

AEASOFT™ SOFTWARE
MORSE UNIVERSITY™

MORSE CODE EDUCATIONAL SOFTWARE
FOR THE COMMODORE 64 COMPUTER
MODEL NO. MU-64

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040 - 981

May, 1985

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OVERVIEW

The Morse University™ software package contains the software (firmware) in EPROM plug-in cartridge form, this manual and a warranty card.

You should fill out and return the warranty card and one copy of the Software Support Agreement. The Support Number is located in the upper corner on the cover of this manual. Please retain a copy of the Software Support Agreement for your records.

This software will help you learn the Morse code and improve your code receiving and sending ability. It features most of the International Morse code characters you will ever hear, including the alphabet, numbers, punctuation, procedure signs, and foreign letters. Other features include variable tone, screen color selection, variable code practice group size, variable character speed, variable delay between code practice groups, gradually increasing or decreasing code practice speed, variable code practice duration, slow/fast (normal/Farnsworth) character speed selection, a sending analysis routine with statistics, a Morse code receiving video game, and a Morse code keyboard program for composing your own code practice sessions.

Throughout this manual the individual keys on the Commodore 64 keyboard will be shown in brackets, such as <G>, which means you are to type a G key. <SHIFT> <A> means that you are to type the <A> key while simultaneously holding the <SHIFT> key down. Do not enter the brackets.

Please read this manual carefully before using the program. It will explain the program in detail including some of the finer points one might not discover on his own. Read on and enjoy Morse University.

THE PROGRAM

The AEASoft Morse University™ program is a collection of several computer routines that teach Morse code using different teaching methods.

The LEARNING routine emulates AEA's BT-1 Basic Morse Trainer. It teaches individual Morse characters by sound.

The PROFICIENCY routine emulates the trainer portion of AEA's KT-2 Keyer-Trainer. It helps increase your code proficiency once you have learned the Morse characters.

The SENDING ANALYSIS routine helps improve your sending ability. It analyzes both Morse character formation and the spacing between characters and words.

The RECEIVING GAME is a modest video game that helps you recognize Morse characters under pressure.

The MORSE KEYBOARD routine enables you to compose your own code practice sessions, or just sound out Morse characters from the computer keyboard.

THE INTERNATIONAL MORSE CODE

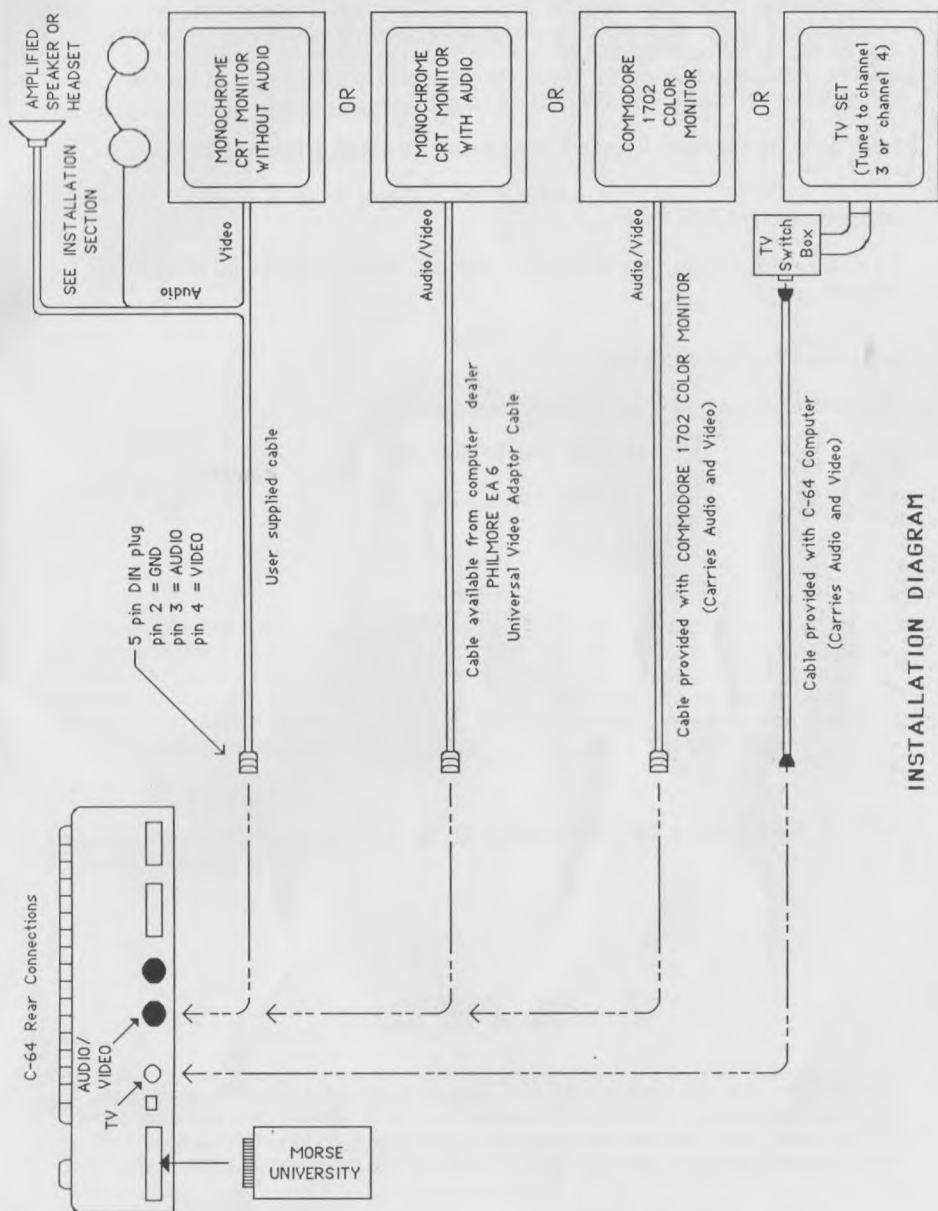
The international Morse code is defined by the word "PARIS". A dot is defined as one code element, and a dash is defined as three code elements. PARIS contains 10 dots, 4 dashes, 9 intracharacter spaces, 3 intercharacter spaces and 1 word space. The space between a dot and a dash (within a character) is defined as one code element, the space between characters (within a word) as 3, and the space between words as 7 code elements. "PARIS", therefore, has 50 code elements. If "PARIS" is sent over and over at 5 WPM for 1 minute, you would have copied 5 X 50, or 250 elements.

