# Completion Checklist (DELETE BEFORE POSTING)

* Update <MONTH> and <YEAR> in header
* Update V<X.Y.Z> in header
* Update <DEVICE NAME> in header
* Add logo to or remove the “Place Logo Here” textbox in header
* Update <YEAR> in footer
* Update <Author> in footer
* Update webpage link in footer
* Complete Overview page
* Update Maker Checklist
  + Maker To Do List
    - Remove irrelevant steps
    - Add specific customization options (if necessary)
  + Items to Give to User
    - List components of the device and quantities needed
    - State that the parts need to be tested, if that is necessary
* Add tools to Tool List
* Add supplies to Supplies table
* Complete relevant parts of Customization Guide
* Remove irrelevant parts of Customization Guide
* Complete 3D Printing Guide
  + Complete summary
  + Complete settings
  + Complete post-processing instructions
  + Add images of quality prints
* Complete Assembly Guide
  + Add required components table
  + Add required tools
  + Add required PPE
  + Complete step-by-step instructions
* Complete Testing section (if necessary)
* Complete Troubleshooting section (if necessary)
* Remove any help text
* Update Table of Contents
* Delete Completion Checklist

For detailed instructions on completing the Maker Guide, please see the OpenAT Documentation Guide [ADD HYPERLINK].

# Examples of “Gold Standard” Maker Guides

* [LipSync](https://github.com/makersmakingchange/LipSync) (for complex devices)

# Overview

This document contains the necessary information to build the Musical Grasping Training Aid. The Maker Checklist outlines the required steps, including questions for the User. The Tool List contains a comprehensive list of tools and supplies required to complete the build. The 3D Printing Guide contains print settings and quantities for the 3d printed components. The Assembly Guide contains all the necessary steps to assemble and program the device. Finally, the Testing Guide contains a set of tests to confirm the Musical Grasping Training Aid works properly.

A blue and gold tube with a blue cap

Description automatically generated with medium confidence

Contents

[Completion Checklist (DELETE BEFORE POSTING) 1](#_Toc177394403)

[Examples of “Gold Standard” Maker Guides 2](#_Toc177394404)

[Overview 3](#_Toc177394405)

[Maker Checklist 6](#_Toc177394406)

[Maker To Do List 6](#_Toc177394407)

[Items to Give to User 6](#_Toc177394408)

[Tool List 7](#_Toc177394409)

[Tools / Equipment 7](#_Toc177394410)

[Supplies 7](#_Toc177394411)

[Personal Protective Equipment (PPE) 7](#_Toc177394412)

[Customization Guide 8](#_Toc177394413)

[Musical Grasping Training Aid 8](#_Toc177394414)

[Device Stand 8](#_Toc177394415)

[3D Printing Guide 9](#_Toc177394416)

[3D Printing Summary 9](#_Toc177394417)

[3D Printing Settings 9](#_Toc177394418)

[*Table 1: Musical Grasping Training Aid 3D Printing Settings* 9](#_Toc177394419)

[*Table 2: Device Stand 3D Printing Settings* 10](#_Toc177394420)

[Post-Processing 10](#_Toc177394421)

[Examples of Quality Prints 10](#_Toc177394422)

[Maker Component List 12](#_Toc177394423)

[Assembly Guide 15](#_Toc177394424)

[Part A: Musical Grasping Training Aid Assembly 15](#_Toc177394425)

[Part A: Required Components 15](#_Toc177394426)

[Part A: Required Tools and Supplies 15](#_Toc177394427)

[Part A: Required Personal Protective Equipment (PPE) 15](#_Toc177394428)

[Part A: Musical Grasping Training Aid Assembly Steps 15](#_Toc177394429)

[Part B: Flashing Firmware to Musical Grasping Training Aid 22](#_Toc177394430)

[Part B: Required Components 22](#_Toc177394431)

[Part B: Required Tools and Supplies 22](#_Toc177394432)

[Part B: Firmware Steps 23](#_Toc177394433)

