Morse Code Practice Oscillator

A device which lets you hear your Morse while you're learning… before you go 'on-air' [updated 2021]

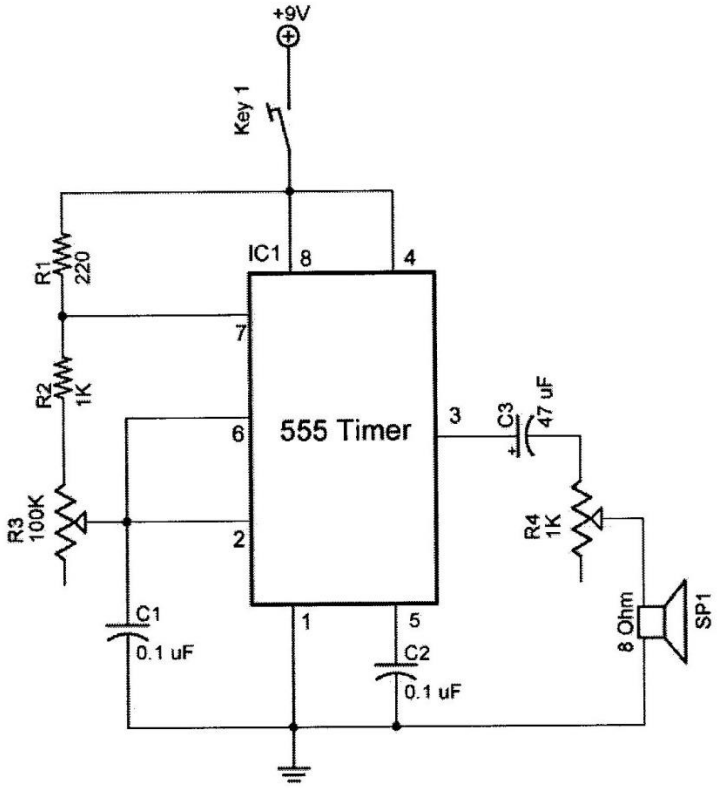

Image 1 – Circuit diagram CW Practice Oscillator

Image 2 – Completed box

This project builds into a box into which you plug a Morse Code Key.
Using the Morse Key creates realistic sounds so you can judge how well you "Send".
A great tool for beginners to improve Morse sending skills before going 'on-air'.

This is NOT new; when Morse was mandatory Amateur Radio books gave directions to build something similar – today it's a fun side aspect of Radio so this project may be new to you.

The NE555 Integrated Circuit is the heart of the project, around which 2 basic circuits are built.

1. A circuit to create the frequencies, which can be changed to the pitch/tone you prefer.
2. A circuit to pass the amplified sound to the speaker - controlled with a volume knob.

Components required:

- **555 Timer IC with PCB mount socket [NE555 – 8 Pin]**
- **Resistors R1 220 Ω**
- **Resistor R2 1k Ω**
- **Variable Resistor R3 [Potentiometer] Logarithmic 100k Ω**
- **Variable Resistor R4 [Potentiometer] Linear 1k Ω**
- **Capacitors C1 & C2 2 x 100nF [non electrolytic]**
- **Capacitor C3 47uF Electrolytic – i.e. polarized – place the "+/--" correctly**
- **Speaker 8 Ω 250mW [0.25W] size to suit your jiffy box [27 – 57 mm]**
- **Socket, panel mount – size to suit your Morse Code Key plug – 6.5mm used**
- **Battery clip to suit 9v battery**
- **Knobs x 2 to fit Frequency & Volume Pot shafts**
- **Jiffy box – approx. 130mm x 68mm x 44mm**
- **PCB circuit board - Vero board**
- **Supply of suitable link wire & solder/tools to suit**
- **Optional – 4Pin header/housing PCB mount blocks to attach components with long wires**

See below for additional information on the 555 Timer and Parts list with Jaycar catalogue numbers