For any code (slow, fast, Farnsworth etc.), count the elements sent in one minute, divide by 50, and the result will be Words Per Minute as defined internationally. Do not divide the total characters sent in one minute by 5 - the results can be very misleading. Many other commercial code training programs do not adhere to the international Morse definition. The Morse code test you receive should utilize the international definition for speed, and will be sent using conventional "Slow Code" - not Farnsworth "Fast Code".

INSTALLATION

Make sure the power is off to the Commodore 64 before proceeding. Check to ensure the cartridge edge contacts are clean. You may want to clean them with a pencil eraser first, then clean any remaining eraser gum using a cotton swab and isopropyl alcohol. Avoid touching the contacts with your fingers or anything else that may cause a static-discharge to them as the integrated circuit can be damaged. Install the cartridge in the Commodore 64 Cartridge Slot on the right rear surface of the computer (near the power light). Plug in the cartridge with its label facing up. Make sure it is fully seated.

If you are using a TV set with your Commodore 64, you can use the TV audio section as your audio output, so skip to the next page. If you are using a monochrome monitor (with no audio amplifier and speaker provisions) as a display, you will need to use an audio output device. On the Audio/Video 5-pin DIN connector on the back of the Commodore 64, pin 4 is Video Out, pin 3 is Audio Out, and pin 2 is Ground. The Commodore 64 alone does not have sufficient drive to power an 8-Ohm speaker, (and barely enough for some headsets) so an amplifier-speaker combination is necessary. We recommend either the AEA PSK-1 Mobile Speaker (\$39.95 Amateur net), which requires a separate 12-Volt supply, or the Radio Shack Archer Mini Amplifier-Speaker (Radio Shack P/N 277-1008, \$11.95) which uses a 9-Volt battery. See the INSTALLATION DIAGRAM on the facing page.



INSTALLATION DIAGRAM

STARTING THE PROGRAM

After you install the cartridge, turn on the Commodore 64. The screen should now show the usual "**** Commodore 64 Basic V2 ****" with 30719 bytes free. If the screen shows 38911 bytes free, then the cartridge is not properly installed in the cartridge slot. Try reinserting the cartridge and/or cleaning the edge connector as described in the INSTALLATION section (pg. 2). If you are still unable to get the correct response, refer to the section IN CASE OF TROUBLE on pg. 24.

Now "boot" the software. If you are using a color TV set as a display, type this:

SYS 33330

and press the <RETURN> key.

If you are using a monochrome computer monitor (CRT) or black-and-white TV set, type:

SYS 33333

and press the <RETURN> key.

The screen should now show the Main Menu below:

MORSE UNIVERSITY™

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SELECT :

- L. LEARNING
- P. PROFICIENCY
- A. SENDING ANALYSIS
- R. RECEIVING GAME
- K. MORSE KEYBOARD
- T. SELECT TONE
- C. SELECT COLOR
- B. BACK TO BASIC

Let's look at each of the Main Menu selections.

B. BACK TO BASIC

This selection gets you back to the BASIC language of the Commodore 64 without removing the cartridge. The "B" is in reverse video as a reminder that you must press <CTRL> , that is the key while you are holding down the <CTRL> key. This helps prevent accidents that might destroy some of the program parameters you have set.

C. SELECT COLOR

If you are using a color TV or color monitor as a display, one of the first things you should do after starting the program is select the colors you would like to use. This selection lets you set the colors of the characters, the screen background and the border.

The first Select Color display looks like this:

CHARACTERS:

- A. BLACK
- B. WHITE
- C. RED
- D. CYAN
- E. PURPLE
- F. GREEN
- G. BLUE
- H. YELLOW
- I. ORANGE
- J. BROWN
- K. PINK
- L. DK. GRAY
- M. GRAY
- N. LT. GREEN
- O. LT. BLUE
- P. LT. GRAY

Choose a Character color, and the next display will appear. It is similar to the above, except it is labeled "SCREEN:". Pick a Screen background color that looks nice against the character color you have already chosen (do not make it the same color as the character color, or you will not be able to read the characters). Finally you will see another similar display labeled "BORDER:". Select a color for the border, and your choices should have taken effect. You should now be back at the Main Menu.

IMPORTANT NOTE :

Pressing <RUN/STOP> at any time will get you back to the Main Menu, without changing the colors.

T. SELECT TONE

This selection lets you set the pitch of the Morse sidetone you will be listening to for the rest of the program. The screen looks like this:

- S. SOUND TONE
- + . HIGHER TONE
- . LOWER TONE

Press <S> to hear what the tone sounds like. If you would like a higher pitch, press <+> until the tone sounds good to you. For a lower pitch, press <->. Now press <RUN/STOP> to get back to the Main Menu.

