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MFJ-498 Display Keyboard Keyer

Features

Memories:

Eight independent 4000 character message memories.

32 Character Liquid Crystal Display:

The MFJ-498 has a 32 character display on which memories, simulations, and keyboard entered text may be viewed.

Type Ahead Buffer:

The MFJ-498 has a 150 character type ahead buffer with audible "buffer full" warning.

Built-In Iambic Keyer:

Using the paddle jack makes the MFJ-498 a keyboard controlled iambic keyer.

Embedded commands:

Auto-incrementing serial numbers, Timed pauses to 99 minutes 99 seconds, Message loop.

Adjustable Parameters:

Code speed is variable from 5 to 100 WPM, weight varies from 5 to 95 %.

Sidetone Speaker:

Internal sidetone speaker with adjustable volume and frequency.

Morse Code Trainer:

Random code generator with 5 character or random 1-8 character length words. Random characters are selectable from alphabetic, numeric, prosign, and punctuation types; or specific 6 character sets.

Random Word Generator:

Sends from a database of many common words used in amateur radio.

FCC Exam Simulator:

Sends a random QSO, just like an FCC code test.

QSO Simulator:

Simulates "real" contacts with the keyer to practice on-the-air operation by calling or answering CQ.

Keying Modes:

Iambic On/Off, Iambic A or Iambic B, Hand Key (straight key), Semi Auto (bug), and Reverse Paddle modes are user selectable.

Output Tune Mode:

Constant key to tune tuners or antennas.

Key Output Disable:

Enable and disable key output to practice operation.

Handkey Mode:

Use the space bar or iambic paddle as a straight key.

Introduction

The MFJ-498 Display Keyboard Keyer is a powerful tool for the radio amateur. The MFJ-498 functions as a contest keyer with 8 memories, a code teaching and practice tool with 4 separate methods of learning, from beginner to expert, and a display keyboard keyer, all code being sent or stored with the keyboard is displayed on the 32 character LCD. The MFJ-498 is also a powerful iambic keyer with all paddle code parameters conveniently controlled by the keyboard interface.

The MFJ-498 has eight 4,000 character message memories which can be loaded by keyboard. When saving a message embedded commands can be inserted that repeat the message continuously, insert timed pauses within the message, and insert an auto-incrementing serial number. Embedded commands allow your keyer to perform contest, foxhunt or beacon operation.

The MFJ-498 has controls for speed and volume on the front of the unit. The paddle jack connects to any iambic or single lever (dual contact) key paddle. The keyboard port allows use of the AT compatible keyboard for keyboard keying operation. The MFJ-498 has both Direct and Grid-Block outputs.

Installation

Power

The MFJ-498 Morse Keyboard requires a 12 VDC 500 milliamp power supply. The power jack accepts a 2.1 mm coaxial plug with the center conductor positive and shield ground. An optional DC supply, the MFJ-1315, is available from MFJ Enterprises. Connect your MFJ-1315 Power Adapter or compatible DC supply into the jack marked **POWER** on the MFJ-498 back panel.

Keying Output

This unit supports both positive and negative keyed radios. The MFJ-498 has both **Direct** or **Grid Block** outputs. Use the **Direct** output for a positive keyed radio (most solid state radios). Use the **Grid Block** output for a negative keyed radio (most radios with tube finals). Use a standard shielded RCA cable between your radio key input and to either the **Direct** or **Grid Block** key output.

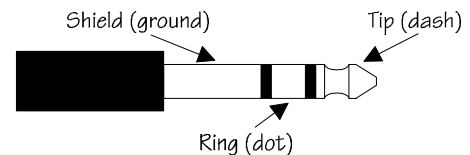
Keyboard

The MFJ-498 is supplied with an IBM-AT compatible keyboard. The MFJ-498X package does not include a keyboard. The unit is guaranteed to support the supplied keyboard but may be used with other standard 101 key AT-style keyboards. However, the use of an AT-compatible keyboard from other manufacturers may cause an increase in susceptibility to radio frequency interference.

If using a switchable keyboard, move the A-X switch on the back of the keyboard to the "A" position. ***Using an XT style keyboard or turning a switchable keyboard to "X" mode may damage both the keyboard and the MFJ-498. This unit will function only with AT compatible keyboards.*** Plug the keyboard into the 5 pin DIN connector marked KYBRD IN on the MFJ-498.

