

The MFJ-492 *Menu Driven Memory Keyer*™ is a full featured keyer with an easy to use menu driven interface. This unit has four soft sector message memories for a total of 192 characters. The MFJ-492X *Menu Driven Memory Keyer*™ is the same keyer but has message memory expanded to 8 separate 1000 character message memories, giving the unit the "X" designation. The keyer can repeat messages continuously, insert timed pauses within messages, insert an auto-incrementing serial number, and have messages call other messages.

The MFJ-492 has adjustable controls for speed and volume on the front of the unit. Also, the speed, weight, and sidetone frequency are adjustable through menu selection or paddle command. Other modes such as Hand Key, Semi-auto, Reverse Paddle, Iambic On/Off, Iambic A/B, Queue, are accessed through menu selection or paddle command. The MFJ-492 has both Direct and Grid-Block outputs and a port for an optional remote control.

# MFJ-492 *Menu Driven Memory Keyer*™

## FEATURES

### **Memories:**

Four soft sectored message memories for a total of 192 characters (MFJ-492) or eight memories of 1000 characters each (MFJ-492X).

### **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-492 *Menu Driven Memory Keyer*™ requires a 12 VDC 250 milliamp power supply. The power jack accepts a 2.1mm 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-492.

This unit supports both positive and negative keyed radios. Connect a standard shielded RCA cable between your radio key input and to the MFJ-492's **Direct** output for positive keyed radios (most solid state radios) or to the **Grid-Block** output for negative keyed radios (most radios with tube finals.)

A paddle connects to the 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 the paddle ground.

The last port in the back of the unit is for the optional remote control. The remote control gives you remote access to the keyer menu if the main unit is out of reach. It is simply plugged into the connector through the back plate.

## BASIC OPERATION

The *Menu Driven Memory Keyer™* 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 "O" and "N" in Morse Code using the sidetone speaker. This tells you the MFJ-492 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 Speed set to 20 WPM.  
cleared.

Weight set to 50% duty Sidetone frequency set to  
cycle. 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), then the keyer will retain all settings prior to power down.

|   | MENU | F1                     | F2                  | F3                   | F4                    | F5                      |
|---|------|------------------------|---------------------|----------------------|-----------------------|-------------------------|
| A |      | Save/Play Message 1    | Save/Play Message 2 | Save/Play Message 3  | Save/Play Message 4   | Serial Number Decrement |
| B |      | Enter Paddle Command   | Speed Set<br>SP     | Weight Set<br>WT     | Sidetone Set<br>HZ    | Output Tune<br>TU       |
| C |      | Semi-Auto On/Off<br>SA | Iambic On/Off<br>IA | Queue On/Off<br>QU   | Sidetone On/Off<br>ST | Output On/Off<br>TX     |
| D |      | Serial No. Store<br>SN | Iambic A or B<br>IX | Paddle Reverse<br>RV | Hand Key<br>HK        | Random Code<br>RC       |

### MFJ MENU DRIVEN MEMORY KEYER™

SPEED

VOLUME

PWR

ON  
OFF

**MODEL MFJ-492**

## MENU OPERATION

The MFJ-492 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 **F1-F5**.

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.

### **MFJ-492X Menu Operation**

The MFJ-492X, a MFJ-492 with expansion RAM, works a little differently than a normal unit. On a MFJ-492X, Menu **A** has a LED that is lit either red or green. The red LED indicates the normal compliment of memories ( 1-4 ). The green LED indicates that there is an extra bank of memories ( 5-8 ) available. Memories are set or played the same way and **F5** remains Serial Number Decrement on both levels.

### **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 /N

/L Create a message loop. ( Message Repeat )  
 Example: BEACON AA5CS 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

/# Inserts 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 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 re-enter 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.

**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.

R1: 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.

### **Command Mode Commands (cont)**

**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 echos "OK" upon entry.

**##** ## = 00 - 09. Select one of the six character sets for the random code generation. Keyer echos "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  | O  | U  | 0  | 6  | "  | ,  | )   |
| D  | J  | P  | V  | 1  | 7  | \$ | -  | /   |
| E  | K  | Q  | W  | 2  | 8  | '  | =  | Sta |

|   |   |   |   |   |   |      |   |     |
|---|---|---|---|---|---|------|---|-----|
| F | L | R | X | 3 | 9 | Para | : | Inv |
|---|---|---|---|---|---|------|---|-----|

### 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 /N 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 Key (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 tester's settings.

Memory #1: CQ TEST DE W8JI W8JI W8JI TEST

Memory #2: TEST W8JI W8JI

Memory #3: UR 599 SN /N OH 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 SETTINGS**

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 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**. Test the voltage of the battery from the battery(+) to the chassis(-). The voltage tested should be over 2.7 volts or the battery should be replaced. ***To replace the battery the unit must be powered ON.*** The battery is carefully removed and a new one carefully inserted.

## **MEMORY EXPANSION**

To expand an MFJ-492 to 8x1000 character message memories, you can order the MFJ-80 Expansion Ram kit from MFJ or upgrade the keyer yourself with an HM6264ALP-10 or equivalent static ram chip. First remove power and the lithium battery. Install the chip matching the notch printed on the circuit board. Turn the unit **ON** with the Menu key held down and reinstall the lithium battery.