L. LEARNING

The Learning routine emulates the operation of AEA's BT-1 Basic Morse Trainer, by teaching the Morse characters by sound one character at a time. It can help a student achieve good copying proficiency in the shortest possible time. By establishing two 20 to 30 minute study periods each day, the average student can develop an ability to copy the Morse code at approximately 20 WPM (Words Per Minute) after four weeks of study.

Each new step you take will present a new challenge -- be sure to practice on the current step long enough so you feel very comfortable that you are copying correctly at that level before you proceed. The Morse University Learning routine is meant to be used as a self-paced trainer. Do not be concerned with how others might be progressing. Each student is entirely different. Some may start out learning the first few characters quickly, but then bog down later because of insufficient practice. Others may show great difficulty at first, but find that the new characters become easier and easier to learn.

To best learn the code, the character elements (dots and dashes) should be sent at 20 WPM, with a three-second interval between characters or letter groups. This ideal method of learning characters at a higher speed eliminates the learning plateau that so many Morse code students encounter at 10-12 WPM. This is because when the code is learned at a 20 WPM element speed, the speed of any given character will not change from 0-20 WPM, thereby making it much easier for you to increase your speed. This system does not encourage the student to learn "dot dot dash dot" for "F", but rather one cohesive sound of "dididahdit" (at an element speed of 20 WPM). As a result, the student will not have to unlearn bad habits such as counting dots and dashes in order to copy the code.

There are generally three ways of copying Morse code. Most students start out with pencil and paper since it is convenient. Others use a typewriter to copy the code since it is faster than writing and makes the copy more readable. The third way is to copy the code in your head, only writing down what is necessary. This takes a lot of practice, even after you know all the Morse characters. Copying the code in your head is however a worthwhile goal to work towards since it makes operating CW more relaxing and fun.

LEARNING TIPS

Write down everything you hear as you practice. Be sure to put spaces in their proper places so that it becomes a good habit for later copy of plain text code.

It is very important to maintain a well-disciplined schedule with good concentration. Each time you miss a day, you may find you have suffered a noticeable setback in your learning of the Morse code. Avoid all interruptions or outside interference so you can be assured of maximum concentration.

THE LEARNING SCREEN

The display in the Morse University Learning routine looks like this:

SESSION NUMBER: 36

01=F	17=J	33=0	49=SN
02=K	18=O	34=8	50= ;
03=B	19=E	35=4	51= :
04=Q	20=R	36=7	52= (
05=T	21=S	37=.	53='
06=C	22=G	38=,	54="
07=Z	23=N	39=?	55=CH
08=H	24=L	40=/	56=Ñ
09=W	25=V	41=---	57=É
10=X	26=I	42=AS	58=Ö
11=M	27=3	43=AR	59=Ü
12=D	28=1	44=SK	60=Ä
13=Y	29=6	45=KN	61=Å
14=U	30=9	46=BK	
15=P	31=5	47=-	
16=A	32=2	48=!	

W. NEW CHAR WT	1/N
G. GROUP SIZE	5
S. CHAR SPEED	20
D. DELAY	3.0

The characters above session 55 are foreign alphabetic characters. You will likely never need to know these characters, but they are available should you wish to learn them.

Session 55's character is the character combination CH as used in some languages; session 56 is a Spanish Ñ; session 57 is an accented É as in Spanish; session 58 is the German umlaut Ö; session 59 is the German umlaut Ü; session 60 is the German umlaut Ä; and session 61 is an accented Å as used in Swedish.

Lets look at the Learning Screen options:

Session Number - The session number refers to the number of the character you will be learning in the session as shown above and on the Character Sequence Chart on pages 10 and 11. When you choose a session number only the character corresponding to that number along with all previous characters will be sent. This insures that as you learn the Morse characters by session number you will not be exposed to any characters you have not yet learned. There are two ways of setting the number. Either type in the 2-digit number directly, or use the <CRSR Down> or <CRSR Up> keys to move the reverse-video block to the session number you want. If you type the number directly, type a number from 01 to 61. If you use the CRSR keys (lower right corner of the keyboard), <CRSR Down> moves ahead one session, and <CRSR Up> (press <CRSR Down> while holding down the <SHIFT> key) moves back one session.

W. New Character Weight - Pressing <W> causes the weight to cycle from 1/1 to 1/2 to 1/N and back again. 1/1 means that the new character appears all the time in the session, and no other characters will appear. 1/2 means the new character appears in the session about half the time, with all previous characters in equal proportion appearing the other half of the time. 1/N means that the new character appears in equal proportion with all previous characters.

G. Group Size - When you press <G>, the program waits for you to press one digit (1-9) as the group size. When you start a new session, you should enter a group size of 1, then progress to group sizes of 2, 3, 4, and 5, as mentioned before. Practice in groups longer than 5 characters should not be necessary.

S. Character Speed - Enter two numbers from 18 to 99 to set the speed at which the new characters will be presented.

D. Delay - Enter two numbers for the delay between character groups, from 01 (0.1 seconds) to 99 (9.9 seconds). A delay of 3.0 seconds is ideal for learning the code.

<RETURN> - When you have set up all the parameters and are ready to start the session, press <RETURN>, and code practice begins.

<SPACE> - To stop the code, press the <SPACE> bar, or any of the option keys (W, G, S, D, or a number).

<RUN/STOP> - Press <RUN/STOP> to get back to the Main Menu.

