MM-3

The Morse Machine™

Owner's Manual

INTRODUCTION

The Morse Machine is a full-featured, high performance keyer featuring 2-–255 WPM program-mable or 2–99 WPM variable speed selection and 8,000 memory characters that can be stored into 20 memories (36,500 characters if 32 k RAM is used. See page 4). Seven programmable modes of operation are included: KEYER/MEMORY SEND, BEACON (to automatically repeat a Morse or RS-232 ASCII message at a programmed interval of one to 999 seconds), MEMORY LOAD, TRAINER (allows random code group practice at steadily increasing speeds), MORSE TERMINAL, CONTEST SIMULATOR and QSO SIMULATOR.

Whether you're an expert or a novice CW'er, The Morse Machine will help improve your code:

- A proficiency trainer allows random code group practice with steadily increasing speed
- A random word generator generates four-letter words for a more realistic practice session
- A QSO simulator simulates QSOs like those you would hear on the air
- A DX Contest simulator hones your CW skills

For the serious CW contester, The Morse Machine includes automatic serial number insertion and incrementing in any memory message. You can use the front panel knob to adjust your send-ing speed or enter a precise speed with the keypad.

A computer serial port can be interfaced to The Morse Machine through its RS-232 compatible I/O allowing any front panel function to be programmed from the computer. Loading memories is as simple as typing them on the computer keyboard. Further, your random code, contest or practice sessions can be displayed on your computer screen.

RF INTERFERENCE

The MM-3 has been certified under Subpart J of Part 15 of the FCC requirements. The unit gen-erates and uses radio frequency energy. If the MM-3 is not installed and used in accordance with this manual, it may cause interference to radio and TV reception. It has been type-tested and com-plies with the limits of a Class 8 computing device in accordance with specifications in Subpart J of Part 15 of the FCC requirements which provides reasonable protection against such interference in residential installations. If the MM-3 causes interference to radio or TV reception (test by turning the unit on and off and noting any change in reception), you are encouraged to correct the interfer-ence using one or more of the following measures:

- Re-orient the TV or radio antenna
- Relocate the computer with respect to the MM-3
- Plug the computer into a different outlet than the MM-3

If necessary, you should consult with the dealer or an experienced radio/TV technician for addi-tional information. You may also find the FCC booklet, "How to Identify and Resolve Radio-TV In-terference Problems" a helpful resource.

Note: Use shielded cable for all connections to your keyer.

INSTALLATION

POWER

Apply 13 volts DC to the power input jack on the rear panel of the MM-3. You can easily accomplish this by connecting the cord attached to the optional AC-1 or AC-4 wall adapters to the power socket on the rear panel of the MM-3.

If you do not have one of the optional power supplies, you must supply 9–16 Volts DC to the MM-3 from any external power source Including batteries) capable of delivering at least 350 mA (see page 5, Low Power). Use the mating power connector supplied for connecting the MM-3 and the power source. BE SURE TO OBSERVE PROPER POLARITY. The center pin is positive.

You can operate the-MM-3-in an automobile by using the optional DC-1 power cord.

PADDLE

Wire your external keyer paddle to the included ¼-inch stereo phono plug, using a cable containing two conductors plus a shield. Connect the shield to the paddle common, the tip to the dash contact and the ring to the dot contact. If you have a paddle wired in reverse, see the [*][C][7][1][2] command described on page 4. For right-handed operators, the thumb activates the dot contact and the index and middle fingers operate the dash contact.
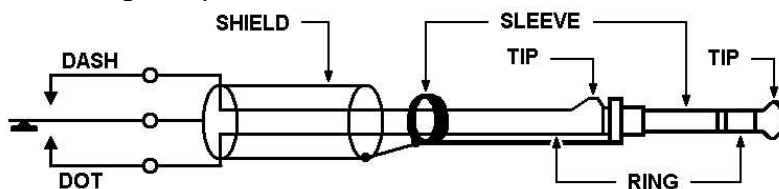
STRAIGHT KEY

You can use the MM-3 with a Straight Key instead of a keyer paddle. Use a two-conductor stereo plug with the key across the tip (dash) terminal and the sleeve (common) terminal. The MM-3 must be programmed for Straight Key mode ([*][C][5]).
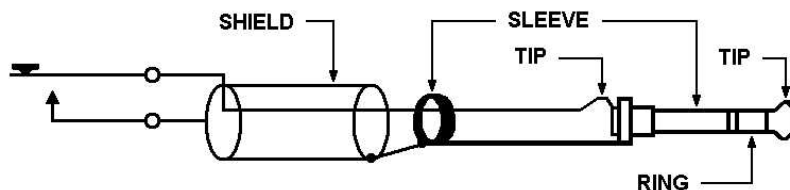
Reversing Paddle

[*][C][7][1][1]   Paddle normal: dot = ring, dash = tip (default)
[*][C][7][1][2]   Paddle reversed: dot = tip, dash = ring

The [*][C][7][1][2] command is for those who have their keyer paddle wired the other way. Unfortunately, there is no standard.

These commands do not affect straight key mode, which always works from the tip and ignores the ring of the connector.

HEADPHONES

The headphone jack will drive low, medium or high impedance headphones. A standard 1/8-inch (3.5 mm) two-conductor headphone plug is necessary.

TRANSMITTER

The Morse Machine will key virtually any modern amateur radio transmitter. There are two output jacks which are diode-protected against inadvertent hook-up to the wrong keying polarity. The ground side of the RCA-type phone jack (keyer output) should be connected to the transmitter's chassis ground on its key input jack. The center conductor of the MM-3 keyed output jack should be connected to the "hot" terminal of the transmitter key input jack. Use a shielded coaxial cable for best RF immunity. Use the plus (+) keyed output jack to key Cathode keyed and most transistor keyed transmitters. Use the minus (–) keyed output jack to key grid-block keyed and some transistor keyed transmitters. If you connect your transmitter key input to the wrong MM-3 keyed output, either the transmitter will not key, or it will be keyed continuously. To correct the situation, simply plug the output line into the other output jack. No damage should occur to either the transmitter or the MM-3 if you momentarily connect to the wrong keyed output jack. Maximum current on these connections is 100 mA on the positive and -30 mA on the negative Keyed output.

MEMORY

The MM-3 comes with an 8 kbyte static RAM (6264) installed. The RAMs contents are preserved with an on-board lithium battery while the power is off. You can expand the message memory yourself by removing the 8 k RAM and installing a 32 k byte static RAM (type 43256 or 62256), which can be purchased at you local electronics supply store (AEA does not carry stock on these items). No jumpers need to be cut or changed. The 32 k RAM increases the maximum message memory size from 8,400 to approximately 36,500 Morse characters. The 32 k RAM also increases the ASCII-to-Morse buffer size if you use the keyer as a Morse terminal.

LOW POWER

There are several ways to reduce the current consumed by the keyer. Normally the MM-3 requires 350 mA at 12 Volts. You can reduce this by 100 mA by disabling the speaker audio. Press [*][B][1] and [*][B][2] to disable the CW and keypad sidetone. By opening the case and removing jumper JP1 from behind the power connector the LEDs and the serial port drivers will be disabled, reducing the current by 20 mA. Also, try substituting CMOS parts for some of the integrated circuits:

- Replacing the 8031 with an 80C31 saves about 100 mA
- Replacing the 8155 with an 81C55 saves about 60 mA

SERIAL PORT

The Morse Machine contains a serial port for communications to and from a terminal or personal computer. On the rear panel are two RCA-type phono jacks labeled "SERIAL IN" and "SERIAL OUT". You will need to construct an adapter so that your computer or terminal can be used with the keyer.

Example:

PIN 1	GND	PIN 5	CTS
PIN 2	TXD	PIN 6	DSR
PIN 3	RXD	PIN 7	GND
PIN 4	RTS	PIN 8	DCD
		PIN 20	DTR
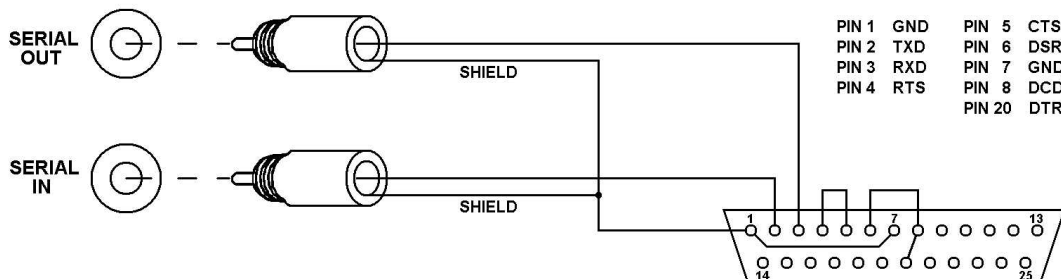
The adapter in the illustration above connects the keyer to a terminal or a computer. If you are going to use the keyer as a controlling terminal for a modem or Packet TNC (Terminal Node Controller), reverse the SERIAL IN and OUT plugs. This eliminates the need for a Null-Modem cable.

QUICK REFERENCE

We recommend that you perform the following functions to quickly acquaint yourself with The Morse Machine and to ensure the unit is operating properly.

Note: Do not connect the MM-3 to your transmitter at this time.

KEYER/MEMORY SEND MODE

1. Turn the power switch on. On the keypad, press [*][C][0] to reset the keyer options. The KEYER mode light and MEMORY BANK A light should be on.
2. Press and release [*], then hold your finger on [1]. The monitor tone will increase in frequency.
3. Press [*] twice and hold [1]. The monitor tone will decrease in frequency.
4. Press the dot contact on your keyer paddle and adjust the SPEED knob to a comfortable sending speed. Send a series of letters with the paddle to "get a feel" for the perfect code the MM-3 produces.
5. Press [*][2][0][5] and send more Morse characters. Note that the length of the dots has shortened by one-half.
6. Press [*][*][2][4][0] and send more Morse characters. Note that the length of the dashes has increased by four-thirds.
7. Press [*][C][0]. The monitor tone will return to 500 Hz and the dot and dash ratios will return to perfect 1:1 and 3:1 respectively.
8. Press [*][A][6] and note that the keyer speed is now 20 WPM; independent of the setting of the SPEED knob. Press [*][6][0][2] and note that the speed has slowed to 2 WPM.
9. Press the dot paddle and very quickly (before the dot has finished sending) press the dash paddle and then let up quickly. After the dot has finished and a proper intracharacter space is inserted, a dash will automatically be sent. This is called Dash Memory.
10. Similar to step 9, press the dash paddle quickly and then press the dot paddle momentarily. After the dash has finished and a proper intracharacter space is automatically inserted, the keyer will send a dot automatically. This is called Dot Memory.
11. Press [*][B][3] and repeat step 10. Note that the Dot Memory is no longer present.
12. Press [*][B][4] and repeat step 9. Note that the Dash Memory is no longer present.
13. Press [*][A][3] and then [*][A][4]. Note that both Dot and Dash Memories are re-enabled.
14. Enter [*][A][6] and a two-digit number corresponding to a sending speed you feel comfortable with (if less than 10 WPM, use [0] as the first digit). Practice sending at that speed for about a minute. Because The Morse Machine has almost perfect dot and dash ratios and spacing, many operators feel the speed calibration is low. However, the MM-3 is calibrated using the FCC definition of "PARIS" as the standard word (see APPENDIX C). You might also note that many code practice tapes are actually faster than the advertised speed. Press [*][8][6] to return the sending speed to the control of the SPEED knob.
15. Press [*][B][5] and note that the tone stays on as long as you hold the dash paddle, but dots are formed normally while you hold the dot paddle. This is called the semi-automatic or "Bug" mode. Press [*][A][5] and the keyer will return to fully automatic or "iambic" operation.
16. Press [*][*][7]. The MM-3 will key continuously until you press any keypad button or touch either paddle. This is the Transmitter Tune feature. The tune feature operates only in the KEYER mode.

MEMORY LOAD MODE

1. Press [*][4] to go to the MEMORY LOAD mode. All of the steps you went through in the KEYER mode could be repeated in MEMORY LOAD mode (except for the Transmitter Tune, which isn't necessary).
2. Press [1] and send a short message with the paddle, one word at time. Upon completion of the message, press the [#] button to terminate message loading.
3. Press [*][3] to return to the KEYER mode and press [1]. Immediately, the message you recorded will be sent. You may change the sending speed if you like and send the message again by pressing [1].
4. Press [1] and play back the message again. Between words in the message playback, press the dot paddle and hold momentarily. The message will halt without inserting an extra dot. Now you may send anything with the paddle. By pressing [0], the message will resume sending from where you interrupted the message. This is a very useful feature for inserting a signal report, for example, in the middle of a message.
5. Press [*][4] to go to the MEMORY LOAD mode and then press [*][A][8][3]. Now send a message with the paddle, one word at a time. End the message by pressing [#].
6. Press [*][3] to return to the KEYER mode and press [3]. Immediately, the message will start playing back with the same pauses that were present between words during the loading operation. This is called the Real Time Space Loading Mode. The other (Auto-Word Space) loading mode will insert a maximum of one word space between characters. Real Time spacing uses more memory to store the extra spaces.
7. Press [*][4] to go to the MEMORY LOAD mode and press [*][B][8] (Auto-Word Space). Now press [4] and send "NR" with the paddle and press [*][0], which inserts the Serial Number Generator at this point in the message. Now send "K" with the paddle and end the message by pressing [#] on the keypad.
8. Press [*][3] to return to the KEYER and press [4]. The keyer should play back: "NR 1 K". Press [4] again and the keyer should play back "NR 2 K". Now press [*][0] and then [4]. The keyer should now play back "NR 2 K" again (it repeated the same serial number). Now press [*][*][0][1][6][1][#] and then press [4] again. Now the message should read "NR 161 K".
9. Press [4] again and press the dot paddle between "162" and "K" to halt the message (right after the serial number).
10. Press [*][4] to go to the MEMORY LOAD mode and press [0] (EDIT). Now, with the paddle, send "DE K1XX K". Press [#] to end the message loading.
11. Press [*][3] to return to the KEYER mode and press [4]. The message should now read "NR 162 DE K1XX K" You have just edited your old message.

BEACON MODE

1. Press [*][4] to go to the MEMORY LOAD mode and press [1][#]. (This erases the old message stored in location 1.) Press [1] again and send a message into memory for about 15 seconds. End the message by pressing [#].
2. Press [*][8] to go to the BEACON mode. Press [*][7][3][0][#]. Now wait until the sweep second-hand on your watch comes to the top of a minute. At that precise time, press [1]. The message should play back for 15 seconds at the speed you loaded in. Note that the BEACON light is blinking on and off. There should be a 15-second pause and then the message will be automatically replayed. A half-second before the message is replayed, the TRANSMIT light will come on and after the message ends it will go out.
3. Halt the sequence by pressing the [#] button on the keypad or by pressing, either paddle. Increase the sending speed by turning the SPEED knob to the right. Now press [1] and note that the message is sent faster and therefore ends sooner, but the silence between messages is longer. If you time the start of each transmission you will see that the message still repeats every 30 seconds.

