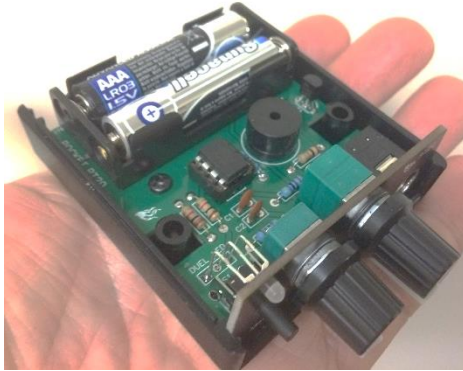




## Pocket PT20 Personal Morse Tutor

### Fully Boxed Kit

This is a small and highly portable pocket Morse tutor, it is approximately 60 x 65 x 28mm in size and completely self-contained with built in battery and sounder.



This was designed to be a personal tutor that would work with headphones but due to the use of a small sounder the tutor also will work standalone too. The volume from the small sounder is not going to be room filling by any means but is fine for personal use



Normally you would expect to find a range of controls, such as Volume/Power, Gap adjustment, WPM (Speed) adjustment, and if lucky Pitch adjustment. That would be a lot of controls to fit on such as small front plate when you also have mode selection and

a headphone socket !

Fortunately thanks to the tutor being microcontroller based, a number of these features can be combined and software controlled.

With just the two knobs and the mode select switch all the functions above can be implemented.

This produces a very compact, portable and affordable pocket tutor that can be taken anywhere, even out jogging.

The tutor is powered by two standard AAA batteries that are low cost and available anywhere.

### How to Setup the PT20

The PT20 tutor is very easy to use. The first task is to set the WPM rate and the pitch to your preference, these setting can be changed as many times as you wish and at any time.

To enter the setup mode press and hold the mode push button while turning on the unit. Do not release the button, the tutor will start flashing its LED red then green and sending the letter 'A' in Morse, now while still holding the mode button adjust the 'Gap' control to change the characters speed to a suitable speed for your abilities. A good starting point would be around 12-14WPM, this is when the GAP control is at the 12 o'clock position.

Now release the button and then immediately press and hold the button again. Now the pitch will change, you can adjust the GAP control again now to change the pitch of the tutor to your preference. When your happy release the button and the setting will be saved in the memory of the tutor. You will find that due to the small size of the sounder it will be louder at certain frequencies so if volume is a concern for you slowly adjust the pitch to find the 'sweet spot'.

**Now you can use the tutor.**

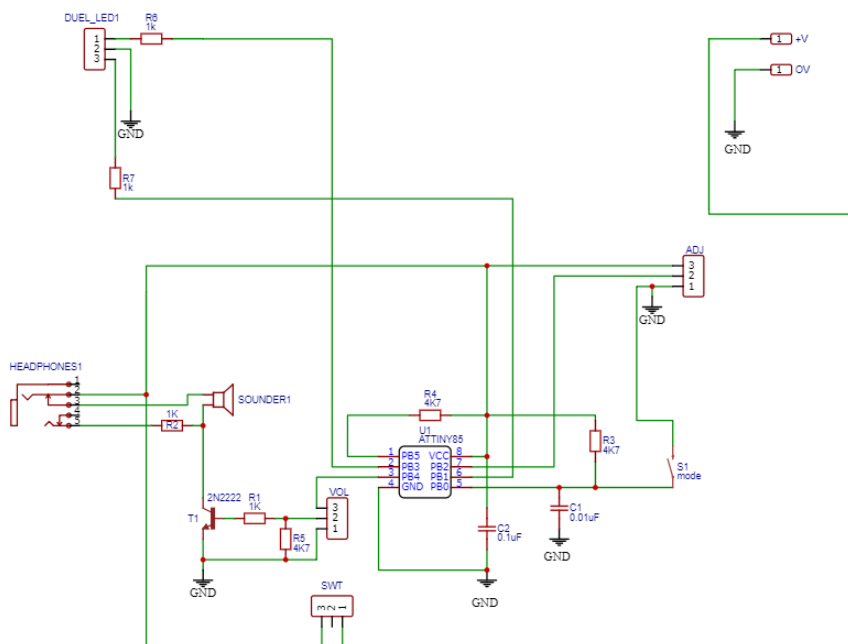
We have now set the WPM rate and the pitch so all we have to do is turn on the tutor, adjust the volume and if you need to, adjust the GAP control to give you more thinking time between characters.

The tutor will now start sending 5 figure letter groups then a longer pause between groups, just like words, if you press and hold the Mode button it will switch to random numbers, next press it will switch to Prosigms, another and mixed letters/numbers/prosigms. One last press and you get a more interesting mode, Callsigns. This mode sends random international callsigns but each callsign will be sent at a slightly different speed and pitch, just to make things a little more realistic. I have also added a Contest Mode where the tutor will send a simple Contest type over. When changing modes the tutor will first send a Morse letter at a higher pitch tone that identifies the new mode ('L' = letters, 'N' = Numbers, 'P' = Prosigms and 'M' = Mixed, 'C' = Callsign, 'CT' = Contest).

A worthwhile tip. There is no point trying to learn the code with a slow character speed, you will only need to relearn the sound of each letter again when you get on air. It's an easy mistake to learn the code with character speeds that are so slow you learn by counting the dots and dashes. This is a big mistake. From day one learn the sound of each letter, DO NOT count the elements of each letter. Yes it will seem harder and take more time at first but it's not a race and the rewards are much higher. So I recommend you use a character speed of around 12-14 wpm which is a realistic speed used by many operators in the real world. I will not be cruel and expect you to start learning Morse at 14 wpm so the Gap control will allow you to set a gap of your choice up to 3 seconds between characters, this will make the task of learning much easier without you falling into the counting trap!.

