# Required Components

|  |  |
| --- | --- |
| *An assortment of components required for the sliding analog joystick assembly. These components are listed in the Bill of Materials (BOM) below. There are numbers beside each item.An assortment of components required for the sliding analog joystick assembly. These components are listed in the Bill of Materials (BOM) below. There are numbers beside each item.An assortment of components required for the sliding analog joystick assembly. These components are listed in the Bill of Materials (BOM) below. There are numbers beside each item.Bottom of the joystick enclosure, 3D printed in light blue.Top of the joystick enclosure, 3D printed in light blue.*An assortment of components required for the sliding analog joystick assembly. These components are listed in the Bill of Materials (BOM) below. There are numbers beside each item.  BOM | |
| 1. Mini 2-Axis Analog Thumbstick 2. Analog Mini Thumbstick Breakout Board with Included Male Headers 3. Universal Proto-Board PCB 4cm x 6 cm 4. 8x M2 x 8 mm Machine Screws | 1. 3D Printed Inner Disk 2. 3D Printed Enclosure Bottom 3. 3D Printed Enclosure Top 4. 3.5 mm Male TRRS Cable |
| Optional parts:  * 3D Printed Joystick Camera Mount Adapter * ¼-20 Tee Nut | * 2x M3 x 10mm Screws * 2x M3 Nuts |

# Required Tools

* Flush Cutters
* Wire Strippers
* Soldering Iron
* Philips Head Screwdriver
* Continuity tester (Such as a multimeter)
* (Optional for mount adapter) ¼-20 Screw or Hex Bolt, at least ½” long

# Required Personal Protective Equipment (PPE)

* Safety Goggles

# Assembly Instructions

## Step 1

|  |  |
| --- | --- |
| Insert the mini 2-axis analog thumbstick into the breakout board.  Solder the 6 pins, shown circled in red. | Close up of the joystick unit on the breakout board intended for use with standard headers. Close up of the bottom of the joystick breakout board. The pads where the joystick pins are circled in red.Close up of the bottom of the joystick breakout board. The pads where the joystick pins have been soldered and are circled in red. |

## Step 2

|  |
| --- |
| Solder two 4-pin male headers to the joystick breakout board. Before soldering, make sure the headers are straight. This can be done by inserting the headers into the protoboard while soldering to the breakout board, as shown in the second picture. |
| Close up of the bottom of the joystick breakout board with male healers soldered on.Joystick unit and breakout board inserted into protoboard. |

## Step 3

|  |  |
| --- | --- |
| Insert the headers of the joystick breakout board into the protoboard. Note the positioning and orientation shown.  **Ensure the text on the breakout board and the protoboard are oriented in the same direction as shown.**  From the top, the joystick breakout board pins should be in positions I06-I09 and R06-R09. | Protoboard with the joystick breakout board installed. |

## Step 4

|  |  |
| --- | --- |
| Ensure the header pins from the joystick breakout board are located at positions C06 - C09 and L06 – L09 (from below). The pins are circled in red.  Solder one leg on each header. | Bottom of protoboard with red ovals showing the locations of the pins for the joystick breakout board. Blue arrows show where to solder. |

## Step 5

|  |  |
| --- | --- |
| Check that the joystick breakout board headers lay flat on the protoboard. | Side view of the protoboard  with joystick installed. |

## Step 6

|  |  |
| --- | --- |
| Solder the rest of the pins on the joystick breakout board. | Bottom of the circuit board showing the headers of the joystick breakout board soldered in their position. A red oval shows where to solder. |

## Step 7

|  |  |
| --- | --- |
| Using your flush cutters, trim the header pins for the joystick breakout board, as shown circled in red. | Side view of the protoboard  with joystick and microcontroller installed. Red circles show where to trim the pins. |

## Wiring

For the next steps, the following diagram and table show the wiring. You should use a multimeter or other continutiy tester to test if your TRRS cable matches the following diagram or to match each wire with the corresponding part of the plug.

A picture containing diagram

Description automatically generated

|  |  |
| --- | --- |
| **TRRS Cable** | **Joystick breakout board** |
| Tip (T) | Y |
| Ring 1 (R1) | X |
| Ring 2 (R2) | - |
| Sleeve (S) | + |

## Step 8

|  |  |
| --- | --- |
| Take the 3.5 mm TRRS cable, cut it in half if it has two male ends, and strip off approxiamtely 2 cm of the outer insulation.  Then separate the individual inner wires and strip off approximately 0.5 cm of insulation. | A 3.5 mm TRRS cable with the insulation stripped off the end and the inside wires separated. From top to bottom the wires are coloured: bare copper, white, red, green. |

## Step 9

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Thread the wires into the holes beside the thumbstick breaklout board headers, in holes H6-HH9 when looking from above. Follow the following table for wiring:   |  |  |  | | --- | --- | --- | | **Hole** | **Pin** | **TRRS cable** | | H9 | + | Sleeve | | H8 | Y | Tip | | H7 | X | Ring 1 | | H6 | - | Ring 2 | | Wires from the TRRS cable are threaded into holes on the circuit board next  to the headers from the thumbstick breakout board. |

## Step 10

|  |  |
| --- | --- |
| Now bend the wires over and solder each one to the corresponding pin from the thumbstick breakout board.  **Note:** make sure that no solder is connecting the pins to each other, or connecting the wires to each other. | Bottom of the circuit board with wires soldered to the headers from the thumbstick breakout board. |

