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| Required Components  |  |  | | --- | --- | | 3D printed Finger Lift Switch parts laid out for reference (listed in BOM, below) | Finger Lift Switch mechanical and electronic parts (non 3D printed) laid out for reference. Also listed in BOM below. | |
| **BOM**   1. 1X Finger Lift Lever (3D) 1A. 1X Finger Lift Pad 2. 1X Balance Screw Holder (3D) 3. 1X Counterweight Nut Holder (3D) 4. 1X Bearing Base (3D) 5. 1X Bearing Base Cap (3D) 6. 1X Reed Switch Plate (3D) 7. 1X Ball Bearing: Type MR85ZZ (8 mm OD 5 mm ID) 8. 2X 5 mm x 1 mm Magnets (Neodymium) 9. 1X Reed Switch (Glass) Contact Normally Open (N/O) Magnetic Induction Switch (2 mm × 14 mm) 10. 2X M3 x 8 mm Stainless Steel screws (Base & Base Cap screws) 11. 1X M3 x 10 mm Stainless Steel screw (Counterweight screw) 12. 1X M3 x 12 mm Stainless Steel screw (Bearing Screw) 13. 1X M3 x 16 mm Stainless Steel screw (Balance screw) 14. 5X M3 Stainless Steel Nut 15. 1X 1/4-20 (Imperial size) Nut 16. 1X 5-foot mono audio cable with 3.5 mm male phono plug |

# Required Tools

* Soldering Iron (fine tip)
* 60/40 rosin core electrical solder
* Multimeter (with continuity reading capability)
* Medium size Phillips screwdriver (type #1)
* Side cutters
* Wire strippers
* Super glue (gel type is best)
* Hot melt glue gun (low temp type)
* Permanent felt marker (fine tip)
* Needle nose pliers
* Sturdy metal tweezers

# Required Personal Protective Equipment (PPE)

* Approved safety glasses

# Assembly Instructions

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| Step 1 Remove any 3D support material using side cutters. Make sure the pad on the Finger Lift Lever is especially free of burrs that could irritate skin. If needed, use a bit of fine sandpaper (or emery cloth) to smooth the pad. Additionally, remove support material from any blocked holes or channels. Holes can also be cleared using a 2.5 mm drill bit (3/32 or #40 in Imperial units) | **Photo of Finger pointing out 3D printer support material to remove** |

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| Step 2 Apply a drop of superglue inside the corner magnet hole rim of the Bearing Base (Part #4 ). | Applying a drop of superglue inside the magnet hole on the Bearing Base |

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| Step 3 Insert one of the 5 mm x 1 mm magnets (Part #8) into the corner magnet hole of the Bearing Base (Part #4). Wipe off any excess glue and allow glue a few minutes to set. | Placing a 5 mm x 1 mm magnet into the superglue in the magnet hole  of the bearing base. |

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| Step 4 Place the second 5 mm x 1 mm magnet (Part #8) on top of the first glued magnet (don’t use glue for the second one!) and mark the top side with a fine felt tip permanent marker. This step is important, as it will mark the side of the second magnet that will repel the face of the glued magnet. | Marking the magnet with a black x using a fine tip felt marker |

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| Step 5 Take the top marked magnet from the marked side of the magnet and place it on the 1/4-20 nut. Make sure the marked side is on top. | Photo of fingers placing marked magnet on a 1/4 - 20 steel nut. |

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| Step 6 Insert the nut (Part #8) and magnet (part #8) into the counterweight retainer (Part #3). Magnet side should go in first, with magnet in the rounded magnet slot, as shown in above photo.  **Important:** The marked side of the magnet must remain facing the plastic bottom well of the retainer. | Photo of Steel Nut being inserted into 3D printed Counterweight retainer. |

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| Step 7 Screw the counterweight retainer (Part #3) onto the Finger Lift Lever (Part #1) using an M3 x 10 mm screw (Part #11). Use one of the M3 nuts (Part #14) to capture the screw on the bottom side. Make sure the counterweight retainer goes on the same side of the lever arm as the bearing screw tube that straddles across it. | Counterweight retainer being screwed onto the tail end of the Finger Lift Lever |

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| Step 8 Insert one of the M3 nuts (Part #14) halfway onto an M3x12 screw and drop it into the slot of Balance Screw Holder (Part #2). Ensure that the screw head faces the small end hole, and that the top side of the nut is flat. | Placing the balance screw, with nut in the middle, into the upside down Balance Screw Holder. |

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| Step 9 Slide Balance Screw Holder (Part #2) onto the Finger Lift Lever arm end (Part #1). Ensure the screw tip is facing towards the rounded end, as shown below on right. | The upside down Finger Lift Lever arm (finger end) is slide into the slot of the upside down balance screw holder. This entombs the balance screw and within the Lever assembly. |

