5 Note Organ Instructor Guide

Design principles

The 5 Note Organ, is designed to be built by young Scouting youth members with limited to no soldering experience. It has many design principles that should ensure lower assembly failure rate, and a longer lasting robust kit

Design features

- Momentary on/off switch - so that it can not be accidentally left on
- Centred On/Off switch and note switches at the bottom so that it can be operated by a left or right handed person
- PCB Mount speaker holes (15mm and 10mm spacing) , but also has through holes for wired speakers (max 40mm), and holes to put cable ties through to hold the speaker on.
- PCB Mount battery holder, but can also accommodate a wired battery holder. Recommend using a small 2mm thick piece of double sided tape to help hold the battery holder on - see assembly section.
- Larger solder pads 2.5-3mm, to make soldering easier for Scouts
- Wider spacing for radial component leads to prevent solder bridges, and components laid down to prevent breakage.
- Longer IC pads to help with Soldering,
- Short Stem switches to help prevent switches breaking
- Hole at the top for connecting to a Lanyard
- Wider tracks so that if through holes are delaminated, then the component lead can be soldered to the track - saves replacing the board and starting again,
- No more than 1 track connected to a through hole to reduce the number of tracks to be reconnected if a pad is delaminated.
- Space for youth members name and group on the back

Circuit details

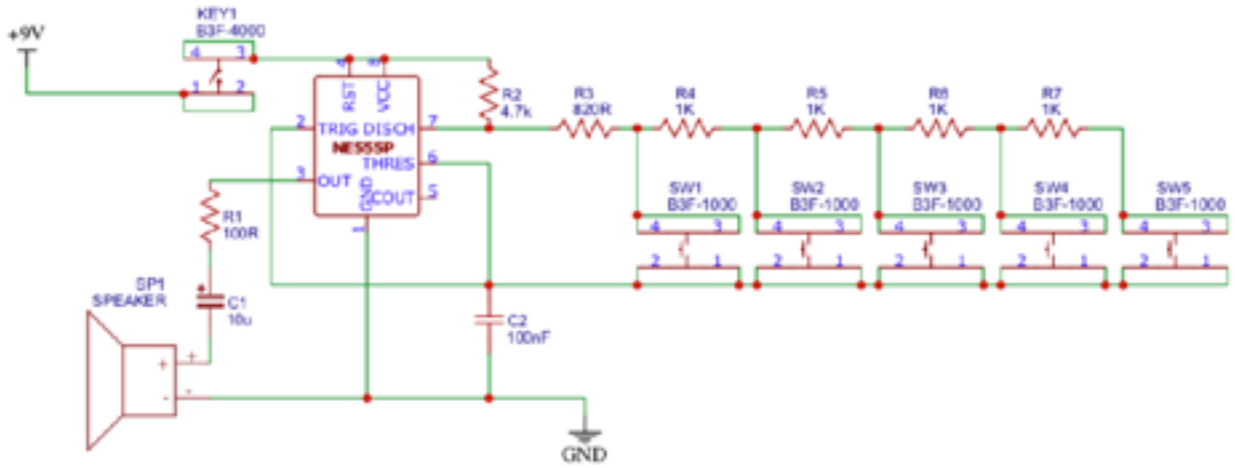
The circuit is based on a 555 timer running as an astable multivibrator.

The frequency of the output is changed by changing the value of the resistor between the 555 discharge and threshold pins.
This changes the output frequency from a low of approx 1.2khz to 2.5khz. This is well within the response range of most small PCB mount speakers, and many of the available small Mylar Speakers

KEY 1 is a momentary switch - this needs to be held down to power the circuit. This was used in preference to a slide, toggle or rocker switch that could be left on and therefore run the battery down. It is a low profile switch with a small stem, to help reduce the risk of breaking the stem.

SW1-5 are also momentary switches used to play the notes. They are also short stemmed to reduce the risk of breakage. Only one note will play at a time, regardless of how many switches are held down.

The circuit will draw between 3mA when no note is being played and approx. 22mA when the lowest note is played.



