microTutor T20

The microTutor T20 is a no nonsense back to basics old school Morse Tutor, but don't let its low cost fool you. It uses a modern micro controller chip that gives features that you would expect in much more expensive units.

Lets look at its features:-

Modes: 5

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.

Controls:

Adjustable Volume
Adjustable Speed (approx. 8 to 30 WPM)
Adjustable Gap (approx. upto 4 seconds)

External Connections:

DC Power (2.1mm Power Socket)
(7 to 15V although the tutor normally runs from a standard PP3 internal 9v battery)

Straight Key Input for use as a practice oscillator (3.5mm plug on key needed)

Headphones / Speaker out socket (3.5mm mono or stereo)

Using the T20

The T20 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 Prosigns, M for Mixed and C for Callsign modes.

The internal battery is a standard PP3 9v type and to replace it remove the two screws holding the case together and lift of the lid.

To use the tutor as practice oscillator

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

To use this feature plug your key into the rear connector, **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.

Word of warning….

The tutor uses an internal 30mm PCB speaker, this is great for normal personal use but some people would like to use headphones, if you do use headphones be careful with the use of the volume control. It can be very loud. There is a modification that can be done by experienced soldering iron users that can limit headphone volume if you wish. Inside the unit on the main board you will see a wire link has been fitted in position marked R8. Remove the link and replace it with a resistor, typically 1 to 5K ohms. This will limit the volume at the socket but may now not be suitable if you use an external speaker. It's there just as an option.

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. 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.

Consider joining a CW Club, FISTS CW Club in the UK is the best one.

www.fists.co.uk

Above all, enjoy it and enjoy using the T20 tutor. Good luck with learning Morse.

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	▬ ▬ ▬ ▬ ▬

Prosigns

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

Building The T20 Tutor

The T20 is a easy project to build, it has been designed to be suitable for a beginner, extra large spacing and larger solder pads make this a easy project.

First lets look at the parts List

Hammond RM2015S case
T20 PCB
Front Panel
Rear Panel
Foam Pads (1 white, 1 Grey)
2 X PCB 3.5mm Jack socket
1 x PCB 2.1mm DC Power socket
1 x PP3 Battery Clip
2 x 2 way blue terminal blocks
1 x Mode Push Button
3 x Control Knobs
2 x Gap/Speed potentiometers (can be any value between 5-100K)
1 x Power/Volume potentiometer 10K Lin
1 x DIP 8 way IC socket
1 x ATTINY85 Controller chip with T20 Code loaded
1 x 78L05 Voltage reg
1 x General Purpose NPN Transistor (Normally 2N2222)
2 x 0.1uF 'Yellow' Capacitors (Marked 104)
1 x 3mm Red LED
1 x 32mm Speaker RS Pt No. 7243119
4 x 4k7 ¼ watt Resistors
1 x 2k2 ¼ watt Resistor
1 x 39 Ohm ¼ watt Resistor
1 x 10 Ohm ¼ watt Resistor
1 x Pack Mounting screws
1 x short wire for Mode switch

Step one

Put the 32mm speaker on one side, if you leave it just lying around where your building you will find it gets full of 'off cuts'. The speaker has a magnet inside and it attracts all the wire ends it comes close to, they will be very hard to remove from the speaker if they find their way inside the housing (and they will do, voice of experence!).

You have been warned!!!!

Step two

Fit the two 3.5mm jack sockets and power socket on the PCB they can not be mounted in the wrong place, they only fit where they need to go, just make sure that the power socket is straight and flush with the edge of the board when fitted.

Step 3

Fit the two blue terminal blocks the cable entry holes should be facing away from the sockets you fitted above.

Step 4

Fit the 8 way IC socket, if you look carefully you will see the socket as a small notch cutout, this notch should be aligned with the silk screen layout for the socket, if you do fit it the wrong way it will not be a problem, you will have to remember it's the wrong way round when you fit the chip later but don't try and remove the socket, you will do more damage if you do.

