

Coach Morse - Morse Code Practice Unit

AA1PJ

The following describes the features and operation of Coach Morse, a Morse code practice unit. This device should help you learn and improve the speed at which you can receive Morse code. It was designed to provide a reliable, easy-to-operate unit with the most features for the lowest possible cost. Unlike other units on the market, it uses very low power. A set of 3 AA batteries can last several thousand hours!

Why use a unit such as this for improving code speed? Few would argue that the only way to get good at receiving Morse code is practice, practice, practice. Code tapes are one popular method, but they are not very flexible. They only send code at fixed speeds, and the messages sent tend to be memorized after listening to them a while. Furthermore, a tape recorder is not always available, and they are often too cumbersome to carry around. Computer programs for sending code are great in that most allow you to choose your sending speed, and they continually send fresh code. But they too are not always available, and even laptop and notebook computers can be too cumbersome to carry around. In addition, every time you want to listen, it can take a minute or so to boot the computer up and get your software set up and running. Listening to code on the air can be excellent practice, but again it is not very flexible and you don't always have a radio with you.

What this device provides is a small, portable unit that you can keep with you and turn on quickly to listen at convenient periods of the day: riding in the car, commuting to work, while exercising, during TV commercials (if you're one of those who watches TV), while you are on the john, during boring meetings at work (just kidding), etc. You can turn the volume way down or use the earphone jack if you don't want to disturb others while you are listening.

Coach Morse includes the following features:

- Plays all letters, numbers and the 7 prosigns from the code tests.
- Random pattern will not repeat (at least in your lifetime!)
- Sends random length words.
- Can adjust speed from 3 to 120 words per minute. Novice, General, and Amateur Extra class speeds are very easy to obtain.
- Can switch between CODEX and PARIS methods of rating the speed.
- Supports Farnsworth method - you pick any character rate and any word rate.
- Repeat feature will repeat each character up to three times.
- Adjustable volume.
- Can have characters sent at the frequency that they appear in normal English text (so E, T, etc. occur most often).
- User can choose a character subset using a combination of two methods:
 - User directs that only the first *n* characters from the character list be sent. (Used for the Koch method.)
 - User enters up to 16 favorite characters and specifies how often (on average) these are sent in place of the regular set.
- All settings are remembered when you shut the unit off.
- Affordable! Priced cheaper than many code tapes.
- Can replay code if desired.
- Very low power consumption—a set of 3 AA batteries can last several thousand hours of continuous play!
- Automatic power off — power turns off automatically after a user-defined period of time.
- Free PC software can generate answers.

Admittedly, one of the main limitations of this unit is that it does not send random QSO's (although it can send with the "rhythm" of actual English text). Adding the feature of sending simulated QSO's would have added quite a bit to the cost. We suggest you take Coach Morse with you everywhere and play code whenever possible. Then listen to a PC program (shareware versions are available), tapes or radio to practice receiving QSO's at times you are able to do so.

USER'S GUIDE

This section covers operation of Coach Morse. It is divided into two major sections. The first section provides a background on code speeds and learning methods. The second covers actual programming of the unit. A command summary is given at the end.

BACKGROUND ON LEARNING MORSE CODE

Morse Code Speed

To understand code speed, it is helpful to look at the method in which code is generated. Code di's (dots) and dah's (dashes) and the spaces between them are sent using standard fixed time intervals. A di takes one unit of time, a dah takes three units of time, the space between di's and dah's of the same character takes one unit of time, the space between characters takes three units of time, and the space between words takes seven units of time. When sending code at a given speed, these units of time remain fixed in duration, and consequently the letters and words take varying amounts of time to send. For example, an 'E' (dit) takes one unit of time to send while a 'Y' (dah-di-dah-dah) takes 13 units of time to send. Similarly, words, even those having the standard number of characters (five), will take varying amounts of time to send.

Code speed is given as a number of words per minute (WPM). Because characters take different amounts of time to send, and because words have different numbers of characters (although we use 5 letters as the average word

size), code speed must be based on the sending of a standard "word". Two choices, PARIS and CODEX, are commonly used as this standard word.

PARIS, which takes 50 units of time to send (including the space between words) is representative of standard English text; i.e., it takes about the same amount of time to send as the average word. Morse code was purposefully designed so that the more common characters, such as 'E' and 'T', take the shortest amount of time to send, making the average text flow as quickly as possible.