HOW TO START LEARNING

We recommend that you spend each 20-30 minute session practicing with one new character. You will first start by hearing the character all by itself (in groups of 1). Practice writing it down until you feel totally comfortable with it. You should repeat the sound of the character in your mind with dits and dahs when you are first introduced to the character in groups of 1. As an example, K should sound like "dahdidah" and F should sound like "dididahdit". Then proceed to groups of 2 where the new character is mixed 50 percent of the time with all the previous characters you have learned in a similar manner. Then progress through groups of 3, 4 and finally groups of 5. Be sure that you are copying correctly in groups of 5 before you progress to the next character.

Typically a student will learn a new character each 20 minute practice session. BE SURE to write down exactly what you hear as you practice and that you put the spaces in their proper place so that it becomes good habit. Start your training in the following manner:

1. Start with Session 01 (enter <0> <1>), Weight 1/1, Groups of 1, Speed of 20 WPM, and Delay of 3.0 seconds. Your copy should look like "f f f f . . .".
2. After you are comfortable with writing the letter F each time you hear "dididahdit," select groups of 2 and write it down so that it looks like "ff ff ff ff . . .".
3. Similarly, select groups of 3. Your copy should resemble "fff fff fff fff . . .".
4. After proceeding through groups of 4 and 5 in a similar manner, you will be ready to proceed to the next character.

Note that you should be sure to follow the EXACT sequence of character presentation outlined on the Character Sequence Chart (pp. 10, 11). If you don't, you will be presented with characters you have not yet learned or practiced. You should weight each new character to appear 1/2 the time against all previous characters you have learned.

Session 02

1. Set up the previous session (session 01), Groups of 5, and confirm that you can copy solidly.
2. Set up Session 02 (enter <0> <2> or press the <CRSR Down> key), Weight 1/1, Groups of 1, and write "k k k k . . .".
3. After you are familiar with writing K each time you hear "dahdidah," proceed to Groups of 2, Weight 1/2. Your copy should now resemble "fk fk kf ff kk . . .".
4. Progress through Groups of 3, 4, and 5, with a Weight of 1/2 as with Session 01.

To continue learning the rest of the characters the following general procedure should be observed for each new character:

1. Always start with the session number of the character you have most recently learned to make sure you know all the characters up to that point. Set-up Groups of 5 and a Weight of 1/N.
2. If in step 1 you find you are having trouble with any previous characters, go back to the session number of the character you are having trouble with and practice it in Groups of 1 through 5 with a Weight of 1/2 until you know it.
3. After you have made sure you can copy all the characters up through the last one you have learned, select the proper Session Number to start learning the next character.
4. Start with Groups of 1 and a Weight of 1/1 and practice writing the character until you are familiar with its sound.
5. After you recognize the sound of the character without hesitation change the Weight to 1/2 so you are practicing all the characters you have learned in groups of 1.
6. With the Weight still at 1/2 change the setting to Groups of 2 and practice until you are comfortable. Repeat this with Groups of 3, 4 and finally Groups of 5.
7. You should now have learned the new character and be ready to practice it along with all of the other characters. To best practice the characters you have learned go to the Proficiency routine or the Receiving Game. Using these other routines to practice the characters you have learned adds variety and helps you maintain concentration.

Repeat the previous steps until you have learned all the Morse characters you desire. The first 26 characters are alphabetic, and the 27th through the 36th are numerals. Following this, the 37th through the 46th characters are common punctuation and Amateur Radio ciphers. The 47th through the 61st characters are uncommon punctuation, and foreign alphabetic characters. For most students, the first 46 characters will fulfill all their needs in Morse code operation.

CHARACTER SEQUENCE CHART

G means GROUP SIZE; W means NEW CHARACTER WEIGHT.

<u>Session Number</u>	<u>Character</u>	<u>Character Introduction</u>	<u>Groups of 2</u>	<u>Groups of 3</u>	<u>Groups of 4</u>	<u>Groups of 5</u>
01	F	G 1	G 2	G 3	G 4	G 5
02	K	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
03	B	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
04	Q	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
05	T	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
06	C	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
07	Z	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
08	H	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
09	W	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
10	X	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
11	M	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
12	D	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
13	Y	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
14	U	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
15	P	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
16	A	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
17	J	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
18	O	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
19	E	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
20	R	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
21	S	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
22	G	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
23	N	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
24	L	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
25	V	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
26	I	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5

This completes the alphabet. Be sure you can copy these accurately and without hesitation before proceeding to the numerals, symbols and procedure signs.

Session Number	Character	Character Introduction	Groups of 2	Groups of 3	Groups of 4	Groups of 5
27	3	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
28	1	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
29	6	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
30	9	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
31	5	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
32	2	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
33	0	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
34	8	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
35	4	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
36	7	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
37	.	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
38	,	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
39	?	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
40	/	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
41	-	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
42	AS	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
43	AR	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
44	SK	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
45	KN	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5
46	BK	G 1, W 1/1	G 2, W 1/2	G 3	G 4	G 5

The remainder of the characters are optional. Their usage in Amateur Radio is limited.