TRAINER MODE

1. Press [*][5] to go to the TRAINER mode. Press [*][6][0][5] and [*][*][6][2][0] for a starting speed of 5 WPM and an ending speed of 20 WPM. Press [*][7][0][5][0][#] for a practice duration of 5 minutes.
2. Press [D] and the keyer should start sending code at a 15 WPM character speed with space between characters such that the beginning word speed is only 5 WPM. The space between characters will shorten gradually until the spacing is proper for 15 WPM. Then both the character speed and character spacing will increase in proper proportion until the ending speed of 20 WPM is reached. The TRAINER will continue to send until you halt it by pressing the [#] button.
3. Press [*][C][3] and then [D]. The Trainer should repeat sending as in step 2 except that difficult characters will be included. Press [#] to stop.
4. Press [*][C][2] and [*][B][9]. Now press [D] and notice that the difficult characters have disappeared, but that the Trainer is sending random word lengths and not continuous five-letter groups. Press [#] to stop.
5. Press [*][C][1]. Pressing [D] will now start code practice in four-letter words. Press [#] to stop.
6. Press [*][B][0]. Pressing [D] will now start slow code. The slow characters will gradually speed up to 20 WPM.
7. See Appendix A for the different character sets.

ASCII/MORSE CONVERTER MODE

1. Connect a computer's serial port to the keyer. Use the DB-25 (or appropriate connector for your computer) to phono adapter as shown in the Hook-Up Instructions (page 5).
2. Set up your computer's terminal communications program for 1200 baud / eight bits / no parity.
3. Press [*][9] to go to the ASCII/MORSE CONVERTER mode.
4. On the computer keyboard, type A B C +. The keyer should sound only the letters "ABC".
5. On the MM-3 keypad, press [*][8][C][3].
6. On the computer keyboard, type A B C + again. This time the keyer should sound the letters "ABC" followed by AR. Using the paddle, send some Morse characters and notice that the computer prints them out on the screen.
7. Set up the terminal program for 300 baud / eight bits / no parity. On the keyer keypad, press [*][C][9][3] and repeat step six to verify that communication still takes place between the keyer and the computer. See chapter 10 for more info.

This concludes the quick reference guide of your Morse Machine. If all these features operate properly, your MM-3 is in good operational condition. If not, please re-read the instructions and if necessary, start over from the beginning. If you are still having problems, see Appendix H regarding technical support. For detailed operating instructions, see the appropriate chapter.

CONTROL FUNCTIONS

1. KEYER MODE INDICATOR
   Light indicates if KEYER mode is activated.

2. MEMORY LOAD MODE INDICATOR
   Light indicates if MEMORY LOAD mode is activated.

3. TRAINER MODE INDICATOR
   Light indicates if TRAINER mode is activated.

4. BEACON INDICATOR
   Light indicates if BEACON mode is activated.

5. POWER ON/OFF AND VOLUME CONTROL
   Turns power on/off and adjusts volume.

6. SPEED CONTROL
   Adjusts Morse speed.

7. KEYPAD
   Enables the various functions of the unit.

   Refer to APPENDIX G for information on the various commands for each mode.

KEYER/MEMORY SEND OPERATION

Speed Set

[*][A][6]	Keypad controls speed
[*][B][6]	SPEED knob controls speed
[*][6][n][n]	Set sending speed of keypad control (n = number 0 through 9)
[*][C][8][6][n][n][n]	Set sending speed of keypad control
[*][C][8][1][n][n]	Set counter-clockwise (lower) SPEED knob limit
[*][C][8][2][n][n]	Set clockwise (upper) SPEED knob limit

When you first turn on or reset your MM-3, it is in the KEYER mode. The SPEED knob controls the sending speed and the sidetone is set at a tone of 500 Hz. To change the speed, rotate the SPEED knob.

For exact speeds in words per minute (WPM), press [*][A][6] to transfer speed control to the keypad. To change the speed, press [*][6] and enter the new speed as two digits, for example 1 and 5. If the new speed is less than 10 WPM, the first digit must be zero. The range of speed is from 2–99 WPM.

Example: To enter 40 WPM, press [*][6][4][0].
To enter 7 WPM, press [*][6][0][7].

Meteor-scatter users may want code faster than 99 WPM. The [*][C][8][6] command is similar to the [*][6] command, except that three digits of speed are permitted, for a range of 2–255 WPM.

To return control of the keyer speed to the SPEED knob, press [B][6].

The SPEED knob normally has a range of 5 to 45 WPM, with 5 WPM in the completely counter-clockwise position and 45 WPM in the completely clockwise position. To change the SPEED knob range, use the [*][C][8][1] and [*][C][8][2] commands.

Example: To set the SPEED knob range to 7–50 WPM, press [*][C][8][1][0][7] and
[*][C][8][2][5][0].

SIDE TONE CHANGE

[*][1]	Tone pitch higher
[*][*][1]	Tone pitch lower
[*][A][1]	CW sidetone on
[*][B][1]	CW sidetone off
[*][A][2]	Keypad tone on
[*][B][2]	Keypad tone off

To raise the sidetone pitch, press [*] and hold the [1] key until the desired tone is reached. The tone may be lowered by pressing [*] twice and holding the [1] key, that is [*][*][1]. The keypad tone will be slightly lower than the CW monitor tone.

AUTOMATIC AND SEMI-AUTOMATIC OPERATION

[*][A][5]	Automatic (Iambic) mode
[*][B][5]	Semi-automatic (Bug) mode
[*][C][5]	Straight key mode
[*][C][7][1][3]	Dot/Dash squeeze generates alternating dots and dashes (default)
[*][C][7][1][4]	Dot/Dash squeeze generates all dots or all dashes

Once the MM-3 is turned on, it is set to Automatic Keyer operation.

You may operate the keyer in the Semi-automatic mode by pressing [*][B][5]. The keyer now behaves as a "bug". For character recognition in the MEMORY LOAD, MORSE TERMINAL and SIMULATOR modes, the keyer recognizes only dashes from the dash paddle, no matter how quickly you tap the paddle. Be sure to use both the dot and dash paddles in the Semi-automatic mode. To return to full Automatic mode, press [*][A][5]. When loading memories or using the QSO Simulator, you must use the dot paddle to form dots and the dash paddle to form dashes.

For Straight Key mode, press [*][C][5]. Now dots and dashes are formed only on the dash paddle, and the dot paddle has no effect. You may connect a straight key in place of the keyer paddle. In the Straight Key mode, you may load message memories in the MEMORY LOAD mode, send ASCII over the serial port in the MORSE TERMINAL mode, and converse in the QSO SIMULATOR modes.

The [*][C][7][1][4] command is for those unaccustomed to the iambic feature of modern keyers. If both the dot and dash paddles are closed, the keyer generates a string of all dots or all dashes, depending on which contact was closed first. Dot and dash memories are disabled.

DOT-DASH RATIO

[*][2][n][n]	Set dot ratio
[*][*][2][n][n]	Set dash ratio

"Perfect" Morse code is sent with the time for a dot equal to the time for a space between dots (a dot/space ratio of 1.0) and the time for a dash equal to three space times (a dash/space ratio of 3.0).

The dot/space ratio is adjustable from 0.5 to 1.5 in 0.1 increments, and is set to 1.0 when the MM-3 is turned on. To adjust the dot/space ratio, press [*][2] and enter the dot ratio in tenths.

Example: To set a dot ratio of 0.7, press [*][2][0][7].
To set a dot ratio of 1.3, press [*][2][1][3].

If the dot/space ratio is more than 1.5 or less than 0.5, the keyer will ignore the command.

The dash/space ratio is set to 3.0 when the MM-3 is turned on and is adjustable from 2.0 to 4.0 in 0.1 increments. To change the dash ratio, enter [*][*][2] and the new dash ratio.

Example: To set a dash ratio of 3.5, press [*][*][2][3][5].

If the dash/space ratio is more than 4.0 or less than 2.0. the keyer will ignore the command.

The code speed is automatically adjusted for other than "perfect" dot and dash ratios and is based on the standard word "PARIS".

DOT AND DASH MEMORY

[*][A][3]	Dot memory on
[*][B][3]	Dot memory off
[*][A][4]	Dash memory on
[*][B][4]	Dash memory off

The selectable Dot and Dash Memories are active (on) when the MM-3 is powered up. The Dot Memory allows insertion of a dot during a string of dashes. For example the letter "Q" could be sent as follows:
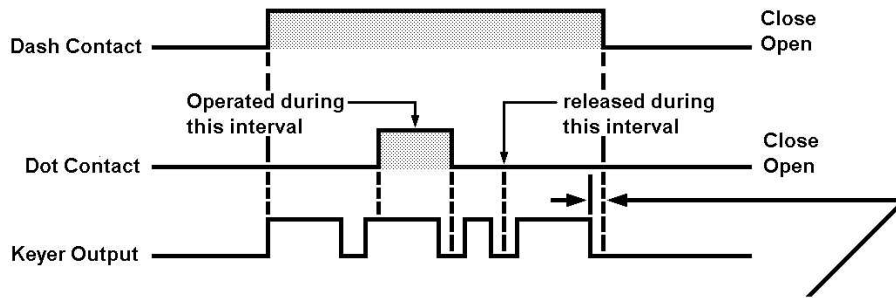
Dot contact made after dash has started but before space time has expired, will give proper dot. Dot contact does not have to be proper duration.

Less than one space time, otherwise another dash will occur.

The Dash Memory works the same way, allowing the insertion of a dash in a string of dots.

TRANSMITTER TUNING

To allow transmitter tuning, the keyer output transistors are activated by pressing [*][*][7]. You can turn off the tuning by pressing any keypad button or touching either key paddle. The tune feature works only in the KEYER mode.

CURTIS KEYING

[*][C][7][3][8]   Curtis type A keying
[*][C][7][3][9]   Curtis type B keying

The default is [*][C][7][3][9] (Curtis B). In type B keying, when both paddles are squeezed and released during an element, the iambic feature adds the opposite element afterwards. In type A keying, the element ends and is not followed by another.

TOGGLE TRANSMIT

[*][*][8]

The transmitter keying outputs are normally enabled in the KEYER mode. To disable the outputs, press [*][*][8] to toggle transmitting off. See also Chapter 11, TRANSMIT CONTROL.

CLEARING ENTRIES

[#]

If you make a mistake programming and the command was not finished, you can clear it by pressing [#]. If you completed the command, repeat with the correct programming.

UNACCEPTABLE ENTRIES

The keyer ignores unacceptable entries and sounds an error tone. For example, if a speed change is entered [*][6][0][1], the result will be no speed change.

TRANSMIT DELAY

[*][C][8][0][n][n]

There is normally a 20 msec. delay between the activation of the PTT output and the activation of the CW keying outputs. The delay gives linear amplifiers time to switch to transmit before the output is keyed. nn is in units of 10 msec. The delay can therefore range from 0 to 990 msec (.99

seconds). The default setting is [*][C][8][0][0][2] (20 msec.). If the PTT output is not used, you should set the command to [*][C][8][0][0][0] (no delay).

AUTOMATIC CHARACTER SPACING

[*][C][7][1][7]   Enable auto character spacing after 1 dot interval
[*][C][7][1][8]   Enable auto character spacing after 2 dot intervals
[*][C][7][1][9]   Disable auto character spacing from paddle

The space between Morse characters is defined to be 3 dot intervals long. If auto character spacing is enabled, there is a dead time after the completion of the last code element until the scheduled beginning of the next character. During this dead time, the keyer paddle is "dead", and no dots or dashes can begin until exactly 3 silent dot-intervals have passed. This ensures a full character-space between characters. Dot and dash memories are active during the dead time.

In the [*][C][7][1][7] command, the dead time starts after 1 silent dot interval and has a duration of 2 dot intervals, for tighter control of character spacing. In the [*][C][7][1][8] command, the dead time starts after 2 silent dot intervals and lasts for 1 dot interval, for looser control of character spacing.

The default is [*][C][7][1][9] (no auto character spacing).

KEYER MEMORY PROGRAMMING

[*][4]

MEMORY LOCATIONS

The Morse Machine has 20 separate memory locations (0 through 9 in Memory Banks A and B) that may be loaded with any length message up to approximately 8,400 characters (36,500 characters if a 32 k RAM is used), assuming a standard word of "PARIS". If you load longer characters such as "5" repeatedly, you cannot load as many. One memory location can store 8,400 characters or they may be allocated as desired. For instance, one location can store 400 characters, another 6,000 and another 2,000, etc. You can expand the memory by substituting a static 32 k CMOS RAM device for the 8 k RAM that comes with the keyer, as described on page 4.

[A]   Select Memory Bank A
[B]   Select Memory Bank B

Select one of the two banks of 10 message memories by pressing [A] or [B]. Note that at all times either the BANK A light or the BANK B light is lit to show which memory bank the keyer is using. Any time you wish to select a message from a particular bank, you may press [A] or [B] before the memory number.

Example: Press [A][1] to select message 1 In Bank A.
           Press [B][7] to select message 7 In Bank B.

You may press A to make sure you are in Bank A, even if the keyer is already using Bank A.

AUTO WORD SPACING

[*][A][8]   Real-time spacing
[*][B][8]   Auto-word spacing

Two memory-loading options are available: Real-Time spacing and Auto-Word spacing. In both load modes, memory loading does not begin until the first character is loaded (that is, there will be no pause when starting the Memory Send in the KEYER/MEMORY SEND mode).

In Auto-Word spacing, a pause in loading that lasts longer than two dot times records a character space. If the pause is longer than five dot times, the keyer records a word space. In this mode you may make long pauses between words while storing at most one word space. The Morse Machine is set to Auto-Word spacing at turn-on or reset.

REAL TIME SPACING

[*][A][8]

To select Real-Time spacing, press [*][A][8]. In Real Time spacing, the keyer records all pauses in sending as you send them. To re-select Auto-Word spacing, press [*][B][8]. Real Time spacing uses more memory to store extra spaces.

MESSAGE ENTRY

To enter a message into the memory, press the number of the desired storage location, key in the message with the paddle and end the message with the [#] key. If you are loading more than 10 messages, specify which memory bank by pressing either [A] or [B] before the message number.

Example: To store a message In memory A5, press [5] or [A][5].
           Now enter the message with the keyer paddle.
           After you finish sending the message, press [#].

At the beginning and at the end of message entry, the MEMORY LOAD light will go out momentarily while the keyer changes the message buffer partition.

For instructions on automatic message entry from a computer, see SERIAL PORT OPERATION, Keyer Commands from the Computer.

SERIAL NUMBER USE

[*][0]   Insert serial number

You can insert an automatically incremented serial number (1 to 9,999) anywhere in any of the 20 messages. You can insert the serial number as many times within a message as you wish (the serial number automatically increases by one only after a message is completed).

To insert the Automatic Serial Number Generator during the loading of a message, stop sending, press [*][0], and resume sending.

[*][*][0][n][n][n][n][#]   Serial number set

On turn-on, the serial number is set to 1. A different starting serial number may be set by pressing [*][*][0][n][n][n][n][#]. Do not change the number during message loading.

