MFJ-490/490X *Menu Driven Memory Keyer™*

FEATURES

Memories:
Four soft sectored message memories for a total of 192 characters

Morse Code Trainer:
Random code generator with 5 character or random 1-8 character length words. Random characters are selectable from alphabetic, numeric, or punctuation sets or specific 6 character sets.

Embedded Commands:
Auto-incrementing serial numbers, Timed pauses up to 99 minutes 99 seconds, Message loop, Linked messages, Message insertion.

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

Parameter Save:
Message memory and keyer parameters saved in nonvolatile memory.

Sidetone Speaker:
Internal sidetone speaker with adjustable volume and frequency.

Output Tune Mode:
Constant key to tune tuners or antennas

Key Output Disable:
Enable and disable key output to practice operation.

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

Positive or Negative Key Output:
Supports both positive and negative keyed radios.

Transmitter Compensation:
Adjustable key down delays to compensate for transmitter rise-time delays.

CONNECTIONS

The MFJ-490/490X *Menu Driven Memory Keyer™* requires a 12 VDC 250 milliamp power supply. The power jack accepts a 2.1 mm coaxial plug with the center conductor positive. An optional DC supply, the MFJ-1312B, is available from MFJ. Connect your MFJ-1312B Power Adapter or compatible DC supply (coaxial line with shield ground) into the power jack on the MFJ-490.

This unit can also be powered with a nine volt battery. See the section on battery installation.

The MFJ-490/490X supports both positive and negative keyed radios but is set to work as a **Direct** key output (most solid state radios). If your radio has a **Grid Block** key input (most radios with tube finals) you must change a jumper setting. Refer to the section on installation for the jumper change. Connect a quality standard shielded RCA cable between your radio key input and the MFJ-490's output.

INSTALLATION

If you purchased a MFJ-490X (keyer without paddle) you must install it onto your paddle. Follow these instructions for installing a MFJ-490X onto a MFJ-564 or Bencher type paddle.

1. Remove any cables from the paddle. Do not apply power to unit while it is disassembled.
2. Remove the rubber foot from the bottom rear of the paddle. When you replace the screw from the foot, use one of the screws supplied in the installation kit.
3. Remove the plastic cable clamp from the bottom center of the paddle.
4. If you wish to use a nine volt battery, install one now. A nine volt battery fits in the bracket sideways over the circuit board. MFJ suggests the use of a good long-life alkaline battery for longest operation.
5. If your radio uses **Grid Block** key input you must change a jumper inside the keyer. A header is located in the rear of the unit between the CPU and the RCA jack. The jumper should be moved to the two rightmost pins (closest the RCA jack).
6. Slide the MFJ-490X on to the back of the paddle. Thread the cable through the slot on the left bottom of the MFJ-490X. Secure the case with the bumper and new screw. The MFJ-564 Iambic Paddle has 4 additional holes to better secure the case to the paddle.
7. Connect the cable shield to the middle rear terminal on the bottom of the paddle. The red wire should connect to the dash solder lug. The white wire should connect to the dot soldier lug. The wires should be as short as possible to minimize RFI.
8. Place the cable in the plastic cable clamp and secure the screw. Fold any excess cable up into the unit.

BASIC OPERATION

The *Menu Driven Memory Keyer*^{TM} is simple to operate. The push-button marked PWR controls power to the unit. After turning the unit on, the keyer will light the four LEDs sequentially and send the characters "0" and "N" in Morse Code using the sidetone speaker. This tells you the MFJ-490X is ready for operation.

Start sending with the paddle. 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 using the Speed Set feature. See Menu Operation.

