FMT MK3   Feature rich CW Trainer

If you're looking for a easy to build but powerful Morse tutor this is it!

Designed for the FISTS CW Club this tutor offers a wide range of features that you will find hard to beat. The tutor modes are:

Random Letters, Random Numbers and Mixed Modes which is the standard from the old type of tutors, but this tutor also offers much more;

Random Prosigns, Random Callsigns, Random common words and abbreviations, Contest mode (More on that later) and even a practice oscillator and session timer.

The tutor is very simple to use, no pages of menus to navigate your way around, just one push button that changes the mode and 3 knobs, one for character speed, one for the gap between characters and finally a volume control.

The tutor can be configured in a number of different ways, in its most simple form there is no display module and the current mode is just announced by a higher pitch Morse character identifier, this way a small highly portable tutor can be made. If you wish, the next level would be to connect to the modules LED outputs and have a row of small LED's that show the current mode. In its most common and default setup a two-line backlit LCD display is used to show the current mode and the last two groups of 5 characters that have been sent.

Learning the code can be hard and you do need to stick to it, but don't spend too long per session, it's not beneficial. I suggest keeping to a 10 min session once a day, every day. To help you know when a session is up the tutor will illuminate a LED for 10 secs every 10 Minutes. This is a sign that you may need to take a break.

Now a note about the contest mode, ok what is contest mode? Well the tutor will send a typical contest type 'Over'. It will send a random callsign followed by a three digit serial number, finally a short random message ending such as 'GD DX', a 4 digit locator (Not necessarily the one for the callsign !) , RST Report, or 'QRZ' etc.

That's all well and good but to add to the realism as much as possible the pitch between overs and also the speed will change randomly if you select the 'ACM' (Advanced Contest Mode) on the tutor's board (a two pin jumper enables it). You may want to start with the standard contest mode but you can change to ACM at anytime. (I activate it all the time on mine)

The tutor will generate code from about 11 to nearly 30 wpm, if this gets too tame for you then you can push the tutor up to about 60WPM, another jumper on the main PCB selects this 'Hyper' mode.

In addition there is now a control on the PCB that allows the user to change the default tones pitch to their own liking.

Select practice mode and plug a straight key in and you have a practice oscillator to play with too.

Runs for many hours of a PP3 9V battery.

Let's see how easy it is to wire up the module, the image below shows a typical configuration, you can see that it is very easy to wire up the finished tutor, the screen and practice key can be omitted if you want a very simple and small tutor.

The full configuration Wiring.