CODEX, which takes 60 units of time to send (including the space between words) is representative of words consisting of random letters; i.e., CODEX takes the same amount of time to send as the average 5-letter "word" of random characters. To convince yourself that the average random word takes 60 units of time, compute the average time to send a random character. (Do this by totaling up the amount of time required to send each of the 26 letters and dividing by 26.) Multiply the average by five and add 19 units of time: 12 for spaces between characters and 7 for the time between words. The result is pretty close to 60 units of time.

The bottom line is that you should use the (slower) PARIS method if you want to hear each character at the rate it would be sent in normal English text. Use the (faster) CODEX method if you want to be writing down random characters at a given rate. We recommend becoming proficient at a given speed using the CODEX method, so when you hear normal English text in a code test, it will sound slower (but you'll be writing the characters down at the rate you're accustomed to).

Farnsworth Method

The classical way to learn code is to start slow and then build up to a higher speed. The problem is that you tend to develop a "table lookup" in your brain, and a plateau develops as you try to progress beyond 10 or so words per minute. You just can't "look up" the characters quickly enough. You need to be learning the

characters by sound and not as a pattern of dots and dashes. Do this from the start and you won't have to relearn it as your speed improves. Writing them down should become a reflex.

Most experts agree that the Farnsworth method is the best way to learn code at a given speed. With the Farnsworth method individual characters are sent at the target speed, but extra space is sent between characters and words to slow the rate at which you have to translate. As you improve the extra space is decreased. This way you learn from the beginning how each character sounds at the target rate. Translation becomes more of a reflex.

To use the Farnsworth method you need control of two sending speeds. We will call these the "character speed" and the "word speed". From the beginning put the character speed at your target rate (13 WPM for the General class exam and 20 for the Amateur Extra exam). Each individual character will then come at the target speed and you learn how it sounds at that speed. Start with a slow word speed, so you have time to think about the characters. Gradually increase the word speed as you improve.

Koch Method

The Koch Method provides one proven method for learning the character set with a minimum amount of frustration. With this method you start with an initial set of two characters. Practice listening to random code containing only these two characters. Listen to the characters at your target speed. You can start with a lower word rate and slowly build it to the target speed (i.e., Farnsworth method). When you can copy this code at your target speed with 90 percent accuracy, then add a third character to the set. After this new character is added your overall accuracy will go down at first and will then build back up. When you can copy code containing these three characters with 90 percent accuracy, then add a fourth character. Continue in this manner, adding an additional character each time your accuracy reaches 90 percent. In this way you learn the characters at full speed from the start, and you only have to learn one new character at a time. The

characters become reflex with a minimum amount of effort.

Note that each time you add a new character to the set, you can learn the new character more quickly if it occurs more often than the others. Coach Morse will easily allow you to do this using the "favorite character set" as described below.

In what order do you learn the characters? Don't start with E and T (the shortest characters) as they will come at you much more quickly than you can copy. The following order has been suggested and is the one built into Coach Morse:

K M R S U A P T L O W I . N J E

F O Y , V G 5 / Q 9 Z H 3 8 B ? 4

2 7 C 1 D 6 X <BT> <SK> <AR>

Other Tips:

Did you ever notice that when you copy down a phone number that someone tells you quickly, you will be several digits behind in writing it down? When the digits come at you quickly you just don't have time to get them "translated" and written down before you hear the next one. Similarly, people who can copy code at the higher rates will "copy behind" up to 5 characters or so. Many agree that forcing yourself to copy behind a few characters at slower speeds will help you in reaching the higher speeds.

When you listen to "real" code, don't try to figure what is being sent as it is coming, and don't try to guess the next character. It is easy to get fouled up and begin missing characters.

Listen to code at a rate which is a little faster than you can copy.

Use Coach Morse's repeat feature, and say the characters to yourself each time they're repeated.

Don't think of code in terms of "dots" and "dashes". Use "di" and "dah" so you relate

more to how the code sounds rather than how it looks.

PROGRAMMING INSTRUCTIONS

This section covers operation and programming of Coach Morse. It covers general programming information and gives details of all operations. A quick reference guide is given at the end. To get started quickly you can read the introductory information below and then skip down to the reference guide.

General information

Coach Morse is programmed using Morse code. (Hey, you're trying to learn code anyway, so why not?) All commands are single characters entered in Morse code. Most commands put the unit in a mode where some programming parameter is sent and/or changed. Any command can be entered at any time (exception: if you are currently adding or deleting favorite characters you must wait about 2 seconds until the unit starts playing back the characters).

