KANGA PRODUCTS

M0TGN Morse Tutor

This kit came about through the need to produce a replacement for the designers ageing **Datong D70 Morse Tutor®** that he had used for many years.

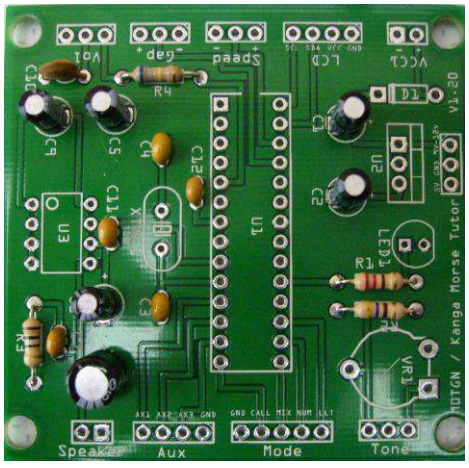
It has similar functions such as Letters, Numbers, Mixed Letters and Numbers, and a position to enable you to plug a key in and use it as a Morse Code Oscillator training unit.

On opening the kit, please check your components against the Component List on Page 7.

Please Note: *That IC's are Static Sensitive so please make sure you take the correct procedure when handling them.* If you have missing or damage components, please contact Kanga Products who will replace the item.

Stage 1.

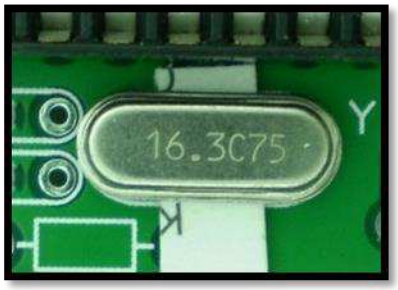
Firstly fit the Resistors in order, double checking the component against the colour code in the Component List. ***DO NOT fit VR1 at this stage***. Once you have soldered them into place, check your work for any solder splashes or possible solder bridges. Fit the Capacitors in order checking with the Component List. Ensure you check the value and polarity of the Electrolytic Capacitors. Again check your work.



Stage 1 complete, the PCB should look like this.

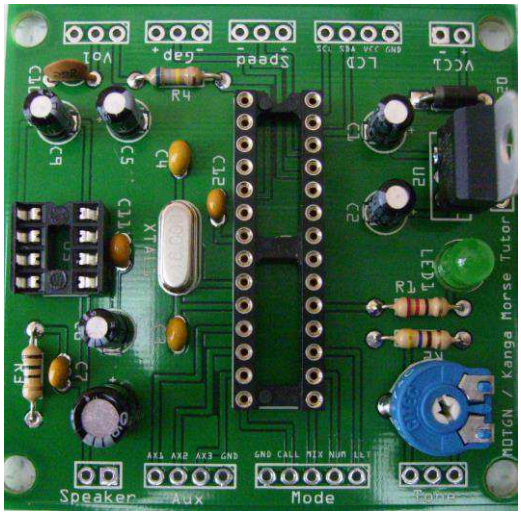
Stage 2.

Now fit the IC Socket's – note the position of Pin 1, followed by D1 and the LED, again check the polarity. Now carefully solder the crystal into place, use a small sliver of paper/card under the crystal to ensure the case does not short out against the PCB, see picture right.



Caution Excessive heat can damage the crystal.

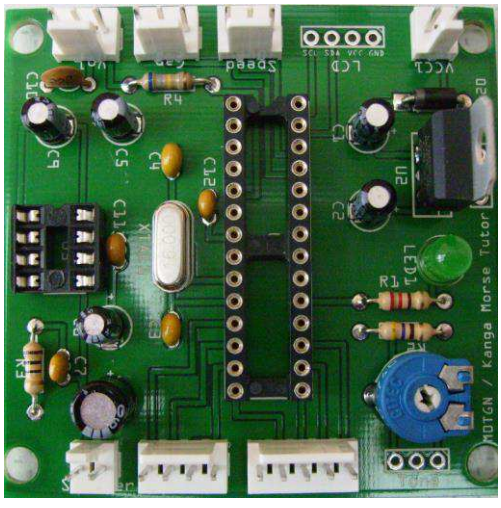
Lastly fit U2 and VR1. Check your work for any solder splashes.