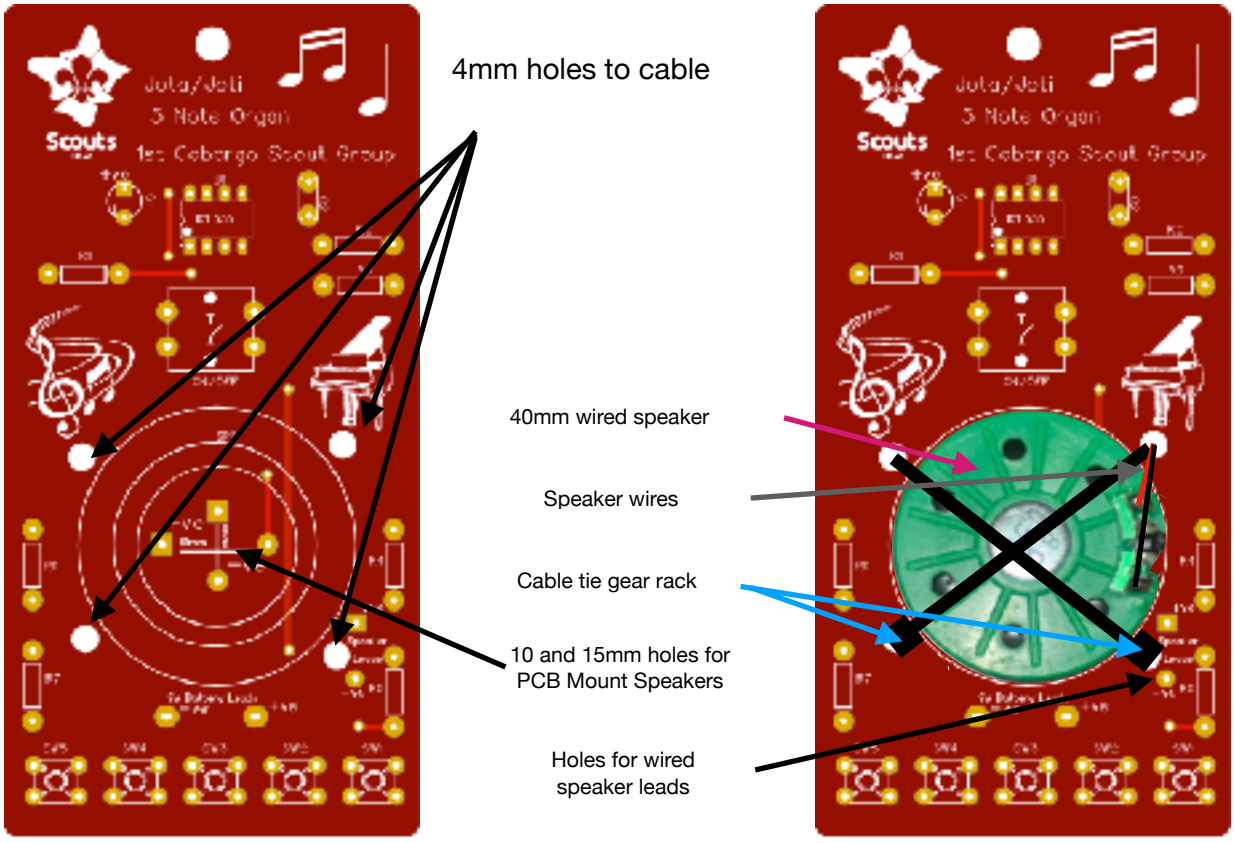
Speaker Options

The Board can accommodate different size PCB mount Speakers it has spacing for 10mm, and 15mm pin spacing. See the component list for suggestions of brands/cost and supplier options that will fit these mounting holes

It can also take up to a 40mm diameter speaker with wires. This could be glued on, but there are also 4 - 4mm holes that can be used with 2.5 mm wide, 200 mm long cable ties crossed over to hold the speaker in These will fit between the pcb mount battery holder on the back, and the board, and not interfere with the screw mounting holes on the battery holder.
It is recommended to put the speaker wires through these holes as well, to take up any slack, to reduce the risk of the wires getting caught and broken off.

I recommend that the gear rack end of the Cable tie is at the bottom end of the board near switches 1-5, on the top side of the board, so that fingers can not come into contact with sharp ends.

The best speaker to use is the COM-11089 from Core-electronics - its worth the extra $1



See the Battery holder page for how the cable ties fit between the battery holder and the board on the rear of the board and how the cable ties do not interfere with the battery holder screw holes.

There are many different small speakers available that you could use. The green one above is from Core-Electronics (see shopping list), the Recommended PCB Mount one is available from Core electronics, or the cheaper one from element 14, (see shopping list) you can also get wired speakers that stick on - check eBay have seen 10 for $16 (have not tried them).

Recommended PCB Mount From Core-Electronics (best sound)

