

FMT MK4e Feature rich CW Trainer



User Guide

The FMT Tutor wasn't so much designed to be what it is today but it just evolved to this stage over a couple of years. It started as a simple practice tutor with a screen that was built on veroboard, and slowly more features and better ways to build it got added following FISTS members feedback. The final tutor is now offered in a nice case either ready to go (Fully Built) or as a DIY Full kit with as much support as

you need to get it going.

The FMT continues to evolve, The latest firmware will always be supplied.

The FMT is now full of features and options, since there are so few controls on the front of the unit I have had to use a short software menu to make some config changes. Most of the 'one off' settings can be selected by jumpers on the main board. There is a lot of flexibility with the FMT that can make it more complicated at first if you want to make changes. I hope the instructions below answer all your questions but I am only an email away if you need help

The latest version of the FMTMk4 is now called FMT MK4e.

This 'e' version of the FMT has a number of differences from earlier versions. The 'd' version had all the Morse Tutor modes as before but also a 39 lesson Koch Morse trainer, this is a better way of learning for someone that doesn't know the code at all. When they feel ready they can switch the tutor back to the standard FMT fully spec with just a few button pushes. This new 'e' version has only very minor changes, the main board now does not use the well known Arduino Nano module any more. The Nano is a great little module but it is getting harder to source good quality versions as many are cheap far east imported ones being sold as 'quality clones' but are in fact poor quality unreliable versions. I have to soak test each module to be sure that they are 'good' and it's surprising how many I reject. I have now moved to using a real ATMEGA 328 chip which is proving to be more reliable and easier to source. The only real change other than that is to allow the user to change the tutors pitch via a menu option in the setup screen.

The Koch trainer mode comprising of 39 'lessons' that start with just two characters (K & M) , when the user can recognise these 90% of the time it's time to move to the next lesson, each lesson adds a character at a time. The order the characters are added was developed by Ludwig Koch and has been shown to be a highly effective method of learning the code.

In addition to this I have added an interesting Historic mode called POW Tap Code. This is the method used by POW's to communicate amongst themselves by just tapping a wall/pipe or even a broom on the floor.

How to use the FMT mk4e

Well you have number of options, let's look at using it in different ways

Standard Morse tutor.

Turn the power knob to turn on the tutor. After the start-up screen the tutor will start sending Morse. The top line of the screen tells you what mode it is in. It will use the last used mode when it starts.

You can change the character speed and the gap between each from the controls on the front of the tutor. To change mode press and release the Mode button, no need to hold the button it will change mode once it finishes sending what code is in its short buffer. You will see a flash of the Blue LED when you press the button, this tells you the mode change has been registered and will happen when the current character/word as finished.

The tutor as 7 different modes and will cycle through them one by one as you push the mode button.

Now you have a few things you can change if you wish. The screen shows the last two groups of 5 characters, when the second group is finished the screen clears and starts again. Many club members have asked if this could be changed as they like to be able to write down what they hear and then use the screen to check what they have copied. So now the FMT can be set to pause for up to 10 secs before it clears the screen and starts sending again. If you want to set a pause before the screen clears you must take the following steps.

Turn off the FMT. Press and **HOLD** the Mode button while turning on the tutor. Do not release the button, after the start-up screen the display will say "Set Screen Delay" and show what the current setting is, to set the pause time now adjust the GAP control to set the value between 0 and 10 seconds, once you have the value you want release the push button and the value will be saved and used until you repeat this stage and set a new value (set to zero to turn this off)

The other options you have while in standard FMT mode are the max character speed. For most of us the standard setup will give you all the range of speed you will need, up to about 30 wpm, if you feel you need it faster inside the FMT you will find a block of 2 pin jumpers, one of these jumpers is marked 'Hyper', placing a jumper over these two pins will set the max speed up to about 50 wpm, if that's not fast enough then I don't think you need a tutor!

