

## microTutor Build-A-Thon edition

The microTutor is a no nonsense back to basics old school Morse Tutor. It uses a modern micro controller chip that gives features that you would expect in much more expensive units.

Let's look at its features:-

### 6 Modes:

- 1:- Random Letters (In 5 figure groups)
- 2:- Random Numbers (In 5 figure groups)
- 3:- Random Prosigns
- 4:- Random Mix of Letters, Numbers, & Prosigns (5 figure groups)
- 5:- International Callsigns, In this mode the pitch and the speed change by approx. +/- 15% to add to the realism and to make things less tiring for longer sessions.
- 6:- Contest Mode, Speed and pitch changes as above but sends a simple contest over, callsign then 5NN and either a three or four digit serial number, the serial number may sometimes use 'Cut' numbers so you may hear 6092 or 6TN2 for example.

### Controls:

- Adjustable Volume
- Adjustable Speed (approx. 8 to 30 WPM) Adjustable
- Gap (approx. upto 4 seconds)
- Adjustable Pitch via user setup options (can be changed whenever you wish)
- Visual on-Board LED CW Indicator

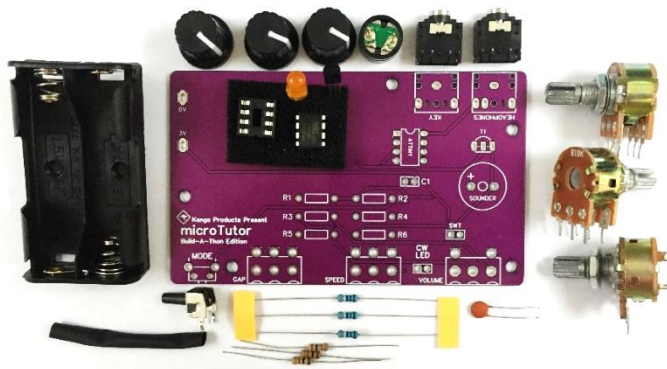
### External Connections:

- Straight Key Input for use as a practice oscillator (3.5mm Mono plug on key needed)
- Headphones out socket (3.5mm mono or stereo)

The instructions are longer and more detailed than you may expect for such a simple kit but that's to help first time builders.

Morse is a great mode to use for communications, a few watts and a wire antenna can give you world wide communications when conditions are good. If you are interested in low power operation then consider joining the G-QRP Club. Take a look on their web site.

[www.gqrp.com](http://www.gqrp.com)





## Using the microTutor

This is refreshingly simple to use, no menus!

Turn the Power/Volume control to start the tutor and that's it your away, adjust the gap and speed control to your preference and start improving your code speed. To change modes press and **hold** the mode push button for a second or so and you will hear a higher pitch Morse letter. L for Letters Mode, N for numbers mode, P for Prosigs, M for Mixed, C for Callsign mode, and CT for Contest Mode.

The tutor as a on board CW Indicator LED too.

The on-board battery pack is just 2 standard AAA cells that will last a very long time.

## To use the tutor as practice oscillator

To increase the tutors value it can also act as Practice Oscillator.

To use this feature plug your key into the rear connector (3.5mm Plug needed) , **hold the key down and turn on the tutor**. The microcontroller looks at the key input at power on and will detect the key now. It will automatically switch to oscillator mode.

The headphone socket needs a standard 3.5mm plug so that normal Walkman type headphones or earphones can be inserted.

## Tips for improving your code speed.

It's very easy to fall into a common trap that can cause you problems with listening to real life Morse. Do not try to count Dits and Dah's to work out the letters. Start to learn the 'sound' of the letters from day one. Set the speed control to a realistic speed (I find setting the SPD control at the 12 O'clock position is about right to start with, about 12 – 14 WPM), adjust the GAP control to give you more thinking time. As you improve reduce the gap time bit by bit. This way you will learn the characters at the right sound and although it may seem hard at first it will be easier when you listen on air (which is the point of learning the code isn't it)

Spend about 10 minutes a session listening to code, much more than this isn't helpful. Take a break between sessions and you will come back fresh and ready to learn.

Above all, enjoy it and enjoy using the microTutor. Good luck with learning Morse.

73 Paul M0BMN (Kanga-Products)



## Building the microTutor

The microTutor is an easy to build project designed for both the beginner and the more experienced builder.