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| Step 10 Put a small drop of Superglue into each of the two ends of the Balance Screw Holder. This will bond the Balance Screw Holder onto Finger Lift Lever arm. | Adding small drops of superglue into the rear underside seams of the balance screw holder. |

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| Step 11 As a test, slide the Finger Lift Pad into the inner slider of the Finger Lift Lever, ensuring that the high side of the pad goes in first, as seen in the second image. Make sure the lift pad slides in all the way. | Sliding the rounded Finger Lift Pad into the finger pad mounting slot of the Finger Lift Lever. With the Finger Lift Lever upside down, a finger is touching the lift pad to ensure the lowest end of the pad is at the end of the lever arm. |

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| Step 12 Slide out the finger lift pad and place a small drop of superglue at the end of the Finger Lift Lever where it was. Next, slide the finger lift pad back into place, in the same orientation as before. This completes the lever arm element. | The finger lift pad is partially slid back out out, and a small drop of superglue is placed where it was. The lift pad is then slid back into place over the glue before it dries, and holds the pad in place.Finger is touching the lift pad again to ensure the lowest end of the pad is at the end of the upside down lever arm. |

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| Step 13 Insert the MR85ZZ bearing (Part #7) into the large hole in the back of the Bearing Base Cap (Part #5, studded side). Make sure the bearing is properly aligned with the hole, or it may be difficult to insert. | Fingers inserting MR85ZZ bearing into the bearing hole in the top back of the Bearing Base Cap. |

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| Step 14 Screw the bearing base cap (Part #5) onto the bearing base (Part #4) with an M3 X 8 mm screw (Part #12). Use one of the M3 nuts (Part #14) on the Bearing base side to hold the screw in place. This completes the Bearing Base element. | The bearing base cap (with bearing) being screwed onto the bearing base. Image showing the receiving M3 nut on the inside of the bearing base. |

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| Step 15 Lay the reed switch (Part #9) into the reed switch slot of the Reed Switch Plate (Part #6) as shown, and GENTLY mark the reed switch with a fine tip felt marker 1 mm shy of the solder cup edges. | Fine tip felt marker placing small black dot on the right side reed switch wire to mark where it will be cut. The left side wire has already been marked. |

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| Step 16 Using needle nose pliers, firmly grip each end of the wire next to the cut marking on the reed switch side. Cut each wire end at the marked point, as shown in the image, with the needle nose pliers in the middle, to prevent wire strain from breaking the reed switch. **IMPORTANT! Be extra careful not to place any pressure on the thin glass tube itself, as it is VERY easily broken.** | Trimming the wire end of the reed switch, with the needle nose pliers in between the  reed switch and cutters, to help protect the reed switch. |

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| Step 17 Once the reed switch wires are trimmed, drop the reed switch (Part #9) into the Reed Switch Plate (Part #6). As one wire on the reed switch will be longer, flipping the reed switch will be needed if the reed switch got turned around. Ensure the reed switch drops in completely without pressure, and that the wire ends aren’t biting into the Reed Switch Plate. | Reed switch placed in the Reed switch plate in preparation for soldering. |

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| Step 18 Being careful not to nick the internal wires, use wire cutters to strip 42 mm of the outer insulation from the wire end of the 5-foot mono jack cable. Note that 42 mm is the same as the total length of the Reed Switch Plate, so you can use it as a ruler. | Mono cable wire end, showing 36 mm of insulation being removed with wire strippers. |

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| Step 19 Insert the cable (Part #6) end into the Reed Switch Plate (Part #6) end hole until it hits the end of the screw slot. Hold it there. Tuck one wire into the long wire channel, and the other, over the side of the Reed switch plate where it crosses over the end of the reed switch (as in below photo). Note that wire color is not important for this application. | Stripped mono cable wire ends being placed into the reed switch plate, with the red wire going to close end of the reed switch and the black wire into the channel going to the other side of the reed switch. |

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| Step 20 Using Side cutters, snip the wires where they cross over the edge of the Reed Switch Plate (Part #6). | Side cutters being used to trim the red wire and the black wire to proper soldering length. |

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| Step 21 Remove the 3.5 mm cable (Part #16) from the Reed Switch. Using wire strippers, strip 3 mm of insulation from each wire within the cable. Pinch the cable end as you strip to prevent pulling wire from the outer insulation. | The red and black wires getting 3mm of insulation removed with wire strippers. |

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| Step 22 Using a heated soldering iron, tin (pre-solder) the wire ends with 60/40 electrical solder. Use just enough solder to coat the wire ends while leaving a minimal solder blob on the end. | The red and black stripped wire ends being "tinned" with a soldering iron, for easier soldering. |

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| Step 23 Return the prepared mono cable end into the Reed Switch Plate (Part #6), tucking the tinned wire ends under reed switch wire ends. Temporarily lift the reed switch wires with a push pin, or wire scrap, if necessary. | Push pin being used to aid in positioning the tinned wire ends over the reed wires in preparation for soldering. Image showing properly laid down wires in Reed Switch Plate. |