The final option you may want to change is the Advanced Contest mode (ACM), you will also find in that block of jumpers two pins marked ACM, a jumper over these (that's the default) will allow the speed and pitch to randomly change while using the tutor in contest mode, this makes things more realistic but if you don't want that remove this jumper.

Using the FMT as a Practice oscillator

Please Note, the FMT practice oscillator is just that, a practice oscillator, it is not a decoder, it will NOT display what you are sending. If you need to do that connect the AUX output to a PC and use software like CWGet, FLDigi and others to decode your sending.

The practice oscillator modes will only be available when in FMT Mode, not Koch Mode.

If using a straight key just plug the key in to the key socket (you must have a MONO plug on you cable) turn off the FMT and press and hold the key down while turning the unit back on, do not release the key yet, after the start-up screen clears the tutor will read the key and display straight key on the top line. The tutor will now respond to the key as you would expect.

To use a Paddle key with the FMT.

To start the FMT as an Iambic practice oscillator (Mode A or B, See below) you must plug the key into the key socket and turn on the FMT, press and hold the left hand paddle while doing this. Continue to hold the paddle until the display startup screen clears and the display will say Iambic Practice mode.

If using a paddle key you have a couple of options. Some of us prefer to use Iambic A or Iambic B mode. If you're not sure what the difference is let me give you brief heads up on what you will notice as the difference, a full detail explanation will be found with a bit of googling.

The following assumes you are right-handed and using standard paddle wiring. When you're sending a dah signal from the paddle and you touch the right hand paddle you will find (if you are using a slower Iambic speed) and you quickly release the paddle and touch the left paddle (the Dit paddle) before sending another Dah the Dit gets missed, sending letters like 'R' can be a problem and you find people can send a 'A' instead. The Dit is missed.

This is because the keyer only 'looks' at the paddle when the last element has finished. So if you're keying faster than the set speed you try and send the Dit before the Dah as finished so the keyer doesn't see that Dit. This is Iambic A mode.

If you switch to Iambic B mode (that's the default setting in the FMT) you will find it works different.

When you now hit the Dit paddle before the Dah is finished the keyer stores the Dit and will insert it in the right place for you when the Dah as finished. Many people like this and Iambic B seems to be the most popular amongst people I have spoken to.

Of course it's up to you, the default is jumper on two pins marked 'Iambic A/B' but remove the jumper and you will be in Iambic A mode. (left handers on the main board is another jumper marked 'REV', this jumper will do a paddle swap over to suit either left or right handers)

Now one more feature that some of you may like. So far we have looked at straight and paddle keys but we haven't considered a less used key that some people just love to use and is fun to try. The Cootie key.

Ok what is a Cootie key?

The traditional Morse key most people will think of is the straight key, with its up and down movement. This can give you a condition call 'glass wrist' or RSI causing pain when sending for long periods. A work around that can make things a little easier is to use a sideways mounted straight key, it's not exactly the traditional straight key as you can press it to the left or right as you would a paddle key but YOU control the duration of the keying signal not the keyer, so if you just touch the left side you get a Dit , if you then just touch the right side you also get a Dit, if you want a Dah press and hold either side a little longer. Often people send alternative sides so to send the letter 'P' you could start with touching the left side for a 1 count, then the right side for a 3 count, next the left side again but this time a 3 count then the right side for a 1 count. This can be hard to master but can reduce the strain on the wrist and once mastered its art form!

You may want to try this method yourself but don't have a cootie key. No problem I've got you covered!

Introducing the Cootie key emulator mode.

Now for this you can use your standard dual paddle key.

With the key plugged in and the unit off squeeze and hold the paddle, turn on the tutor and wait for the splash screen to clear, the screen will show (in all likelihood) Straight Key mode, that's not what we want, so what we need to do is the following, turn the tutor off and let's start again.

First turn the GAP control fully clockwise. Again with the power off squeeze the key and turn on the unit. This time the display will show 'Paddle Key Cootie Emulator'. Now either side of your paddle key will produce tone and it up to you to control the timing. Have fun.