[Step B-01: Connect Musical Grasping Training Aid to the Computer 23](#_Toc177394434)

[Step B-02: Setup Arduino IDE on Computer 23](#_Toc177394435)

[Step B-03: Setup Arduino IDE for QT Py Board 23](#_Toc177394436)

[Step C-04: Install Libraries 23](#_Toc177394437)

[Step C-05: Setup Local Code Directory 23](#_Toc177394438)

[Step C-05: Flash Firmware to the Musical Grasping Training Aid 24](#_Toc177394439)

[Testing 24](#_Toc177394440)

[Battery Power Test 24](#_Toc177394441)

[Voltage Regulator Test 24](#_Toc177394442)

[QT Py Power Test 24](#_Toc177394443)

[DF Player Mini Power Test 24](#_Toc177394444)

[DF Player Mini Speaker Test 24](#_Toc177394445)

[QT Py to DF Player Mini Data Test 25](#_Toc177394446)

[Troubleshooting 25](#_Toc177394447)

# Maker Checklist

This list provides an overview of the steps required to build and deliver the device.

## Maker To Do List

* Read through the Maker Guide to become familiar with required components, tools, supplies, safety gear, and overall assembly steps.
* Talk to the User about customization options (e.g., color, any special requests, etc.)
  + Device Body Color
  + End Cap Color
  + Device Stand Color
* Order hardware components
* Print 3D printed components
* Gather tools, supplies, and safety equipment.
* Assemble the device Musical Grasping Training Aid
* Flash firmware to Musical Grasping Training Aid
* Test the Musical Grasping Training Aid
* Print “User Guide” (if the User would like a physical copy)

## Items to Give to User

* (1) Musical Grasping Training Aid
* (1) Training Aid Stand
* Printed Musical Grasping Training Aid User Guide

# Tool List

## Tools / Equipment

|  |  |  |  |
| --- | --- | --- | --- |
| Tool ID | Description | Required / Recommended | Notes |
| T01 | Screwdriver, Philips, Medium | Required | For screwing/ unscrewing device screws |
| T02 | Wire Stripper | Required | For stripping wire |
| T03 | Flush Cutters | Required | For trimming soldering leads |
| T04 | Needle Nose Pliers | Recommended | For installing battery clips and wiring |
| T05 | Soldering Iron | Required | For soldering electronic components |
| T06 | Multimeter | Required | For device testing |
| T07 | Scissors | Required | For cutting copper tape |
| T08 | Computer with Arduino IDE | Required | For flashing firmware onto microcontroller |

## Supplies

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Supplies ID | Description | Quantity | | Notes |
| S01 | Solder | spool | Used for soldering connections | |

## Personal Protective Equipment (PPE)

|  |  |  |
| --- | --- | --- |
| PPE ID | Description | Notes |
| P01 | Safety Goggles | Provides eye protection when soldering |

# Customization Guide

The Musical Grasping Training Aid tube body, end caps and device stand can be printed in the user’s desired colour.

### Musical Grasping Training Aid

The Musical Grasping Training Aid is comprised of two tube halves screwed together (electronics and battery halves) and two end caps. There is also a battery cap attached to the battery tube half. Each of these components can be printed in a combination of different or matching colors to customize the look of the Musical Grasping Training Aid.

### Device Stand

The device stand is assembled from three 3D printed components which can be printed in a combination of different or matching colors to customize its look.

#### Matching

Print the Electronics Tube Half, Battery Tube Half and Battery Cap in the same colour.

#### Different Coloured End Caps

Print the end caps in a different color from the Tube Halves, and optionally different from each other.

# 3D Printing Guide

The device was originally printed on a Bambu Lab P1S 0.4 nozzle using Bambu Studio.

## 3D Printing Summary

|  |  |
| --- | --- |
| **Metrics** | **Single Unit** |
| Total Print Time (hour:min) | 3:17 |
| Total Number of Components | 6 |
| Typical Total Mass (g) | 97.61 |
| Typical Number of Print Setups | 1 |

## 3D Printing Settings

Note that the 3D printing material should be assumed to be PLA unless otherwise noted in the table below.