Iambic paddle

An iambic or single lever (dual contact) paddle connects to the 1/4" stereo phone jack with a shielded cable through the back of the unit. Connect the dot wire of the paddle to the ring on the plug and the dash wire to the center conductor. The shield on the plug should be attached to paddle ground.



Lithium Battery Removal and Installation

The lithium cell on this keyer should last 2 years or more. The battery can be tested by removing the cover and turning the unit ON. With a voltmeter, test the voltage of the battery from the battery(+) to the chassis(-). If the voltage tested is below 2.7 volts the battery should be replaced. ***To replace the battery, the unit must have power and be turned ON.*** The battery is then carefully removed and a new one carefully inserted.

LCD Contrast Adjustment

The MFJ-498 has a contrast adjustment pot accessed through the case on the left side. Insert a small screwdriver or flat tuning tool into the pot and turn to adjust the LCD viewing angle. The LCD will widen the viewing angle as you turn clockwise or close the viewing angle as you turn counter-clockwise.

Basic Operation

The MFJ-498 is simple to operate. After turning the unit on, it will send the characters "ON" in Morse code over the sidetone speaker and display "MFJ-498 Display Keyboard Keyer" on the LCD. This tells you the MFJ-498 is ready for operation.

Start sending with a paddle or keyboard. Adjust the volume and speed to your preference. If the speed is still too fast or too slow, adjust the range of the speed knob by pressing **F10**. See Adjusting Code on page 6.

All characters or code sent by the user are played on the sidetone speaker. This allows the user to hear what he is keying or typing.

Only when the keyer is used with a paddle is the code sent as soon as it is keyed. When using the keyboard you may type ahead of the code that is being transmitted. This allows you to enter words and phrases faster than the transmitted code. The buffer permits smoother code with less pauses. You can fix misspelled words and think about your next sentence while the previous sentence is being sent.

When you are entering commands or saving memories the key outputs are disabled. This keeps all erroneous code off of the air.

Keyboard Operation

The keyboard on the MFJ-498 is like that of a computer, not like a typewriter. A key is pressed and immediately released. If a key is held down, a character will be repeated until the key is released. To make word breaks press **Space Bar**. Press **Space Bar** several times to make a longer break.

After a keyboard key is pressed, a character will be saved in a 150 character type-ahead buffer until it is sent to the key output and the speaker. The character will also appear on the top line of the LCD. The bottom line of the LCD displays characters as they are sent over the speaker and the key output. If you type characters faster than they are being sent, the top line of the LCD will be "ahead" of the bottom line.

As the "type ahead" buffer is filled to 140 characters the sidetone frequency lowers as a warning. When the buffer is full, an error tone will sound for every key that is pressed. These characters are lost and will not display on the LCD. As code plays the buffer will empty and eventually the bottom line will catch up with the top.

Pressing the backspace key will remove a single character from the "type ahead" buffer before it is played. While the buffer is being sent you may clear it by pressing **Esc**. The buffer will clear, all text in it will be lost, and the keyer will stop playing code. Now you may enter new text or play a stored message.

If you press **Pause** while your type ahead buffer is playing your message will stop playing. You can now insert text with the paddle. Press **Esc** and your type ahead buffer will continue playing where it stopped.

Prosigns

The following prosigns are assigned to keyboard characters: AAA, MIM, KR, OS, WG, AF, DN, IMI, DU, IQ, BT, AR, SN, HH, AL, SX, KA, K, AS, SK, KN, KK, and AL. See Page 16 for a complete chart showing keyboard assignments. To create prosigns not included on the keyboard, use the **Alt** key. The MFJ-451 produces prosigns by removing the intercharacter spaces from characters of keys while the **Alt** key is pressed.

ex: To produce the prosign AA (.-.) hold the **Alt** key down, press **A** twice, then release **Alt**

Message Memories [F1-F8]

The function keys **F1** through **F8** are used to store and send messages. The **Alt** key is used with a function key to store a message. The function key is then used alone to send the stored message. See the Message Memories section for more details.

Command Mode (F9)

The command mode is accessed by selecting the **F9**. This selection is followed by a one-character keyboard command.