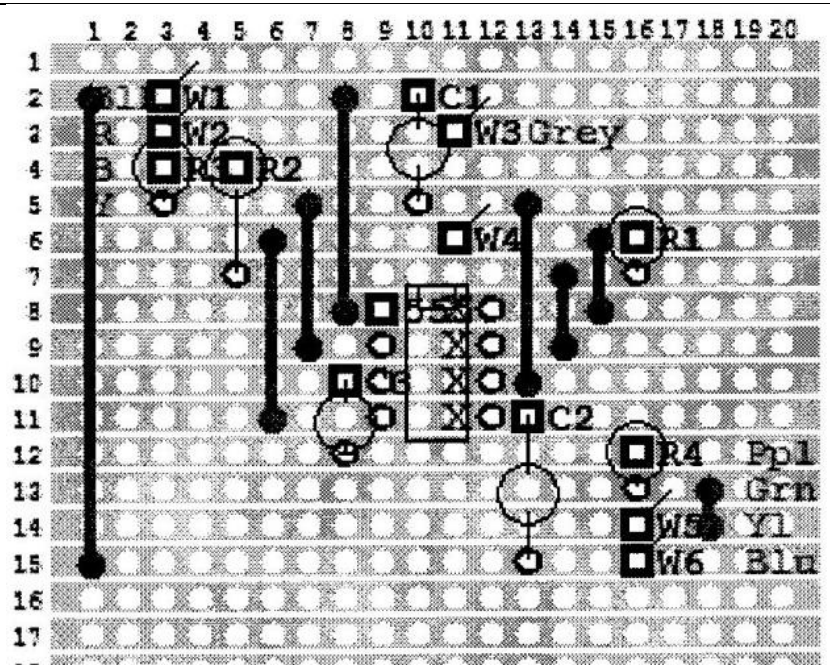

Image 3
Design layout on paper

Design your circuit on paper before you begin to solder onto a board

Plan where each component will go & ensure it meets up with the next component at the correct point on the board. *See image 3* – this is the most important [and difficult] step for beginners.

Check that power is flowing in a continuous line around the board.
Broken links or components sitting alone on the board mean the 'circuit' is not complete and it will not work.

Draw your design on paper with the 555 IC near the centre and work out from each pin – noting how components are connected at junctions – one row can be 'common' to 2, 3 or 4 components in this project.
Double and triple check your workings. Follow the line from each Pin of the IC to be sure it matches the Schematic.
Your plan may not look like mine, that's OK, work with whatever board you have…. just refer to the points above.
Ensure your final circuit board size will fit into the jiffy box you purchased!

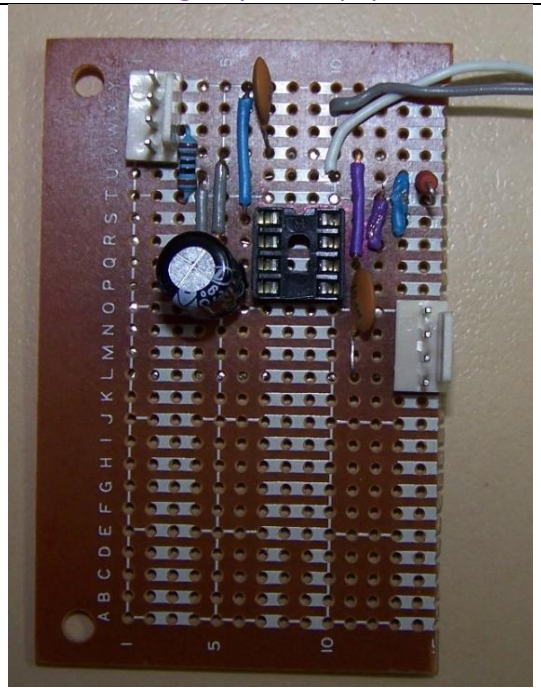

Image 4

Solder components to the board
Begin with the Wire links first as they lay flat on the board then add each component according to its height. The order that I follow placed components: *Links, resistors, IC socket, capacitors, 4Pin mounts and Large Capacitor.*

When the design is marked with an "**X**" it means: **CUT** the copper track under the board.

When using an IC it's quite common to isolate the Left and Right sides of the IC. Use a sharp knife and carve a small ditch in the copper – test to make sure you have isolated both sides of the IC. *Quick continuity test with meter will do*.

Solder the IC Socket in but **do NOT** put the 555 IC chip into the board until you've finishing adding/heating components with soldering iron.

Pay attention to any components that are 'Polarized' – i.e. they need a particular Positive/Negative placement.
See Capacitor C3 must to be placed with the +ve leg joining Pin 3.