Alternative PCB Mount From Element 14

Suggested 40mm wired FromCoreElectronics

Stick on one found on eBay

Battery Holder options

The Board can accommodate different 9v battery holder types

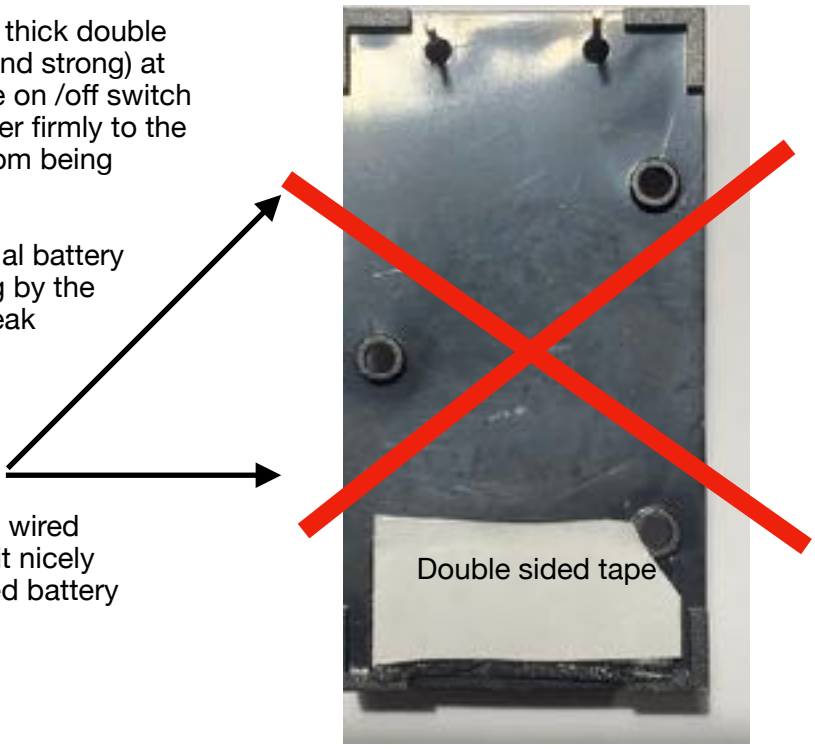
The main preference is a PCB Mount battery holder, there are many different brands available, in qty of 10 or more they are about $1 each. See the shopping list for suggestions. The recommended one in the shopping list is available from Altronics, but I have also seen it at, Jaycar and Radio parts for a similar price.

Different manufacturers have different pin spacing, the board has slotted holes for the battery holder that can accommodate pin spacing from approx 12.5 to 14 mm. Just be aware if you are using a different brand battery holder, you will need to check the cable ties do not interfere with the mounting holes

It is advisable to use a piece of 2mm thick double sided tape (automotive tape is nice and strong) at the end of the battery holder near the on /off switch end. This will secure the battery holder firmly to the board at both ends, and prevent it from being broken off.

It is not recommended to use a normal battery snap, as the battery ends up hanging by the wires and it does not take long to break these off.

Approximate position of the cable ties when using them to hold down a wired speaker, the battery holder will just sit nicely round the holes if using the suggested battery holder in the shopping list.



Double sided tape can go diagonally as long as it does not interfere with the cable ties if you are using them

To Do list before the Day

1) Order Boards
2) Order Components
3) Source and buy the Double sided tape
4) **Solder requirements** - 60cm solder (approx 2.3g) (Can do it with about 40cm)
5) Print one copy of the Component Sorter per Soldering station, and laminate them. Stick these to the table so that the Scouts do not take them with them. These are used by the Scouts to sort the components, do not let them start soldering until you have checked that they have sorted them correctly

6) Print two copies of the Assembly guide (double sided) per table (4 - 6 scouts) - they can just share them. Laminate this as well, and maybe put a hole in it and tie it to the table leg so they do not take these with them.

7) Cut the double sided tape and stick it on the lower bottom edge of the battery holder
8) Paint a pink stripe on the +ve terminal of the speaker - it will make things a lot easier if you do this as its much quicker to check orientation of the speaker before giving out the battery holder.

8) Package the kits in the Mylar bags. Only put in the resistors, ceramic, and electrolytic capacitor, speaker, 6 switches and IC socket. As per the component sorter do not give out the battery holder until the speaker orientation and soldering has been checked. Its not easy to get the battery holder off if they have stuffed up the speaker orientation or soldering. Also do not give out the IC and battery until the battery holder is soldered in.

Assembly guide suggestion

Install the components in the following order (the board will stay relatively flat on the bench this way, and will not require you to splay the wires much to keep the component from falling out.

1. Resistors - 7
2. Ceramic Capacitor
3. Switches - 5 small and 1 large
4. IC Socket -1
5. Electrolytic capacitor

6. Speaker - Depending on what you have ordered will depend on the installation process. If you are using the recommended PCB mount speaker from Core Electronics with the 15mm pin spacing, or any other PCB mount, they tend to only have the + and - markings on the bottom so you can not tell when they are soldered in round the right way. **It may be worthwhile marking the +ve pin on the outside of the case with some nail polish to enable easy identification of the correct way to orient them**. If you are using a wired speaker, you will need to either cable tie them in or try some hot glue.

7. Battery socket - this is installed on the rear of the board, Check the PCB mount speaker soldering before you do this, and remember the double sided tape.
8. 555 IC - Give this out when the soldering has been checked and the Battery holder soldered in, and it pays to help them put it in ,as they are very good at bending legs under the IC's which are hard to see.
9. Get them to write their name and Scout Group on the back in the space provided.