Note that there appear to be two display ports and two Mode switch connections, These are just in parallel with each other so that you can connect to which every side of the board fits in with your layout wishes.
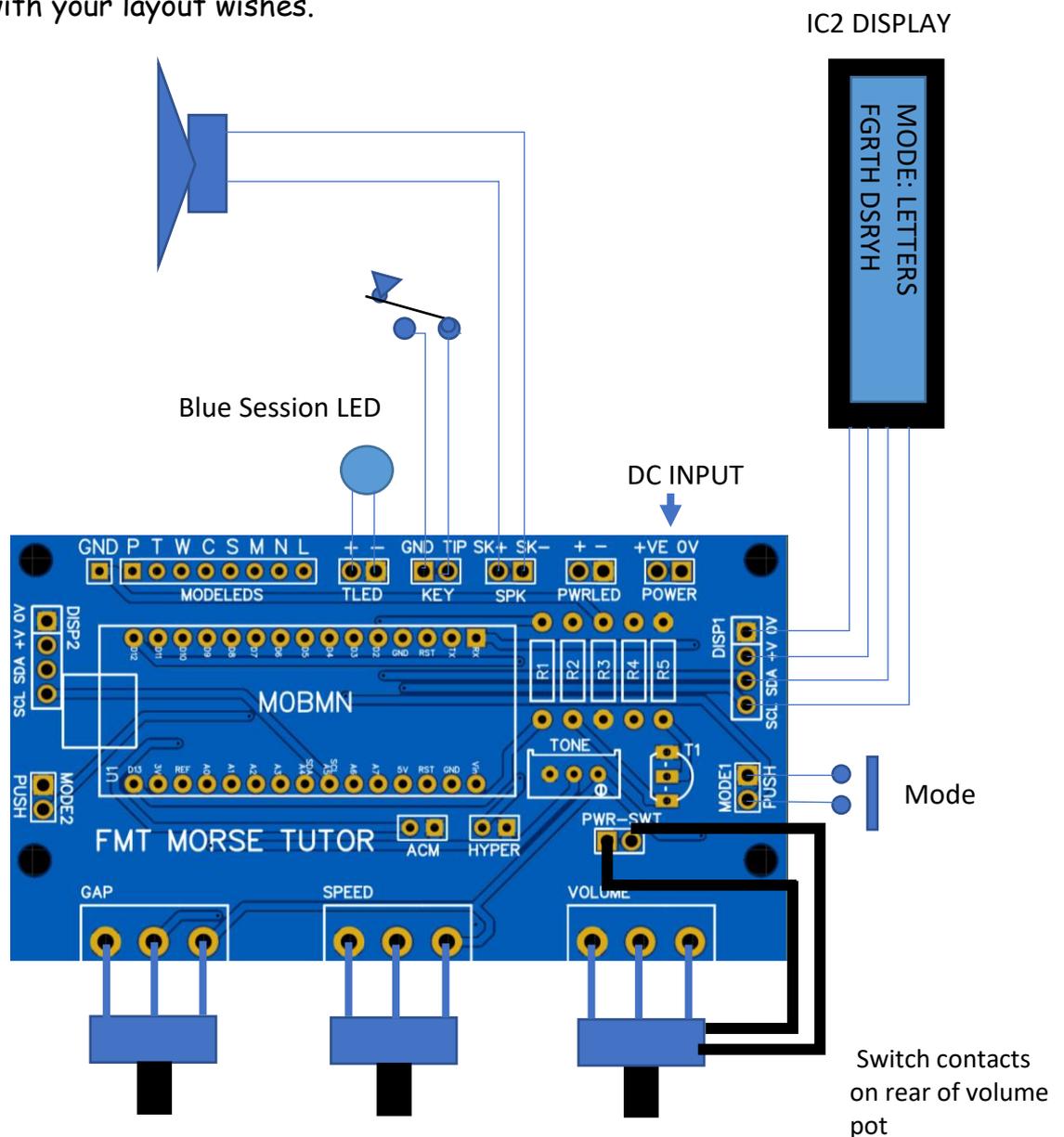
If required, another option would be to use the MODE LED's outputs. A separate LED can be illuminated for each mode if required. Just connect 8 LEDs with their −Ve legs all connected to the 'COM' position on the PCB and one wire from each mode position to the +Ve of each LED.
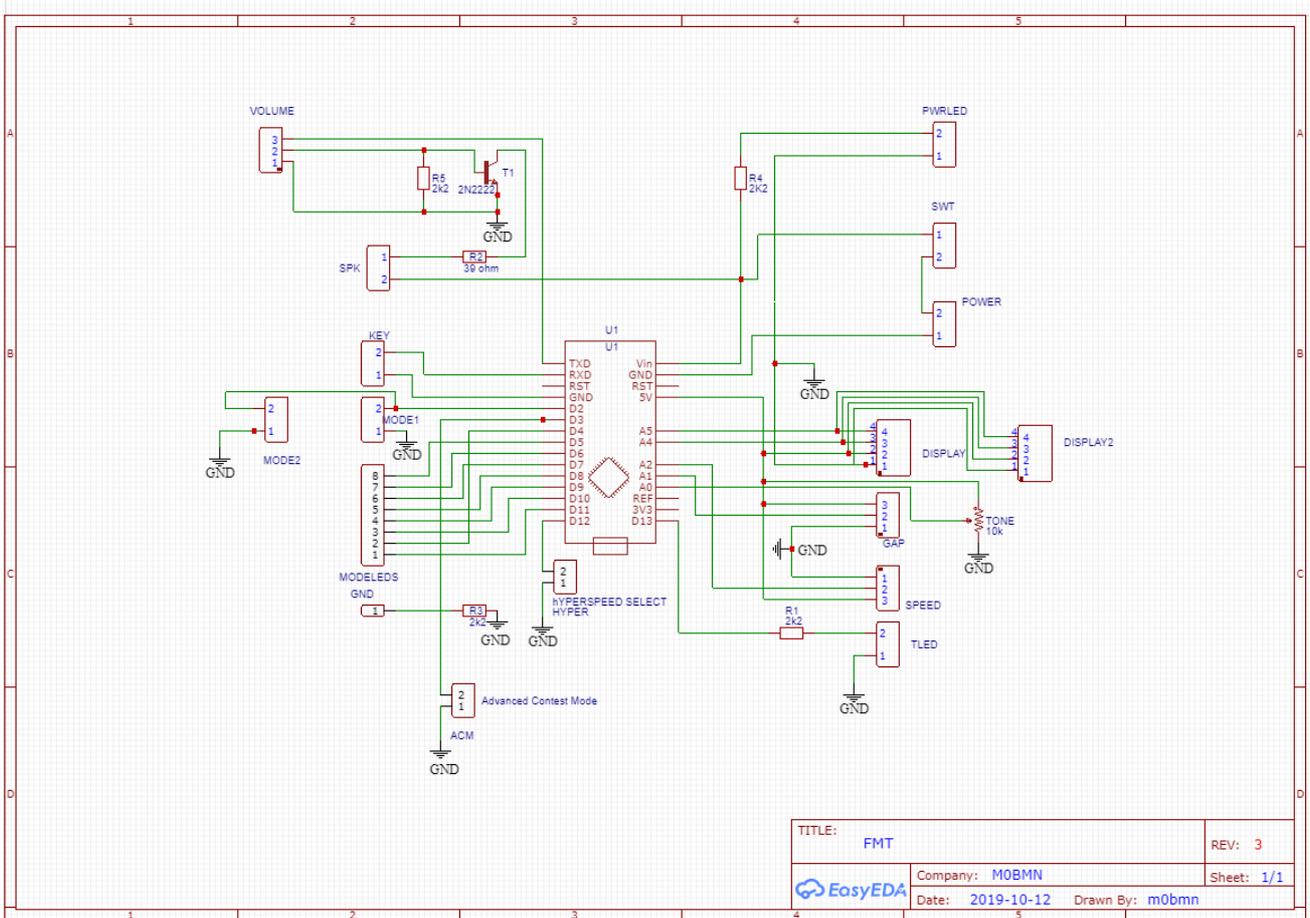
How to build the FMT?
Read ALL the following instructions BEFORE you start.