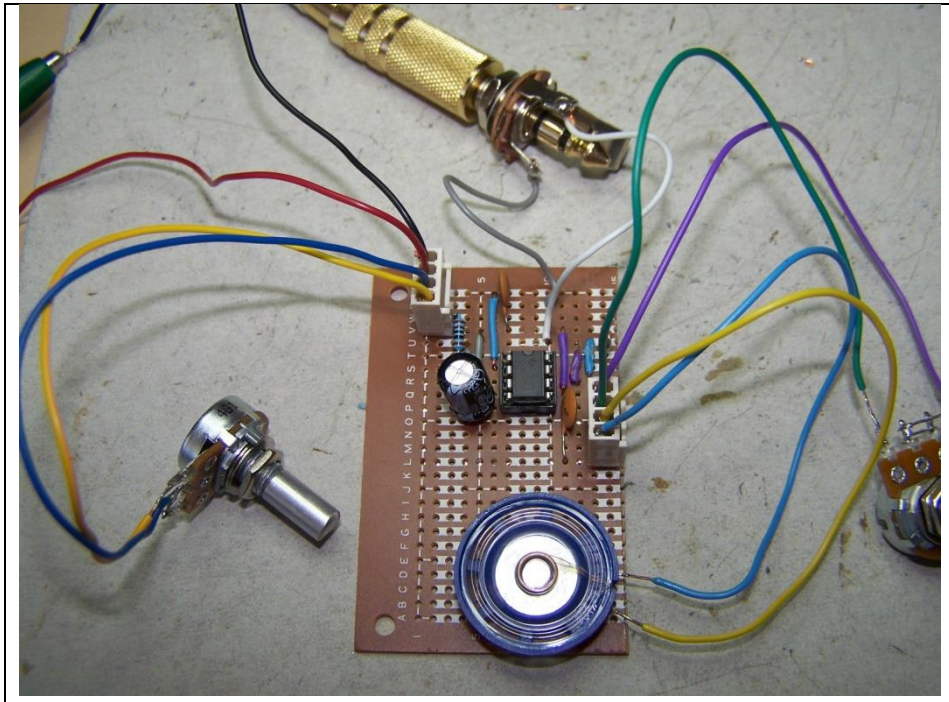

Image 5

Test the circuit

When all components are added, do a final physical check following the line from each Pin of the IC. Does each pin have a correct line of power and components as per the schematic?

- Add the NE555 IC to the circuit – it's time to be brave
- Connect a 9V battery & Morse Key to the circuit
- *Press the Morse Key* to close the circuit
- Adjust the Frequency and the Volume knob until the Tone suits your ear

IF it isn't loud enough? Look to your Pots – the variable resistors. The Linear 1k must be connected to the speaker and the Logarithmic 100k must be connected through Pins 2 & 6 to create the Frequency or Pitch.
If it doesn't work – YOU have done something wrong! Walk away and come back with fresh eyes. Start following the schematic around your circuit…. What's missing? What's in the wrong place?
Are all your solder joints holding – test under the board with a continuity tester to be sure power runs along each rail.

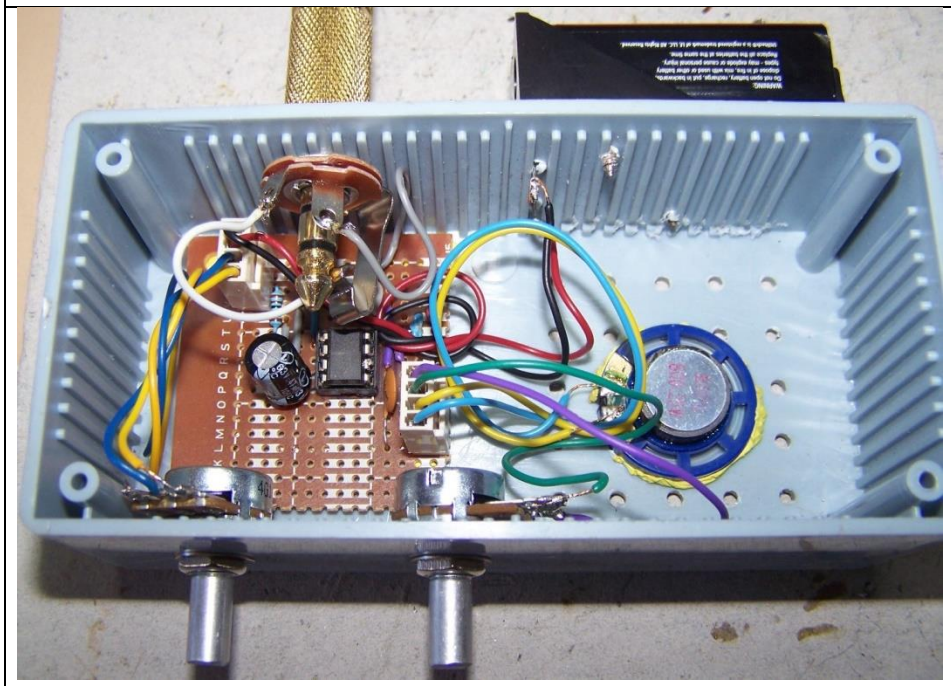

Image 6

Success!

The circuit worked so it's time to drill holes in the Jiffy Box

- Two tiny pinholes for the battery mount clip pins
- Two for the Pots [frequency & volume knobs]
- *Jaycar only sell **100k Log** variable resistors in 24mm – noticeable larger than 16mm Linear, so shaft is longer and needs to be cut off to match 16mm*.
- Drill holes in a pattern over where the Speaker will sit *[Image 6 shows more holes than necessary because I originally used a larger speaker but found these 27mm Mylar speakers from Jaycar to be excellent for their size – so less drilling is necessary]*
- Hole for the Morse Key Socket.
- I used 4Pin Block Mounts to keep coloured wires under control – each wire could be soldered directly to the board if you prefer
- Those beige mount blocks makes the board modular and repairable.