Example: To start at serial number 1, press [*][*][0][1][#].
           To start at serial number 57, press [*][*][0][5][7][#].
           To start at serial number 4234, press [*][*][0][4][2][3][4][#].

SPEED-UP PART OF A MESSAGE

[*][*][3]   Insert speed change

When played back, a message starts out at the selected keyer code speed. You can speed up parts of the message by 41 % by inserting [*][*][3] before the part you want sent faster. Subsequent use of [*][*][3] in the message will alternate between fast and normal code speed. Contest operators may wish to use this feature to speed up parts of messages such as CQs and signal reports.

Example: On keypad, press [1]
           On paddle send "NR"
           On keypad, press [*][0] and [*][*][3]
           On paddle send "EPA"
           On keypad, press [#]

Message 1 now contains "NR nn EPA" as a contest exchange, with "NR nn" at normal speed and "EPA" at 41 % faster speed.

Example: On keypad, press [1] and [*][*][3]
           On paddle, send "CQ TEST DE"
           On keypad, press [*][*][3]
           On paddle, send "N7ML"
           On keypad press [#]

Message 1 now contains "CQ TEST DE N7ML" with "CQ TEST DE" at fast speed and "N7ML" at normal speed.

Fast speed is always 41 % faster than normal speed, even if the SPEED knob is adjusted or if the code speed is changed from the keypad.

INSERT ONE MESSAGE INTO ANOTHER

[*][*][9][n]   (n = message number 0 through 9)

The contents of one message may be inserted into another message. The two messages must be in the same message memory bank (A or B).

Example: Message 8 contains "DE N7ML"
On keypad, press [1]
On paddle, send "CQ TEST"
On keypad, press [*][*][9][8]
On paddle, send "K"
On keypad, press [#]

Now message 1 will play back "CQ TEST DE N7ML K". This feature works only one level deep; that is, the inserted message must not itself contain [*][*][9][n].

MEMORY FULL

The memory is almost full when the sidetone pitch suddenly becomes lower and the MEM LOAD light starts blinking. When this happens, the keyer has room for only about 20 more characters. When the sidetone shuts off, the memory can no longer accept characters, and there is room only for the [#] at the end of the message. If you need to load further to complete the current message, you must erase or shorten one of the other messages (use the Edit command to reduce a previous message and then continue the current message).

ERASING

If the on-board lithium back-up battery is good, turning The Morse Machine VOLUME knob to the OFF position will not erase the memory. With the standard RAM chip installed, the lithium battery should last three to five years.

If an individual message is to be erased, go to MEMORY LOAD mode and simply press the message number [n] and [#]. The entire message in that location will be erased.

Example: To erase messages 3 and 7 in the current memory bank, press [3][#] and
[7][#] or [7][#] and [3][#].

If you wish to enter very long messages, you should erase unused or undesired messages. The sidetone pitch will suddenly drop in pitch to signal that the memory is almost full.

EDITING

[D] *Edit* [#]

If in the KEYER mode you halt a message before it is completed, you can terminate or change the remainder at that point. Switch to the MEMORY LOAD mode by pressing [*][4]. To change the remainder of the message, press [D], enter the new part of the message normally, and finish with [#]. If you want to erase the remainder of the message, press [D][#].

SEMI-AUTOMATIC (BUG) MEMORY LOAD

[*][B][5]

You may enter a message in the Semi-automatic (Bug) mode ([*][B][5]). In the KEYER mode, the message will be sent with the selected dot and dash ratio. Some paddles require a 1 µF capacitor across the dash contacts to prevent loading multiple dashes due to contact bounce.

STRAIGHT KEY MEMORY LOAD

[*][C][5]

You may also enter a message in the Straight Key mode ([*][C][5]). In the KEYER mode, The message will be sent with the selected dot and dash ratio. Some straight keys require a 1 µF capacitor across the contacts to prevent multiple dot loading due to contact bounce.

TOGGLE TRANSMIT

[*][*][8]

The transmitter keying outputs are normally disabled in MEMORY LOAD mode. To enable the outputs, press [*][*][8] to toggle transmitting on.

BATTERY LIFE

The internal lithium battery should last three to five years with the standard CMOS RAM installed. Expanding the memory with to 32 k may reduce the battery life somewhat.

MEMORY SEND OPERATION

[*][3]

The messages stored in any of the 20 memory locations may be sent at any speed between 2 and 255 WPM, regardless of their loading speed.

SENDING A MESSAGE

Number of message

To start a message, press the number of the desired message. If the light for Bank A is lit and the message is in Bank B, be sure to press [B] before the number.

Example: To send message 6 in the current bank, press [6].
To send Bank A's message 3, press [A][3].

REMOTE SENDING

Memory locations 1 through 4 may be remotely activated. The Remote Memory jack J5 contains the four message lines plus a common. For fast access to messages 1–4 in a contest, you can mount four push-buttons on your keyer paddle and wire them to J5 as shown below.
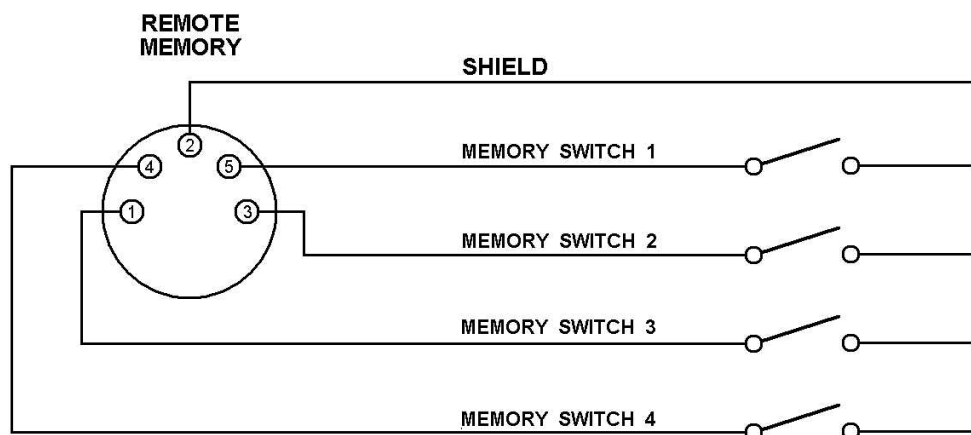
INTERRUPTING AND RESTATING A MESSAGE

[#] or key paddle

You may interrupt a message by either pressing the [#] button or tapping either of the key paddles. The Morse Machine then enters normal keyer operation. You may either restart the message by pressing the message number or resume the message from the point of interruption by pressing [D].

SENDING THE NEXT MESSAGE

[D]

Once a message is finished, pressing [D] will start the next message in the series 0 to 9. Pressing [D] after message 0 ends will start message 1. Pressing [D] after message A9 ends will start message B0 without changing the current memory bank from A to B. Pressing [D] after message B9 ends will sound the error tone.

EDITING

See MEMORY SEND PROGRAMMING, Editing.

SERIAL NUMBER CHANGE OR REPEAT

You may enter one serial number in a message as many times as you wish. Serial numbers automatically increase by one only after a message has been completed.

[C]   Repeat last serial number

It is common in contests for a station to ask for a repeat of the serial number only. Pressing [C] causes the keyer to send only the serial number last sent without automatically incrementing it.

[*][*][0][n][n][n][n][#]   Serial number set

In the KEYER mode, you may enter a new serial number. For example: To reset the serial number to 285, press [*][*][0][2][8][5][#]. Note that leading zeros are not necessary.

[*][0]   Retain last serial number

If you sent a message with a serial number and the contact was not completed, press [*][0] before making your next contact and the previously sent serial number will be used again for the new contact.

MESSAGE 1 REPEAT

[*][7][n][n][n][#]

Contest operators may wish to have one of the message memories, such as a CQ message, repeat at regular intervals automatically. Message 1 in the current memory bank (A or B) can be set up to do this. The range of the Message 1 Repeat Interval is from zero seconds to 999 seconds in one second increments. The time entry must be terminated with the [#] key. An interval of zero seconds disables the repeat feature so that Message 1 is sent only once every time you press 1. At turn-on or reset, the feature is disabled (interval = 0).

Example: To make Message 1 repeat after pausing for 15 seconds,
               press [*][7][1][5][#] and then press [1].

Example: To return Message 1 to normal, non-repeating operation,
               press [*][7][0][#].

The BEACON light flashes on and off while the repeat feature is cycling. If you press the [#], [0]...[9], [C] or [D] buttons or tap either of the key paddles while the repeat feature is cycling, Message 1 will not repeat until you press 1 again.

Note: The keyer must be in the KEYER mode ([*][3]) or Contest Simulator mode ([*][*][4]) for the [*][7] command to have this effect. The [*][7] command has other functions in other keyer operating modes.

There is a difference in the repeat operation between the KEYER and BEACON modes. In KEYER only Message 1 repeats. Pressing any other message number key causes Message 1 to stop repeating and the new message to be sent only once. In BEACON, the last memory number pressed is the one that repeats. The TRANSMIT light and transmitter send-receive output are activated a half-second before the message repeats.

LITERAL OR CUT SERIAL NUMBERS

[*][A][7]	Serial number as is
[*][B][7]	Serial number 9 = N, 0 = T
[*][C][7][2][1]	0 in a serial number is sent as a numeral 0 (default)
[*][C][7][2][2][2]	0 in a serial number is sent as letter T
[*][C][7][2][3]	0 in a serial number is sent as letter 0
[*][C][7][2][4]	1 in a serial number is sent as numeral 1 (default)
[*][C][7][2][5]	1 in a serial number is sent as letter A
[*][C][7][2][6]	9 in a serial number is sent as numeral 9 (default)
[*][C][7][2][7]	9 in a serial number is sent as letter N

To save sending time in a contest, some operators prefer to shorten Morse 9 to N and Morse 0 to T. Pressing [*][B][7] causes the keyer to send the serial number this way automatically. Press [*][A][7] to return to literal serial numbers.

These are for customizing the serial number. Many contesters are particular about this. Note that the commands [*][A][7] and [*][B][7] can be implemented with other commands.

[*][A][7] does the same thing as [*][C][7][2][1] and [*][C][7][2][6]
[*][B][7] does the same thing as [*][C][7][2][2] and [*][C][7][2][7]

LEADING 0's IN SERIAL NUMBERS

[*][C][7][0][1]	Serial number contains no leading zeros (default)
[*][C][7][0][2]	Serial number minimum 2 digits, 0 fill
[*][C][7][0][3]	Serial number minimum 3 digits, 0 fill
[*][C][7][0][4]	Serial number always 4 digits, 0 fill

This is for those operators who like leading zeros on low serial numbers. Example: For leading zeros on serial numbers below 100. select [*][C][7][0][3]; this will send 001–099, 100–999 and 1000–9999.

FARNSWORTH CODE FROM MESSAGE BUFFERS

[*][C][7][3][1]	Message buffers send Farnsworth code
[*][C][7][3][2]	Message buffers send slow code
[*][6][n][n]	Set sending speed if keypad control
[*][C][6][n][n]	Farnsworth character speed
[*][A][0]	Farnsworth code
[*][B][0]	Slow code

(See TRAINER OPERATION, Fast (Farnsworth) or Slow code mode.)

Press [*][C][7][3][1] to send code practice from the message buffers using the Farnsworth method. The overall code speed is set by [*][6][n][n], and the character speed is set by [*][C][6][n][n]. The keyer must be set to Farnsworth code ([*][A][0], not [*][B][0]) and keypad control of speed ([*][A][6] not [*][B][6]). Hand-sent code on the paddle will be at the Farnsworth speed ([*][C][6][n][n]), not the keypad set speed ([*][6][n][n]).

Note that the keyer must not be in TRAINER mode when setting the overall code speed ([*][6][n][n]).

The default is [*][C][7][3][2] (no Farnsworth from message buffers).

Example: Issue these commands to set up a message at 5 WPM with a Farnsworth character speed of 18 WPM:

1. [*][4]   MEMORY LOAD mode
2. [*][B][8]   Auto-Word spacing
3. [1] *text* [#]   Load Message 1 text
4. [*][3]   KEYER mode
5. [*][A][0]   Farnsworth code
6. [*][C][6][1][8] Farnsworth speed = 18 WPM
7. [*][6][0][5]   Code speed = 5 WPM
8. [*][A][6]   Keypad control of speed
9. [*][C][7][3][1] Message buffers send Farnsworth
10. [1]   Start message 1

BEACON OPERATION

[*][8]

In certain areas of communications such as moonbounce, tropospheric and meteor scatter, it is desirable to transmit a message during a fixed time interval and then receive for another fixed time interval. The Morse Machine does this by sending any of the 20 memory messages at repeating intervals.

BEACON INTERVAL

[*][7][n][n][n][#]

The Beacon Interval is the time from the start of one beacon message to the start of the next one. The range of the Beacon Interval is from one second to 999 seconds in one-second increments. The time entry must be terminated with the [#] key.

> Example: Message 1 Is to be sent for 15 seconds, followed by 45 seconds of receive time. Press [*][4] to go to MEMORY LOAD mode, press [1], and send the text to load message 1, ending with [#]. Now press [*][8] to go to BEACON mode. Set the Beacon Interval to 60 seconds by pressing [*][7][6][0][#]. Now press [1] and adjust the sending speed until the message lasts for 15 seconds.

Note: The keyer must be in BEACON mode for the [*][7] command to have this effect. [*][7] has other functions in other keyer operating modes.

INITIATING BEACON MODE

Message number digit

To start the beacon, press the digit that stores the desired message. The BEACON light will blink on and off while the beacon is cycling.

INTERRUPTING BEACON MODE

[#] or keyer paddle

As in the KEYER mode, you may interrupt the Beacon by pressing the [#] button or touching either of the keyer paddles.

RESTARTING OR RESUMING BEACON MODE

Message number or [D]

As in the KEYER mode, you may restart the Beacon by pressing the number of the desired message. You may also resume the Beacon message by pressing [D].

TRANSMITTER SEND-RECEIVE OUTPUT

An accessory PTT output is available on The Morse Machine to operate a transmitter send-receive switch for a half-second before the Beacon starts sending until the Beacon message is completed. This output follows the XMIT light on the front panel. The first time the Beacon is sent, the accessory output is not operated. This allows a test of the message speed before operating the transmitter. You can disable this output by using the Toggle Transmit command ([*][*][8]).

TOGGLE TRANSMIT

[*][*][8]

The transmitter keying outputs are normally enabled in the BEACON mode. To disable the outputs, press [*][*][8] to toggle transmitting off.

TRAINER OPERATION

[*][5]

The TRAINER mode sends randomly selected Morse characters for a programmable duration. You may select increasing, decreasing or constant speeds. The random character sequences are programmed using a pseudo-random generator. Several modes of operation are possible.

[*][6][n][n]	Trainer starting speed
[*][*][6][n][n]	Trainer finishing speed
[*][C][6][n][n]	Farnsworth character speed

On turn-on, the Trainer is in the Farnsworth mode, the starting speed is 5 WPM, and the finishing speed is 15 WPM. The Farnsworth speed is 15 WPM, and the practice duration is 10 minutes.