Let's start.
Check you have all the parts before you start.
Mark off each part as you check.

FMT PCB ☐
2 x 15 way Socket Strips ☐
R2   39 Ohm ¼ watt Resistor (ORANGE WHITE BLACK) ☐
R1, R3, R4, R5   2K2 Ohm ¼ watt Resistor (RED RED RED) ☐
T1   2N2222 (OR 2N2222A) ☐
U1   Pre-Programmed NANO Module ☐
2 x   10K potentiometer ☐
1 x   10K potentiometer with integrated switch ☐
1 x   7mm Push Button ☐
3 x   Control Knobs ☐
1 x   Alarm Blue LED ☐

1 x   Display 4 core cable ☐

1 x   8 Ohm Loudspeaker ☐

2 x   2.54mm jumpers ☐

2 x   2.54mm 2 Pin Headers ☐

1 x   2.54mm 4 Pin Header (to be fitted to main PCB for display wiring) ☐

1 x   10K 25 turn blue trimmer ☐

1 x   3.5mm Practice Key Jack socket ☐

1 x   LCD mounting bezel ☐

1 x   Mounting Spacers/Hardware pack ☐

1 x   2 line LCD Display ☐

1 x   I2C Board ☐

The build of the Morse Tutor is straight forward and shouldn't present much in the way of problems. Many people have built the MK1 and MK2 as a first project and this new version should be just as easy to build.

To start with find your FMT Nano Module and its 2 x 15 way pin header's, Carefully push the socket strips onto the Nano's pins, put the Nano with its sockets in place on the PCB, make sure you are fitting it the right way round (look at the outline on the PCB), solder the two strips into place.
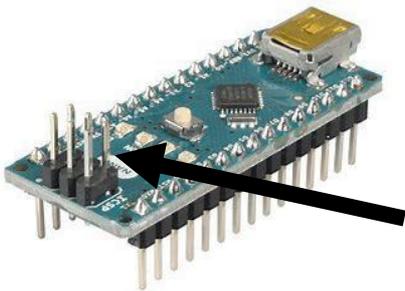
You could just solder the two socket strips without the Nano being plugged in but this way make's sure the angle between the PCB and the sockets is right.
You do **not** need the small 6 way block that is shown on the picture here.

Next fit the 5 resistors R1-R5 as indicated on the PCB silk screen and making reference to the parts list above to check the values.