## Step 11

|  |  |
| --- | --- |
| Tie a knot in the 3.5 mm TRRS cable, close to the board and solder connections.  This knot will be used for strain relief on the wire. The end of the knot should be at least 3.5 cm away from the board. | A close-up of the circuit board with the thumbstick unit and wires soldered to it. There is a knot in the 3.5 mm TRRS cable.  3.5 cm |
|  |  |

## Step 12 – Optional

If mounting the joystick (not using on a tabletop) and using a mount adapter, take the two M3 nuts and slide them into the slots inside the enclosure as shown.

|  |  |
| --- | --- |
| Bottom of sliding joystick enclosure, showing two M3 nuts beside the nut slots, with two red arrows indicating the direction to slide the nuts into the slots. | Bottom of the sliding joystick enclosure, showing two nuts in the nut slots. Two red circles show the locations of the nuts. These are used for mounting. |

## Step 13

|  |  |
| --- | --- |
| Take the protoboard and the bottom of the 3D printed enclosure and insert M2 screws in each of the four corners of the board, as shown circled in red. | Bottom of the joystick enclosure with the circuit board screwed into it. There  are 4 red circles showing the locations of the 4 screws. |

## Step 14

|  |  |
| --- | --- |
| Remove the joystick topper.  Place the 3D printed inner disk on the joystick, around the joystick post.  Replace joystick topper. | Close up of the joystick unit without the joystick topper. Close up of the joystick unit without the joystick topper. A black disk has been placed on the joystick peg. Close up of the joystick unit with the joystick topper and black disk. |

## Step 15

Move the knot so it is inside of the enclosure base with the cable threading out through the hole on the side, and place the 3D printed enclosure lid on top of the enclosure base.

|  |  |
| --- | --- |
| Bottom half of the joystick enclosure with the circuit board screwed into it. This shows where to position the knot in the cable. | Top view of the joystick, with the top of the enclosure installed. |

## Step 16

|  |  |
| --- | --- |
| Flip the joystick around and insert an M2 screw into each of the 4 screw holes circled in red and tighten them. | Bottom of the 3D printed enclosure, with red circles showing the locations of the screw holes. |

## Step 17

|  |  |
| --- | --- |
| Your joystick is now finished and ready to test. | Blue sliding joystick with a 3.5 mm TRRS cable coming out of it. |

# Testing using an Xbox Adaptive Controller

1. Connect the Xbox Adaptive Controller (XAC) using a USB C cable to the computer.
2. Plug the joystick into either X1 for the left joystick or X2 for the right joystick.
3. If using Windows, open “Set up USB Game Controllers” from the Control Panel. You can find this by searching your computer in the search bar next to the Windows icon.
4. Select the Xbox Adaptive Controller from the list of controllers and go to “Properties”.
5. Move your joystick and observe the movement of the cross hatch in the “Axes” window. Ensure it moves in the proper directions when you move the joystick (the arrow points in the up direction). If not, open up the joystick and check your connections.

Alternatively, you could use the XAC with Steam or an Xbox itself to test that moving the joystick results in the corresponding movements on the controller.

# Optional – Mounting

## Table Top Mounting – Non-Slip Pads

|  |  |
| --- | --- |
| If using the joystick on a tabletop, and height of the joystick is not a concern, nonslip pads can be added in each of the four corners on the bottom, as shown. |  |

## Table Top Mounting – Hook and Loop Fastener

|  |  |
| --- | --- |
| If using the joystick on a tabletop or other surface with hook and loop fasteners, such as Velcro, stick the hook side to the joystick and the loop side to the surface to mount to. | Back of the joystick with the hook half of a hook and loop fastener stuck to the back. |

## Camera Mount

To mount the joystick on a camera mount, the optional Joystick Camera Mount Adapter can be used.

|  |  |
| --- | --- |
| Step 1 Flip the camera mount adapter around to reveal the recess with small slots.  Ensure all supports are removed from the 3D print. | Blue 3D printed part for the camera mount adapter. There are two holes on the sides and one hole in the middle with small slots around it. |

|  |  |
| --- | --- |
| Step 2 Insert the tee nut, lining up the barbs with the small slots in the 3D print. | Blue 3D printed part for the camera mount adapter, with a tee nut sitting inside of it, not fully inserted. |

|  |  |
| --- | --- |
| Step 3 Flip the part around and screw in a ¼-20 hex bolt. | Blue 3D printed part for the camera mount adapter, with a hex bolt being screwed into it. There is a white arrow showing to screw in the hex bolt clockwise. |

|  |  |
| --- | --- |
| Step 4 Tighten the bolt until the tee nut is seated down as far as possible.  (Alternatively, if you do not have acces to a bolt, the tee nut may be press fit as long as it sits flush with the 3D print.) | Top of the camera mount adapter, with a hex bolt fully screwed into it. There is a white arrow showing to screw in the hex bolt clockwise. Bottom of the camera mount adapter, showing a tee nut fully installed into the 3D print, and sitting flush. There are two arrows pointing down to indicate that the tee nut is all the way down. |

|  |  |
| --- | --- |
| Step 5 Using 2 M3 screws, screw the camera mount adapter to the bottom of the Sliding Analog Thumbstick in the two middle holes. | The camera mount adapter screwed into the bottom of the Sliding Analog Thumbstick, using two small screws. Both the camera mount adapter and the joystick are light blue. The screws are circled in red. |