Stage 2 complete, the PCB should look like this.

Stage 3.

Fit the Molex headers to the board. DO NOT fit the LCD and TONE headers; these are features we will be adding to the Tutor in the future. Please also note that all pins face outwards. Check your work for any solder splashes.



Stage 3 complete, the PCB should look like this.

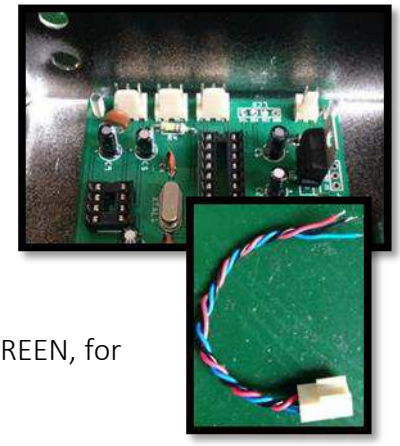
Fit the 3 Potentiometers to the Front Panel; remove the 'locating pip' using pliers before fitting.

It is recommended to solder all wires to the Switch before fitting the Switch to the Front Panel.

Fit the Battery Clip using the M3x6mm Screw and Nut, and the 4 off M3x12mm Screws that will hold the PCB in place, see picture above.

Once you are happy that the controls are tight enough, fit the Knobs to the Potentiometers.

Stage 4.



Temporarily place the PCB in position on their mounting screws, with the *Speed, Gap and Volume* Connectors at the back of the box.

Take the three (3) wires (Red, Black, and Blue) and cut them to length and twist together, this makes them look tidy and professional.

Alternatively wires can be kept tidy using small cable ties or silicone sleeve. The finished example on Page 5 used silicone sleeve.

Take the Five (5) Pin Molex Socket with 4 wires, RED, BLACK, YELLOW and GREEN, for MODE connections, and do the same.

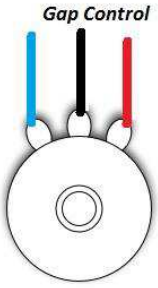
Take the Four (4) Pin Molex Socket with 3 wires, GREEN, RED and BLACK, for AUX connections, and do the same.

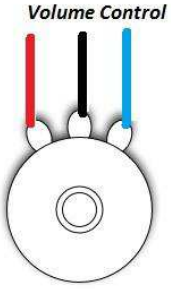
The battery lead (Red/Black) will now need to be prepared. Take one of the Red wires and strip approximately 2cm of insulation, and the second red wire strip approximately 3mm of insulation. Place to one side with the other prepared cables.

We now need to wire the respective sockets to the controls, see the respective pictures to help with this.

Speed Control is wired as Gap Control.

View from spindle/shaft.





Switch Wiring

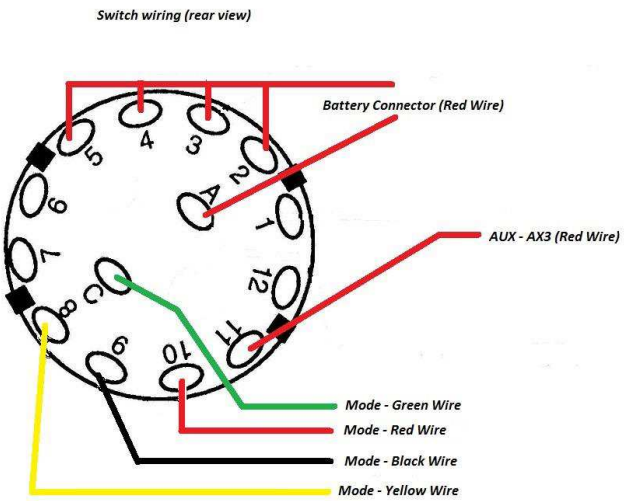
PIN C Green Wire: (MODE) Common

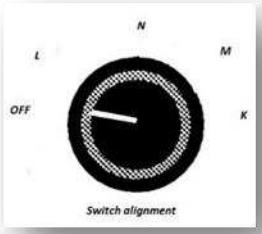
PIN 8 Yellow Wire: (MODE) LETTERS

PIN 9 Black Wire: (MODE) NUMBERS

PIN 10 Red Wire: (MODE) MIXED

PIN 11 Red Wire (AUX): KEY





Cut switch spindle/shaft to approximately 8mm length.