47	-	Hyphen
48	!	Attention
49	SN	Understood
50	;	Semi-colon
51	:	Colon
52	()	Parentheses
53	'	Apostrophe
54	"	Quotation
55	CH	
56	N	Spanish
57	É	accent
58	Ö	German
59	Ü	German
60	Ä	German
61	Å	Swedish

SPECIAL CHARACTERS

For Session Numbers of 41 and above, the special signs and foreign characters not on the keyboard are linked to shifted keys and others on the keyboard as shown below:

<SHIFT> <A>	= German umlaut Ä	<#>	= [BK]
<SHIFT> <C>	= CH	<\$>	= [SN]
<SHIFT> <E>	= accented É	<+>	= [SK]
<SHIFT> <N>	= Spanish Ñ	<@>	= [AS]
<SHIFT> <O>	= German umlaut Ö	<*>	= [AR]
<SHIFT> <U>	= German umlaut Ü	<Up Arrow>	= [KN]
<SHIFT> <W>	= Swedish Å	<=>	= -

P. PROFICIENCY

The Proficiency routine emulates the trainer portion of AEA's MM-2 Morsematic™, Keyer-Trainer. It sends a pseudo-random sequence of code practice character groups, with programmable starting and finishing speeds during a programmable time frame. This is a typical display:

S. START SPEED 05
F. FINISH SPEED 20
D. PRACTICE DUR 10.0
C. CHARACTERS 36
G. GROUP 5-CHAR
M. MODE FAST

CURRENT SPEED 05

This display shows that code practice will begin at 5 WPM, and over a period of 10.0 minutes will gradually increase to 20 WPM. The code will consist of the letters A-Z and the numerals 0-9, which make up the content of session 36 (see Character Sequence Chart, pp 10, 11). The characters will be arranged in groups of 5, with an element speed of 20 WPM the entire code practice duration.

Here are the descriptions of each option:

S. Start Speed - The start speed can be any speed from 5 to 99 WPM. For speeds of 5 to 9 WPM, enter the speed as 05, 06, 07, 08, or 09 WPM.

F. Finish Speed - The finish speed can be any speed from 5 to 99 WPM. Note that the finish speed can be slower, faster, or the same as the start speed.

D. Practice Duration - This option sets the time it takes to get from the Start Speed to the Finish Speed, in tenths of minutes. Enter three digits for a duration of from 00.1 minutes to 59.9 minutes. For example to enter a duration of 8.0 minutes you should enter the following: <D> <0> <8> <0>. After the speed reaches the Finish Speed (as indicated by the CURRENT SPEED reading), the code practice continues at the Finish Speed until you stop it (by pressing the <space> bar or any of the option keys <S>, <F>, <D>, <C>, <G>, or <M>). If the Start Speed is the same as the Finish Speed, the code practice is sent at the same speed the whole time, so in this case the Duration setting is not important. Set a duration of 00.0 minutes for no increase in speed (high character speed with constant spacing between characters).

C. Characters - This is the same as the Session Number (refer back to the Character Sequence Chart, pp 10, 11). It picks the character set that will be used in code practice. If you know the Session Number that you want, just type in the two-digit Session Number. If you need a reminder of the characters included in each session, go back to the Learning menu and pick out the Session Number. Remember that the characters you get are the character for the session number, and all characters from previous sessions. For the letters A-Z, use Session 26. For the letters and numbers 0-9, use Session 36. For most of the characters you are ever likely to need in Amateur Radio, pick Session 46.

G. Group - Pressing <G> causes the program to alternate between 5-character groups (5-CHAR) and random length groups (RANDOM). Random length groups will vary from groups of 1 to groups of 9 in a random fashion.

M. Mode - Many people have found that it takes far less time to learn Morse code if the Morse elements are sent at speeds of greater than 12 to 15 WPM, but with spaces between elements much longer than normal for these speeds. This method is referred to as "fast code" in this trainer. It is also called the Farnsworth method. In this mode, the characters are sent at the faster of the two speeds (Start and Finish) and the space between is initially set to make the overall code speed equal to the slower speed. The extra inter-character space is gradually shortened (if the Finish Speed is faster than the Start Speed) or lengthened (if Finish is slower than Start) throughout the training period. At the end of the training period the code will continue at the Finish Speed.

"Slow" code sends the code with the proper inter-character spacing to match the element speed. Unless you can copy code at speeds greater than 12 WPM, we strongly urge use of the Fast code method. The M option alternates between FAST and SLOW code.

<RETURN> - Press the <RETURN> key to start code practice.

<SPACE> - Pressing the <SPACE> bar, or any of the option keys (S, F, D, C, G, or M) will stop the code practice.

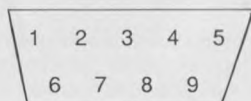
<RUN/STOP> - Press the <RUN/STOP> key to return to the Main Menu.

Note that the Proficiency routine uses the Session Number from the Learning program, but ignores other Learning options. In the Proficiency routine, the session's new character is weighted in proportion to all previous characters, which corresponds to a learning weight of $1/N$. The delay between groups is always a space sent at the current speed.

S. SENDING ANALYSIS/CONNECTING THE KEY

The Morse University Sending Analysis routine takes a look at your sending style or "fist" as it is referred to and compares it to machine-sent code. In this way, possible sending problems can be detected and worked on before you get on the air. The analysis is useful whether you are using a straight key, semi-automatic key ("bug"), electronic keyer or the <f7> key on the Commodore 64.

To connect a key or keyer to the Commodore 64, you need a 9-pin connector to plug into Control Port 1 (Radio Shack P/N 276-1538, \$2.49 and P/N 276-1539, \$1.99 or Jim Pak P/N DE9S, \$2.49 and P/N DE9H, \$1.39). This is the connector on the right-hand side of the computer closest to the front of the unit. Looking at the connector on the computer, the pins are numbered:



Pin 4 is the key input, and pin 8 is ground. For a straight key or semi-automatic key, just connect the key across pins 4 and 8. For an electronic keyer, make sure that the keyer's output is open-collector positive keying or equivalent; connect the key output to pin 4 and the ground to pin 8.