Step 5

Time to fit the resistors, the resistors can be fitted either way round but I like to fit them all the same way to make it easier to read their values later if you need to.

R1, R4, R5, R6 : - all 4K7 ¼ watt types (first two colour bands are Yellow , Violet)

R2 :- 39 Ohm ¼ watt type (First two bands Orange and White)
R7 :- 10 Ohm ¼ watt type (First two bands Brown, Black)

R8 :- For now fit a Link wire, I use a off cut from one of the resistors, more on this later in the instructions.

Step 6

Fit the two capcitors

C1, C2 Both 100nF (or 0.1uF) marked '104' these are Yellow in colour

Step 7

You need to take care with this stage.

We are now going to fit the two Transistor type devices, in fact although the both look just the same one is in a Intergrated Circuit, it is a voltage regulator. The ATTINY85 chip is only happy between 3 to 5v more than 5.5V and its goodby Mr Chip!

Take a look at the two devices, on their flat side is a number that tells us what they are.

Image of 2N2222
(2N2222A may be supplied)

Image of 78L05   Don't get them mixed up!

The PCB is a little misleading as it shows these as T1 and T2, Really T2 is a IC so should be labeled as such, my fault.

So lets find the 2N2222 first, makes sure you select the right one.

You will need to spread the legs a little as the spacing on the PCB is wider than normal to make it a easy build for beginners, the postion for T1 is shown on the board (top left section) the outline on the slik screen shows which way to fit the transistor as this MUST be fitted the right way, the flat should face towards the back of the board. DON'T try and push this right down to the board you will just

break its legs off, it can sit 5 to 10mm above the board, this also applies to the voltage regulator below.

 Now fit 'T2' which is in fact the 78L05 voltage regulator, this is between the two yellow capacitors, again make sure you fit it the correct way round this time the flat side points towards the FRONT of the board. Read these instructions again to make sure you understand before you fit these two parts.

Step 8

Speed/Gap and Volume controls

You have 3 control potentiometers with the kit, the Speed and Gap ones are not critical with regards to there value, any value between 5 and 100K will be fine, normally either 10 of 50K will be provided. The volume control is a combined pwr/volume potentiometer and will be 10K.

If you look carefully at these controls you may see a little diecast aluminumum tag just under the main threaded shaft, this is used in some applications, in this project the tab is not used. If there is a tab then use a small pair of old cutters and snip it of cleanly, it will snap off very easierly. Most likley I will have already done this for you but its possible one might escape me. If you do not cut the tag off you may find the control looks at funny angle when tighten onto the front panel.

Some times I have noted as slight variation is size on the body of these controls (different suppliers) so I have used slight elongageted soldering holes for their legs, just align them so that all three of the controls are flush with the edge of the PCB when fitted and none stick out further than the others.

The mounting of these should be self explanitory as they can only fit in one place.

Step 9

The power on LED.

LED's can only be fitted one way, it is very important to get this right first time, it is easy to damage them with two much heat.

If you look at the supplied 3mm red LED you will see it has one leg longer than the other, this is the Positive side of the LED, look at the PCB, (Bottom Right) you will see where the LED fits, the long leg MUST go into the round hole (on the right) the short leg into the square hole. When fitted the LED must sit about 20-25mm from the PCB, it will be bent later to push through a small hole in the front panel.

Step 10,

Nearly done!

Now I hope you didn't leave the speaker lying around on the bench, if you did really inspect it for off cuts, I have spent age trying to get an off cut from out of the speaker housing and in the end due to the nasty buzz the offcut made when the speaker was in use I had to replace the speaker.

Now is the time to fit it, if you look under the speaker you will see the two PCB pins and one is marked +Ve, the positive pin goes to the right hand side of the speaker mounting points on the PCB, solder one pin first and then check the speaker is sitting right down on the board.

Step 11

Take a break! Well done you have finished building the T20 main board. Now we can test the board before we fit it in the case.

