone data (also refer to the memory organization table on page). The Home channel memory is recalled instantly by pressing (#) and L1, U1, L2 & U2 memories can be used in pairs to store the programmable tuning and scanning limit as described on page 34, in addition to general purpose operation.

01: MEMORY WRITE

- To store a frequency in memory, first select th desired frequency (and repeater split manually, desired) in the dial mode as already described.
- Press (C) so that the memory label blinks. If th memory has not been previously programme <VACANT> appears, otherwise <AVAILABLE> displayed. If you select one that is already bein used (stored with data), it will be overwritten wit new data in the next step.
- Press (A)/(B), or use the DIAL to select channe groups or L1, U1, L2, U2 & PRI. With a channe group appearing, press (OWN)/(UP) once to "open" u the group, then (A)/(B) or use the DIAL to selec a specific memory within that group to fill. To attac a name to the memory, proceed to the next ste otherwise press (D)→(0) to save the entry and exi
- To name the memory, press (UP) so that the firs underline blinks. Pressing (A)/(B) selects any c 85 characters (including upper-case and lowe case alphabet, numbers and special symbols With the desired first character appearing, pres (UP) to move to the right and select the next charac ter in the same manner.
- After entering the desired name or after six charac ters, press (D)→(0) to save all data for the channe and exit to the dial mode.

02: MEMORY CLEAR

This is used to temporarily erase all data from a previously-programmed memory. Memories can later be restored if needed.

❒ Press C so that the small group number blinks.

❒ Press MHz/UP, then A/B (or use the DIAL) to select the memory to erase or restore. In the lower left display one of three cases appear:

- INCRNT indicates the memory has not been previously programmed.
- RESTORE appears for previously written memories which have been erased.
- ERASE indicates memories stored with data but not yet erased.
- PERMANENT only appears on memory 1-01, this memory cannot be erased.

❒ Pressing D→9 erases and restores selected memories with previously-programmed data, and exits to the dial.

03: HOME CHANNEL WRITE

❒ The instant-recall home channel is programmed in similar fashion to regular memories (remember to first select a frequency and any other desired settings). To attach a name to the Home channel, proceed to the next step, otherwise press D→0 to save the entry and exit. Press C so that H appears in the memory window, and the first character's place blinks.

❒ Press A/B to select the first character of the name for the home channel.

❒ Press UP to select the next character. Repeat the sequence (UP, then A/B to finish the name, then press D→0 to save the entry and exit to the dial.

04: VFO WRITE

❒ Names can be entered for display to identify VFO (Dial) operation. Press C so that the underline of the first character's place blinks.

❒ Press A/B to select the first character, then press UP to move once to the right, then A/B to select the next character. Repeat the sequence to finish the name, then press D→0 to save the entry and exit. When overwriting old entries, pressing D→9 clears any characters to the right of the cursor.

Note

While selecting and entering characters for names, you can instantly return to the first character of the alphabet set (upper & lower case) or numeral set by simply pressing #. You can also move among the first characters of each set by repeatedly pressing #. Refer to the table on page 48.

<STEP/TONE SET> [2]

Tuning steps are preset for the country the unit is exported, but can be changed to any one of seven available steps. Tone selection is used to access repeaters that require a CTCSS (continuous, subaudible) tone, and to silently monitor for calls on busy channels. See page 36 for an explanation on CTCSS operation.

05: STEP SIZE

❒ Press Ⓒ for the channel step selection, then DWN/UP (or turn the DIAL) to choose the desired step. Press Ⓒ again to save the entry and exit.

08: TONE SELECT

❒ Press Ⓒ to display the current CTCSS tone, then Ⓐ/Ⓑ (or turn the DIAL) to choose a different tone. Press Ⓒ again to save the entry and exit. CTCSS tone frequencies (Hz) are listed below:

67.0	85.4	107.2	136.5	173.8	225.7
69.3	88.5	110.9	141.3	179.9	233.6
71.9	91.5	114.8	146.2	186.2	241.8
74.4	94.8	118.8	151.4	192.8	250.3
77.0	97.4	123.0	156.7	203.5	
79.7	100.0	127.3	162.2	210.7	
82.5	103.5	131.8	167.9	218.1	

<REPEATER SET> [2]

The repeater shift is pre-set to 600 kHz for VHF and 5, 7.6 or 1.6 MHz for UHF. When tuning through standard repeater subbands, ARS (Auto Repeater Shift) selects the appropriate shift and offset (+/-) for easy operation. The following entries enable changing the default offset or turning ARS on/off.

