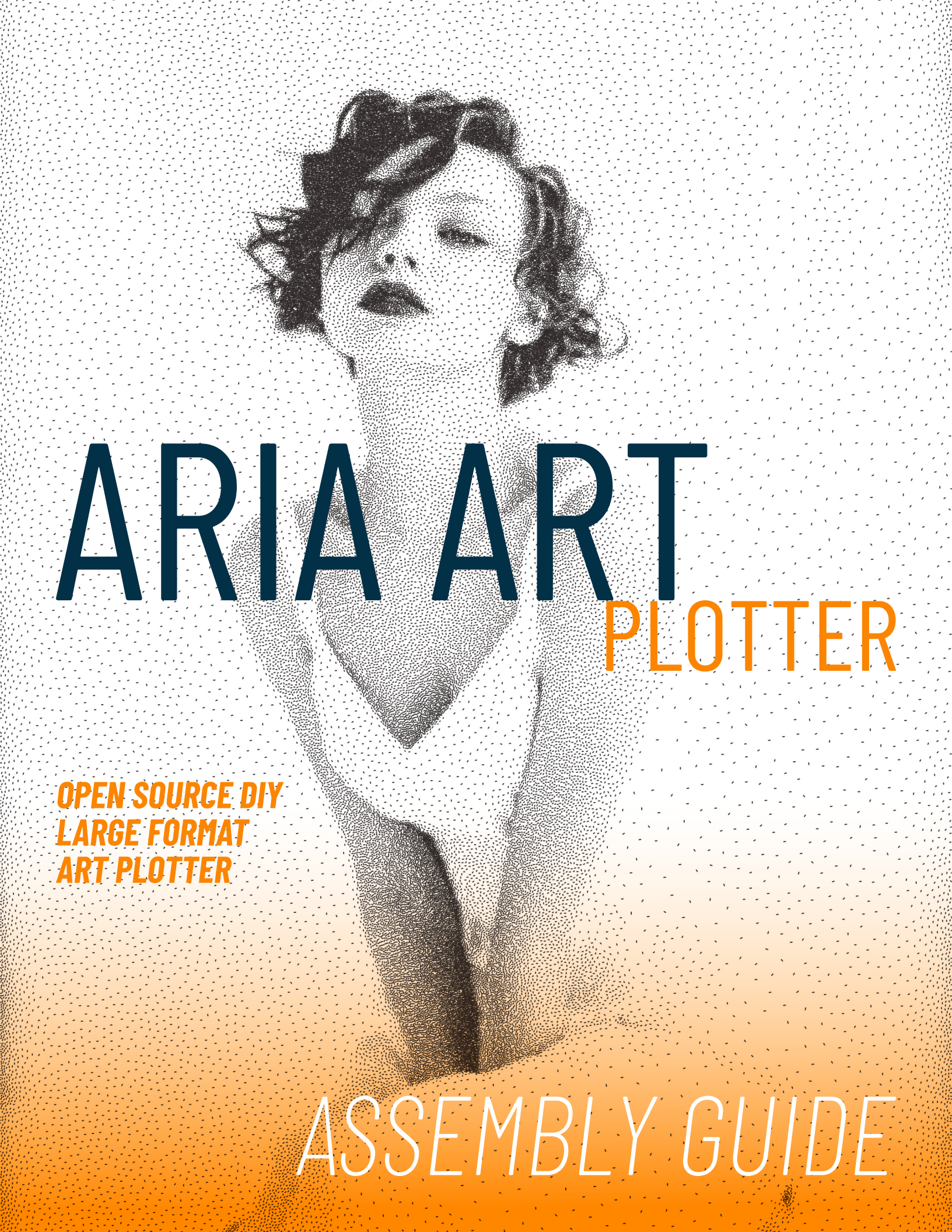

ARIAART PLOTTER

OPEN SOURCE DIY LARGE FORMAT ART PLOTTER

ASSEMBLY GUIDE

Table of Content

"Welcome to the community. Let's build something amazing together..."

Gustavo Mayoral / Aria Creator

NOTES

Acknowledgements

Creating the Aria Art Plotter has been an incredible journey, made possible by the support, inspiration, and dedication of many remarkable people and communities.

Personal Thanks

To God, my parents and—your unwavering support, patience, and belief in this project made all the difference. Through late nights of troubleshooting, countless iterations, and moments of doubt, you stood by me and helped turn this vision into reality. This project exists because you believed in it, even when the path forward wasn't clear.

The Artist Community

To the artists who push boundaries, experiment fearlessly, and continuously redefine what's possible with technology and creativity—you inspire every line of code and every mechanical detail in this plotter. Your work reminds us that the intersection of art and technology isn't just about efficiency; it's about expanding human expression and making the impossible tangible.

The Open Source Heroes

This project stands on the shoulders of giants in the open source community:

> **The Klipper Team** - For revolutionizing 3D printer firmware and creating a platform that makes precision motion control accessible to makers worldwide. Your commitment to open development has transformed what's possible in the maker space.
>
> **The Arduino Community** - For democratizing electronics and embedded programming, making it possible for artists, makers, and dreamers to bring their ideas to life without needing years of engineering education.
>
> **The Countless Contributors** - To everyone who spends hours and hours creating extraordinary products, writing documentation, answering forum questions, and sharing knowledge freely. You are the unsung heroes who make projects like this possible. Your willingness to share code, troubleshoot problems, and build upon each other's work embodies the very best of human collaboration.

A Living Tribute

The Aria Art Plotter isn't just a machine—it's a testament to what becomes possible when passionate communities come together. Every drawing it creates carries forward the spirit of open collaboration, artistic expression, and the belief that powerful tools should be accessible to everyone.

Thank you for being part of this journey,

Gustavo Mayoral

May your own creative projects be supported by communities as generous and passionate as these.

1. Welcome to Your Aria Build

Welcome to the Aria Art Plotter assembly manual! You're about to build a professional-grade CNC drawing robot designed for artists and DIY enthusiasts. The Aria transforms digital designs into precise physical artwork using pens, pencils, brushes, and more. With its large 20x20 inch drawing area, silent operation, and artist-friendly features like automatic pressure control and tool tracking, it's perfect for creating detailed illustrations, patterns, and custom art pieces right in your workshop.

This manual will guide you step-by-step through the entire build process, from preparation to your first test drawing. Whether you're an experienced maker or new to CNC projects, we've made these instructions clear, visual, and easy to follow—with checklists, diagrams, and tips to help you succeed.

What's Included in This Manual

> **Step-by-Step Assembly Instructions**: Detailed guides for each component, with photos, diagrams, and torque recommendations where needed.
>
> **Technical Specifications**: Full details on the Aria's capabilities, including drawing area, precision, and supported tools (see Appendix A).
>
> **Bill of Materials (BOM)**: A complete list of parts, quantities, and sourcing notes to ensure you have everything ready.
>
> **Tools Checklist**: Required and recommended tools for a smooth build.
>
> **Visual Instruction Guides**: Step by Step illustrations with hardware needed on each step on how to manufacture and assemble the plotter
>
> **Firmware and Setup Guides**: Instructions for electronics configuration and software installation.
>
> **Calibration and Testing**: Tips for optimizing performance and running your first drawings.
>
> **Troubleshooting and Maintenance**: Common fixes, FAQs, and care routines for long-term use.
>
> **Appendices**: Legal notices (Appendix B), contact info (Appendix C), revision history (Appendix D), and printable quick-reference sheets.

All files, including 3D print models, firmware, and sample test patterns, are available for download at aria-art.com

How to Navigate These Instructions

> **Follow Sequentially**: Start with preparation sections (1-4) to gather tools and parts, then to, core assembly (5-7), and testing (8-9). Maintenance and support (10-11) help after completion.
>
> **Visual Aids**: Look for numbered steps, notes, checklists, and diagrams. Each section includes these.
>
> **Cross-References**: Links to related sections (e.g., "See Section 3 for BOM details") and appendices for deeper info.
>
> **Digital Features**: If viewing as a PDF, use bookmarks for quick jumps and search for specific terms like "wiring" or "calibration." I recommend printing the manual 2 pages per letter size. It will be easier to follow and take notes.

If you get stuck, check the troubleshooting guide in Section 10 or contact support (Appendix C).

Estimated Build Time: 20-40 Hours (Depending on Experience)

> **Beginners**: 30-40 hours (spread over a weekend for drying times and breaks).
>
> **Experienced Builders**: 20-30 hours.
>
> **Factors**: Add time for 3D printing parts (up to 24 hours total if printing all) or troubleshooting electronics. Take breaks to avoid fatigue, especially during wiring.

2. Safety Guidelines

Building your Aria Art Plotter is an exciting project, but it involves working with tools, electronics, and mechanical parts that can pose risks if not handled properly. Always prioritize safety to avoid injury or damage. Read this section fully before starting, and refer back to it as needed.

Key Precautions for Safe Building and Operation

Wear Personal Protective Equipment (PPE): Always use safety glasses to protect your eyes from flying debris, dust, or sparks. Wear gloves when handling sharp tools or hot components, and use ear protection if operating noisy power tools like drills or grinders.

Handle Electrical Components Carefully: This project includes 120V/240V AC power connections, which can cause electrocution, fire, or serious injury if mishandled. Unplug all power sources before working on wiring. Use insulated tools for electrical tasks, and double-check connections to prevent shorts.

Be Aware of Mechanical Hazards: Moving parts, sharp edges on metal extrusions, and lead screws can cause cuts or pinches. Keep fingers clear of pinch points during assembly and testing. Secure loose clothing, hair, or jewelry to avoid entanglement.

Tool Safety: Power tools like drills, Dremel tools, or angle grinders can cause injury if used improperly. Follow manufacturer instructions, secure workpieces, and never force a tool. For cutting or tapping, use clamps to hold materials steady.

Chemical and Material Risks: 3D printing filaments may emit fumes—ensure good ventilation. Heat shrink tubing requires a heat gun; avoid overheating to prevent burns or fires.

Build at Your Own Risk: You assume full responsibility for personal safety, property damage, electrical hazards, mechanical risks, and tool-related injuries. If you're unsure about any step, stop and seek help.

Best Practices for Your Workshop

Prepare a Safe Workspace: Work in a well-lit, ventilated area with plenty of space. Keep your bench clear of clutter to avoid accidents. Use a non-flammable surface for soldering or heat-related tasks, and have a fire extinguisher rated for electrical fires nearby.

Organize and Label Parts: Sort components into labeled containers to prevent mix-ups or lost pieces. This reduces frustration and the chance of using the wrong fastener, which could lead to structural failures.

Follow Local Regulations: Ensure your build complies with local electrical codes, building regulations, and safety standards. Obtain any required permits, especially for AC wiring. Use Ground Fault Circuit Interrupter (GFCI) protection for outlets near water sources.

Work Methodically: Take breaks to avoid fatigue, which can lead to mistakes. Double-check measurements and alignments before tightening screws. Test sub-assemblies (like motors) before full integration.

Child and Pet Safety: Keep your workspace off-limits to children and pets during assembly to prevent accidents or ingestion of small parts.

Emergency Preparedness: Know the location of first aid supplies, and have emergency contacts ready. In case of injury, stop work immediately and seek medical attention if needed.

When and How to Seek Assistance

For Electrical Work: If you're not experienced with AC wiring or electronics, hire a qualified electrician for Section 7 (Wiring & Electrical Installation). Signs you need help: uncertainty about voltage, wiring diagrams, or local codes.

For Mechanical or Technical Issues: If a part doesn't fit, a tool malfunctions, or you're stuck on calibration, refer to Section 10 (Troubleshooting Guide) first. For advanced problems, check community forums or resources listed in Appendix C (Contact Information).

General Advice: Pause if something feels unsafe or unclear—better to ask than risk damage.

3. Tools & Materials Checklist

Before starting your Aria Art Plotter build, gather all the tools and materials listed below. This section helps you prepare efficiently, so you can focus on the fun part—assembling your drawing robot. We've organized everything into clear categories for easy reference. Double-check your inventory against this checklist to avoid interruptions during assembly. For a digital separate version of the BOM, check the github page (Appendix C) or the website: **http://aria-art.com/bom**

Required Tools (with Budget-Friendly Alternatives)

These are the essential tools you'll need for assembly. We've included alternatives where possible, in case you don't have the exact item. Most are common workshop tools, but some are specific for electronics and fabrication.

Metric Hex Key Set: For tightening hex screws (sizes 1.5mm to 5mm recommended). Alternative: Individual hex keys if you don't have a full set.

Phillips Head Screwdrivers: Small and medium sizes for various screws. Alternative: A multi-bit screwdriver set.

Metric Small Wrench Set: Especially for M5 nuts. Alternative: Adjustable wrench or pliers, but a dedicated set is more precise.

Cable Cutter: For trimming wires cleanly. Alternative: Sharp scissors, but cutters prevent fraying.

Cable Stripper: For removing insulation from wires. Alternative: Utility knife, but strippers are safer and more accurate.

Needle Nose Pliers: For bending and holding wires. Alternative: Electric pliers.

Cable Crimping Tool for JST-XH: Specific for crimping JST-XH connectors. Alternative: None recommended—invest in this for reliable connections.

Ferrule Crimping Tool: For securing ferrule terminals on wires. Alternative: None recommended.

Heat Gun: For shrinking heat-shrink tubing. Alternative: Hair dryer on high heat, but a heat gun is faster and more controlled.

Dremel Tool or Angle Grinder with Metal Cutting Disk: For minor modifications or cutting T8 and/or Rail. Alternative: Hand metal saw.

M5 Tap Tool: For threading holes in aluminum extrusions. Alternative: Self-tapping screws if you skip tapping.

3D Printer: For fabricating custom parts. Alternative: Buy our kit (easiest) or order printed parts from a service if you don't own one.

Jig Saw: For cutting 2020 extrusions, panels or materials. Alternative: Handsaw, but jig saw is quicker for curves.

Power Drill: For drilling holes. Alternative: Hand drill, but power makes it easier.

Optional Wire Labeler

Organize your tools on a clean workbench for quick access. If you're new to some of these, practice on scrap materials first.

Full Bill of Materials (BOM) Breakdown

Here's a complete list of all parts needed, grouped by category for simplicity. Quantities are for the standard 20x20 inch build—check the build instructions if scaling up. We've included notes where helpful, like part sources or kits. Source these from electronics suppliers (e.g., Amazon, AliExpress) or hardware stores. Verify availability, as some components may vary by region.

Electronics

1 pc BIGTREETECH Manta M5P V1.0 (Main Board)

1 pc BIGTREETECH CB1 V2.2 (MCU)

1 pc BIGTREETECH CB1 Heatsink

4 pc BIGTREETECH TMC2209 V1.3 Stepper Motor Driver (For X, 2Y, Z)

4 pc NEMA 17 STEP MOTOR (For X, 2Y, Z)

1 pc BIGTREETECH Mini12864 V2.0 LCD Graphic Smart Display

1 pc .91 OLED I2C Display (Pre-soldered is better, sold on Amazon)

1 pc Seeeduino Xiao (Non-ESP version is fine)

1 pc Power Supply Mean Well LRS-350-24 (24V 350W)

1 pc B07PCN6T6F R REIFENG Limit Switch (Support and wiring made for this switch)

1 pc AC-01A Fixed Hole 10A 250V Power Socket (Make sure it has a fuse; if not, add a 10A fuse)

1 pc BIQU MicroProbe V2.0 (Get the kit that includes the brackets)

1 pc BIQU MicroProbe B1/H2 V2S Bracket (Sold with the MicroProbe as a kit)

30 ft 22 AWG 4 cable (For stepper motor cables)

21 ft 22 AWG 2 cable (For limit switches)

9 ft 22 AWG 5 cable (For probe)

10-15 ft 18 AWG for DC Wiring (Consult Section 6 for details)

6 ft 14 AWG for AC Wiring (Optional, consult Section 6 for details)

3 pc 4P(F) JST-XH Connector (For Steppers. Usually included with M5P Manta Board; no need to buy if included)

6 pc 3P(F) JST-XH Connector (For Limit Switches. Usually included with M5P Manta Board; no need to buy if included)

1 pc 6P JWF-VSLE Series JST Connector. To wire the probe on the pen side

4 pc 4P JWF-VSLE Series JST Connector. To wire the NEMA motors on the plotter side.

100 pc AMP-TE crimping terminals (Usually included with M5P Manta Board; no need to buy if included)

1 pc 12 inch 4 cable Dupont connector F-F

2 pc 2P(M) JST-XH Connectors to wire power and data from/to the Xiao side & OLED

1 pc 4P(M) JST-XH Connectors to wire power and data from/to the Xiao & OLED side.

1 pc USB-C to USB-A cable (1 feet) Make sure it can communicate data and not power only.

Hardware

6m (20 ft) 2020 Aluminum Profile V-SLOT (For 20x20 Plotter) Recommended: Get a few more meters for mistakes or practice cuts

12 pc 24mm POM Wheels V-SLOT 5mm bore

12 pc PCS Eccentric Spacers

1 pc 39.3 in Carrier Drag Chain Cable R18 10x15 (For 20x20 Plotter; see instructions for larger versions)

1 pc 39.4 in Carrier Drag Chain Cable R28 15x30 (For 20x20 Plotter; see instructions for larger versions)

10 ft GT2 Timing Chain Belt 2mm pitch, 6mm wide

3 pc GT2 Pulley, 20 teeth, 5mm bore Width 20T

1 pc Flanged Ball Bearing 8mmx19mmx6mm

1 pc T8 Lead Screw 150mm length

1 pc T8 Brass Nut (Sold as a kit with the lead screw)

1 pc Flexible Coupling 5mm shaft to 8mm T8

1 pc 200mm MGN9 Linear Sliding Rail with MGN9H Carriage

1 pc 100mm MGN9 Linear Sliding Rail with MGN9H Carriage

1 pc 0.7*7*15mm 8 Coils Compression Stainless Steel Spring

1 pc M6x25mm Thumb Screw Knob

1 pc M4x25mm Thumb Screw Knob

1 pc M6 * 8 *8 Brass Threaded Insert

1 pc M4 * 6 *6 Brass Threaded Insert

1 pc Rubber Band (optional if not using spring mehanism)

Fasteners

8 pc M5 or #10 Sheet Metal or Wood Screws Pan Head (For the screen; length depends on top control panel thickness)

22 pc M5x10 or M5x8 Self Tapping or #10-24 Self Tapping (For 2020 Extrusion Face Plate; tapping recommended with M5x10)

85 pc M5x8 Button Head Hex Screws

14 pc M5x12 Button Head Hex Screws

6 pc M5x16 Button Head Hex Screws

14 pc M5x40 Button Head Hex Screws

19 pc M5 Nuts

14 pc M5 Nylon Insert Locking Nuts

13 pc M5 Locking Washers (Star)

81 pc M5 Sliding Nuts for 2020 Extrusion V Slot

6 pc M5 Flat Sliding T-Nuts for T-Slot

4 pc M4x8 Button Head Hex Screws

4 pc M3 Sheet Metal or Wood Screws Pan Head (For the card reader bracket; length depends on top control panel thickness)

4 pc M3x8 Hex Head Cap Screws

8 pc M3x12 Hex Head Cap Screws

22 pc M3x8 Button Head Hex Screws

17 pc M3x12 Button Head Hex Screws

2 pc M3x25 Button Head Hex Screws

2 pc M5x30 Button Head Hex Screws

29 pc M3 Nuts

7 pc M3 Flat Washers

13 pc M3 Locking Washers

Additional Materials

Small Zip Ties (For cable management)

Medium Zip Ties (For securing larger bundles)

Electric Cables (Assorted lengths as needed)

Assorted JST-XH Kit (For connectors)

Heat Shrinking Tubing (For wire insulation)

Ferrule Terminals (For clean wire ends)

6 meters of Aluminum Extrusion Slot Cover

100 pc Heat Shrink Butt Connectors, 22-16 AWG

1 foot of 1 in Split Wire Loom Tubing

Optionally ½ inch expanded sleeving. About 6 inches for pen probe wiring

Standard 10 Amps 125 Volts Black 3 Prong AC Power Cord Cable

Print this BOM as a checklist and mark off items as you gather them.

Optional Upgrades and Tools for Easier Assembly

To make your build smoother or enhance performance, consider these extras. They're not required but can save time or improve the final robot.

Tools for Easier Assembly:

Digital calipers for precise measurements (great for checking tolerances).

Soldering iron kit if you prefer soldered connections over crimps.

Magnetic parts tray to keep screws organized.

Anti-static mat and wrist strap for handling sensitive electronics.

You can buy kits for fasteners, crimping tools and connector

These can reduce frustration, especially if you're a beginner.

Part Fabrication Tips (3D Printing, Laser Cutting)

Several parts need to be fabricated—most are designed for 3D printing, but some can be laser cut or CNC machined from metal for durability. Download the STL files from CodeAgents.com/AriaV1 (or the provided files package). Here's a list of all manufactured parts with tips:

0001: Pen Holder Back Plate (3D Print) – Use PLA or PETG; infill 20–30% for strength.

0002: Pen Holder Bracket (3D Print) – PETG recommended for flexibility.

0003: Pen Rail Support (3D Print) – High infill (40%) for stability.

0004: Z Axis Support Plate (3D Print or Metal Cut) – Aluminum sheet if metal; laser cut for precision.

0005: Carriage Bracket (3D Print) – ABS for heat resistance near motors.

0006: Z NEMA Top Support (3D Print) – Infill 30%; orient flat for best layer adhesion.

0007: Z Bottom Support (3D Print) – Same as above.

0008: X Axis Back Plate (3D Print or Metal Cut) – Metal for rigidity if possible.

0009: X Axis Rail Support (3D Print) – Low infill (20%) is fine.

0010: Y Gantry Back Plate (3D Print or Metal Cut) – Laser cut aluminum for pro builds.

0011: Y Gantry Rail Bracket (3D Print) – PETG for durability.

0012: Y Gantry Wheel Holder (3D Print or Metal Cut) – Metal if you expect heavy use.

0013: Bottom Limit Switch Bracket (3D Print) – Quick print; PLA okay.

0014: Top Limit Switch Bracket (3D Print) – Same as above.

0014-Z: Top Limit Switch Bracket Z Axis (3D Print) – Ensure tight tolerances.

0015: Limit Switch Z Column (3D Print) – High infill for stability.

0016: Left Foot (3D Print) – High infill for stability.

0017: Right Foot (3D Print) – Mirror of left; print both at once.

0018: AC-01 A Power Bracket (3D Print) – PLA fine.

0020: Screen Bracket (3D Print) – Orient for smooth surfaces.

0021: Front Cover Panel (3D Print or Metal Cut) – Laser cut acrylic for a clean look.

0022: Power Supply Bracket (3D Print) – Sturdy infill.

0023: M5P Left Bracket (3D Print) – PETG.

0024: M5P Right Bracket (3D Print) – PETG.

Other components needed (3D Printed)

L Brackets can be sourced made in metal, but they must be same dimensions (not common). Printing them is more practical and work well.

0025: L Bracket (3D Print) – 24 pieces.

0026: Pen Bracket Spacers (3D Print) – 2 pieces.

0027: 7mm Wheel Spacer (3D Print) – 12 pieces.

0028: 1mm Wheel Washers (3D Print) – 24 pieces

0029: 2020 End Face Plate (3D Print) – 6 pieces

0030: Tool Load Puck 10mm (3D Print) – 1 piece

0031: Tool Load Puck 9mm (3D Print) – 1 piece

0033: Xiao Bracket Bottom (3D Print) - 1 piece.

0034: Xiao Bracket Top (3D Print) - 1 piece.

0037: Spring Pen Bracket (3D Print) - 1 piece.

Tips:

You can print all the parts on PLA. It will work, but for extended life use recommended materials.

For 3D printing: Use a 0.4mm nozzle, 0.2mm layer height. Print with supports only where needed to save time. Test fit parts before full assembly—sand lightly if tolerances are off.

For laser cutting/CNC: Use 3mm aluminum or acrylic sheets. This is ideal for structural parts like back plates. If outsourcing, provide DXF files.

Calibration: After fabrication, measure parts with calipers to ensure they match specs (e.g., holes for M5 screws should be exact).

Time estimate: 10–24 hours of printing total, depending on your printer speed, this may vary significantly.

With everything ready, you're set to move on. If anything's missing, order it now to keep your build on schedule!

4. Workspace Setup

With your tools and materials gathered (from Section 3), it's time to prepare your workspace for a smooth assembly. This section ensures everything is organized and ready, minimizing delays and errors. Set aside 30-60 minutes for this step, depending on your space and how much 3D printing you need to do.

Pre-Assembly Checklist

Before diving in, run through this checklist to confirm you're fully prepared. Tick off each item as you go—print this page if it helps!

> **Review Previous Sections**: Double-check you've read Sections 1-3, including safety guidelines and the BOM. Verify all parts are accounted for and undamaged.
>
> **Inspect Components**: Open packages and inspect electronics (e.g., boards, motors) for shipping damage. Test basic functionality if possible, like powering on the display briefly (unplugged from other components).
>
> **Charge Devices**: If using rechargeable tools (e.g., cordless drill), charge them now.
>
> **Backup Plans**: Have alternatives ready for any optional tools or parts (e.g., if a 3D printer isn't available, confirm outsourced prints are en route).
>
> **Legal Acknowledgment**: Confirm you've read and agree to the terms in Appendix B.
>
> **Time Commitment**: Block out dedicated time slots for the build to avoid rushing—aim for sessions of 2-3 hours.
>
> **Helper Availability**: If needed, schedule assistance for heavy lifting or electrical steps (e.g., a second pair of hands for wiring in Section 7).

If anything's missing, pause here and order it to prevent mid-build stops.

Organizing Parts and Workspace

A tidy workspace reduces mistakes and speeds up assembly. Set up in a dedicated area to keep things efficient and safe.

> **Choose Your Space**: Select a flat, stable surface at least 4x6 feet, like a garage workbench or large table. Ensure good lighting (overhead and task lamps) and ventilation for any fumes from heat guns or adhesives. Keep it away from high-traffic areas to avoid disturbances.
>
> **Layout Zones**: Divide your workspace into clear areas:

- **Parts Station**: Use trays, bins, or egg cartons labeled by category (e.g., "Fasteners," "Electronics," "3D Printed Parts"). Group small items like screws in magnetic bowls to prevent loss.
- **Tool Area**: Arrange tools within arm's reach, grouped by type (e.g., screwdrivers together). Hang frequently used items like hex keys on a pegboard.
- **Assembly Zone**: Clear a central space for building—cover with a mat or newspaper to catch debris.
- **Testing Corner**: Dedicate a spot for electronics checks, with access to power outlets (use a surge protector).

Label Everything: Use sticky notes or printed labels matching the BOM codes (e.g., "M5x8 Screws"). For 3D printed parts, mark them with their codes (0001-0034) for quick identification.

Waste Management: Have a trash bin and recycling nearby for packaging. Keep a notepad for jotting down notes or measurements.

Ergonomics Tip: Work at a comfortable height to avoid strain—use a stool if needed. Play some background music if it helps you focus, but keep volume low for concentration.

This setup will make following later sections, like mechanical assembly in Section 6, much easier.

Downloading Files and Preparing 3D Prints

Custom parts are key to your Aria build—most are 3D printable, with options for laser cutting. Get these ready now to align with your build timeline.

Download Files: Visit aria-at.com (or use the provided files package) to download:

- STL files for all 3D printed parts (codes 0001-0034).
- DXF files for laser-cuttable parts (e.g., back plates etc).
- Configuration files for Section 7 (controller setup).
- .ino Sketch files for XIAO-OLED

3D Printing Preparation:

- **Printer Setup**: Calibrate your printer for accuracy—use a 0.4mm nozzle and 0.2mm layer height for best results. Materials: PLA or PETG for most parts; ABS for heat-prone ones like the carriage bracket (0005).
- **Print Queue**: Start with structural parts first (e.g., gantry plates). Use 20-40% infill based on part needs (higher for load-bearing like feet, 0016-0017).
- **Supports and Orientation**: Add supports only for overhangs; orient parts flat for strength. Print test pieces if tolerances seem off (e.g., holes for M5 screws).
- **Post-Processing**: After printing, remove supports carefully, sand rough edges, and test-fit with hardware. If a part doesn't fit, reprint with slight scaling (e.g., 101% if too tight).
- **Alternatives if No Printer**: Order prints from services like Printful or local makerspaces. For metal versions, use online CNC/laser services—upload DXF files and specify 3mm aluminum or acrylic.
- **Timeline Tip**: If printing yourself, start now so parts are ready by Section 6. While waiting, proceed to Section 5 for electronics.

Once set up, you're ready. If your workspace feels cluttered, reorganize now— a clean start sets the tone for a successful build!

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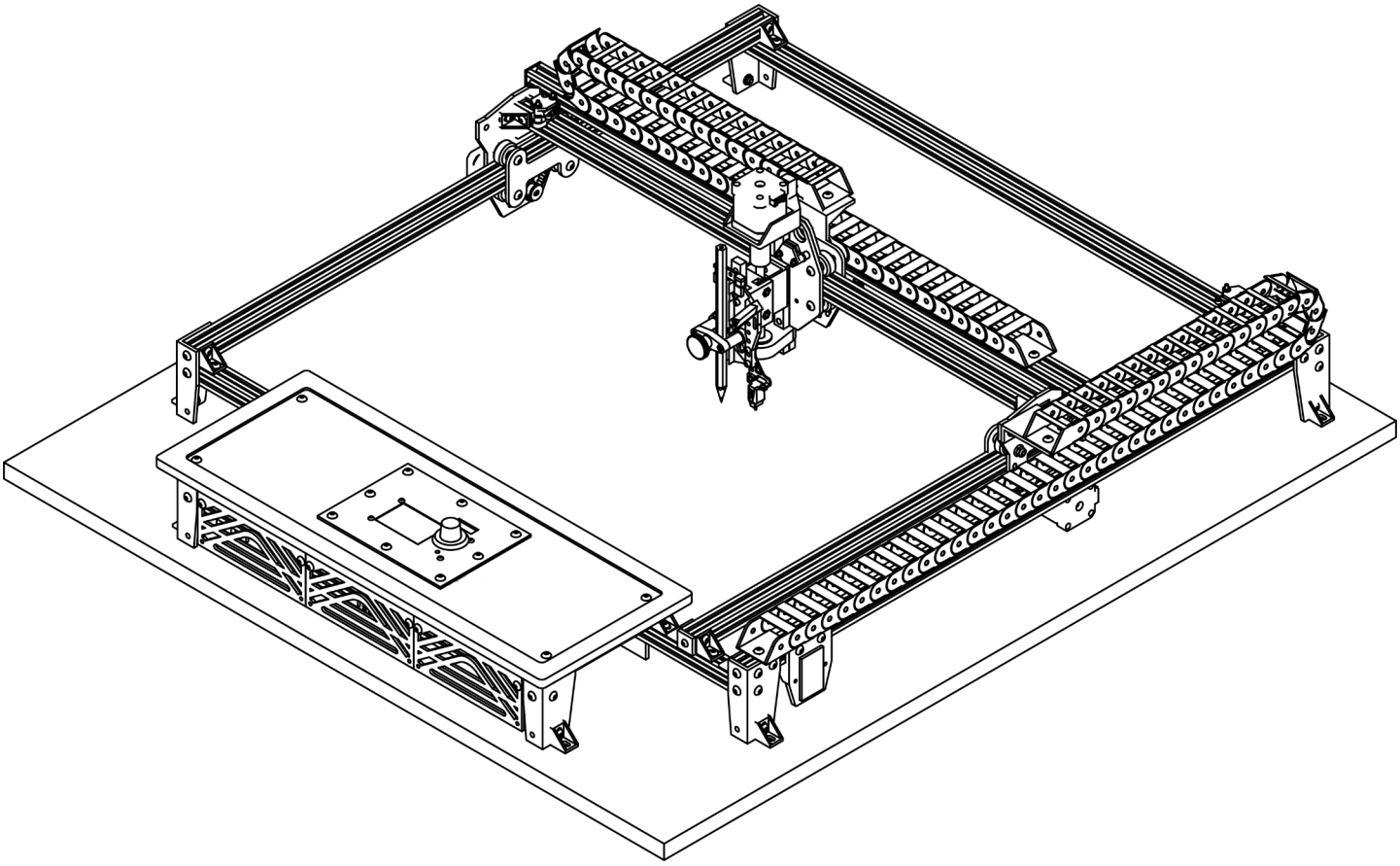
5. Building the Mechanical Components



Cutting 2020 Aluminum Extrusions

Preparing the 2020 Aluminum Extrusions Before assembling the main frame and gantries, you'll need to cut your 2020 aluminum extrusions to the precise lengths required for the Aria Art Plotter. This step ensures a stable, square structure for accurate drawing. Take your time with measurements—double-check everything to avoid errors.

Important Notes:

> **Wear Protective Equipment: Protect your eyes and skin.**
>
> **Material**: Use high-quality 2020 V-slot aluminum extrusions (standard 20mm × 20mm profile).
>
> **Total Length Needed**: Approximately 5 meters (16.4 feet) for all cuts. Purchase extra for practice or mistakes.
>
> **Cutting Tips**:
>
> - **Recommended Tool**: Power miter saw or chop saw with a fine-toothed metal-cutting blade (non-ferrous aluminum blade preferred) for clean, square cuts. Clamp the extrusion securely and wear safety glasses.
> - **Manual Alternative**: Hacksaw with a metal blade and miter box for straight cuts. File edges smooth after cutting to remove burrs.
>
> Always measure twice and cut once. Mark cuts with a permanent marker and use a square for perpendicular lines.
>
> Debur all cut edges with a file or sandpaper to prevent injury and ensure smooth assembly.
>
> **Tolerances**: Aim for ±1mm (±0.04") accuracy. Slight variations can be adjusted during assembly, but precision here saves time later.

Cutting Guide Table
Here's the complete list of required sections. Cut from longer stock pieces to minimize waste—group similar lengths together.

Quantity	Name	Length (mm)	Length (inches)	Notes	Tap (5mm)
3	Y Sections	773 mm	30.43 in	Main vertical supports; ensure all three are identical.	One piece both sides
2	X Sections	758 mm	29.84 in	Horizontal cross members; cut square for proper alignment.	None
1	X Rail Support	741 mm	29.17 in	Supports the X-axis rail; critical for smooth motion.	Both Sides
1	X Gantry	697 mm	27.44 in	Forms the moving X-gantry; debur thoroughly.	Both Sides
1	Control Panel Front	480 mm	18.90 in	Front face of control panel; cosmetic—sand for clean finish.	None
2	Control Panel Sides	164 mm	6.46 in	Side panels; match lengths exactly for symmetry.	Both one side

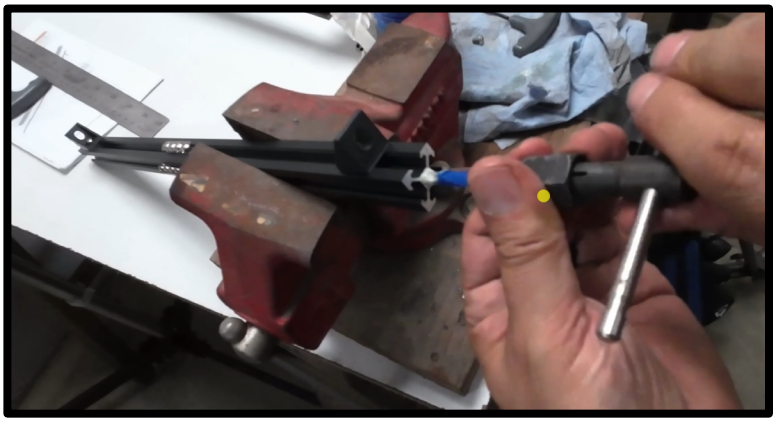
Step-by-Step Cutting Process:

1. Gather your extrusions, measuring tape, marker, and cutting tool.
2. Measure and mark each piece starting from one end. Use a square to ensure perpendicular marks.
3. Secure the extrusion in a vise or clamp. If using a power saw, set to low speed to avoid melting the aluminum.
4. Make the cut slowly and steadily. For manual hacksaw, use long, even strokes.
5. After each cut, measure the piece again and file any sharp edges or burrs.
6. Label each cut section (e.g., "Y Section 1") with tape or marker to stay organized.
7. Clean up metal shavings immediately to maintain a safe work space.

Pro Tip: If you're new to cutting aluminum, practice on scrap pieces first. Total cutting time: 30-45 minutes.

Tapping the Extrusion Ends

After cutting your 2020 aluminum extrusions, you'll need to tap M5 threads into the ends where indicated on the table. (YOU MAY SKIP THIS STEP, if you will be using self tapping bolts) This creates secure mounting points for screws without needing nuts in every slot. Not all ends require tapping—refer to table for specifics, but prepare extras if needed. Tapping ensures strong, vibration-resistant joints for precise drawing.



Important Notes:

> **Thread Size**: M5x0.8 (standard for 2020 extrusions' center hole).
>
> **Why Tap?**: The extrusion's core hole is approximately 4.2-5mm, perfect for M5 tapping with minimal drilling.
>
> **Safety**: Wear safety glasses and gloves. Work in a well-ventilated area if using cutting fluid. Secure the extrusion firmly to prevent slipping.
>
> **Time Estimate**: 2-5 minutes per end, depending on experience.
>
> **Common Issues**: Over-tapping can weaken threads; under-tapping may cause binding. Practice on scrap if unsure.

Tools and Materials Needed:

> M5 tap (included in your required tools from Section 3)
>
> Tap handle or wrench
>
> Cutting fluid or lubricant (e.g., WD-40, tapping oil, or even vegetable oil in a pinch)
>
> Vise or clamps to secure the extrusion
>
> Deburring tool or file (for cleaning threads)
>
> Compressed air or brush (for chip removal)

Step-by-Step Tapping Process:

1. **Prepare the Extrusion**: Select the end to tap. Clean any debris from the core hole using compressed air or a brush. If the hole feels too tight (under 4.2mm), carefully drill it out with a 4.2mm (#19) bit—most 2020 extrusions don't need this, but check with a caliper.

2. **Secure the Piece**: Clamp the extrusion vertically in a vise, with the end facing up. Pad the jaws with cloth or wood to avoid scratching. Ensure it's stable but not crushed.

3. **Lubricate**: Apply a few drops of cutting fluid to the tap's threads and into the hole. This reduces friction and prevents aluminum from galling (sticking).

4. **Start Tapping**: Insert the tap into the hole, ensuring it's perpendicular (straight). Use a printed tap guide jig if available (download from Printables.com or similar—search for "2020 extrusion M5 tap guide"). Turn the tap clockwise slowly (1/2 turn at a time) while applying firm, even downward pressure (about 5-10 pounds). Back out counterclockwise 1/4 turn every full rotation to break and clear chips.

5. **Continue Tapping**: Proceed until the tap goes about 10-15mm deep (or as needed for your screws—typically full depth for M5x10 or longer). Don't force it; if resistance builds, back out fully, clear chips, and re-lubricate.

6. **Clean Up**: Remove the tap. Blow out or brush away aluminum chips. Test-fit an M5 screw—it should thread in smoothly without wobbling. File any burrs around the hole for a clean finish.

7. **Repeat as Needed**: Tap only the required ends based on your build. Label tapped pieces to avoid confusion.

Pro Tip: For blind (closed-end) tapping, use a bottoming tap if available for deeper threads

With your extrusions tapped, you're ready to move on the next step.

Expanding the plotter size

If you want to make a bigger printing area for your plotter, you can do this using the table below. You can add inches, or use the guide to upgrade to a set number. Take care that you have the space to mount the plotter if you expanded, it takes a larger space to mount the machine. We do not recommend going larger than 40” x 40”

Expand to	Apply to	Length to Add (mm)	Length To Add (inches)	Notes
Per inch	3 Y Sections, 2 X Sections, 1 X Gantry, X Rail Support	26 mm	1 in	You will also need to add to **the wire harnesses, Extrusion Slot Sleeves and update the printer.cfg file in Klipper** to account for new size. Additionally, you will need to add same amount to the **Y and X timing belts. Buy additional drag chain to match sizes also.**
24 x 24	Same	102 mm	4 in	Same
30 x 30	Same	254 mm	10 in	Same
40 x 40	Same	508 mm	20 in	Same

NOTES

Creating the Control Panel Back Plate

Creating the Control Panel Back Plate

The control panel back plate (part 0032) serves as protective shield for the electronics, display, and controls against debris, liquids etc. It's designed to be fabricated from sheet material using the provided 0032_ControlPanelBackPlate.dxf file. This DXF outlines precise dimensions, hole patterns, and cutouts. You can create this part from aluminum (for durability), plastic (for lightweight ease), or wood (for cost-effectiveness). Choose based on your tools, budget, and desired finish—aluminum is ideal for professional builds, while wood suits beginners.

Safety Note: Wear eye protection and gloves when cutting. Work in a well-ventilated area if using power tools.

Materials and Sourcing

Sheet Material (1 piece, 3-5mm thick, at least 300x200mm):

- **Aluminum**: 3mm 6061 alloy sheet for strength and heat dissipation. Source: Online metals suppliers like OnlineMetals.com, McMaster-Carr, or local fabrication shops ($10-20 per sheet). Avoid thinner than 3mm to prevent warping.
- **Plastic**: 3-5mm acrylic (clear or colored) or ABS sheet for easy cutting and visibility. Source: Plastics suppliers like TAP Plastics, Amazon, or hobby stores ($5-15 per sheet). Acrylic is laser-friendly.
- **Wood**: 3-5mm plywood or MDF for affordability and ease of finishing. Source: Home improvement stores like Home Depot, Lowe's, or lumber yards ($5-10 per sheet). Use Baltic birch for better stability.