Code WPM Speed (F10)

To change code speed use the **F10** key. The speed can then be varied using the up and down arrow keys or direct two-character entry. Press **ESC** to exit. See Adjusting Code on page 6.

Output Tune (F11)

An output tune is activated by selecting **F11**. A constant key is sent to the antenna and tuner. Press **Esc** to exit.

Serial Number Decrement (F12)

The **F12** command decrements the serial number. The keyer will echo "-." or "D" for every decrement of the serial number.

Paddle Operation

The paddle input supports iambic or single lever (dual contact) paddles. The use of single lever paddles eliminates all iambic features. A straight key can be used only in the hand key mode. While in the hand key mode all other features of the MFJ-498 are disabled. The speed, weight, and tone for paddle operation is the same as that for the keyboard.

The iambic paddle has a unique feature that the single lever paddle does not have. The two key paddles are independent and can be squeezed together. When both the dot and dash contacts touch ground, the MFJ-498 sends alternating sending code elements, "-.-" or "-.-". This is called **iambic keying**.

Iambic keying has two modes: A and B. In iambic B mode, the keyer will send an extra alternating element when you release both paddles. In iambic A mode, no extra elements are sent. The iambic paddle modes, A and B, are selected with the "I" and "B" commands. See the "Entering Commands" section on page 10.

Adjusting Code: Speed, Weight, And Tone

NOTE: *While changing parameters or loading memories, the MFJ-498 disables the output key so that erroneous code is not sent over the air.*

Code WPM Speed (F10)

Code speed is set using the front panel control and the **F10** key. The front panel control changes the wpm speed range while the "**F10**" key changes speed within that range. If you cannot set the speed high or low enough with "**F10**" you must change the range with the front panel control. When the front panel control is fully *counter-clockwise* the speed range is from 5-24 wpm. When the front panel control is fully *clockwise* the speed range is from 24-100 wpm.

When you press "**F10**" the MFJ-498 sends a series of dot-dashes over the sidetone speaker to indicate the current speed. There are two methods to change code speed. The up and down arrow keys can be used to vary the speed gradually. Code speed can also be set to an approximate words-per-minute by pressing two numbers (i.e., 05 or 13). The speed will then change automatically. When you have found a speed that is comfortable for you, hit the "**Esc**" or "**Enter**" key.

Weight (W)

Weight is set with "**F9**" to enable command mode and press "**W**". After pressing "**W**", a series of dot-dashes is played from the sidetone speaker. Pressing the up arrow key lengthens the on time of a dot or dash and shortens the off time. The down arrow key shortens the dot or dash length. To exit press either "**Esc**" or "**Enter**". This feature lets you personalize your code and can help to avoid clipping if your radio or amplifier has a send delay. It can also increase your power out by increasing on time.

Sidetone Frequency (T)

To adjust sidetone frequency, press "**F9**" to enable command mode and press "**T**". The unit will sound the present tone setting. Use the up and down arrow keys to increase or decrease the sidetone setting. Note that the tone will not affect your transmitted signal, only the sidetone speaker frequency changes. When you have found a tone setting that you like, press either "**Esc**" or "**Enter**" to exit the tone change mode.

Message Memories

The MFJ-498 has eight 4000 character message memories. Each memory is represented by a function key, "**F1-F8**". To play a message simply press a function key.

To record a message to memory, press and hold the "**Alt**" key while selecting a memory position. When the MFJ-498 signals the characters "--. ---" or "GO" in Morse, it is ready to record the message, which is displayed on the bottom line of the LCD readout as it is typed. At approximately 16 characters before the message memory fills, the playback frequency lowers to indicate that memory is short. Characters may be removed from memory by using the "**Backspace**" and new characters may be entered. No more than 4000 characters may be stored in any message location. Any attempt to enter additional characters will generate a long, low-frequency tone for each character entered. *To complete the saving of a message, press "Enter".* An end of message character (.-.-.) will sound to confirm the save.

A programmed message can be replayed by pressing the appropriate function key "**F1-F8**". The keyer will display a lower case character on the top line of the display to indicate which message is sent. The character "a" is displayed for message 1, "**F1**"; "b" for message 2, "**F2**"; "h" for message 8.

example: Select "**Alt-F2**". The keyer signals "--. ---" to indicate readiness. Type the message "AA5MT BEACON BEACON 5 W BEACON." Press "**Enter**" and the message is stored at memory location "**F2**". Select "**F2**" to play message.