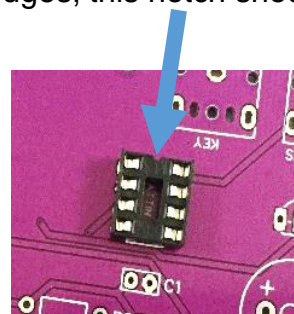
Check you all the parts needed are with your kit:- Tick them off as you check

- 1 x microTutor PCB
- 1 x AAA battery Holder
- 1 x 8 Pin Dip Socket Holder
- 1 x Mode PCB Push Switch
- 1 x PCB Mounting Sounder
- 1 x CW LED
- 1 x Audio Amplifier Transistor (2N2222)
- 1 x microTutor Control Chip
- 1 x 0.1uf Capacitor (orange disk marked 104) C1
- 1 x Volume Control with built-in on/off switch
- 1 x Gap control (10K potentiometer)
- 1 x Speed control (10K potentiometer)
- 2 x 3.5mm PCB Jack Sockets
- 3 x 3K9 ¼ watt Resistor (1<sup>st</sup> two bands Orange, White) R1, R2, R4
- 3 x 1K ¼ watt Resistor (1<sup>st</sup> two bands Black, Brown) R3, R5, R6
- 3 x Control Knobs
- 4 x Stick on rubber feet
- 2 x Stiff wire for power switch
- 1 x Short Length of heatshrink

### Step one

Fit the 8 pin IC socket

There is a small notch in the socket on one of the short edges, this notch should be towards the top of the board.

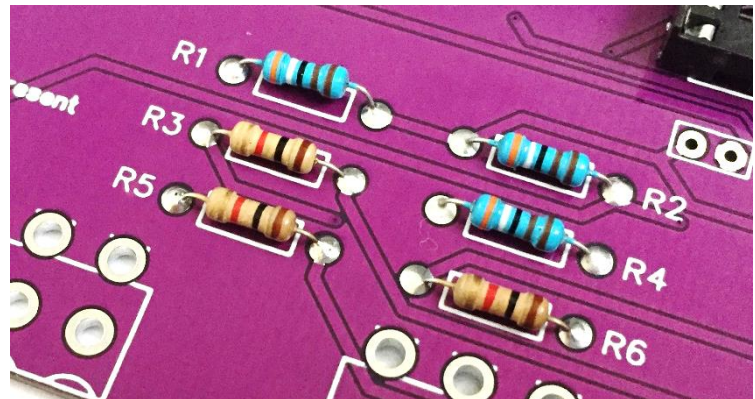




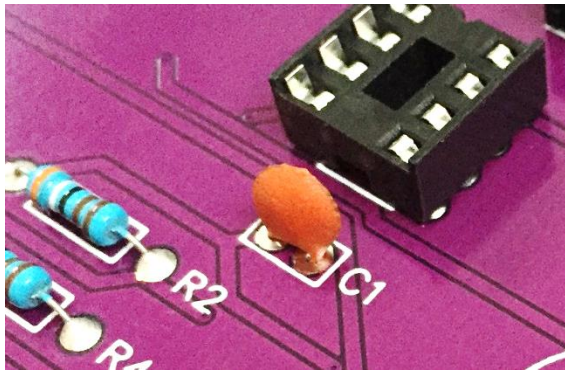
## Step 2

Fitting the resistors

R1, R2, and R4 are all the same value, 3K9, the colour bands on the resistor tell you the value, the first 2 bands are Orange and White. The resistors can be fitted either way round.



Next fit the 1K Ohm resistors R3, R5, and R6 (first two bands are Brown and Black).



## Step 3

Fit the Capacitor C1

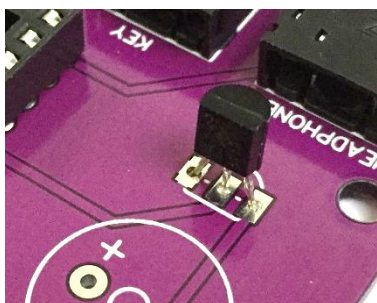
There is only one capacitor in this kit its value is 100nf, it is marked 104.



## Step 4

Fit the two 3.5mm PCB sockets, they can only be fitted one way round and are both the same type.

## Step 5



Fit the Transistor

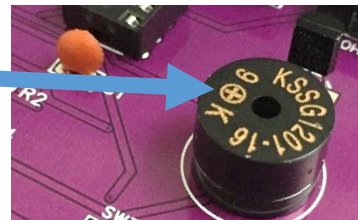
There is just one transistor in this project, it is used to amplify the audio from the controller chip to drive the small on board sounder or external phones/speaker.