Other Supplies:

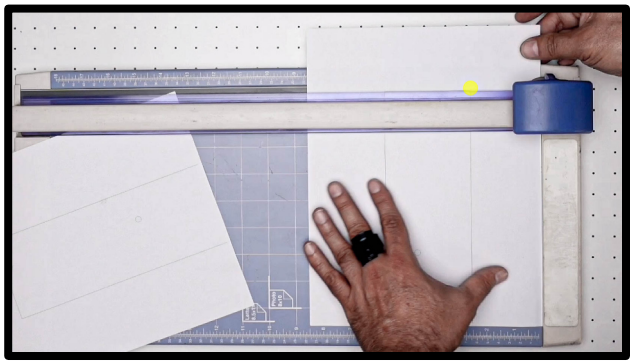
- Sandpaper (220-400 grit) for smoothing edges.
- Primer/paint (optional: rust-preventive for aluminum, acrylic-safe for plastic, wood sealer for wood).

- Masking tape for marking cuts.
- Files or deburring tool for clean edges.

Sourcing Tips: Download the DXF from the provided files package or CodeAgents.com/AriaV1. If you lack fabrication tools, outsource to services like SendCutSend (for metal/plastic) or Ponoko (for laser cutting)—upload the DXF and specify material/thickness for quotes under $20-30.

Fabrication Steps

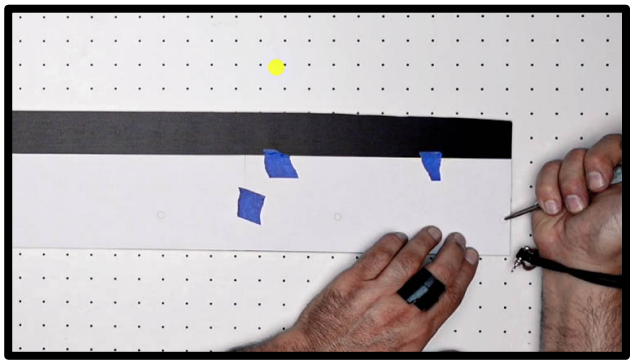
1. **Prepare the Design**:



Open the 0032_ControlPanelBackPlate.dxf in CAD software (free options: LibreCAD or QCAD) to verify dimensions (approx. 250x150mm overall).

Print a 1:1 paper template for test-fitting if needed.

2. **Mark and Cut the Material**:



Secure your sheet to a stable work surface.

Transfer the DXF outline: Print and trace for manual cutting, or import directly into your machine's software.

For Aluminum:

- Best method: CNC mill or waterjet (professional service recommended).
- Alternative: Use a jigsaw with metal-cutting blade or Dremel with cutoff wheel. Clamp firmly and cut slowly to avoid burrs.

For Plastic:

- Best method: Laser cutter for precise edges (settings: 3mm acrylic at 100% power, 10-15mm/s speed).
- Alternative: Jigsaw with fine-tooth blade or score-and-snap for straight lines.

For Wood:

- Best method: CNC router or laser cutter (if not MDF, which can char).

- Alternative: Jigsaw or handsaw—drill holes first, then connect cuts.

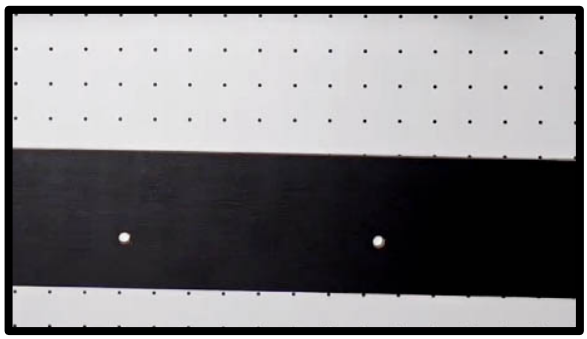
3. **Drill Holes and Cutouts**:

Use the DXF as a guide for mounting holes (M3/M5 sizes) and component cutouts (e.g., for display and switches).

Start with pilot holes (2mm drill bit) and enlarge to spec (e.g., 3.2mm for M3 screws).

For clean holes: Use a drill press if available; otherwise, mark centers with a punch and drill slowly.

4. **Finish the Part**:



Deburr edges: File/sand all cuts to remove sharp spots.

Clean: Wipe with isopropyl alcohol.

Optional finish:

- Aluminum: Anodize or paint for corrosion resistance.
- Plastic: Flame-polish edges for clarity (acrylic only).
- Wood: Sand smooth and apply varnish for protection.

Test fit: Mount sample components to verify alignment—adjust with files if needed.

Common Tips & Troubleshooting

Accuracy Check: Measure twice—holes must align with the aluminum extrusion.

If Edges are Rough: Use finer sandpaper or a deburring tool.

Material-Specific Issues:

- Aluminum may conduct heat—add thermal pads under hot components.
- Plastic can crack—avoid over-tightening screws.
- Wood may swell—seal edges if in humid environments.

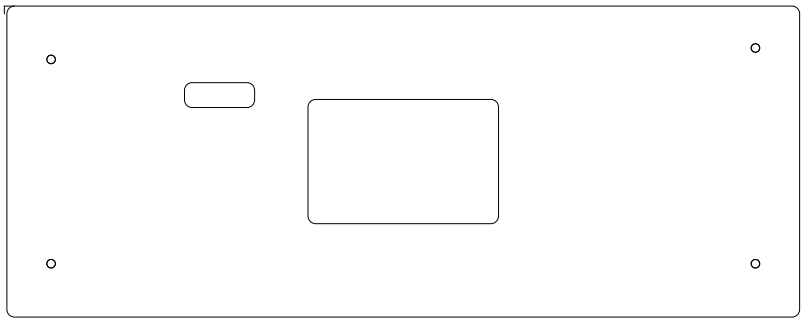
Next Steps: Proceed to mounting electronics in Section 6.10. If issues arise, reference the troubleshooting guide in Section 10.

!

Cutting the Control Panel Top

Sourcing and cutting the Control Panel Top

In this section, we'll create the wooden base for your control panel enclosure using the provided DXF sketch (0030_ControlPanelBoard_Sketch.dxf). This panel houses the electronics and display, providing a sturdy, aesthetic mount. We'll use 1/2-inch thick wood for optimal strength and ease of cutting. Wood offers a professional, customizable finish that's perfect for artists—it's stable, easy to work with, and can be stained or painted to match your studio.



Materials Recommendations

Wood Type:

- **Hardwood (Recommended)**: Maple, oak, or walnut for durability and a premium feel. These resist warping and finish well. Thickness: 1/2 inch (12.7mm) for proper fit with fasteners.
- **Alternatives**: Baltic birch plywood for better stability and affordability if you're new to woodworking—it's less prone to splitting. Avoid softwoods like pine, as they dent easily and may not hold screws securely.

Size: Start with a board at least 12x8 inches (305x203mm) to match the sketch dimensions with room for cuts.

Quantity: 1 board (plus scrap for practice if needed).

Finishing Supplies: Sandpaper (120-220 grit), wood stain or clear sealant (e.g., polyurethane), wood filler for any imperfections, and optional paint if you want a custom color.

Tools Needed

Jig saw or band saw for curved cuts (power drill with hole saw for ports if no jig saw).

Power drill with bits (for mounting holes).

Sanding block or orbital sander.

Clamps for securing the board during cutting.

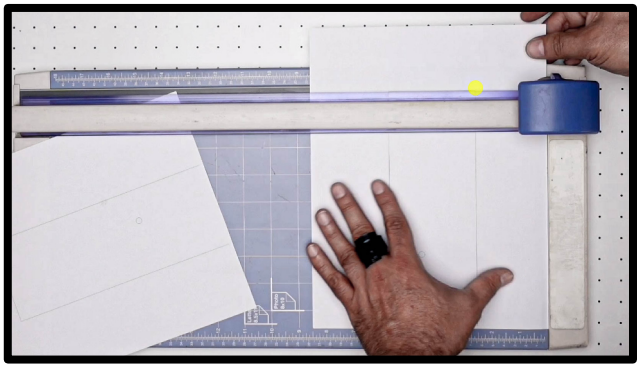
Measuring tape, pencil, and straightedge.

Safety gear: Dust mask, safety glasses, and gloves.

Optional: CNC router if available for precise cuts using the DXF file directly.

Step-by-Step Cutting Instructions

1. **Prepare the Template**:

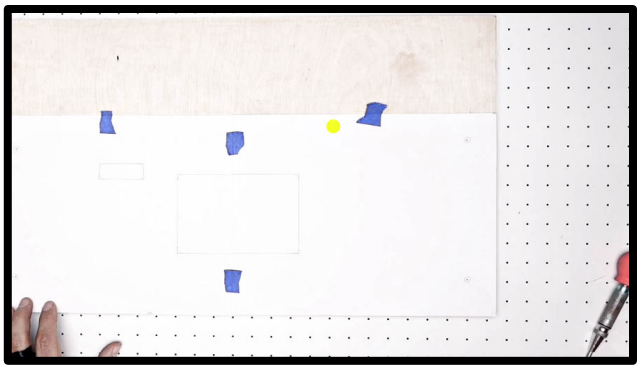


Open the DXF file (0030_ControlPanelBoard_Sketch.dxf) in software like Inkscape, AutoCAD, or a free viewer (e.g., LibreCAD).

Print a full-scale template (scale 1:1) on paper or cardstock. Verify dimensions with a ruler—the overall panel should measure approximately [insert exact dimensions from DXF, e.g., 10x6 inches].

If you have access to a CNC machine or laser cutter, load the DXF directly for automated cutting (set material thickness to 1/2 inch).

2. **Transfer the Design**:



Place your wood board on a stable workbench.

Tape the printed template onto the board, aligning it straight.

Trace the outline, holes, and cutouts using a pencil. Mark drill points for mounting holes and ports (e.g., for USB, power switch).

3. **Cut the Board**:

Clamp the board securely to your workbench.

Drill holes first: Use a spade bit or Forstner bit for larger ports (match sizes from DXF, e.g., 1/2 inch for buttons). Start with pilot holes to prevent splintering.

Cut the outer shape: Use a jig saw with a fine-tooth blade for clean edges. Follow the traced lines slowly—cut outside the line and sand to fit.

- For curves: Take your time; pivot the saw gently.
- Tip: If using plywood, cut with the good face down to minimize tear-out.

Test-fit components (e.g., display, switches) as you go—sand edges if needed for smooth insertion.

4. **Safety Note**: Always cut in a well-ventilated area. Keep hands clear of the blade and unplug tools when changing bits.

Finishing the Board

1. **Sanding**:

Start with 120-grit sandpaper to remove rough edges and burrs.

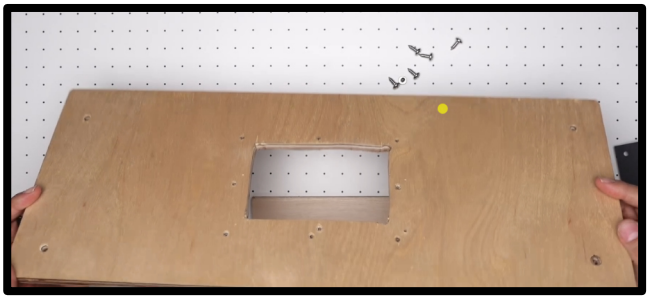
Progress to 220-grit for a smooth surface. Sand with the grain to avoid scratches.

Fill any holes or imperfections with wood filler, let dry, and sand flush.

2. **Sealing and Finishing**:

Wipe the board clean of dust.

Apply wood stain (if desired) with a cloth, following the grain. Let dry (1-2 hours), then apply a second coat for deeper color.



Seal with clear polyurethane (2-3 thin coats, sanding lightly between each). This protects against moisture and wear—dry time: 4-6 hours per coat.

Optional: Paint with acrylic or spray paint for a modern look; prime first for better adhesion.

3. **Drying Time**: Allow 24 hours for full cure before assembly.

Suggested Providers

Local Hardware Stores: Home Depot or Lowe's—stock pre-cut 1/2-inch hardwood boards (e.g., oak project panels, ~$20-30 for 2x4 ft).

Specialty Lumber Yards: Rockler Woodworking or Woodcraft—higher-quality hardwoods with custom cutting services (~$30-50 for a small board).

Online Suppliers:

- Amazon: Search "1/2 inch maple board" (e.g., from brands like Walnut Hollow, ~$15-25).
- Etsy or eBay: Custom-cut panels from woodworkers (upload your DXF for precision cuts, ~$20-40 including shipping).
- If using plywood: Baltic Birch from Woodpeckers (via Amazon, ~$20 for 12x12 inch sheets).

Tips for Success

Practice on scrap wood first to get comfortable with cuts.

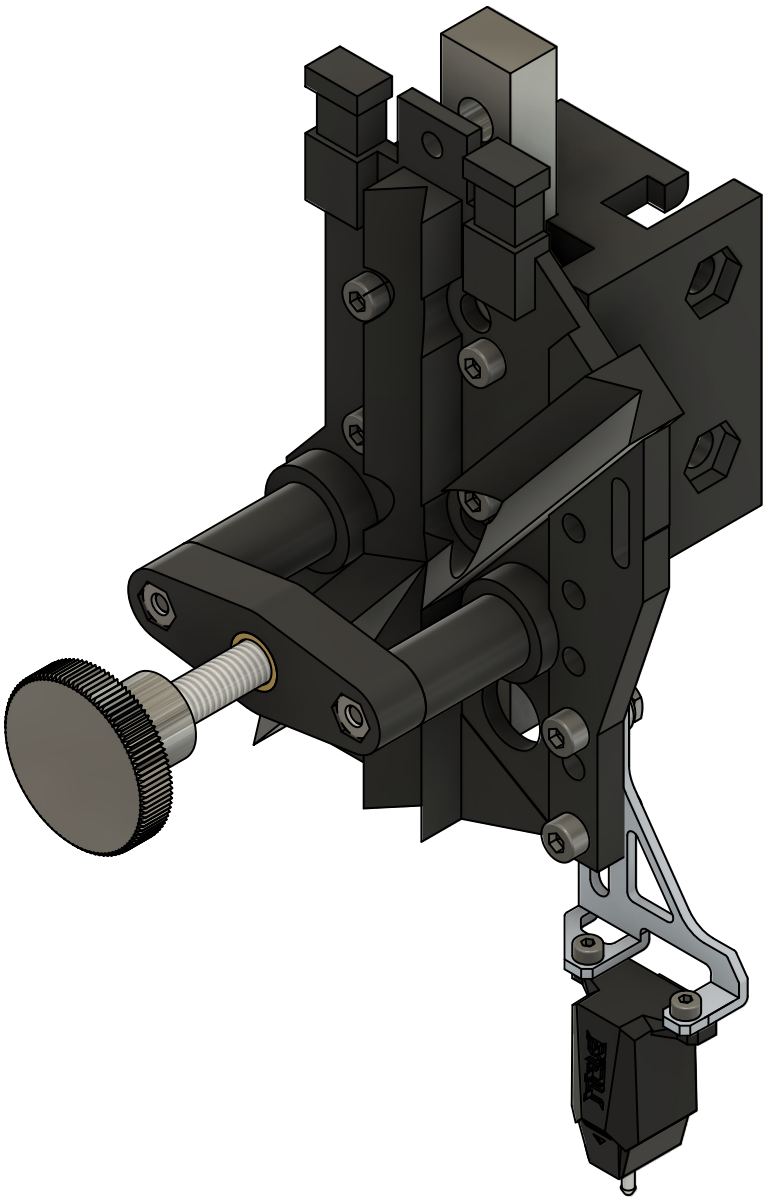
If edges splinter, apply painter's tape along cut lines before sawing.

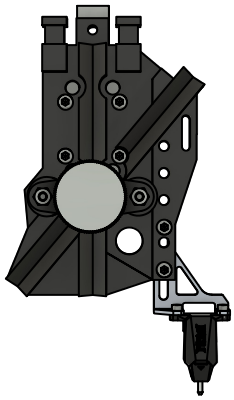
For a pro finish, consider engraving your name or artwork on the panel using a CNC router.

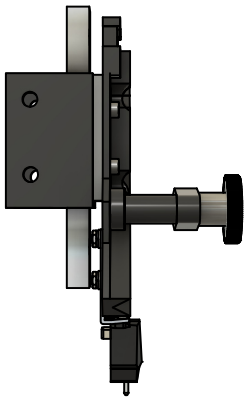
Once finished, proceed to mounting your electronics in Section 7. If the panel doesn't fit perfectly, minor sanding usually resolves it—contact support if dimensions seem off.

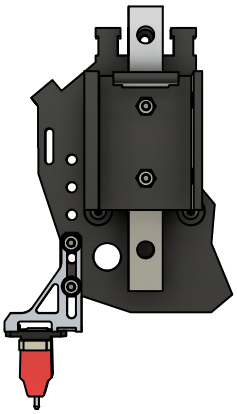
NOTES

Assembling the Pen Holder





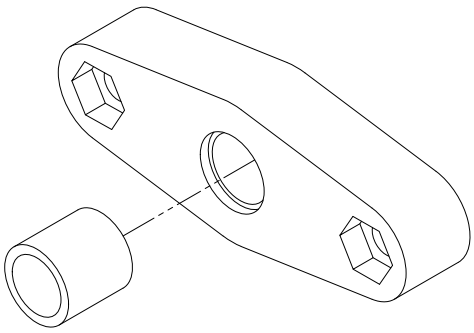




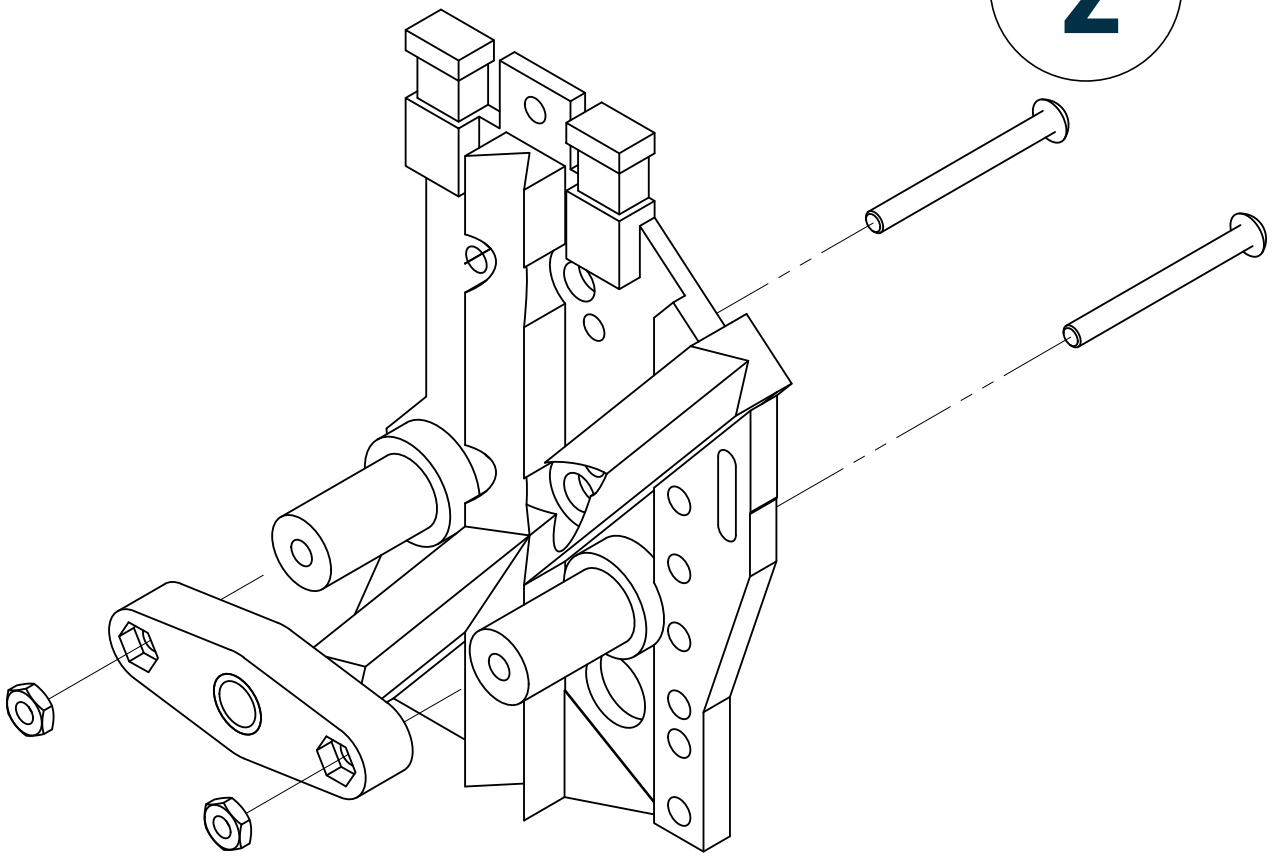
QTY	PART
1	Pen Holder Back Plate (0001)
1	Pen Holder Bracket (0002)
1	Insert M6 * 8 * 8
2	M3 Nut
2	M3 x 30mm Hex Socket Button Head

USE SOLDERING IRON TO INSTALL THE INSERT

1

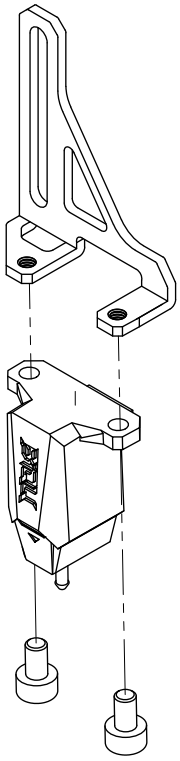


2

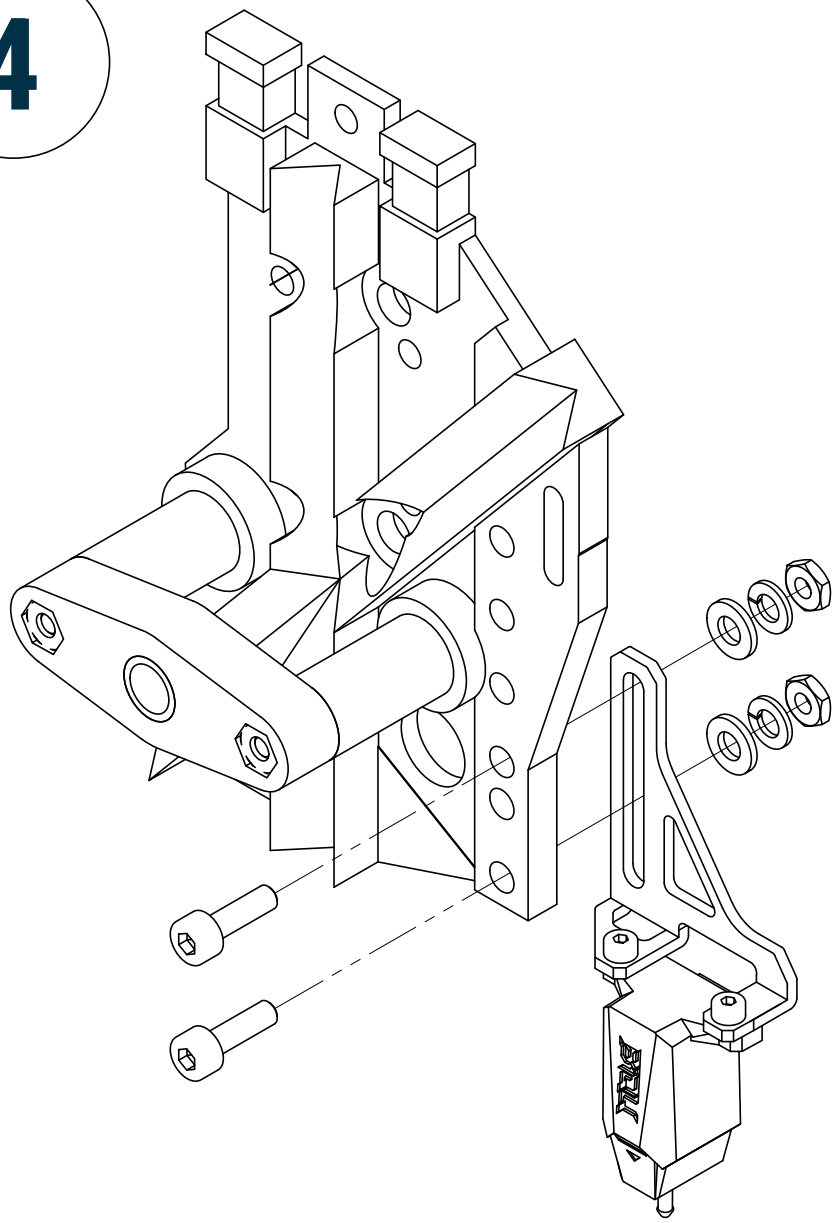


QTY	PART
1	Micro Probe Bracket B1 H2 (Included on the probe kit)
2	M3 bolts (Included on the probe kit)
1	BIQU Micro Probe
2	M3 x 12mm Hex Socket Head Cap
2	M3 Nut
2	M3 Flat Washer
2	M3 Lock Washer
1	Assembly Step 2

3



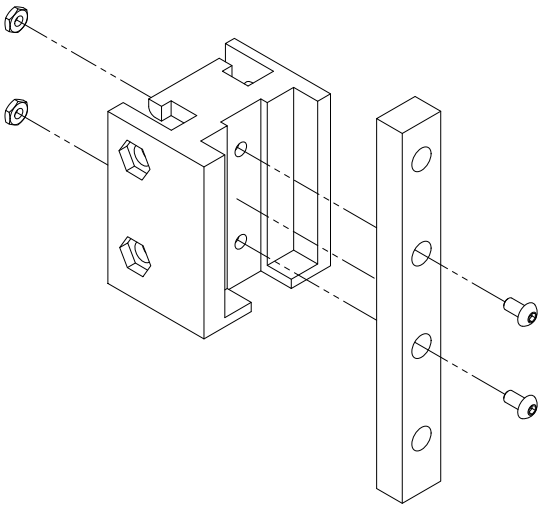
4

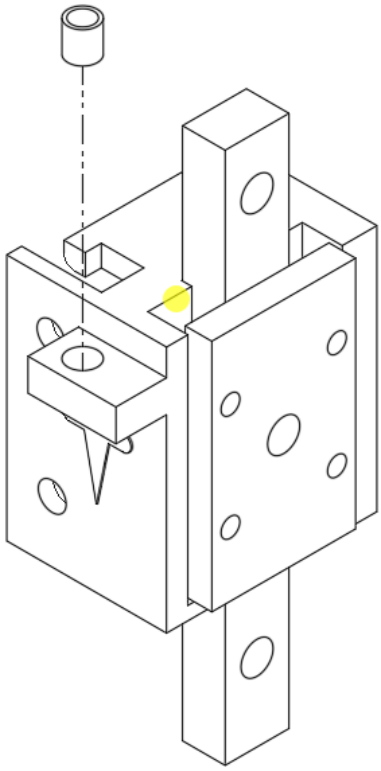


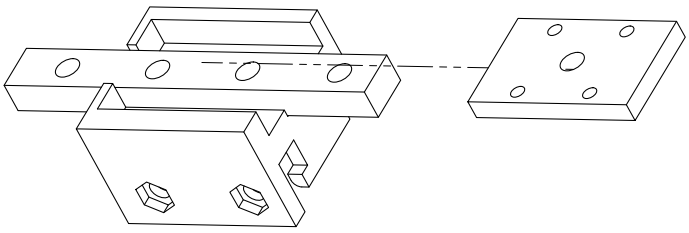
5

QTY	PART
1	Pen Rail Support (0003)
1	100mm MGN9 Rail
1	MGN9H Carriage
2	M3 x 8mm Hex Socket Button Head
2	M3 Nut
1	M4 * 6 * 6 Insert

INSTALL THE INSERT
FOR SPRING RETAINER.
USE SOLDER IRON







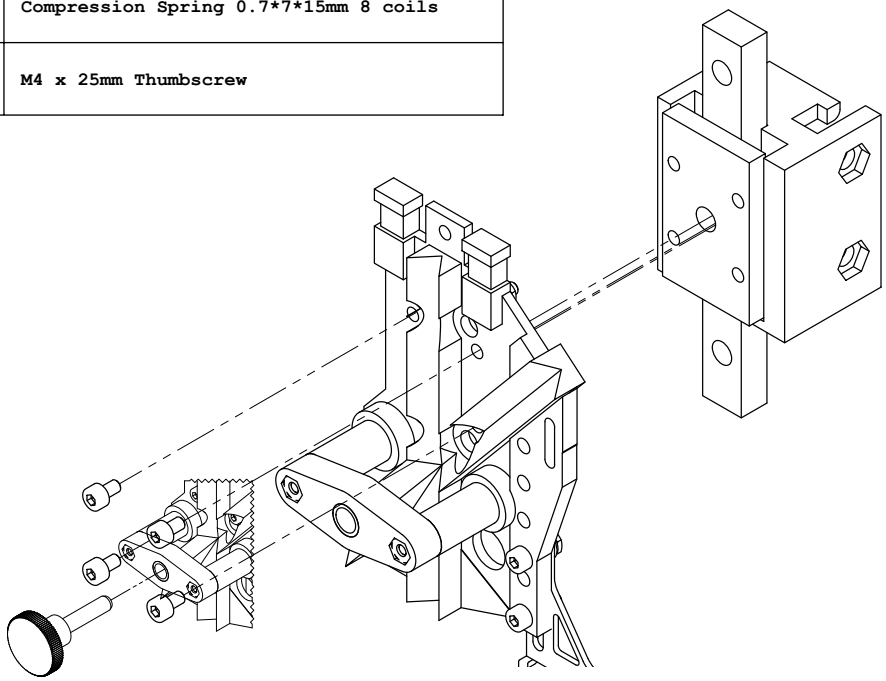
6

BE CAREFUL WITH THE
BALL BEARINGS

QTY	PART
1	Assembly Step 4
1	Assembly Step 6
1	M6 x 25mm Thumb Screw Nut
4/2	M3 x 8mm Hex Socket Head Cap Right side if using spring
2	M3 x 12mm Hex Socket Head Cap If installing the spring mechanism instead of the rubber band (recommended)
1	0037 Spring Pen Bracket
1	4mm Plain Washer
1	Compression Spring 0.7*7*15mm 8 coils
1	M4 x 25mm Thumbscrew

7

IMPORTANT: AT THIS POINT, INSTALL THE RUBBER BAND OR SPRING KNOB BETWEEN THE PEN RAIL SUPPORT AND THE PEN GANTRY TO KEEP THE CARRIAGE FROM SLIPPING



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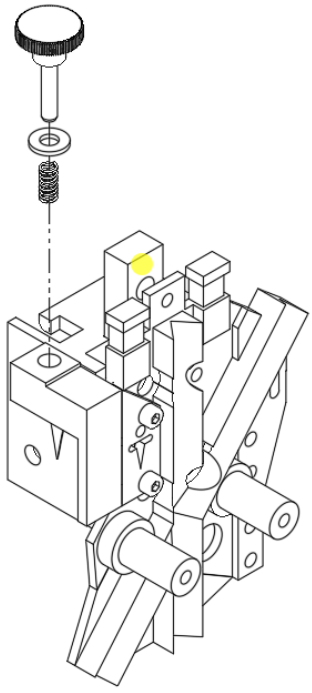
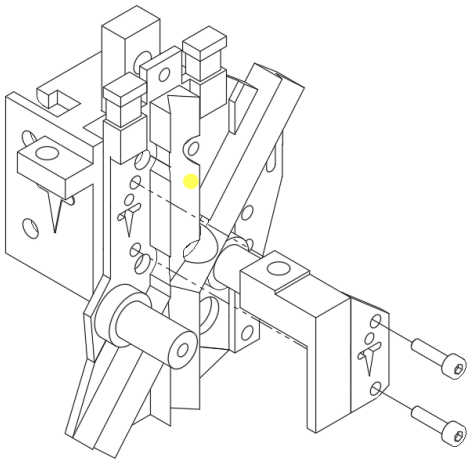
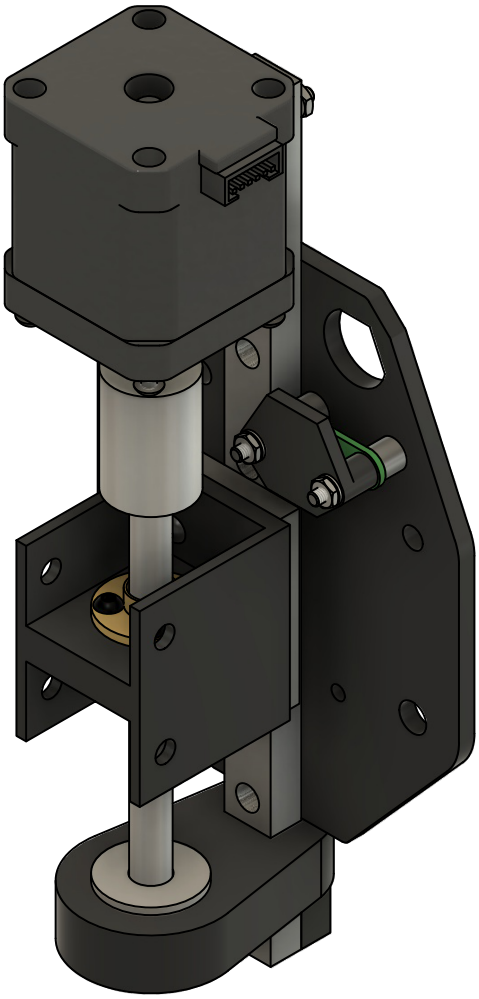
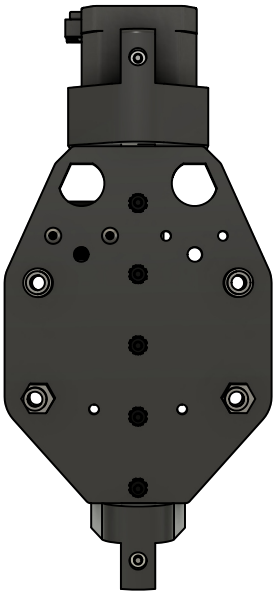


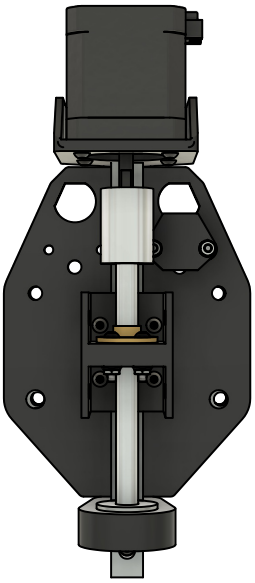


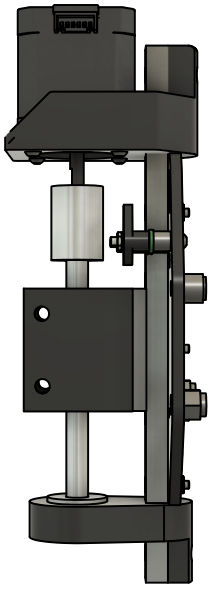
NOTES

Constructing the Z-Axis

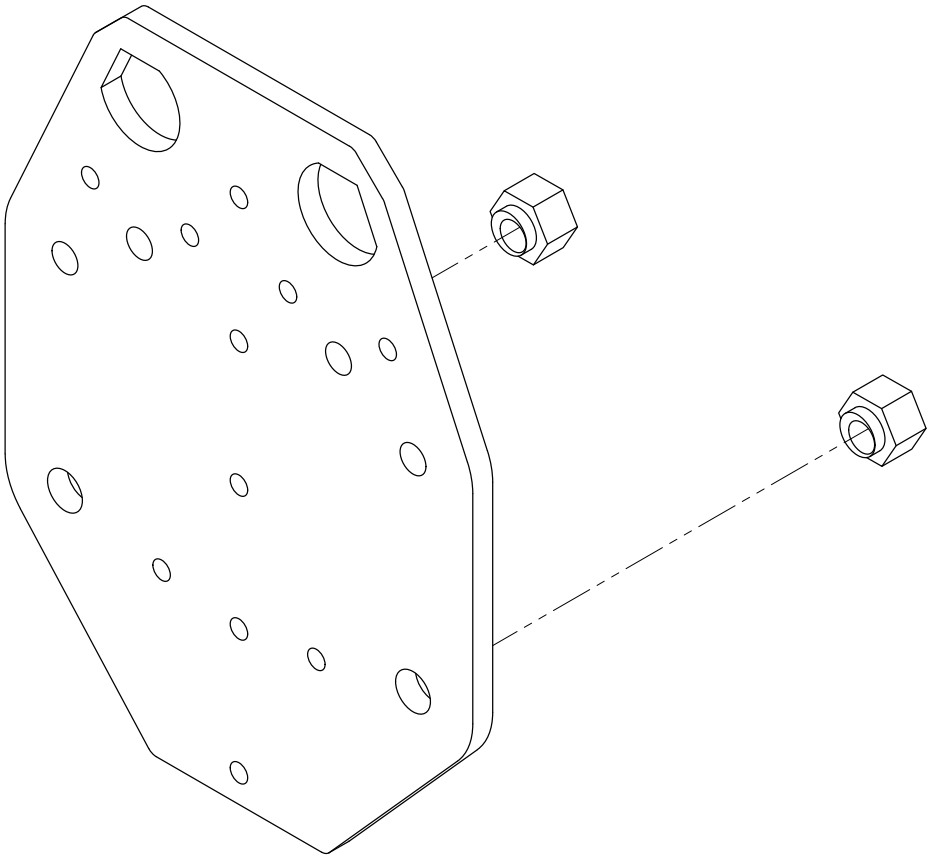








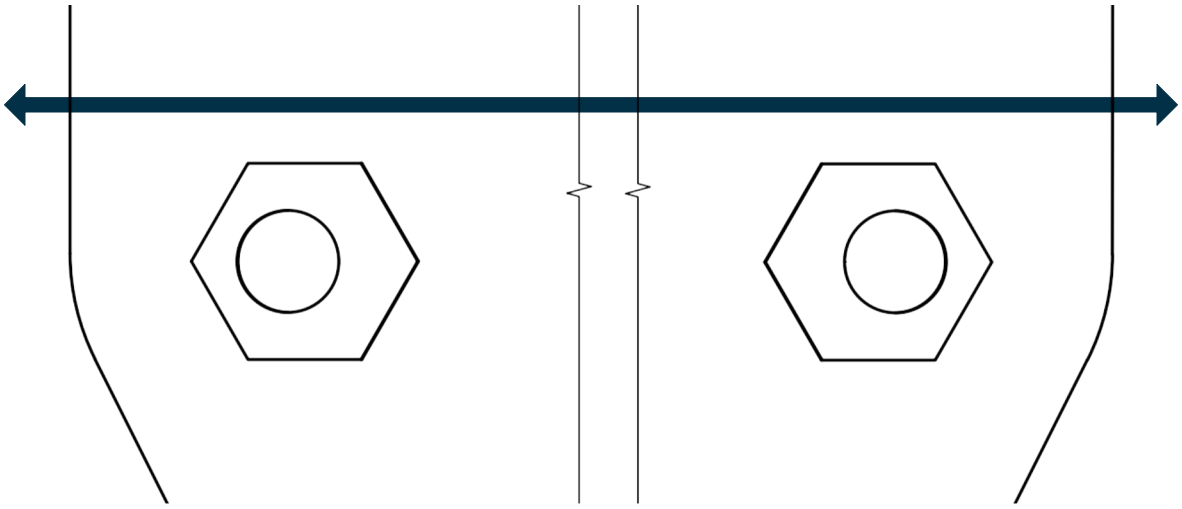
QTY	PART
1	Z Axis Support Plate 0004
2	PCS Eccentric Spacers