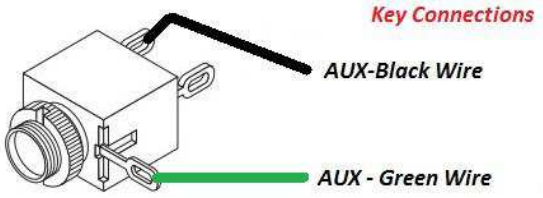
Remove the 'locating pip' before fitting the switch.

Set switch for 5 Way operation.

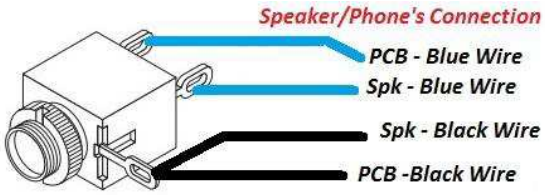
Fit the switch to the Front Panel.

Turn the switch fully CCW and position the switch such that when the knob is fitted the knob pointer is at the 'OFF' position, see the picture on the left for the alignment of the Rotary Switch Knob.

Stage 5.



Now wire the 3.5mm Stereo Socket (Black) for the Key connection.



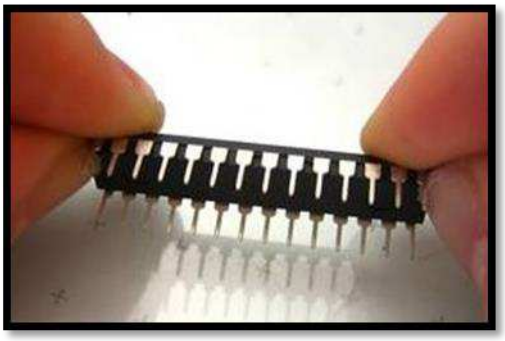
Now wire the 3.5mm Mono Socket (White) for the Speaker/Headphone connections.

Once you are happy with the connections, double check your work and solder joints. Before we fit the IC's we need to ensure that we have the correct voltage on the respective pins of the IC sockets.