The transistor **MUST** be fitted the right way round. On the board the shape of the transistor is shown, carefully push the transistor down onto the board so its shape matches the image. Don't push the transistor right down on the board, you will break the legs off if you try! It should stand off the board with around 5mm of leg showing.



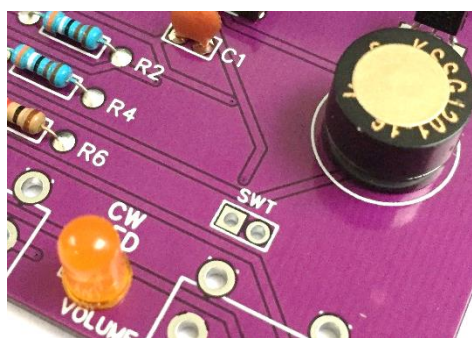
## Step 6

Next we will fit the mini speaker and the CW LED. On top of the speaker you will see a small circle with a '+' symbol, this side of the speaker must be nearest to C1. When fitted place a small stick-on Dot over the hole in the speaker. This seems to go against



conventional wisdom, the speaker is small and has limited volume so why would you effectively block the only hole in the speaker! Well normally that would be a strange idea but with this little speaker it makes a big improvement to the volume, the speakers peak volume is designed for tones around 2KHz, that would sound awful for CW. If we block this hole we increase the back pressure on the speaker, this has the effect of changing the peak frequency response to a much lower pitch and so in our application the volume at pitches below 1KHz are greatly improved and so is the tone quality. If you can't find the small stick-on dot or threw it away any small piece of stick-on tape will work just as well. (Due to Covid and the global supply problems it's caused, the sounder you receive with the kit may have different markings on the top but the positive side will be marked.)

## Step 7 The CW LED



On the MK1 version of this tutor there was a power on LED, I got asked many times if this LED could be made to flash the CW it was sending, well in this MK2 version that's just what it does, you can change the LED to any colour you like, I have supplied a nice Orange LED with the kit. If you look at the LED's leads you will see one leg is

longer than the other. On the PCB position for this LED you will see that there are two holes for the legs to go through, there is one square hole and one round, the long leg MUST go into the ROUND hole. You can push the LED right down onto the board if you wish or leave it at any height you want.

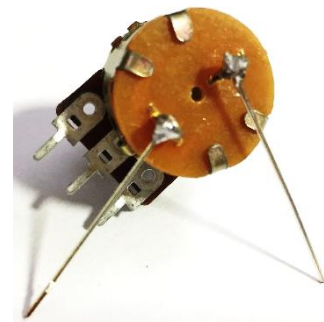


## Step 8 Mode Switch



Now we need to fit the Mode selector button, carefully push the pins through the board and make sure the switch is sitting nicely before soldering.

**Step 8** Now we need to fit the Volume, Gap, and Speed controls. The first thing we need to do is to prepare the volume controls power switch wires, the volume control looks like the other two controls but you will see two switch contacts protruding at the rear. These are the switch contacts, find two nice off-cuts from the resistors, or use the two short stiff wires I sent with the kit.



Solder them as shown in the picture below. Use a small piece of heatshrink that came with the kit to insulate one of the wires, no need to shrink this if you don't want to. Solder them to the rectangle behind the control marked SWT. Fit this control and then the other two controls on the PCB, the other two controls are identical to each other and either can be fitted in the speed or gap positions.



Volume/ Power Switch



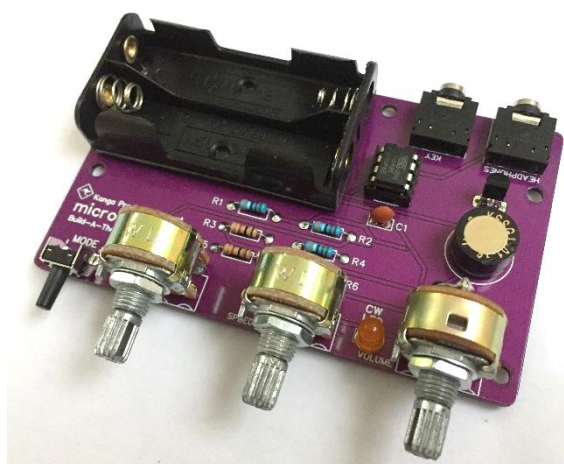
All Controls Fitted



### Step 9 Battery Holder

The Tutor is powered by two standard AAA batteries, these will power the tutor for a very long time. The battery holder has a stick-on pad on the bottom. Remove the tape and CAREFULLY place the holder on top of the board with the two pins past through the '+' and '-' holes.