FAST (FARNSWORTH) OR SLOW CODE MODE

[*][A][0]	Farnsworth code
[*][8][0]	Slow code
[*][C][6][n][n]	Farnsworth character speed

Many people find learning code takes far less time if the characters are sent at speeds greater than 12 to 15 WPM, but with the spaces between characters much longer than normal for these speeds. This is called the Fast Code or Farnsworth Method. In this mode, the characters are sent at the Farnsworth speed, but the space between letters is adjusted to make the code speed equal to the starting speed. The extra space is gradually shortened until the code is sent at the Farnsworth speed. From then on, the code is sent with no extra space, gradually increasing speed until the finishing speed is reached.

Slow Code sends code with the proper intracharacter spacing during the speed increase. Unless you can copy at speeds greater than 12 WPM, we strongly recommend use of the Fast Code method.

At turn-on, the Fast Code mode is selected. To select Slow Code, press [*][B][0}. Re-select Fast Code by pressing [*][A][0].

TRAINER STARTING SPEED

[*][6][n][n]

In the Farnsworth mode, the practice session begins with a word speed equal to the starting speed. If the Farnsworth speed is higher than the starting speed, the character speed is the Farnsworth speed. On turn-on, the word speed starts out at 5 WPM with a character speed of 15 WPM. To change the starting speed, press [*][6] and enter the two-digit speed desired.

<u>Example</u>:   For 7 WPM starting speed, press [*][6][0][7].

TRAINER FINISHING SPEED

[*][*][6][n][n]

In the Farnsworth mode, the practice session ends with a word speed equal to the finishing speed. If the Farnsworth speed is higher than the finishing speed, the character speed is the Farnsworth speed. On turn-on, the word speed ends up at 15 WPM with a character speed of 15 WPM. To change the finishing speed, press [*][*][6] and enter the two-digit speed desired.

<u>Example</u>:   For 20 WPM finishing speed, press [*][*][6][2][0].

The finishing speed may be higher than, lower than or equal to the starting speed.

TRAINER FARNSWORTH SPEED

[*][C][6][n][n]

Some instructors prefer a character speed of 18 WPM for slower word speeds. To change the Farnsworth speed, press [*][C][6] and enter the two-digit speed desired.

Example: For 18 WPM Farnsworth speed, press [*][C][6][1][8].

Thus, in our example of 7–20 WPM with 18 WPM Farnsworth, the code starts out at a word speed of 7 WPM and a character speed of 18 WPM. The word speed increases to 18 WPM while maintaining a character speed of 18 WPM. At this point the word speed and character speed stay the same as the speed increases to 20 WPM and then continues at 20 WPM.

TRAINER SPEED CHANGE INTERVAL

[*][7][n][n][n][#]   (n = number 0 through 9)

On turn-on, the Trainer practice session is set for 10 minutes. The duration is entered in tenths of minutes, with a range of 0.1 minute to 99.9 minutes.

Example: 15 min. 0 sec. Press [*][7][1][5][0][#].

At the end of the speed change interval, the Trainer will continue to send at the finishing speed.

Note: The keyer must be in TRAINER mode for the [*][7] command to have this effect. The [*][7] command has other functions in other keyer operating modes.

INITIATING TRAINER MODE

[0]...[9], [D]

After you have selected the various Trainer options, start the Trainer by pressing any of the keypad digits or the [D] button. Each digit will send its own unique character sequence. Your copy may be compared with the published Answer Booklet ($20.00 from AEA), or with the serial output on your computer screen if one is connected (see SERIAL PORT OPERATION). If you find that you are memorizing the character sets, press the [D] button for a random start.

TERMINATING TRAINER MODE

[#]

To stop the Trainer, press the [#] button or one of the keyer paddles.

FIVE-CHARACTER OR RANDOM CODE SPACING

[*][A][9]   Five-character groups
[*][B][9]   Random length groups

On turn-on, the Trainer is set to transmit five-character code groups. If you desire, select random spacing by pressing [*][B][9].

CHARACTER SET

[*][C][1]	Four-letter groups
[*][C][7][3][5]	Letters A-Z
[*][C][7][3][6]	Numbers 0-9
[*][C][7][3]]7]	Letters and numbers
[*][C][2]	Easy character set
[*][C][3]	Medium difficulty character set
[*][C][4]	Complete character set

On turn-on, the Trainer is set to send the Easy Character Set, which includes only those Morse characters that you need to know to pass a US amateur radio code test. The code tests of other countries may require only letters and numbers ([*][C][7][3][7]). The advanced code student may select additional characters from the Medium Difficulty or Complete character sets. The Medium Difficulty set includes the Easy set plus all other punctuation and prosigns that might be encountered. The Complete set includes the Medium Difficulty set plus foreign Morse characters. Tables of character sets are listed in APPENDIX A.

The Morse Machine includes a four-letter word generator that you can use for code practice by pressing [*][C][1]. A pseudo-random generator is used to generate more than 5,200 four-letter words. Most of these are nonsense words, but all are pronounceable. The character set consists of all letters except Q, X, Y and Z. Start the Trainer by pressing any of the keypad digits or the [0] button. Each digit will send its own unique word sequence. Your copy may be compared with the published Answer Booklet, or with the serial output on your computer screen if one is connected (see SERIAL PORT OPERATION). If you find that you are memorizing the words, press the [0] button for a random start.

TOGGLE TRANSMIT

[*][*][8]

The transmitter keying outputs are normally disabled in the TRAINER mode. To enable the outputs, press [*][*][8] to toggle transmitting on SERIAL PORT OPERATION.

SERIAL PORT OPERATION

The Morse Machine's serial port can be connected directly to an RS-232 interface through the adapter described under Hook-Up Instructions on page 5. Although the keyer's SERIAL OUT port sources only +5 Volts and Ground, it uses the same circuit as a home computer serial port adapter and will work with many RS-232 computers as it is. The SERIAL IN port consists of a series resistor to the base of a transistor, so it will handle a range of voltage levels. No inverters are necessary on the serial port.

The keyer's serial port has many practical uses. It can be used to echo Trainer code practice text to the screen so you can check your copy. Everything you hear and send on the QSO Simulator also goes to the serial output and shows up on your computer screen. The Contest Simulator prints log entries or QSO text on the serial output. You can use the computer to type in the contents of message memories and then load them into the keyer via the SERIAL IN jack. In fact, you can use the computer to issue commands to the keyer to change modes, load memories, set up the Trainer, etc. Any command that you can enter via the keypad you can also enter via the computer.

CONNECTING TO A TERMINAL OR COMPUTER

[*][C][9][n]

Connect your DB-25 to a phono adapter as in the diagram under Hook-up Instructions. Set up your computer terminal program[1] (see next page) for 1200 baud / eight bits / no parity. The Morse Machine accepts serial input data of eight bits / no parity, or seven-bit data with any parity. The parity bit is stripped off internally before the data is used. The serial output data is always eight bits / no parity.

[*][C][9][n] **Set serial ASCII baud rate**

On turn-on, the keyer is set up for 1200 baud serial operation. If you wish to use a different serial baud rate, press [*][C][9][n], where [n] is a digit from the following list:

1 = 1200 baud	6 = 600 baud
2 = 2400 baud	7 = 7200 baud
3 = 300 baud	8 = 1800 baud
4 = 4800 baud	9 = 9600 baud
5 = 150 baud	(0 = 1200 baud)

Example: For 2400 baud operation, press [*][C][9][2].

CONNECTING TO A MODEM OR PACKET TNC (TERMINAL NODE CONTROLLER)

Connect the adapter as in the diagram under Hook-Up Instructions (page 5) except reverse the RCA-type phono plugs on the SERIAL IN and SERIAL OUT jacks. This will eliminate the need for a Null-Modem adapter cable.

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[1] A terminal program is referred to by many names: modem software, dumb terminal software and communications software to name a few. All of these programs are similar in nature, in that they allow you to communicate with a modem attached to your computer. The modem then communicates with your computer using a special language called ASCII (American Standard Code for Information Interchange). We have designed the MM-3 to communicate In ASCII, therefore the same software used for your modem is compatible with the MM-3. For the IBM-PC environment, programs include Pro-Comm, Cross Talk and 0 Modem. For the Apple, ASCII Express Pro, Modem Manager and Hayes SMARTCOMM are suitable. AEA's COM-PakRatt is designed for the Commodore 64 or 128. The Red-Ryder program is suitable for the Macintosh.

MORSE-TO-ASCII DATA TO THE COMPUTER

In all modes except MEMORY LOAD, the Morse code from the paddle is translated to ASCII and sent to the SERIAL OUT line.

KEYER COMMANDS FROM THE COMPUTER

In all operating modes except ASCII/MORSE CONVERTER, the ASCII that the computer sends to the keyer is interpreted as a command stream that controls the keyer the same way the keypad does. You can use this feature to change keyer operating modes, load message buffers, set various parameters and options, etc. For example, consider this ASCII data stream from a computer:

[*][4]	Puts keyer in MEMORY LOAD mode
[A][1]	Selects message memory 1 In Bank A
CQ TEST DE N6IA	Text for message 1
[#]	End of message 1
,,,	Delay (example)
[2]	Selects message memory 2 (Bank A)
NR [*][0] SCV K	Message 2 text, with serial number
[#]	End of message 2
[*][3]	Puts keyer In KEYER/MEMORY SEND mode
[*][*][0][1][#]	Set serial number to 1
[*][B][6]	Use the SPEED knob

The commands may be placed on separate lines, since Carriage Returns and Linefeeds have no effect as command keys, and are not translated to Morse as message text. Their only effect is delay. Similarly, commas have no effect as command keys, and may be used for delay between message loads to give the buffers time to realign their boundaries.

[*][9]

In most of the keyer operating modes, sending Morse code on the paddle produces ASCII output to a computer, and ASCII input characters from a computer are treated as commands to the keyer. In the ASCII/MORSE CONVERTER mode, Morse code sent on a paddle, bug or Straight Key is still converted to ASCII on the SERIAL OUT line as before, but ASCII on the SERIAL IN line is converted to audible Morse code. This mode turns the keyer into an inexpensive terminal that can be used as a data entry device for a computer, or a master terminal for a radio communications data controller or telephone modem.

MORSE SPEED

[*][6][n][n]

The Morse paddle speed is controlled by either the SPEED knob or the keypad, depending on whether [*][A][6] or [*][B][6] was pressed. The speed of the incoming ASCII-to-Morse is also controlled by either the SPEED knob or the keypad, depending on whether [*][C][7][1][5] or [*][C][7][1][6] was pressed. This way you may send and receive at different speeds if you wish.

USING THE KEYER AS AN I/O DEVICE

When keying in data to be sent to a computer, you can send a carriage return/linefeed code by sending · · – – on the paddle.

USING THE KEYER AS A MORSE TERMINAL

[*][9]

To converse with a TNC or modem, press [*][9] to set up the converter BEFORE turning on the TNC. Set [*][6][n][n] to a comfortable receiving speed.

Some TNCs use auto-baud routines to initialize their serial ports. AEA units such as the PK-232 and PK-88 operate in this manner. With the keyer character set at any level below Complete (use [*][C][1], [*][C][2] or [*][C][3]), send several – – – – characters (CH, or four dashes). The keyer translates each of these characters to an asterisk (*) for the auto-baud routine. Then send the · – · – character, which is the carriage return. You should then hear the TNC's sign-on message. The first command to give the TNC is "ECHO OFF".

DO NOT use the · · – – character (CRLF) to end a line; always use the · – · – <CR> character. The extra linefeed confuses the TNC.

Example: To use the AEA PK-88 to connect to N7BTI on packet radio, send

– · – ·	– ·	– – · · ·	– · · ·	–	· ·	· – · –
C	<SP>	N	7	B	T	I	<CR>

SERIAL CHARACTER SETS

You can filter out difficult ASCII-to-Morse characters from the serial port so that the keyer does not sound them out on the speaker. Use the Character Set commands (see APPENDIX B, Serial Port Character Sets). Carriage returns and linefeeds from the computer are never translated to audible Morse.

SENDING CONTROL CHARACTERS

To send ASCII Control characters, send **– · – · –** <CT> followed by the Morse letter A–Z. For example, to send an ASCII CTRL-C, send:

– · – · –   – · – ·
      CT   C

CORRECTING ERRORS

Send the Morse error character (eight dots) to correct any sending errors you make. The MM-3 will produce enough ASCII backspace characters to erase to the beginning of the last word you sent.

CHARACTER BUFFERS

In the CONVERTER mode, the keyer sets aside 256 bytes as an ASCII transmit buffer, and whatever else is unused by the message memories as an ASCII receive buffer. Thus it is possible to have almost 8 k characters of ASCII-to-Morse receive buffer. This is fortunate, as the Morse output is much slower than the ASCII input, and there will be quite an accumulation of data after a while.

CANCEL BUFFER CHARACTERS

A CRTL-X, or hex $18 character, sent from a terminal to the serial data input of the keyer, cancels any unsent Morse characters in the buffer. This character may be sent while the keyer is in ASCII CONVERTER mode, in either command or data mode.

FLOW CONTROL

The keyer uses software flow control (XON/XOFF) in both the send and receive directions to control the serial ASCII data.

COMMAND MODE

CTRL-C

In the ASCII/MORSE CONVERTER mode, the keyer normally treats incoming ASCII as text to be translated into audible Morse code. However, typing a CTRL-C from the computer keyboard will place the keyer into the same "command mode" as in all the other keyer operating modes (see SERIAL PORT OPERATION, Keyer Commands from the Computer, page 27). To return the ASCII stream to "data mode" type [*][C][7][0][9]. This command does not clear the ASCII buffers; the [*][9] command does clear the buffers as it re-initializes ASCII/Morse Converter mode.

TRANSMIT CONTROL

[*][*][8]	Toggle the enable for PTT and output keying
[*][C][7][0][5]	Enable PTT and keying for current mode
[*][C][7][0][6]	Disable PTT and keying for current mode
[*][C][7][0][7]	Turn on PTT
[*][C][7][0][8]	Turn off PTT
CTRL-D	(In CONVERTER data mode) Turn off PTT

Push-to-Talk and output keying are normally enabled in the ASCII CONVERTER mode. To change to the opposite enable state, use the [*][*][8] command. If the enable state is not known, use the [*][C][7][0][5] or [*][C][7][0][6] commands.

The user may turn on PTT from the serial port before starting to transmit Morse characters. The [*][C][7][0][7] command turns on PTT, which is then turned off automatically after 20 seconds of no activity. This type of PTT assertion stays activated between Morse characters.

If the last character the terminal sends to the keyer is a CTRL-D, the keyer sends Morse until it gets to the CTRL-D, when it turns off the PTT that the [*][C][7][0][7] command activated. After processing the CTRL-D, the keyer is still in data mode.

Instead of CTRL-D, the terminal may send
CTRL-C   [*][C][7][0][8]

to turn off PTT at the end of a string of data. PTT stays on until all data characters before the CTRL-C are transmitted.