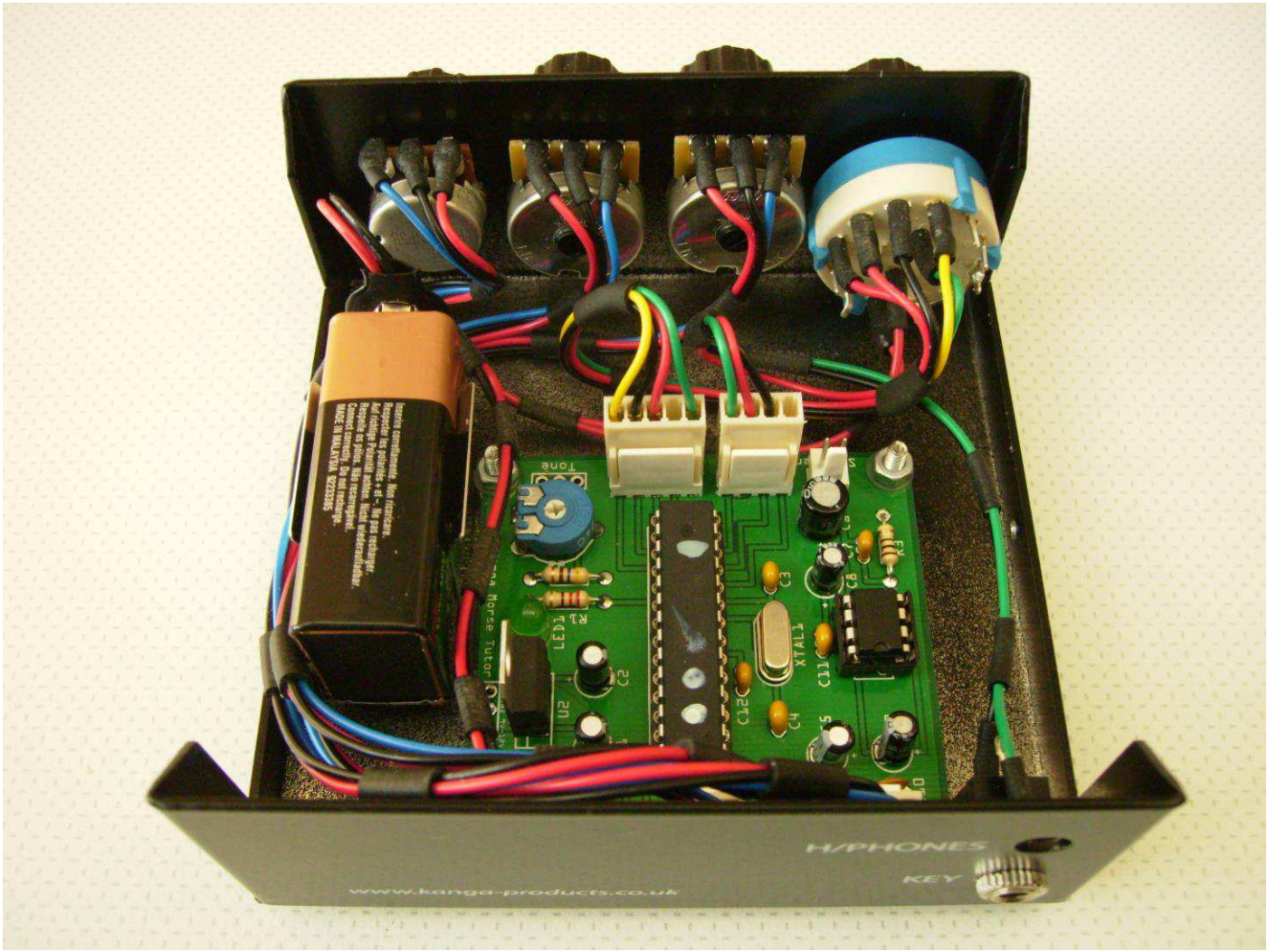
Connect a PP3 9V Battery to the Battery Clip and set MODE switch to 'L'. Using a Multimeter check for 9V and 5V at the test points adjacent to U2. Now check for 5V on U1 Pin 7 (the Atmega 328) and 5v on U3 Pin 6 (the LM386). Refer to Circuit Diagram.

Once you are happy this is correct, set MODE switch to ‘OFF’ and disconnect the Battery.

Insert the IC’s noting the position of Pin 1.



Please Note: *Before installing both IC’s take a look at the 28 pin CPU part. DIP ICs are shipped from the factory with their leads slightly bent out. This is done to accommodate auto insertion machines. Before we can insert them into the board or a socket, the leads need to be straightened. Carefully bend the leads against the table until they're at a 90° angle to the body of the IC. Now carefully insert the CPU into its socket. Press evenly, working from end to end, watch for leads that miss, they can potentially bend under or over the socket. Now do the same for the 8 pin LM386.*



Stage 5 complete, the Morse Tutor should look something like this.

Testing the Tutor

Reconnect the Battery and place into the clip so as to hold it in place.

Connect the 2 Pin Speaker/Phones Molex Socket to the Speaker Header on the PCB.

Switch the MODE switch to ‘L’ (Letters) you should hear the letter ‘L’ in Morse code through the loudspeaker, the Tutor will continue to send random characters of the Alphabet in groups of five.

Check the function of the Speed, Gap and Volume controls, check these functions increases/decrease as the controls are turned CW/CCW.

Switch the MODE switch to ‘N’ (Numbers) you should hear the letter ‘N’ in Morse code through the loudspeaker, the Tutor will continue to send random numbers in groups of five.

Switch the MODE switch to ‘M’ (Mixed) you should hear the letter ‘M’ in Morse code through the loudspeaker; the Tutor will continue to send mixed letters and numbers in groups of five.