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| Step 24 Solder the wire ends to the reed switch ends, on the Reed Switch Plate (Part #6), Solder as quickly as practical. Prolonged heat may weaken the magnetic properties of the reed switch or melt through the Reed Switch Plate plastic. | The prepped mono cable wires being soldered to the reed switch wire ends using rosin core solder, and a fine tipped soldering iron. |

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| Step 25 View the Reed Switch Plate (Part #6) from the side, to ensure no solder or wire protrudes above the grip edge. Use side cutters to cut off any excess solder blobs or protruding wires. | Side cutters tips being used to trim any protruding solder from Reed Switch Plate. |

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| Step 26 After soldering and trimming, it’s a good idea to test the reed switch using the magnet previously glued into the bearing base. Clip multimeter leads to the Mono plug contacts, set the multimeter to continuity, and enable the beeper (if possible). Bring the base magnet up against the cable end of the reed switch solder joint. Your multimeter should beep and/or show a low resistance reading. If all is well, it’s time to continue If not, it’s time to troubleshoot. | *Image of Reed Switch Plate end being placed next to the magnet in the Bearing Base. A red multimeter (on right) is displaying a low resistance reading (0.91 ohms).* |

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| Step 27 Add a drop of superglue to the cable end inside the Reed Switch Plate. Gently twist the cable back and forth 2-3 times, to work the glue around the full cable diameter. | Superglue being dispensed onto 3 mm cable where it enters the Reed Switch Plate |

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| Step 28 Fill the reed carrier glue cavity (largest circle) with hot melt glue. Make sure the cable end is completely covered in glue, but don’t overfill, as the glue shouldn’t protrude above the plastic. If you get excess glue, use a side cutter to trim away excess glue once it has set. | Left forefinger holding down Reed Switch Plate, while a glue gun (on right) is squirting hot glue into the plate's glue cavity. |

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| Step 29 Add Preparation for mounting. Install the Reed Switch Plate onto the Bearing Base with an M3 x 8 mm screw, going through the M3 nut installed earlier. Position the Reed plate so that you see just a 1 mm crescent of the base magnet showing on back and side. Screw should only be kept finger tight. | The reed switch plate being screwed into the Bearing BaseImage showing a visible "crescent" of the base magnet which is mostly covered by the Reed Switch Plate. |

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| Step 30 Screw a M3 X 12 mm screw through the bearing, and through the shaft tube on the lever arm. Use one of the M3 nuts (Part 14) to capture the screw and secure the lever arm to the base. The screw should be finger tight, but still allow the lever arm to tilt without noticeable resistance. Make sure the screw head is centered within the outermost rim of the bearing. Note, the screw should be tightened just enough, to prevent side to motion of the lever arm. | Screwing the completed Finger Lift Lever to the base. |

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| Step 31 To complete the Finger Lift Switch, the reed switch plate needs to be adjusted for optimum performance. Using a narrow Phillips screwdriver, loosen the reed switch plate, just enough to allow it to slide forward (towards user) or back (towards cord end). | Screwdriver being used to loosen the reed switch plate screw prior to adjustment |

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| Step 32 Setup your Finger Lift Switch for testing, by connecting a multimeter to the 3 mm plug end of the switch. Ensure the Multimeter is set to (lowest) ohms setting, and that the continuity feature is turned on (if your meter has this). | Finger lift Switch with multimeter leads attached to the 3.5 mm plug |

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| Step 33 Using a multimeter set to continuity (or ohms), slide the reed switch plate to the position where it best triggers when the finger lift pad is lifted. At one extreme the switch will always be on, and at the other the switch will always be off. It may help to mark the extreme positions with a pencil, and then slide to the middle point between them. Note: you may need to ensure your screwdriver is removed during testing, as it may have magnetic properties that can interfere with calibration. | Reed switch plate moved about 3 mm left of centre on bearing base |
| More sensitive |
| Reed switch plate in centre position on base |
| Typical |
| Reed switch plate moved about 3 mm right of centre on base |
| Less sensitive |

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| Step 34: Completion Again, using the multimeter set to continuity, and leads connected to the plug, lift the finger pad to confirm proper operation of the switch. The switch is now complete. If you wish, you can test the on resistance of the switch by using the multimeter set to the ohms range. Ideally, the resistance of the switch should be below 1 ohm when on, but may *be up to 12 ohms, depending on application.* | Back of third finger being used to lift the finger lift switch lever from below. On the left, the Lift Switch plug shows multimeter clips attached. To the right, the multimeter shows .56 ohms being measured on the ohms setting. |

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| Step 35: Optional Mounting Step The finger lift switch can be mounted to a base plate (or splint) using double sided tape or hook and loop fastener (e.g., VELCRO). The use of hook and loop fasteners can allow for some minor repositioning of the switch if needed. Cut the tape to 34 x 14 mm. | Photo of double sided tape being applied to the underside of the Finger Lift Switch base. |