At any time the unit is on it is sending something, either random code or programming parameters. The programming information is sent over and over until a new command is entered, giving you a chance to read and perhaps change it. Note that you can use a speed changing command to slow down the speed during programming if you can't pick up what it is saying.

Code should be entered at around 6 WPM. The tone changes slightly as the key press changes from a di to a dah. An extra long push (about 2 seconds) at any time will turn the unit off. This can also be used to cancel an entry (e.g., dah di daaaaaah). Note that when you are entering code, the tone is slightly higher than when the unit is playing code.

There are several different error tones: one for entering a character which is not a Morse code character, one for entering a command which is invalid, and one for entering too many favorite characters or for deleting a favorite character which is not in the set (see below).

Listen/change commands

Many commands (C, W, V, M, F, S, T) are of the listen/change type. These commands will cause the unit to output a value (in Morse code) and allow you change it. After the command is entered the value and a keyword are sent repeatedly. This playback will continue until a new command is entered. If a number is entered during this playback, then the value will be set to that number and playback will continue with the new value.

As an example, at any time you can enter V in Morse code using the push-button, and the unit will change to a "program volume" mode.

While the unit is in this mode it will continuously send "N" VOLUME where "N" is a number from 0 to 9 representing the current volume level. At any time you can enter a new number (in Morse code) and the volume level will change to that value.

Numbers may have one or more digits. For multiple digit numbers just enter the digits using less than a 2-second gap between digits. A quick tone will sound when the unit considers the previous character to be complete and the unit is ready for the next character. After the two-second gap the number is considered to be complete and the unit begins playing back the new value and its keyword. Entering a new digit after this time will then begin a new number, thereby replacing the old one. Numbers out of range are brought back within range. (E.g., entering a volume of 25 will cause the volume to change to 9, the maximum possible). Numbers entered at unexpected times are ignored.

On, Off, Canceling commands, and Reset – O, long push

An extra long push (about 2 seconds) at any time will cancel the current entry and turn the unit off. The unit will also turn off automatically (if the APO timer is enabled—see below) if no commands are entered for a user-defined period of time. When the unit is first turned off, it is put in a "drowsy mode" for 10 seconds. During this time, entering any command (or other character) will turn it back

on and cause the command to be executed. If no commands are entered during this 10-second period, the unit is put in a low power “sleep mode”. Once in this state, the ‘O’ command (dah dah dah) must be used to wake it back up. This feature prevents the unit from coming on if the button is bumped accidentally when the unit is stored. Note that all settings are remembered when the unit is turned off.

Reset occurs when power is restored after the batteries have been removed. On reset all parameters are set to their default values. The unit will output the word RESET in Morse code to let you know that a reset has occurred.

Sending random code – E, R

Enter ‘E’ (dit) to begin sending random code. This may be done at any time. If the unit is in the drowsy mode, it will turn on and begin sending. Note that the characters are grouped into words of random length. Word length distribution is similar to real English; i.e., shorter words occur more often and the longest words occur only occasionally.

Entering ‘R’ (di dah dit) will also cause the unit to send random code, but each character will be repeated to help you in memorizing the sound patterns. The first time R is entered, each random character is played twice. Enter R again and each random character is played three times. Enter R a third time and each random character is played four times (the maximum). Entering E will return the unit to normal play.

Controlling speed – N, G, X, W, C, L, P

Novice, General, and Amateur Extra speeds:

The easiest way to set the speed is to enter ‘N’ (dah dit), ‘G’ (dah dah dit), or ‘X’ (dah di di dah) to change to Novice (5 wpm), General (13 wpm), or eXtra class (20 wpm) speeds, respectively. Unlike most other commands, these three commands do not change the mode; i.e., the unit will still send the same thing it was sending before the command was entered.

User Speeds: W and C are listen/change commands for setting the word and character speeds, respectively. Note that for Farnsworth

rates (see above) you should make the character speed faster than the word speed. Entering ‘W’ (di dah dah) causes the unit to send “W WORD WPM” repeatedly, where W is the value of the word speed. Entering a number will then change the word speed to that value. Similarly, entering ‘C’ (dah di dah dit) causes the unit to send “C CHAR WPM” repeatedly, where C is the character speed. Entering a number will then change the character speed to that value. The word rate can be set to any value between 3 and 120 words per minute. The character rate can be set to any value from the word rate to 120 words per minute. The character rate is automatically raised if you set the word rate above it.