The rear terminal block is for the battery connector I have marked the +Ve and 0V terminal, the battery clip is already cut to size, fold the short ends of exposed wire on the end of the clips twol eads back on their insulation and push the ends into the approriate terminals, by folding the ends over the insulation I find that I don't get the wire breaking off when I need to swap the battery.

Ok now to test the T20, fit the battery and turn on the unit by turning the volume control, the LED should light red, if it doesn't

turn it off again and remove the battery recheck your work and find what is wrong, you did solder the two pins on the PCB behind the Volume control didn't you (often missed)

Once you have sorted any problems try again and hopfully the LED should light, if not and you have a meter check the voltage across the LED, if its there when turned on then you may have fitted the led the wrong way round, also then check the voltage from the 5V regulator, it should be 5V, you can check this between Pin 8 (5v) and Pin 4 (0V) of the IC socket. Once your happy that all is good turn off the tutor and insert the ATTINY85 chip, Now be very careful when doing this, Pin 1 of the chip is top left hand side of the socket. The chips has a very small 'Dot' on its body right by pin 1. I don't know why the manufactors didn't make that bigger, my poor old eyes struggle to see it. If you do fit it the wrong way the chances are no damage will be done, I have done that a number of times and never had a problem but it will only work the correct way and why risk the damage, check twice.

Turn the Gap control fully anticlockwise, the speed control about half way and then turn on the tutor ,the LED should illuminate and you should start hearing a string of random letters, adjust the volume /speed and gap controls to make sure they all work as they should, if they do not work right check for dry joints and solder bridges between the controls pins.

Now to box it up,

Find the case and carfully set aside the small bag of screws, you will need the four PCB mounting screws first.

You have a front and back panel in the kit.

Find the bottom case panel
and fit the rear panel, make
sure you push it right down.
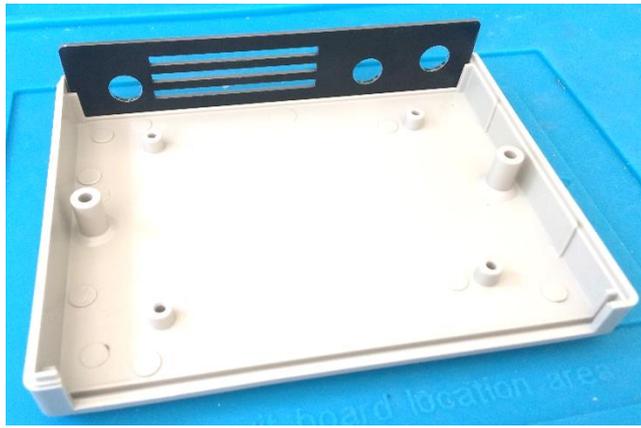
Now push the front panel onto the PCB and drop the PCB into the bottom of the box so it lines up with the back panel holes .

You have two lengths of foam tape, Take the white one and peel the backing from the one side, the side to peel is the plastic finish side , not the paper. Fit this on the bottom case in the cutout area (this is to stop the battery from moving around.)

Now fix the PCB to the base using the screws provided.

The next job is to wire the mode switch,
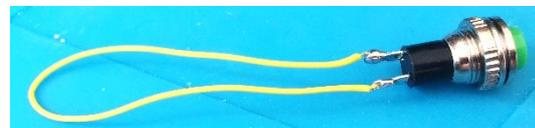
Now fit the switch, this is a little fiddly so take your time. And when fitted cut the loop and wire the two end to the terminal block just behind the switch.

Now fit the other larger foam strip to the lid of the tutor, again this is to stop the battery from moving, be carful the lid will only fit one way so check you have it right before you fit the foam, once its stuck, its stuck!

Now just fit a battery (9V PP3) and fit the lid, well done you have finished the T20 Tutor.

Now get on with learning the code, 10 minuite sessions are a good way , take a break after that. I hope to hear you on the bands.

Since your interested in Morse then why not join the best CW Club FISTS. Take a look at our web site www.fists.co.uk

73 es GL

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