07 AUTO RPTR SHIFT

❒ Press Ⓒ to display the default offset, then DWN/UP to select the offset digits place, and Ⓐ/Ⓑ to change the offset value.

❒ With the correct offset displayed, press Ⓒ again to save the entry and exit.

08: REPEATER SHIFT

❒ Press Ⓒ to see if ARS is presently enabled or disabled. Press DWN/UP to turn ARS on or off, then press Ⓒ to save the entry and exit.

NOTE! Since offsets are independent for VHF and UHF, this setting must be repeated for *both* bands.

DTMF SET (3)

Ten memories, numbered 1~9 & USr, are reserved for storing DTMF tone sequences of up to 16 digits each. These can be used to store telephone numbers for auto-patching systems. The user-memory is reserved for programming a melody to be played back during paging operation.

A special mode must be activated to use the DTMF autodial memory features, and is covered on page 46. The icon appears at the display center when this mode is active.

*09: DTMF AUTODIAL

❒ Press © to see if the DTMF autodialer is set for auto or manual operation. Press DOWN/UP to select operation and press © to save and exit.

*10: AUTODIAL MEMORY

To store a DTMF Auto-Dial Memory:

❒ Press © so that a small digit blinks to indicate the displayed autodial memory. From the factory, DTMF Autodial memories are named DTMF 1 ~ DTMF 9 and USER BP (covered later), but can be renamed later with a name of your choice.

❒ Pressing */A/*/B cycles through the autodial memories. With the desired memory displayed, press UP if you want to rename the memory while programming autodial digits, or else DOWN to skip renaming the memory and go straight into programming the digits.

❒ The blinking underline shows the current digit's or character's place. Enter the digits directly using the keypad buttons. If you make a mistake, you can always press DOWN to go back and correct any entries. Remember, the small number must be blinking before you can enter digits or characters.

❒ With the desired DTMF string appearing, press D→MENU/0 to finish and exit.

To program the user-melody (for paging and CTCSS bell functions):

❒ Press */A/*/B until USR appears blinking in the memory box. To rename the memory, press UP, or else DOWN to skip renaming and go directly to melody entry.

❒ With the first underline blinking, press */A/*/B to select a note (C4~D7#) or rest (1/8 or 8/8), then UP to save it and move on to the next place (up to 16 notes/places). The piano keyboard on the next page outlines the four octaves of notes available for entry.

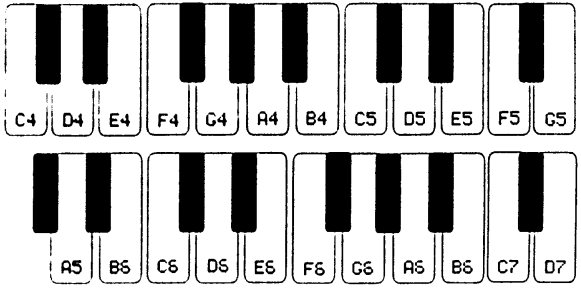
❒ The small number appearing in the memory box indicates the serial place of the next note entry. For example, U 15 means you are entering the 15th note/rest of the melody. If you make a mistake, you

can always press (OWN) to go back and correct any entries.

❒ After entering the desired DTMF melody, press (D)→(O) to finish and exit. To play back what you have just composed, proceed to the next entry.

*11:DTMF MONITOR

❒ You can play back the *User-Composed Melody* at any time from this entry by merely pressing (C). The entire melody repeats each time (C) is pressed.



<MESSAGE SET> [4]

The following entries determine how the transceiv responds and operates when sending and receivir DTMF messages. Refer to page 44 for details c message operation and configuring the following.

*12:MESSAGE FORMAT

❒ Press (C) to display the current message operatic format. Press (OWN)/(UP) to select MSG, MSG+ID c OFF.

❒ With the correct message format selected, press (C) again to save the entry and exit.