MORSE SPEED FROM SERIAL DATA

[*][C][7][1][5]   Keypad controls speed of data from serial
[*][C][7][1][6]   SPEED knob controls speed of data from serial

The ASCII/MORSE CONVERTER mode converts serial data to audible Morse characters. Either the keypad or the SPEED knob can control the speed of the Morse characters.

SPACE CHARACTERS

[*][C][7][3][3]   Literal space characters from serial
[*][C][7][3][4]   Limited space characters from serial

A group of space characters sent on the serial port to the keyer normally results in only one Morse space being transmitted. To remove this limit, use the [*][C][7][3][3] command. The keyer will then send the same number of Morse spaces as the number of ASCII spaces it receives from the serial port. To reinstate the limit, press [*][C][7][3][4].

<u>EPROM VERSION</u>

[*][C][7][0][0]

The terminal can find out the MM-3's firmware version number by sending the [*][C][7][0][0] command. The keyer responds with two ASCII numerals on the serial port. The Fall 1990 release number is 12.

QSO SIMULATOR

[*][*][5]

The QSO Simulator is a Morse code training mode that lets you take part in everyday amateur radio conversations without actually being on the air. You need no antenna, no linear amplifier, no postage for QSL cards. You can learn CW operating skills at your own comfort level.

The QSO Simulator creates computer generated CW signals that call CQ, talk to each other, or talk to you. The keyer simulates the CW portion of an unspecified amateur band, at no particular time of day, season, or location. Good radio propagation across the United States is assumed. All call letters of the stations you hear are random United States call signs.

The typical conversation, or "ragchew", involves exchanging call letters, signal reports, station locations, operator names, transmitter types, antennas, and weather. If you miss a piece of information, you can ask for it to be repeated. If you make a mistake, the other station may ask you to repeat the information. You may even ask the other station to slow down (QRS) or speed up (QRQ) and he/she will.

The Morse Machine QSO Simulator is an excellent training aid for prospective hams, new operators and hams improving their CW speed. It enables you to send and receive before getting on the air. You can keep track of your progress by connecting the keyer's serial port to a computer and watching the text come out on the screen.

Important: End all your transmissions with either K, <KN> or <AR>. The QSO Simulator will answer after you send one of these and wait.

SETTING A CODE SPEED LIMIT

[*][D][6][n][n]

At turn-on, the highest code speed the simulator will produce is 24 WPM. Press [*][D][6][n][n] to establish the highest speed you can copy comfortably. The lowest speed is about two-thirds of the speed limit.

Example: To set a range of 12–18 WPM for the simulator, press [*][D][6][1][8].

STARTING THE QSO SIMULATOR

[*][*][5]

Press [*][*][5] to start the simulator. If you now call CQ (see Operating below), a simulated "station" may answer you. If you do nothing, within about 60 seconds you will hear a computer generated "station" calling CQ. If you do not answer, another "station" may answer and a conversation (QSO) between the two will start.

CHANGING SIMULATOR "CHANNELS"

[C] Change channel
[D] Start simulated CO

Press [C] to abandon the current conversation. This has the same effect as pressing [*][*][5] again to re-start the simulator. Press [D] to abandon the current conversation and bring up a simulated station calling CQ. This lets you answer another station's CQ if you do not want to call CQ yourself.

OPERATING

In amateur radio conversations (QSOs) on CW (Continuous Wave, or Morse code), the idea is to be as friendly and as clear as possible in the shortest amount of time. Hams use abbreviations as often as they can; as a result, a decoded QSO looks quite different from a written conversation. See APPENDICES D and E for some common CW abbreviations. Here is an example of a CW ragchew, or friendly conversation, and a translation into clear text:

CQ CQ CQ CQ CQ DE KB2NYA KB2NYA KB2NYA K	I'd like to talk to anyone who is around. My call sign is KB2NYA Go ahead.
KB2NYA DE KB2BOF KB2BOF AR	Calling KB2NYA. This is KB2BOF.
KB2BOF DE KB2NYA GE TNX FER CALL -- UR RST 57N 57N -- QTH IS OSSINING NY ? OSSINING NY ES NAME IS CURLY CURLY -- SO HW CPY? AR KB2BOF DE KB2NYA K	KB2BOF, this is KB2NYA. Good evening, thanks for the call. Your signal report is 579. My location is Ossining, New York, I repeat, Ossining, New York, and my name is Curly. So How are you receiving me? (End of message) KB2BOF, this is KB2NYA. Go ahead.
KB2NYA DE KB2BOF R GE CURLY -- UR RST IS 56N 56N HR IN BROOKLYN NY BROOKLYN NY -- NAME HR MOE MOE -- SO BK TO U CURLY AR KB2NYA DE KB2BOF K	KB2NYA, this is KB2BOF. Okay. received. Good evening, Curly. Your signal report is 569 here in Brooklyn, New York. The name here is Moe. So back to you, Curly. (End of message) KB2NYA, this is KB3BOF. Go ahead.
KB2BOF DE KB2NYA R FB MOE -- RIG HR IS HEATH DX60B RUNNING 6T WTS -- ANT IS DIPOLE -- RCVR IS SX 101 -- WX HR IS SUNNY ES TMP ABT 5T DEGR -- SO HW NW MOE? AR KB2BOF DE KB2NYA K	KB2BOF, this is KB2NYA. Okay, received. Fine, Mow. The transmitter here is a Heath DX-60B running 60 watts. The antenna is a dipole. The receiver is the SX-101. The weather here is sunny and the temperature is about 50 degrees. So how are you receiving me now, Moe? (End of message) KB2BOF, this is KB3NAY. Go ahead.
KB2BOF DE KB2NYA OK MOE FB -- WL QRM GETTING BAD HR SO BETTER QRT FER NW -- 73 ES CUL MOE <SK> KB2BOF DE KB2NYA	KB2BOF, this is KB2NYA. Okay, Moe, fine. Well, the interference is getting bad here so I'd better get off the air for now. Best regards and see you later, Moe. (End of contact) KB2BOF, this is KB2NYA. Go ahead.
KB2NYA DE KB2BOF R OK CURLY -- TNX FB QSO ES HPE CUAGN -- 73 CURLY KB2NYA DE KB2BOF	KB2NYA, this is KB2BOF. Okay, Curly. Thanks for the fine conversation and I hope to see you again. Best regards, Curly. (End of contact) KB2NYA, this is KB2BOF

Let's take this conversation apart.

A CQ (literally from "seek you") is a general call made by an operator who wants to have a contact with anybody who hears him/her. The most effective CQs are short CQs. The best is called the "five by three": five CQs followed by DE (from) and three transmissions of the call sign, and then K. If this does not bring a response, it is repeated until someone answers. DE is sent only once. At the end, K is sent, which is a general "go ahead" to anybody.

When you answer a CQ, or call another station, send the other operator's call sign first, then DE, and then your call sign. This sequence is required and cannot be reversed. The DE is optional, but it's almost indispensable as a separator between call signs. End with <AR> (end of message).

The double dash, which sounds like the letters <BT> sent as one character, is used to separate thoughts or sentences, much as the period is used in written text. You may hear stations in real life sending periods, but the standard practice is to use the double dash. It's shorter than the period, and you can send it repeatedly as you pause for words.

Signal reports on CW follow the RST format, which consists of three numbers: 1–5 for Readability, 1–9 for Strength, and 1–9 for Tone. A detailed break-down of each number's meaning can be found in several ARRL publications. The best report, 599, means that the station is perfectly readable, has an extremely strong signal, and has a perfect tone. The number "9" is frequently shortened to an "N" - reports of 5NN are commonplace.

Names and locations are frequently sent twice. Actual radio conditions are worse than what the keyer simulates, so if you repeat important information the other operator has a better chance of copying everything.

At the end of a transmission, send <AR>, his/her call sign DE your call sign, K. You could send <KN> instead of K, which would mean you don't want anybody to break in on your QSO, but many operators really wouldn't mind the unlikely event of a third party breaking in. If you use <KN>, remember to send it as one character, not the two separate characters K and N.

Some hams use "BK TO U" ("back to you") as a transitional phrase which implies the transmission will be ending shortly, so get ready to send. Critics of "BK TO U" prefer to use "SO HW?" or "HW NW?", meaning how are you copying (receiving) my signal, fully expecting a response like "UR SIGS FB".

When you send numbers, you can save some time by abbreviating 0's as T's. Exception: In call signs such as KAØXXX you must send the full 0.

On the last transmission from each side of a QSO, goodbyes are said and then the sign <SK> is sent instead of <AR>. This is the End of Contact signal, meaning the conversation is over.

So far ham conversations must seem a bit mechanical. In real life, some QSOs consist of exchanging names, locations, ham gear, weather, and nothing else, but many QSOs have more substance. For the first few exchanges, that stiff format is useful, but then comes the opportunity for transmissions to reflect the operator's personality, interests, feelings, and opinions. Pleasant ragchews come from the exchange of ideas. You might expand upon something the other operator has said, or ask questions to follow up on what he/she has said.

Listen to some QSOs for a while before transmitting. Notice the format of the conversations between stations. When you feel ready, answer a CQ. The simulator decides you are finished sending a transmission after you send either a K (go ahead), a <KN> (go only), or <AR> (end of transmission), and then pause for a certain length of time. If you pause too long after a K in the middle of your transmission, the other station might interrupt you. If you are getting interrupted too often, slow down your sending speed. Remember to send K, <KN> or <AR> at the end, because the other operator is waiting for it.

Now that you have become used to the ragchew format, change to a clear channel and try calling CQ yourself. If you don't get an answer, keep trying. Enjoy your QSO.

STOPPING THE SIMULATOR

[#]

To stop the simulator temporarily, press the [#] key. The Morse code stops while the keyer idles in QSO Simulator mode. Pressing [#] again makes the simulator resume. To use the MM-3 as an ordinary keyer, press [*][3].

TOGGLE TRANSMIT

[*][*][8]

The transmitter keying outputs are normally disabled in the QSO SIMULATOR mode. To enable the outputs, press [*][*][8] to toggle transmitting on.

DX Contest Simulator

The Contest Simulator is a Morse code training mode that brings you the excitement of the DX chase without actually being on the air. You can place yourself anywhere in the world, at any time of the day you wish, and experience shortwave amateur radio operating conditions as they would occur at that time and place. You need no antenna, no linear amplifier, no postage for QSL cards. You can improve your CW operating skills at your own comfort level.

Before starting the Contest Simulator, you go through a simple procedure of setting the keyer's internal clock for the simulated time of day at which you wish to start the contest. Once you are operating, you can change bands when you wish. If the simulator decides that the selected band is normally open for the current time of day, you will hear computer generated CW signals. The signals are working each other or calling CQ. Some are even talking with stations in your skip zone, which you cannot hear.

After you complete each contact, the simulator can print a log entry on the Serial Out port (see page 45, Serial Port Output). If you are using the keyer without a terminal or computer, you can get a Morse report of your score at any time with a keypad command.

The radio propagation programmed for each band represents what you would expect to hear on a good propagation day with an omni-directional antenna. The propagation follows the internal time of day that you set before the contest. For example, the 15- and 10-meter bands are wide open during local daylight hours and closed at night. 160 and 80 meters are open at night and closed during daytime hours. The simulated stations you hear (with proper prefixes) are at distances you would expect to hear under normal condition for the time of day and frequency band selected.

All call letters of the stations you hear are totally random (subject to the country's callsign assignment rules). The prefixes are weighted according to the population density, with the guarantee that for each of the 300 + countries, there is at least on station represented.

A typical two-way contest exchange involves call letters, signal reports and CQWW zones. If you miss a piece of information, you can ask for it to be repeated. If you make a mistake, the other station may ask you to repeat the information. You may even ask the other station to slow down (QRS) or speed up (QRQ).

CONTEST SIMULATOR COMMANDS

[*][D][1][a][n][n]   Latitude
[*][D][2][b][n][n][n]   Longitude
[*][D][3][n][n]   Hour (UTC)

These commands set the time and place for the contest. Each of these commands also sets your contest score to zero.

To enter your contest location, you need to know your latitude and longitude to the nearest whole degree. Set your latitude and longitude with the [*][D][1] and [*][D][2] commands. On the right edge of the keypad the keys from top to bottom are A, B, C and D. These keys have additional functions of North, East, West and South respectively, for setting the latitude and longitude.

The range of "nn" for latitude is 00 to 90. Longitude "nnn" ranges from 000 to 180. The default coordinates are for Washington, DC: 39 North by 77 West.

Example: To set coordinates of 48 degrees North by 122 degrees West (Seattle, WA), the commands are [*][D][1][A][4][8] and [*][D][2][C][1][2][2].
To set coordinates of 1 degree South by 37 degrees East (Nairobi, Kenya), the commands are [*][D][1][D][1] and [*][D][2][B][0][3][7].

Notes: 0 degrees latitude is either [*][D][1][A][0][0] or [*][D][1][D][0][0].
0 degrees longitude is either [*][D][2][B][0][0][0] or [*][D][2][C][0][0][0]
180 degrees longitude is either [*][D][2][B][1][8][0] or [*][D][2][C][1][8][0]

Set the starting time of the contest with the [*][D][3] command. "nn" is the hour in UTC, 00–23. As the contest progresses, the internal time of day advances in real time, causing simulated radio conditions to change. The time of day advances as long as the keyer is on, no matter what the keyer's operating mode. The time is saved when the keyer is off, and resumes where it left off when the keyer is turned on again. The default time of day is [*][D][3][0][0] (0000 UTC).

Start the Contest Simulator

[*][*][4]

Press [*][*][4] to start the contest. Listen to some QSOs for a while before transmitting. Notice the patterns in the contest exchanges you hear. The contest exchange is RST and CQWW zone, usually run together (e.g., 59903). Some of the numbers are abbreviated in the interest of faster exchanges:

    T = 0
    A = 1
    N = 9

There are two ways to go in a contest. In the Hunt and Pounce strategy you wait for station to call CQ and you answer them. In the Call CQ Forever technique you stake out a frequency (simulator "channel") and call CQ for hours, letting the stations come to you. Newcomers should listen to a CQer for a while and then call it.

You might not copy the complete callsign of a station that answers your CQ. This is not a problem; just send the station's suffix if you heard it, then the exchange (RST zone). Most of the time the station will come back to you. You must, however, acknowledge callers by sending at least part of their callsign, or they will not come back to you.

You don't need to send a complete CQ at the end of each contact. Try sending just "R TU TEST" or just "R TU" at the end of several contacts. You may or may not get an answer depending on which station is waiting to call you, so keep trying. If the "R TU" gets no answer, send a full CQ that includes your callsign.

As soon as the simulator knows your callsign, it can use the callsign and your geographical coordinates to determine your country. Your callsign must agree with those normally found at your latitude and longitude. If it doesn't, you will get no points for your QSOs until your callsign agrees with your location. If you are setting yourself up outside your native country, assume a local callsign, such as ZA2RPS for Albania.

The main idea behind the simulator's callsign detector is that every callsign has a number in it somewhere. If you make a mistake in sending your call and the number is faulty, the callsign will not be recognized and no QSO will result. You can reduce sending errors by sending CQs, exchanges and your callsign from message memories. See the "Keyer Memory Programming" section.