Embedded Commands

While a message is being saved, one or more **embedded commands** may be added as special features.

Note: *To use the "Ctrl-L" command, press and hold Ctrl, press and release the "S" key, then release the Ctrl key.*

Ctrl-L creates a repeating message. Use the "**Ctrl-L**" at the end of the message before pressing "**Enter**". The MFJ-498 will play the message to the point where "**Ctrl-L**" is entered and then repeat.

example: AA5MT BEACON 5 W "**Ctrl-L Enter**". This message repeats until "**Esc**" is pressed.

Ctrl-P creates a timed pause within a message. Use "**Ctrl-P**" followed by four numbers in a "xxxx" format to set the pause duration from 00 minutes, 01 seconds to 99 minutes, 99 seconds.

example: CQ CQ CQ DE KC5LIP "**Ctrl-P** 0045 "**Ctrl-L Enter**". This message repeats every 45 seconds until "**Esc**" is pressed.

Ctrl-S controls the serial numbering feature. Use "**Ctrl-S**" at the end of the message before pressing "**Enter**". The MFJ-498 will play the message to the point where "**Ctrl-S**" is entered, at which point the serial number is played and auto-incremented up to 9999. The serial number function sends an "N" character for nine and a "T" for zero. A new serial number may be stored by selecting "**F9**" to enable the command mode and then pressing "**S**" followed by four numbers in a "xxxx" format. Pressing "**F12**" will decrement the serial number and the keyer will echo "D" for every decrement.

example: YOU ARE CONTACT NR **Ctrl-S Enter**

Typical Settings for a Contest

This is an example of some typical settings for a contest. Each contest has different rules for exchanges etc. and you may have a different method of contesting. This is an example of one contester's settings.

Memory #1: CQ TEST DE W8JI W8JI W8JI TEST
Memory #2: TEST W8JI W8JI
Memory #3: UR 5NN SN Ctrl-S OH DE W8JI
Memory #4: R 73 TEST W8JI

Memory #1 is set for CQ at slow periods or at the end of a contest when most stations have already been worked.

Memory #2 is set for busy times when contacts are plentiful. This memory is set with a simple quick message. A listener will immediately know who is calling and what they want. A contester would not spend much time listening to this station if they have already worked it.

Memory #3 is set with the contest exchange. It gives the serial number and some other contest information. Any contest's exchanges can be inserted here.

Memory #4 is set to close a QSO and announce that you are ready for another contact.

Code Practice Utilities

There are four code practice utilities built into the MFJ-498: the QSO simulator, the FCC exam simulator, the random word generator, and the random code generator. Each is accessed by entering the appropriate character in the command mode.

QSO Simulator

Use the interactive QSO simulator to practice sending and receiving code. After you enter "0" in the command mode you may send CQ and the keyer will answer you. If you wait without sending CQ, the keyer will initiate the QSO and you can answer it. *In each exchange end with a "k" and press **ENTER**.* The more that you "talk" to the keyer the more it will "talk" to you back. You may even talk to simulated fashion models who are hams.

FCC Exam Simulator

The FCC Exam sends a QSO text just like in a real exam. After you enter "E" you will hear traffic between two stations in a simulated QSO. Use this feature to reinforce your copy or to study for your code test.

Random Word Generator

The random word generator sends words from the data base for the QSO and FCC exam simulators. Using this feature improves your word recognition. Press **F9** and "Z" to start.