Factory Reset

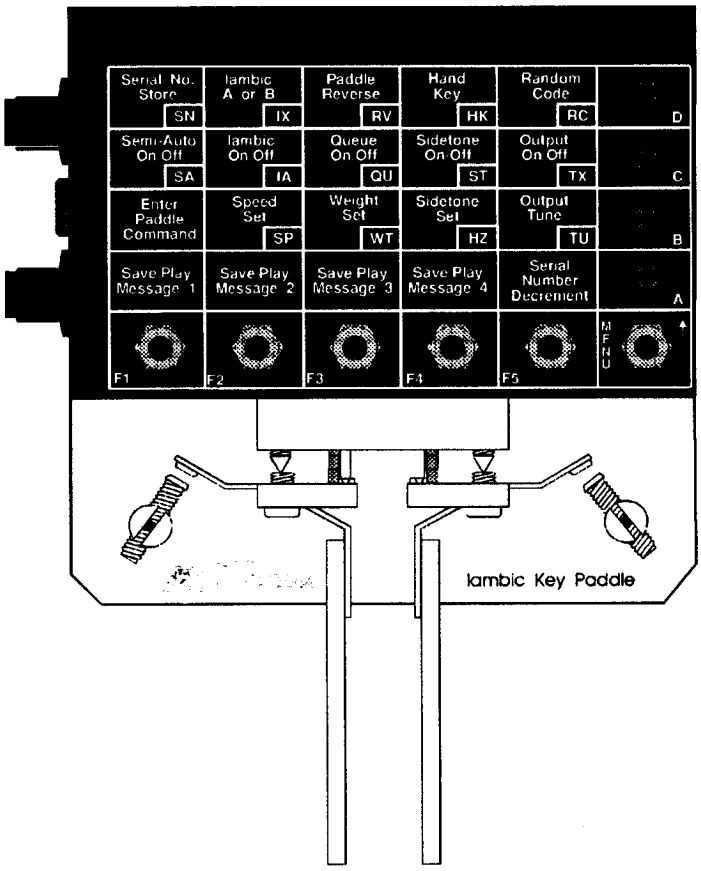
To reset the keyer to default settings, the MENU key is held down through power-up. This resets all settings to the factory default:

All memory messages are cleared.	Speed set to 20 WPM.
Weight set to 50% duty cycle.	Sidetone frequency set to 2000 Hz.
Iambic A mode selected.	Queue mode off.
Break mode off.	Output enabled.

If the keyer is turned on in the normal mode (without the MENU key held down), it will retain all settings prior to power down.

MENU OPERATION

The J-490/490X menu system consists of a menu button marked MENU, five function buttons marked F1-F5, and four menu LEDs marked A-D. Pressing the MENU key changes the menu level. The keyer will sound an audible key click and light the Menu LED of the new level. The row of boxes beside that LED now contains the functions of keys **FlF5.**



For example, to enable the Tune (key down) function, look for the box marked Output Tune on the front panel. It is found on Row B under the column F5. Press the MENU key until the LED marked B lights up. Then press the F5 key. The keyer will respond by entering the Tune mode. Squeeze the paddles to exit that mode.

Menu A
Message Memory

To play or save to a message memory, select Menu A. To save a message to memory, press and hold the function key until the keyer plays "GO" in Morse code. You may now key in the message of your choice. As you pause after every word, the keyer will play a "W" over the sidetone speaker to show that it is inserting a word break. If the keyer does not recognize your code as a valid character, the keyer will play a series of 8 dots and that character will not be saved. If you make a mistake entering a word, you can back up over it by keying in 8 continuous dots. The keyer will erase the previous word, then play the word before it (if any) to let you know where you stopped. At the end of your message hit the memory function key again to end your message. The keyer will respond by sending an end of message character (+). If you try to save more characters than you have memory, the keyer will automatically end your message, send you an end of message character and lock any unused messages. To play a message, press and release a function key quickly.

Embedded commands:

While in the save message mode you may use embedded commands for special features. To use an embedded command simply store the two character, embedded command code within your message.

/N Inserts a serial number into a message. All nines are sent as "N" and zeros are sent as "T". A serial number is automatically incremented each time it is sent. To decrement the serial number, press the serial number Decrement menu button. A new serial number can be saved by using the serial number store menu feature.
Example: YOU ARE CONTACT NR IN

/L Create a message loop. (Message Repeat)
Example: BEACON AA5MT 5 W /L

/P Inserts a timed pause into a message. This command is followed by 4 numbers in xx minutes xx seconds format. May be in either / Pxxxx or /Pxxxx format.
Example: TIMEOUT 1 HOUR /P6000 TIMEOUT 1.5 MIN / P0090 TIMEOUT 1 H 40 MIN 39 S / P9999

/# # = 1, 2, 3, 4 Insert's memory message number # into message. (Message Call) This command allows you to include any other message into another message. *A* ***message may not call any other message that contains an embedded message call*** *If* no message is saved for that number nothing will play at the /#.
Example: message 1: CQ CQ CQ CQ
message 2: /1 DE KB5VKY
Sending message 2 plays CQ CQ CQ DE KB5VKY /S
Can be added into messages to insert an extra word space.

