

FMT MK4_{SMD} 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 FMT is the FMT MK4g Now with a part SMD PCB

'g' Version Firmware Notes

The 'g' Version Firmware only has a small customer requested modification that will be of limited interest I am sure but since it didn't cost anything to add this feature it was worthwhile. Now when you go into the setup menu the last option is signal generator. When active this option will continually produce tone between 100Hz and 5KHz, the frequency of the tone is adjustable by using the GAP (Course) and SPEED (fine) Controls. To exit this function turn off and on the FMT. This feature can be used when testing audio filters and amplifiers, normally use the AUX output on the rear of the FMT for this signal. The signal isn't perfect by any means but can be useful if you need to do a quick test as the frequency readout is accurate to a few Hz, it's a zero-cost addition that may be of use for some.

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 we 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.

The FMT can be used as a basic keyer too, a few extra parts allow the user to select what the AUX output does, a 3 way jumper block on the board can be set for low level audio output or for the AUX output to be used as a keyer for a radio. See notes later in this guide for details.

From Oct 2023 the FMT came out with a small change. It was only a change to a part SMD PCB to speed up the build time, the features remain the same. The older FMT had a number of two pin jumpers to set different options but the new version uses a bank of PCB switches

How to use the FMT MK4g

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 (**Now you will see 0-11 but don't use 11 just yet read the rest of this document first as its not 11 seconds but screen hold not pause**), 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)

From rev 'F' firmware we have made a small change to the pause screen option, you will notice you can set this to 11 not just 10, well 11 is NOT 11 seconds delay, in fact 11 is a full screen hold. The screen will not update and the tutor will display the last screen full of characters until you tap an attached Morse key (or left paddle if using a paddle key). This means you have as much time as you need to check your readback, once you have checked a tap of the key will release the screen and the next group will be sent. This feature needs some form of Morse key attached to the tutor to work correctly, if you don't have a key connected then only use the pause feature up to setting of 10 seconds. There is also a position associated with this new feature on the bank of switches, its marked '2', with the switch set to 'OFF' the hold feature is only enabled on the basic modes (random letters, numbers, mixed), with the switch set to 'ON' fitted the feature will work on ALL modes including the advanced ones such as callsigns, contest etc.

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 Switch position '5' 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), That is switch '4', with this set to ON (that's the default) it 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 set the switch to OFF.

Default Switch Settings (Details of functions in instructions)

Switch Setting

- 1 Left/Right Paddles Standard (ON Default, OFF Reve Paddles)
- 2 Full Screen Hold (OFF Default)
- 3 Iambic A/B (ON Default= Iambic B / OFF=Iambic A)
- 4 Advance Contest Mode (ON Default)
- 5 Hyper Speed setting (OFF Default)
- 6 Volume Limiter for Headphones (ON Default)
- 7 & 8 Not Used in this firmware

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 fix low level sinewave audio output (marked AUX output on the rear of the tutor) to a PC and use software like CWGet, FLDigi and others to decode your sending.

Please Note:-

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 setting is controlled by switch '3' but switching this to 'OFF' and you will be in Iambic A mode. (left handers use switch 1 and you can do a paddle swap over to suit either left or right handers) (ON is Iambic B (default) / OFF is Iambic A.

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 it's 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 lesson.

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 5 character group. (Screen hold feature will also work in this mode)

Adjusting the Pitch/Tone used by the tutor

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.

If you now release the Mode button all the adjustments are saved and stored for next time you use the tutor.

If you quickly repress AND HOLD the mode button after adjusting the Pitch the screen will now show 'Signal Generator' the FMT will now function as a very simple audio frequency signal generator over the range of 100Hz to 5KHz. The Gap and speed controls now will adjust the frequency, the frequency is displayed on the screen. It is intended that the AUX output is used for this function connected to an amplifier or filter undertest. The output is not perfect but will provide a useful no extra cost feature. To exit this mode turn the FMT off .

Screen Brightness and Contrast

The back of the LCD display module has a small trimmer attached that if you wish you can adjust to change the contrast of the text on the screen. Also from version 'F' a small piggy back board is plugged

into the two pin connect on the edge of the display board. This board also has a small trimmer fitted that will adjust the brightness of the display (saves battery power if set low), you could even remove the piggy back board and the display will no longer have a LED light BUT its still readable and that will save a lot of battery power.

Keyer

Inside the FMT you will find a 3 pin header block marked AUX/Keyer . To use the FMT as Standard (AUX is low level Audio Output) you need to put the 2 pin jumper on the bottom two pins of the 3 way header, to use the FMT as a keyer then you need to put the jumper on the top two pins (nearest to the headphone socket). You will need a paddle key of course to use this feature and then the Speed control will adjust the keyers speed. The setting for the Iambic mode will also work with the keyer option.

P.O.W. Tap Code

This is a newly added mode (from version 4e) , 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 . 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.

Good Luck with your FMT

73 Paul MOBMAN