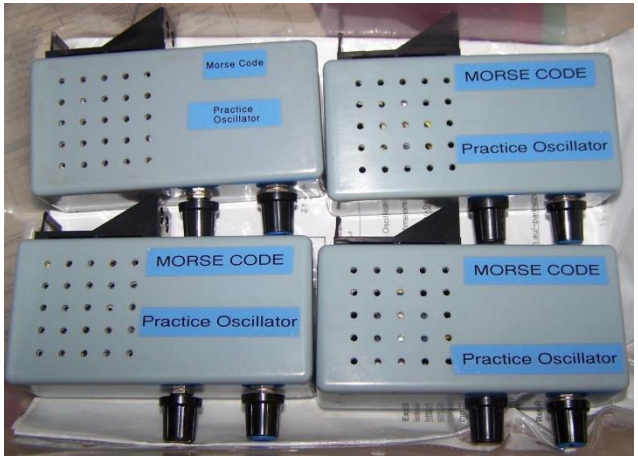

Image 7 Practice Oscillators ready Basic Morse Code Training

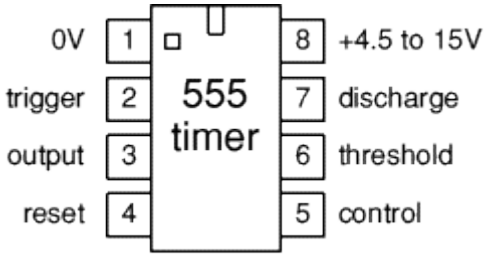

Image 8 – 555 IC Pin designation

Notes: **NE555 Integrated Circuit**

I'm keeping this simple so that beginners can have confidence use them in circuits. See Image 8 for the Pin Designations for a 555 Timer

Keeping it simple, just know what this IC is performing many small jobs so you don't have to build lots of small circuits to accomplish the same thing. Each Pin is numbered and has a designated FUNCTION.

Note the cutout "U" at the top of the IC that's 'the top' and Pin 1 is always the top left. With 1 to 4 down the left side and 5 to 8 back up the right side. When you look at the real chip it also has a 'dip' or 'U' at the top – so does the socket. Make sure you know Pin1/Top.

Comparing these Pins to our original circuit. Pin 1 went direct to Negative or Zer0volts – ***check.***
Pin 3 to output…. Ours went Pin 3, through a capacitor and then to the output – [the speaker and the volume control] – ***check***.

To build this Oscillator you do not need an in-depth course in the mysteries of these devices but do some internet research if you want to know more… or else just build and have fun… you can learn more as you go along.

Creating a layout on paper

Just because you can identify the components in the schematic doesn't mean you know how to place them on a circuit board, and I found this website http://electronicsclub.info useful for beginners.
It takes you step by step in building up a simple circuit and understanding how components should be linked to each other.

On the last page of this document there is the parts list with the JAYCAR Australia part numbers.
I hope this helps you get into this simple project and then come and learn Morse Code.

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*There are also some **beginner level computer design** programs around, which are free.*

Do a search for 'circuit design software for beginners' and read about the free ones which might help you.

Parts list with *Jaycar* part numbers & Cost *as at Nov2021*

	Part #	***Price***		***Part #***	***Price***
Vero board [95x75mm]	HP9540	$5.50	NE555 IC	ZL3555	$2.25
Speaker 27mm all-purpose	AS3002	$3.75	IC Socket 8Pin	PI6500	$0.38
Knob [red]	HK7705	$1.25	Capacitor 100nF ceramic [2pk]	RC5360	$0.46
Knob [blue]	HK7709	$1.25	Capacitor 47uF Electrolytic	RE6332	$0.42
Mount 9V Battery holder	PH9235	$1.45	Resistor 200 Ω 0.5w [8pk]	RR0555	$0.85
6.5mm mono phono line plug	PP0150	$1.55	Resistors 1k Ω 0.5w [8pk]	RR0572	$0.85
6.5mm mono chassis socket	PS0162	$1.95	Potentiometer Logarithmic {A} 100k Logarithmic single-gang 24mm	RP3618	$3.95
Jiffy Box 130x68x44 - black	HB6013	$4.50	Potentiometer linear {B} 1k Linear single-gang 16mm	RP7504	$3.95
PCB 4Pin Mount block header/base	HM3404	$0.85			
			[with a few components left over]	**Total**	**$33.61**