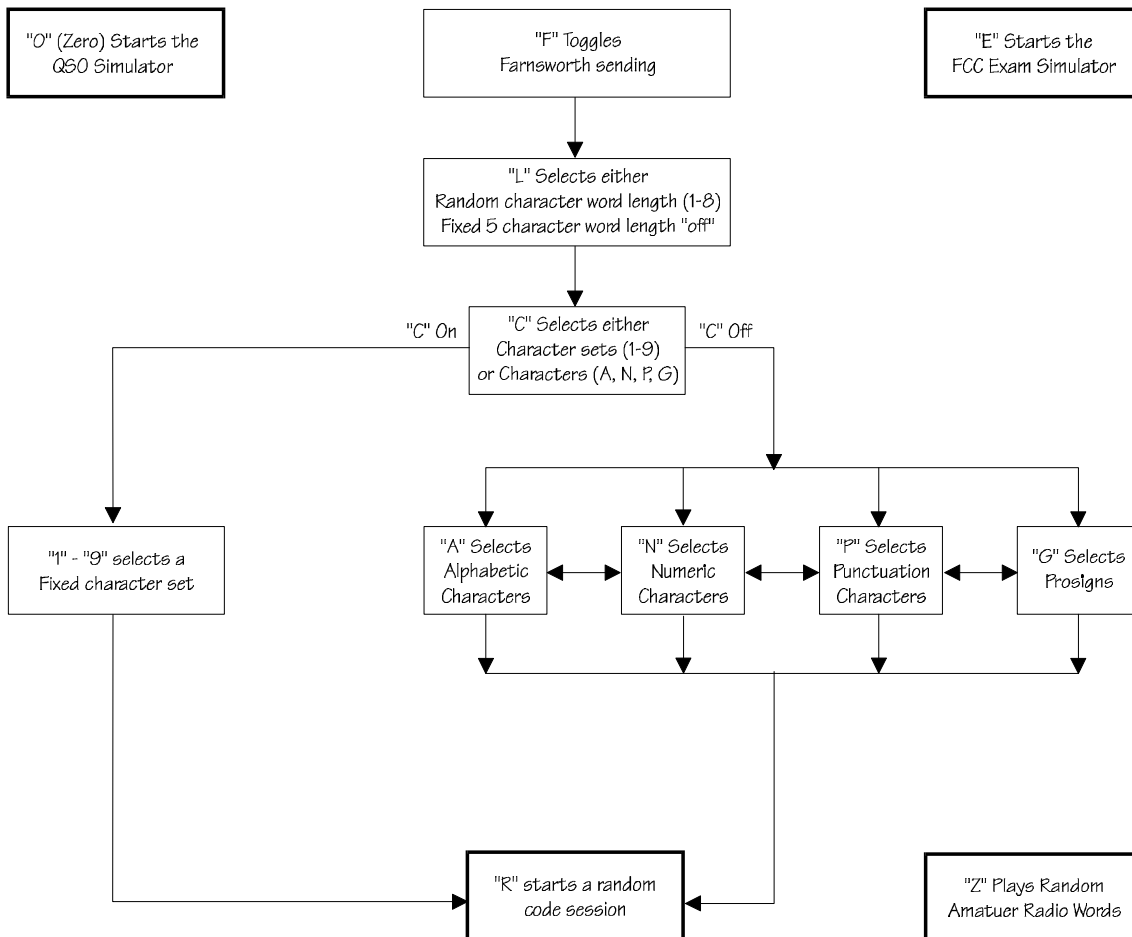
Random Code Generator

The random code generator is designed to teach the beginner the Morse alphabet. Enter "R" in the command mode to start the code generator.

The random code generator can be configured in two ways. When "C" is "on", the keyer sends fixed sets of characters and punctuation. Use the command mode and "1"- "9" to choose a set. Refer to the table on page 13. When "C" is "off", the keyer sends alphabetic, numeric, prosign, or punctuation characters. Use the command mode and "APNG" to enable any or all character types to be sent. The keyer's default is "C" "off", 5 character words with alphabetic type characters. To study a group of individual characters, select "C" to choose a fixed character set and then select a fixed group "1" through "9". The default set is "1" (A-F).

When you are setting your keyer up for code practice, remember to use "F9" "Q" to see which commands are selected.

Note that when "C" is "off" and "APNG" are also all set to "off", the keyer is not able to start the random code generator!



Learning Code with the Random Code Generator

This is an example of a typical code practice session. We will work first on the letters A-F in Farnsworth mode so that you will learn the sound of each character at a high speed.

Press "**F9**" and type '**F**'. This enters Farnsworth mode.

Press "**F9**" and type '**C**'. This selects the fixed character sets.

Enter '**1**' in the Command Mode to choose the A-F character set. The default settings are set to fixed 5 character length.

Now adjust the code speed by pressing "**F10**" and typing '**05**'. This sets word spacing to 5 words per minute while character speed is set to 18 words per minute (Farnsworth). Hit ESC or ENTER.

Get ready to copy. Press "**F9**" and type '**R**'.