Last user speed: The L command will return the unit to the last user speed, as entered via the W and/or C commands (i.e., the speed just prior to any N, G, or X command). This is useful if you wish to temporarily slow the speed (e.g., using N) and then return to your “user” speed. It is also useful to get back to your speed if N, G, or X was entered accidentally. Like the N, G, and X commands, this command does not change the mode; i.e., the unit will still send the same thing it was sending before the command was entered.

PARIS/CODEX: ‘P’ (di dah dah dit) will toggle between PARIS and CODEX methods of calculating speed (see the discussion on code speed at the beginning of the user’s guide). The unit will then send the word PARIS or CODEX, indicating the new mode. Note that this word is sent repeatedly, so timing it for one minute is a good check on the unit’s speed calibration.

Controlling volume – V

‘V’ (di di di dah) is a listen/change command for adjusting the volume level. When ‘V’ is entered the unit sends “V VOLUME” repeatedly, where V is the volume level. Entering a number will then set the volume to that level. Possible levels are from 0 to 9.

Controlling What Is Sent – F, M, A, D, Z

When playing each character of random code the unit will randomly select from one of two character sets. The first set is the regular set of all possible characters (or a subset thereof). This set contains the 43 characters from the amateur radio code tests: 26 letters, 10 digits, and 7 prosigns (period, comma, question mark, slant, <BT>, <SK>, and <AR>). The second set is a set of up to 16 “favorite” user-defined characters.

The command ‘F’ (di di dah dit) is a listen/change command (sends “**F** FAVORITE”) for selecting the fraction of characters, in sixteenths, which are chosen from the set of favorite characters. For example, if F is 0 then 0/16 (none) of the characters are chosen from the favorite set (all are from the regular set). If F is 5, then on average 5/16 of the characters are chosen randomly from the favorite set (11/16 are from the regular set). And if F is 16 then 16/16 (all) of the characters are chosen randomly from the favorite set (none are from the regular set).

The command ‘M’ (dah dah) is a listen/change command (sends “**M** CHARS”) for selecting how many of the characters in the regular set are actually used. The regular set of characters is internally ordered as given above in the section on the Koch method. A character will be randomly chosen from among the first M characters whenever a character from the regular set is to be sent. For example if M is 3 then a character is randomly chosen from among the first three in the list (K, M, and R) whenever a character from the regular set is desired. On power-up M is given a default value of 43, meaning that regular characters are chosen from among all 43 characters of the amateur radio exam.

Giving M a value of 44 (the maximum) has special meaning. Whereas other values of M cause characters to be chosen with equal probability, M equal to 44 causes characters to be chosen at the frequency they occur in normal English text. In this way E and T will occur much more often than Q and Z. Non letters are also mixed in occasionally. This setting

produces code which has a rhythm similar to regular English.

The commands ‘A’ (di dah) and ‘D’ (dah di dit) are used to add characters to and delete characters from the set of “favorite” characters. Unlike the listen/change commands, these are “change/listen” commands. After entering the command, you must immediately enter the characters to be added or deleted using less than a 2-second gap between. For example, entering “A X W Y <pause>” will add X, W, and Y to the set of favorite characters. As with entering multiple digit numbers, a quick tone will sound when the unit considers the previous character to be complete and the unit is ready for the next character. An error tone will sound if a character that is not a Morse code character is entered. A different error tone will sound if the user tries to enter more than 16 favorite characters or tries to delete a character that is not in the set. If an error occurs, the user has up to two seconds to retry the character.

After a 2-second gap the additions/deletions are considered complete, and the unit begins playing back the set of characters followed by a higher pitched tone to mark the end of the list. Note that if the list is empty, then all you hear is this higher pitched tone. Any characters entered after playback begins are considered to be new commands.

The user may enter up to 16 favorite characters. Characters may be duplicated to increase the probability that character is transmitted. For example, if the favorite character set consists of {A, A, B} and if F (the fraction of favorite characters) is 16, then A will be sent twice as often as B. If you delete a duplicated character, only one copy is deleted from the set.

The command ‘Z’ (dah dah di dit) will “zero” (clear) the set of user characters. As with commands N, G, X, and L (for changing speeds), this command does not change what is being sent. Whenever the character set is empty and F (the fraction of favorite characters) is non-zero, then ‘E’ is sent if a character is to be chosen from the favorite set.

Note that Coach Morse supports a variety of learning methods. Some examples are:

- To implement the Koch method (see above): increase M from 2 to 43.
- With the Koch method you may want to hear the new characters more often: put the new character(s) in the favorite set using A and set F to a value between 1 and (for example) 8.
- To hear all characters with the rhythm of English text: set M = 44.
- To work on a subset of characters by themselves: set F to 16, and use A to define your character set.
- To emphasize some favorite characters more than others: duplicate them in the set.
- Mix favorite characters with the entire regular character set so you don't know what to expect, but get lots of practice with your favorite characters.