Next fit the transistor, the board shows which way round to fit this so make sure you follow the outline.

Now fit the two 2 pin Headers, they fit into the positions marked ACM and HYPER. Do not fit the jumpers to these pins just yet.

The last part is the small blue trimmer, there is a brass screw at one end on the top, if you look at the board silk screening you will see which way round this needs to be fitted.
Now all you need to do is to connect the wires to the controls, screen and speaker.
The controls can be fitted directly to the PCB if you wish, if you do then connect two wires from the 2 way terminal pin layout marked 'SWT' (which is just behind the volume control) to the switch contacts on the back of the volume control. If you are not

using the controls mounted on the PCB you can wire this set of two pins to the volume control switch via a length of cable.

<u>Important</u>

If you wish just wire the power direct to the switch on the back of the volume control but then you **<u>MUST</u>** fit a small link between the SWT terminals on the PCB.

Follow the layout drawing above, it shows where each wire needs to go.
This really is a very simple project to build.

The LCD display comes with a piggy back board. That will need to be soldered onto the back of the display, again very easy, make sure you fit it so that the trim pot is visible. (the board mounts on the back of the display NOT on top of the LCD itself). The long pins will protrude at the front of the module, if you are going to mount the display in a box then these will need to be trimmed back once soldered, be warned, these pins are tough, I used some cheap cutters and it was very difficult to cut them find some heavy duty ones is my recommendation ! Now a word or two of warning. The piggy back board can have a number of different addresses. I have made sure that the one supplied with your kit is correct for your tutor chip. Also when you fit the piggy back board make sure you push it right down on the back of the display. If you fit the display on top of the main PCB on the standoffs supplied it will only just clear the mini USB connector on the Nano module, if you do not fit the piggy back board as low as it will go you may have problems mounting the display onto the standoffs later. To start with adjust the small blue trimmer about half way, this will need to be adjusted later to give the best display.
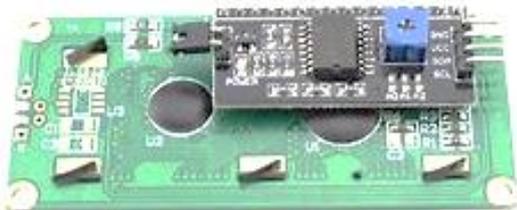
Wire the screen, just take care to connect the 4 wires to the correct pins as this is the most common mistake. The piggy back board and the tutor PCB have labels on the display terminals.

You will see you have two display sets of terminals and two sets of Mode terminals for the push button, use whichever one suits your build and which will fit into your enclosure the best. You can fit the supplied 4 Pin header on the display port of your choice. I have also supplied a short pre-wired 4 way cable that can be used between the display and the main PCB if you fit the display on the standoffs directly to the PCB, in this case I use the display port on the left hand edge of the PCB.

If you wish to use the supplied bezel and mounting hardware to attach the main PCB to the display to make one 'module' you need to fit the mounting hardware to the screen. The photo below shows the screen fixed to the bezel and the mounting hardware. If fixed into an enclosure then of course the box top will be between the bezel and the small white standoffs.
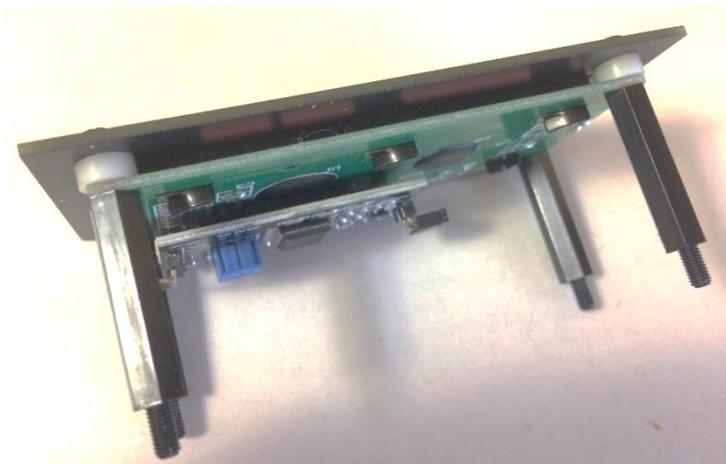
Connect the 4 way cable between the display and the main PCB before you screw the display and PCB together as it is difficult to get to the connectors when the screen assembly is fitted to the main PCB. I would also test the tutor before screwing the screen and PCB together as if you need to adjust the pitch or screen contrast it will be impossible to do so without removing the screen.