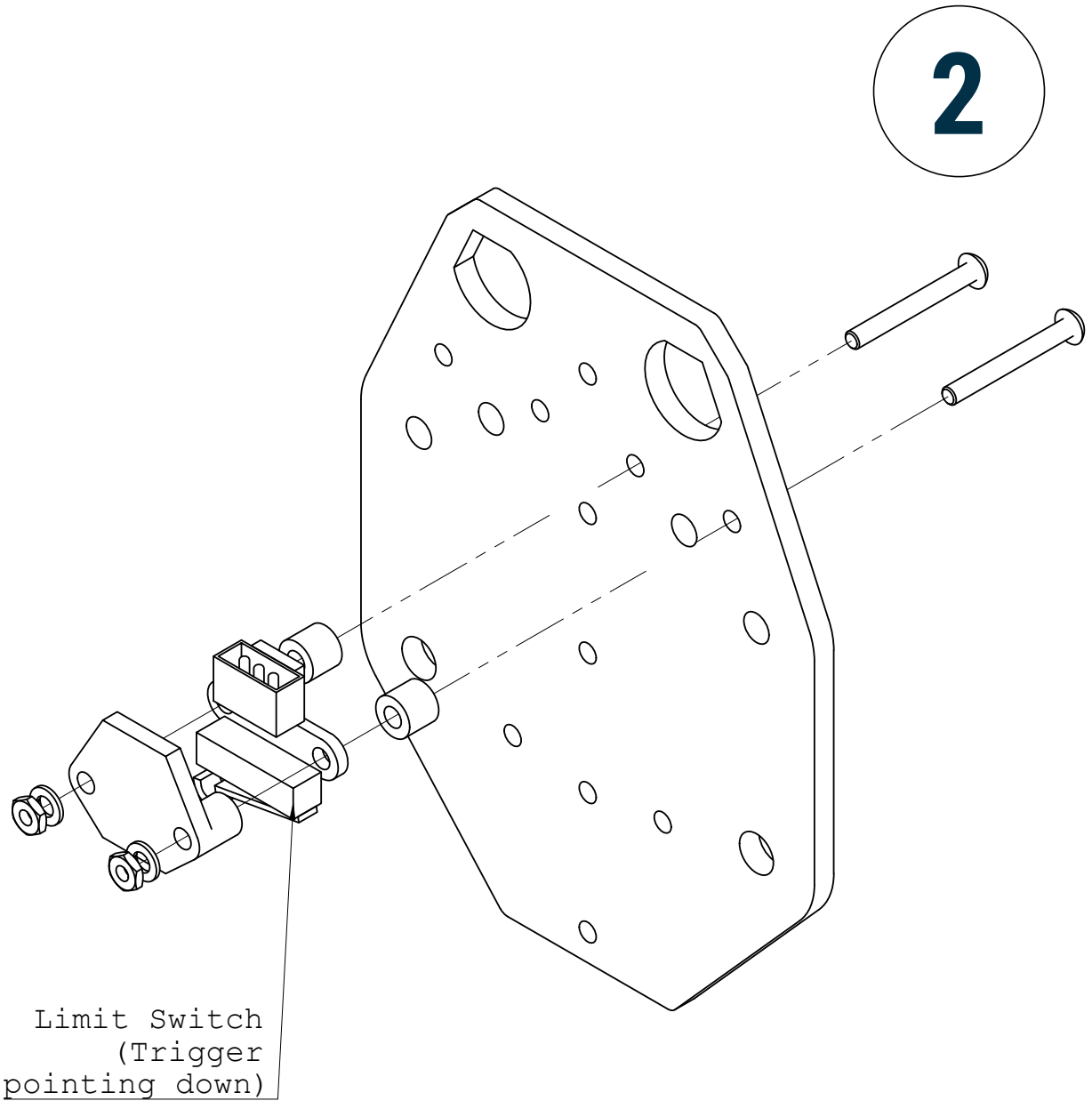
1

USE A DEFBURRING TOOL TO COUNTERSINK THE HOLES FOR EASY INSTALLATION

ALIGN ECCENTRIC HOLES TO THE OUTER EDGENS

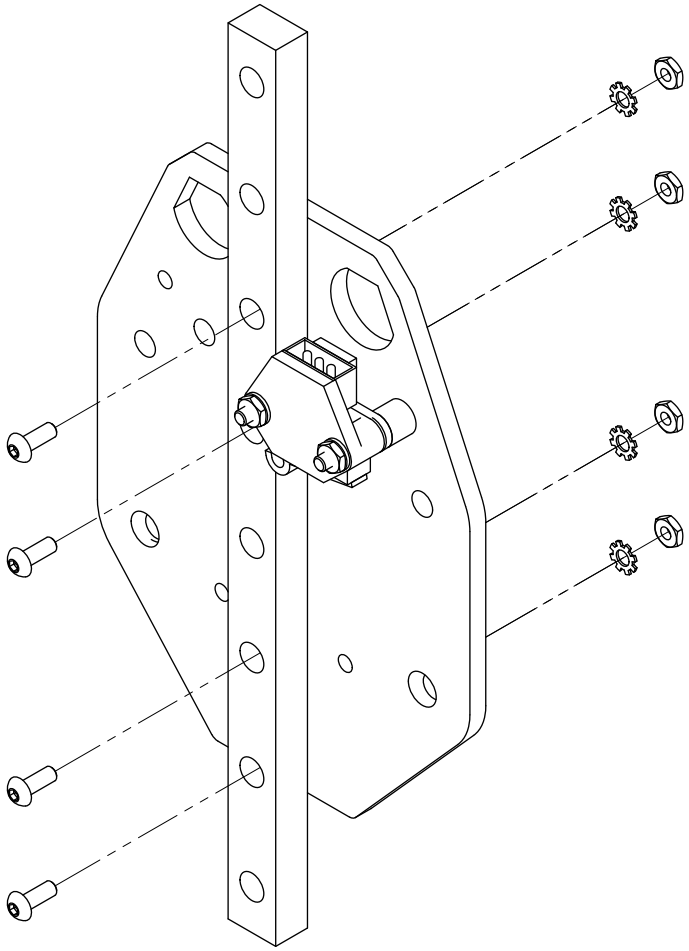


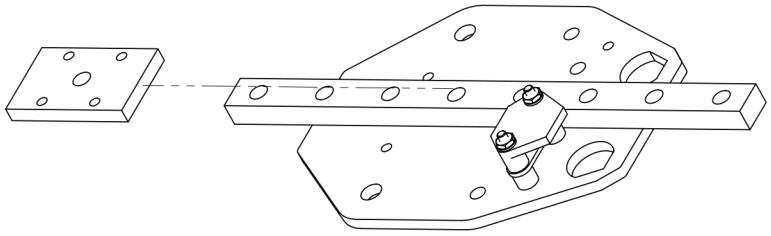
QTY	PART
2	6mm Limit Switch Column
1	Limit Switch REIFENG
2	M3 Nuts
2	M3 Lock Washer
2	M3 x 25mm Hex Socket Button Head Bolts
1	Top Limit Switch Bracket Z 0014-Z



QTY	PART
1	200mm MGN9 Rail
1	MGN9H Carriage
4	M3 x 12mm Hex Socket Button Head Bolts
4	M3 Lock Washers
5	M3 Nuts

3

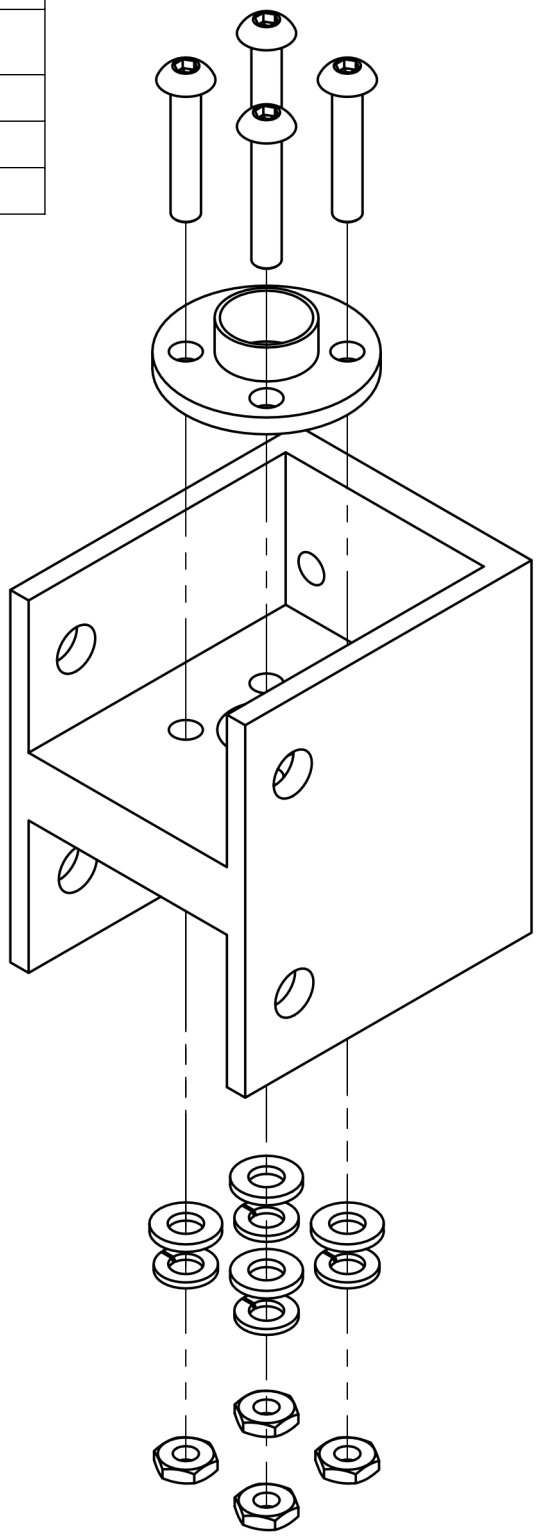




4

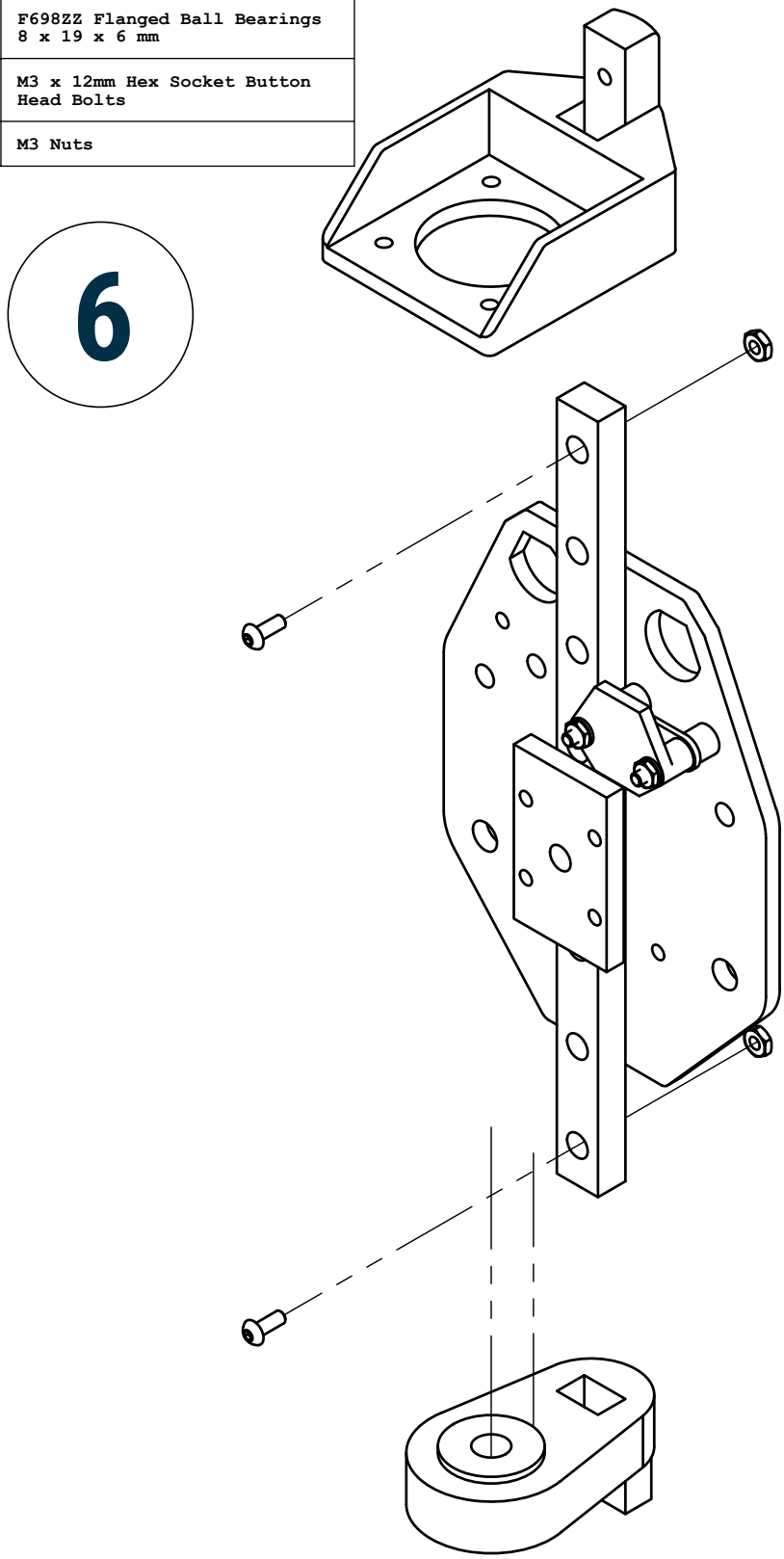
BEWARE OF BALL
BEARINGS FALLING OUT

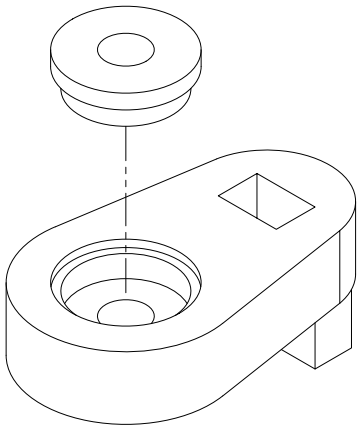
QTY	PART
1	Carriage Bracket 0005
1	T8 Brass Nut 4 Starts
4	M3 x 16mm Hex Socket Button Head Bolts
4	M3 Flat Washers
4	M3 Lock Nuts
4	M3 Nuts



5

QTY	PART
1	Z NEMA Top Support 0006
1	Z Bottom Support 0007
1	F698ZZ Flanged Ball Bearings 8 x 19 x 6 mm
2	M3 x 12mm Hex Socket Button Head Bolts
2	M3 Nuts



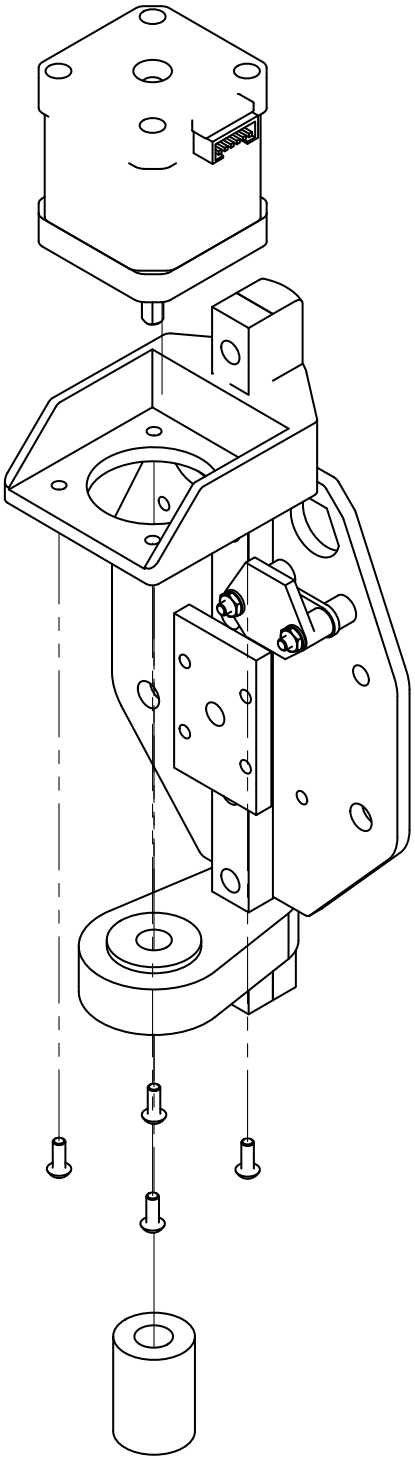


FOR SECURE SETTING
USE A DROP OF
INSTANT GLUE

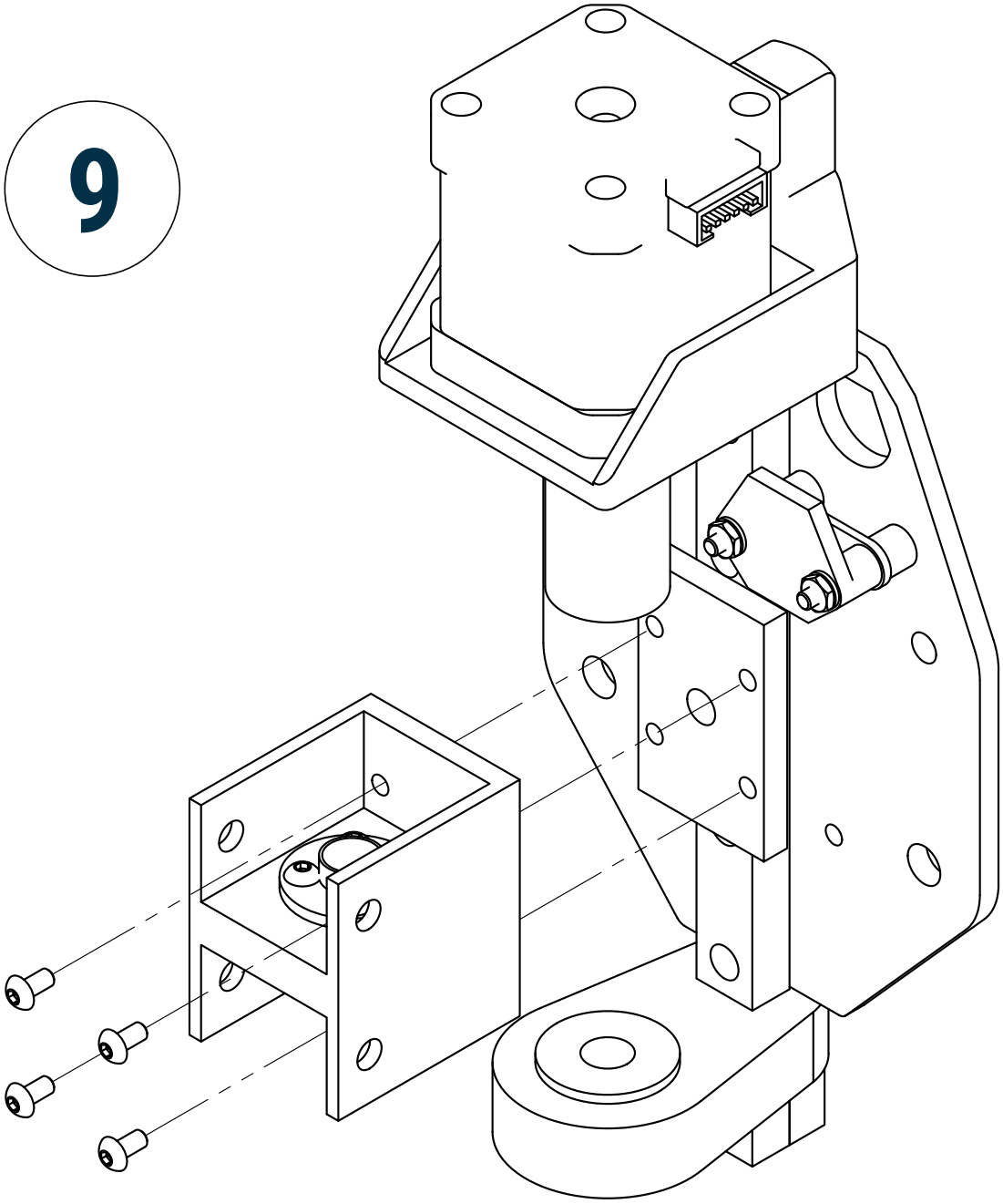
QTY	PART
1	NEMA 17 STEPPER MOTO
1	Flexible Coupling 5mm to 8mm
4	M3 x 8mm Hex Socket Button Head Bolts

8

NEMA CONNECTOR POINTING RIGHT

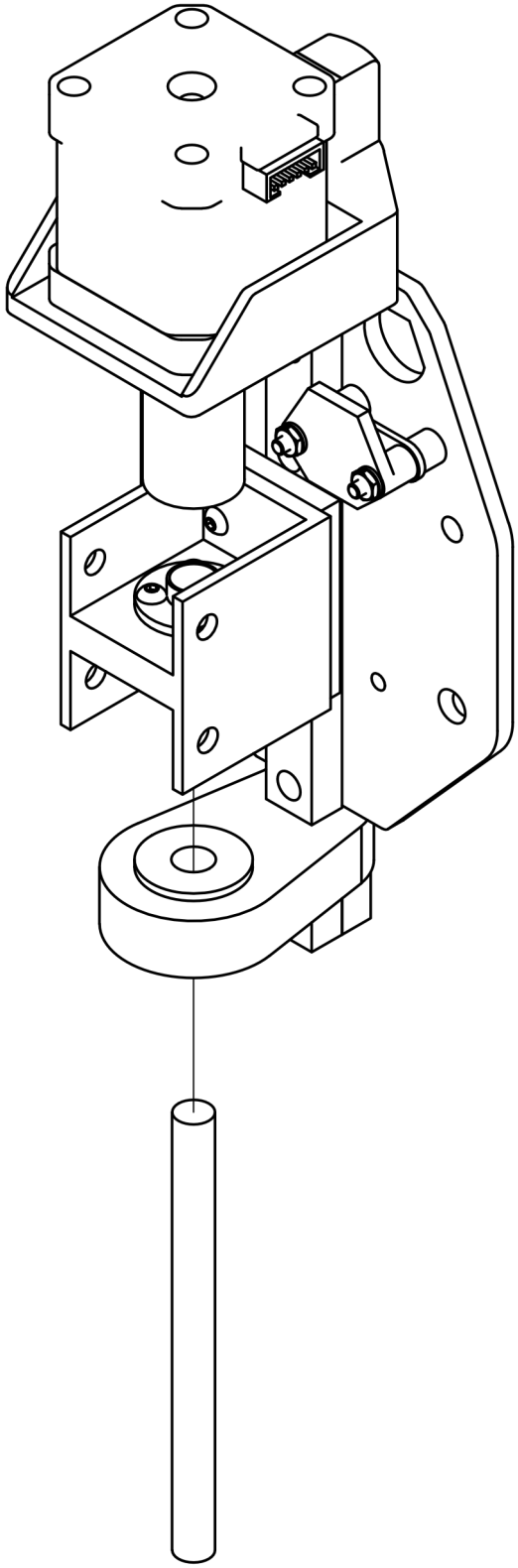


QTY	PART
1	Assembly Step 5
4	M3 x 8mm Hex Socket Button Head Bolts



QTY	PART
1	Assembly Step 9
1	T8 120mm Rod

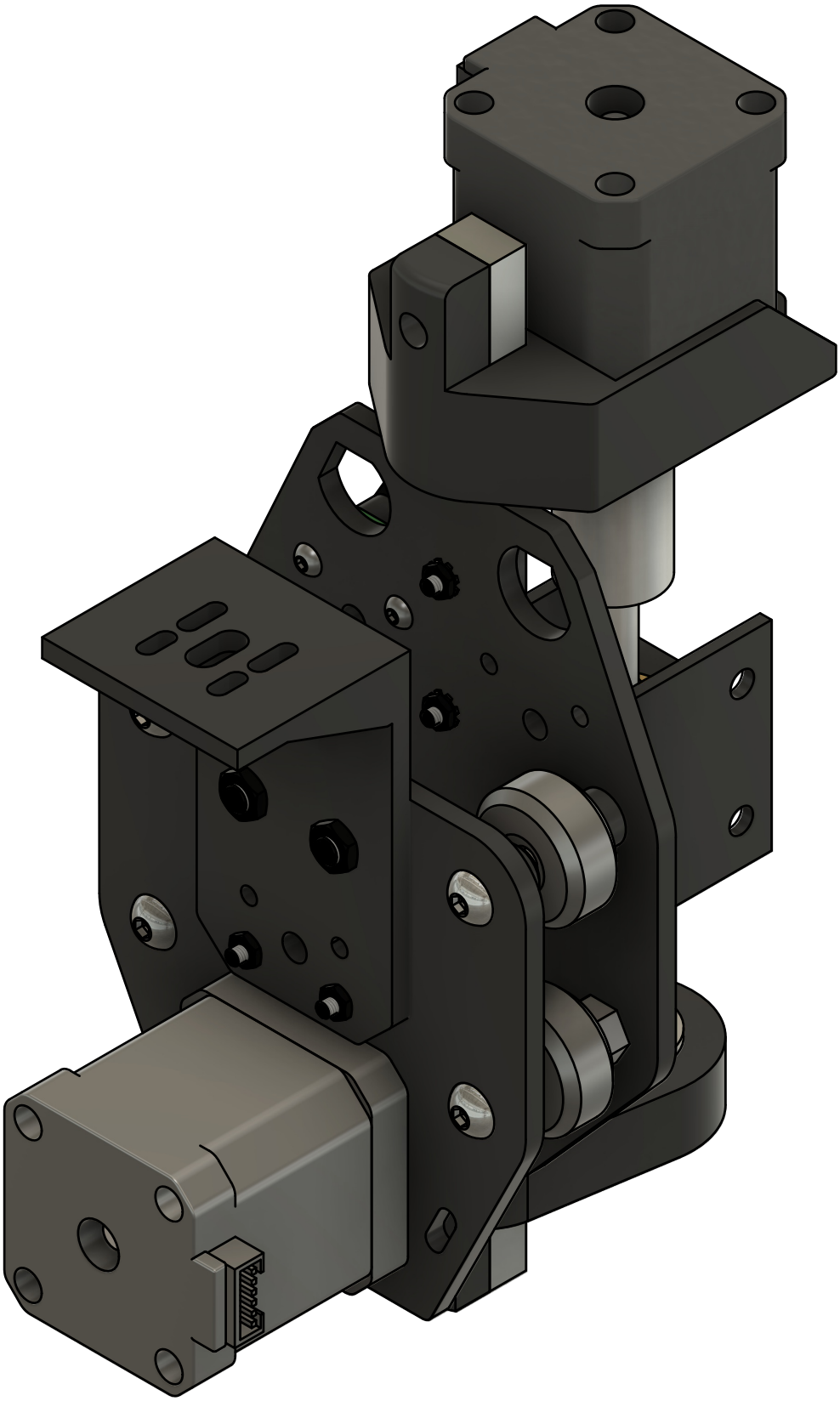
10



SCREW IN THE T8 ROD
AND TIGHTEN THE
FLEXIBLE COUPLING

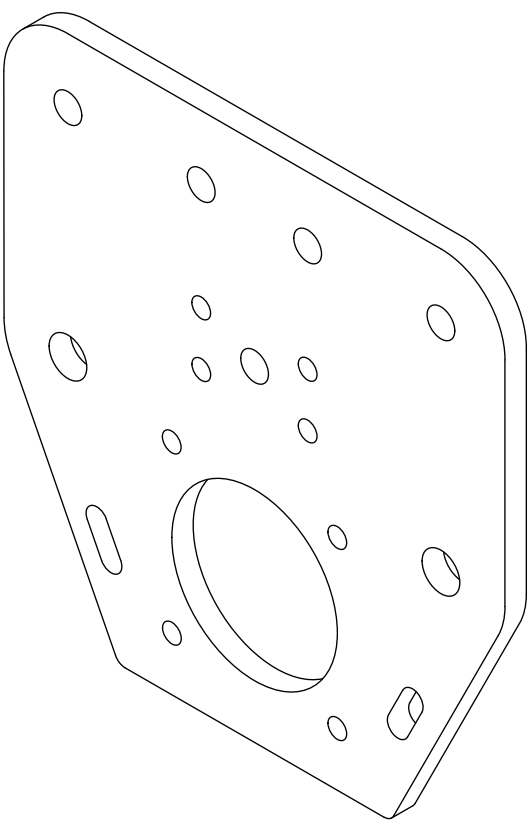
NOTES

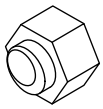
Assembling the X-Gantry

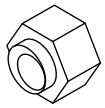


QTY	PART
1	X Axis Back Plate 0008
2	PCS Eccentric Spacers

1

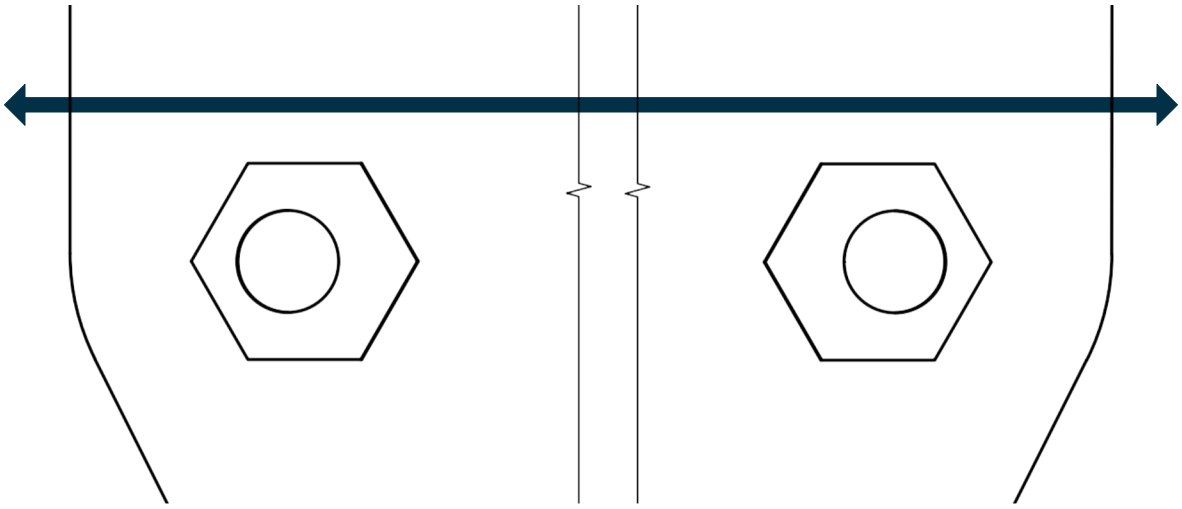




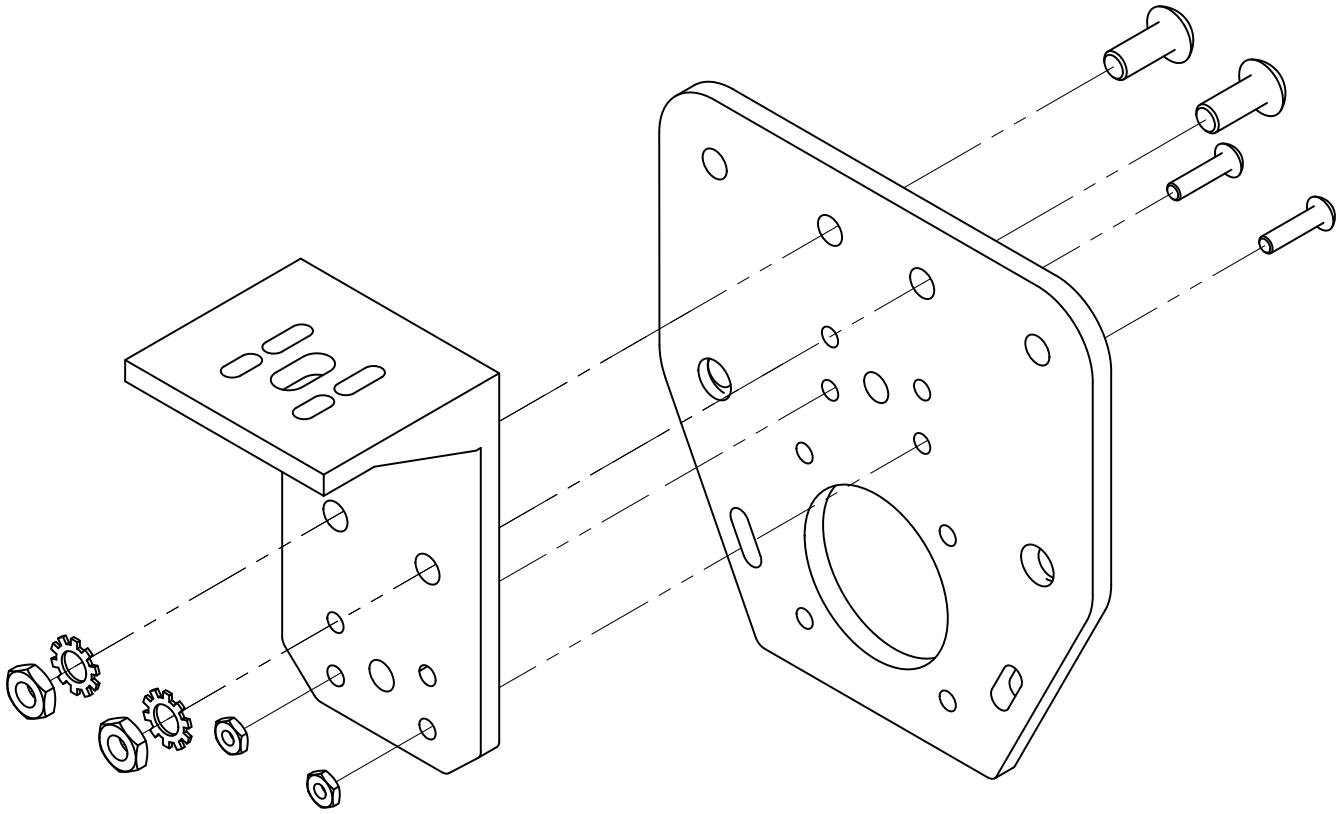


USE A DEBURRING TOOL AND PLIERS TO COUNTERSINK THE HOLES AND EASY INSTALLATION

ALIGN ECCENTRIC HOLES TO THE OUTER EDGES

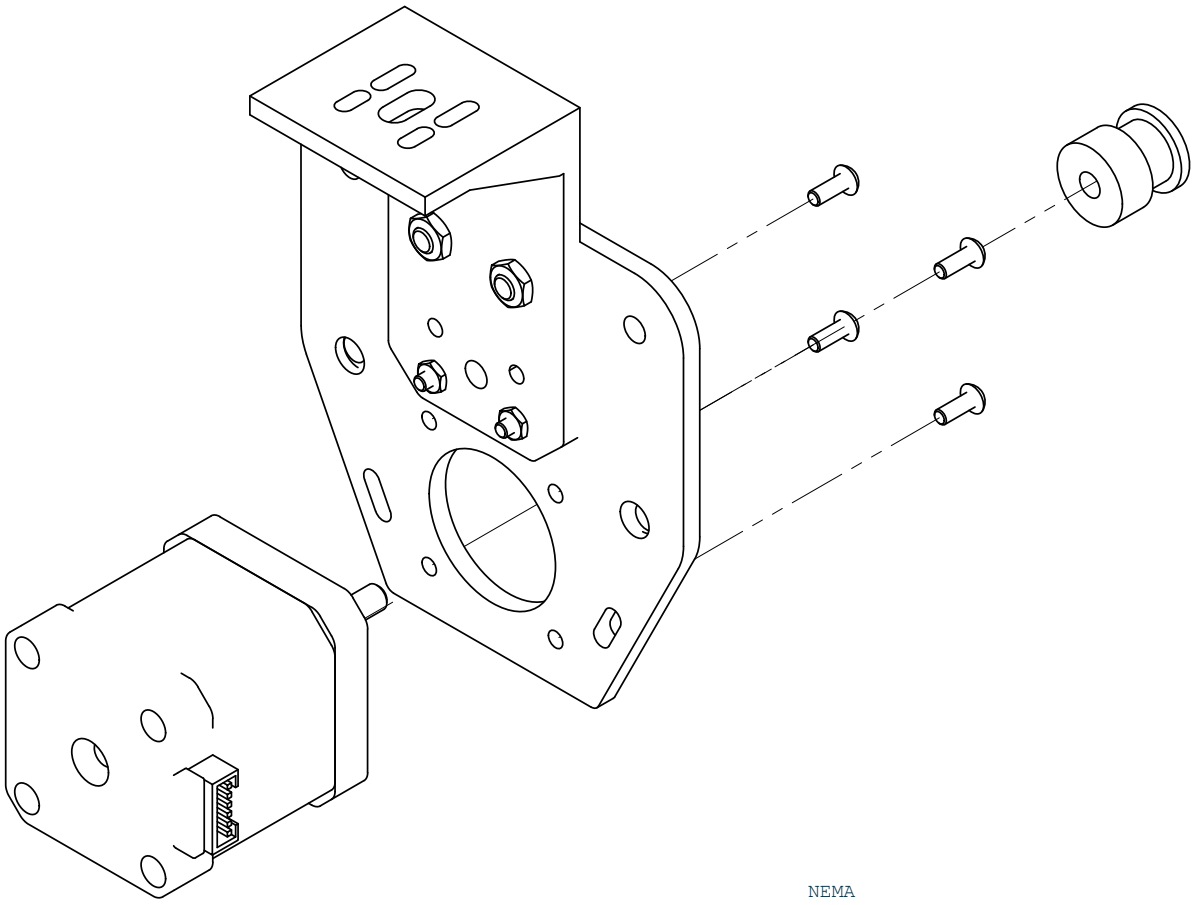


QTY	PART
1	X Axis Rail Support 0009
2	M5 x 12mm Hex Socket Button Head Bolts
2	M3 x 12mm Hex Socket Button Head Bolts
2	M5 Lock Washers
2	M5 Nuts
2	M3 Nuts



QTY	PART
1	NEMA 17 STEPPER MOTO
1	GT2 Timing Belt Pulley 5mm bore
4	M3 x 8mm Hex Socket Button Head Bolts

3

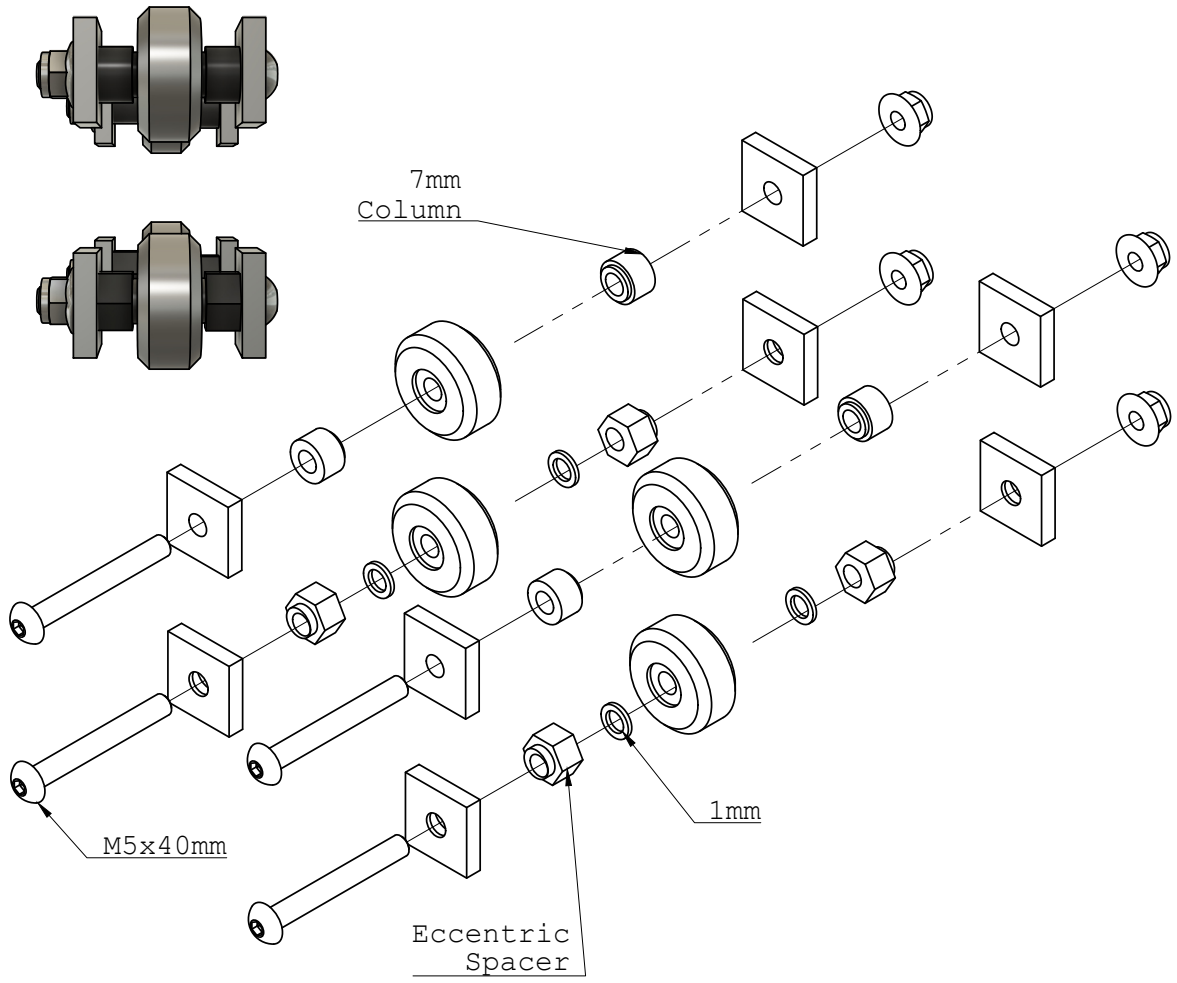


NEMA CONNECTOR POINTING RIGHT

QTY	PART
4	24mm, 5mm Bore Vslot Wheels
4	M5 x 40mm Hex Socket Button Head Bolts
4	M5 Lock Nuts
4	PCB Eccentric Spacer
4	1mm Flat Wheel Washers
4	7mm Wheel Column Spacers