While you take copy you may notice that the characters being sent are also displayed on the LCD. The characters are there only for reference and should not be *read* during a code practice session unless it is just occasionally.

When you get to a stopping point press "**ESC**" to end the session.

After you have practiced the A-F set you can move to the next set by pressing "**F9**" and typing '**2**' to select G-L.

Teaching Code

Those that give practice sessions will find the MFJ-498 of great help. The MFJ-498 can be taken to the classroom and give several sessions of practice. The code sent is always perfect and can be modified to whatever method of teaching one prefers.

Entering Commands

During normal operation, the **F9** key is used to enter the command mode. When the command mode has been enabled, the keyer responds by signaling "CO". The unit is now ready to receive one of the available one-character commands listed below through the keyboard or paddle. The keyer responds to an invalid entry by returning to normal mode.

- A** Enables, "on", or disables, "off", alphabetic characters when the "**C**" option is "off" and using the random code generator.
- B** Use Iambic A or B to toggle between the Iambic A and Iambic B modes. The keyer responds with the current mode "A" or "B". Iambic modes A and B work when you squeeze both paddles together. See "I", Iambic On/Off. In Iambic B mode the keyer plays the alternating element after the paddles are released during an element. Iambic A mode does not produce an alternating element when the paddles are released during an element. For example, a release during the dash in "-." produces "-." or "A" in Iambic A mode but produces "-." or "R" in Iambic B mode.
- C** When "**C**" is "off" the random code generator sends character types: alphabetic "**A**", numeric "**N**", prosigns "**G**", and/or punctuation "**P**". When "**C**" is "on" the random code generator sends fixed character sets "**1 - 9**". See the A, N, G, P, and # commands.
- E** The "**E**" option starts the FCC exam simulator. The exam simulator gives an FCC style exam for practice. You will hear QSOs between 2 random simulated stations.
- F** This command toggles the Farnsworth mode in the random code generators. When in Farnsworth mode character speed is set to 18 WPM while the overall word speed remains at the keyer's current setting. If the keyer is set to 5 WPM in Farnsworth mode, it will send characters at 18 WPM while inserting extra word-break and inter character timing to maintain an effective speed of 5 WPM. This feature *makes* beginners learn Morse characters by sound rather than by counting dots and dashes.
- G** Enables, "on", or disables, "off", prosign characters when the "**C**" option is "off" and using the random code generator.
- H** This command allows use of the space bar or paddle as a hand (straight) key. The keyer responds to this command by sending "HK." Dots and dashes are then made manually by using either the space bar on the keyboard or one of the paddle keys. When using handkey all other modes of operation are disabled. Press **Esc** to exit.
- I** Toggles the Iambic mode. The keyer responds with the current mode "ON" or "OFF". Iambic mode allows you to squeeze both paddles and get alternating dashes or dots. When "off" the keyer does not alternate dots and dashes during a squeeze, it plays whichever side made contact first until it is released. See "**B**", Iambic A or B.
- L** Toggles 5-character word length or random word length from 1 to 8 characters. The keyer signals "OK" after the command is entered. The keyer's default setting sends 5 character words.
- N** Enables, "on", or disables, "off", numeric characters when the "**C**" option is "off" and using the random code generator.

- O** Use "**O**" to disable the key output. The keyer responds with the current mode "ON" or "OFF". If the output is turned "off", signals are not sent to the keyer's gridblock or direct outputs allowing practice operation. The output is automatically disabled during memory message storing, command mode operation, status information, and keyer setup.
- P** Enables, "on", or disables, "off", punctuation characters when the "**C**" option is "off" and using the random code generator.
- R** This command is used to start the random code generator after the code generator-defaults have been set (see **F**, **L**, **N**, **P**, **G**, **A**, and **C**). Press **Esc** to exit the code generator.
- S** This command is used to store a new serial number. After entering "**S**" the new serial number should be entered. A serial number is four digits in length, and can range from 0000 to 9999. Press **Enter** after the fourth character.
- T** This command is used to set the frequency of the sidetone speaker with the keyboard by using the up and down arrows to vary sidetone. Press **Esc** to exit.
- U** Use the Semi-auto command to enable the semi-auto (bug) mode. The keyer responds with the current mode "ON" or "OFF". Semi-auto mode creates automatic dots but requires dashes to be hand keyed.
- V** Entering "**V**" reverses the paddle to change the dot/dash paddle assignments. The keyer responds with "RV" and changes the dot paddle to dash and the dash paddle to dot.
- W** This command enables the code weight settings mode. An alternating dot and dash signal is produced and the signal is modified with the keyboard by using the up and down arrows to vary code weight. Press **Esc** to exit.
- X** Use "**X**" to disable the sidetone speaker audio. The keyer responds with the current mode "ON" or "OFF". If the sidetone is disabled, it will still play command messages and status information.
- Z** Starts the random word generator. After entering "**Z**" the MFJ-498 will start sending random words that are from a built-in database of frequently used words on the air. Examples are words like radio, antenna, VHF, TNC, and computer.