// To store a / in a message you must use the embedded command //.

Commands can be combined into messages:
FOXHUNT DE AA5MT /S /S /S BEACON WILL REPEAT 5 MIN DE TRANSMISSION NR /N /S /S /S CATCH ME IF YOU CAN /P 0500 /L

Serial Number Decrement

Use Serial Number Decrement to decrement the current serial number by one. The unit will echo a "D" for every number that is decremented. *If* you decrement down from zero you will get 9999 for your serial number. When a message plays 9999 the serial number will then increment to zero which does not play.

Menu B

Command Mode

The first function on Menu B is the enter paddle command mode. After you push the function button F1 the keyer will respond with "CO". Now a two or four character command can be entered on your paddle. If the instruction is invalid then the keyer will send 8 rapid dots (error) and return the keyer to normal mode. If the user wishes to re-attempt modifying features using command mode, he must reenter command mode by pressing F1 again.

All of the menu commands can also be accessed through the Command Mode using the two character shorthand found on the front panel. However, some features are not on the menu. A summary of those commands and a brief description of each feature follows:

Command Mode Commands

BK Use Break On/Off to toggle between break mode on and off. The keyer responds with the current mode "ON" or "OFF". Break mode allows you to insert code into a message that is playing. Press a dot or dash to break into a message. The keyer will stop the current memory message. Begin sending code. After you finish sending code, press any message button to resume playing the message where you interrupted it. Press **Menu** to clear a message.

C# Where #=0-9. Use character break to customize the length of the intercharacter spacing. A standard character break is 3 dot lengths long. The number following the C is the number of extra dot lengths added to a character break.

Command Mode Commands (cont.)

FA Use Farnsworth mode to toggle between Farnsworth mode on and off. Farnsworth mode works with the random code generator. It sets the code character speed to 18 words per minute while keeping the overall word speed at the defined setting. If the keyer is set to 5 WPM in Farnsworth mode, the keyer will send 18 WPM characters while inserting extra word break and intercharacter timing to maintain an effective speed of 5 WPM. At speeds above 18 WPM the keyer reverts to normal timing. This feature allows a user to associate Morse characters with their sound rather than by counting dots and dashes.

KC## ##=00-15 sets a keying compensation value. Some radios have a key delay of 5 mS or more. By entering KC05, the keyer will add 5 mS to the dots and dashes. This eliminates the problems with a keying delay

R# Where #=1-8. Use Random Number to customize the Random Code Generator. The keyer will play "OK" after your command has been entered.

RI: Enable either 5 character word length or random (1-8 character) word length. R2: Toggle random numeric characters on and off.

R3: Toggle random punctuation characters on and off.

R4: Toggle random prosign characters on and off.

R5: Toggle random alphabetic characters on and off.

R6: Enable either fixed character sets (01 - 09) or enabled sets (R2 - R5). See ## command. R7: Enable either repeat code session or new code session.

W# Where #=0-9. Use word break to customize the length of the interword spacing. A standard word break is 7 dot lengths long. The number following the W is the number of extra dot lengths added to a word break. Keyer echoes "OK" upon entry.

= 00 - 09. Select one of the six character sets for the random code generation. Keyer echoes "OK" upon entry.

01	02	03	04	05	06	07	08	09
A	G	M	S	Y	4		_	;
B	H	N	T	Z	5	?	+	
C	I	0	U	0	6	to	9	)
D	J	P	V	1	7	$	-	/
E	K	Q	W	2	8		=	Start
F	L	R		3	9	Para		Invite

Speed Set _____ (SP)

Use Speed Set (wpm) mode to change the speed of code . An alternating dot/dash is produced and the speed is modified by using the paddles to increase/decrease speed. Squeeze paddles to exit.

Weight Set _____(WT)

Use Weight Set to modify the weight settings for code. An alternating dot/dash is produced and the weight of the code is modified by using the paddles to increase/decrease weight. Squeeze paddles to exit.

Sidetone Set (HZ)
Use Sidetone Set to change the sidetone speaker frequency. The paddles now change the tone of the sidetone that is emitted from the speaker. This will not change the frequency of the code transmission because the keyer does not affect the tone that a radio emits. Squeeze paddles to exit.