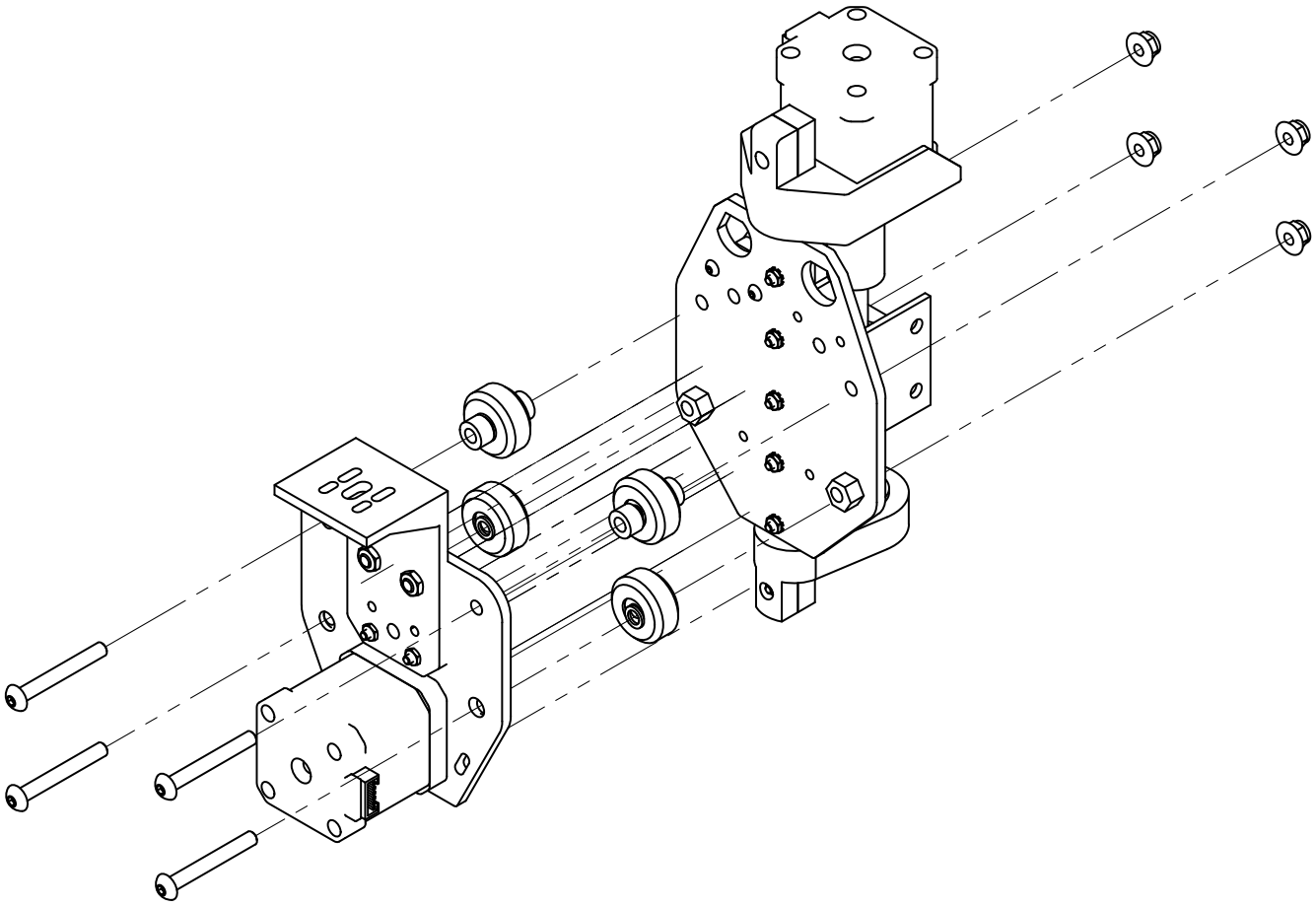
4

THIS IS THE WHEEL ASSEMBLY. BUILD IN STEP 5
ALL AT ONCE



QTY	PART
1	Z Axis Assembly
1	Assembly Step 3

5



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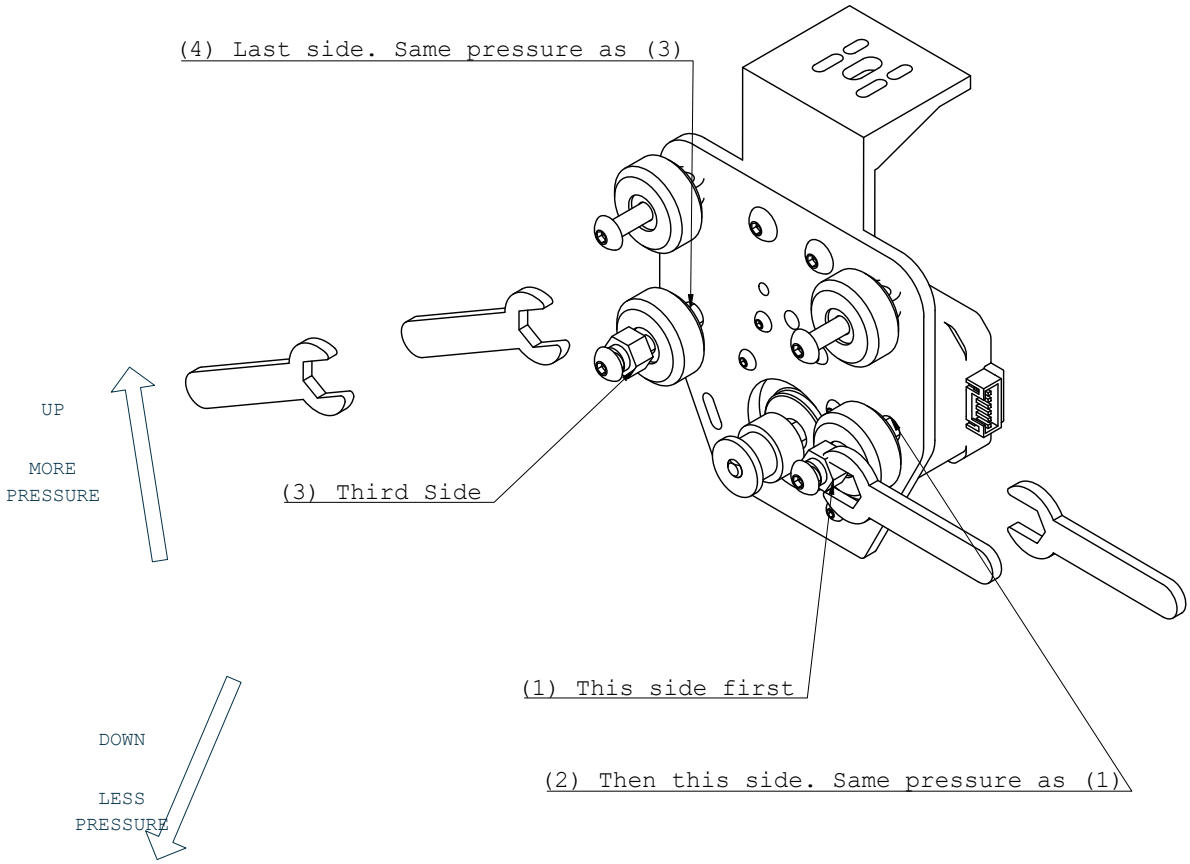
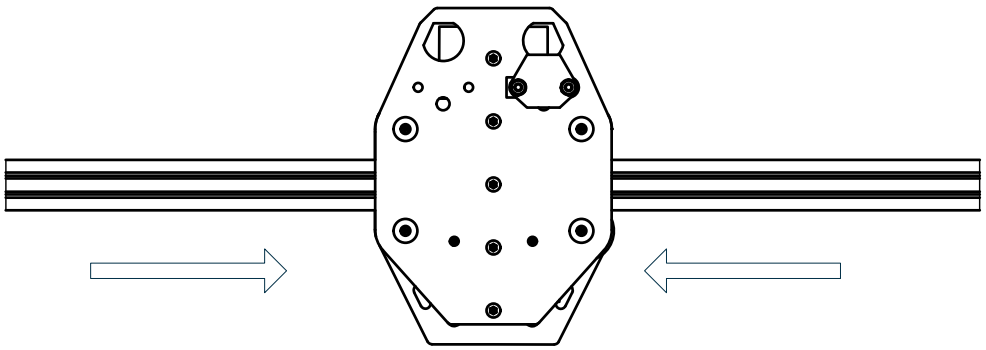
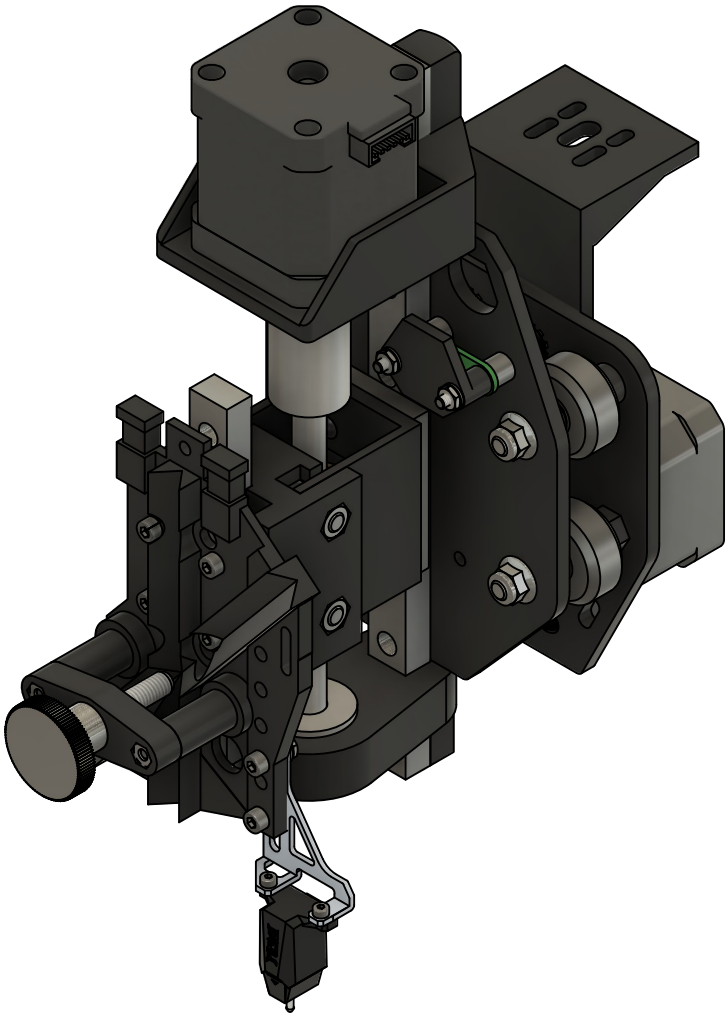


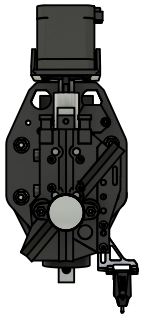
USE A 2020 EXTRUSION TO CALIBRATE THE WHEEL PRESSURE. USE DIAGRAM TO LOOSEN (DOWN) OR TIGHTEN (UP) THE WHEELS. THE GANTRY SHOULD MOVE BACK AND FORTH EASILY BUT SOLID.

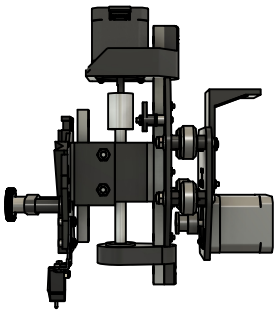


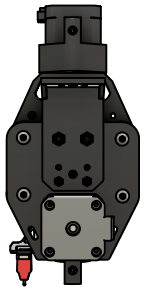
NOTES

Integrating the XZ-Gantry



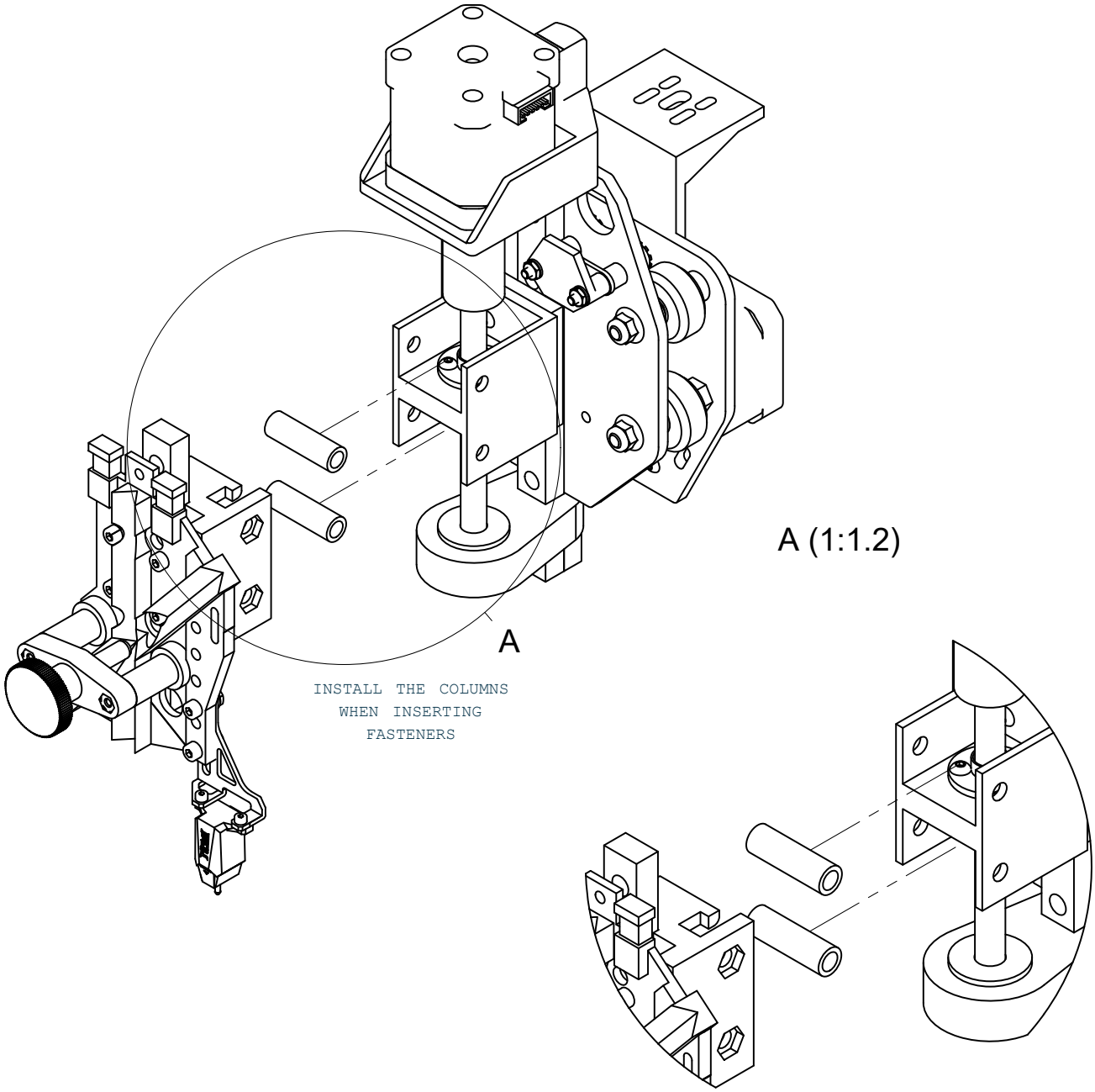






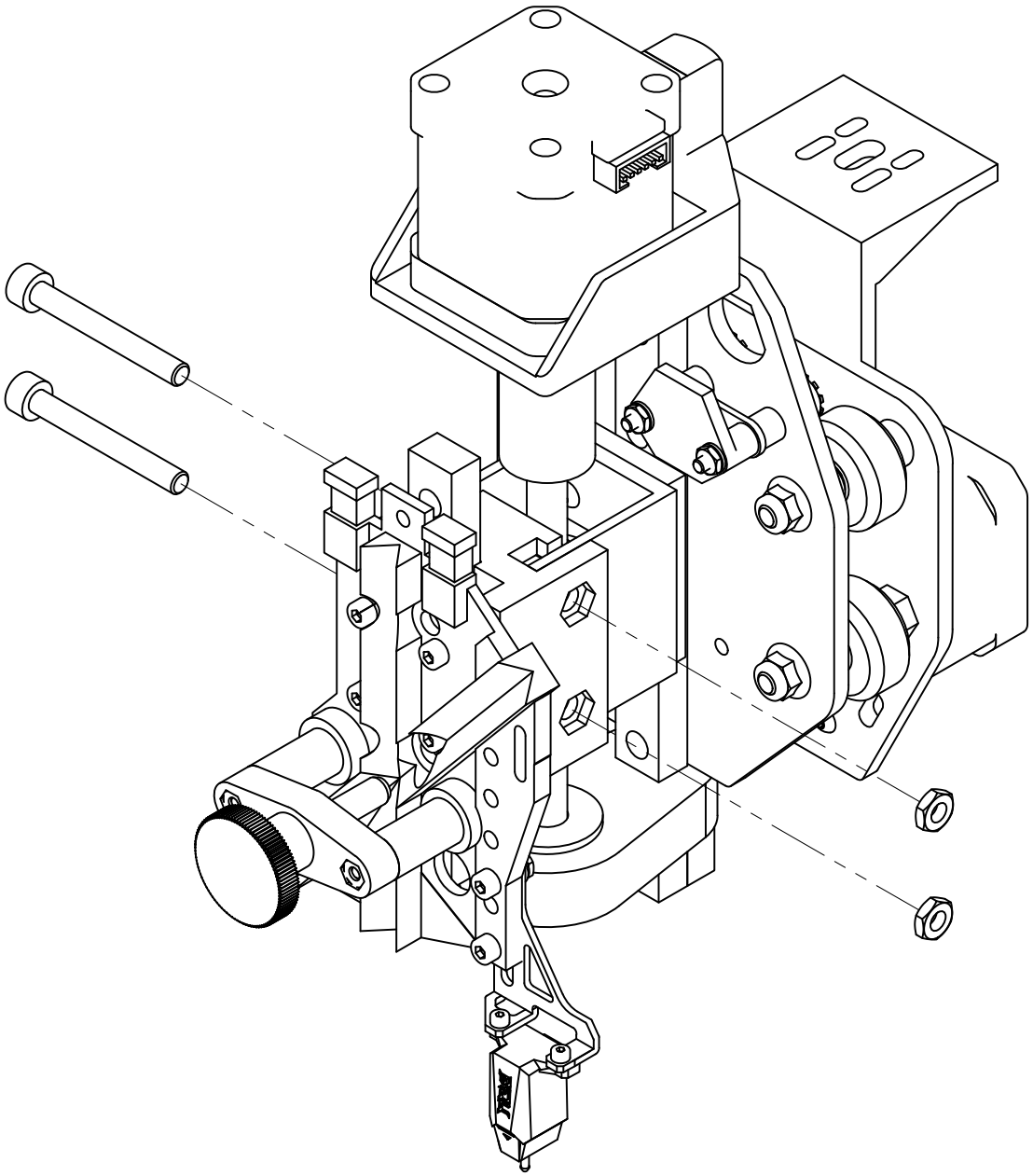
QTY	PART
1	Pen Assembly
2	XZ Gantry
2	27mm Column Spacers

1



QTY	PART
2	M5 x 40mm Hex Socket Button Head Bolts
2	M5 Nuts

2



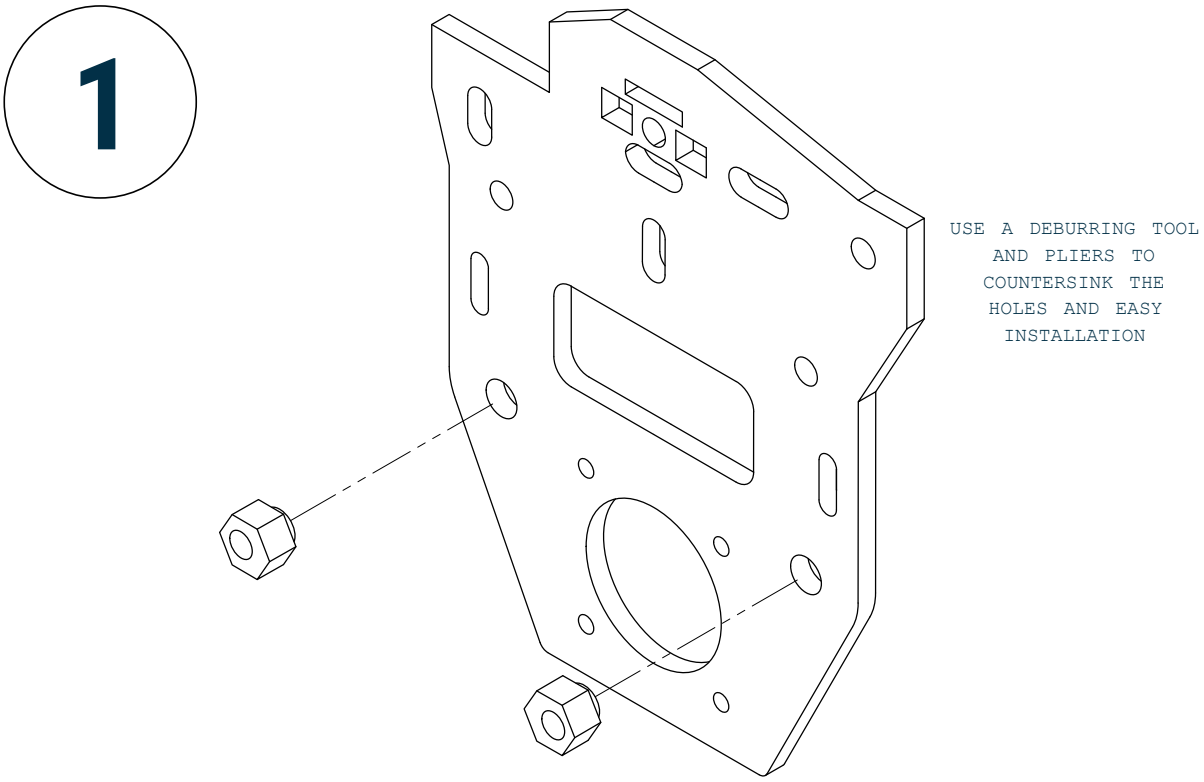
NOTES

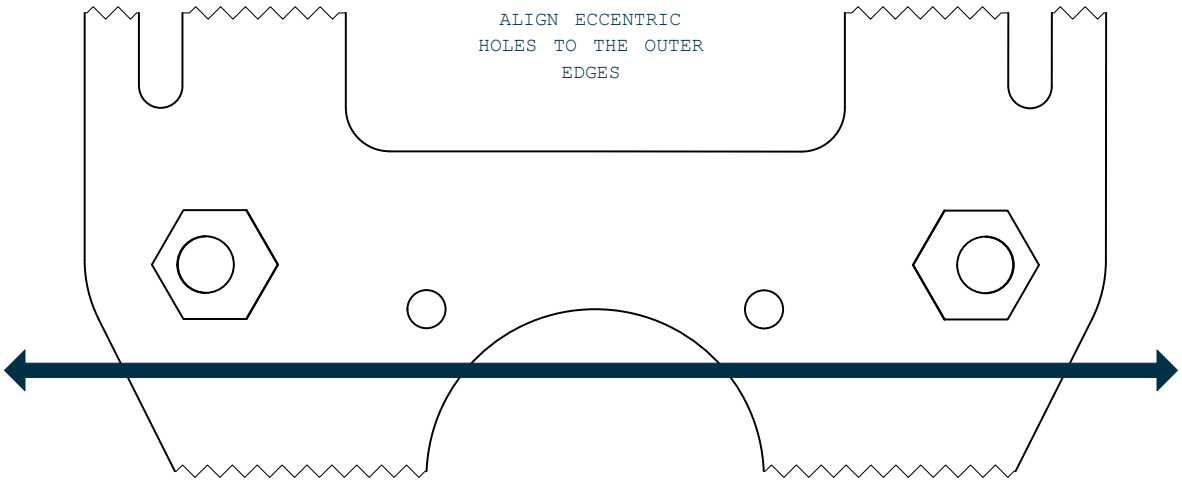
Building the Y1 & Y2 Gantries

Y2 Gantry

Build Right Side First

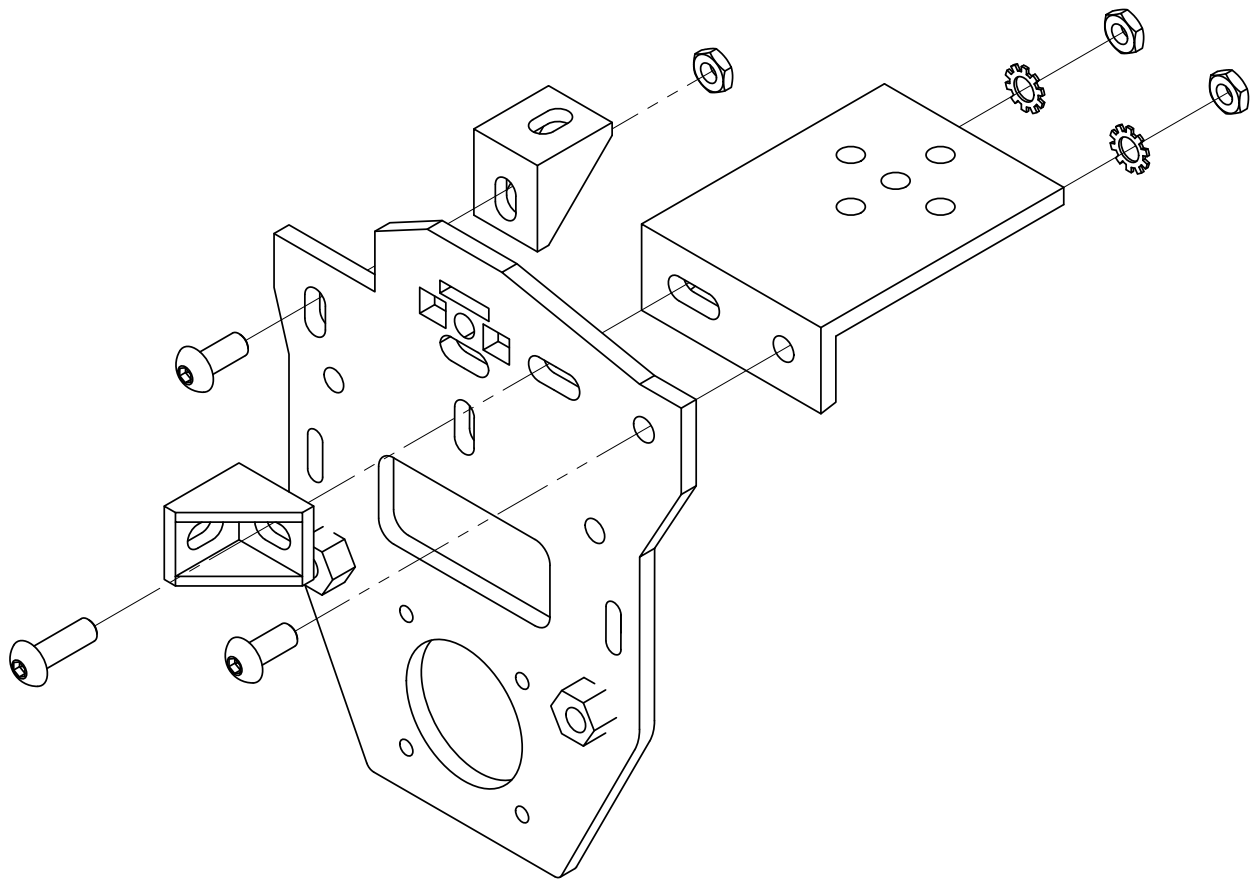
QTY	PART
1	Y Gantry Back Plate 0010
2	PCS Eccentric Spacers





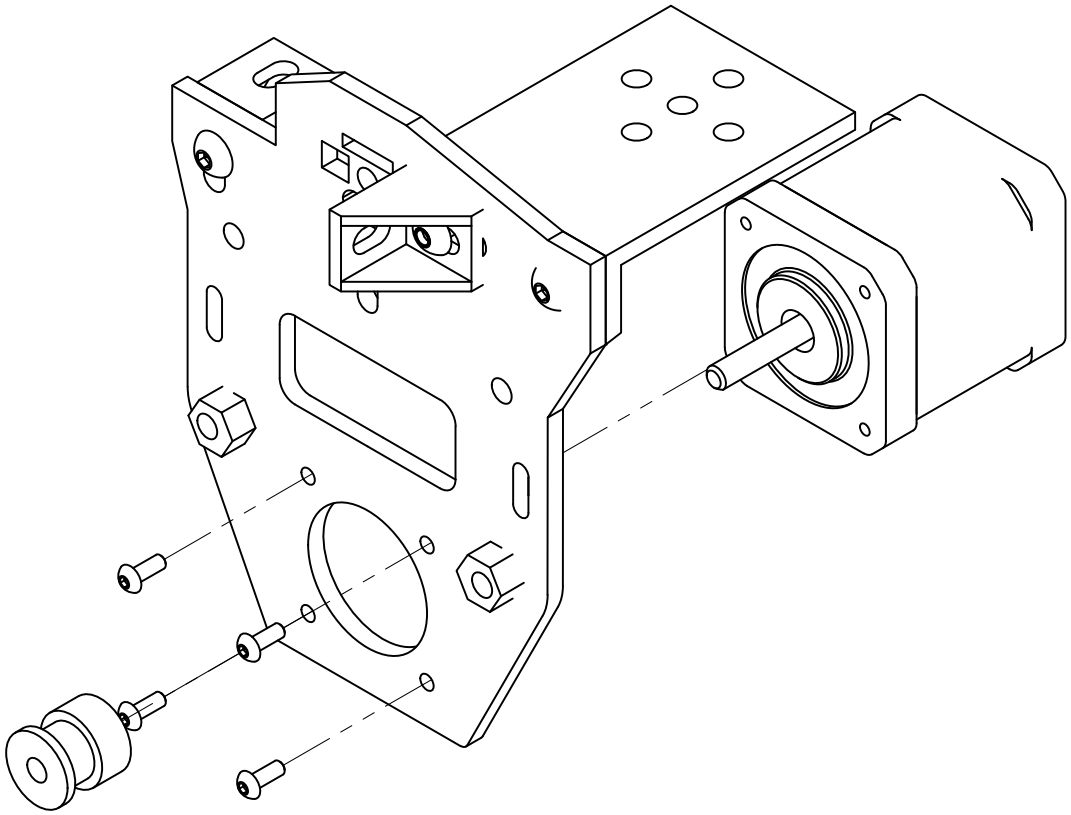
QTY	PART
1	Y Gantry Rail Bracket 0011
2	L Brackets
2	M5 x 12mm Hex Socket Button Head Bolts
1	M5 x 16mm Hex Socket Button Head Bolts
3	M5 Lock Washers
3	M5 Nuts

2



QTY	PART
1	NEMA 17 STEPPER MOTO
1	GT2 Timing Belt Pulley 5mm bore
4	M3 x 8mm Hex Socket Button Head Bolts

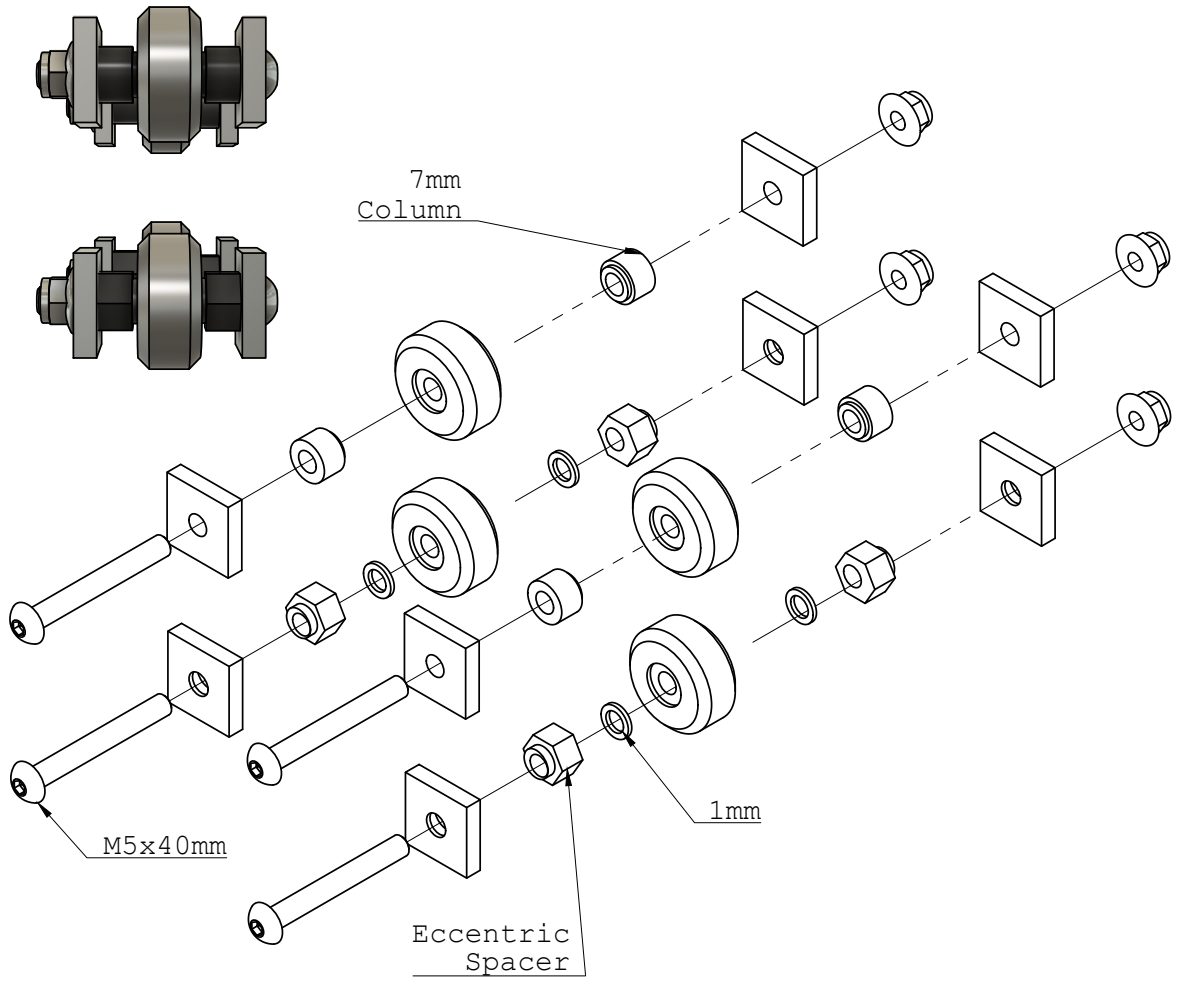
3



4

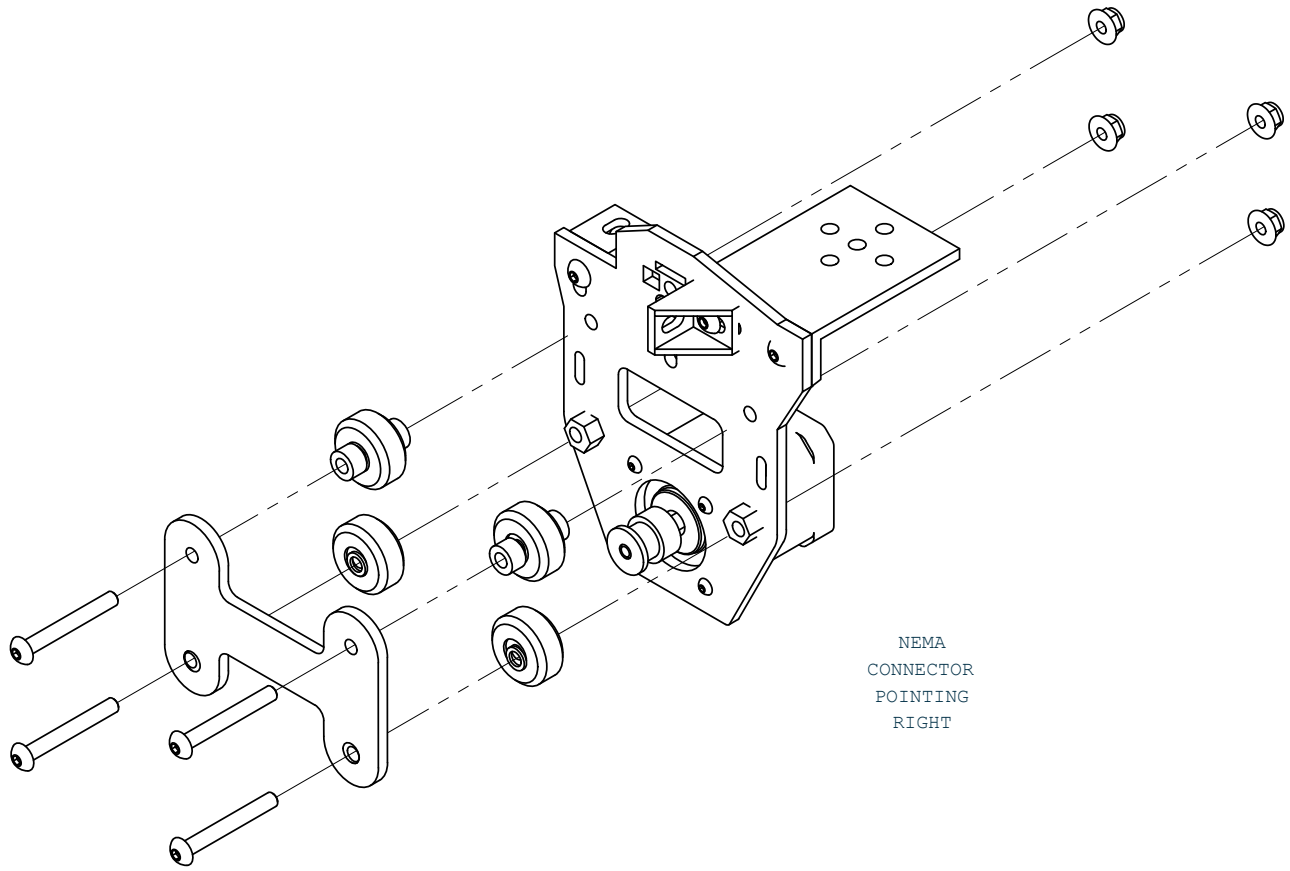
QTY	PART
4	24mm, 5mm Bore Vslot Wheels
4	M5 x 40mm Hex Socket Button Head Bolts
4	M5 Lock Nuts
4	PCB Eccentric Spacer
4	1mm Flat Wheel Washers
4	7mm Wheel Column Spacers

THIS IS THE WHEEL ASSEMBLY. BUILD IN STEP 4
ALL AT ONCE



5

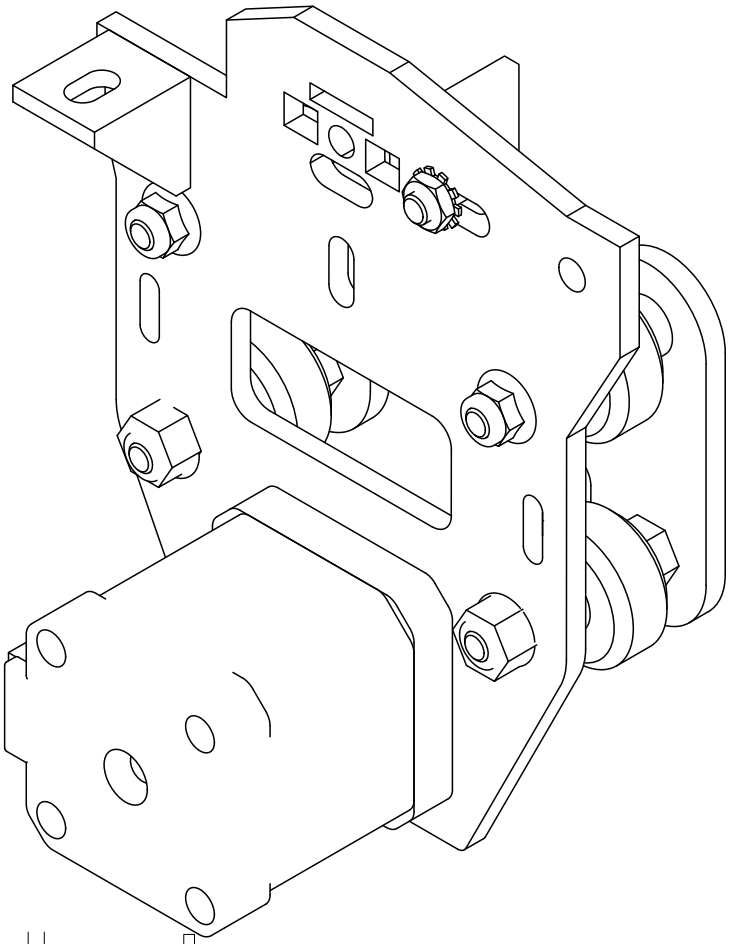
QTY	PART
1	Z Axis Assembly
1	Assembly Step 3
1	Y Gantry Wheel Holder 0012



Y1 Gantry

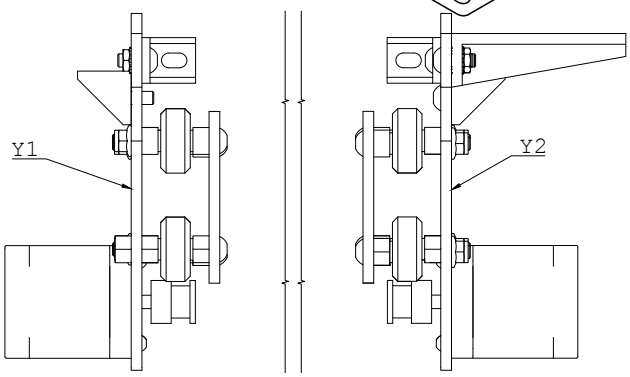
Use same instructions as Y2. Make sure you install the parts on the opposite side of Y2 (Mirrored). This side has NO rail bracket.