Function Key Quick Reference

<u>Key</u>	<u>Usage</u>
F1	Message memory #1
F2	Message memory #2
F3	Message memory #3
F4	Message memory #4
F5	Message memory #5
F6	Message memory #6
F7	Message memory #7
F8	Message memory #8
F9	Enables command mode. See Command Mode Quick Reference .
F10	Sets speed mode. Changes the WPM of the code. Esc exits.
F11	Engages the output tune. Esc exits.
F12	Decrements the serial number. The keyer will echo a "D" for every decrement.
Alt	Used for making prosigns by removing the intercharacter spacing of keys pressed while the Alt key is also pressed. For example, to produce the prosign <u>AA</u> (.-.-) hold the Alt key down, press A twice, then release Alt . Also used in conjunction with keys F1 - F8 to store message memories.
Alt-Print Screen	Plays the EPROM code version number of your unit.
Backspace	Deletes the last character entered into message memory or the last character entered into the type-ahead buffer if that character has not already been transmitted.
Esc	Exits any mode.
Pause	Enters pause mode. The keyer will stop the current message being played and will resume when Esc is pressed.
Enter	Stores a stop character at the end of message memory.
Shift	Enables upper case characters if applicable. If the upper case character does not have a Morse translation then the keyboard simply repeats the lower case character. For example, Shift-A is the same as "A" but Shift - ";" produces ":"
Spacebar	Inserts a word break space into the message in normal operation. While the MFJ-498 is in handkey mode the spacebar is a straight key.

Command Mode Quick Reference

<u>Command</u>	<u>Description</u>
0 (zero)	Starts the QSO simulator
1	Sets fixed character set 1 (see "#" in the Entering Commands section)
2	Sets fixed character set 2
3	Sets fixed character set 3
4	Sets fixed character set 4
5	Sets fixed character set 5
6	Sets fixed character set 6
7	Sets fixed character set 7
8	Sets fixed character set 8
9	Sets fixed character set 9
A	Random alphabetic characters on/off
B	Iambic mode A or B toggle
C	Fixed 6 character sets on/off (on fixed sets, off alphabet, numbers, punctuation, and/or prosigns)
E	Starts the FCC Exam Simulator
F	Farnsworth random code spacing On/Off
G	Random prosign characters on/off
H	Handkey mode
I	Iambic mode on/off
L	Random 1-8 character group length on/off (off fixed 5 character group length)
N	Random numeric characters on/off
O	Output key on/off
P	Random punctuation characters on/off
Q	Query (see "Q" in the Entering Commands section)
R	Starts the random code generator
S	Stores a new serial number
T	Sidetone frequency set mode
U	Toggle Semi-Auto (manual dashes)
V	Reverse Dot-Dash paddle assignments
W	Weight set mode
X	Speaker sidetone on/off
Z	Plays random amateur words