Session Timer

The last thing to be aware of in the FMT mode is the session Timer, the little blue LED is connected to a timer and will light up bright every 10mins for 10 seconds, this is a signal to take a break, two or three 10 min sessions each day will be a great way to improve you RX skills.

Now what about this Koch Trainer Mode?

The Koch method of learning Morse is a great way for a complete beginner to learn the code.

How to select Koch Trainer Mode

To put the FMT into Koch Trainer mode is easy, turn off the tutor, press and hold the mode button while turning back on. After the start screen it will display 'Set Screen delay' as it did before, and if you want a delay on the Koch mode to allow for checking your receiving after 2 x 5 fig groups now is

the time to select the pause time as you did for the FMT mode, so set the time anywhere from 0 to 10 secs, now release the mode button. Now as soon as you do hold the mode button again. Now it will say 'Mode? Adjust Gap to select ' and next to that either FMT, Koch, or Tap. Turn the GAP control to choose or change modes. With the control turned to the left hand stop point you will see FMT selected, midway and it will say Koch, and to the right it will say 'Tap'. Adjust the control to your desired mode. When happy with your selection release the button and the mode will be set until you repeat the process.

If you are starting on the path of Morse you may want to follow a more structured method of learning the code.

A well respected method is one developed by Ludwig Koch. This was developed to produce instant character recognition, this is what we need to be good CW operators.

The way it does this is to start with just two different Characters, K & M. in the first lesson these two letters will be randomly repeated in groups of 5 characters. The student must learn the sound of the letters and not count the Dits and Dahs, to make it a letter sound it is important not to have to slow a character speed, I would suggest about 18-20 wpm. Set the speed control to the 3 O'clock position as a good starting point.

Now use the gap control to put a large gap between the characters. When you can recognise the letters you can reduce the gap between them. When you can correctly identify the letters 90% of the time (Not 100% note) move to the next lesson. (How to do that below) and start listening to the two letters you now know and the new extra letter added in this lesson. Work your way through the lesson as you improve by the time you get to lesson 39 you will have learned all letters numbers and a selection of punctuation.

To Change between lessons in the Koch mode press AND HOLD the Mode button, while holding it rotate the GAP control to change the displayed lesson number to the lesson you want (1 to 39). When you have selected the lesson number you want release the mode button and the Koch tutor will use the new mode.

You can set the delay before the screen clears as you did with the standard FMT mode, that way write down what you hear (without looking at the screen) and then when it pauses check what you have got right before it starts the next two 5 character groups.

Adjusting the Pitch/Tone used by the tutor (New in version 4e)

You have learned how to set the screen clear gap and how to select the FMT/Koch/POW mode, well now when you release the button after making the mode selection you can push it again and this time the pitch frequency will be displayed (and the tone heard) adjust the Gap control to adjust the pitch to your desired frequency.

P.O.W. Tap Code

This is a newly added mode, really added for historic interest and I don't expect 1000's of you all using this mode on Air (But you could!! Tap the microphone) Knowing this code could save your life in an emergency!

One of the most important parts of a POW's life was communicating with his fellow captives. The first communication between isolated prisoners of war may have been a name scrawled on a piece of toilet paper with the burnt end of a matchstick. Notes and whispers were attempted, but both were often detected and severely punished.

In June 1965, four POWs — Captain Carlyle ("Smitty") Harris, Lieutenant Phillip Butler, Lieutenant Robert Peel and Lieutenant Commander Robert Shumaker — who were imprisoned in the same cell in Hoa Lo devised a simple, secretive code. The four men, expecting to be split up again, vowed to continue their resistance. To do so, they knew communicating closely would be essential.

Harris remembered an Air Force instructor who had shown him a secret code based on a five-by-five alphabet matrix. Each letter was communicated by tapping two numbers: the first designated the horizontal row and the second designated the vertical row. The letter W, for example, would be 5-2; the letter H would be 2-3. The letter x was used to break up sentences and the letter "c" replaced the letter "k." (One of the famous, yet inelegant, usages of the letter "c" for "k" was in the transmission "Joan Baez Succs," which POWs sent around the camp after the American anti-war activist's songs were played over the camp's public address system.) Here is the way the alphabet code was set up.