The contest simulator decides you are finished sending a transmission after you pause for a certain length of time (shorter than in the QSO simulator). If you pause too long between words, the other station might interrupt you. If you are getting interrupted too often, slow down your sending speed.

When you have completed a QSO successfully, the simulator awards you your QSO points and prints a log entry on the serial port, including your new score. If you have just worked a new country or zone on your present band, the log entry shows the new country or zone number for that band.

CHANGE SIMULATOR BAND

[*][D][4][n]   Change band

Change bands with the [*][D][4] command. "n" is a number from 0 to 5 which selects one of the shortwave amateur bands:

0 = 1.8 MHz	3 = 14 MHz
1 = 3.5 MHz	4 = 21 MHz
2 = 7 MHz	5 = 28 MHz

Changing bands does not reset your contest score. The default value is [*][D][4][3] (14 MHz).

CODE SPEED LIMIT

[*][D][6][n][n]

At turn-on, the highest code speed the simulator will produce is 24 WPM. Press [*][D][6][n][n] to establish the highest speed you can copy comfortably. The lowest speed is about two-thirds of the upper speed limit.

Example: To set a range of 24-36 WPM for the simulator, press [*][D][6][3][6].
The slower simulated stations generally send more lengthy exchanges.
Faster stations are more efficient in their transmission content.

CHANGE SIMULATOR CHANNELS

[C]   Change channels
[D]   Change channels

The [C] and [D] keys change '"frequency" within a "band". The current channel activity is abandoned. Most of the time the simulator switches to a channel that has other activity in progress; sometimes the new channel has no activity. Press [C] or [D] and listen for a few seconds; if you hear nothing then it is probably safe to send your own CQ.

REPORT CONTEST SCORE IN MORSE

[*][D][7]

During the contest, the simulator prints a contest log on the keyer's serial port. If you are not using a terminal or computer to read the serial port, you can still get a report of your contest score by pressing [*][D][7]. This command changes channels, sends the score in Morse numerals, and then changes channels again. The [*][D][7] command works only in Contest Simulator mode.

Your score remains unchanged when you change bands, suspend the simulation or turn the keyer's power off. The score is reset to zero if you change your latitude, longitude or time of day with the [*][D][1], [*][D][2] or [*][D][3] commands. To purposely reset the score to zero (e.g. when changing operators), use the [*][D][3] command to enter a new time of day or the same time of day.

SERIAL PORT OUTPUT

[*][C][7][4][2]   Print contest QSO, not log
[*][C][7][4][3]   Print contest log, not QSO (default)

In the QSO Simulator mode ([*][*][5]), the serial port output shows the text of all QSOs, both user-generated and machine-simulated. The Contest Simulator ([*][*][4]) normally uses the serial port to print a log of all successful contacts completed by the user.

The commands control the use of the serial output in Contest Simulator mode. [*][C][7][4][2] yields serial output of the text, similar to the serial activity in the QSO Simulator, but not the log entries of the contacts. [*][C][7][4][3] yields the contest log, containing callsigns, time and score, but without a transcript of the actual text exchanged.

SUSPEND/CONTINUE THE SIMULATION

[#]

Press [#] to stop the simulator tones. The time of day continues to advance while the tones are suspended. Press [#] again to make the simulator continue where it left off. Pressing [*][*][4] also continues the simulation.

To freeze the simulation, including the time of day, turn off the keyer. If the internal battery is working, the simulation will continue when the keyer is turned on again. Your contest score will remain unchanged.

To use the MM-3 as a keyer again, press [*][3].

VOCABULARY

Here is a list of some of the words the simulator responds to:

AGN	QRZ
CALL	RPT
CODE	RST
DE	TEST
QRQ	ZONE
QRS	?

SCORING

Here are the rules of the contest:

- Exchange RST and CQ zone. Example: 59903 or 5NNT3.
- Work as many countries and CO zones on as many bands as possible.

QSOs between stations in the same country are worth 0 points. QSOs between stations in different countries on the same continent are worth 1 point, except for North America where they count 2 QSO points. QSOs between different continents are worth 3 QSO points.

The score is computed as follows:

Score = QSO points × (Countries + Zones).

Countries and zones may be worked once on each band for multiplier credit. New countries or zones worked on a band are shown in the log entry on your terminal.

Contest Simulator Countries List

A22	Botswana	FGO/FS	St. Martin Is.
A35	Tonga	FH8	Mayotte
A41	Oman	FK8	New Caledonia
A51	Bhutan	FM	Martinique
A61	United Arab Emirates	FO	French Polynesia
A71	Qatar	FO0X	Clipperton Is.
A92	Bahrain	FP5	St. Pierre & Miquelon
AP2	Pakistan	FR7	Reunion
BV2	Taiwan	FR7/G	Glorioso Is.
BY	China	FR7/J	Juan de Nova/Europa
C21	Nauru	FR7/T	Tromelin Is,
C31	Andorra	FT8W	Crozet Is.
C53	Gambia	FT8X	Kerguelen Is.
C6A	Bahamas	FT8Z	Amsterdam/S1, Paul
C9M	Mozambique	FW0	Wallis & Futuna Is.
CE	Chile	FY	French Guiana
CE0A	Easter Is.	G	England
CE0X	San Felix Is.	GD	Isle of Man
CE0Z	Juan Fernandez Is.	GI	Northern Ireland
CN8	Morocco	GJ	Jersey
CO, CM	Cuba	GM	Scotland
CP	Bolivia	GM/S*	Shetland Is.
CT	Portugal	GU	Guernsey
CT3	Madeira Is.	GW	Wales
CU	Azores Is.	H44	Solomon Is.
CX	Uruguay	HA, HG	Hungary
CY9	S1, Paul Is.	HB9	Switzerland
CYO	Sable Is.	HB0	Lichtenstein
D2A	Angola	HC	Ecuador
D44	Cape Verde Is.	HC8	Galapagos Is.
D68	Comoros	HH2	Haiti
DF, DJ-L, Y2-8	Germany	HI	Dominican Republic
DU	Philippines	HK	Colombia
EA	Spain	HK0	Malpelo Is.
EA6	Balearic Is.	HK0	San Andres/Providencia
EA8	Canary Is.	HL	Korea
EA9	Ceuta & Melilla	HP	Panama
EI	Ireland	HR	Honduras
EL	Liberia	HS1	Thailand
EP2	Iran	HV	Vatican City
ES	Estonia	HZ1	Saudi Arabia
ET3	Ethiopia	I	Italy
F	France	IS0	Sardinia
FG	Guadeloupe	IT9	Sicily
J28	Djibouti	OZ	Denmark
J37	Grenada	P29	Papua New Guinea
J5	Guinea-Bissau	PA	Netherlands
J6L	St. Lucia	PJ2-3	Netherlands Antilles
J73	Dominica	PJ5	St Eust./Saba/St Maar.
J88	St. Vincent	PY, PR-W	Brazil
JA,JE-S	Japan	PY0/F*	Fernando de Noronha
JD1	Minami Tori Shima	PY0/P*	St. Peter & Paul
JD1	Ogasawara Is.	PY0/T*	Trinidade/Martim Vaz.
JT1	Mongolia	PZ1	Surinam
JW	Svalbard Is.	S23	Bangladesh
JX	Jan Mayen Is.	S79	Seychelles
JY	Jordan	S92	Sao Tome & Principe

KG4	Guantanamo Bay	SM	Sweden
KH1, AH1	Baker & Howland Is.	SP	Poland
KH2, AH2	Guam	ST2	Sudan
KH3, AH3	Johnston Is.	SU	Egypt
KH4, AH4	Midway Is.	SV	Greece
KH5	Palmyra & Jarvis Is.	SV5	Dodecanese Is.
KH6, AH6	Hawaii	SV9	Crete
KH7	Kure Is.	T2	Tuvalu
KH8, AH8	American Samoa	T30	West Kiribati
KH9, AH9	Wake Is	T31	Central Kiribati
KH0, AH0	Mariana Is.	T32	East Kiribati
KL7, AL7	Alaska	T5	Somalia
KP1	Navassa Is.	T77	San Marino
KP2, NP2	Virgin Is.	TA	Turkey
KP4, NP4	Puerto Rico	TF3	Iceland
KP5, NP5	Desecheo Is.	TG	Guatemala
LA	Norway	TI	Costa Rica
LU	Argentina	TI9	Cocos Is.
LX	Luxembourg	TJ1	Cameroon
LY	Lithuania	TK5	Corsica
LZ	Bulgaria	TLB	Central African Rep.
OA	Peru	TN8	Congo
OD5	Lebanon	TR8	Gabon
OE	Austria	TT8	Chad
OH	Finland	TU2	Ivory Coast
OH0	Aland Is.	TY1	Benin
OJ0	Market Reef	TZ	Mali
OK	Czechoslovakia	UA 1,3,4,6	Eur. Russian SFSR
ON	Belgium	UA2	Kaliningrad
OX3	Greenland	UA9,0	Asiatic Russian SFSR
OY	Faroe Is.	UB5	Ukraine
UC2	Byelorussia	XF4	Revilla Gigedo Is.
UD6	Azerbaijan	XT2	Burkina Faso
UF6	Georgia	XU1	Kampuchea
UG6	Armenia	XV, 3W	Vietnam
UH8	Turkmen	XW8	Laos
UI8	Uzbek	XX9	Macao
UJ8	Tadzhik	XZ2	Myanmar
UL7	Kazakh	YA1	Afghanistan
UM8	Kirghiz	YB, YC	Indonesia
UN1	Karelia	YI1	Iraq
UO5	Moldavia	YJ8	Vanuatu
V2A	Antigua & Barbuda	YK1	Syria
V31	Belize	YL	Latvia
V44	St. Kitts & Nevis	YN	Nicaragua
V51	Namibia	YO	Romania
V73	Marshall Is.	YS	El Salvador
V85	Brunei	YU, YT, 4N	Yugoslavia
VE, VO, VY	Canada	YV	Venezuela
VK	Australia	YV0A	Aves Is.
VK9L	Lord Howe Is.	Z2	Zimbabwe
VK9N	Norfolk Is.	ZA2	Albania
VK9X	Christmas Is.	ZB2	Gibraltar
VK9Y	Cocos (Keeling) Is.	ZD7	St. Helena Is.
VK9Z	Willis Is.	ZD8	Ascension Is.
VK0/H*	Heard Is.	ZD9	Tristan de Cunha
VK0/M*	Macquarie Is.	ZF2	Cayman Is.
VP2E	Anguilla	ZK1	Southern Cook Is.
VP2M	Montserrat	ZK1M	Northern Cook Is.

VP2V	British Virgin Is.	ZK2	Niue Is.
VP5	Turks & Caicos Is.	ZK3	Tokelaus
VP8	Falkland Is.	ZL	New Zealand
VP8/G*	South Georgia Is.	ZL7	Chatham Is.
VP8/0*	South Orkney Is.	ZL8	Kermadec Is.
VP8/S*	South Sandwich Is.	ZL9	Auckland & Campbell Is.
VP8/SH*	South Shetland Is.	ZP	Paraguay
VP9	Bermuda	ZS	South Africa
VQ9	Chagos Is.	ZS9	Walvis Bay
VR6	Pitcairn Is.	1S1	Spratly Is.
VS6	Hong Kong	3A2	Monaco
VU2	India	3B6,7	Agalega/St. Brandon
VU7	Andaman & Nicobar Is.	3B8	Mauritius
VU7	Laccadive Is	3B9	Rodriguez Is.
W, K, N	United States	3C1	Equatorial Guinea
XE	Mexico	3D2	Fiji
3D6	Swaziland	6Y5	Jamaica
3V8	Tunisia	7P8	Lesotho
3X	Guinea	7Q7	Malawi
3Y	Bouvet Is.	7X	Algeria
4J1	Malyj Vysotskij Is.	8P6	Barbados
4S7	Sri Lanka	8Q7	Maldives
4W1, 7O	Yemen	8R1	Guyana
4X	Israel	9G1	Ghana
5A	Libya	9H	Malta
5B5, ZC4	Cyprus	9J2	Zambia
5H3	Tanzania	9K2	Kuwait
5N	Nigeria	9L1	Sierra Leone
5R8	Madagascar	9M2	West Malaysia
5T5	Mauritania	9M6,8	East Malaysia
5U7	Niger	9N1	Nepal
5V7	Togo	9Q5	Zaire
5W1	Western Samoa	9U5	Burundi
5X5	Uganda	9V1	Singapore
5Z4	Kenya	9X5	Rwanda
6W	Senegal	9Y4	Trinidad & Tobago

* Artificial suffix added so you can tell which country you're working.

RESET AND RESTART

[*][C][0]   Reset keyer (Erase all memories)
[*][D][0]   Restart keyer

If you get the keyer into an unknown state, or the commands have made the keyer unusable, press [*][C][0] to reset the keyer's options to their default values. This will erase any messages you have stored in memory.

Pressing [*][D][0] to restart the keyer is a less drastic measure. It starts the keyer from a known state without changing any of the options you have set. You may use [*][D][0] to stop beacons, end code training sessions, etc.

INTERESTING USES FOR THE MORSE MACHINE

Connect the serial port to a computer. The Morse Machine will echo the Trainer code practice text to the screen so you can check your copy. Everything you hear and send on the QSO and OX Simulators also can go to the serial output and show up on your computer screen.

Connect the serial port to a computer, set up the ASCII/MORSE CONVERTER mode, and upload a text file from the computer to the keyer. This gives you a code practice session with plain English text at a constant speed. When the file is finished, compare your copy with the actual text in the computer.

With The Morse Machine, packet radio is now accessible to the blind without expensive ASCII-to-voice synthesizers. Just set up the keyer as a terminal connected to a packet TNC. The keyer also is useful as a highly portable terminal to operate packet radio in the field.

Connect an AEA CP-1 or CP-100 Computer Patch to your receiver's audio. Connect the digital output from the CP-1 to The Morse Machine's dash input. Press [*][C][5] to set Straight Key mode. Connect the keyer's serial port to a computer. You now have a Morse reader.

Slow down the Morse code you hear on the air by connecting the keyer's serial port to an AEA PK-232 data controller. Set up the PK-232 in Morse operation, find a fast Morse signal, use the PK-232 to convert the Morse to ASCII, and use the MM-3 to convert the ASCII back to Morse code, only slower.

Generate on-the-air code practice by connecting the keyer to a transmitter, setting the keyer to the ASCII/MORSE CONVERTER mode and uploading a text file from a computer. Or set the keyer to Trainer mode, then press [*][*][8] to activate the Transmit output. Put four-letter words on the air, and remember to identify every 10 minutes.