### Table 1: Musical Grasping Training Aid 3D Printing Settings

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Print File Name** | **Qty** | **Total Print Time (hr:min)** | **Mass (g)** | **Infill (%)** | **Support(Y/N)** | **Layer Height/ Nozzle Diameter(mm)** | **Notes** |
| MGTA\_Electronics\_Tube\_Half.stl | 1 | 1:13 | 33.56 | 15 | N | 0.2/0.4 | Print on the second hexagonal edge. |
| MGTA\_Battery\_Tube\_Half.stl | 1 | 1h26 | 42.34 | 15 | Y | 0.2/0.4 | Print on the second hexagonal edge. |
| MGTA\_Speaker\_End\_Cap.stl | 1 | 0:28 | 8.92 | 15 | N | 0.2/0.4 | Print on flat speaker grill surface. |
| MGTA\_Switch\_End\_Cap.stl | 1 | 0:25 | 10.15 | 15 | N | 0.2/0.4 | Print on flat hexagonal surface. |
| MGTA\_Battery\_Cap.stl | 1 | 0:12 | 2.31 | 15 | N | 0.2/0.4 | Print with “Batteries” label facing print surface |
| MGTA\_MPR121\_Clip.stl | 1 | 0:10 | 0.80 | 15 | N | 0.2/0.4 | Print on the flat edge. |

### Table 2: Device Stand 3D Printing Settings

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Print File Name** | **Qty** | **Total Print Time (hr:min)** | **Mass (g)** | **Infill (%)** | **Support(Y/N)** | **Layer Height/ Nozzle Diameter(mm)** | **Notes** |
| MGTA\_Device\_Stand\_Base.stl | 1 | <Time> | <Mass> | 15 | N | 0.2/0.4 |  |
| MGTA\_Device\_Stand\_Top.stl | 1 | <Time> | <Mass> | 15 | N | 0.2/0.4 |  |
| MGTA\_Device\_Stand\_Pin.stl | 1 | <Time> | <Mass> | 15 | N | 0.2/0.4 |  |

## Post-Processing

Inspect the 3D printed parts for any printing defects, sharp edges, or burrs. Sharp edges and burrs can be removed with sanding or deburring tools.

## Examples of Quality Prints

Compare your 3D prints to the images here. If there are significant differences, you may need to reprint the part.

|  |  |  |
| --- | --- | --- |
| Musical Grasping Training Aid | | |
| MGTA\_Electronic\_Tube\_Half.stl | MGTA\_Battery\_Tube\_Half.stl | MGTA\_Speaker\_End\_Cap.stl |
|  |  |  |
| MGTA\_Switch\_End\_Cap.stl | MGTA\_Battery\_Cap.stl |
|  |  |

|  |  |  |
| --- | --- | --- |
| Device Stand | | |
| MGTA\_Device\_Stand\_Base.stl | MGTA\_Device\_Stand\_Top.stl | MGTA\_Device\_Stand\_Pin.stl |
| <INSERT IMAGE OF PART> | <INSERT IMAGE OF PART> | <INSERT IMAGE OF PART> |