*13:MESSAGE WRITE

A memory bank stores 10 transmit (outgoing) mes sage slots, each up to 8 characters in length. Th pre-programmed messages can be rewritten as fol lows:

❒ Press (C) so the message display appears. The lef field is the selected message slot number. Dis played at the right is the current message writter into that memory slot.

❒ Press (A)/(B) or use the DIAL to select slots, ther press (UP) to move to the message field for writing

❒ Press (A)/(B) or use the DIAL to choose the firs character, then press (UP) again to move to the nex place. Repeat this again to complete the message

If you make a mistake entering a character, move left (press UP) to backstep to the incorrect entry, make the correction and continue.

❒ Move back to the slot number, select a new slot and write a new message if desired. When all message slots have been filled as desired, press D→0 to save the entries and exit.

◆14:MESSAGE STORAGE

❒ Press C to display the default storage format for received DTMF messages. Press DWN/UP to select FILL or QUEUE, then press C again to save the entry and exit.

15:MESSAGE CW MONITOR

❒ Press C to display the default monitor setting. Press DWN/UP to turn the CW monitor on or off, then press C again to save the selection and exit.

<PAGER SET> [8]

The following entries configure the transceiver for DTMF paging operation.

16:PAGING CODE

❒ Press C so the paging code display appears, with the selected code channel blinking.

Code channels 1~6, C & P are selected by pressing A/B or turning the DIAL. You can move between fields by pressing DWN/UP. Note that code channel C cannot be written to. The setting in the last field (enable/disable) determines whether the transceiver responds to the selected 3-digit if received in a paging sequence or not.

❒ First select a 3-digit code for your personal ID and store it in code channel P. In the first field, press A/B to select channel P, then press UP to jump to the 3-digit code field.

❒ Press A/B (or tun the DIAL) to choose the first digit, then press UP to move right to the next digits place. Repeat this step to complete the ID code, then move right to the last field. ***Note*** - in code channel P (only), the last field cannot be selected.

❒ Press A/B to disable or enable the code channel from paging operation. If you make a mistake entering a character, backstep to the incorrect entry, make the correction and continue.

❒ With your ID entered, you can repeat this procedure to program the remaining code channels. After ID codes and settings are entered for each code channel, press Ⓒ to save the entry and exit.

17:PAGING TX DELAY

When calling stations using DTMF Paging or Code Squelch, particularly through repeaters, some may not receive your calls because their receiver squelch is not opening fast enough (after receiving your transmitted carrier) to allow all of the DTMF digits to be decoded. To correct this problem, you can set a longer delay (750 or 1000 ms) between the time the transmitter is keyed and the first DTMF digit is sent.

❒ Press Ⓒ to display the current Tx delay in milliseconds.

❒ Press DWN/UP to select the desired delay, then press Ⓒ to save and exit.

18:ANSWER-BACK MODE

Two choices of automatic DTMF paging response are available from this entry:

- *Answer-Back* - acknowledges a received page by "paging back" the calling station (just as if you manually selected their 3-digit code and pressed the PTT).
- *Page Forwarding* - takes a received DTMF paging string and re-transmits the *original* sequence (rather than reversing the ID code pair as in answe back format), relaying the call to extend your pagir range.

❒ Press Ⓒ to display the current paging mode.

❒ Press DWN/UP to select the FWD or ANS-BK, the press Ⓒ to save and exit.

19:PAGER RINGER

The ringer response to DTMF Paging calls depenc on the configuration you select. Three types of DTM ringer melodies are available:

- Beep Melody (factory-programmed)
- User-programmed Melody
- CW (Morse Code) Ringer

❒ Press Ⓒ to display the currently selected DTM Paging ringer.

❒ Press DWN/UP to select the BEEP, USER or CI then press Ⓒ to save and exit.

20:PAGING ALERT

The DTMF ringer can be enabled to sound only once or else repeat the selected melody (or Morse ar nouncement) every minute until the PTT is pressec

❒ Press Ⓒ to display the current ringer alert.

❒ Press DWN/UP to select SINGLE or REPEAT, the press Ⓒ to save and exit.

26:RINGER REPETITION

The CTCSS Bell ringer can be turned off, or else enabled to repeat the selected melody (or Morse announcement) 1, 3, 5 or 8 times when a call is received.

- ❒ Press Ⓒ to display the currently selected ringer repetition.
- ❒ Press DWN/UP to select 1, 3, 5, 8 or OFF, then press Ⓒ to save and exit.