TAPS	1	2	3	4	5
1	A	B	C	D	E
2	F	G	H	I	J
3	L	M	N	O	P
4	Q	R	S	T	U
5	V	W	X	Y	Z

The guards separated the four prisoners after one was caught passing a note, and thus inadvertently spread the code, as the separated men taught it to others. By August 1965, most of the prisoners had been initiated, and were passing messages by tapping on the walls to fellow prisoners. "The building sounded like a den of runaway woodpeckers," recalled POW Ron Bliss.

Stockdale also talks of the pleasures of coming up with abbreviations, a necessity imposed by the time constraints on both the message giver and receiver. "Passing on abbreviations like conundrums got to be a kind of game," remembered Stockdale. "What would ST mean right after GN? 'Sleep tight,' of course. And DLTBBB? I laughed to think what our friends back home would think of us two old fighter pilots [Stockdale refers to Air Force Major Samuel Johnson, in an adjoining cell] standing at a wall, checking for shadows under the door, pecking out a final message for the day with our fingernails: 'Don't let the bedbugs bite.'" POW Vice Admiral James Stockdale, recalling the code in the book he wrote with his wife Sybil, *In Love and War*, recalls sending the code: "Our tapping ceased to be just an exchange of letters and words; it became conversation. Elation, sadness, humour, sarcasm, excitement, depression — all came through."

Some of the acronyms entered POW popular usage. One acronym, GBU, was used as a universal sign-off. It was shorthand for "God Bless You."

This mode when selected will use the same random set of words and abbreviations as used in the FMT mode but now Tap code will be used to send these words. The 'Tap' sound is shorter than the Dit sound and cannot be adjusted. After all a tap is just a tap and cannot be elongated. It's the most basic form of communication we can do. The gap between letters can be adjusted by the 'Gap' Control. To give yourself more time to decode and check the message the screen delay setting you have set for the Morse tutor mode will also be used in this mode too.

A Larger conversion chart is at the end of this guide.

If you run into problems let me know and I am sure I can help.

Enjoy using the FMT Mk4e. 73 Paul

Common CW Abbreviations used in the FMT (also used in 'Tap Code' Mode)

ABT	About	RPT	Report/Repeat
ADR	Address	RX	Receiver
AGN	Again	SED	Said
ANT	Antenna	SIG	Signal
CUL	See you later	SKED	Schedule
ES	And	SRI	Sorry
FB	Fine Business	TMW	Tomorrow
GA	Good Afternoon	TNX	Thanks
GE	Good Evening	TU	To You
GM	Good Morning	UR	Your
GN	Good Night	VY	Very
GND	Ground	WKD	Worked
GUD	Good	WX	Weather
HI	Laugh	XYL	Wife
HR	Hear/Here	YL	Young Lady
HV	Have	XMTR	Transmitter
HW	How	RCVR	Receiver
NR	Number		
PSE	Please		
PWR	Power		

Koch Lesson Plan : Each lesson add a new character to the mix.