Output Tune (TU)
Use Output Tune to tune up your station. This sends a constant key to allow tuning of your station.
Squeeze paddles to exit.

MENU C

Semi-Auto On/Off (SA)
Use Semi-auto On/Off to toggle between semi-auto (bug) mode on and off. The keyer responds with the current mode "ON" or "OFF". Semi-auto mode creates automatic dots but requires dashes to be hand keyed. ***Note: Semi Auto mode may not be used to enter messages, serial numbers or in command mode.***

Iambic On/Off (IA)
Use Iambic On/Off to toggle between iambic modes on and off. The keyer responds with the current mode "ON" or "OFF". Iambic mode allows you to squeeze both paddles and get alternating dashes or dots. Non-iambic mode does not alternate between dots and dashes during a squeeze. It plays whatever side made contact first until it is released. See Iambic A or B

Queue On/Off (QU)
Use Queue On/Off to toggle between queue mode on and off. The keyer responds with the current mode "ON" or "OFF". Queue mode enables the user to load messages into a buffer to play messages sequentially. In queue mode, if you press a memory button while a message is playing, that message will play after the current message is done. In normal operation pressing a message memory will abort any message being played and play the new message.

Sidetone On/Off (ST)
Use Sidetone On/Off to toggle between sidetone speaker on and off. The keyer responds with the current mode "ON" or "OFF". If the sidetone is turned off, it will still play command messages and status information.

Output On/Off (TX)
Use Output On/Off to toggle between output on and off. The keyer responds with the current mode "ON" or "OFF". If the output is turned off, no signal goes to the keyer gridblock or direct outputs to allow for practice operation. The output is automatically disabled during memory message storing, command mode operation, status information, and keyer setup.

Menu D

Serial No. Store (SN)

Use Serial Number Store to set the current serial number. You must enter four numbers in Morse code for a valid serial number. All numbers must be in the proper Morse code format. For example, the number "1" must be " " and the number "0" must be " ". The serial number can be set from 0000 to 9999. See IN under Embedded Commands. See also Serial Number Decrement.

Iambic A or B (IX)

Use Iambic A or B to toggle between Iambic A and Iambic B. The keyer responds with the current mode "A" or "B". The Iambic modes work when you squeeze both paddles together. See 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 produces ".-" or "A" in Iambic A mode but produces ".-." or "R" in Iambic B mode.

Paddle Reverse (RV)

Use Paddle Reverse 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.

Hand Kev (HK)

Use Hand Key to use your paddle as a hand (straight) key. The keyer responds with "HK". Dots and dashes are made manually by using either key of the paddle. Squeeze paddles to exit.

Random Code (RC)

Use Random Code to start the random code generator. Set up the Random Code generator using the Command Mode. Use FA, R1-8 and the set selection numbers to customize your code tutor to select exactly what you need to study. Squeeze paddles to exit.

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 W8J1 W8JI

Memory #3: UR 599 SN /N 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. Each of these memories are set with simple to the point messages. A listener will immediately know who is calling and what they want. The call is repeated after a short CQ TEST so that someone will not spend much time listening to stations they have already worked.

Memory #3 is set with the contest exchange. It gives a serial number and other contest information. Remember, all contests require different exchanges.

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

TYPICAL CODE PRACTICE SESSION

This is an example of a typical code practice session. Work first on the letters A-F. You can do all our practice in Farnsworth mode so that you will learn the sound of each character at a high speed. Enter Command Mode and key in'FA'. This enters Farnsworth mode.
Now fix the code generator to the 6 character sets by entering R6.
Enter '01' in the Command Mode to choose the A-F character set. The default settings are set to fixed 5 character length and repeat session.
Now adjust the speed with the speed set feature. Remember you are in Farnsworth mode so you can only adjust word spacing. All character speed is set to 18 words per minute. Get ready to copy.
Press the Random Code Function key and take code for a couple minutes. When you get to a stopping point squeeze the paddles together to end the session.
Restart the session again by pressing the Random Code Function key. The code session will start again and you should be able to check your copy. The same code session will repeat until you turn off the power or toggle the R8 command in the Command Mode.
After you have practiced the A-F set you can move to the next set by entering 02 - 08 in the command mode.