APPENDIX A - Trainer ([*][5]) Character Sets

Easy Character Set ([*][C][2]):

A · –	P · – – ·	4 ···· –			
B – ···	Q – · – ·	5 ·····			
C – · – ·	R · – ·	6 – ····			
D – ··	S ···	7 – – ···			
E ·	T –	8 – – – ··			
F ·· – ·	U ·· –	9 – – – – ·			
G – – ·	V ··· –	. Period · – · – · –			
H ····	W · – –	, Comma – – ·· – –			
I ··	X – ·· –	? Question Mark ·· – – ··			
J · – – –	Y – · – –	/ Fraction bar – ·· – ·			
K – · –	Z – – ··	+ End of Message (AR) · – · – ·			
L · – ··	0 – – – – –	End of Work (SK) ··· – · –			
M – –	1 · – – – –	= Double Dash (BT) – ··· –			
N – ·	2 ·· – – –				
O – – –	3 ··· – –				

Medium Difficulty Character Set ([*][C][3]) - Easy plus the following:

! Understood (SN) ··· – ·	**'** Apostrophe · – – – – ·
& Wait (AS) · – ···	- Hyphen – ···· –
> Attention (KA) – · – · –	; Semicolon – · – · – ·
(Left parenthesis (KN) – · – – ·	) Right parenthesis – · – – · –
* Quote · – ·· – ·	: Colon – – – ···

Complete Character Set ([*][C][4]) - Medium Difficulty plus the following:

_	Underline	·· – – · –
$	Dollar Sign	··· – ·· –
[	AE (Ä)	· – · –
\	OE (Ö)	– – – ·
]	á, à	· – – · –
^	UE (Ü)	·· – –
@	é	·· – ··
c		– · – ··
e	(Separation signal)	· – ·· –
h	CH	– – – –
ñ		– – · – –
z		– – ·· –

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APPENDIX B - Serial Port Character Sets

ASCII Serial Data In to Morse Output:

Char. Set	ASCII Char.	Also Known As	Morse
[*][C][1]	A – Z		
	0 – 9		
	.	Period	· — · — · —
	,	Comma	— — · · — —
	?	Question Mark	· · — — · ·
	/	Fraction Bar	— · · — ·
[*][C][2]	Above, plus:		
	-	Hyphen	— · · · · —
	:	Colon	— — — · · ·
	;	Semicolon	— · — · — ·
[*][C][3]	Above, plus:		
	!	Understood (SN)	· · · — ·
	*	Quote	· — · · — ·
	&	Wait (AS)	· — · · ·
	'	Apostrophe	· — — — — ·
	(	Left paren. (KN)	— · — — ·
	)	Right paren.	— · — — · —
	+	End of msg. (AR)	· — · — ·
	<	End of work (SK)	· · · — · —
	=	Double dash (BT)	— · · · —
	>	Attention (KA)	— · — · —
[*][C][4]	Above, plus:		
	$	Dollar sign	· · · — · · —
	@	Swedish E	· · — · ·
	[	German AE (ä)	· — · —
	\	German OE (ö)	— — — ·
	]	Swedish A (å)	· — — · —
	^	German UE (ü)	· · — —
	_	Underline	· · — — · —
	c	French C (ç)	— · — · ·
	e	French E (é, è)	· — · · —
	h	German CH	— — — —
	n	Spanish N (ñ)	— — · — —
	z	Foreign Z	— — · · —

For [*][C][1], [*][C][2] and [*][C][3] upper and lower-case ASCII letters are translated the same. For [*][C][4], only upper-case ASCII letters are translated to the English alphabet; the lower-case letters c, e, h, n and z are reserved for foreign code characters. The other lower-case letters are not translated.

The characters * and # are not translated from ASCII to Morse. They are used only to emulate keypad commands from the computer. Carriage Return and Linefeed are never translated from ASCII to Morse.

Morse Paddle Input to ASCII Serial Data Out:

The resulting ASCII codes are the same as above, except some characters in [*][C][1], [*][C][2] and [*][C][3]:

·· – –	becomes ASCII Carriage Return, Linefeed
· – · –	becomes ASCII Carriage Return
– – – –	becomes ASCII *

Use ·· – – (CRLF) to end a line when talking to a computer or terminal. Use · – · – (CR) to end a line when talking to a modem or packet TNC.

In [*][C][4], these characters become ASCII ^, [and h respectively.

To send Control characters on the SERIAL OUT line, send – · – · – (CT) followed by the letter A–Z. For example, to send a CTRL-C to force a TNC's command mode, send:

```
   – · – · –        – · – ·
     CT               C
```

APPENDIX C - Code Speed

The International Morse Code speed is defined by the word "PARIS". It has 10 dots, four dashes, nine intracharacter spaces, four intracharacter spaces and one word space for a total equivalent of 50 code elements (dot or space time). To adjust code speed for various dot/space and dash/space ratios, the number of code elements in the word "PARIS" is used as a reference so that with any allowable dot/space and dash/space ratios, the code speed is correct for the reference word "PARIS".

A rule of thumb says that to calculate code speed in words per minute, divide the total number of characters sent in one minute by five. That can be quite misleading! This method does not accurately take into account the variable length of individual characters.

Quite often, when the speed of the MM-3 is compared against tape recordings of certain speeds, the MM-3 appears to be sending too slowly. but many tapes on the market are actually sent faster than the labeled speed!

APPENDIX D - CW ABBREVIATIONS

ABT	about		OP	operator
ADR	address		OT	old timer
AGN	again		PSE	please
ANT	antenna		PWR	power
BCNU	be seeing you		R	received, roger
BK	back, break		RCVE	receive
BN	been, between		RCVR	receiver
CONDX	conditions		RIG	equipment
CPY	copy		RPT	repeat, report
CQ	general call to any station		RST	signal report
CUAGN	see you again		RTTY	radio teletype
CUD	could		SA	say
CUL	see you later		SSB	single sideband
CUZ	because		SIG	signal
CW	continuous wave		SKED	schedule
DE	from		SRI	sorry
DEGR	degrees		STN	station
DX	distance, rare station		SUM	some
ES	and		TEMP	temperature
FB	fine business		TFC	traffic
FER	for		TKS	thanks
FONE	phone, voice		TMW	tomorrow
FREQ	frequency		TNX	thanks
GA	good afternoon, go ahead		TT	that
GE	good evening		TU	thank you
GESS	guess		TVI	television interference
GG	going		U	you
GL	good luck		UR	your
GM	good morning		VY	very
GN	good night		WL	well, will
GND	ground		WT	watt
GUD	good		WAT	what
HI	high, laughter		WATSA	what do you say
HPE	hope		WID	with
HR	here		WK	week, weak
HVE	have		WRK	work, have OSO with
HW	how		WX	weather
K	go ahead		XCVR	transceiver
KNW	know		XMTR	transmitter
MSG	message		XYL	wife
MTRS	meters		YL	young lady
NR	number		YR	year
NW	now		73	best regards
OM	old man		88	love and kisses

APPENDIX E - INFORMAL MEANINGS OF Q SIGNALS

QRL	busy
QRM	interference from other stations
QRN	atmospheric interference static
QRO	high power. increase power
QRP	low power. decrease power
QRQ	send faster
QRS	send slower
QRT	stop sending. get off the air
QRU	I have no traffic for you. all talked out
QRV	ready
QRX	call again later, wait
QRZ	who is calling me?
QSS	fading signal
QSK	CW break-in
QSL	acknowledge receipt. send confirmation card
QSO	contact. conversation
QST	calling all radio amateurs
QSY	change frequency
QTH	location

APPENDIX F - ABBREVIATED COMMANDS

Mode/Command	Keypad	Range	At Turn-on
KEYER:			
Go to KEYER Mode	[*][3]		KEYER
Keypad Speed Control SPEED Knob Control	[*][A][6] [*][B][6]		SPEED Knob
Keypad Code Speed SPEED Knob Speed limits	[*][6][n][n] [*][C][8][6][n][n][n] [*][C][8][1][n][n] [*][C][8][2][n][n]	2–99 WPM 2–255 WPM 2–99 WPM (lower) 2–99 WPM (upper)	20 WPM 20 WPM 5 WPM 45 WPM
Tone Increase Tone Increase	[*][1] [*][*][1]	122–2500 Hz 122–2500 Hz	500 Hz 500 Hz
CW Sidetone On CW Sidetone Off	[*][A][1] [*][B][1]		On
Keypad Tone On Keypad Tone Off	[*][A][2] [*][B][2]		On
Dot/Space Ratio Dash/Space Ratio	[*][2][n][n] [*][*][2][n][n]	0.5–1.5 in 0.1 increments 2.0–4.0 in 0.1 increments	1.0 3.0
Dot Memory On Dot Memory Off Dash Memory On Dash Memory Off	[*][A][3] [*][B][3] [*][A][4] [*][B][4]		On On
Automatic (Iambic) Semiautomatic (Bug) Straight Key	[*][A][5] [*][B][5] [*][C][5]		On
Tune On Tune Off	[*][*][7] Any		Off
Retain Serial Number Set Serial Number Repeat Serial Number	[*][0] [*][*][0][n][n][n][n][#] [C]		1
Serial Number As Is Cut Serial Numbers	[*][A][7] [*][B][7]	Sends actual numbers 9 = N, 0 = T	On
Send Message Send Bank A Message Send Bank B Message Send Next Higher Msg.	[n] [A][n] [B][n] [D]	Message 0–9, current bank Message 0–9 Message 0–9 (A9 wraps to B0)	
Message 1 Repeat Time	[*][7][n][n][n][#]	0 to 999 seconds in 1 sec. increments	0 second
Toggle Transmit	[*][*][8]		Transmit On
Farnsworth Messages Slow Code Messages Farns. Character Speed	[*][C][7][3][1] [*][C][7][3][2] [*][C][6][n][n]		Slow Code

Mode/Command	Keypad	Range	At Turn-on
MEMORY LOAD:			
Go to MEMORY Load	[*][4]		
Select Bank A Select Bank B	[A] [B]		
Load Erase	[n] *msg* [#] [n][#]		
Insert Serial Number Insert Speed Change Insert Other Message	[*][0] [*][*][3] [*][*][9][n]	Toggle Normal / +41 % n must be in same bank	Normal
Real-Time Spacing Auto-Word Spacing	[*][A][8] [*][B][8]		On
TRAINER:			
Go to TRAINER Mode	[*][5]		
Start Speed Finish Speed Farnsworth Speed Speed Change Interval	[*][6][n][n] [*][*][6][n][n] [*][C][6][n][n] [*][7][n][n][n][#]	2–99 WPM 2–99 WPM 2–99 WPM 00.1–99.9 minutes in 0.1 minutes increments	5 WPM 15 WPM 15 WPM 10 min.
Fast Code Method Slow Code Method	[*][A][0] [*][B][0]		On
Five-Character Groups Random Length Groups	[*][A][9] [*][B][9]		On
Four-Letter Words Easy Character Set Easy Set Medium Difficulty Complete Set	[*][C][1] [*][C][2] [*][C][3] [*][C][4]		
Start Trainer Start Random Trainer Stop Trainer	[n] [D] [#]	0–9	
BEACON:			
Go to BEACON Mode	[*][8]		
Beacon Cycle Time	[*][7][n][n][n][#]	1 to 99 seconds in 1 second increments	60 seconds
Beacon Start	[n]	Message 0–9	
QSO SIMULATOR:			
Go to QSO Simulator	[*][*][5]		
Simulator Speed Limit	[*][D][6][n][n]	2–99 WPM	24 WPM
Change Channel	[C]		
Start Simulated CQ	[D]		
Stop Simulator	[#]		

Mode/Command	Keypad	Range	At Turn-on
DX CONTEST SIMULATOR:			
Go to Contest Simulator	[*][*][4]		
Latitude Longitude Hour (UTC)	[*][D][1][a][n][n] [*][D][1][b][n][n] [*][D][3][n][n]	00–99 degrees 000–180 degrees 00–23 hours	39 North 77 West 0000 UTC
Change Band	[*][D][4][n]	0 = 1.8 MHz 3 = 14 MHz 1 = 3.5 MHz 4 = 21 MHz 2 = 7 MHz 5 = 28 MHz	14 MHz
Code speed limit	[*][D][6][n][n]	2–99 WPM	24 WPM
Change simulator channels	[C], [D]		
Report Contest score in Morse	[*][D][7]		
Print Contest QSO, not Log Print Contest Log, not QSO	[*][C][7][4][2] [*][C][7][4][3]		Contest Log
Suspend/Continue Simulation	[#]		
OTHER:			
Set Serial Baud Rate	[*][C][9][n]	1 = 1200 6 = 600 2 = 2400 7 = 7200 3 = 300 8 = 1800 4 = 4800 9 = 9600 5 = 150 0 = 1200	1200 baud
Go to ASCII/Morse Converter	[*][9]		
Keyer Reset	[*][C][0]	Resets all options to default values. Clears memories.	
Keyer Restart	[*][D][0]	Just re-starts the keyer in case of trouble; options and memories are unchanged.	

APPENDIX G - Commands in numerical order

K = KEYER/MEMORY SEND mode   M = MEMORY LOAD mode
T = TRAINER mode   B = BEACON mode
Q = QSO SIMULATOR mode   D = OX Contest Simulator

[*][1]   Tone pitch increase   [*][*][1]   Tone pitch decrease
[*][2]   Set dot ratio   [*][*][2]   Set dash ratio
[*][3]   Keyer send mode (= K)   [*][*][3]   Insert speed change (M)
[*][4]   Memory load mode (= M)   [*][*][4]   Contest Simulator Mode (= D)
[*][5]   Trainer mode (= T)   [*][*][5]   QSO simulator mode (= a)
[*][6]   Start speed (T)   [*][*][6]   End speed (T)
            Keypad speed (K/M)
[*][7]   Message 1 repeat interval (K,D) [*][*][7]   Tune (key down) (K)
            Beacon interval (B)
            Speed change interval (T)
[*][8]   Beacon send mode (= B)   [*][*][8]   Toggle transmit
[*][9]   ASCII/Morse converter mode   [*][*][9]   Insert message number (M)
[*][0]   Retain last serial number (K)   [*][*][0}   Serial number set
            Insert serial number (M)

[*][A][1]   CW sidetone on   [*][B][1]   CW sidetone off
[*][A][2]   Keypad tone on   [*][B][2]   Keypad tone off
[*][A][3]   Dot memory on   [*][B][3]   Dot memory off
[*][A][4]   Dash memory on   [*][B][4]   Dash memory off
[*][A][5]   Iambic mode   [*][B][5]   Bug mode
[*][A][6]   Use keypad speed   [*][B][6]   Use analog speed
[*][A][7]   Serial number as is   [*][B][7]   Serial number N = 9, T = 0
[*][A][8]   Real time spacing   [*][B][8]   Auto-word spacing
[*][A][9]   Five-character groups   [*][B][9]   Random length groups
[*][A][0]   Farnsworth code   [*][B][0]   Slow code

[*][C][1]   4-letter groups   [*][D][1]   Latitude (D)
[*][C][2]   Easy character set   [*][D][2}   Longitude (D)
[*][C][3]   Medium difficulty character set [*][D][3]   Time of Day (D)
[*][C][4]   Complete character set   [*][D][4]   Band (D)
[*][C][5]   Straight key mode
[*][C][6]   Farnsworth character speed   [*][D][6]   Simulator speed limit (D/Q)
[*][C][7]   (See special commands next page) [*][D][7]   Score
[*][C][8]   "   "
[*][C][9]   Set ASCII baud rate
[*][C][0]   Reset   [*][D][0]   Restart