Switch the MODE switch to ‘K’ (Key) you should hear the letter ‘K’ in Morse code through the loudspeaker, this Mode allows the user to plug a Key into the tutor and to enable them to practice their sending.

Connect a Morse Key to the Tutor, press the Key, you will hear the oscillator through the loudspeaker.

Using a trim tool, carefully adjust VR1 to set the preferred tone frequency of the oscillator.

Finally assemble the Case. To avoid contact with the Battery and U2 the Loudspeaker must be to the left hand side when viewed from the front. Secure using the Self-Tapping screws provided.

M0TGN MORSE TUTOR - FRONT VIEW

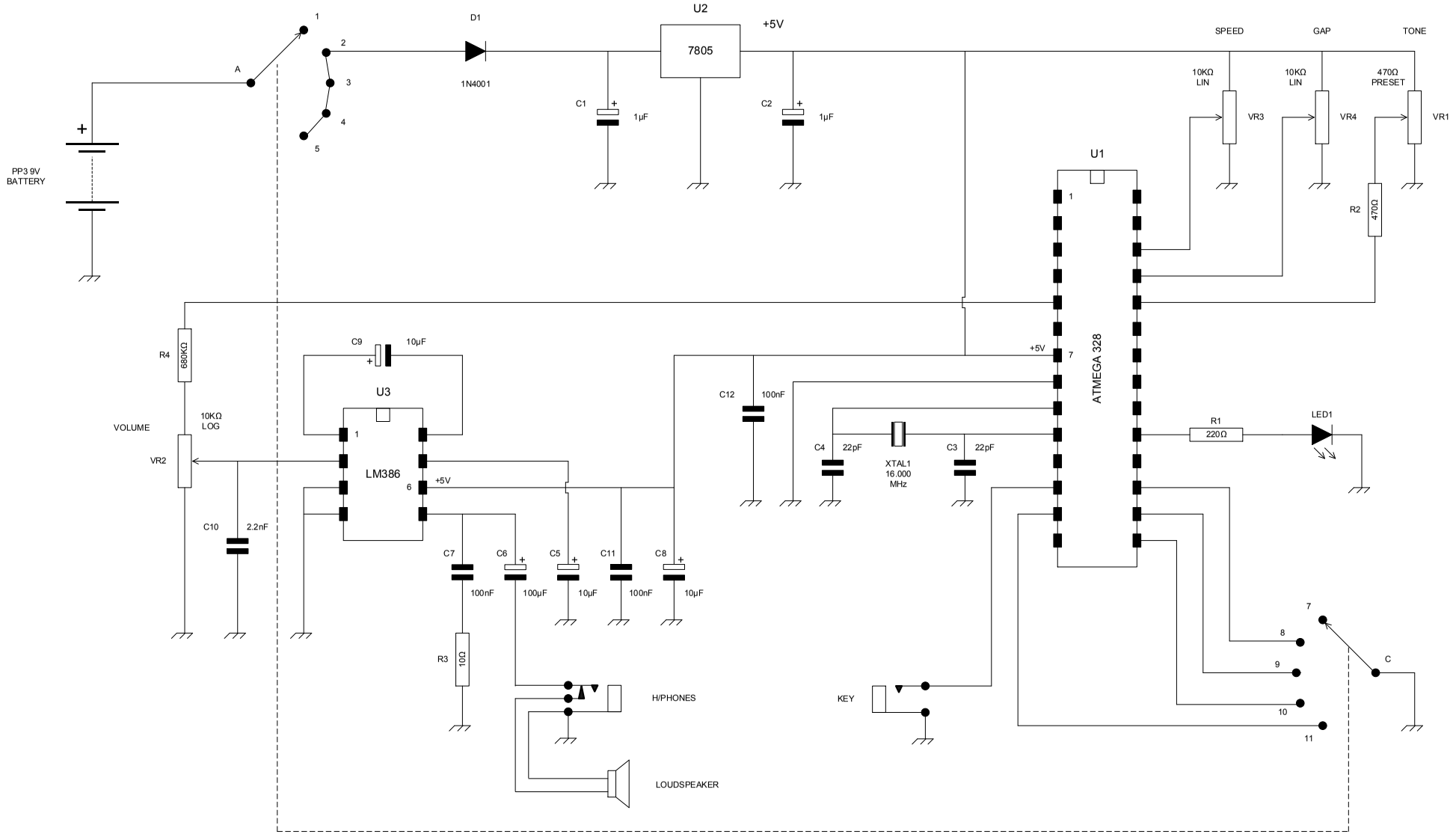
Kit Distributed by Kanga Products (UK). www.kanga-products.co.uk

MORSE TUTOR designed by Dan Trudgian, M0TGN.