Lesson Characters

- 1 K,M
- 2 K,M,R
- 3 K,M,R,S
- 4 K,M,R,S,U
- 5 K,M,R,S,U,A
- 6 K,M,R,S,U,A,P
- 7 K,M,R,S,U,A,P,T
- 8 K,M,R,S,U,A,P,T,L
- 9 K,M,R,S,U,A,P,T,L,O
- 10 K,M,R,S,U,A,P,T,L,O,W
- 11 K,M,R,S,U,A,P,T,L,O,W,I
- 12 K,M,R,S,U,A,P,T,L,O,W,I,' . '
- 13 K,M,R,S,U,A,P,T,L,O,W,I,' . ',N
- 14 K,M,R,S,U,A,P,T,L,O,W,I,' . ',N,J
- 15 K,M,R,S,U,A,P,T,L,O,W,I,' . ',N,J,E
- 16 K,M,R,S,U,A,P,T,L,O,W,I,' . ',N,J,E,F
- 17 K,M,R,S,U,A,P,T,L,O,W,I,' . ',N,J,E,F,O
- 18 K,M,R,S,U,A,P,T,L,O,W,I,' . ',N,J,E,F,O,Y
- 19 K,M,R,S,U,A,P,T,L,O,W,I,' . ',N,J,E,F,O,Y,' , '
- 20 K,M,R,S,U,A,P,T,L,O,W,I,' . ',N,J,E,F,O,Y,' , ',V
- 21 K,M,R,S,U,A,P,T,L,O,W,I,' . ',N,J,E,F,O,Y,' , ',V,G
- 22 K,M,R,S,U,A,P,T,L,O,W,I,' . ',N,J,E,F,O,Y,' , ',V,G,5
- 23 K,M,R,S,U,A,P,T,L,O,W,I,' . ',N,J,E,F,O,Y,' , ',V,G,5, /
- 24 K,M,R,S,U,A,P,T,L,O,W,I,' . ',N,J,E,F,O,Y,' , ',V,G,5,/,Q
- 25 K,M,R,S,U,A,P,T,L,O,W,I,' . ',N,J,E,F,O,Y,' , ',V,G,5/,Q,9
- 26 K,M,R,S,U,A,P,T,L,O,W,I,' . ',N,J,E,F,O,Y,' , ',V,G,5/,Q,9,Z
- 27 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
- 28 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
- 29 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
- 30 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
- 31 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,?
- 32 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
- 33 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
- 34 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
- 35 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
- 36 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
- 37 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
- 38 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
- 39 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

P.O.W. Tap code

How to read and use the code.

	1	2	3	4	5
1	A	B	C	D	E
2	F	G	H	I	J
3	L	M	N	O	P
4	Q	R	S	T	U
5	V	W	X	Y	Z

The matrix above shows the order of the letters used in this code, let's say we want to send the word hello.

The first letter 'H'.

It's in the second row so that's a 2.

It's in the 3 column so that gives us a 3.

So to send the H we would tap twice, then pause and the tap 3 times.

The next letter 'E'

1st Row, 5 column, so 1 tap, pause, 5 taps.

Then two 'L's

3rd Row, 1st Column, so 3 taps, pause, 1 tap

Repeat for second 'L'

Final 'O'

3rd Row, 4th column, so 3 taps, pause, 4 taps.

Not the fastest communications method but it works well.

The keen of eye will notice that there is no letter 'K' in the matrix, This is not a mistake.

The letter 'K' is normally replaced by 'C' and it's left to the receiver to decide if it's intended to be a C or K depending on the context.

An interesting and historic code for sure.

Your FMT MK4e Features

Morse Tutor Features:-

7 Modes:-

- Random Letters,
- Random Numbers,
- Random Mixed letters/Numbers
- Random Prosigns
- Random International Callsigns
- Random Common words and Abbreviations
- Contest mode (With changing pitch and speed)

User adjustable, Pitch, Speed, Gap, Volume.

User adjustable High Speed Mode.

User adjustable Screen Clear delay.

10 Minute Session Timer indicator LED

Koch Tutor Mode:-

39 structured Koch training lessons (developed by Ludwig Koch and has been shown to be a highly effective method of learning the code.)

User can change lessons at will.

POW Tap code Mode

Try your hand at this very simple but effective historic Prisoner of War communication method.

Practice Oscillator Modes

In addition the Tutor can be set as a practice oscillator for :-

Straight Keys,

Iambic (users selectable Mode A or B, also Rev paddle option)

Cootie Key Emulator (Lets you use a standard paddle key as a Cootie)

Extra Features:-

Fixed Low level Sinewave output for use over Zoom/teams/Decoders etc

Phones/external speaker output with option to limit volume level if using headphones.

Internal 9v battery or external DC supply via 2.1mm DC power socket.