Y1 HAS NO RAIL BRACKET



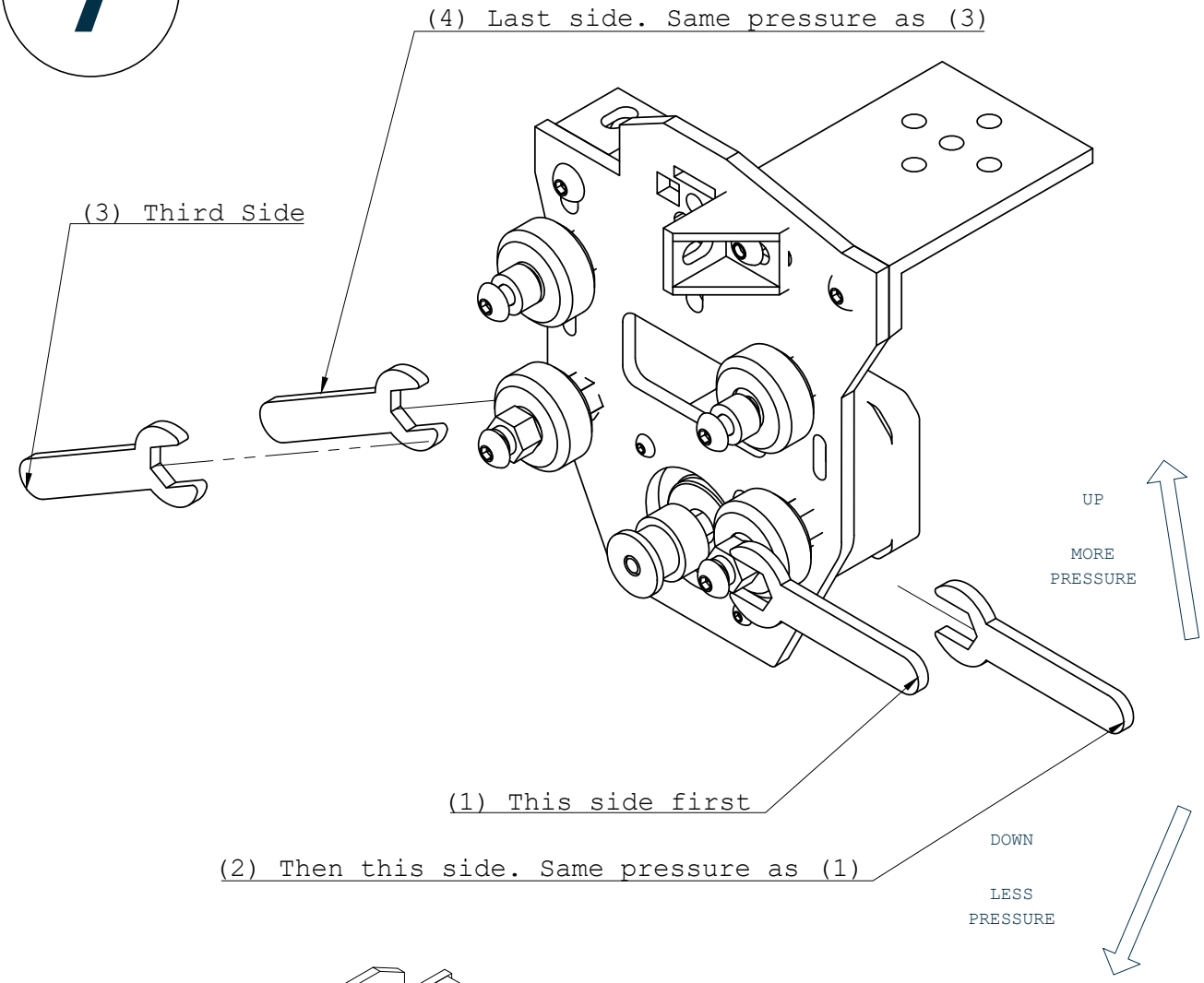
Y1 IS THE SAME AS Y2 JUST OPPOSITE PART INSTALLATION

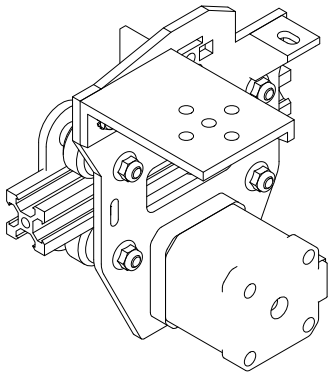
Y1 NEMA CONNECTOR POINTING LEFT



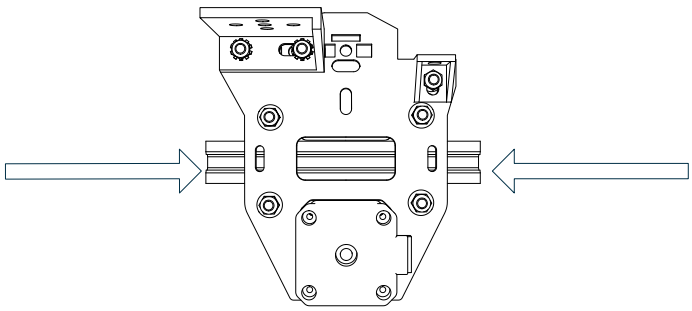
6

7

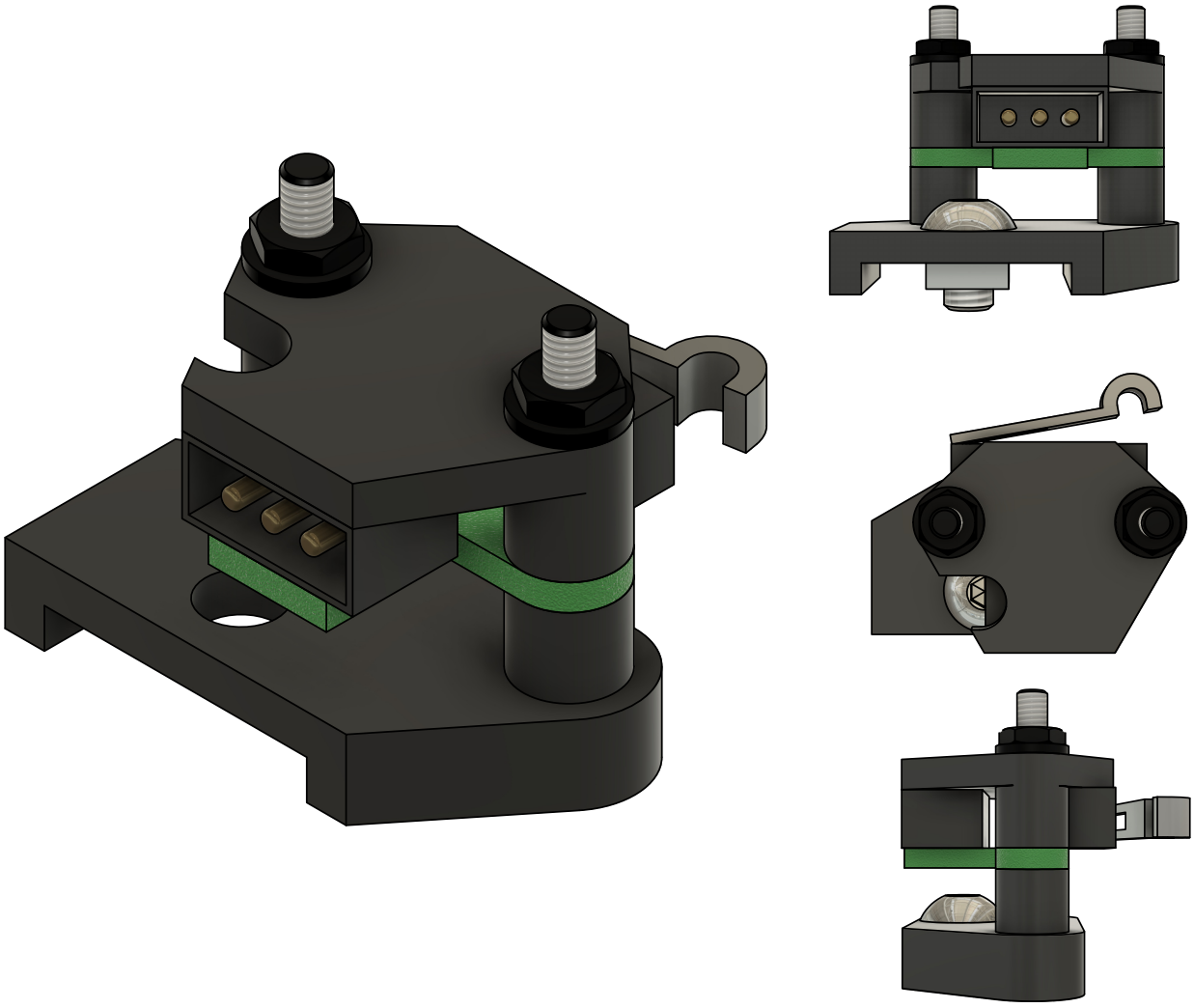




USE A 2020 EXTRUSION TO CALIBRATE THE WHEEL PRESSURE. USE DIAGRAM TO LOOSEN (DOWN) OR TIGHTEN (UP) THE WHEELS. THE GANTRY SHOULD MOVE BACK AND FORTH EASILY BUT SOLID. CALIBRATE BOTH (Y1 AND Y2) GANTRIES



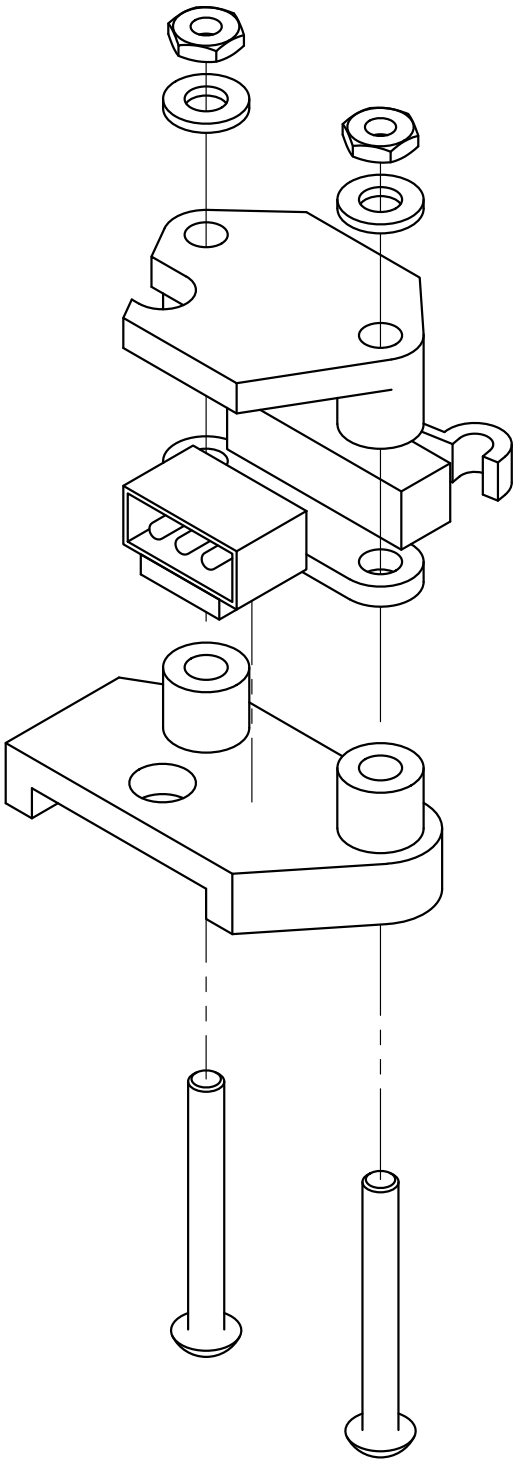
Assembling the Limit Switches



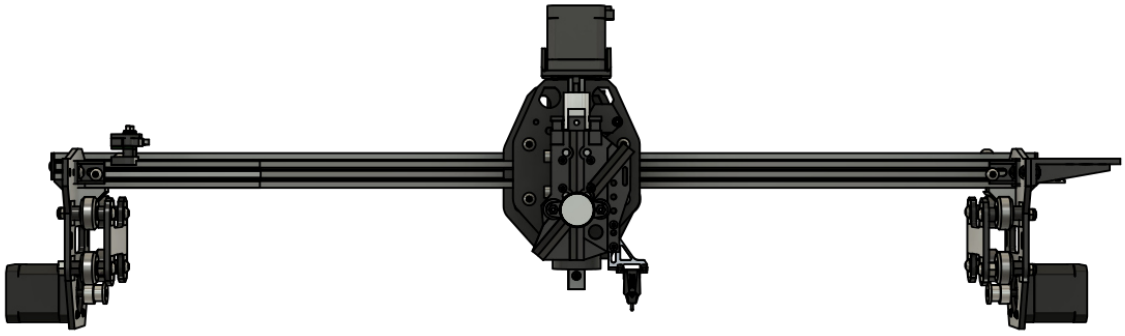
1

YOU WILL NEED 2 OF THESE

QTY	PART
1	R. REIFENG Limit Switch
1	Bottom Limit Switch Bracket 0013
1	Top Limit Switch Bracket 0014
2	M3 x 25mm Hex Socket Button Head Bolts
2	M3 Washers
2	M3 Nuts

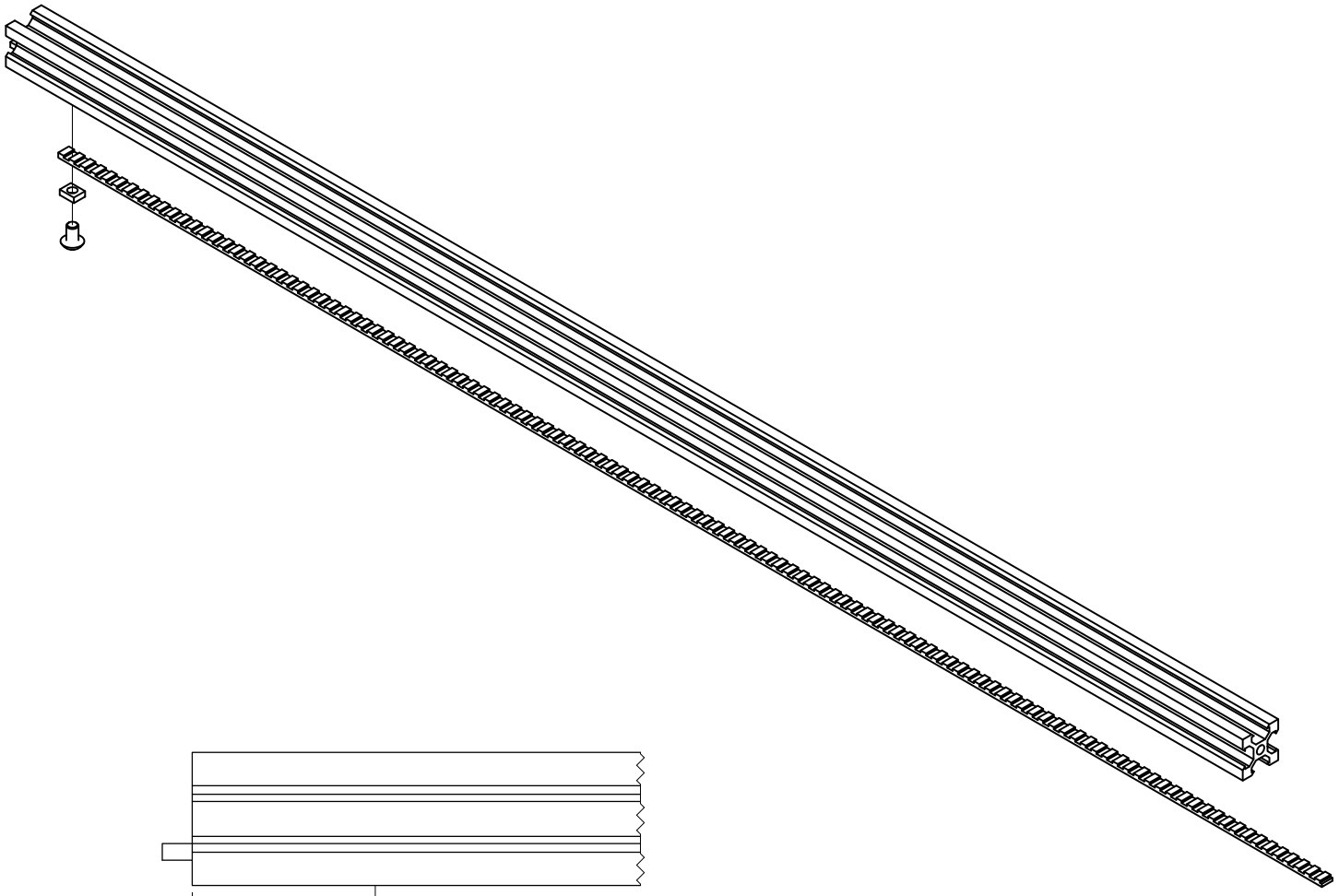


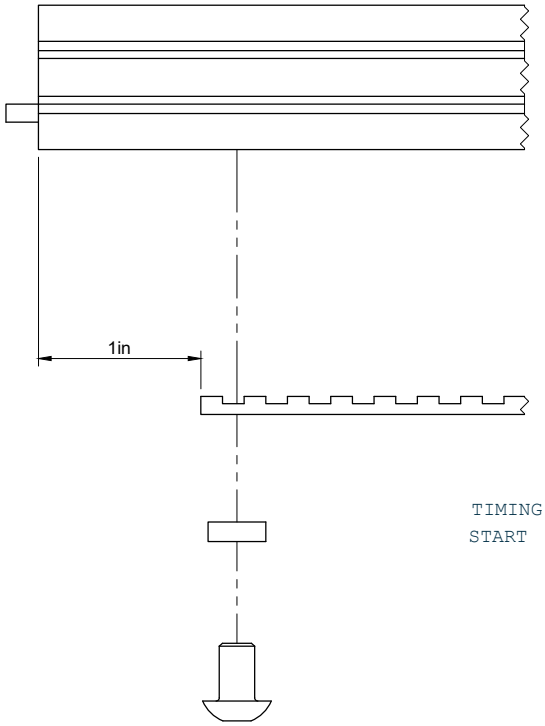
Assembling the Drawing Carriage



QTY	PART
1	2020 X Axis Extrusion
1	X Axis GT2 Belt 6mm Wide
1	GT2 Slide Holding Nut
1	M5 x 8mm Hex Socket Button Head Bolts

1



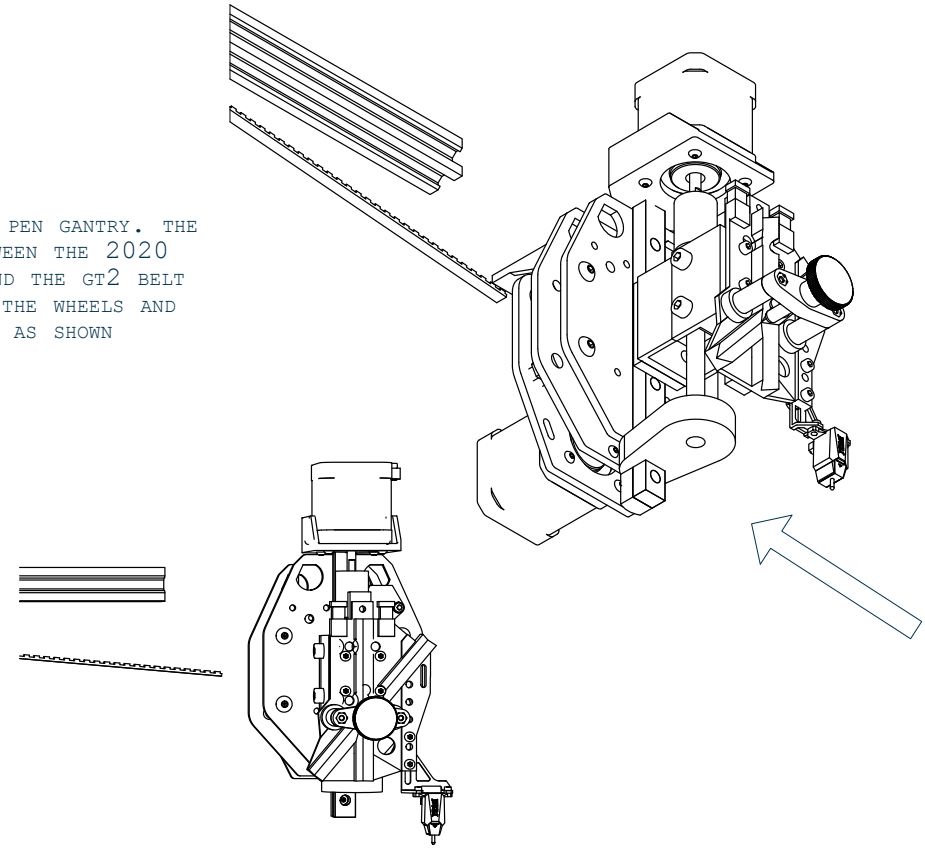


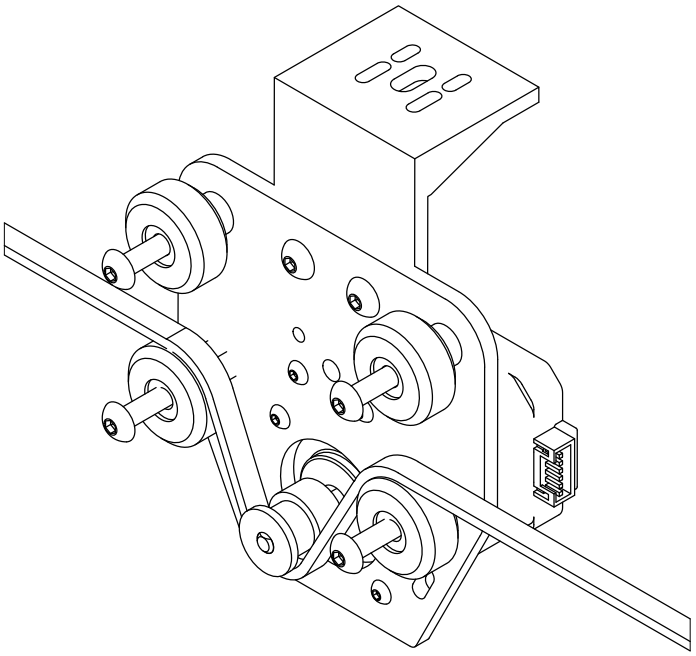
TIMING BELT SHOULD START 1IN FROM THE SIDE

QTY	PART
1	XZ Pen Ganrty

2

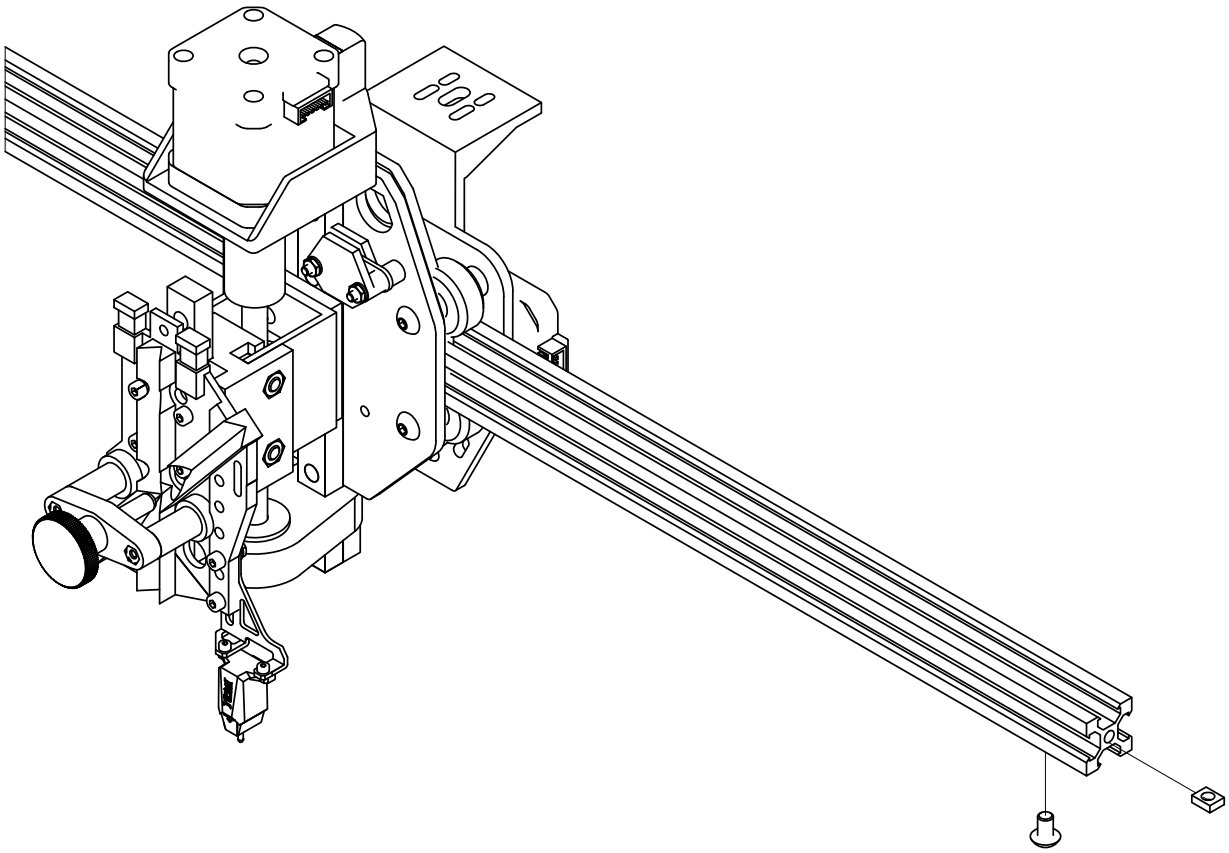
SLIDE THE XZ PEN GANTRY. THE WHEELS BETWEEN THE 2020 EXTRUSION AND THE GT2 BELT IN BETWEEN THE WHEELS AND PULLEY AS SHOWN



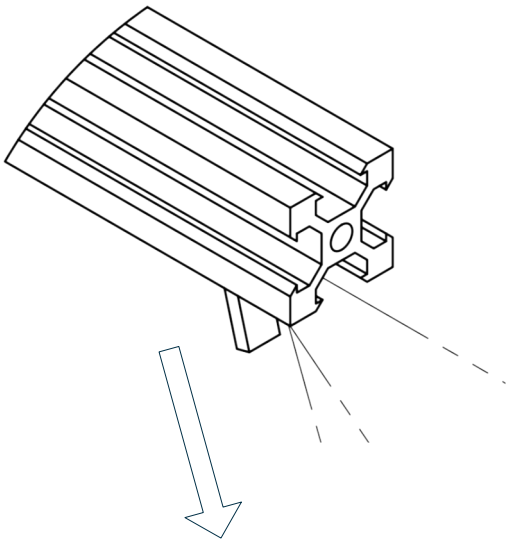


QTY	PART
1	GT2 Slide Holding Nut
1	M5 x 8mm Hex Socket Button Head Bolts

3

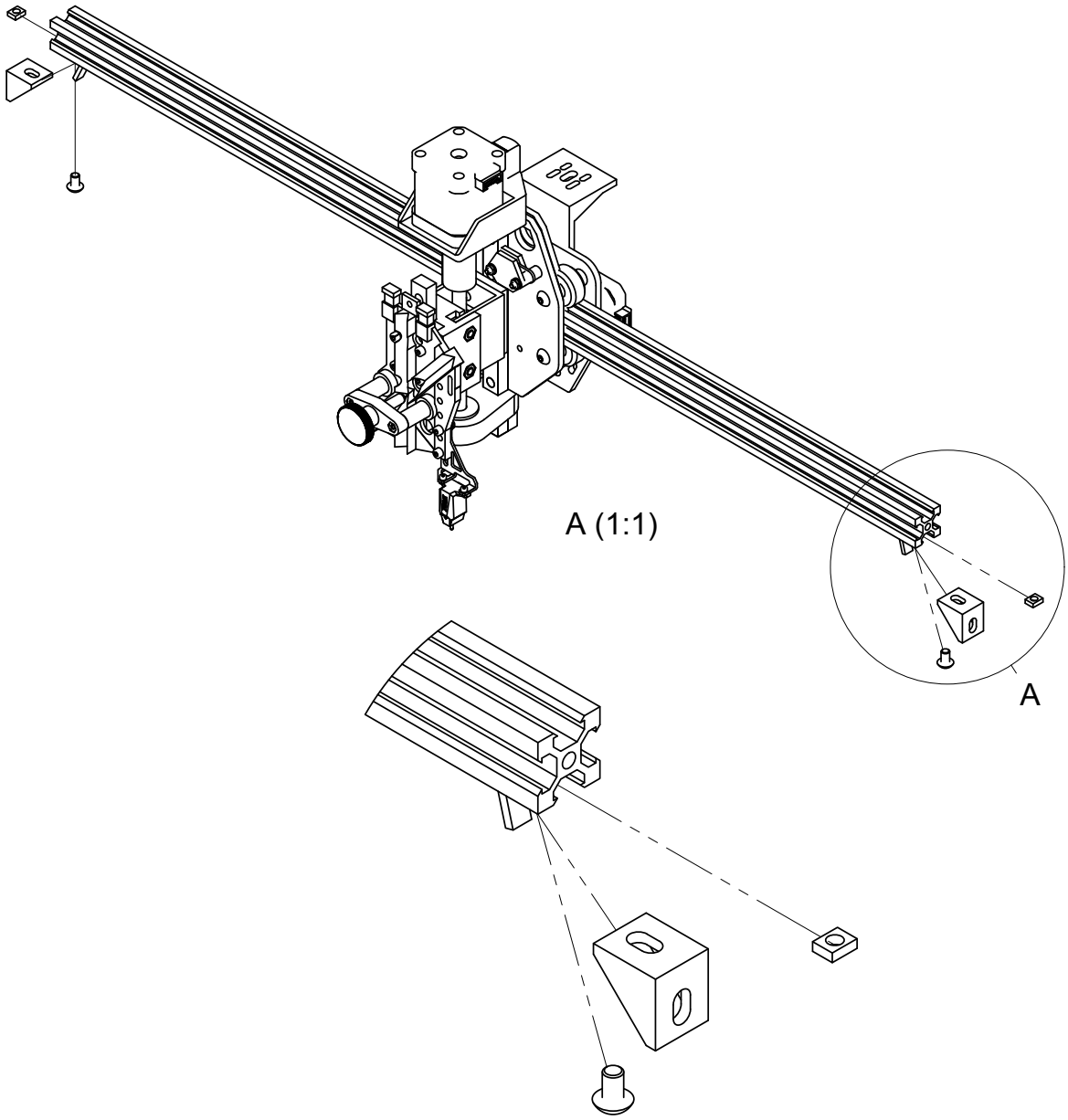


IMPORTANT PULL THE TIMING BELT WITH PLIERS AS YOU TIGHTEN THE SUPPORT BOLD



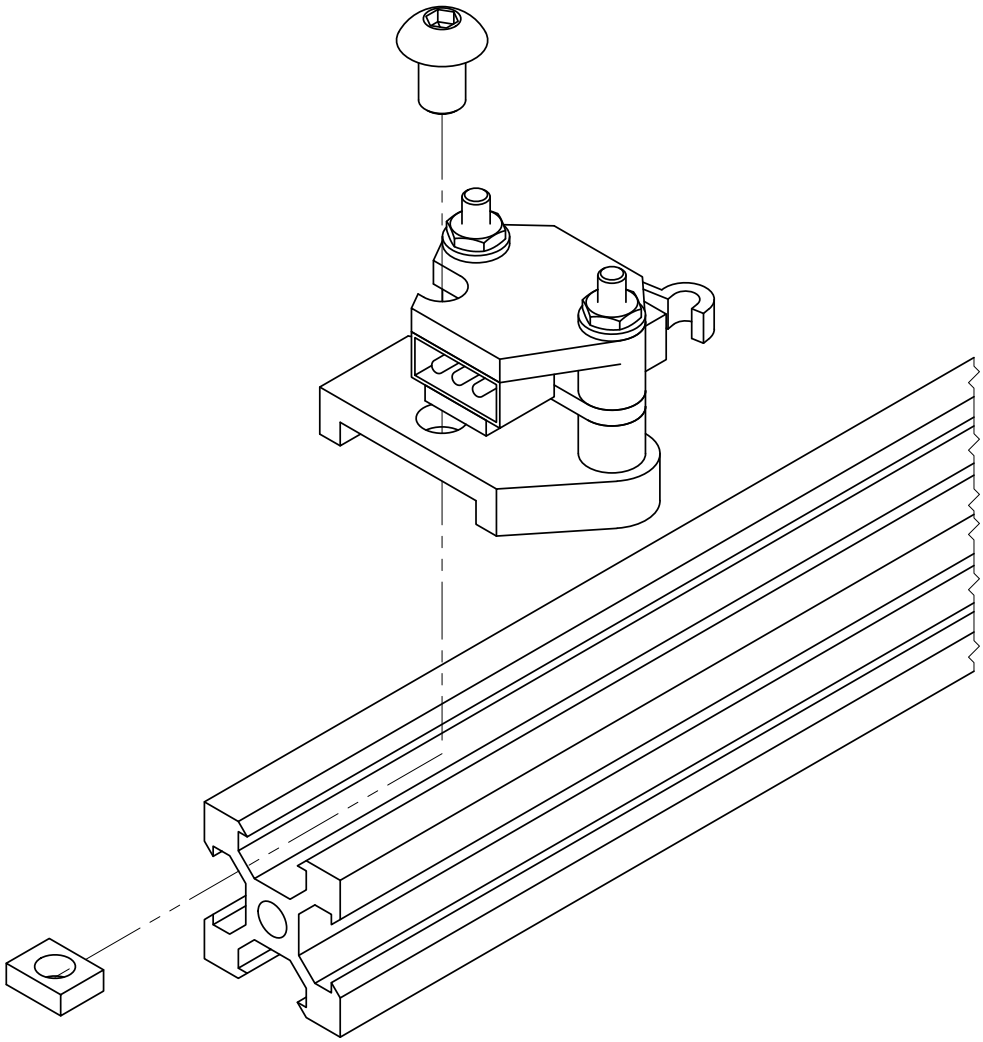
QTY	PART
2	L Bracket
2	Slide Holding Nut
2	M5 x 8mm Hex Socket Button Head Bolts

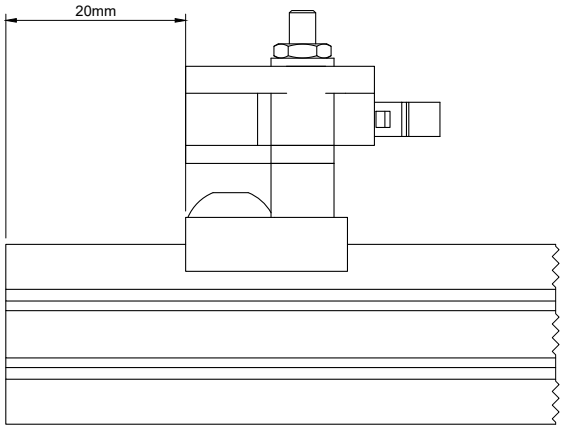
4



QTY	PART
1	Limit Switch Assembly
1	Slide Holding Nut
1	M5 x 8mm Hex Socket Button Head Bolts

5

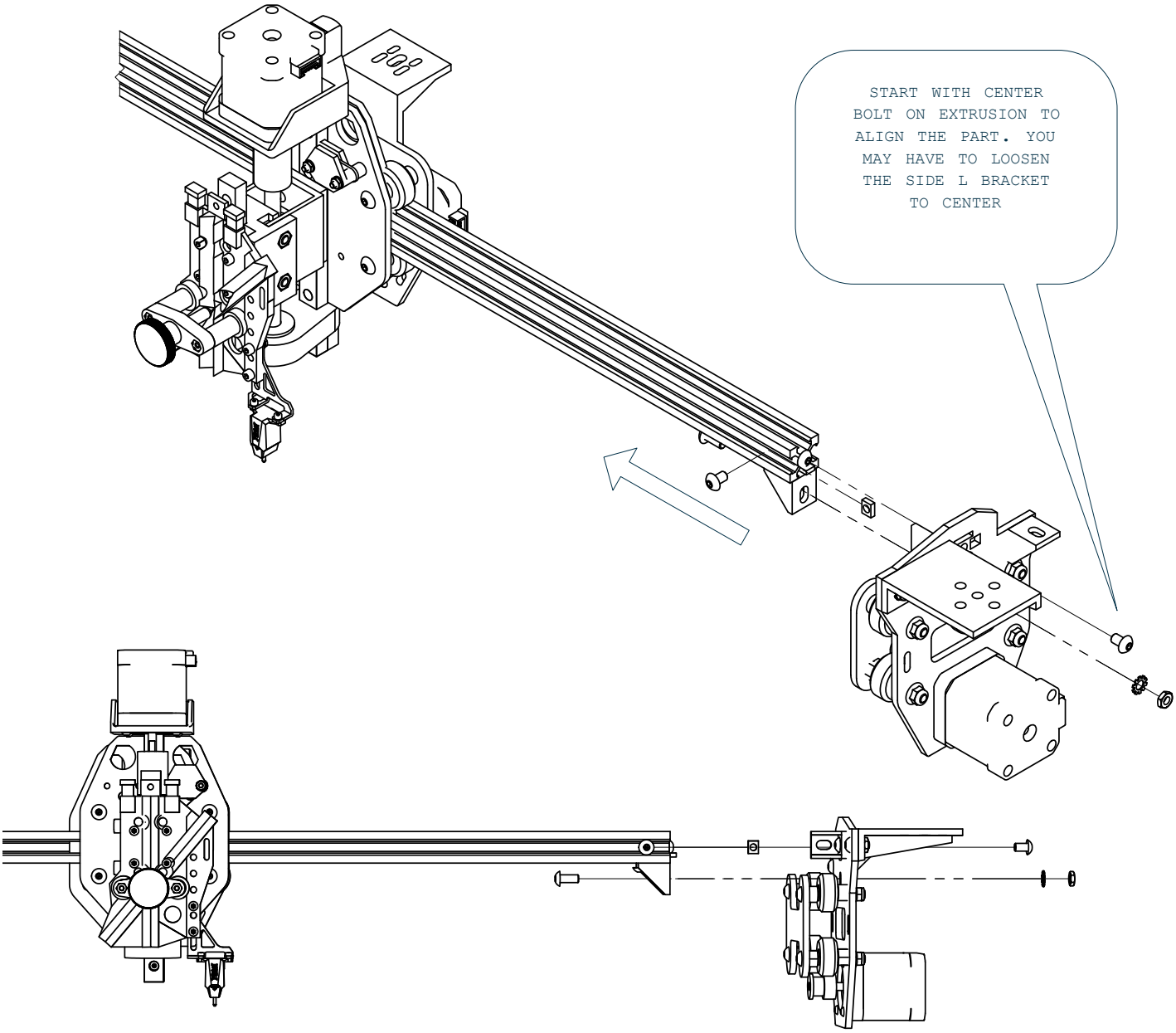




INSTALL LIMIT SWITCH ON THE LEFT SIDE (Y1 SIDE) 20MM FROM EDGE

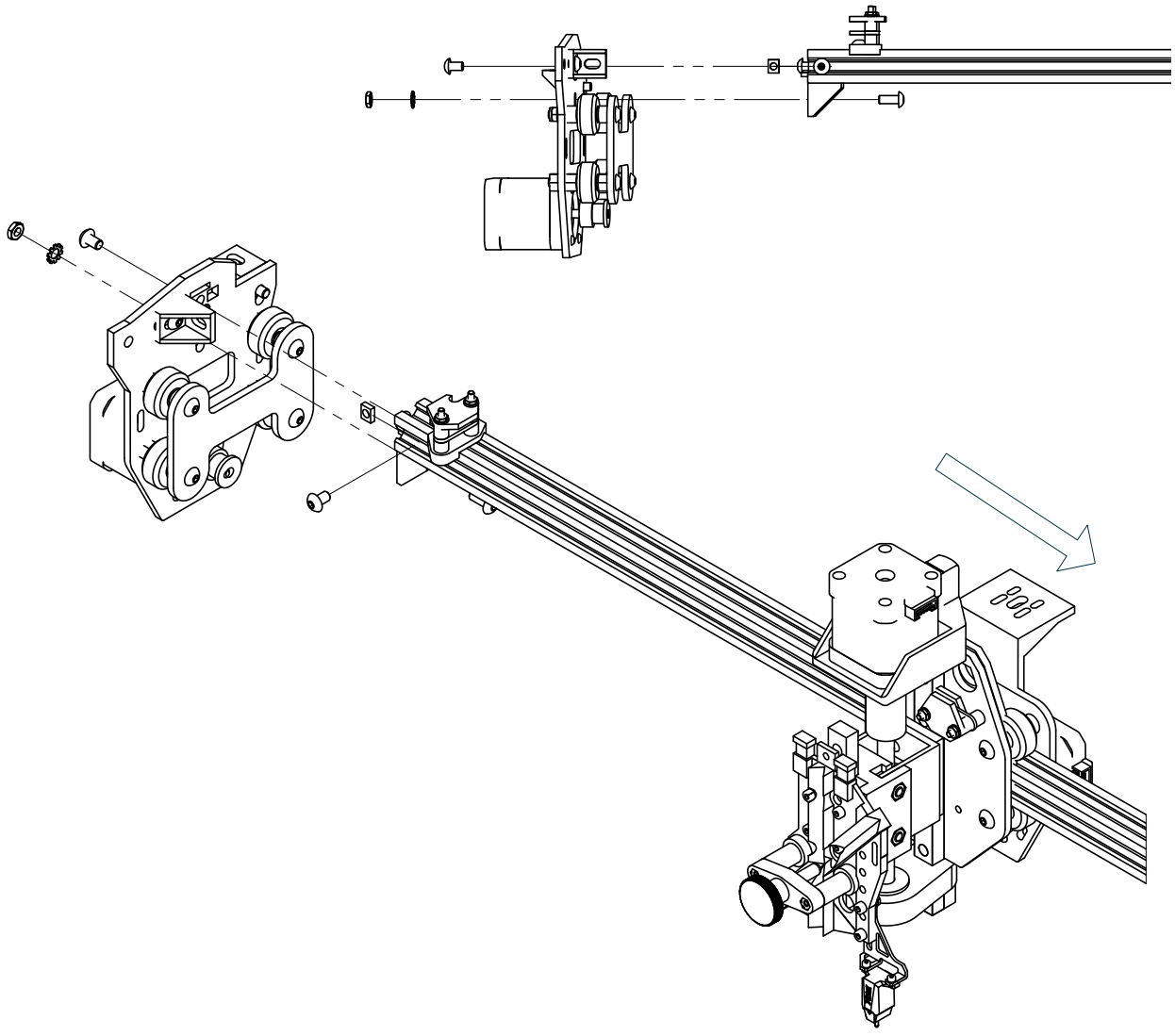
QTY	PART
1	Y2 Gantry
1	Slide Holding Nut
1	M5 x 8mm Hex Socket Button Head Bolts
1	M5 x 12mm Hex Socket Button Head Bolts
1	M5 x 8mm Self Tapping Bolt
1	M5 Locking Washer
1	M5 Nut