If you want a full blown Morse tutor with a LCD readout then look at the popular FMT Tutor Kit.

The circuit for the PT20 is shown below.





### **Building the PT20**

The PT20 is very easy to build, just a couple of points that you need to be careful of, please read ALL the instructions BEFORE you start work.

Here is the parts list, make sure you have all the parts before you start, any problem please contact me .  
[Paul@kanga-products.co.uk](mailto:Paul@kanga-products.co.uk)

#### Parts List

- 1 x PT20 PCB
- 1 x PT20 Front Panel
- 1 x Case
- 2 x Case Screws
- 2 x PCB Screws
- 4 x Stick on feet
- 1 x 2 cell AAA Holder
- 1 x PCB Sounder
- 1 x 8 pin DIP Socket
- 1 x ATTiny85 PT20 Chip
- 1 x Volume/Pwr Control
- 1 x Gap Control
- 1 x 3.5mm Headphone socket (Stereo)
- 1 x Mode Push button
- 1 x Dual Colour LED
- 2 x Control Knobs
- 4 x 1K ¼ W resistors
- 3 x 3K9 ¼ W resistors
- 2 x 0.1uF Disk Capacitors
- 1 x 2N2222 Transistor

Really you should wear eye protection when soldering and cutting wires, not many of us do but when you fit the Battery holder at a later stage you will need to take care when cutting the leads, they fly off at speed so take care, I will remind you later about this too.

#### **OK let's make a start**

Fit the 8 way socket to the PCB, it should be fitted so the small notch in the socket is pointing towards the back of the board as per the silk screen layout.

Now fit the resistors, the resistors can be fitted either way round.

R1, R2, R6 and R7 are all 1K resistors.

R3, R4, and R5 are all 3K9 resistors.



Next move onto the capacitors

There are two capacitors in the kit, both are the same value which is 0.1uF they are yellow and marked 104 on one side.

Now fit the one transistor in the kit, it must be fitted the correct way round and the silk screen prining on the PCB shows how to fit it.

Next fit the headphone socket, this can only be fitted in one place so should not be difficult to sort.

Now the Volume and the Gap controls, the volume control also has a built in switch.

Now before you fit these look at the front of the pot, just under the shaft. You will see a small metal tag, take you cutters and snip this off, it's easy to break off if you try and snap it rather than cut it, it's a diecast tag and comes off with ease.

Put the volume control on the board and carefully solder all 5 pins in place, make sure the control is flat on the board.

Next do the same with the GAP pot, when you solder it make sure it's in line with the volume pot.

Now the Mode push button, make sure it sits square on the PCB. It can be a little hard to fit.

The LED is a more difficult part so leave that for now.

Fit the Sounder. On the sounder you will see a '+' mark on the top in a little circle, this should be aligned so that the positive mark is nearest to the chips socket.

Now that brings us to the battery holder, I spoke about this before. The holder has two PCB pins, these pins are strong, they are not the normal soft copper wire that the other parts have. They will need some force to cut them, if you're lucky I may have already cut them down for you but you may have one that hasn't been cut. Use an old pair of cutters if you can and don't try and cut them with the tip of the cutters. Most of us buy tools that are 'fit for the job' and to be honest with you are only intended for light use. These leads are much tougher and can damage the cutting edge of the cutters so take care and only cut them at the base of the cutters not the tip. The cut leads will fly off at some speed so remember my earlier advice about eye protection.

The Battery holder also has some double sided tape (ON THE BOTTOM) that needs the film peeling off before you place the holder on the board. Take care you will find it hard to remove the holder once the tape touches the PCB.

Now we can fit the LED, The LED has 3 legs, they are all different lengths, the shortest leg will be towards the centre of the board. I fold the LED's legs at about 12mm from the LED body at 90 degrees.

Now fit the front plate to the PCB with the washers and nuts on the Volume and Gap controls. Important! After building about 50 of these myself a worth while tip for you. Put the gap/volume control nuts and washers on loose, then 'Jiggly' the front panel to get the mode switch and headphone socket central to their holes, it is important that the mode switch is not trapped hard against the edge of the hole for it in the front plate or the switch will not work.

Once you're happy that the switch and headphone socket are correctly aligned then tighten the two nuts.

When the board and front panel are fixed together put the LED into the PCB and then push the LED through its hole on the front panel. Now we can solder the LED in place





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Drop the PCB into its case and use the supplied fixing screws to fix it to the case. Fit the supplied black plastic blank back panel now too.

Install two AAA batteries, make sure they are fitted correctly.

Now turn on the tutor.

After a second the Red led will light and you will hear some Morse code, it may be fast or slow and the pitch may be not what you want, that's fine we have still to set up these. Refer to the start of this document which explains how to do this.

Fit the lid and if you wish the top panel sticker.

Well done now get on with learning the Code.

The tutor is intended for personal use and so many people will use headphones but the small sounder will be fine for in home use. Leave the small sticker over the sounders hole, or if its missing a small piece of clear tap will work fine, this changes the peak frequency response of the sounder and brings a good boost in volume around the typical frequency used for CW practice.

I hope you enjoy building this kit. Take care with the build and you will get years of good service from the tutor.

Best 73 Paul M0BMN



## 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	■■ ■■ ■■ ■■ ■■