IMPORTANT NOTE: DO NOT plug a key or keyer into the control port of the Commodore 64 unless you are using the Sending Analysis routine. Having a key connected when in other routines can cause erratic responses. This is due to the internal construction of the Commodore 64.

If you want to try the analysis without a key or keyer plugged in, you can "key" using the <f7> key located at the right side of the keyboard.

The Analysis display looks like this at first:

```
C. CHAR ANALYSIS
S. SPACING ANALYSIS
```

You have the choice of pressing <C> for analysis of individual Morse characters, <S> for analysis of the space length between characters and words, or <RUN/STOP> to return to the Main Menu.

MORSE CHARACTER ANALYSIS

When you press <C>, the "C. CHAR ANALYSIS" option is displayed in reverse video to show which kind of analysis is being done.

Below the options, the routine asks you to send a specific letter, for example as follows:

SEND F

This means that you should send the letter "F" in Morse code, using a keying input or the <f7> key. It does not mean that you should press the <F> key. The letter you are asked to send comes from the Session Number in the Learning routine. For example, if you picked session 03 from the learning menu, the Character Analysis routine would ask you to send only F, K, or B. The Analysis routine does not use any of the other Learning options such as New Character Weight or Character Speed.

As you send the letter on your key, you hear the sidetone follow your key input. When you are finished sending the character, the Analyzer shows your average character speed and a picture of your dots and dashes as they might appear on an oscilloscope.

Then the routine sends a machine-sent version of the same character at roughly the same speed you sent yours. Beneath the picture of your character's dots and dashes, a display of the same character with perfect dot/dash/space proportions is shown. Now you can inspect the differences between your code and machine-sent code. Pay close attention to the dot/dash ratios, and make sure that all dashes are the same length, and all dots are the same length. Ideally, the space between dots and dashes should be the same length as the dots.

Now the routine is waiting for you to press <C> to analyze another character, an <S> to analyze spacing, or <RUN/STOP> to return to the Main Menu.

MORSE SPACING ANALYSIS

When you press <S>, the routine highlights the SPACING ANALYSIS option to show which kind of analysis is being performed. Beneath the options, it says:

SEND TEXT, PRESS E

This means that the analyzer is waiting for you to send a sample of text in Morse code using a key input or the Commodore <f7> key. There is room in the memory for about 45 characters, or about 9 words. At the end of your text, press the <E> key to show that you have finished sending.

You will get a list of statistics on your character and word spacing, followed by the analyzer's interpretation of the text you sent. Here is a sample display of analysis results:

C. CHARACTER ANALYSIS
S. SENDING ANALYSIS

SEND TEXT, PRESS E

AVG SPEED = 19 WPM

CHAR SPACING = 213 MS.
SHOULD BE 183 MS.

WORD SPACING = 401 MS.
SHOULD BE 427 MS.

THE QUICK BROWN FOX JUMPS OVER THE

In the example, the spacing between characters was a little bit too long, and the spacing between words was a little too short. We can tell the results are meaningful because the interpretation of the text ("THE QUICK BROWN FOX . . .") came out with the spacing correct. If the character or word spaces were way out of line, the text would appear with words broken up or run together.

If the analyzer could not find any character spaces or word spaces, the analysis shows "?? MS".

Note that in the character spacing and word spacing in the "SHOULD BE" displays, the ratio is always 3:7. This is because a character space should be 3 dot lengths, and a word space should be 7 dot lengths.

At this point the routine is waiting for you to press <C>, <S>, or <RUN/STOP>.

R. RECEIVING GAME

This section is a modest video game in which a character is sent, and you must press the corresponding key within a short period of time.

Your task is to protect a small town's antennas from a lightning storm. There are 19 houses, each with a 3-element beam on its roof. A series of single thunderclouds pass overhead. As each one approaches, it sends one or more Morse characters instead of a thunder clap. As soon as the character or characters have been sent, a lightning bolt is released. If you press the correct key or keys, the lightning bolt will blow up in mid-air and you will score 1 point. If you press an incorrect key, or if you are not fast enough, the lightning bolt will knock down the antenna on one of the 19 houses. When all 19 antennas have been knocked down, the game is over. The lightning bolts speed up as the game progresses, so your goal is to blow up as many lightning bolts as you can before all 19 of your antennas are gone.

Before you begin the game, go back to the main menu (using the <RUN/STOP> key) and press <L> to get to the Learning menu. The Receiving Game uses some of the Learning options, namely the Session Number, the New Character Weight (W), the Group Size (G), and the Character Speed (C). For a game in which you must recognize single letters and numbers, enter a Session Number of 36, a Weight of 1/N, Group Size of 1, and Speed of 20. Now press <RUN/STOP> to get back to the Main Menu, then <R> to get back to the Receiving Game.

Now you see this display:

SKILL LEVEL 0-9 :

To start out at the lowest or easiest level, enter <0> or just press the <RETURN> key.

Now at the top of the screen you see some indicators:

LEVEL 0

0 %

SCORE 0

The Level is an indicator of how fast the lightning bolts will fall, or how difficult the game is at this point. After every twenty correct responses, the game increases one level of difficulty. The percentage reflects the number of correct responses you have made so far. The score indicates how many times you were successful.

If you set a Group Size of 1, a single character will be sent before the cloud drops its lightning bolt, and you must press the correct key on the keyboard to prevent an antenna from being blown up.