6



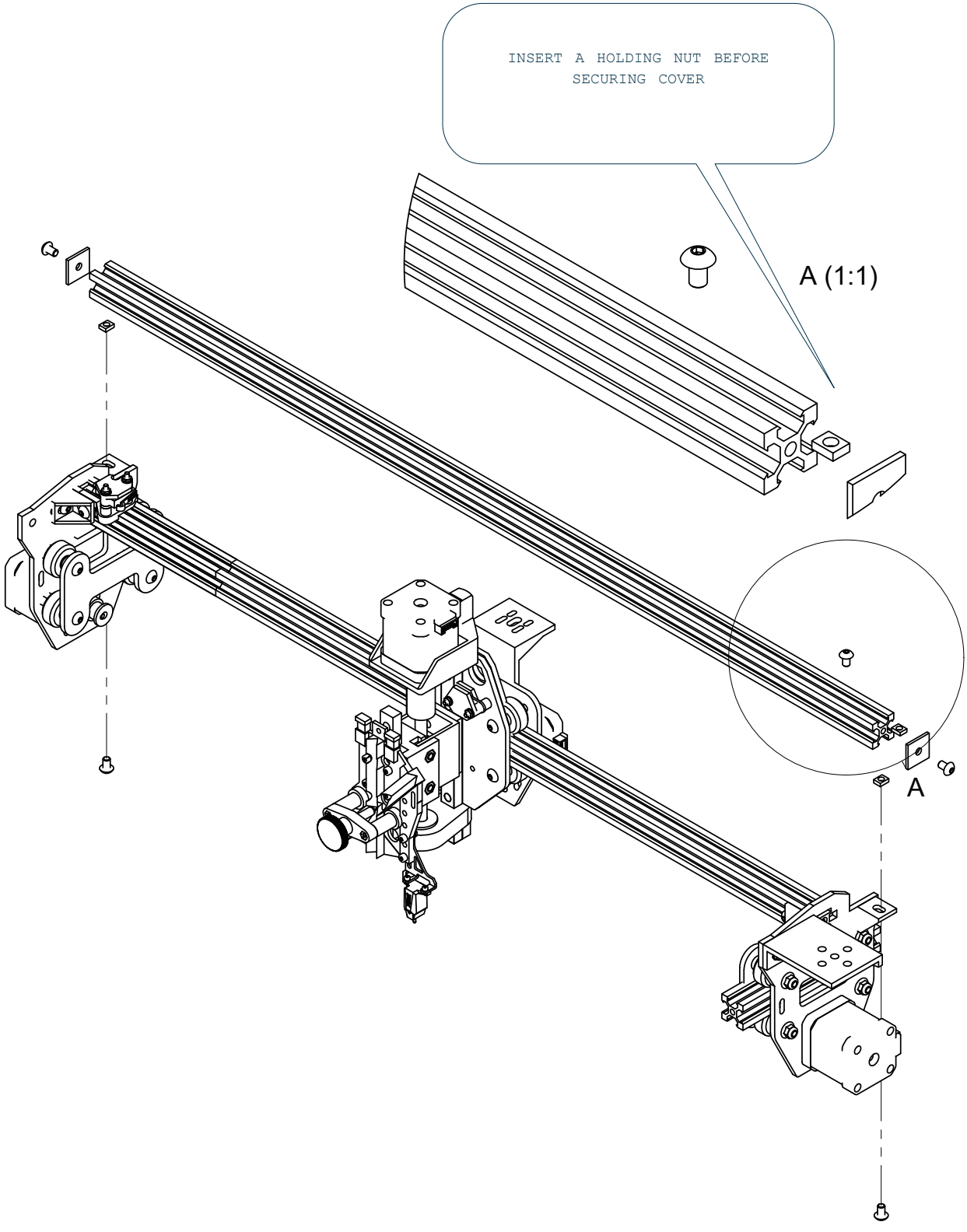
QTY	PART
1	Y1 Gantry
1	Slide Holding Nut
1	M5 x 8mm Hex Socket Button Head Bolts
1	M5 x 12mm Hex Socket Button Head Bolts
1	M5 x 8mm Self Tapping Bolt
1	M5 Locking Washer
1	M5 Nut

7



QTY	PART
1	Y Rail 2020 Extrusion
2	2020 Side Cover
3	Slide Holding Nut
2	M5 x 8mm Self Tapping Bolts
2	M5 x 8mm Hex Socket Button Head Bolts

9

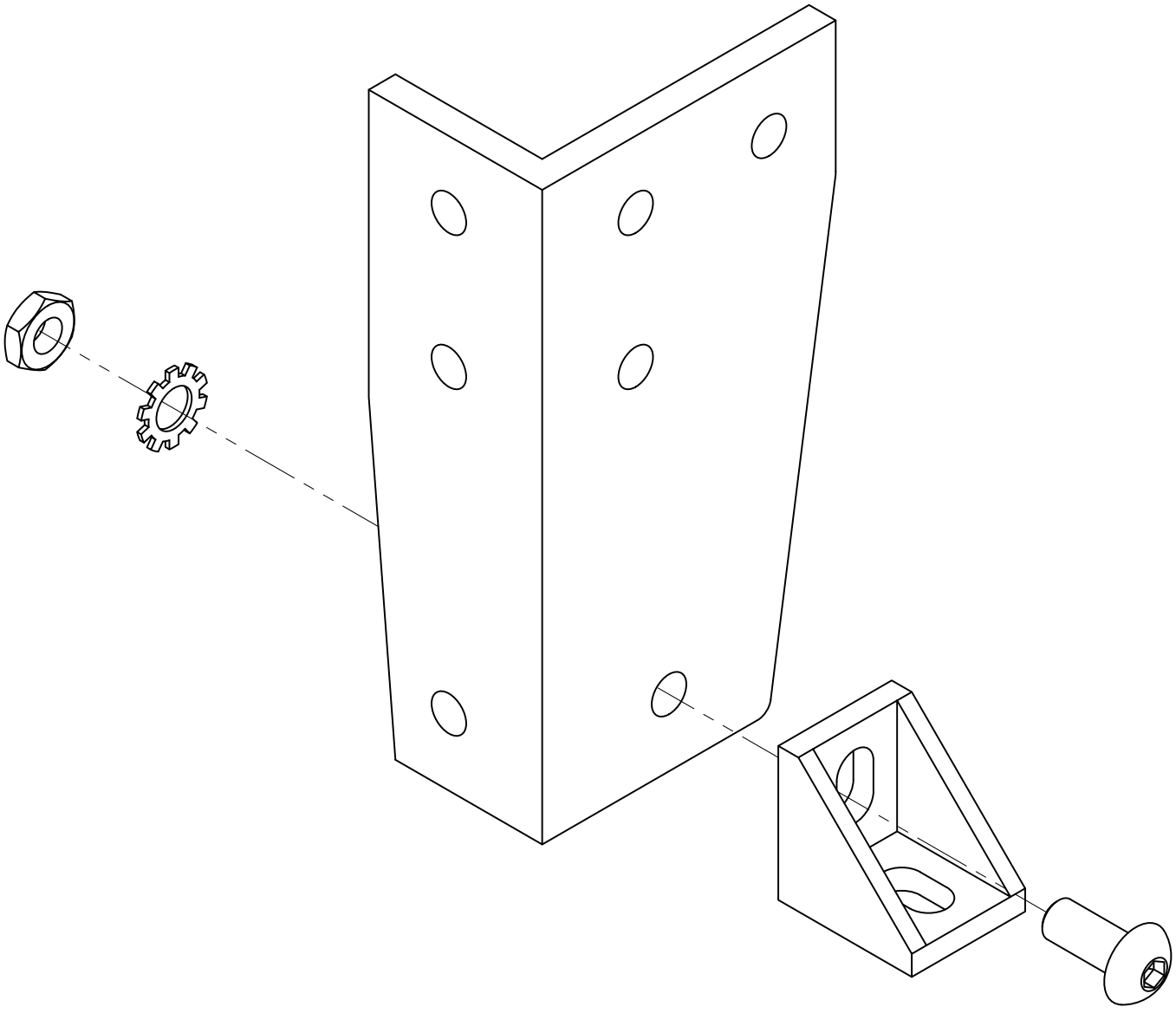


NOTES

Building the Plotter Feet

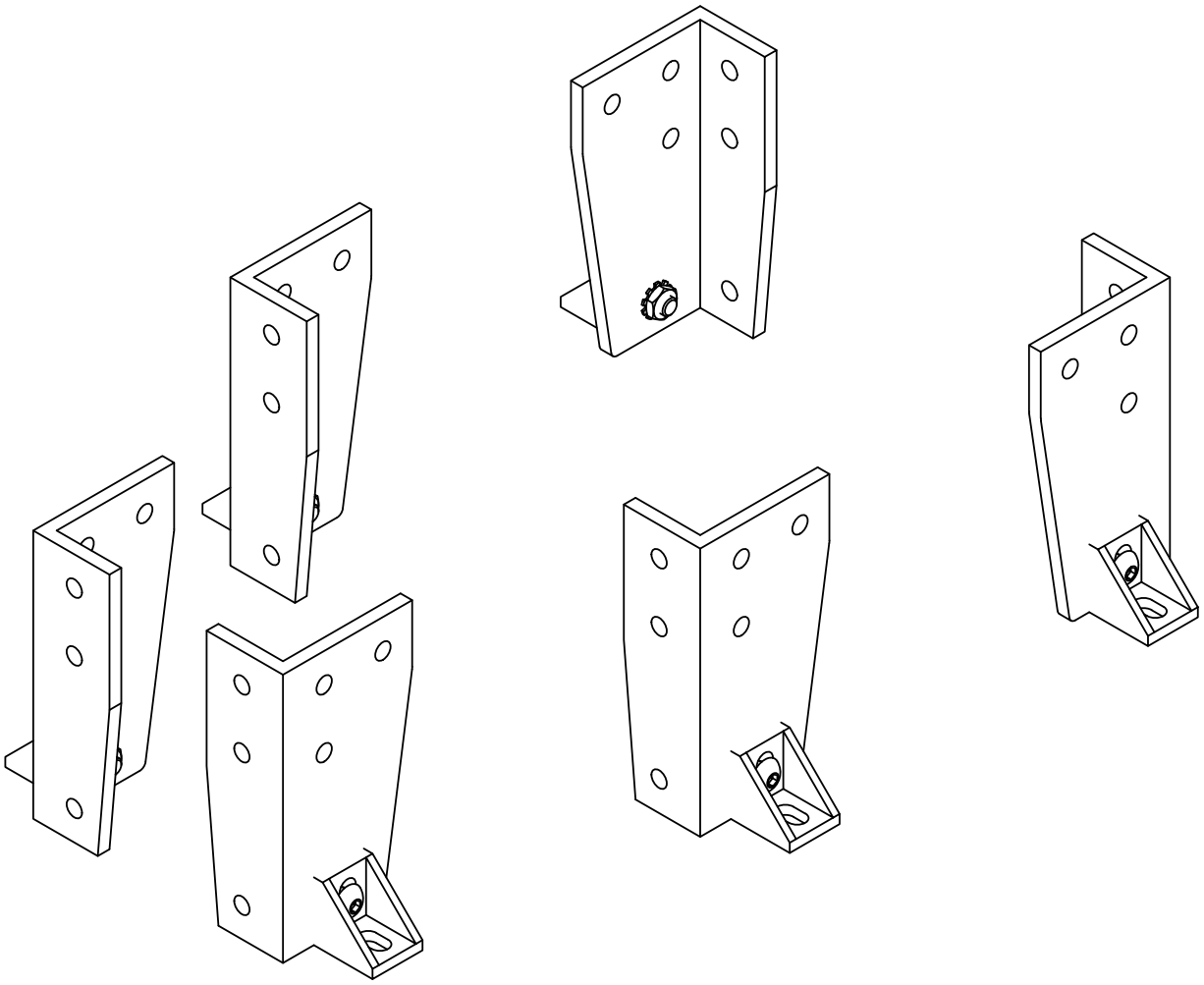
1

QTY	PART
1	M5 x 12mm Hex Socket Button Head Bolts
1	M5 Lock Nut
1	M5 Nut
1	L Bracket
1	Left (0016) or Right (0017) Foot (3 each)



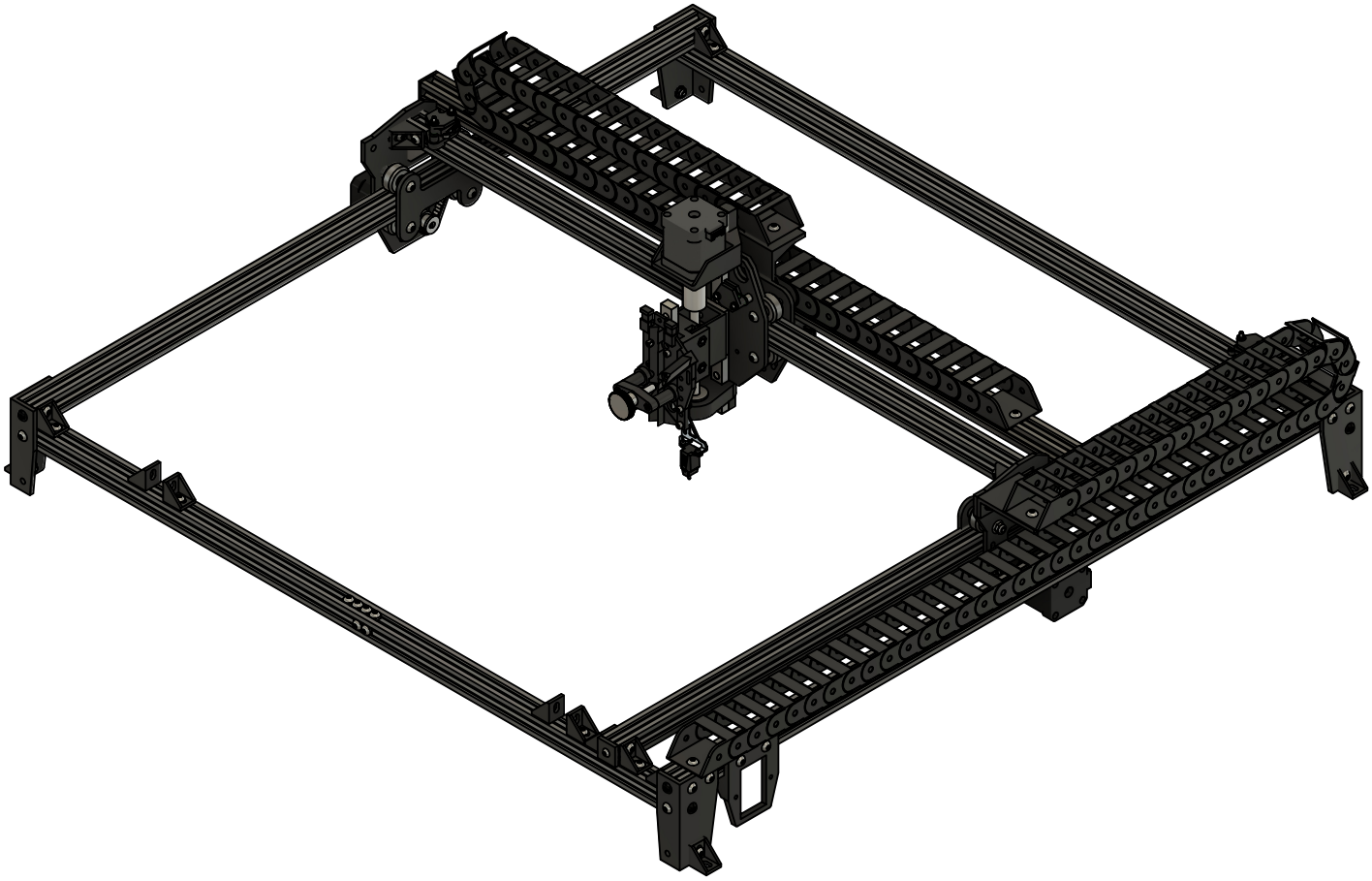
2

YOU WILL NEED 3
LEFT AND 3 RIGHT
FEET FOR THE PLOTTER



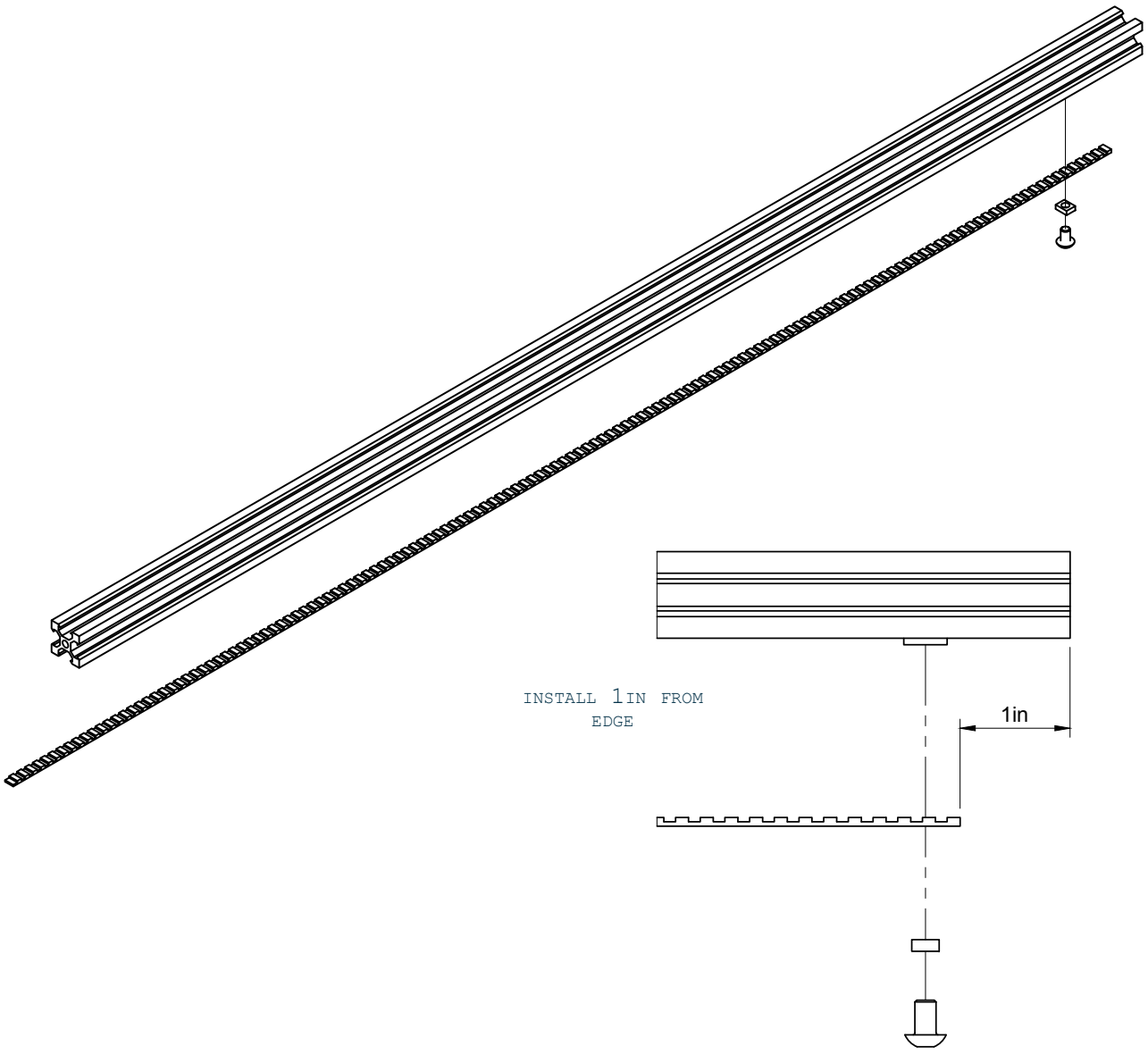
NOTES

Constructing the Main Frame



1

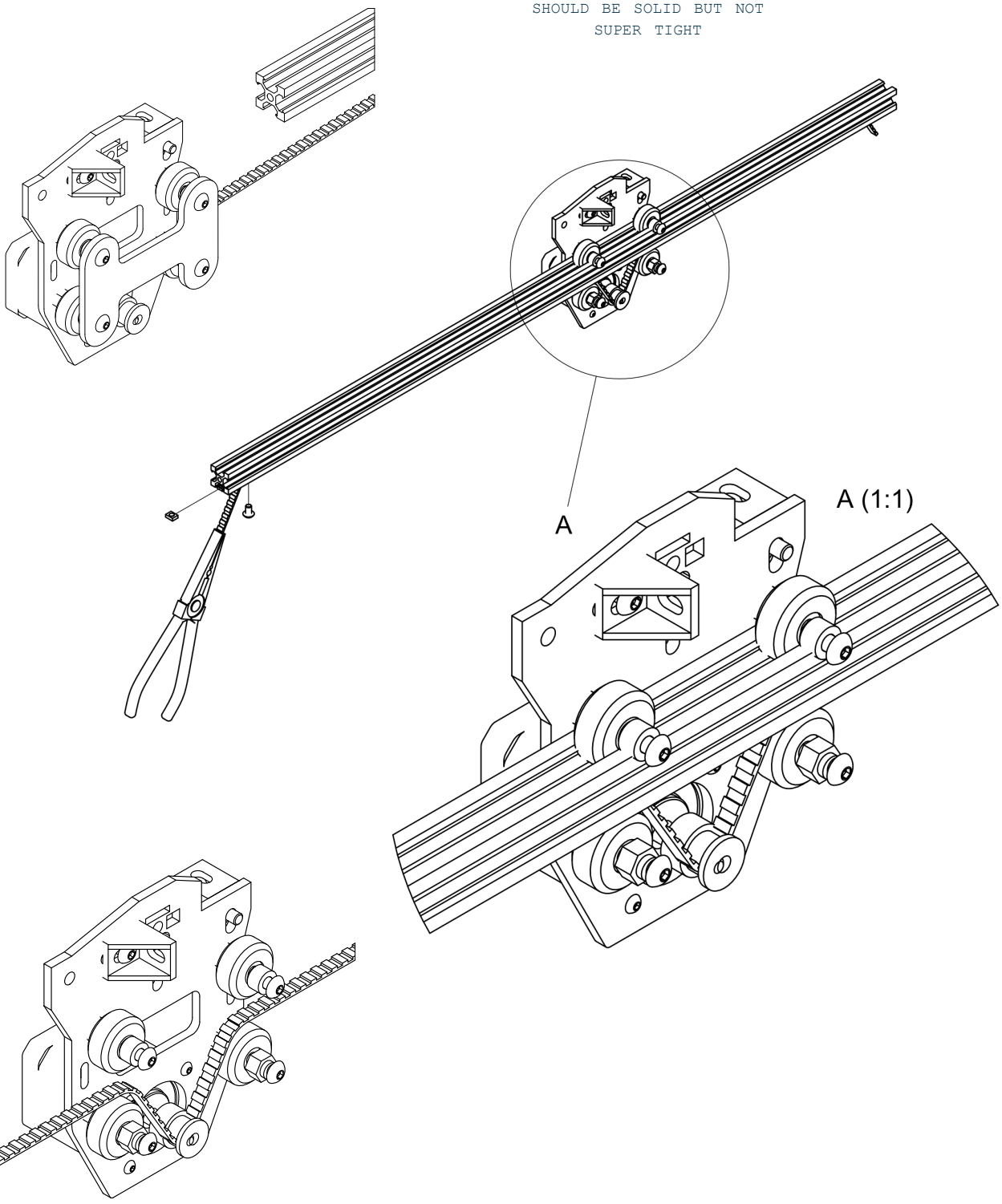
QTY	PART
1	2020 Extrusion for Y Axis
1	GT2 Timing Belt for Y Axis
1	M5 x 8mm Hex Socket Button Head Bolts
1	M5 Timing Belt Nut



QTY	PART
1	Drawing Carriage Assembly (Y1 Gantry Side)
1	M5 x 8mm Hex Socket Button Head Bolts
1	M5 Timing Belt Nut

2

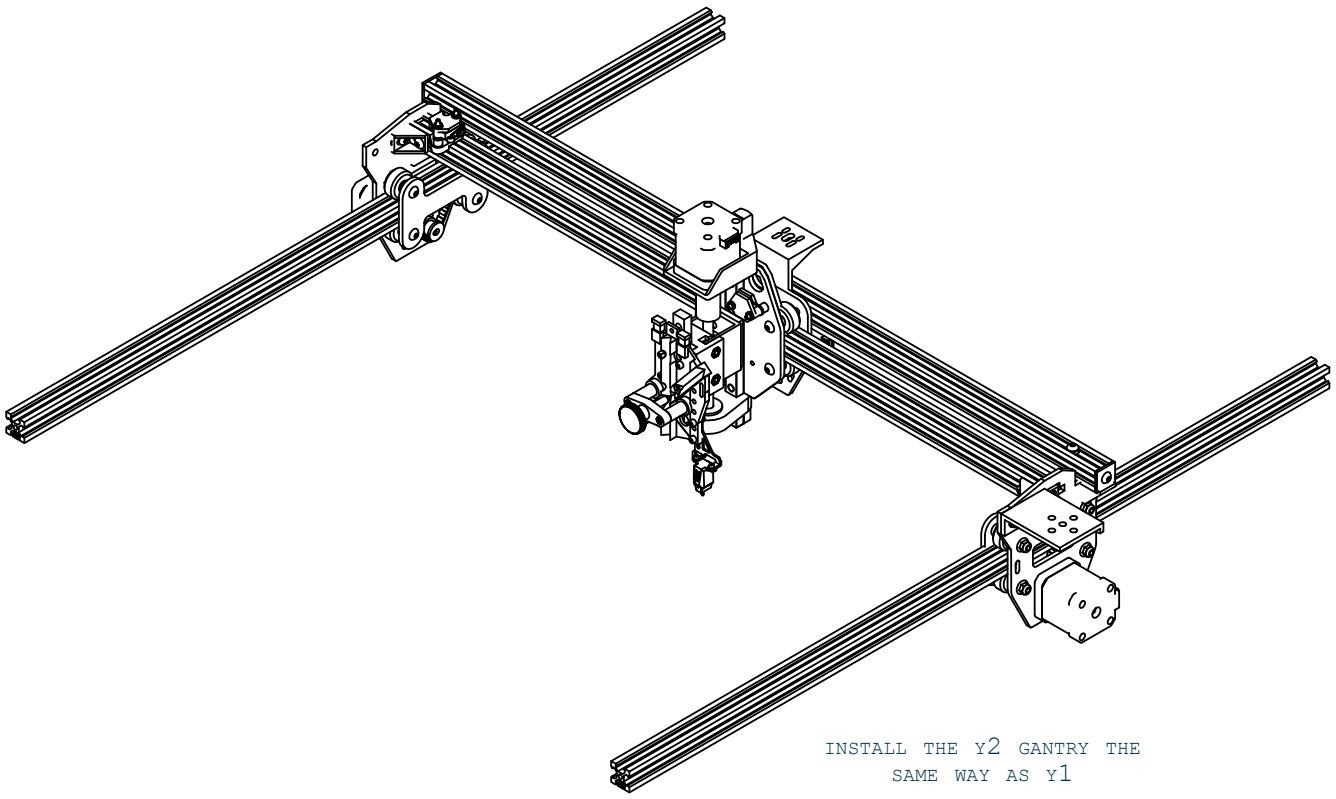
SLIDE IN GANTRY AND ROUTE THE BELT AS SHOWN. LOCK THE BELT AS YOU PULL WITH PLIERS TO TIGHTEN THE BELT. IT SHOULD BE SOLID BUT NOT SUPER TIGHT



QTY	PART
1	Drawing Carriage Assembly (Y2 Gantry Side)

QTY	PART
1	2020 Extrusion for Y Axis
1	GT2 Timing Belt for Y Axis
1	M5 x 8mm Hex Socket Button Head Bolts
1	M5 Timing Belt Nut

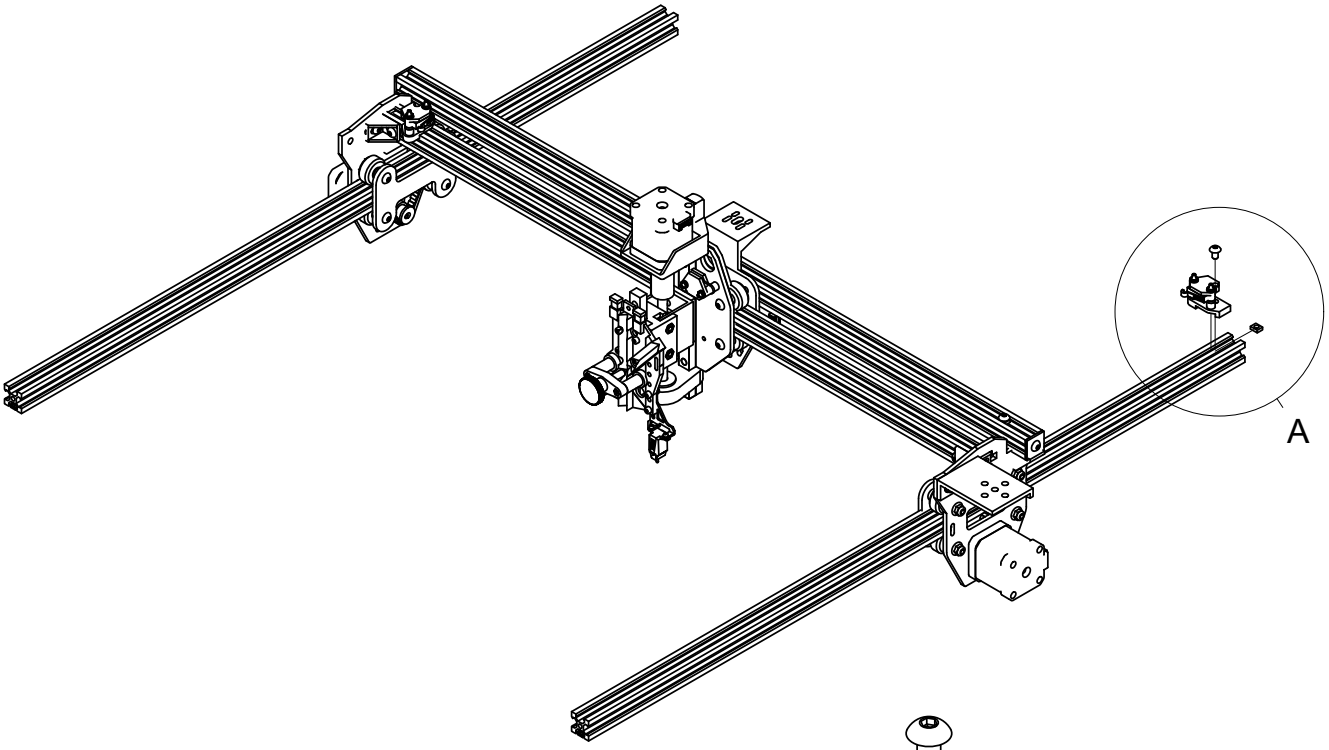
3



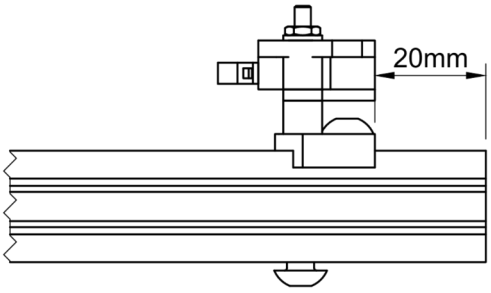
INSTALL THE Y2 GANTRY THE SAME WAY AS Y1

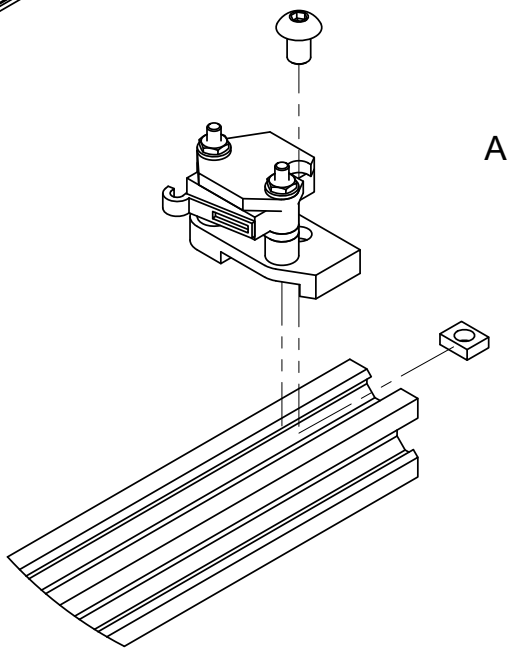
QTY	PART
1	Limit Switch Assembly
1	M5 x 8mm Hex Socket Button Head Bolts
1	M5 Sliding Nut

4



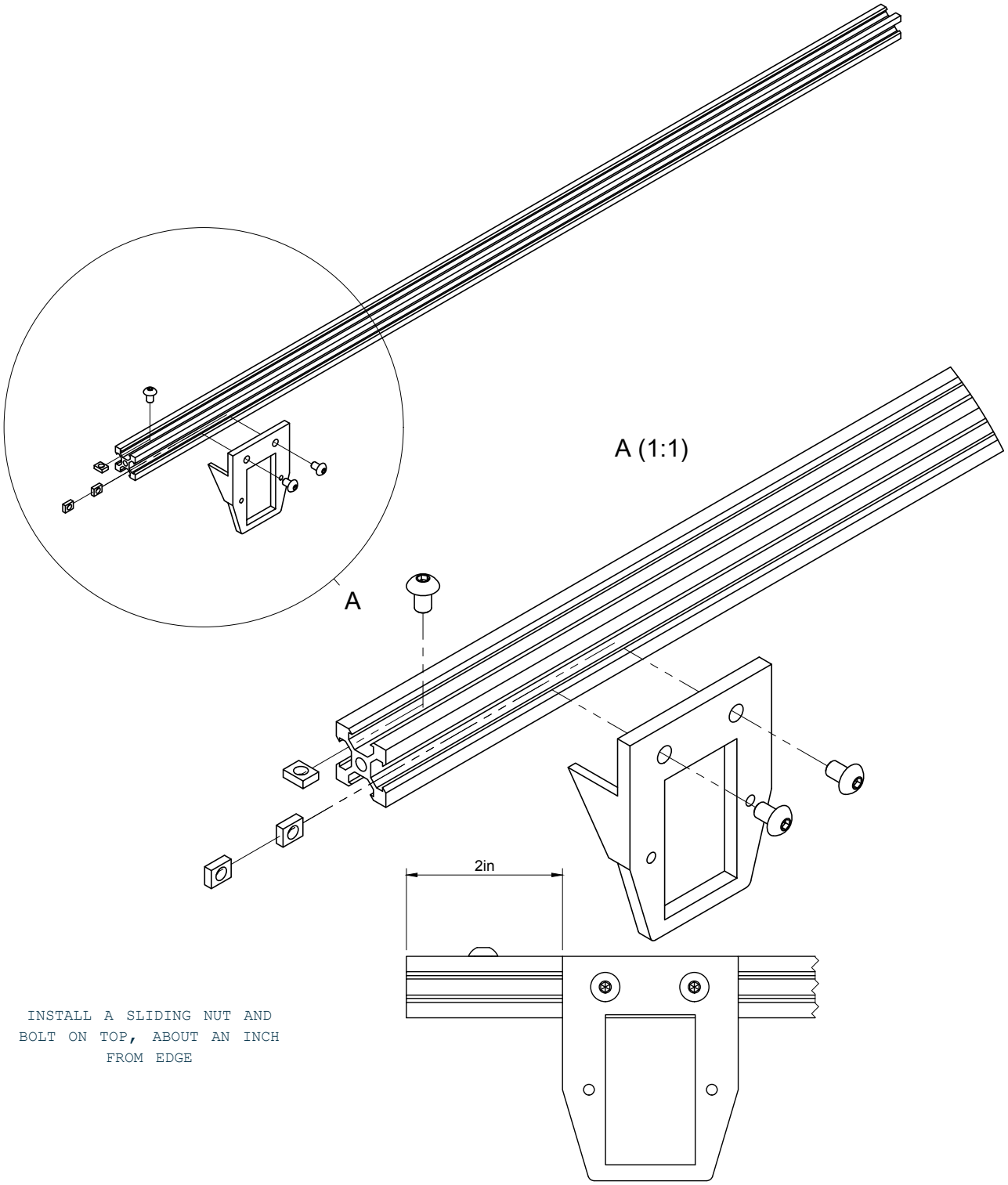
INSTALL THE LIMIT SWITCH AT Y2 (RIGHT) SIDE. 20MM FROM EDGE





QTY	PART
1	AC-01A Power Bracket 0018
1	2020 Extrusion for Y Axis
3	M5 x 8mm Hex Socket Button Head Bolts
3	M5 Sliding Nut

5

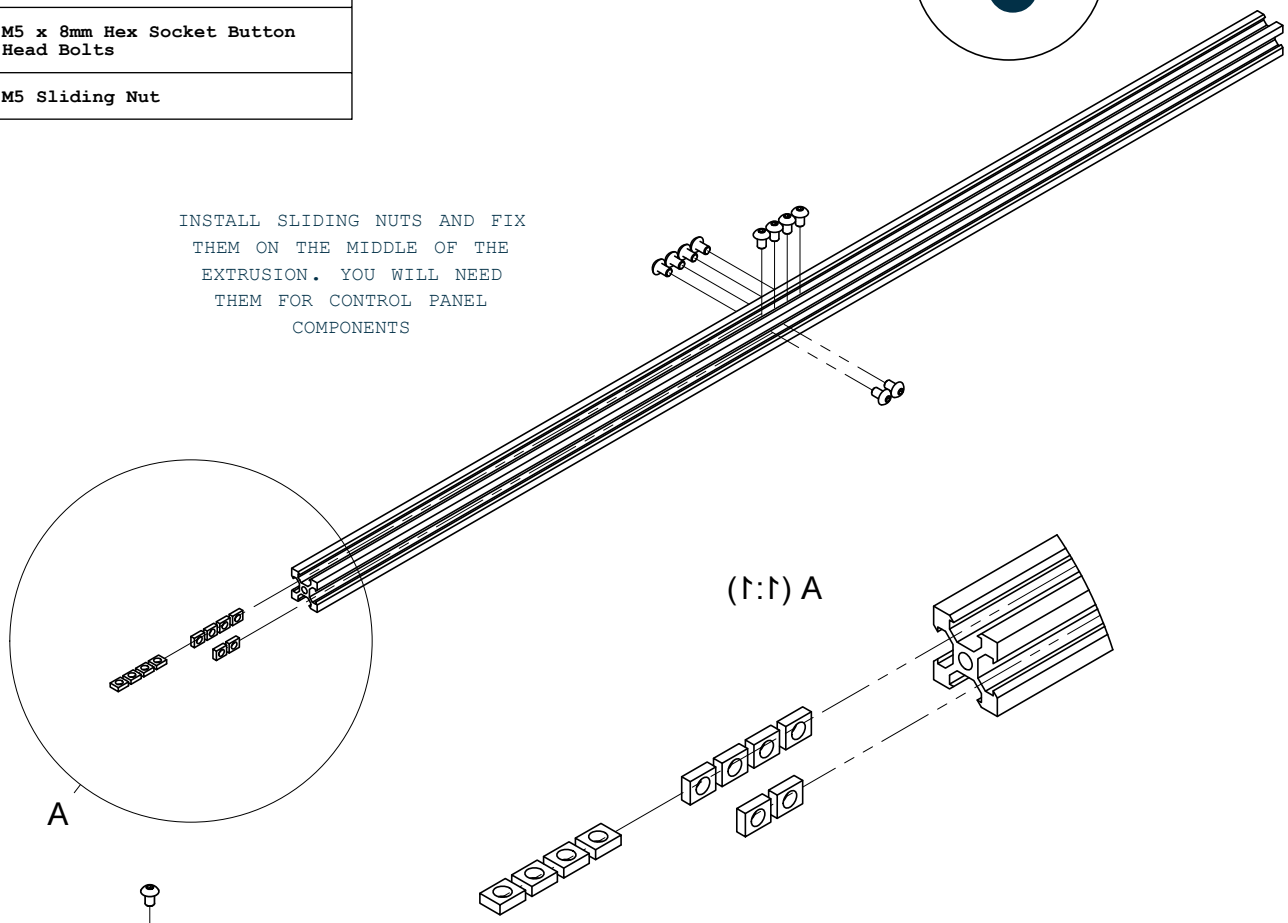


INSTALL A SLIDING NUT AND BOLT ON TOP, ABOUT AN INCH FROM EDGE

QTY	PART
1	2020 Extrusion for Y Axis
8	L Brackets
18	M5 x 8mm Hex Socket Button Head Bolts
18	M5 Sliding Nut