Now you should be ready to turn it on, apply power, a 9v Battery is fine. When you turn it on the display will flash and then a welcome message will appear for a second or two then the tutor will start sending CW. The speed/gap and volume can be adjusted to suit, If the screen is hard to read you can change the contrast level by adjusting the small trimmer on the back of the display I2C board. Push the mode button and the tutor will cycle through the modes.

You can adjust the pitch of the tutor by adjusting the small 25 turn trimer on the Main PCB.

In the basic modes Letters/Numbers/mixed, you will note that the Gap control changes the space between each character. The speed control changes the speed of each character.

In the advanced modes, Callsigns, Words, Contest etc. the Gap control works slightly different, the tutor will send the word at the selected speed but the gap control changes the space between words, not the letters. In these modes you are learning to read CW as it sent on air and so you need to recognise the sound of words not just letters.

Now if you want a little more realism put one of the supplied jumpers across the ACM pins on the main PCB, this activates and changes the normal contest mode to advanced contest mode, the contents of each message is the same but now, like on air, each 'Transmission' will be at a slightly different pitch and speed. (I would suggest doing this to start with but it's up to you)

If you get really good and want more of a challenge put another jumper across the 'HYPER' terminals, this will increase the tutors WPM speed to about 60wpm at its max setting.

Now it's time to box it up, you are on your own for that one. Look at the offerings on Ebay, RS Components, Farnell and others, local Ham Rallies are also a good source for enclosures, or even use a 3D printer if you have one.

One tip, I mounted mine in a plastic box. I covered it in masking tape and drew a rectangle the size of the cut out for the LCD (use the supplied bezel as a guide), I then drilled a row of holes all the way around the shape to cut it out, I finished it off with a hand file.

If you fit the supplied LCD bezel you will not need to be as neat with the cut-out as in the previous versions of the tutor kit. Take care and you can do a good job.

If you have problems, contact me direct
m0bmn@yahoo.co.uk
 73 Paul M0BMN

Extra Tips
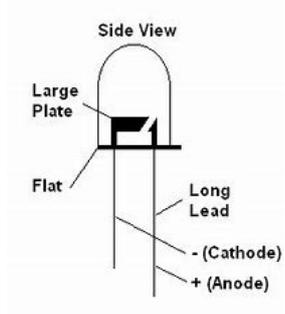
If you fit the Alarm LED or a Power LED make sure you wire it the correct way round

The long leg on the LED is the +Ve. Make sure this is connected to the +Ve LED terminal on the PCB

When mounting the display you will note that one side of the display module as a white plastic strip where the backlight LED is mounted. This strip stands proud from the display PCB and would normally stop the display from sitting properly through a mounting hole. I have supplied 4 small white spacers that can be used to make the display sit correctly. Place one spacer on each mounting screw between the enclosure and the display board mounting holes.
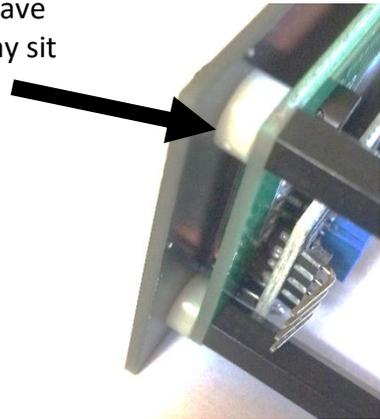
Problems?

Just a row of black boxes on the display:-

Normally one of two things. First check that the wires marked SDA and SCL are not crossed between the board or PCB. Second check the trimer on the I2C board.

No text at all on the screen:-

The I2C interface board you fitted above has a small trimmer on it. This trimmer adjusts the contrast for the display. If the display is lit but no text check the adjustment of this trimer, if its turned right down there will be no text displayed. You may find it worthwhile to adjust this anyway for the clearest display.

Display Not Lit:-

On the I2C board you will see two pins with a jumper on, this jumper controls the backlight to the display. If the display does not seem to be working check the jumper has not come off, if you lose it a small solder 'Blob' or link can be used just to short out the two pins.

If the display is too bright for your liking remove the jumper and fit a resistor or a variable trimmer of about 1 to 5K, the resistor will reduce the brightness of the display