The sharp eyed amongst you may notice that the board here shows a LARGER AA holder, the kit now uses a AAA holder and this is a better fit for the PCB. Please don't fit an AA holder if you have one, the polarity is different on an AA holder and so damage could occur. Solder the two battery holder pins.



### Step 10 Finishing it off !

Now if you haven't already fit the controller chip. The chip MUST be fitted the right way round. On the chip there is a small notch and a dot near pin 1. The notch on the chip should be nearest to the KEY sockey and so the dot will be nearest to the battery holder. Next fit the 4 stick on feet to the rear of the board, finally turn all the controls fully anticlockwise and fit the three control knobs so they all line up to your liking.



### Using the tutor

That's it built! Pop two AAA batteries into the holder and turn on. If all good the CW LED will start to flash Morse and if you turn the volume up you will hear CW. Adjust the speed control and check the speed changes, adjust the GAP control and the gap between characters should increase too. If all that works set the gap to minimum and press and hold mode button, you should hear a higher pitch morse character announcing the mode and the tutor will change mode.



## **Test the practice oscillator**

To test the practice oscillator you will need a straight key, plug one into the Key jack on the rear of the tutor and turn off the power. Now hold the key down and turn the power back on while holding the key down. The tutor will first look at the key socket when it's turned on and if it finds the key down it will start up as a practice oscillator rather than in tutor mode, the LED will also work with your sending, adjust the volume to suit.

When finished as a practice oscillator turn off the power and then turn it back on, this time do not hold the key down.

## **Setup the Tutors Pitch**

The Tutor (and oscillator) use the same basic pitch. You can change the pitch to your own liking if you wish, it's very easy to do so.

To change the pitch turn off the tutor. Press and hold the mode button and continue to hold it down while you turn it on. Now you will hear the pitch the tutor will use.

Adjust the GAP control and the pitch will change, set this to the pitch you want to use, the small sounder has a noticeable peak response and you will notice certain tones sound louder than others, adjust the pitch to your requirements. When your happy release the mode button and the pitch will be saved in the chips memory ready for next time you use the tutor. It's a sign of the times but it's very easy for someone to just copy the code used in products like the microtutor and claim it's their own. So to identify this code as mine if you quickly press and hold the Mode button again just has you exit setup the tutor will send my callsign in Morse (M0BMN), if you hear that don't worry it's just to identify the owner of the code.

Headphones, The tutor also has a head phone output, this output is volume limited to protect your hears, the volume on this output can be increased if you intend to use the tutor with a speaker. To make the tutor more suitable for use with a speaker replace R6, which is a 1K Ohm resistor with a 39 Ohm resistor. If you do this and then use headphones be careful the audio will be very loud.





## Morse Code

A	● ■■	N	■■ ●
B	■■ ● ● ●	O	■■ ■■ ■■
C	■■ ● ■■ ●	P	● ■■ ■■ ●
D	■■ ● ●	Q	■■ ■■ ● ■■
E	●	R	● ■■ ●
F	● ● ■■ ●	S	● ● ●
G	■■ ■■ ●	T	■■
H	● ● ● ●	U	● ● ■■
I	● ●	V	● ● ● ■■
J	● ■■ ■■ ■■	W	● ■■ ■■
K	■■ ● ■■	X	■■ ● ● ■■
L	● ■■ ● ●	Y	■■ ● ■■ ■■
M	■■ ■■	Z	■■ ■■ ● ●

### Numbers

1	● ■■ ■■ ■■ ■■
2	● ● ■■ ■■ ■■
3	● ● ● ■■ ■■
4	● ● ● ● ■■
5	● ● ● ● ●
6	■■ ● ● ● ●
7	■■ ■■ ● ● ●
8	■■ ■■ ■■ ● ●
9	■■ ■■ ■■ ■■ ●
0	■■ ■■ ■■ ■■ ■■

### Prosigns

(.)	● ■■ ● ■■ ● ■■
(.)	■■ ■■ ● ● ■■ ■■
(?)	● ● ■■ ■■ ● ●
(/)	■■ ● ● ■■ ●
(=)	■■ ● ● ● ■■
(AR)	● ■■ ● ■■ ●
(BK)	■■ ● ● ● ■■ ● ■■
(CT)	■■ ● ■■ ● ■■
(VA)	● ● ● ■■ ● ■■
(KN)	■■ ● ■■ ■■ ●