MCWA Code Practice Oscillator Assembly Instructions v1.0

The MCWA Code Practice Oscillator kit is a project to allows you to practice sending Morse Code. It is a simple kit to assemble that only requires basic soldering skills. The battery connector, battery holder, and speaker are already mounted to simplify the build for you. Take your time and follow the instructions and you will have a fun and working project.

Tools required

- Phillips screwdriver
- 1/4" nut driver, wrench, or pliers
- Soldering iron or workstation
- Solder (electrical, not acid-core solder used in plumbing)

Assembly steps

[ ] Identify and inventory the parts

C1	.01 uF	Small yellow capacitor marked "103"
C2	10 uF	Red tubular electrolytic capacitor
R1	10k ohms	Brown, Black, Orange bands (blue/green paper tab)
R2	47k ohms	Yellow, Purple, Orange bands (brown paper tab)
RV1 - Frequency	100k ohms variable	Marked with "F" with black marker
RV2 - Volume	10k ohms variable	Marked with "V" with black marker
U1	NE555	Eight pin integrated circuit in foam carrier
Key	Key assembly	Yellow 3D printed part with two 5/8" screws and nuts
	4-40 nut	
	4-40 5/8" screw	

Note: To avoid misplacing the small capacitor, C1 is taped to C2's cardboard carrier.

[ ] Install resistor R1.

[ ] Install resistor R2.

[ ] Install capacitor C1.

[ ] Install electrolytic capacitor C2. This is a polarized component that must be installed properly. Looking at the capacitor, you will note that the negative post is marked by a labeled white band on the case and its lead is shorter. Insert the negative lead into the printed circuit board, the other lead into the "+" hole, and solder.

[ ] Install U1. This is another part that must be installed properly. Examine the chip and note that one corner has a circle on the top. This is pin 1. Insert U1 with the circle aligned with the circle drawn on the printed circuit board. Solder the eight pins.

[ ] Install the volume control (marked with a "V").

[ ] Install the frequency control (marked with a "F").

[ ] Insert the 3/8" 4-40 screw from the bottom of the printed circuit board and attach the nut. This forms one contact of the key (switch).

[ ] Prepare the yellow key assembly by removing the insulation from the end of the yellow wire. Twist the bare wire together and optionally tin it with some solder. This wire will be wrapped around one of the two screws on the top side of the printed circuit board and the exposed wire will be held in place by the printed circuit board and the yellow key assembly

[ ] Mount the yellow key assembly using the two nuts that are on the assembly. Make sure that the bare wire is wrapped around one of the screws on the top side of the printed circuit code and held firmly in place. To avoid breakage of the wire, be sure not to over tighten or twist the wire excessively.

[ ] Attach the four plastic feet to the bottom of the printed circuit board.

[ ] Insert a 9 volt battery in the holder.

Congratulations, assembly is complete!

Using the code practice oscillator

Turn the volume control about 80% clockwise and the frequency control midway. Press the key down until it contacts the screw. You should hear a tone coming from the speaker. Adjust the volume and frequency to suit. Refer to the Morse Code sheet and the online resources provided and have fun!

How does this thing work?

An oscillator is an electronic circuit that produces a periodic repeating waveform, in this case, a square wave audio tone. The NE555 is configured as something called an astable multivibrator. Capacitor C1 is charged via R1, R2, and a variable resistor. Once the capacitor charge reaches a certain level, it is quickly discharged and the process repeats. This produces an output that is coupled to the speaker via capacitor C2 and the volume control. Adjusting the frequency control changes how fast the capacitor charges and the output frequency.

If the volume is turned up all the way, you will notice a slight buzzing of the sound. The output of the NE555 is a square wave which has this characteristic. When the volume is turned down, the volume control, capacitor, and speaker form a crude filter which smooths out the waveform and removes some of the buzziness.