If you are wrong, or not fast enough, your antenna disappears, and the correct letter appears over the bare roof, so that you will know the character next time. The next time occurs right away, repeating that character until you get it. For group sizes of 2 and more, several characters are sent, and then the cloud drops the bolt after the last character is finished. You must press the correct keys, in the correct order. If you make a mistake, an antenna blows up, and the character you missed appears over the house. The same character group is sent the next time, and again until you get all of it right.

This game is good practice since it forces you to react quickly when you hear Morse characters. Use it whenever you would like to practice the characters you have learned.

K. MORSE KEYBOARD

This routine gives you a means of composing your own practice for other students, with your own text. You can store up text, and then have it sent in Morse code, or you can sound out the letters in Morse as you type them on the keyboard.

What you see on the screen are three areas, divided by horizontal lines. The top area is a status line, which at first looks like this:

HOLD

20 WPM

10240

"HOLD" means that whatever text you type in will be held in a Transmit Buffer until you are ready to send it. The code will be sent at 20 WPM. The number on the right side stands for bytes free in the Transmit Buffer, which is 10,240 characters at the moment.

The second area is the Transmit Line, which shifts characters in from the right towards the left as they are sent, like a "Times Square" display.

The bottom area of the screen is the Transmit Buffer display. This shows the last characters you have typed into the Transmit Buffer. As you fill up the lower area, the text scrolls up a line at a time to leave room for the next line of text.

To try the keyboard routine out, type in a few lines of text. Notice that the number of Bytes Free, or available space in the Transmit Buffer decreases with every keystroke.

Now press the <f3> key on the right side of the keyboard. Note that the status line says "SEND" instead of "HOLD". You hear the code being sent; you can see it being shifted into the Transmit Line. As each character is sent, the number of Bytes Free increases, until it reaches 10,240, which means the Buffer is empty again.

When all of the text has been sent, try typing a few characters, and notice they are sent as soon as you type them.

Now press the <f1> key, and notice that the Status Line says "HOLD" again. Type some more text, then send it by pressing the <f3> key.

To correct mistakes before they are sent, you can use any of these keys to backspace:

<Left-Arrow> (upper left-hand corner of the keyboard)

<INST/DEL>

<CRSR Back> (<SHIFT> <CRSR Forward>, lower right-hand corner)

In this routine the function keys perform the following:

<f1> - Hold Buffer - This key puts the Transmit Buffer in Hold mode, so that you can type in and edit your text before it is sent.

<f3> - Send Buffer - This key puts Transmit Buffer in the Send mode, causing any text stored in the buffer to be sent. When the buffer is empty, characters are sent as soon as you type them.

<f4> - <SHIFT> <f3> - Clear Buffer - This key clears out the Transmit Buffer and blanks the lower part of the display.

<f5> - Change Speed - This key lets you change the code speed. When you press it, the display says "ENTER 2 DIGITS" on the Transmit Line. Type in two numbers for a new code speed of from 05 to 99 Words Per Minute. For speeds of 5-14 WPM, the code is sent as Farnsworth code; the characters are sent at 15 WPM and the space between characters is lengthened to make the overall rate 5-14 WPM.

OPERATING HINTS AFTER THE LICENSE ARRIVES

In Amateur Radio conversations (QSO's) on CW (Continuous Wave, or Morse code), the idea is to be as clear as possible in the shortest amount of time. Hams use abbreviations as often as they can to send as much information as possible with the fewest number of characters. Abbreviations are useful only if you and the person you are talking to know what they mean. The following is a list of common CW abbreviations you may encounter:

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 QSO with
HW	how	WX	weather
K	go ahead, over	XCVR	transceiver
KNW	know	XMTR	transmitter
MSG	message	XYL	wife
MTRS	meters	YL	young lady
NR	number, near	YR	year
NW	now	73	best regards
OM	old man	88	love and kisses

INFORMAL MEANING OF Q-SIGNALS

In addition to abbreviations, hams also use Q-signals. A Q-signal is a 3-letter group beginning with the letter Q that has a specific meaning. The most commonly used Q-signals, and their informal meanings appear below:

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?
QSB	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

To tie it all together are a few procedural abbreviations, some of which are used in every contact. The brackets around the letters mean that they are sent together with no space between them. The most common ones are listed with their meanings below.

--	(dahdidididah)	separates two thoughts like a period.
[AS]	(didahdididit)	wait, or waiting
[AR]	(didahdidahdit)	end of message
[SK]	(didididahdidah)	end of contact
K	(dahdidah)	go ahead (anyone)
[KN]	(dahdidahdahdit)	go ahead (only the station I am talking to)
[BK]	(dahdidididahdidah)	break, or back

SAMPLE QSO

Because of all the abbreviations, and Q-signals, a decoded CW QSO (contact) looks quite different from a written conversation. 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 callsign is KB2NYA. Go ahead (anyone)

KB2NYA DE KB2BOF K

Calling KB2NYA. This is KB2BOF. Go ahead.

KB2BOF DE KB2NYA GE OM 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 KB2BOF. Go ahead.

KB2BOF DE KB2NYA R FB MOE
-- RIG HR IS HEATH DX60B
RUNNING 6T WTS -- ANT IS
DIPOLE -- RCVR IS SX101 --
WX HR IS SUNNY ES TEMP ABT
5T DEGR -- SO HW NW MOE?
[AR] KB2BOF DE KB2NYA K

KB2BOF, this is KB2NYA. Okay, received. Fine, Moe. 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 KB2NYA. Go ahead.