27:RINGER MONITOR

- ❒ You can play back the selected CTCSS Bell ringer melody (beep, user or CW) by pressing Ⓒ in while this is displayed. Move DWN/UP to stop playback and exit.

<MISC SET> [5]

Various convenient features to enhance transceiv operation are configured within these menu entrie

*28:AUTO POWER OFF

The transceiver can be set to turn itself off after preset period of inactivity (keys or PTT are n pressed).

- ❒ Press Ⓒ to display the current APO status.
- ❒ Press *Ⓐ/*Ⓑ to select an inactivity period of 1~ hours or OFF, then press Ⓒ in to save and exit.

*29:TIME-OUT TIMER

The transceiver can be set to unkey after a pres period of *continuous* transmission.

- ❒ Press Ⓒ to display the current TOT status.
- ❒ Press *Ⓐ/*Ⓑ to select an inactivity period of 1~(minutes or OFF, then press Ⓒ to save and exit.

21:PAGER REPETITION

The DTMF Paging ringer can be turned off, or else enabled to repeat the selected melody (or Morse announcement) 1, 3, 5 or 8 times when a call is received.

❒ Press [C] to display the currently selected ringer repetition.

❒ Press [DWN]/[UP] to select 1, 3, 5, 8 or OFF, then press [C] to save and exit.

22:PAGING MONITOR

❒ You can play back the selected DTMF Paging ringer melody (beep, user or CW) by pressing [C] while this is displayed. Move [DWN]/[UP] to stop playback and exit.

23:ONE TOUCH PAGER SET

This feature is not available with the MH-39 DTMF microphone. Refer to the instructions supplied with the FS-10 Smart Controller (optional).

<RINGER SET> [4]

The ringer response CTCSS Bell operation depends on the configuration you select. Three types of ringer melodies are available (note that the CTCSS Bell and DTMF alert ringers and their settings are *independent*):

- Beep Melody (factory-programmed)
- User-programmed Melody
- CW (Morse Code) Ringer

24:RINGER TONE

❒ Press [C] to display the currently selected CTCSS Bell ringer.

❒ Press [DWN]/[UP] to select the BEEP, USER or CW, then press [C] to save and exit.

25:RINGER INTERVAL

The CTCSS Bell ringer can be enabled to sound only once, or else repeat the selected melody (or Morse announcement) every minute until the PTT is pressed.

❒ Press [C] to display the current ringer alert.

❒ Press [DWN]/[UP] to select SINGLE or REPEAT, then press [C] to save and exit.

✱30: LCD CONTRAST

LCD contrast can be continuously adjusted for maximum clarity.

❒ Press [C] to display the current contrast level.

❒ Press [A]/[B] (or use the DIAL knob) to adjust the contrast to a comfortable level between 1~16, then press [C] to save and exit.

✱31: DIMMER

The LCD backlighting has 6 brightness levels that can be adjusted manually, automatically (via the front panel ADS sensor) or turned off for best viewing under different lighting conditions.

❒ Press [C] to display the current backlighting level.

❒ Press [A]/[B] (or use the DIAL knob) to adjust the backlight to a comfortable level between 1~6 (manual), 1-6 (auto), or OFF. Press [C] to save and exit.

✱32: DC POWER CHECK

❒ Press [C] once to check the present DC supply voltage, then again to exit.

<FUNCTION SET> [12]

Other features that custom-configure transceiver operation and display appearance are included here.

✱33: DIRECT FREQ ENTRY

❒ Press [C] and press DWN/UP to turn the feature on/off. Press [C] to save and exit.

✱34: KEYPAD BEEPER

❒ Press [C] and press DWN/UP to turn the key beeper on/off. Press [C] to save and exit.

35: SUB BAND OPERATION

❒ Press [C] to display the current sub band display configuration.

❒ Press DWN/UP to turn the sub band display on or off, or else have the DC supply voltage displayed in place of the frequency. Press [C] to save and exit.

✱36: INTEL BAND DISPLAY

❒ Press [C] to display the current IBD setting.

❒ Press DWN/UP to turn Intelligent Band Display on or off, then press [C] to save and exit.

*37:SCAN SPEED SELECT

❒ Press Ⓒ, then DWN/UP to select NORMAL or SLOW scan speed (see table below). Press Ⓒ to save and exit.