The yellow key assembly forms a simple switch that applies power to the circuit.
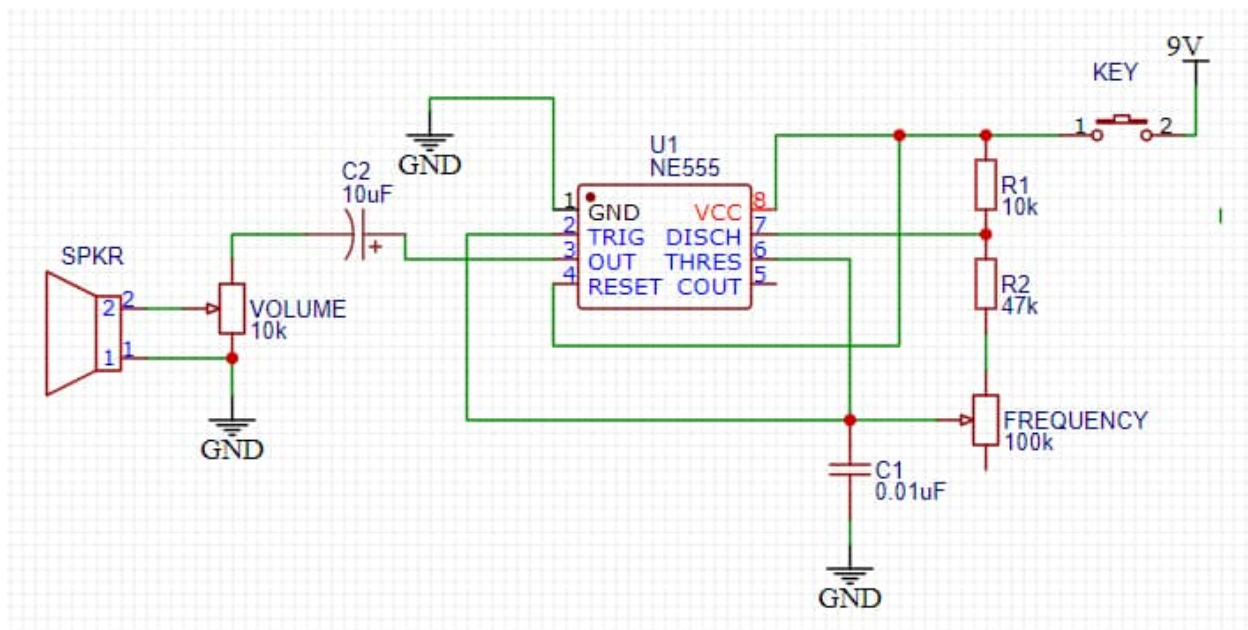
Project notes

The battery can be always connected as power is only drawn when the key is pressed (switch is closed). However, if leaving the unit unused for a long period of time, remove the battery to avoid potential damage from battery leakage.

Because of its small size, don't expect high quality audio from the speaker. If desired, the speaker can be replaced with a better one, earbuds can be attached for private listening, or the output can be connected to the line input of an amplifier. The NE555 can produce room filling audio with the right speaker or external amplifier.

You will notice that the volume control has very little range and must be turned up nearly all the way to hear sound. This is by design. If plugging the project into an amplifier or using earbuds, it is essential to be able to reduce the audio to safe levels.

IMPORTANT: It is not recommended to use earbuds due to the high audio level from the NE555. If using earbuds, turn the volume control ALL the way down and slowly increase the volume to a comfortable level. The same process should be followed if plugging the output into an external amplifier.

What if I need help and where do I go from here?

As long as you are comfortable with a soldering iron and know how to make good solder connections, we don't expect that you will have any difficulties assembling this kit. However, if you have any questions or difficulties with assembling the kit or want to know more about amateur radio, contact us at info@mcwa.org and we will do our best to help you.

The latest copy of these instructions and other resources concerning the Morse Tutor and Code Practice Oscillator can be found at https://mcwa.org/morse-tutor.

We hope you enjoy building this kit and have fun using it. Amateur radio is a rich and rewarding hobby with something to offer everyone. What you have seen today at the Maker Faire is just a glimpse of what amateur radio offers.

We look forward to having you join the almost three million radio amateurs worldwide!

73,

Ralph (WB9ICF), Gary (W9GD), Dave (K9AT), Sam (KC9GPY), and Andy (WB7DKZ)

Note: "73" is a shorthand that has been used in Morse Code communications almost since the beginning and means "Best Regards". Other abbreviations commonly used are "TU" (thank you), "GL" (good luck), and "CQ" (calling any station).

International Morse Code