Instructions edited by Lewis Thomas, G4YTN.

COMPONENT LIST

	PRESENT	FITTED	PART	TYPE	MARKING	COMMENTS
STAGE 1			PCB		M0TGN/Kanga Morse Tutor V1.20	
			R1	220Ω	Red, Red, Brown, Gold	
			R2	470Ω	Yellow, Purple, Brown, Gold	
			R3	10Ω	Brown, Black, Black, Gold	
			R4	680KΩ	Blue, Grey, Yellow, Gold	
			C1	1µF	1µF Electrolytic 50v	Observe Polarity +VE Long Lead
			C2	1µF	1µF Electrolytic 50v	Observe Polarity +VE Long Lead
			C3	22pF	220 - Multilayer Capacitor	
			C4	22pF	220 - Multilayer Capacitor	
			C5	10µF	10µF Electrolytic 16v	Observe Polarity +VE Long Lead
			C6	100µF	100µF Electrolytic 16v	Observe Polarity +VE Long Lead
			C7	100nF	104 - Multilayer Capacitor	
			C8	10µF	10µF Electrolytic 16v	Observe Polarity +VE Long Lead
			C9	10µF	10µF Electrolytic 16v	Observe Polarity +VE Long Lead
			C10	2.2nF	222 - Brown Disc Ceramic	
			C11	100nF	104 - Multilayer Capacitor	
			C12	100nF	104 - Multilayer Capacitor	
STAGE 2			VR1	470Ω	Pre-set Potentiometer (470Ω)	
			D1	1N4001	1N4001 - Silicon Diode	Observe Polarity
			LED	Green	Green or Red may be supplied	Observe Polarity
			U2	5V Regulator	7805	Observe Polarity
			Xtal 1	Crystal	16.000 Mhz	See Notes
			8 Pin DIL Socket			Note Pin 1
			28 Pin DIL Socket			Note Pin 1
STAGE 3			VR2	10KΩ Log	Volume	
			VR3	10KΩ Linear	Speed	
			VR4	10KΩ Linear	Gap	
			2 x 2 Pin Molex Header			
			3 x 3 Pin Molex Header			
			1 x 4 Pin Molex Header			
			1 x 5 Pin Molex Header			
			4 x M3x12mm Screws			
			1 x M3x6mm Screw			
			9 x M3 Nuts			
			PP3 Battery Retaining Clip			
			4 x Knob - Black			
STAGE 4 & 5			1 x 2 Pin Molex Socket		Red/Black - **Battery Clip**	Battery lead wired to Molex Socket
			1 x 2 Pin Molex Socket		Blue/Black - **Speaker/Phones**	
			3 x 3 Pin Molex Socket		Red/Black/Blue - **Speed, Gap, Volume**	
			1 x 4 Pin Molex Socket		NC/Black/Red/Green - **Aux Connector**	NC = No Connection
			1 x 5 Pin Molex Socket		Green/NC/Red/Black/Yellow - **Mode Switch**	NC = No Connection
			Rotary Switch		Set to 5-Way	MODES: OFF-L-N-M-K
			3.5mm Stereo Jack Socket (Black)			
			3.5mm Mono Jack Socket (White)			
			PP3 Battery Clip			
			U1	Atmega 328	Pre-Programmed	Note Pin 1
			U3	LM386	LM386-N	Note Pin 1
			Speaker			Mounted in Case
			4 x Feet			Self adhesive stick on
			Screen Printed Case + Screws			



M0TGN MORSE TUTOR

Schematic by G4YTN