Scan Speed		
	Normal	Slow
MR	20 ch/sec.	6 ch/sec.
VFO	33 steps/sec.	6 steps/sec.

38:SCAN RESUME MODE

❒ Press Ⓒ to display the current scan resume mode.

❒ Press Ⓐ/Ⓑ (or use the DIAL) to select one of four available modes (see page 33 for a detailed explanation), then press Ⓒ to save and exit.

*39:CW SPEED SET

❒ Press Ⓒ, then DWN/UP to select the desired CW playback speed. Press Ⓒ to save and exit.

*40:DATA JACK SELECT

❒ Press Ⓒ and press DWN/UP to select VHF or UHF operation via the rear panel **DATA** jack (used for TNC interconnection). Press Ⓒ to save and exit.

*41:DATA BAUD RAT

❒ Press Ⓒ to display the current data rate configuration.

❒ Press DWN/UP to select either 1200 baud or 9600 baud operation (see page 51 for a detailed explanation), then press Ⓒ to save and exit.

42:A/N TAG DISPLAY

❒ Press Ⓒ, then DWN/UP to turn display of alphanumeric name tags on or off. Press Ⓒ to save and exit.

43:FREQ DISPLAY

❒ Press Ⓒ, then DWN/UP to turn display of channel frequencies on or off. Press Ⓒ in to save and exit.

*44:MENU SELECT

❒ Press Ⓒ to display the selected language for the menu display. *Do not change this setting to prevent confusion.* Press Ⓒ to exit.

LOCK SET [2]

The keypad buttons and DIAL knob and can each be "locked" (disabled), to prevent inadvertent adjustments. You will find 🔒 displayed at the left when any of these are locked. The PTT can also be locked to prevent transmitting accidentally, and ★ appears in the *right* display when this lock is active. *Note:* do not confuse the PTT lock with the *blinking* ★ in the *left* display, which indicates AM receive is on.

The keypad and DIAL knob are locked by pressing [D]→[MONI] (🔒 appears). Press [D]→[MONI] again to unlock. The PTT lock is separately enabled via menu function 46.

✻45: LOCK SELECT

❒ Press [C] to display the current locking scheme. To lock only DIAL knob input, select DIAL, to additionally disable all keypad buttons and controls, select BOTH (using [DWN]/[UP]). Press [C] to save and exit.

✻46: PTT LOCK

❒ Press [C], then [DWN]/[UP] to enable or disable the PTT lock.

<MUTE SET> [3]

This function mutes or disables audio from a selected band (channel) when two stations are received simultaneously.

✻47: MUTE TIME

❒ Press [C], then ✻[A]/✻[B] (or use the DIAL) to select 1-60 minutes mute duration or OFF for continuous mute.

❒ Press [C] to save and exit.

✻48: MUTE LEVEL

❒ Press [C], then ✻[A]/✻[B] to select level 1 (pre-set mute) or level 2 (full mute).

❒ Press [C] to save and exit.

✻49: AUTO MUTE

❒ Press [C], then [DWN]/[UP] to select VHF or UHF muting, or else OFF to disable the auto mute function.

❒ Press [C] to save and exit.

<SPECT DISP SET> (3)

The following settings determine how signal activity appears when viewing the Spectra-Analyzer. Refer to pages 25~27 for a complete description of each entry and how settings affect the spectrum silhouette.

*50:SIGNAL WIDTH

❒ Press Ⓒ to display the signal width in pixels. Press DWN/UP to select the desired width, then press Ⓒ to save and exit.

*51:SIGNAL SPACING

❒ Press Ⓒ to display the signal spacing (separation) in pixels. Press DWN/UP select the desired spacing then press Ⓒ to save and exit.

*52:SPAN MARKERS

❒ Press Ⓒ to display the span marker calibration (in kHz). Press DWN/UP to select the desired bandwidth then press Ⓒ to save and exit.

<AM MODE SET>

AM mode can be turned on to enable reception of aeronautical band transmission between 110~137 MHz in transceiver versions offering extended receive capability.

*53:AM SET

❒ Press Ⓒ to display if AM receive is enabled or not. Press DWN/UP to turn AM mode on/off, then press Ⓒ to save and exit.