## 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 of 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-492 PARTS LIST

| Part Number          | Designation                                     | MFJ Part #  |
|----------------------|-------------------------------------------------|-------------|
| C1,C2                | CAPACITOR, MULTILAYER CER., 5%, 50 V, 33 PF     | 205-0020    |
| C3,C5,C6,C12,C13,C16 | CAPACITOR, DISC CERAMIC, 1 KV, 20%, .01 UF      | 200-2015    |
| C4,C18               | CAPACITOR, ELECTROLYTIC, RADIAL, 50V, 1 UF      | 203-0006    |
| C7                   | CAPACITOR, ELECTROLYTIC, RADIAL, 35V, 2.2UF     | 203-0002    |
| C8,C9,C10,C19        | CAPACITOR, MULTILAYER, .2, X7R, 10%, 50V, .1 UF | 205-2210    |
| C14                  | CAPACITOR, DISC CERAMIC, 1 KV, 20%, .1 UF       | 200-2017    |
| C15                  | CAPACITOR, ELECTROLYTIC, RADIAL, 35V, 47 UF     | 203-0007    |
| C17,C20,C21,C22,C24  | CAPACITOR, DISC CERAMIC, 1 KV, 20%, .01 UF      | 200-2015    |
| CR1                  | LED, DUAL COLOR                                 | 320-0004    |
| CR2,CR3,CR4          | LED, RED, MV5753                                | 320-0001    |
| R1                   | RESISTOR, NETWORK, COMMON, 10K OHM              | 126-4100-09 |
| R2,R12               | RESISTOR, 1/4 WATT, 5%, FILM, 100K OHM          | 100-5100    |
| R3,R17               | RESISTOR, 1/4 WATT, 5%, FILM, 1.0K OHM          | 100-3100    |
| R4                   | RESISTOR, POT, LINEAR TAPER, 1K POT             | 162-3100-1  |
| R6                   | RESISTOR, 1/4 WATT, 5%, FILM, 100 OHM           | 100-2100    |
| R7                   | RESISTOR, 1/4 WATT, 5%, FILM, 15 OHM            | 100-1150    |
| R8                   | RESISTOR, POT, LINEAR TAPER, 10%, 250 OHM       | 162-2250-1  |
| R10                  | RESISTOR, 1/4 WATT, 5%, FILM, 1.5K OHM          | 100-3150    |
| R11                  | RESISTOR, 1/4 WATT, 5%, FILM, 20K OHM           | 100-4200    |
| R13,R14,R15,R9       | RESISTOR, 1/4 WATT, 5%, FILM, 10.0K OHM         | 100-4100    |
| R16                  | RESISTOR, 1/4 WATT, 5%, FILM, 470 OHM           | 100- 2470   |
| PC1                  | PC BOARD ASSEMBLY                               | 90-1201-1   |
| Q1                   | TRANSISTOR, DARLINGTON, TO-92, NPN, MPS-A13     | 305-2007    |
| Q2,Q5                | TRANSISTOR, TO-92,NPN, MOT 2N3904               | 305-0018    |
| Q3                   | TRANSISTOR, TO-92, PNP, MPS-A92                 | 305-2006    |
| Q4                   | TRANSISTOR, SWITCHING, VN10KM                   | 305-6005    |
| Y1                   | CRYSTAL, HC18/U, 16 MHZ                         | 405-0067    |
| D1,D4                | DIODE, ZENER, 1N5225B                           | 301-5225    |
| D2,D3,D5,D7,D8       | DIODE, RECTIFIER, 1N4006                        | 300-1005    |
| D6                   | DIODE, SWITCHING, 1N4148                        | 300-0003    |
| IC1                  | IC, CPU, 8-BIT, INTEL, P80C32-1                 | 313-08032   |
| IC2                  | IC, TRI-STATE OCTAL LATCH, 74HCT373             | 310-4373    |
| IC3                  | IC, EPROM, 28 PIN, 64K, 27C64                   | 312-2081    |
| IC4                  | VOLTAGE REGULATOR, TO-92, 78L05AC               | 307-0010    |
| IC6                  | IC, 8 BIT SHIFT REGISTER, 74HC164               | 310-3164    |
| FOR IC1              | SOCKET, IC, LOW PROFILE, 40 PIN                 | 625-0181    |
| FOR IC2              | SOCKET, IC, LOW PROFILE, 20 PINS                | 625-0291    |
| FOR IC3, IC5         | SOCKET, IC, LOW PROFILE, 28 PINS                | 625-0292    |
| FOR IC6              | SOCKET, IC, LOW PROFILE, 14 PIN                 | 625-0031    |
| JMP1                 | WIRE JUMPER                                     | 870-5000    |
| J1                   | JACK, 1/4" PHONE, STEREO                        | 601-0012    |
| J2/P2                | JUMPER RIBBON, 12 POS                           | 620-6031    |
| J3                   | JACK, 2.1 MM, DC COAXIAL JACK                   | 601-6021    |
| J4,J5                | JACK, RCA PHONO                                 | 600-0011    |
| J6                   | CONNECTOR, JUMPER, 2 POSITION                   | 612-4001    |

|                         |                             |          |
|-------------------------|-----------------------------|----------|
| J7                      | CONNECTOR, RT. ANGLE, 9 POS | 612-1009 |
| SW1, SW2, SW3, SW4, SW5 | SWITCH, PUSH BUTTON, SPST   | 504-1003 |
| SW6                     | SWITCH, PUSH BUTTON         | 504-1003 |
| SW7                     | SWITCH, PUSH-BOTTON 2P2P    | 504-0022 |
| CAP                     | KEYCAP RED                  | 760-2140 |
|                         | BATTERY, COIN, 3V, LITHUM   | 730-1308 |
|                         | HOLDER, BATTERY, LITHUM     | 730-2293 |
|                         | BATTERY, HOLDER, 9-V        | 730-2001 |
|                         | BATTERY, SNAP, 9V, 8        | 730-3005 |
|                         | SPEAKER, 8 OHM              | 410-0024 |