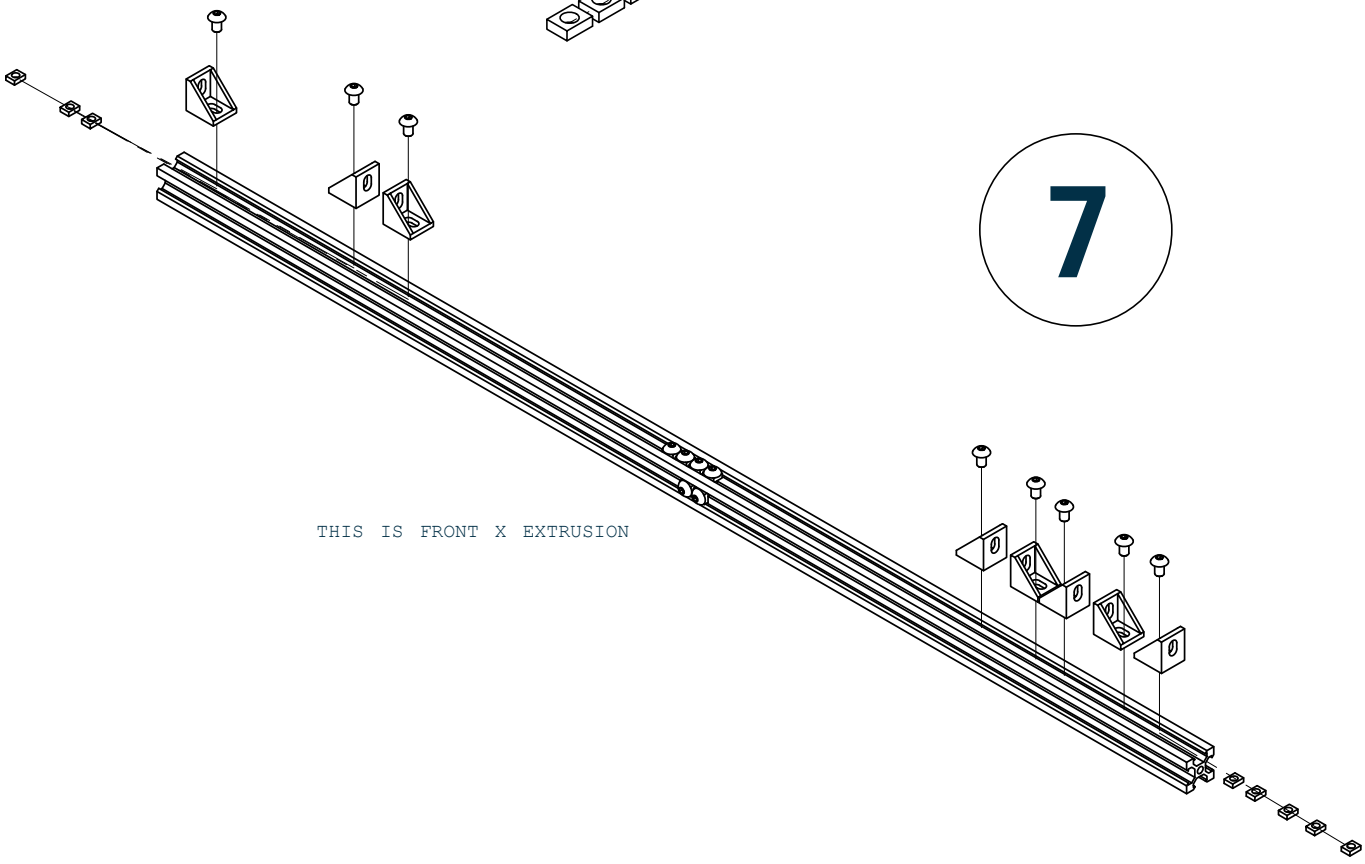
6

INSTALL SLIDING NUTS AND FIX THEM ON THE MIDDLE OF THE EXTRUSION. YOU WILL NEED THEM FOR CONTROL PANEL COMPONENTS



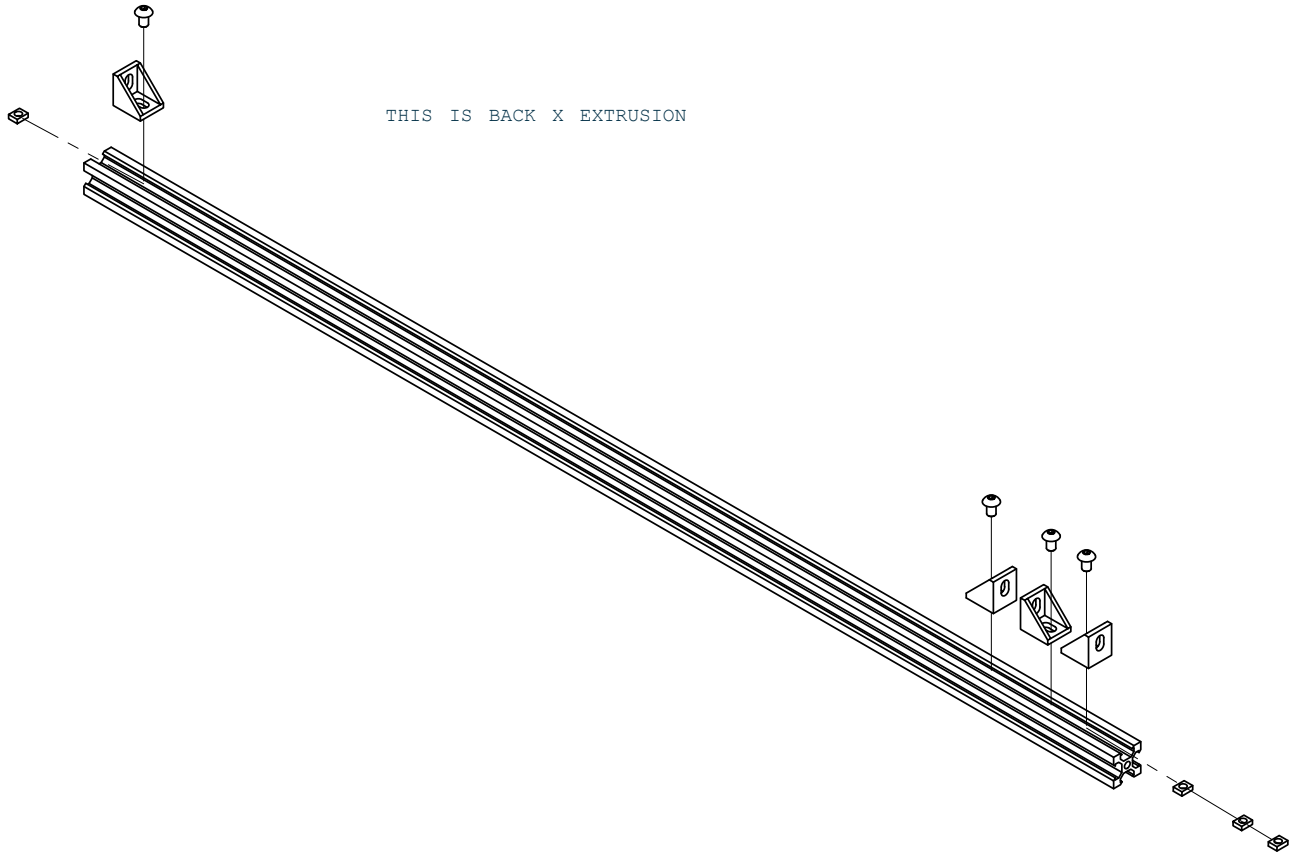
7

THIS IS FRONT X EXTRUSION



QTY	PART
1	2020 Extrusion for Y Rail Axis
4	L Brackets
4	M5 x 8mm Hex Socket Button Head Bolts
4	M5 Sliding Nut

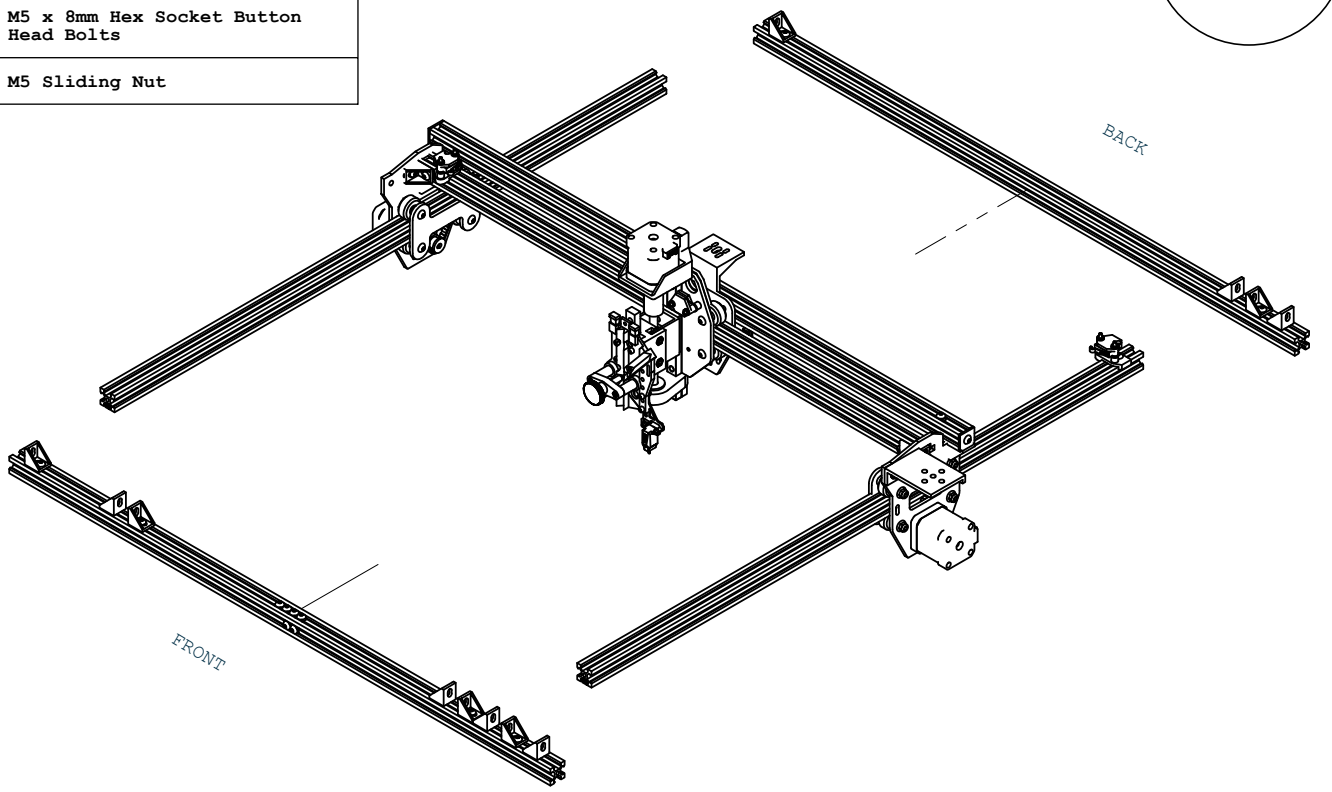
8



QTY	PART
1	Front Rigged Extrusion
1	Back Rigged Extrusion
3	M5 x 8mm Hex Socket Button Head Bolts
3	M5 Sliding Nut

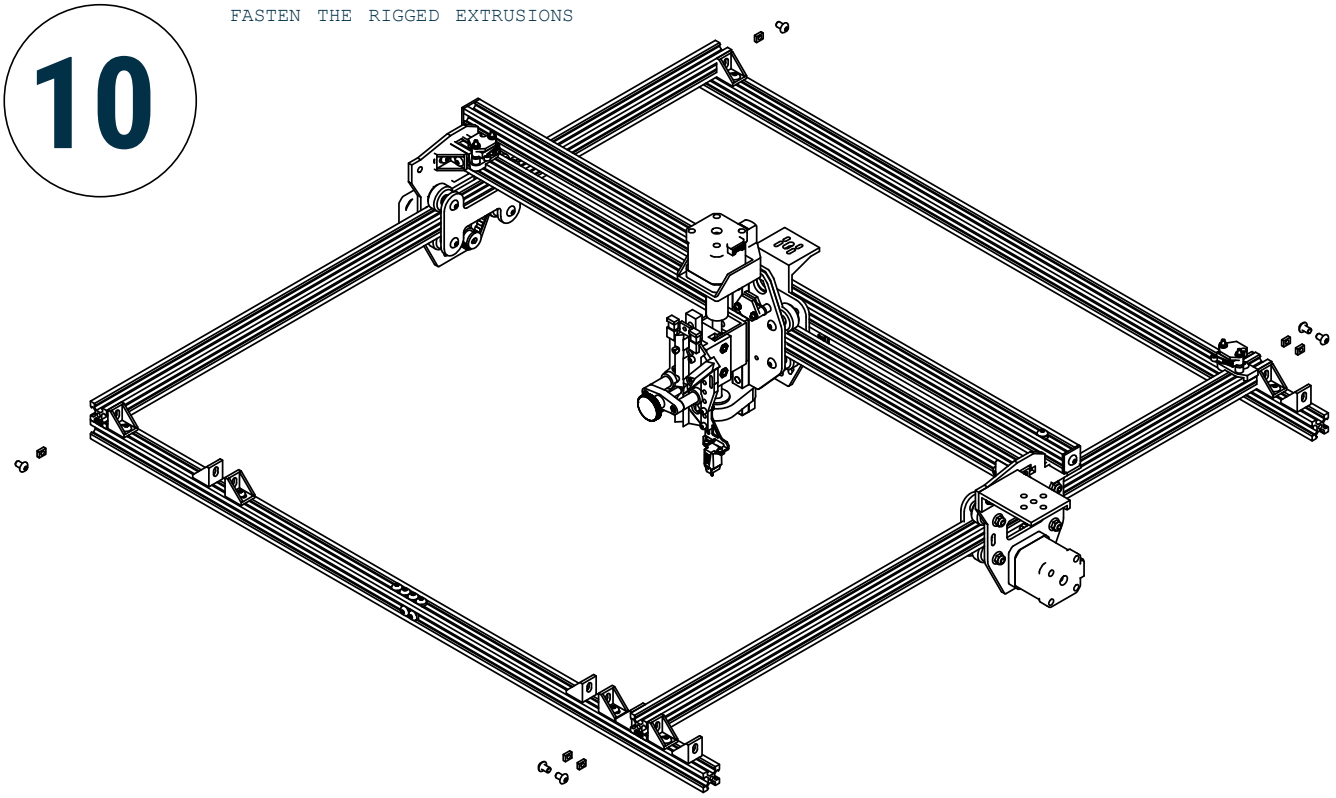
9

POSITION FRONT AND BACK X EXTRUSIONS



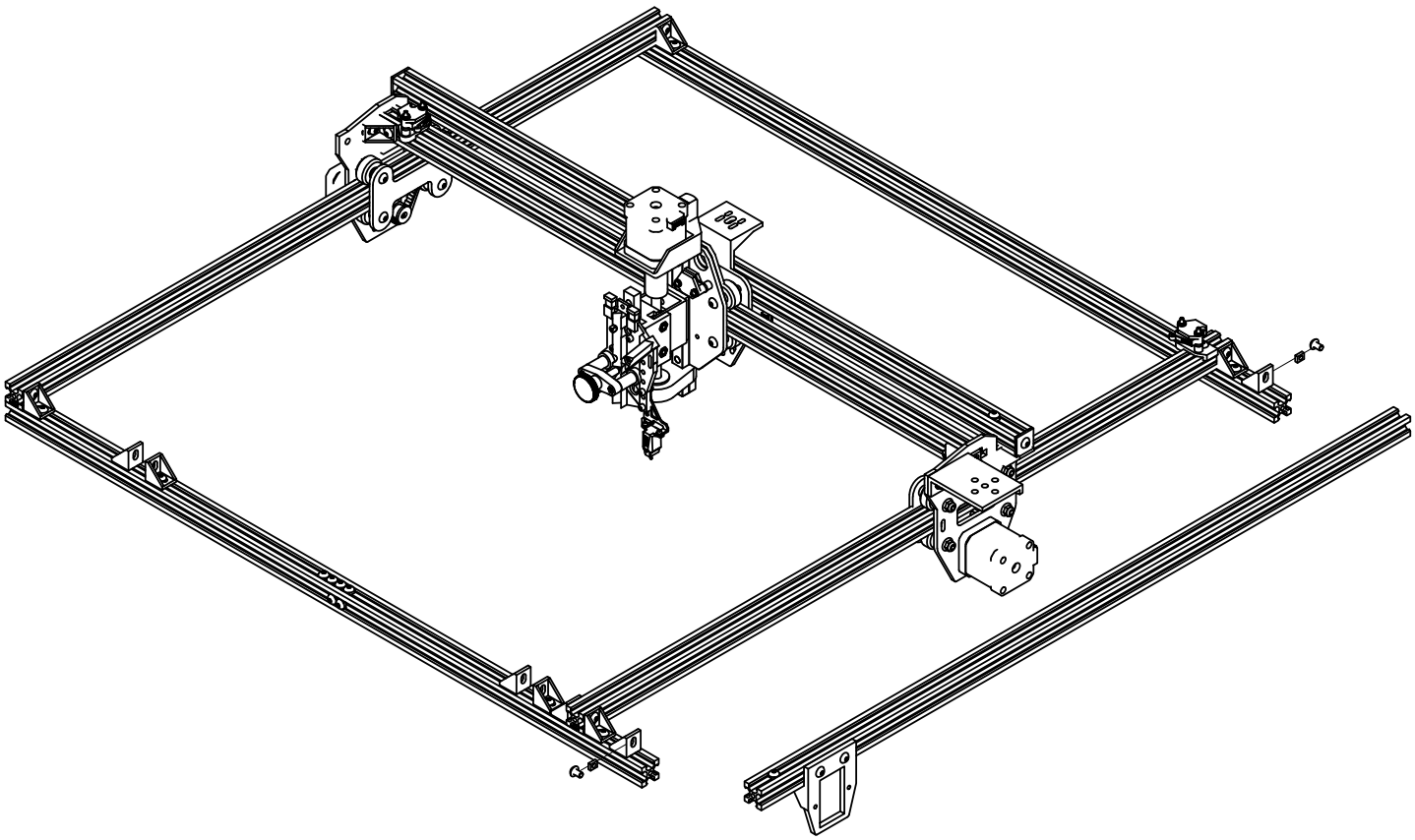
10

FASTEN THE RIGGED EXTRUSIONS



QTY	PART
1	2020 Rigged Extrusion for Y Rail Axis
2	M5 x 8mm Hex Socket Button Head Bolts
2	M5 Sliding Nut

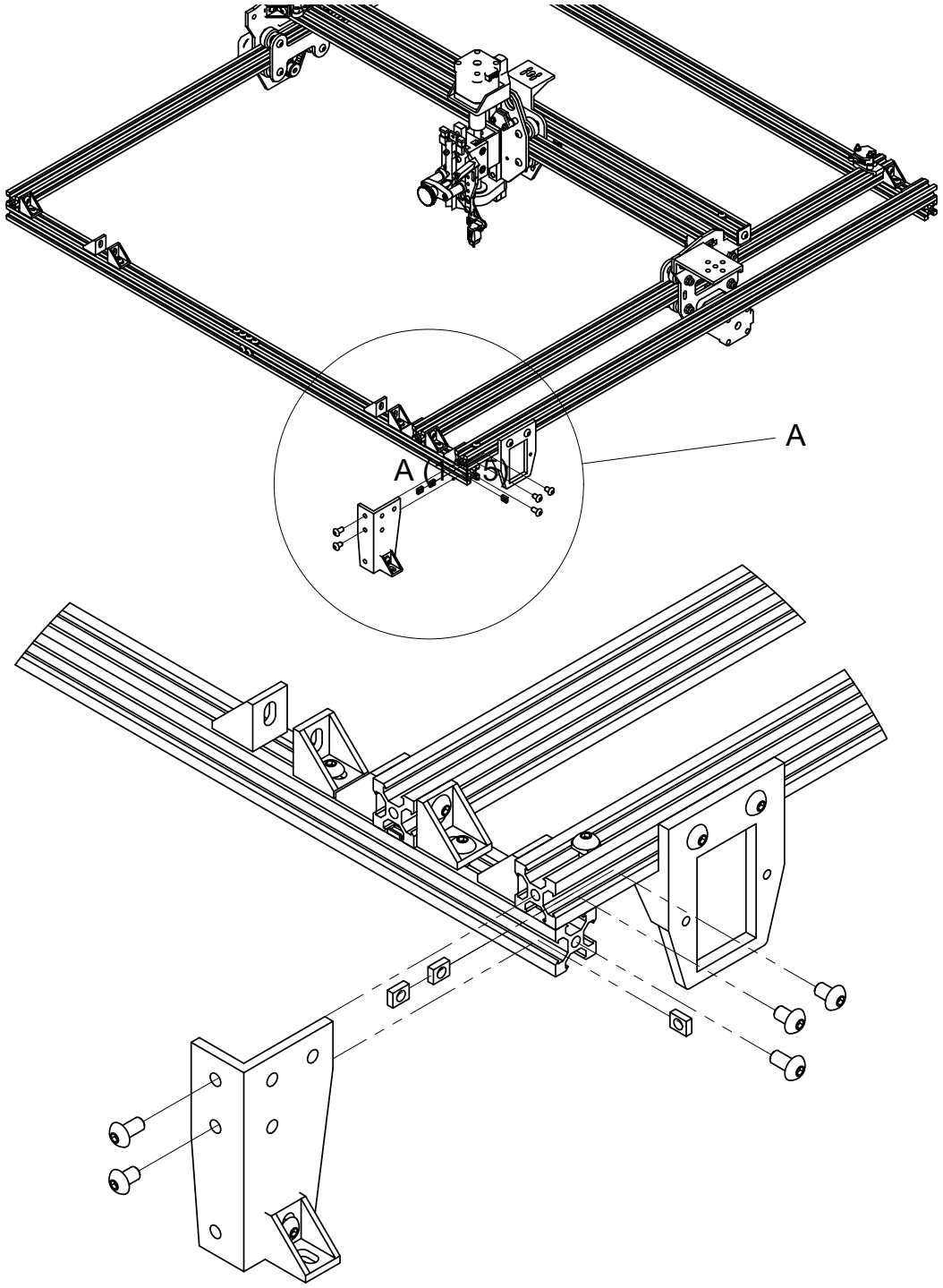
11



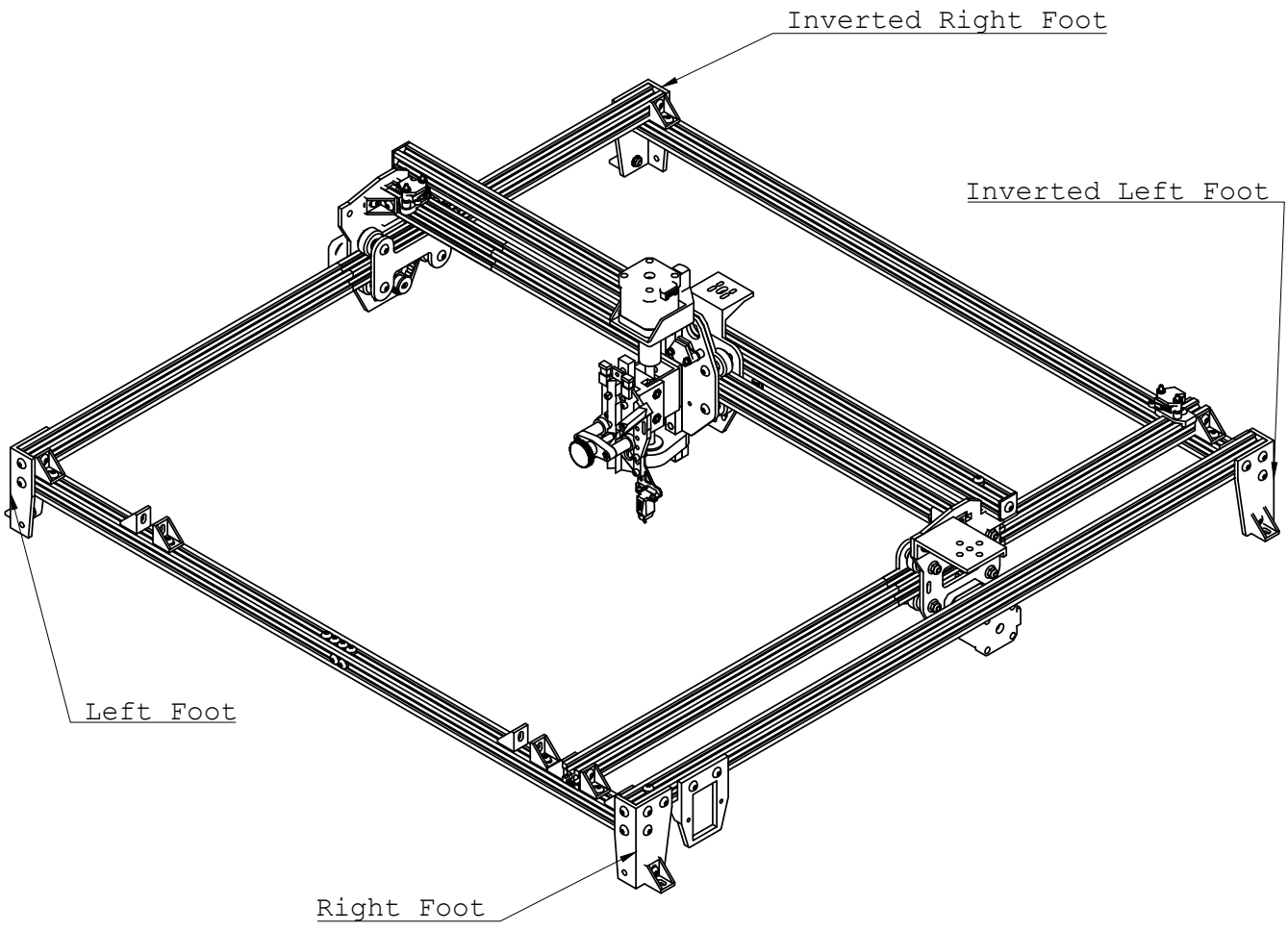
INSTALL AND FASTEN THE RIGGED
Y RAIL EXTRUSION

QTY	PART
2L, 2R	Foot Assembly (2 Left and 2 Right)
3 x 4	M5 x 8mm Hex Socket Button Head Bolts
3 x 4	M5 Sliding Nut
2 x 4	M5 x 8mm Self Tapping Bolts

12



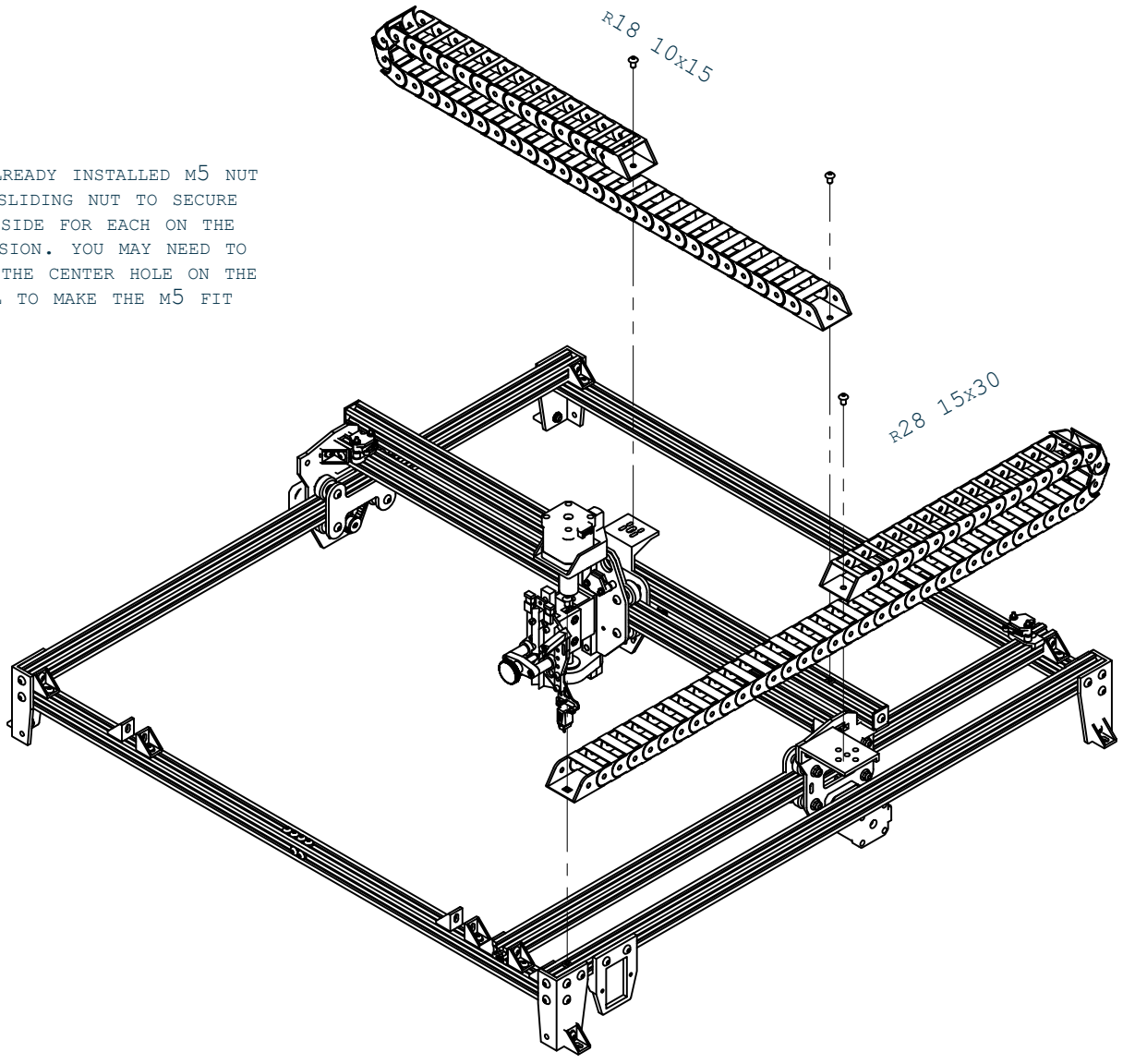
INSTALL 2 LEFT AND 2 RIGHT
FEET AS SHOWN



QTY	PART
1	R18 10x15 Rail
1	R28 15x30 rail
2	M5 x 8mm Hex Socket Button Head Bolts
2	M5 Nuts
2	M5 lock Washers

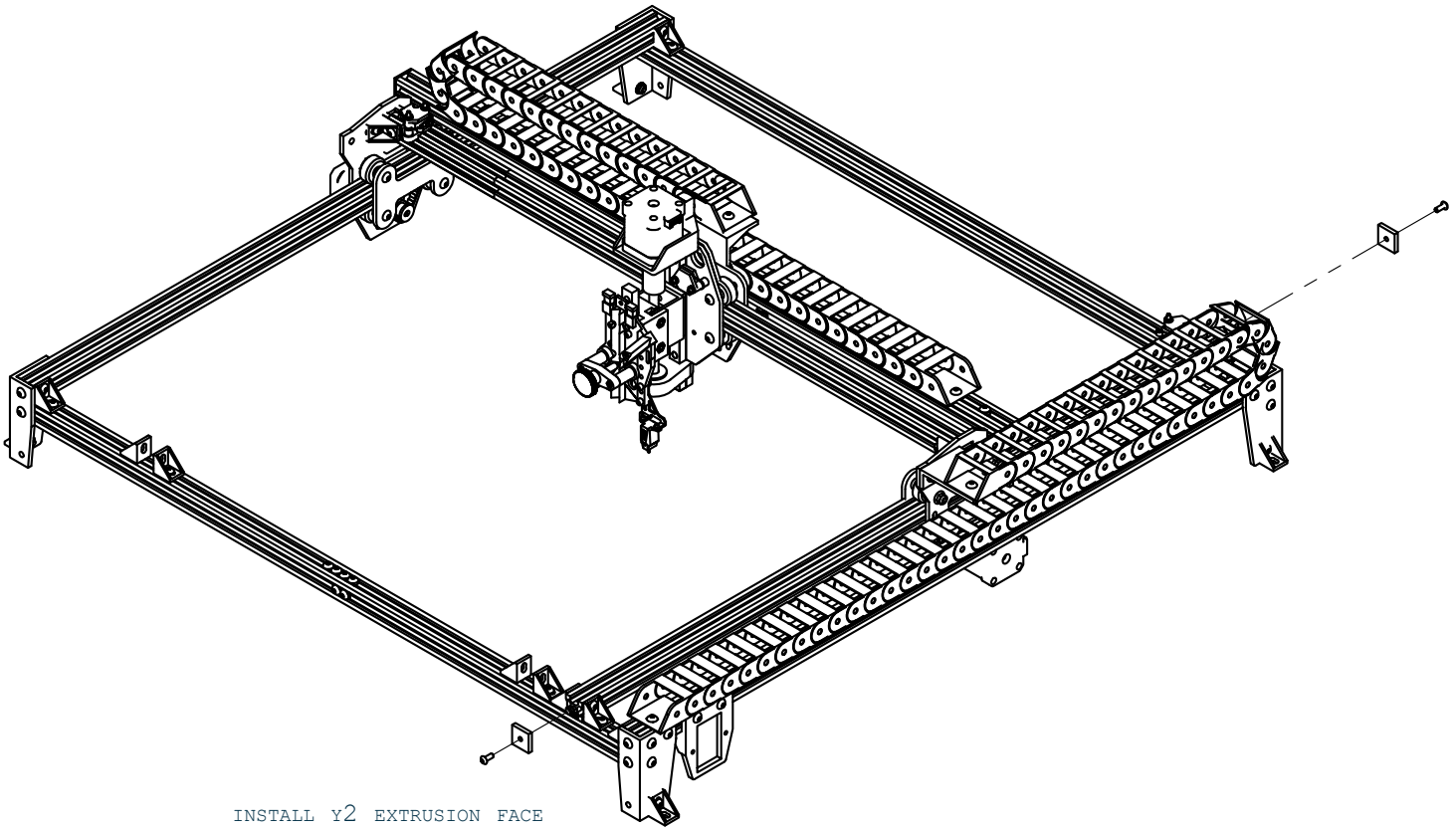
13

USE ALREADY INSTALLED M5 NUT AND SLIDING NUT TO SECURE ONE SIDE FOR EACH ON THE EXTRUSION. YOU MAY NEED TO DRILL THE CENTER HOLE ON THE RAIL TO MAKE THE M5 FIT



QTY	PART
2	2020 Face Plate
2	M5 x 8mm Self Tapping Bolts

14



INSTALL Y2 EXTRUSION FACE PLATES

Configuring the M5P Motherboard

Follow these steps to prepare the Manta M5P motherboard for installation. This includes setting up the stepper drivers and compute module. Work on a static-free surface and handle components gently to avoid damage.

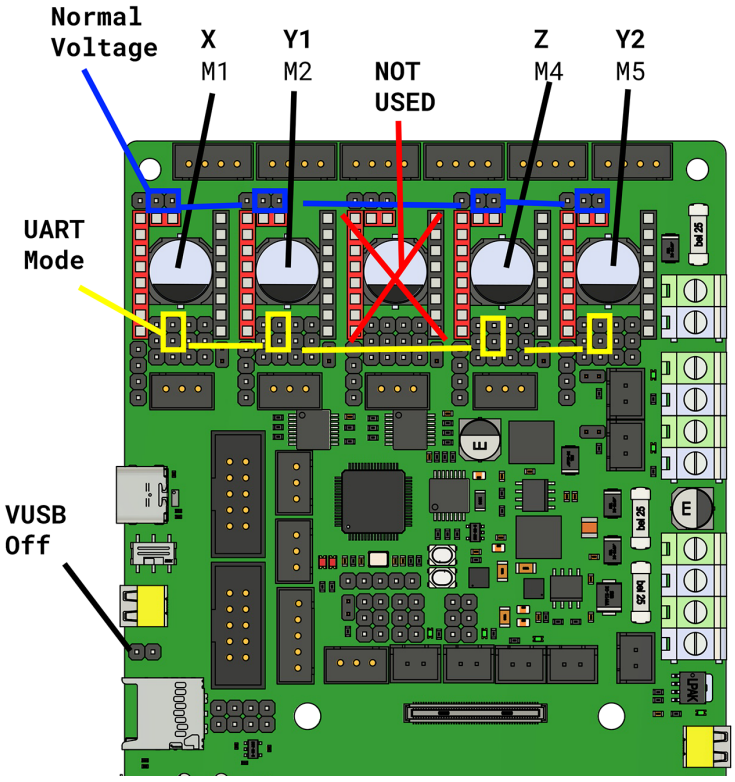
1. **Install TMC2209 Stepper Drivers**:

Insert one TMC2209 driver into each of the following slots: M1, M2, M4, and M5.

Align the pins carefully and press firmly until seated.

2. **Set Jumpers for Motor Drivers**:

For each TMC2209 driver, configure the jumpers to **UART mode**. Refer to diagram for exact jumper positions.



3. **Set Jumpers for Motors**:

Configure the motor voltage jumpers to **Normal Voltage.**

4. **Verify VUSB Jumper**:

Ensure the **VUSB jumper is in the off position**. (This is only required if powering the board solely via USB.)

5. **Install CB1 Chip**:

Align and insert the CB1 chip into its designated socket on the board. There is only one way to insert, you should hear a click when properly seated.

6. **Install CB1 Antenna**:

Connect the antenna to the CB1 module.

7. **Install CB1 Heatsink**:

> Attach the heat sink to the CB1 chip for thermal management. Use the heat sink paste as instructed on the CB1 Manual

Tips:

> Double-check jumper positions with a magnifying glass to prevent shorts.
>
> Total time: 10-15 minutes.

Configuring the Seeeduino Xiao and OLED Screen

This setup prepares the Seeeduino Xiao for controlling the OLED display. Use proper soldering technique to ensure reliable connections.

1. **Solder Pin Headers**:

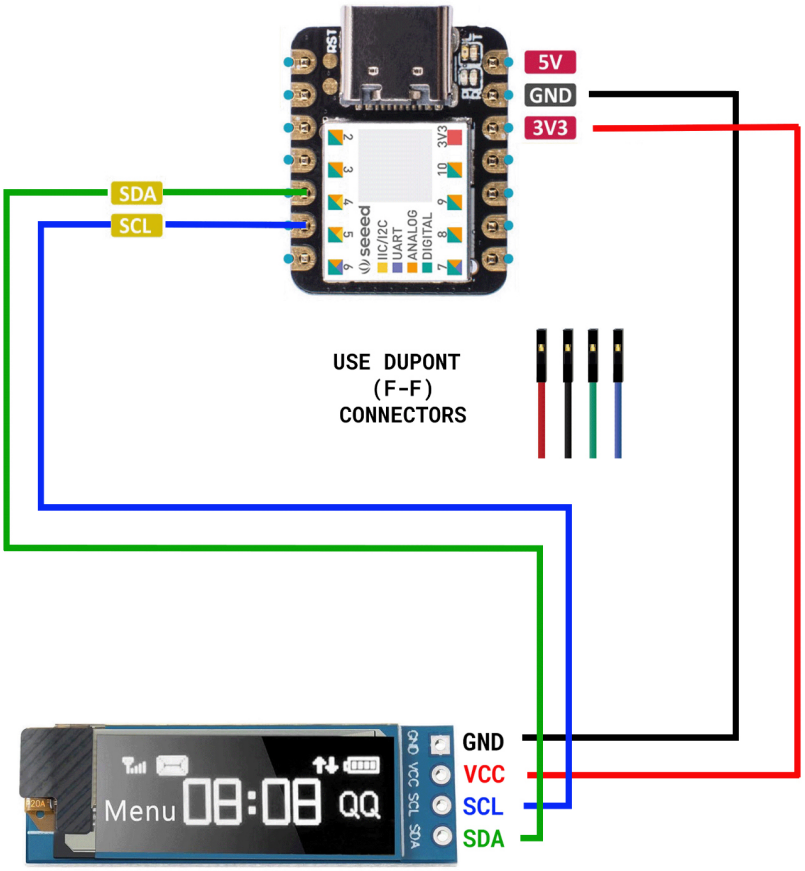
Solder pin headers onto the OLED display and Seeeduino Xiao boards.