BATTERY REMOVAL AND INSTALLATION

The MFJ-490 has two batteries. An optional nine volt for operation and a lithium cell for memory backup. MFJ suggests the use of a good long-life alkaline nine volt battery for longest operation. Turning the sidetone "off' will conserve the nine volt battery as the speaker pulls more current than any other keyer component. The lithium cell on this keyer should last 2 years or more.

To replace the nine volt battery do steps **1-4, 14.** To repace the lithium cell do all steps ***except 4.***

1. Remove the rubber foot from the bottom rear of the paddle. Remove all extra screws from the paddle if you have an MFJ-564.
2. Remove the plastic cable clamp from the bottom center of the paddle. 3. Slide the keyer off the paddle
4. If you are *not* installing a lithium cell install a nine volt battery now. A nine volt battery fits in the bracket sideways over the circuit board. Go to step 14.
5. Remove the wires to the paddle by removing the solder lugs from the paddle. This will make things easier but it will not be necessary.
6. Remove the knobs with a 1/16 Allen wrench. Remove the nuts from the pots.
7. Remove the two large headed screws from the corners of the top of the keyer.
8. Grasp the half of the keyer shell with the speaker and slide it out of the shell with the buttons.
9. Lay the 2 halves of the shell flat so that the speaker wire is not flexed.
10. Locate the lithium cell battery holder under the **PCB.** ***Turn the power switch to the "ON" position.***
11. With a small flathead screwdriver lever the lip of the lithium cell forward over the edge of the battery holder. Lever the cell sideways out of the holder.
12. Hold the battery clip up with the small screwdriver and slide the new battery sideways under the battery clip. Remove the screwdriver and slide the cell into place.
13. Slide the 2 halves of the keyer back together and reinstall the screws, pot nuts, and knobs.
14. Slide the keyer back on the paddle and replace the screws. Reconnect the solder lugs if you removed them. Replace the plastic cable clamp and rubber foot.

COMMAND MODE QUICK REFERENCE

COMMAND	DESCRIPTION
BK	**TOGGLES BREAK IN MODE ON/OFF**
C# # = 0-9	SELECTS CHARACTER BREAK LENGTH
FA	**TOGGLES FARNSWORTH MODE ON/OFF**
HK	**ENABLES HAND KEY (STRAIGHT KEY) MODE**
HZ	**ENABLES SIDETONE FREQUENCY SET MODE**
IA	**TOGGLES IAMBIC MODE ON/OFF**
IX	**TOGGLES IAMBIC MODES A/B**
KC## ## = 00-15	SELECTS KEYING COMPENSATION VALUE QU
	TOGGLES MESSAGE QUEUE MODE ON/OFF
RA	ENABLES RANDOM CODE MODE
RV	TOGGLES DOT/DASH PADDLE ASSIGNMENTS
R# # = 1-8	SELECTS RANDOM CODE MODES
SA	ENABLES SEMI-AUTOMATIC (BUG) MODE
SN	ENABLES SERIAL NUMBER STORE MODE
SP	ENABLES SPEED (WPM) SET MODE
ST	TOGGLES SIDETONE ON/OFF
TU	ENABLES TUNE (KEY UP) MODE
TX	TOGGLES OUTPUT KEY ON/OFF
WT	ENABLES WEIGHT SET MODE
W# # = 0-9	**SELECTS WORD BREAK LENGTH**
## ## = 01-09	**SELECTS RANDOM CODE 6 CHARACTER SETS**

TECHNICAL ASSISTANCE

If you have any problem with this unit first check the appropriate section of this manual. If the manual does not reference your problem or your problem is not solved by following the manual you may call MFJ toll-free at 1-800-647-TECH (8324) or FAX to 601-323-6551, or TELEX 53 4590 MFJ STKV. Outside the continental U.S.A. 601-323-5869. You will be best served if you have your unit, manual and all information on your station handy so you can answer any questions the technicians may ask.

You can also send questions to MFJ Enterprises, INC., P.O. Box 494, Mississippi State, MS 39762. Send a complete description of your problem, an explanation of exactly how you are using your unit and a complete description of your station.