[0]...[9]   Send message (KID)
            Load message (M)
            Beacon start (B)
            Start code practice session (T)

[A]   Select memory bank A
[B]   Select memory bank B
[C]   Repeat last serial number (K/B)
            Change simulator channel (Q/D)
[D]   Resume message / Select next higher message (K)
            Edit message (M)
            Random code practice (T)
   Change simulator channel (D)

Special Commands

|	
[*][C][7][0][0]	Sends the EPROM version number in Morse
[*][C][7][0][1]	Serial number contains no leading zeroes
[*][C][7][0][2]	Serial number minimum 2 digits, 0 fill
[*][C][7][0][3]	Serial number minimum 3 digits, 0 fill
[*][C][7][0][4]	Serial number always 4 digits, 0 fill
[*][C][7][0][5]	Enable PTT and keying for current mode
[*][C][7][0][6]	Disable PTT and keying for current mode
[*][C][7][0][7]	Turn on PTT
[*][C][7][0][8]	Turn off PTT
[*][C][7][0][9]	Go to data mode
[*][C][7][1][0]	Sends the EPROM version number in ASCII
[*][C][7][1][1]	Paddle normal; dot = ring, dash = tip
[*][C][7][1][2]	Paddle reversed; dot = tip, dash = ring
[*][C][7][1][3]	Dot/dash squeeze generates alternating dots and dashes
[*][C][7][1][4]	Dot/dash squeeze generates all dots or all dashes
[*][C][7][1][5]	Keypad controls speed of data from serial
[*][C][7][1][6]	SPEED knob controls speed of data from serial
[*][C][7][1][7]	Enable auto character spacing after 1 dot interval
[*][C][7][1][8]	Enable auto character spacing after 2 dot intervals
[*][C][7][1][9]	Disable auto character spacing from paddle
[*][C][7][2][1]	0 in a serial number is sent as numeral 0
[*][C][7][2][2]	0 in a serial number is sent as letter T
[*][C][7][2][3]	0 in a serial number is sent as letter O
[*][C][7][2][4]	1 in a serial number is sent as numeral 1
[*][C][7][2][5]	1 in a serial number is sent as letter A
[*][C][7][2][6]	9 in a serial number is sent as numeral 9
[*][C][7][2][7]	9 in a serial number is sent as letter N
[*][C][7][3][0]	Read spare parallel port inputs
[*][C][7][3][1]	Message buffers send Farnsworth code
[*][C][7][3][2]	Message buffers send slow code
[*][C][7][3][3]	Literal space characters from serial
[*][C][7][3][4]	Limited space characters from serial
[*][C][7][3][5]	Trainer letters A-Z
[*][C][7][3][6]	Trainer numbers 0-9
[*][C][7][3][7]	Trainer letters and numbers
[*][C][7][3][8]	Curtis type A keying
[*][C][7][3][9]	Curtis type B keying
[*][C]8[0][n][n]	Transmit delay time
[*][C]8[1][n][n]	Set the counter clockwise limit of the SPEED knob
[*][C]8[2][n][n]	Set the clockwise limit of the SPEED knob
[*][C]8[6][n][n]	Set the code speed

APPENDIX I - Component Placement Diagram
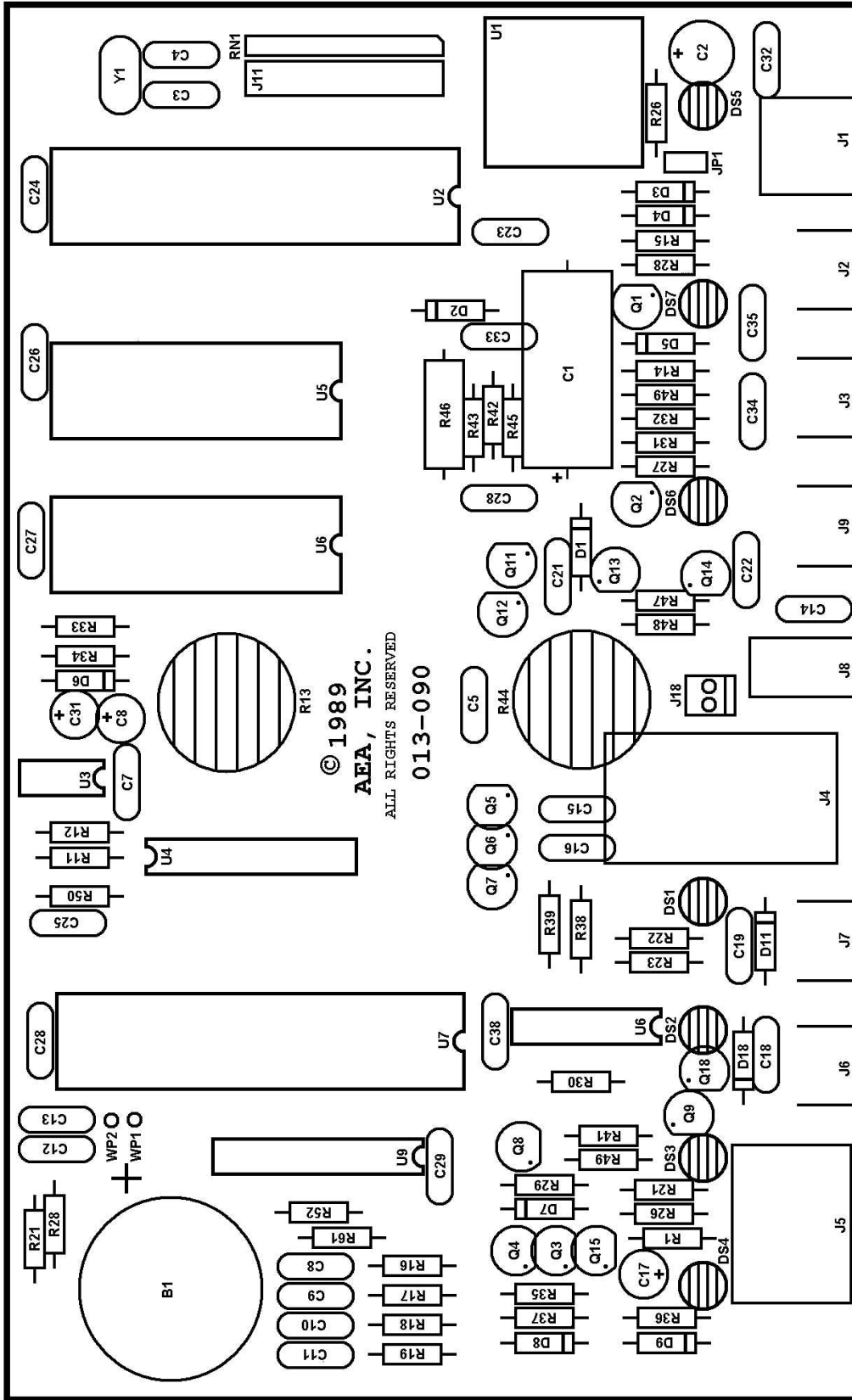
Shaded Components are on farside of Board

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APPENDIX J - Schematic Diagram
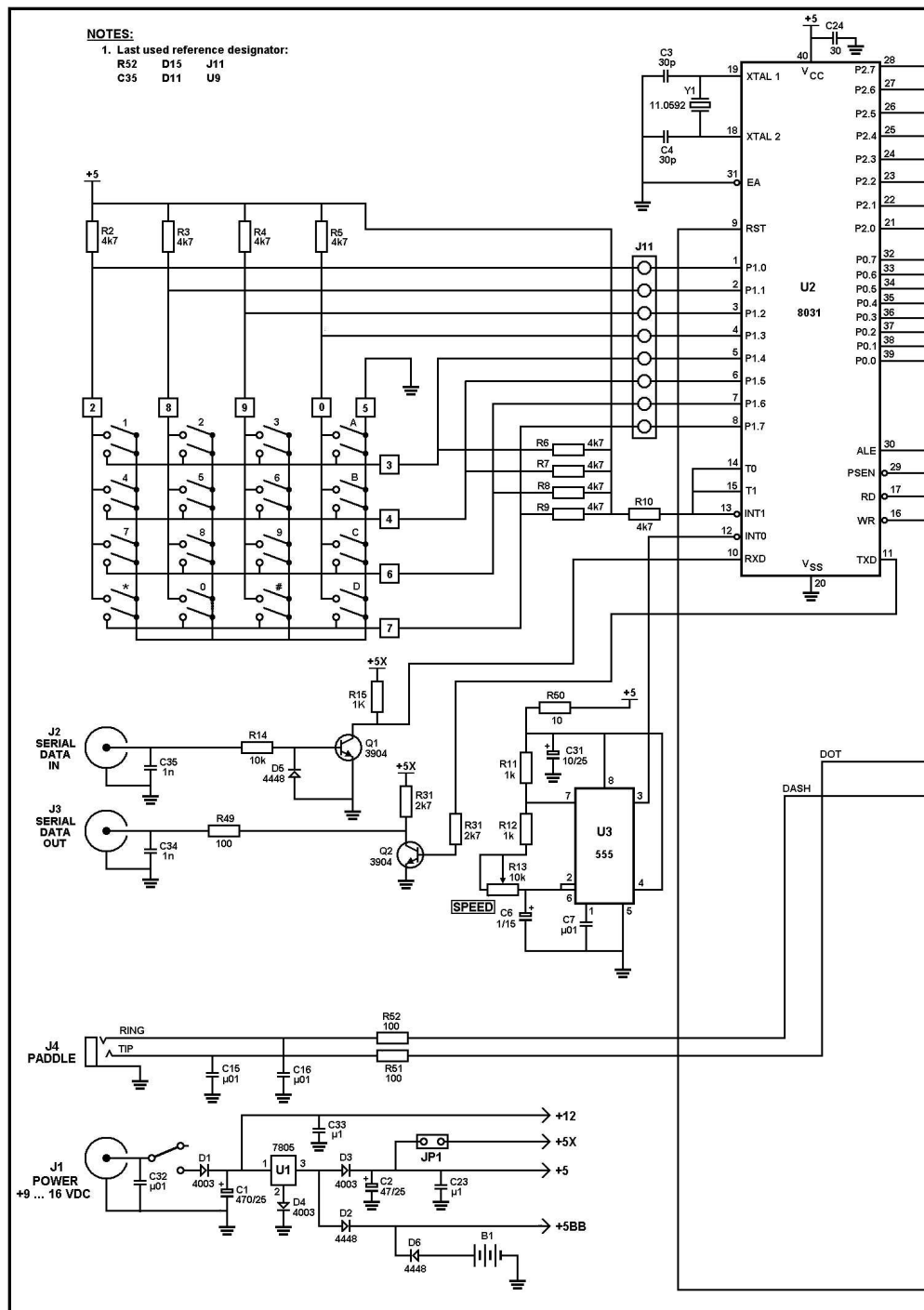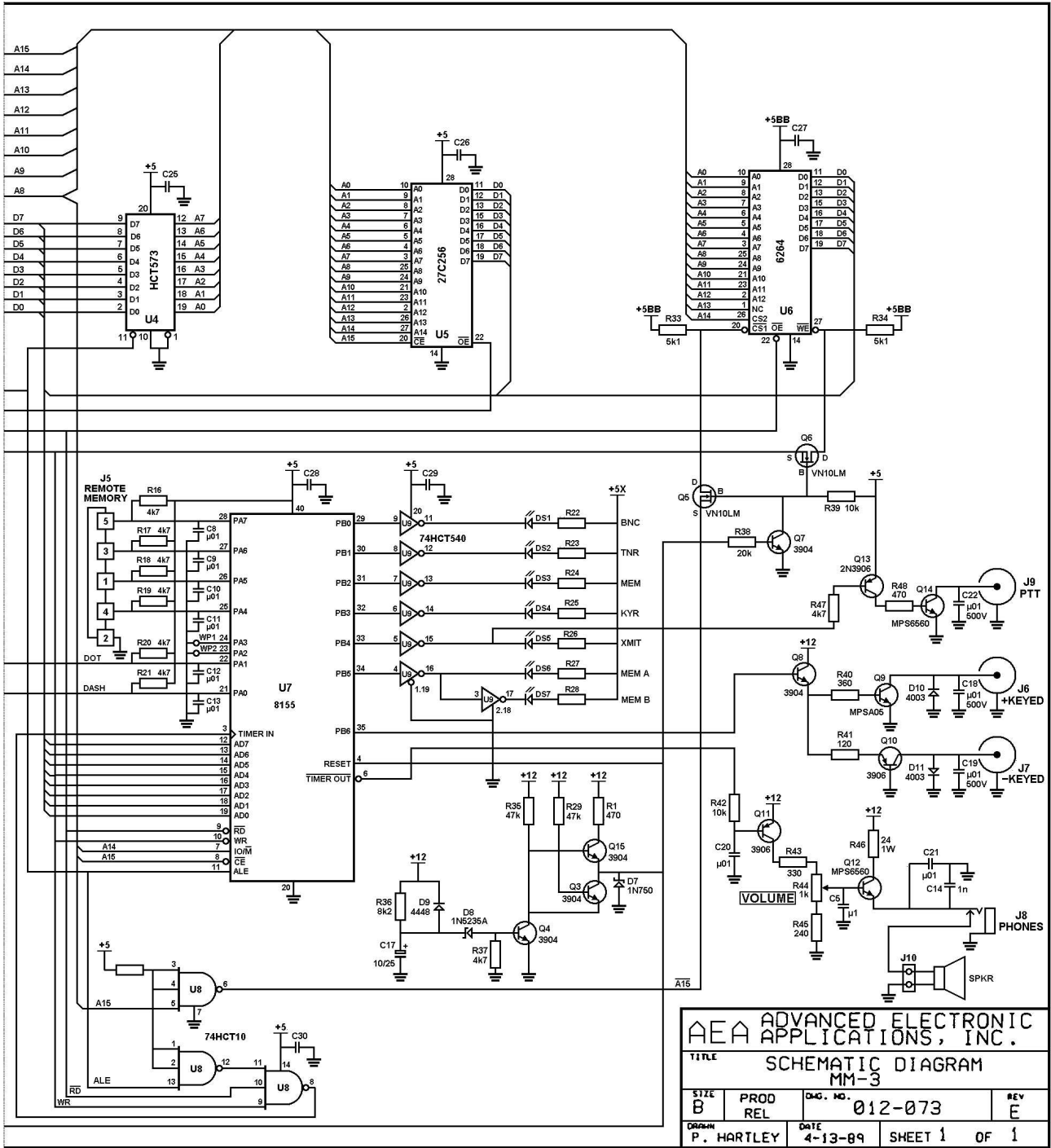
AEA ADVANCED ELECTRONIC APPLICATIONS, INC.

TITLE
SCHEMATIC DIAGRAM
MM-3

SIZE	PROD	DWG. NO.	REV
B	REL	012-073	E

DRAWN	DATE		
P. HARTLEY	4-13-89	SHEET 1	OF 1