# Introduction

Some assistive technology devices are equipped with stereo switch input jacks. Generally, these provide the option to connect one or two input devices. These input devices can be a single switch with a 3.5 mm mono plug, a two-input switch with a 3.5 mm stereo plug. To connect two single switches that each has a 3.5 mm mono plug, an adapter is required.

# Research

Commercial adapters are available, but they can be difficult either difficult to source or expensive. Sourcing can also be difficult because there is a type of audio adapter that looks the same but is wired differently.

## Commercial Options

**Assistive Technology**

* [~~https://cadanat.com/product/mono-to-stereo-adapter/~~](https://cadanat.com/product/mono-to-stereo-adapter/)~~, $10 USD + Shipping~~ (No longer available)
* Stereo-to-mono plug adapter (splitter) - <https://www.adaptivetechsolutions.com/cable-kit/> - $31.08 USD, US Shipping only

**Audio**

3.5 mm TRS to Dual 3.5 mm TSF Stereo Breakout Cable

* <https://www.amazon.ca/Hosa-YMM-261-Stereo-Breakout-Cable/dp/B000068O5H>, ~$17 CAD

## DIY Options

While the basic schematic is available, we were unable to locate any existing plans for creating a DIY adapter.

## Assistive Device Compatibility

There are several commercial and DIY assistive devices that have a stereo input jack:

* Origin SwiftyTMUSB Switch interface
* Origin TapioTM
* Origin HeadMouse
* Darci USB (No longer available, but often still in use)
* LipSync Switch Input Module

# Requirements

## Goals

|  |  |
| --- | --- |
| G01 | The device components should be easy to source. |
| G02 | The device should be easy to build. |
| G03 | The device should cost less than the commercially available option, or at least comparable. |

## Functional Requirements

|  |  |
| --- | --- |
| F01 | The adapter must have two 3.5 mm female inputs. |
| F02 | The adapter must have one 3.5 mm stereo output. |
| F03 | The inputs must be connected to the output pins using the typical AT wiring (i.e., left input tip to output ring, left input sleeve to output sleeve, right input tip to output tip, right input sleeve to output sleeve.) |

## Non-functional Requirement

|  |  |
| --- | --- |
| NF01 | Design must be easily manufacturable for a person with skills in soldering, 3D printing, and moderate mechanical handwork |
| NF02 | Left and right inputs must be labelled. |
| NF03 | 3D printable components should require minimal support material. |

## Constraints

|  |  |
| --- | --- |
| C01 | Single-build cost must be less than $20 CAD. |

# Ideation

There are numerous ways that an adapter with the desired schematic could be constructed:

**Cables**

* 1X 3.5 mm male stereo plug
* 2X 3.5 mm female stereo or mono jack
* Heat-shrink tubing / tape

The cables need to be cut and the wires stripped and then soldered. Shrink tube or tape is then used to reinforce and cover the connection.

**All-Female Jacks**

* 1X 3.5 mm stereo jack
* 2X 3.5 mm mono or stereo jack
* Wire to solder connections
* Something to hold / contain jacks
* 1 X 3.5 mm extension cable (Male-male)

The jacks need to be soldered together to create the proper connections. The jacks should be mounted inside something to make it easy to plug and unplug cables.

**Male Plug and Female Jacks**

* 1X 3.5 mm stereo plug
* 2X 3.5 mm mono or stereo jack
* Wire to solder connections
* Something to hold / contain jacks

The jacks and plugs need to be soldered together and contained within an enclosure.

# Conceptual Design

## Schematic

This is not the same as a headphone splitter.

* Left mono tip to stereo ring
* Left mono sleeve to stereo sleeve
* Right mono tip to stereo tip
* Right mono sleeve to stereo sleeve

# Detailed Design – Version 1.0

This version of the device consists of three 3.5 mm stereo jacks that are held in a snap-fit 3d printed enclosure. This configuration was selected to take advantage of an abundance of jacks on hand, and to provide some flexibility in positioning cables (i.e., not requiring the enclosure to connect directly to the device).

## Jack Selection

This particular jack model was selected because a large number were available on-hand from another project (AT Maker Keyswitch) and they were also readily available online (i.e., Amazon <https://www.amazon.com/Gikfun-Stereo-Female-Connector-Arduino/dp/B01KFP0M4S>). These are now no longer available, so an equivalent part was found on DigiKey.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| ID | MPN | Manufacturer | Cost | Link |
| 1 | SJ1-3535NG | CUI Devices | $1.91 | <https://www>.digikey.ca/en/products/detail/cui-devices/SJ1-3535NG/738699 |
| 2 | SJ1-3533NG | CUI Devices | $1.86 | <https://www>.digikey.ca/en/products/detail/cui-devices/SJ1-3533NG/738701 |
| 3 |  |  |  |  |



Figure : SJ1-353NG

Source: Datasheet ([**https://www.cuidevices.com/product/resource/sj1-353xng.pdf**](https://www.cuidevices.com/product/resource/sj1-353xng.pdf)**)**

## Enclosure

A simple two-part, 3d-printed, snap-fit enclosure was designed to cover and contain the switch jacks.

# Opportunities for Improvement

* This design is cost-effective if the jacks are already on-hand or are purchased as part of a larger order. A single-one off build that incurs shipping charges will be more expensive than the commercial option from Amazon.
* It may be beneficial to include the wiring diagram directly on the 3d printed enclosure somehow to aid the maker.
* The design should be easy to modify to accommodate a different model of switch jack.