KB2BOF DE KB2NYA OK MOE FB
-- WL QRM GETTING BAD HR SO
BETTER QRT FER NOW-- 73 ES
CUL MOE [SK] KB2BOF DE
KB2NYA K

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 [SK] 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. 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 callsign, and then K. If this does not bring a response, it is repeated until someone answers. The DE is sent only once during each CQ transmission. At the end of the CQ a K is sent which is a general "go ahead" to anybody. This makes sense, since KB2NYA does not know who will answer. Sending [KN] at the end of the CQ transmission would not make sense since it means "only the station I'm talking to, go ahead."

When you answer a CQ, or indeed call anybody, send the other operators callsign first, then DE, and then your callsign. This sequence is required and cannot be reversed. The DE is optional, but it is almost indispensable as a separator between callsigns.

OM ("Old Man") is a phrase from the early days of this century. It is equivalent to today's "pal" or "buddy" and is used mostly when you don't know the other operators name yet.

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 a few stations on the air sending periods, but the double dash is shorter, and you can send it repeatedly as you grope for words.

Signal reports on CW follow the much-abused RST format, which consists of the numbers 1-5 for Readability, 1-9 for Strength, and 1-9 for Tone. A detailed breakdown 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 perfect tone. The number 9 is frequently shortened to an "N", and reports of 5NN are cliché.

Some say the RST system isn't useful; that people aren't honest in their reports. In practice, the most useful portion is the middle number, the signal strength. Most people just send a 5 for readability since they can presumably hear the other station. Modern technology has put a T9 signal within everyone's grasp. The tone part of the report is still useful, since receiving a tone report of less than 9 indicates that you may have a transmitter problem. This may be the only way you would find out you had a problem. A good operator is accurate and honest in his reports.

Band conditions are not always quiet, and signal strengths are not always S9, so names, locations, and other important information is frequently sent twice. This gives the other operator a much better chance of copying everything correctly.

At the end of a transmission, send [AR], his callsign DE your callsign, 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. Sending [AR] followed by K is considered bad form.

The phrase "BK TO U" ("back to you") is a transitional phrase which implies the transmission will be ending shortly, so get ready to send. Other transitional phrases of this nature include "SO HW?" or "HW NW?". These also imply the question "how are you copying (receiving) my signal?". A typical response to this under good radio conditions might be "UR SIGS FB" ("your signals are fine business").

Since the zero in Morse is a fairly long character (dahdahdahdah), it is often abbreviated by a T (dah). This should only be done when the other operator is expecting to receive a number as in the following example: "MY XMITER RUNS 1TT WTS" ("my transmitter runs 100 watts"). EXCEPTION: In callsigns such as KA0XXX you MUST always send the complete 0.

On the last transmission from each side of a QSO, good byes are said and then the sign [SK] is sent instead of [AR]. This is the end of contact signal meaning the conversation is over.

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, the stiff format above 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 on something the other operator has said or ask questions to follow up what he has said.

For those who would like to practice "real" QSOs by computer simulation before actually getting on the air, AEA offers the unique Dr. QSO™ for the Commodore 64. Contact AEA (by mail or telephone - see back cover) for more information.

We welcome you to Ham Radio, and hope you enjoy the hobby for many years to come.

PARTS LIST

<u>REFERENCE</u>	<u>AEA P/N</u>	<u>DESCRIPTION</u>
C1	121-103	Cap. Ceramic .01 μ F
	or 121-104	Cap. Mono .1 μ F
U1	322-787	I.C. EPROM, Morse University™
Socket	400-028	28 Pin
Case	053-031	Comm 64 S/W
Manual	040-981	Morse University™

IN CASE OF TROUBLE

Please do NOT return the software cartridge if you suspect it needs repair without FIRST contacting our Service Department. Frequently, the unit is fully operational upon receipt. We would like determine if the unit needs to be returned before you do so - in many cases the problem can be isolated to other sources, saving the both of us time and money! Any correspondence should be directed to the address shown on the back cover of this manual. Do NOT use the back cover address for UPS deliveries! All deliveries other than mail should be sent to:

A.E.A., INC.
2006 196th SW
Lynnwood WA 98036-7009

Application and troubleshooting assistance may be had by calling AEA during our 8:00 - 12:00, and 1:00 - 4:30 working hours in Seattle, Washington and asking for the Service Department. Telephone (206) 775 - 7373. Please have your Software Support number and the release date of your software ready. The first you have recorded on the Support Agreement included with this manual, the second is available from the screen after system boot.

If the product has to be returned for WARRANTY SERVICE and is sent via mail or UPS surface (brown), it will be returned prepaid UPS surface. If it is returned to us by UPS air (blue), Express Mail or one of the overnight services, it will be returned prepaid UPS air. Transportation charges for all NON-WARRANTY work will be born by the customer. All items returned for NON-WARRANTY service will be returned by UPS surface unless otherwise specified.

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Customer Name _____
Address _____, City _____, State _____, Zip _____
Phone: (_____) _____
Product _____
Purchased from _____
Support Number _____
Customer Signature _____
Date _____
Support Transferred to _____
Address _____, City _____, State _____, Zip _____
Phone _____
Date _____
For AEA by _____ Date _____

NOTES

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Customer Name _____
Address _____, City _____, State _____, Zip _____
Phone: (_____) _____
Product _____
Purchased from _____
Support Number _____
Customer Signature _____
Date _____
Support Transferred to _____
Address _____, City _____, State _____, Zip _____
Phone _____
Date _____
For AEA by _____ Date _____



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