# Maker Component List

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Part A Components | | | | | | | | | | | | | |
| A01 | | 30x70mm Protoboard | QTY: 1 | A02 | Adafruit QT Py SAMD21 | | QTY: 1 | | A03 | | DFPlayer Mini | | QTY: 1 |
| A green circuit board with many small holes  Description automatically generated | | | |  | | | | |  | | | | |
| A04 | | Resistor, 1K Ω, ¼ W, through hole | QTY: 1 | A05 | Capacitor,  10uF | | QTY: 1 | | A06 | | LM4931 voltage regulator | | QTY: 1 |
| 1 0 x100 ±5% | | | |  | | | | |  | | | | |
| A07 | | STEMMA QT Cable – 50 mm | QTY: 1 | A08 | Adafruit MPR121 Capacitive Touch Sensor | | QTY: 1 | | A09 | | Electronics Tube Half | | QTY: 1 |
|  | | | |  | | | | |  | | | | |
| A10 | | Copper Tape | QTY: 1 | A11 | 24 AWG wire | | QTY: 1 | | A12 | | 4 Ω Speaker | | QTY: 1 |
|  | | | | <INSERT IMAGE OF PART> | | | | |  | | | | |
| A13 | | Tactile Buttons | QTY: 2 | A14 | DPDT Slide Switch | | QTY: 1 | | A15 | | microSD card, 8-32 GB | | QTY: 1 |
|  | | | |  | | | | | A close up of a memory card  Description automatically generated | | | | |
| A16 | | MPR121 Clip | QTY: 1 | A17 | Speaker End Cap | | QTY: 1 | | A18 | | Switch End Cap | | QTY: 1 |
|  | | | |  | | | | |  | | | | |
| B01 | | Battery Spring Plate, Negative | QTY: 1 | B02 | Battery Plate, Positive | | QTY: 1 | | B03 | | Battery Bridge Plate | | QTY: 1 |
|  | | | |  | | | | |  | | | | |
| B04 | Screw, #4, 3/8” Length | | QTY: 1 | B05 | | Battery Tube Half | | QTY: 1 | B06 | Battery Cap | | QTY: 1 | |
|  | | | |  | | | | |  | | | | |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Part B Components | | | | | |
| B01 | Assembled Musical Grasping Training Aid | QTY: 1 | A02 | USB-C-  USB-A Cable | QTY: 1 |
|  | | | A black cord on a white tray  Description automatically generated | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Part C Components | | | | | | | | |
| A01 | Assembled Musical Grasping Training Aid | QTY: 1 | A02 | Device Stand Base | QTY: 1 | A03 | Device Stand Top | QTY: 1 |
|  | | | A drawing of a three-way fan  Description automatically generated | | |  | | |
| A04 | Device Stand Pin | QTY: 1 |
|  | | |

# Assembly Guide

The assembly of the Musical Grasping Training Aid is divided into several parts. In Part A, the electronic tube half of the device is populated. In Part B, the battery tube half of the device assembled. In Part C, the final firmware is loaded onto the device. In Part D, the Musical Grasping Training Aid is assembled.

## Part A: Musical Grasping Training Aid Assembly

### Part A: Required Components

### Part A: Required Tools and Supplies

* Screwdriver, Philips, Medium
* Wire Strippers
* Flush Cutters
* Needle Nose Pliers
* Soldering Iron
* Multimeter
* Scissors

### Part A: Required Personal Protective Equipment (PPE)

* Safety Glasses

### Part A: Musical Grasping Training Aid Assembly Steps

Note that all electronic components will be inserted and soldered onto one side of the protoboard (doesn’t matter which side).

#### Step A-01: Solder QT Py microcontroller

|  |  |
| --- | --- |
|  |  |

#### Step A-02: Insert and solder QT Py microcontroller

|  |  |
| --- | --- |
| Place the QT PY microcontroller into the left hand side of the circuit board.  Make sure the microcontroller is positioned as far left as possible (USB connector is on the left-hand side) and that the top side of the protoboard has two rows free above the microcontroller.  Once the microcontroller is firmly pressed in, flip the board and solder the QT Py to the proto board on the bottom left (TX pin) and top right pin (5V pin) as show in the second photo. |  |

#### Step A-04: Insert and solder DFPlayer Mini module

|  |  |
| --- | --- |
| Insert the DFPlayer Mini into the protoboard, as far right as it will go. Be sure to leave a row of holes above and below the module.  Once inserted, flip the board and solder the top left (pin 1) and bottom right pin (pin 9). |  |

#### Step A-05: Insert and solder 1KΩ resistor

|  |  |
| --- | --- |
| Take the 1KΩ resistor and bend the metal leads on either side so they will line up with the holes on the proto board as shown in the picture.  Insert the resistor leads all the way in. Flip the board and bend the lead below the DFPlayer Mini so that it touches the pin (pin 2) from the DFPlayer Mini. Solder the pins into place and the right hand side to pin 2 of the DFPlayer Mini module.  Trim the resistor wires at the second row from the edge of the proto board as shown in the photo. |  |