Keyboard Character to Morse Code Table

Keyboard key	Morse character	Keyboard key	Morse character	
A	A .-	5	5 	
B	B -...	6	6 -....	
C	C -.-.	7	7 --...	
D	D -..	8	8 ---..	
E	E .	9	9 ----.	
F	F ..-.	0	0 -----	
G	G --.	.	. .-.-.- $\overline{\text{AAA}}$	
H	H 	,	,	--.-.- $\overline{\text{MIM}}$
I	I ..	;	;	-.-.-. $\overline{\text{KR}}$
J	J .---	:	:	---.. $\overline{\text{OS}}$
K	K -.-	'	'	.----. $\overline{\text{WG}}$
L	L .-..	"	"	.-.-.- $\overline{\text{AF}}$
M	M --	/	/	-.-.- $\overline{\text{DN}}$
N	N -.	?	?	..-.- $\overline{\text{IMI}}$
O	O ---	-	-	-.-.- $\overline{\text{DU}}$
P	P .-.-	_	_	..-.- $\overline{\text{IQ}}$
Q	Q --.-	=	=	-.-.- $\overline{\text{BT}}$
R	R .-.	+	+	.-.-. $\overline{\text{AR}}$ (1)
S	S ...	!	!	...-. $\overline{\text{SN}}$ (2)
T	T -	@	Error <div></div>
U	U ..-	#	Paragraph	.-.-.- $\overline{\text{AL}}$
V	V ...-	\$	\$...-.- $\overline{\text{SX}}$
W	W .--	%	%	-.-.- $\overline{\text{KA}}$ (3)
X	X -.-	^	K	-.- $\overline{\text{K}}$ (4)
Y	Y -.-.	&	&	.-... $\overline{\text{AS}}$ (5)
Z	Z --..	*	*	...-.- $\overline{\text{SK}}$ (6)
1	1 .----	((-.-.- $\overline{\text{KN}}$
2	2 ..---))	-.-.- $\overline{\text{KK}}$
3	3 ...--	tab	Paragraph	.-.-.- $\overline{\text{AL}}$
4	4 -			

NOTES: (1) Also 'End of Message'
 (2) Also 'Understood'
 (3) Also 'Start Signal'

(4) Also 'Invitation to Transmit'
 (5) Also 'Wait'
 (6) Also 'End of Work'

Full 12 Month Warranty

MFJ Enterprises, Inc. warrants to the original owner of this product, if manufactured by MFJ Enterprises, Inc. and purchased from an authorized dealer or directly from MFJ Enterprises, Inc. to be free from defects in material and workmanship for a period of 12 months from date of purchase provided the following terms of this warranty are satisfied.

1. The purchaser must retain the dated proof-of-purchase (bill of sale, canceled check, credit card or money order receipt, etc.) describing the product to establish the validity of the warranty claim and submit the original of machine reproduction or such proof of purchase to MFJ Enterprises, Inc. at the time of warranty service. MFJ Enterprises, Inc. shall have the discretion to deny warranty without dated proof-of-purchase. Any evidence of alteration, erasure, of forgery shall be cause to void any and all warranty terms immediately.
2. MFJ Enterprises, Inc. agrees to repair or replace at MFJ's option without charge to the original owner any defective product provided the product is returned postage prepaid to MFJ Enterprises, Inc. with a personal check, cashiers check, or money order for **\$7.00** covering postage and handling.
3. MFJ Enterprises, Inc. will supply replacement parts free of charge for any MFJ product under warranty upon request. A dated proof of purchase and a **\$5.00** personal check, cashiers check, or money order must be provided to cover postage and handling.
4. This warranty is **NOT** void for owners who attempt to repair defective units. Technical consultation is available by calling (601) 323-5869.
5. This warranty does not apply to kits sold by or manufactured by MFJ Enterprises, Inc.
6. Wired and tested PC board products are covered by this warranty provided **only the wired and tested PC board product is returned**. Wired and tested PC boards installed in the owner's cabinet or connected to switches, jacks, or cables, etc. sent to MFJ Enterprises, Inc. will be returned at the owner's expense unrepaid.
7. Under no circumstances is MFJ Enterprises, Inc. liable for consequential damages to person or property by the use of any MFJ products.
8. **Out-of-Warranty Service:** MFJ Enterprises, Inc. will repair any out-of-warranty product provided the unit is shipped prepaid. All repaired units will be shipped COD to the owner. Repair charges will be added to the COD fee unless other arrangements are made.
9. This warranty is given in lieu of any other warranty expressed or implied.
10. MFJ Enterprises, Inc. reserves the right to make changes or improvements in design or manufacture without incurring any obligation to install such changes upon any of the products previously manufactured.
11. All MFJ products to be serviced in-warranty or out-of-warranty should be addressed to MFJ Enterprises, Inc., 921A Louisville Road, Starkville, Mississippi 39759, USA and must be accompanied by a letter describing the problem in detail along with a copy of your dated proof-of-purchase.
12. This warranty gives you specific rights, and you may also have other rights which vary from state to state.