Setting the seed for code replay and getting answers from the PC – S

The command 'S' (di di dit) is a listen/change command (sends "S SEED") for setting the internal random number generator to one of 256 possible values. When 'S' is entered the unit will randomly pick a new seed and begin sending "S SEED" where S is the new seed. The user can then enter their own seed value (from 0 to 255) if desired or keep the given

random value. By setting the seed, the unit is put in a known state so the (free) PC software can sync up with the unit's random number generator. The PC software can then output the random code produced by Coach Morse so the user can check their answers. Note that by resetting the seed to a previous value the user can replay the same code multiple times.

Note that the string of characters generated depends not only on the seed, but also on the commands M and F and the set of favorite characters. Changing any of these will alter the code pattern. The PC software will prompt for these values, and it will generate correct code until any of them changes. None of the other commands have any affect on the code pattern.

Automatic Power Off – T

The command 'T' (dah) is a listen/change command (sends "T APO TIME") for setting the Automatic Power Off (APO) time in minutes. If the unit is on (in any mode) for the given APO time without any button presses, then it will automatically turn off. This feature will save power if the unit is left on. (However, this is not generally important as the batteries last for several thousand hours of continuous operation!) It can also be used to time yourself if you want to listen for a given period of time without having to watch a clock or set an alarm. Setting the APO time to zero will disable this feature, and the unit will remain on until explicitly turned off by the user. On reset the APO time is set to 10 minutes.

Summary of commands - quick reference

In the first column of the table below:

space = optional pause, any length

nn = digits

cc = characters

Command	Meaning [range]	<Defaults>	Code	What is sent
long push	cancel / turn off [†]		daaaaaah	(turns unit off)
O	O n (if off > 10 seconds)		dah dah dah	(random code)
E	sE nd code (without repeats)		dit	(random code)
R	R epeat code (up to 3 times)	<no repeat>	di dah dit	(random code)
N	N ovice speed, 5 wpm	<NOVICE>	dah dit	(no change)
G	G eneral speed, 13 wpm		dah dah dit	(no change)
X	eX tra speed, 20 wpm		dah di di dah	(no change)
L	L ast user speed	<5/5>	di dah di dit	(no change)
W nn	W ord wpm [3,120]	<5>	di dah dah	W WORD WPM
C nn	C haracter wpm [W,120]	<5>	dah di dah dit	C CHAR WPM
P	P aris/codex toggle	<PARIS>	di dah dah dit	PARIS or CODEX
V nn	V olume [0,9]	<5>	di di di dah	V VOLUME
M nn	nuM ber of chars [1,44] 44 = realistic freq.	<43>	dah dah	M CHARS
F nn	F raction favorite [0,16]	<0>	di di dah dit	F FAVORITE
Acc	A dd favorite chars	<empty>	di dah	(favorite char set)
Dcc	D elete favorite chars		dah di dit	(favorite char set)
Z	Z ero favorite char set		dah dah di dit	(no change)
S nn	S et Seed [0,255]	<random>	di di dit	S SEED
T nn	APO T ime [0,255] 0 = disabled	<10>	dah	T APO TIME

[†] For first 10 seconds any command turns it on

Morse Code Characters

A	di dah	L	di dah di dit	W	di dah dah	7	dah dah di di dit
B	dah di di dit	M	dah dah	X	dah di di dah	8	dah dah dah di dit
C	dah di dah dit	N	dah dit	Y	dah di dah dah	9	dah dah dah dah dit
D	dah di dit	O	dah dah dah	Z	dah dah di dit	.	di dah di dah di dah
E	dit	P	di dah dah dit	0	dah dah dah dah dah	,	dah dah di di dah dah
F	di di dah dit	Q	dah dah di dah	1	di dah dah dah dah	?	di di dah dah di dit
G	dah dah dit	R	di dah dit	2	di di dah dah dah	/	dah di di dah dit
H	di di di dit	S	di di dit	3	di di di dah dah	<BT>	dah di di di dah
I	di dit	T	dah	4	di di di di dah	<SK>	di di di dah di dah
J	di dah dah dah	U	di di dah	5	di di di di dit	<AR>	di dah di dah dit
K	dah di dah	V	di di di dah	6	dah di di di dit		