MFJ-490 PARTS LIST

Part Designator	Part Description	**MFJ Part Number**
R1	RESISTOR, NETWORK, SIP, COMMON, 9 ELEMENTS, 10K	126-4100-09
R2,R12	RESISTOR, 1/4 WATT, 5%, FILM, LOOK OHM	100-5100
R3,R17	RESISTOR, I/4 WATT, 5%, FILM, 1.0K OHM	100-3100
R4	RESISTOR, POT, PCB, LINEAR TAPER, 1K	162-3100-1
R6	RESISTOR, I/4 WATT, 5%, FILM, 100 OHM	100-2100
R7	RESISTOR, 1/4 WATT, 5%, FILM, 15 OHM	100-1150
R8	RESISTOR, POT, PCB, LINEAR TAPER, 250 OHM	162-2250-1
RIO	RESISTOR, 1/4 WATT, 5%, FILM, 1.5K OHM	100-3150
R1 l	RESISTOR, I/4 WATT, 5%, FILM, 20K OHM	100-4200
R13,R14,R15,R19	RESISTOR, 1/4 WATT, 5%, FILM, 10.0K OHM	100-4100
R16	RESISTOR, I/4 WATT, 5%, FILM, 130 OHM	100-2130
C1.C2	CAPACITOR, MULTILAYER CER., NPO, 5%,50 V, 33 PF	205-0020
C3,C12,C13,C20,C21,C24	CAPACITOR, DISC CERAMIC, 1 KV, 20%, .O1 OF	200-2015
C4,C18	CAPACITOR, ELECTROLYTIC, RADIAL, 50V, 1 OF	203-0006
C7	CAPACITOR, ELECTROLYTIC, RADIAL, 35V, 2.2UF	203-0002
C8,C9,C10,C19	CAPACITOR, MULTILAYER,.2, X7R, 10%, 50V, .1 OF	205-2210
C14	CAPACITOR, DISC CERAMIC, 1 KV, 20%,.l OF	200-2017
C15	CAPACITOR, ELECTROLYTIC, RADIAL, 35V, 47 OF	203-0007
Q1	TRANSISTOR, TO-92, NPN, MPS-A13	305-2007
Q2,Q5	TRANSISTOR, NPN, MOT 2N3904	305-0018
Q3	TRANSISTOR, TO-92, 300V,PNP, MPS-A92	305-2006
Q4	TRANSISTOR, FET, SWITCHING, VN1OKM	305-6005
Y 1	CRYSTAL, HC18/U, 16 MHZ	405-0067
D1,D4	DIODE, ZENER,. DO-35, 500 mW, 3V, 1N5225B	301-5225
D2,D3,D5,D7,D8,D9	DIODE, RECTIFIER, DO-41, 1 A, 800 PIV, 1N4006	300-1005
D6	DIODE, SWITCHING, DO-35, 10 mW, 75 PIV, 1N4148	300-0003
CR1	LLT, OPTO, LED, 5MM, ROUND, GREEN	320-0002
CR2,CR3,CR4	LLT, OPTO, LED, 5 MM ROUND, RED, MV5753	320-0001
1C1	IC, CPU, 40 Pin, 8-BIT, INTEL, P80C32-1	313-08032
1C2	1C, HCT 20 Pin, TRI-STATE OCTAL LATCH, 74HCT373	310-4373
1C3	1C, EPROM, 28 PIN, 64K, 21V, CMOS, 27C64	312-2081
1C4	VOLTAGE REGULATOR, +5 VOLTS, 78L05AC	307-0010
1C6	IC, HC, 8 BIT SHIFT REGISTER, OUT, 14 PIN, 74HC 164	310-3164
J3	JACK, 2.I MM, PCB, DC COAXIAL JACK	601-6021
J4	JACK, RCA PHONO, PCB, SINGLE	600-0011
J5	CONNECTOR, JUMPER, SHORTING,. I, 2 POSITION	612-4001
B1	BATTERY, COIN, 3V, LITHUM, (1480), .	730-1308
FOR B1	HOLDER, BATTERY, PCB MT, COIN, 3 V, LITHUM	730-2293
SPKR	LLT, SPEAKER, 2", ROUND,.2 WATT, 8 OHM	410-0024
SW1 - SW6	SWITCH, PUSH BUTTON, 3 AMP, 125 VAC, SPST	504-1003
SW7	SWITCH, PUSH-BUTTON, PC, .5 A, 125 VAC, 2P2P	504-0022
FOR SW7	KNOB, PLASTIC, PUSH-BUTTON,.350" DIA, RED	760-2140

MFJ-490 SCHEMATIC DIAGRAM