#### Step A-06: Insert and solder 10 µF capacitor

|  |  |
| --- | --- |
| From the top side of the proto board, insert the 10 µF capacitor into the holes two columns over from the microcontroller.  Once inserted all the way into the board, flip the board and bend the top lead (closest to the edge of the board) to the left and solder it to the donut it emerges from.  Bend the other lead downwards and leave it for future steps. |  |

#### Step A-07: Insert and solder micro TX wire

|  |  |
| --- | --- |
| Cut a 3.5 cm wire and strip the ends of the wire.  Insert the wire in the top left donut above the microcontroller and the other end in |  |

#### Step A-08: Insert and solder micro RX wire

|  |  |
| --- | --- |
| Cut a 6.5 cm wire and strip the ends of the wire.  Insert the wire in the top left donut above the microcontroller and the other end in |  |

#### Step A-09: Insert and solder “Player Busy” wire

|  |  |
| --- | --- |
| Insert a wire from donut below A2 pin on the micro controller and insert the other end into the donut above DFplayer ‘BUSY’ pin (as shown with green wire in photo).  Bend the DFplayer ‘BUSY’ pin wire (top left circle in photo) down to the DFplayer ‘BUSY’ pin, and solder them together.  Bend the DFplayer ‘BUSY’ pin wire (top left circle in photo) up to pin A2, and solder them together. |  |

#### Step A-10: Insert and solder voltage regulator wire

|  |  |
| --- | --- |
| Insert a wire into the donut above the voltage regulator 5V output (red wire, top left in photo). Insert the other wire end into the donut left of the 5V input pin of the DF music player module. (red wire, bottom right in photo).  From the bottom side of the proto board, bend the inserted wire end (bottom left circle in photo) to the 5V pin of the micro controller, and solder together.  Bend the other end of the inserted wire, right towards the 5 V power pin of the DF music player, module, and solder together. |  |

#### Step A-11: Install DFPlayer GND wire

|  |  |
| --- | --- |
| Insert a wire into the donut above the voltage regulator GND (black wire, top left in photo).  Insert the other wire end into the donut left of the GND pin of the DF music player module. (Black wire, top right in photo). This will be the ground wire for the DF Player module. |  |

#### Step A-12: Wire power to DFPlayer

|  |  |
| --- | --- |
| From the bottom side of the proto board, bend the inserted wire end (bottom left circle in photo) to the 5V pin of the micro controller, and solder together.  Bend the other end of the inserted wire, right towards the 5 V power pin of the DF music player, module, and solder together. This completes the power wire for the DF Player module. |  |

#### Step A-13: Wire capacitor to regulator

|  |  |
| --- | --- |
| Insert a one end of wire into the donut right of the voltage regulator, above the ‘MO’ pin of the micro controller.  Insert the other end of the wire into the donut to the left of the capacitor’s upper pin, as shown in photo.  From the bottom side of the proto board, bend the left inserted wire end left towards the capacitor and solder to the capacitor lead.  Bend the right side of the inserted wire end rightward, towards the voltage regulator and solder to the regular input pin, as shown in photo. |  |

#### Step A-14: GND extension wire preparation

|  |  |
| --- | --- |
| Strip 25 mm of insulation from a wire, using wire cutters set to 22AWG (or your actual wire thickness).  Bend down the free end of the regulator GND wire (left circled side in photo) down flush with the PCB. Tuck one end of the stripped wire underneath the regulator lead. Tuck the other side of the stripped wire the capacitor lead, (right circled side in photo). |  |

#### Step A-15: Solder capacitor GND side

|  |  |
| --- | --- |
| Solder the tucked wire at each end. Trim the wire end on the right side of the capacitor lead, as in photo.  **Note:** Wire type transition point: Stranded wire is highly recommended for the following wiring steps: |  |

#### Step A-16: Insert battery plates

|  |  |
| --- | --- |
| Insert the battery plates inside the slots in the Battery Tube Half. Make sure they are pushed all the way in. |  |

#### Step A-17: Cut and tin wire ends

|  |  |
| --- | --- |
| Cut wires to connect the battery plates to the protoboard. Strip the ends of the wire and tin them. |  |

#### Step A-18: Solder battery plates to proto board

|  |  |
| --- | --- |
| Solder the red wire from the first battery holder to the negative terminals of the second battery holder. Solder the 5 cm wire (from the previous step) to the positive terminal as shown in the photo. |  |

#### Step A-19: Solder battery wire to switch

|  |  |
| --- | --- |
| Solder one end of the remaining wire to the upper terminal of the switch, as shown in the photo.  Pull back the negative terminal wire from the first battery case, so that it is mostly free from the red wire as shown in the photo. |  |

#### Step A-20: Install switch

|  |  |
| --- | --- |
| Press the switch into the slot in the 3-D printed battery side case.  This must also be flush with the 3-D printed shell, as the case will not close if it protrudes. Make sure the switch is turned off, with the black switch slider moved left. |  |

#### Step A-21: Install batteries

|  |  |
| --- | --- |
| Install four fresh AAA batteries (Two in each insert). Observe proper battery orientation on the battery cap. |  |

#### Step A-22: Insert Stemma Cable

|  |  |
| --- | --- |
| Insert the Stemma cable into the micro-controller Stemma slot.  Insert the other end of the Stemma cable into the MPR121 sensor board. Test the connection by turning on the switch and making sure the accelerometer’s green LED lights up, to indicate power. Turn off the switch when done |  |

#### Step A-23: Insert Stemma Cable

|  |  |
| --- | --- |
| Insert the Stemma cable into the micro-controller Stemma slot.  Insert the other end of the Stemma cable into the MPR121 sensor board. Test the connection by turning on the switch and making sure the accelerometer’s green LED lights up, to indicate power. Turn off the switch when done |  |

#### Step A-24: Solder Speaker

|  |  |
| --- | --- |
| Measure two 15 cm (6 inch) length wires. Strip the wires to 8 mm on all ends, and tin the wire ends as shown.  Solder one end of the wire pair to the 4-ohm speaker terminals as shown.  Insert the speaker wires into the holes below pins 6 and 8 of the DF Music Player, as shown. |  |

#### Step A-25: Solder Speaker wires to DFPlayer

|  |  |
| --- | --- |
| From the underside of the proto board, bend the speaker wires towards 6 and 8 of the Music Player, and solder them to the header pins, as shown. |  |

#### Step A-26: Insert Speaker

|  |  |
| --- | --- |
| Slide the speaker into the speaker slot on the electronics tube half with the wires facing the bottom. There is a smack channel where they need to pass through otherwise the device will not close properly. |  |

#### Step A-27: Close the device

|  |  |
| --- | --- |
| Gently close the two tube halves and screw together using the four screws. |  |

## Part B: Flashing Firmware to Musical Grasping Training Aid

### Part B: Required Components

<Copy and paste the firmware sub-assembly table from the [Maker Component List section](#_Maker_Component_List)>.

### Part B: Required Tools and Supplies

* Computer that is able to install Arduino IDE and other Arduino libraries to flash firmware

### Part B: Firmware Steps

### Step B-01: Connect Musical Grasping Training Aid to the Computer

Before flashing the device, make sure that the Musical Grasping Training Aid tube body is disassembled into halves as shown in the picture. Remove the end caps, unscrew the four securing screws along the Battery Tube Half and gently pull apart the two halves.

Plug in the Musical Grasping Training Aid to a computer via USB Cable.

### Step B-02: Setup Arduino IDE on Computer

1. Download Arduino IDE for your operating system at <https://www.arduino.cc/en/software>.
2. Install the Arduino IDE.

### Step B-03: Setup Arduino IDE for QT Py Board

1. Open Arduino IDE.
2. Click on **File -> Preferences**
3. Locate the text field that reads **Additional Boards Manager URLs** beside it.
4. Copy and paste the following link into the field as a new line:

<https://adafruit.github.io/arduino-board-index/package_adafruit_index.json>

1. Click on **OK**.
2. Restart the Arduino IDE by closing and opening the program.
3. Open the **Boards Manager** option from the **Tools -> Board -> Boards Manager…** menu.
4. Search for “Adafruit SAMD” and select “Adafruit SAMD Boards” Adafruit. Make sure you select the exact board manager name stated as there may be some with similar names that will not work.
5. Click **Install** to install the board.

### Step C-04: Install Libraries

1. Go to the **Tools -> Manage Libraries…** menu.
2. For each library in the table below, search for the name. Ensure the Author and Version is correct, then install the library. If prompted to install any dependent libraries, click **OK**.

|  |  |  |
| --- | --- | --- |
| Library Name | Author | Version |
| DFRobotDFPlayerMini | DFRobot | 1.0.6 |
| Adafruit\_MPR121 | Adafruit | 1.1.3 |

### Step C-05: Setup Local Code Directory

1. Download the Firmware\_Files from the GitHub Repository

<Insert link to GitHub firmware files zip file>

1. Extract / unzip the folder to a known location on your computer.
2. Confirm you have the following folder structure:

* Musical\_Grasping\_Training\_Aid\_Firmware (folder)
  + Musical\_Training\_Aid\_Firmware.ino

### Step C-05: Flash Firmware to the Musical Grasping Training Aid

1. Open the Musical\_Training\_Aid\_Firmware.ino with Arduino IDE.
2. Select **Adafruit QT Py M0 (SAMD21)** from the **Tools -> Board -> Adafruit SAMD Boards** menu.
3. Connect the Grasping Musical Training Aid to the computer using the USB cable.
4. Select the correct port from the **Tools -> Port** menu.
5. Verify and upload to code by clicking the arrow in the top-left corner of the Arduino program.

# Testing

To test the Grasping Musical Training Aid, you will need a multimeter. Perform the following tests to ensure the device works properly.

## Battery Power Test

1. Turn off the power switch.
2. Insert four new AAA batteries into the battery inserts.
3. Turn on the power switch.
4. Measure the voltage across the capacitor. You should obtain a reading of 6-6.5 V.

## Voltage Regulator Test

1. Using a multimeter, set to the 10-20 V range.
2. Measure the voltage between the 5 V and GND pins of the QT Py (pins 14 and 13). You should obtain a reading of 5V.

## QT Py Power Test

1. Using a multimeter, set to the 10-20 V range.
2. Measure the voltage between the 3 V and GND pins of the QT Py (pins 12 and 13). You should obtain a reading of 3 V.

## DF Player Mini Power Test

1. Using a multimeter, set to the 10-20 V range.
2. Measure the voltage between the 5 V and GND pins of the DFPlayer Mini (pins 1 and 10). You should obtain a reading of 5 V.

## DF Player Mini Speaker Test

1. Turn off the power switch.
2. Remove microSD card from the DFPlayer Mini (gently press on the microSD card until it pops out and then gently remove).
3. Turn the power switch back. Listen carefully to the speaker with your ear directly against it. You should hear a faint hissing sound. If you do not hear a hissing sound, double check the speaker connections.
4. Turn off the power switch. The hissing should disappear.
5. Insert the microSD card back into the DFPlayer Mini.

## QT Py to DF Player Mini Data Test

1. Turn off the power switch.
2. Using a multimeter, set to the ohms range.
3. Measure the resistance between pin 7 of the QT Py and pin 2 of the DFPlayer Mini. You should obtain a reading of less than 15 ohms.
4. Measure the resistance between pin 8 of the QT Py and pin 3 of the DFPlayer Mini. You should obtain a reading of less than 15 ohms.

# Troubleshooting

Music doesn’t play when device is grasped.

* Double check to make sure the song files are uploaded to the microSD card using the correct naming convention.
* Double check speaker connections.
* Make sure microSD card is inserted.