2. **Wire OLED to Xiao**:

Use Dupont connectors to make the following connections:

OLED VCC > Xiao 3.3V OLED GND > Xiao GND

OLED SCL > Xiao Pin A5 OLED SDA > Xiao Pin A4



3. **Trim Unused Pins**:

Cut any unused pin headers on the Xiao to reduce size and potential interference.

4. **Secure Connectors**:

Apply super glue to fix the connectors in place for durability.

Tips:

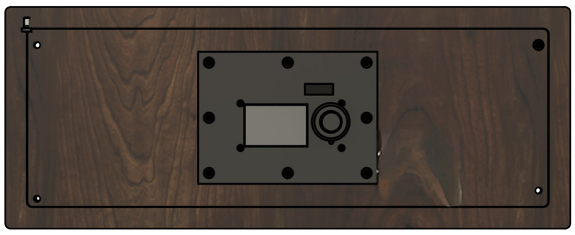
Test connections with a multimeter before gluing.

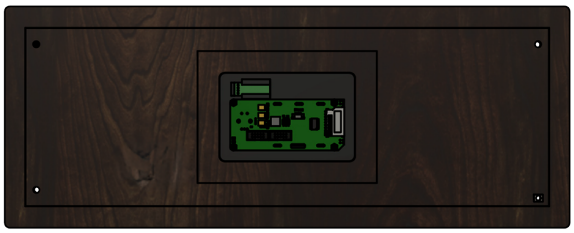
Total time: 10-15 minutes.

Warning: Avoid overheating during soldering to prevent component damage.

NOTES

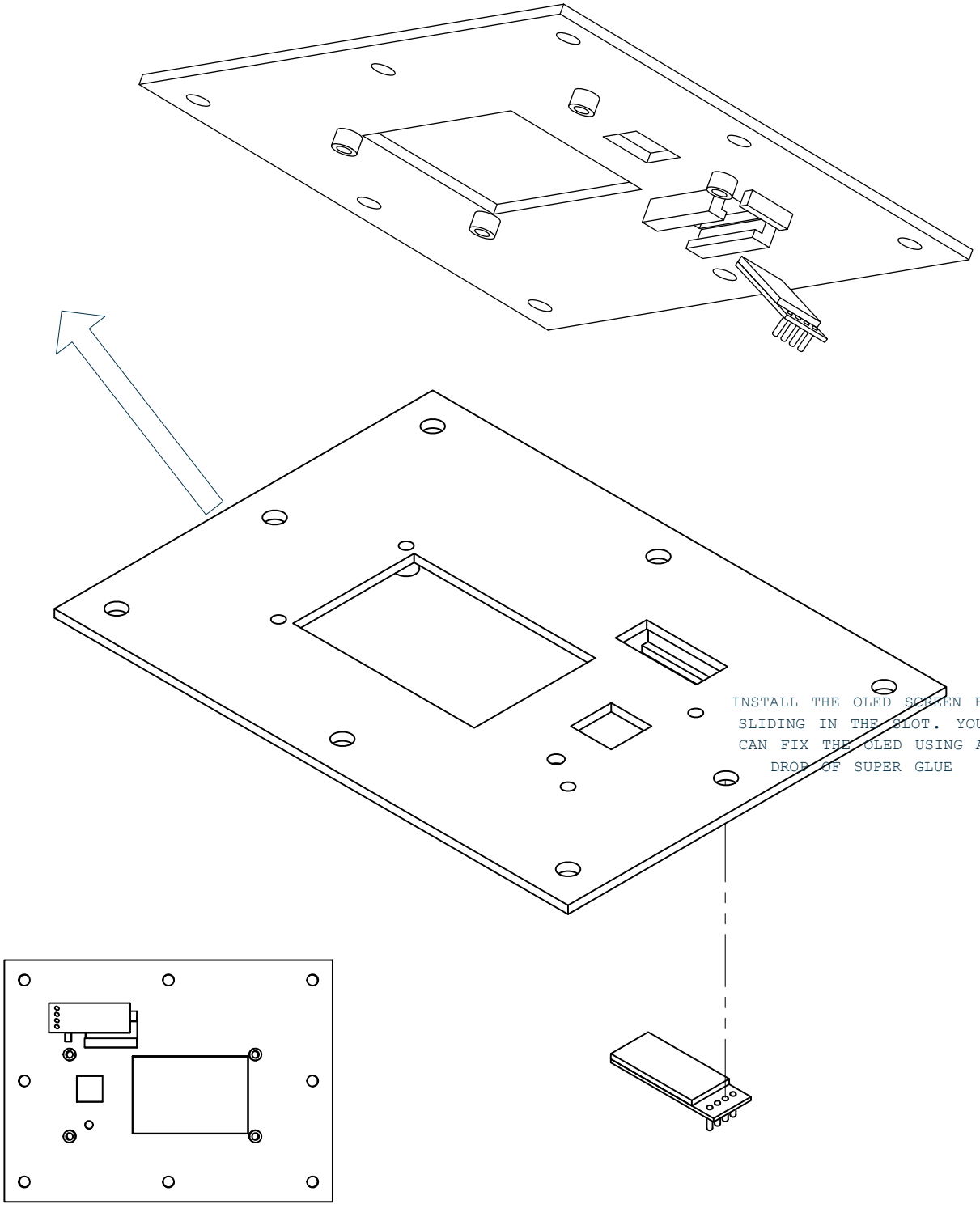
Assembling the Control Panel Screen Top





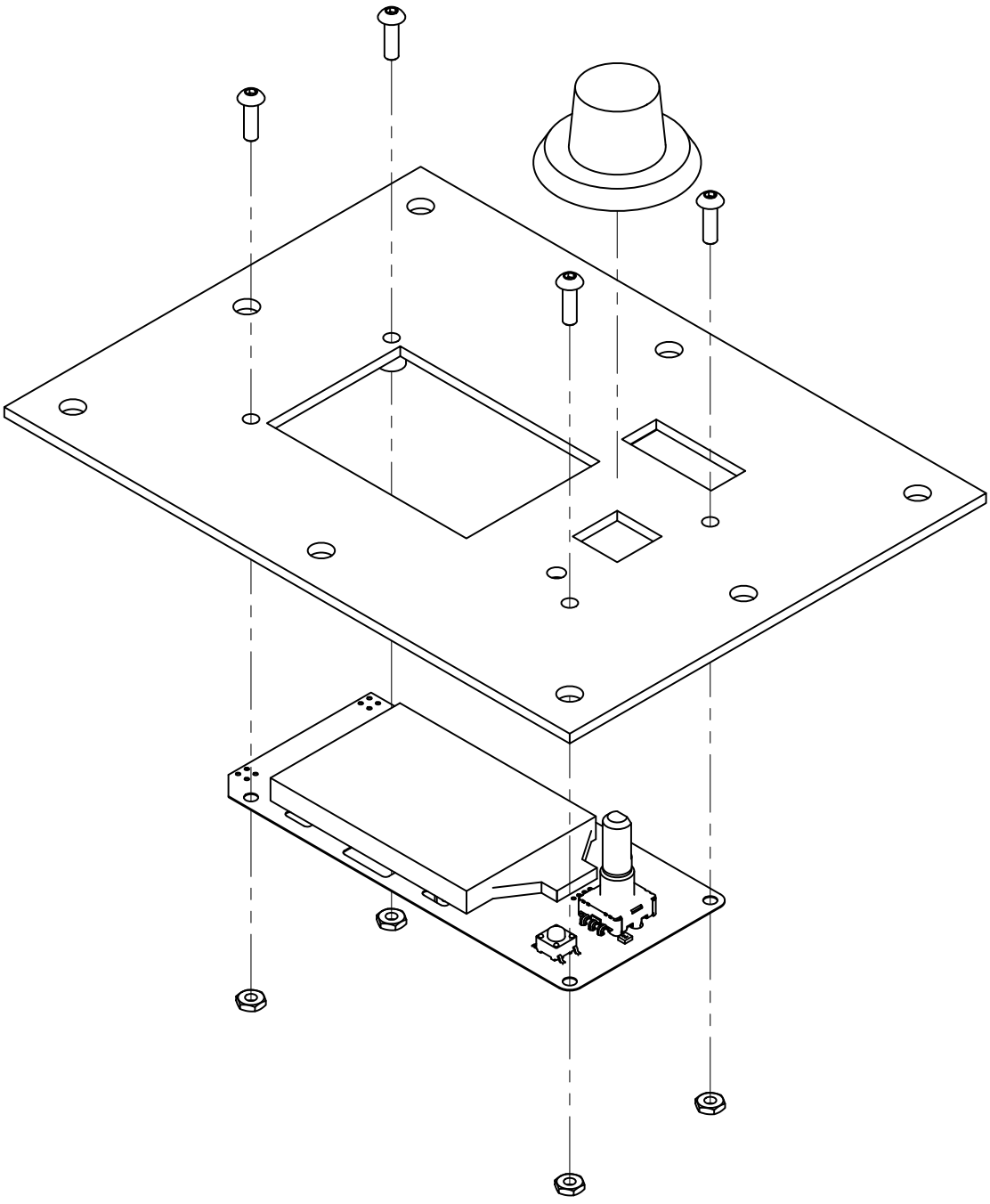
1

QTY	PART
1	Screen Bracket 0020
1	.91 OLED



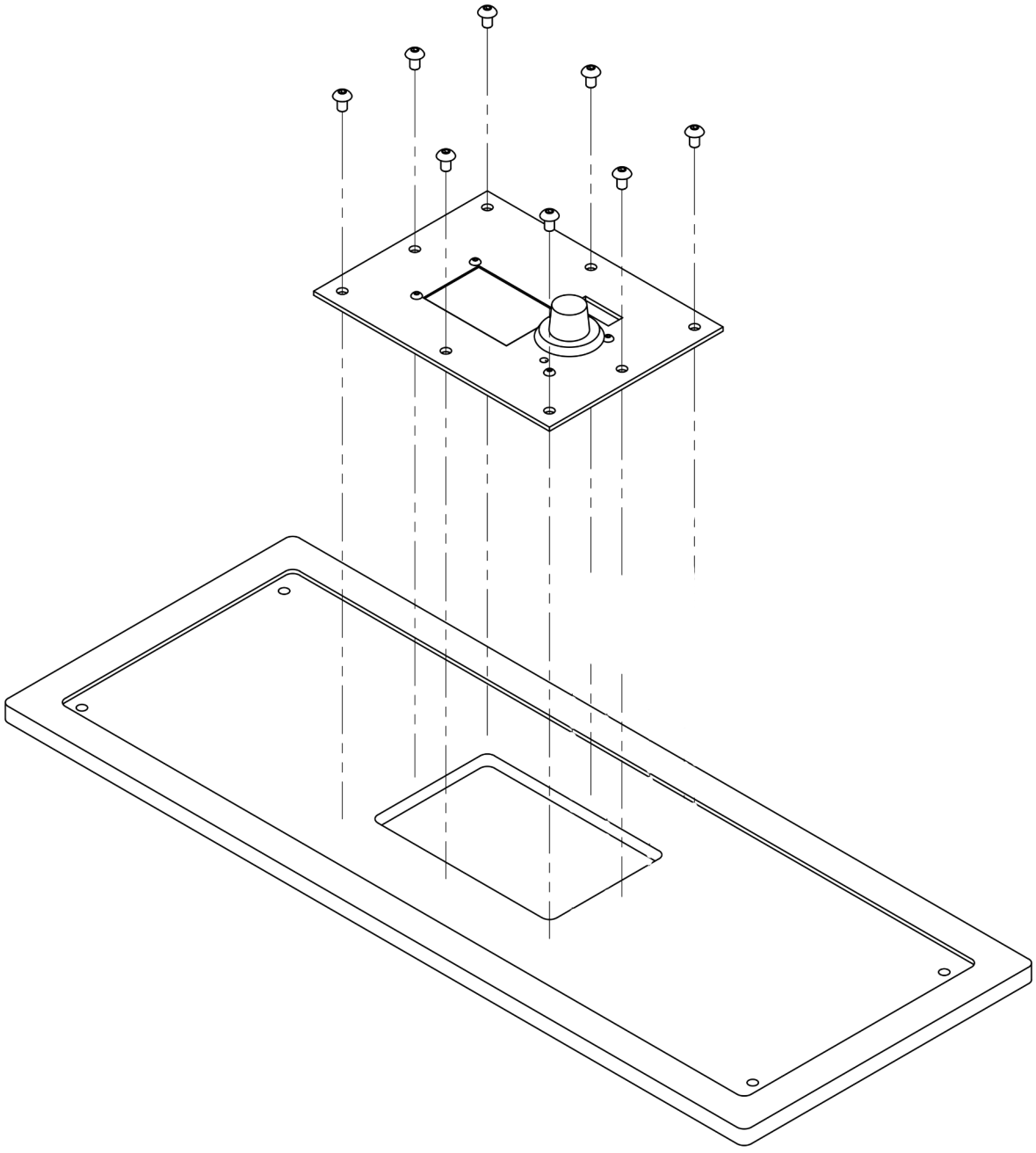
2

QTY	PART
1	Mini 12864 Screen
1	Screen Button
4	M3 x 12mm Hex Socket Button Head Bolts
4	M3 Nuts

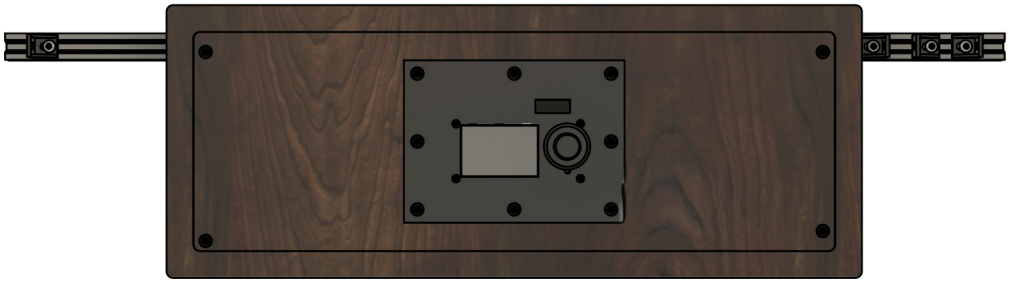


3

QTY	PART
1	Mini 12864 Screen Assembly
1	Pre-drilled Base
4	M3 x 8mm Wood Bolts
8	M5 x 8mm Wood Bolts



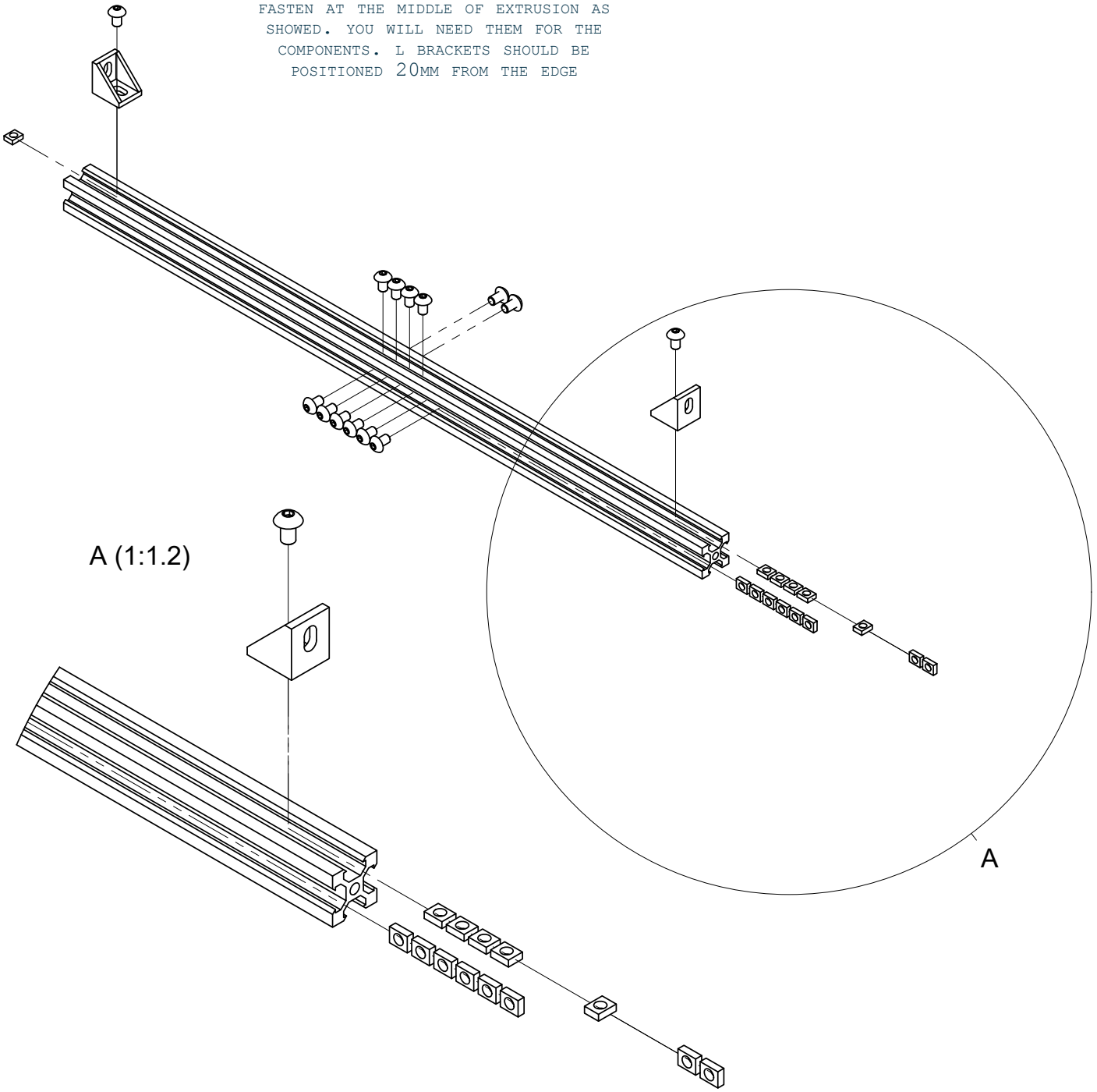
Setting Up the Control Panel Rig



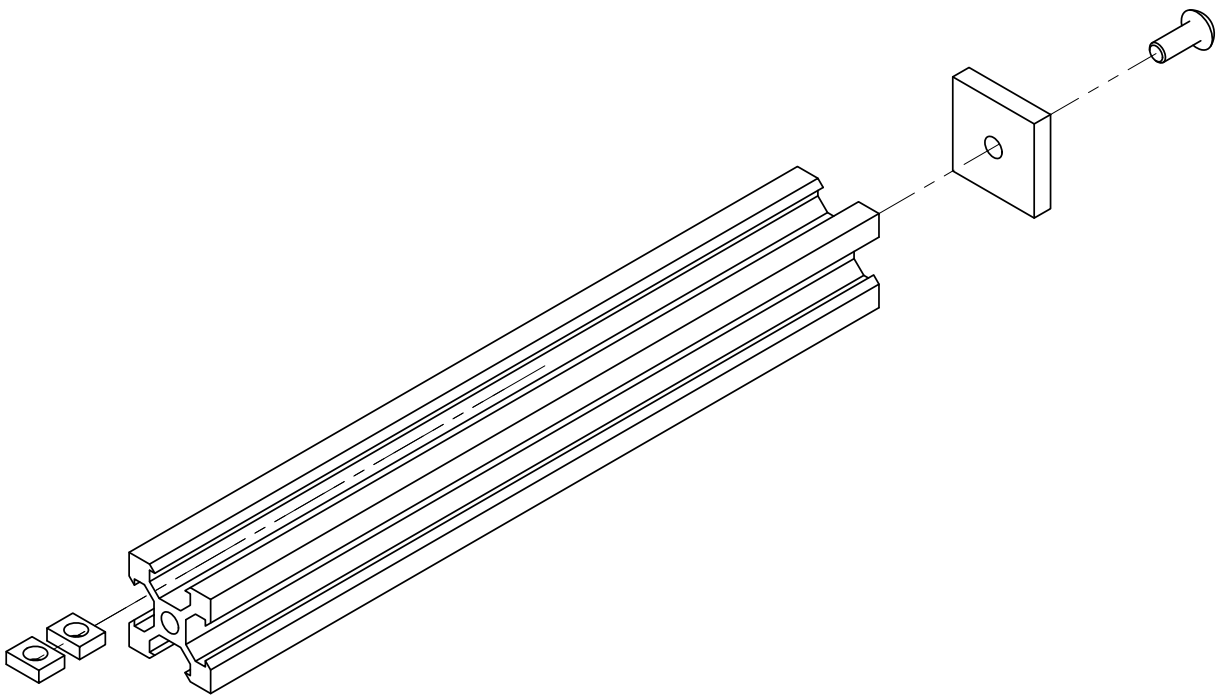
QTY	PART
1	2020 Extrusion for Control Panel Front
2	L Brackets
14	M5 x 8mm Hex Socket Button Head Bolts
14	M5 Sliding Nut

1

INSERT 12 NUTS AND SLIDING NUTS AND FASTEN AT THE MIDDLE OF EXTRUSION AS SHOWED. YOU WILL NEED THEM FOR THE COMPONENTS. L BRACKETS SHOULD BE POSITIONED 20MM FROM THE EDGE



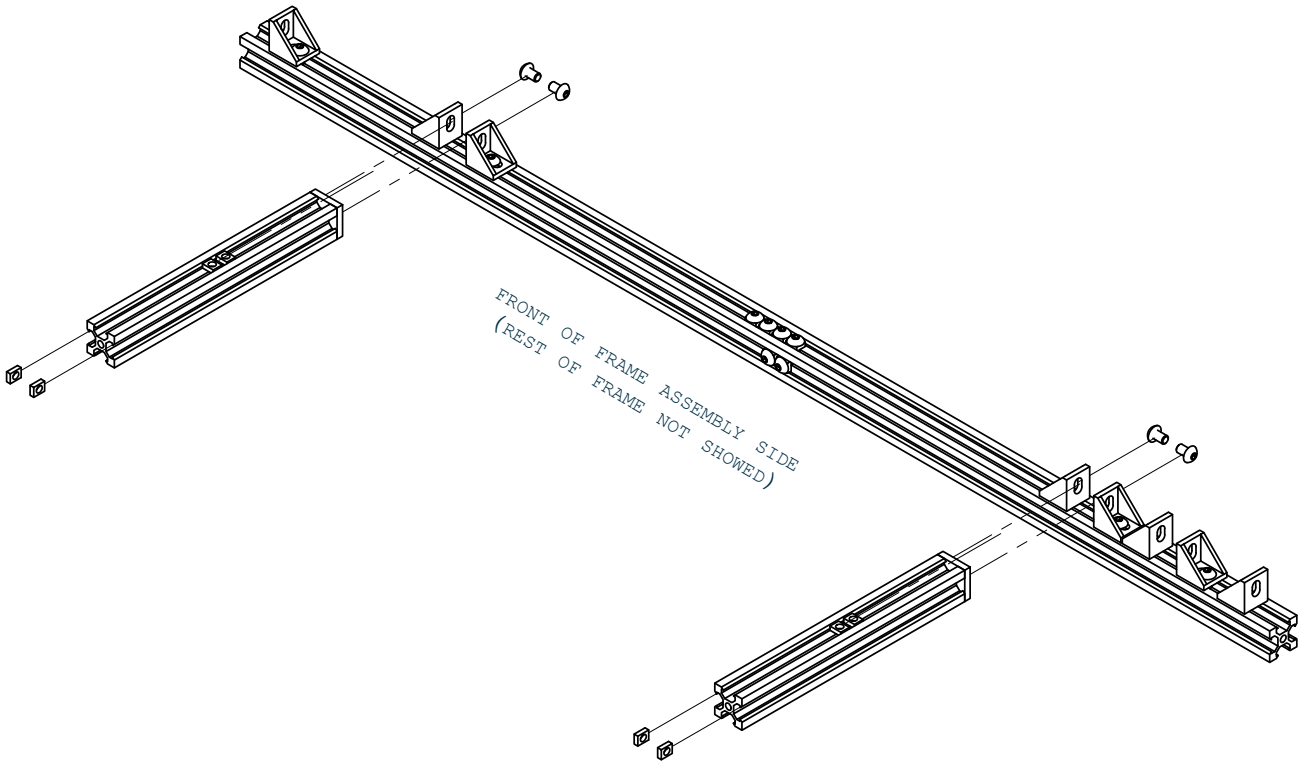
QTY	PART
1 x 2	2020 Extrusion for Control Panel Sides
1 x 2	2020 Face Plates
1 x 2	M5 x 8mm Self Tapping Bolts
2 x 2	M5 Sliding Nut



TWO NEEDED FOR LEFT AND RIGHT SIDE

QTY	PART
1	Frame Assembly
2	Rigged Extrusions Sides
4	M5 x 8mm Hex Socket Button Head Bolts
4	M5 Sliding Nut

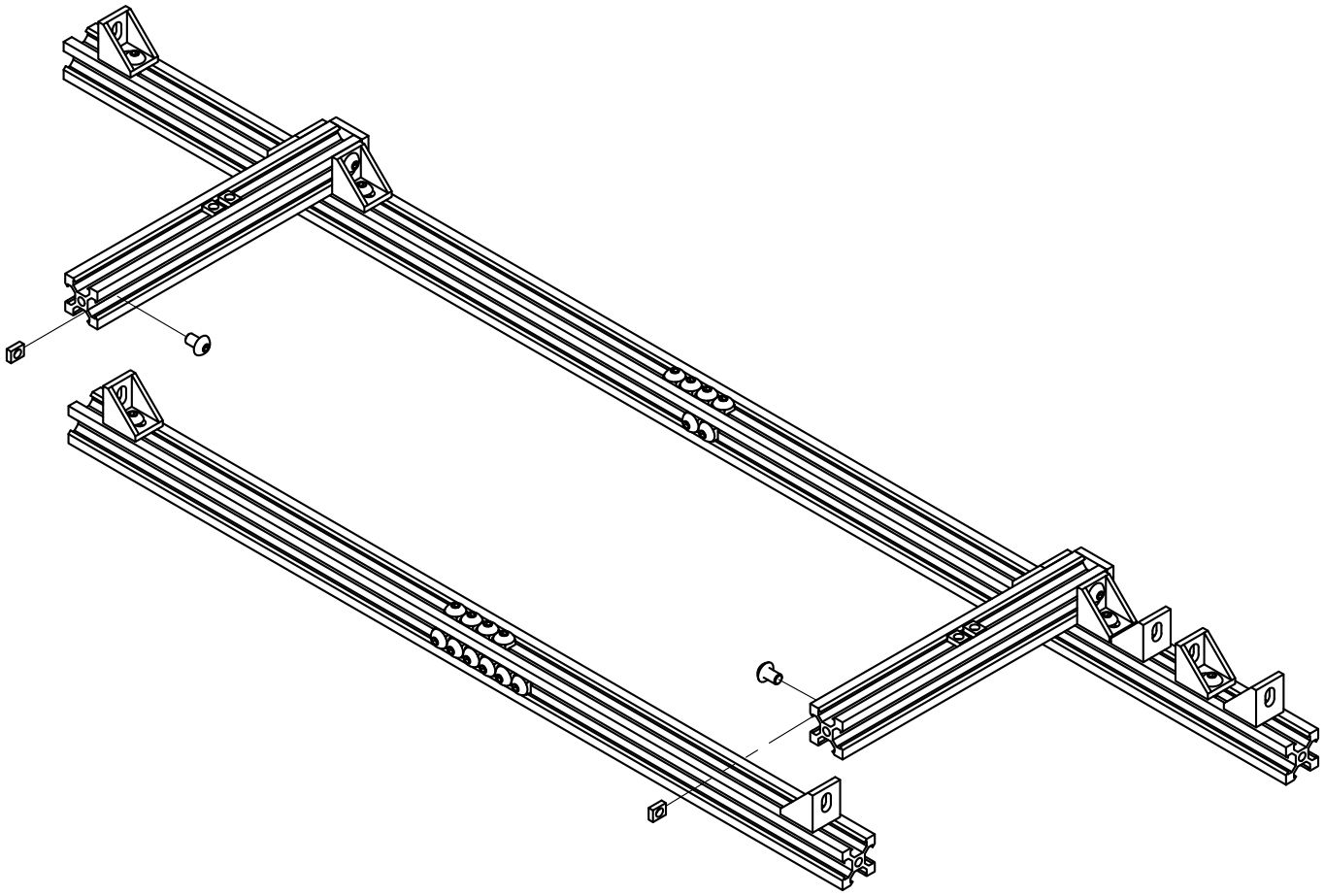
3



QTY	PART
1	Rigged Front Control Panel Extrusion from Step 1
2	M5 x 8mm Hex Socket Button Head Bolts
2	M5 Sliding Nut

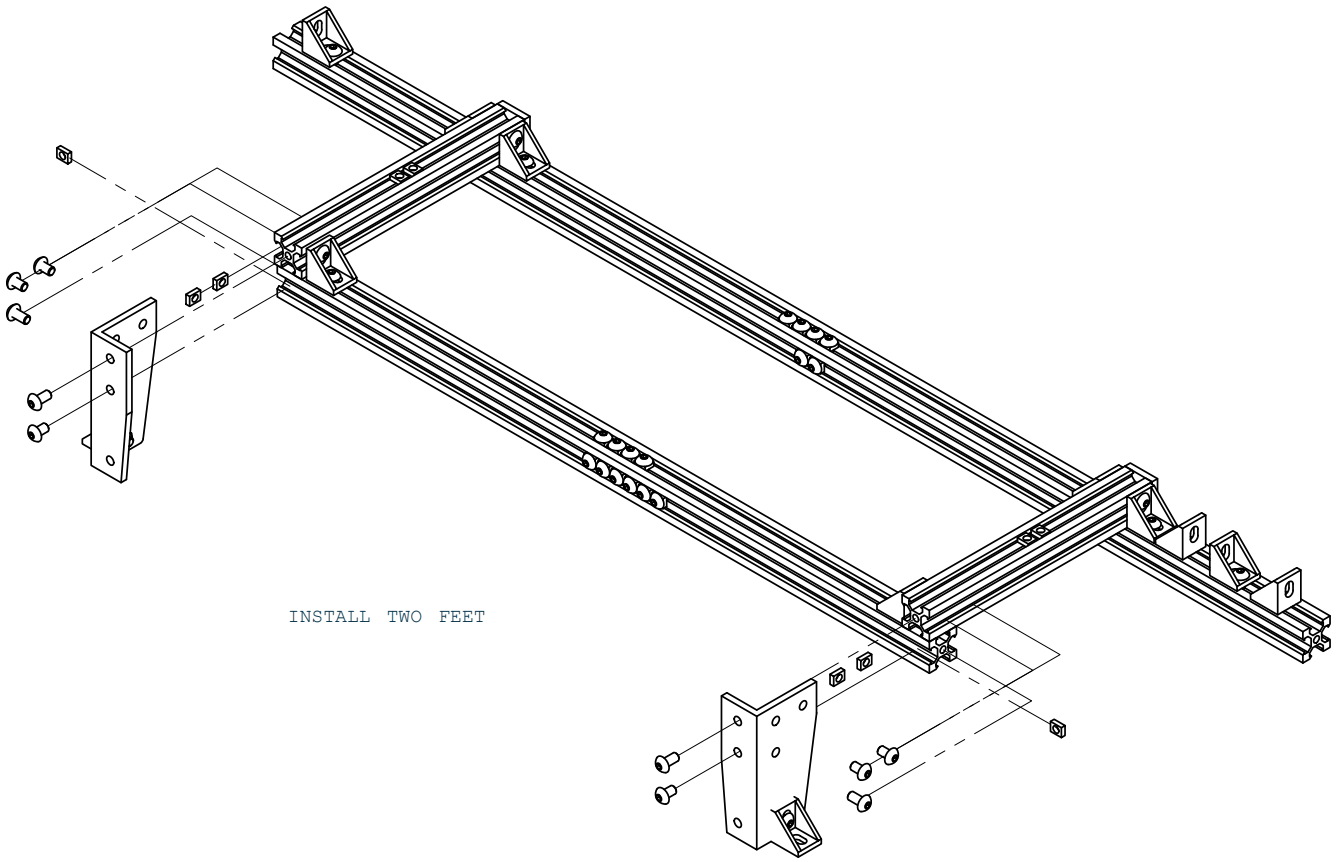
4

INSTALL FRONT ASSEMBLY



QTY	PART
1L, 1R	Foot Assembly (1 Left and 1 Right)
6	M5 x 8mm Hex Socket Button Head Bolts
6	M5 Sliding Nut
4	M5 x 8mm Self Tapping Bolts

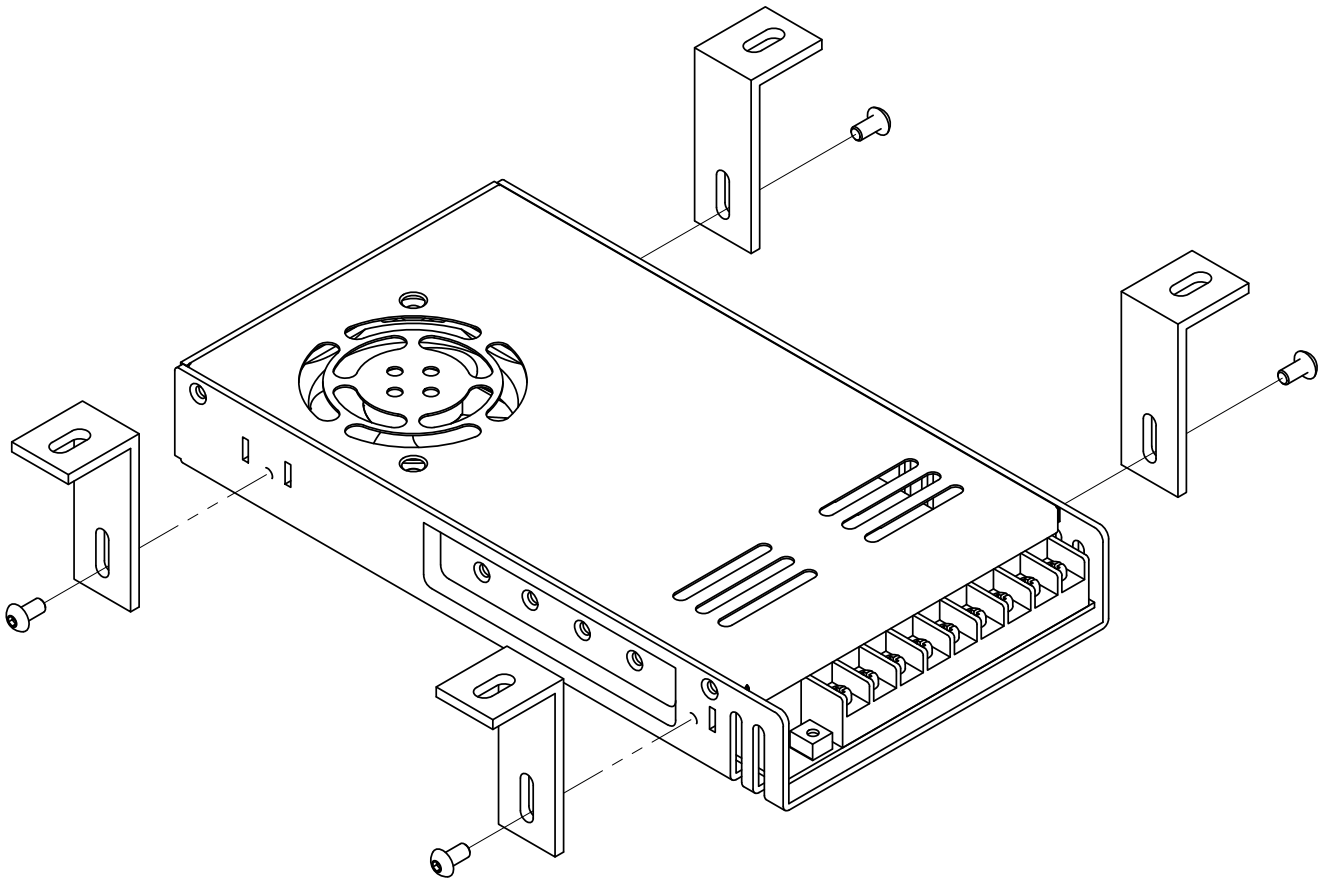
5



QTY	PART
4	Power Supply Brackets 0022
4	M4 x 8mm Hex Socket Button Head Bolts

6

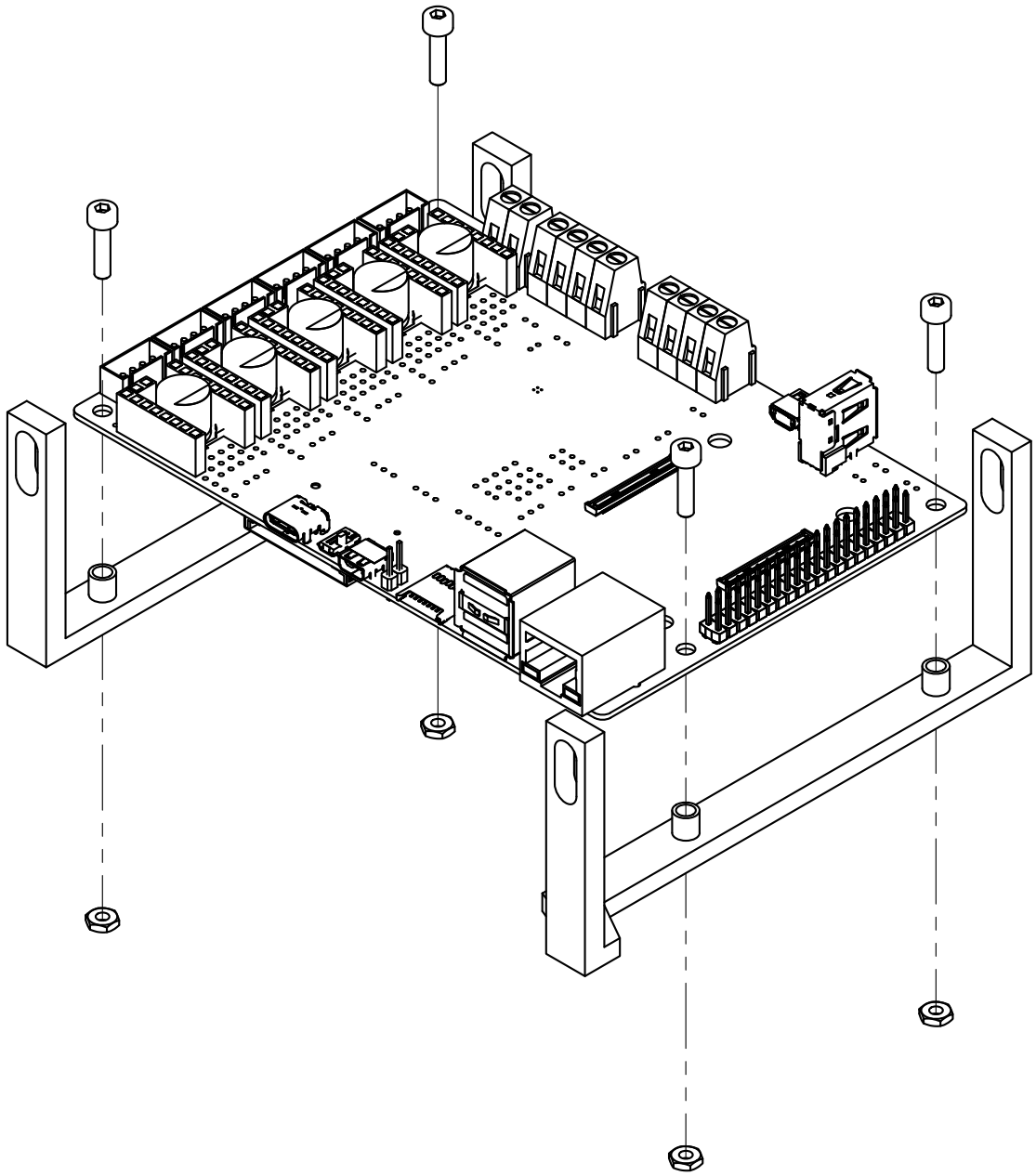
INSTALL THE POWER SUPPLY BRACKETS



QTY	PART
2	M5P Brackets Left (0023) and Right (0024)
4	M3 x 12mm Hex Socket Head Cap Bolts
4	M3 Nuts

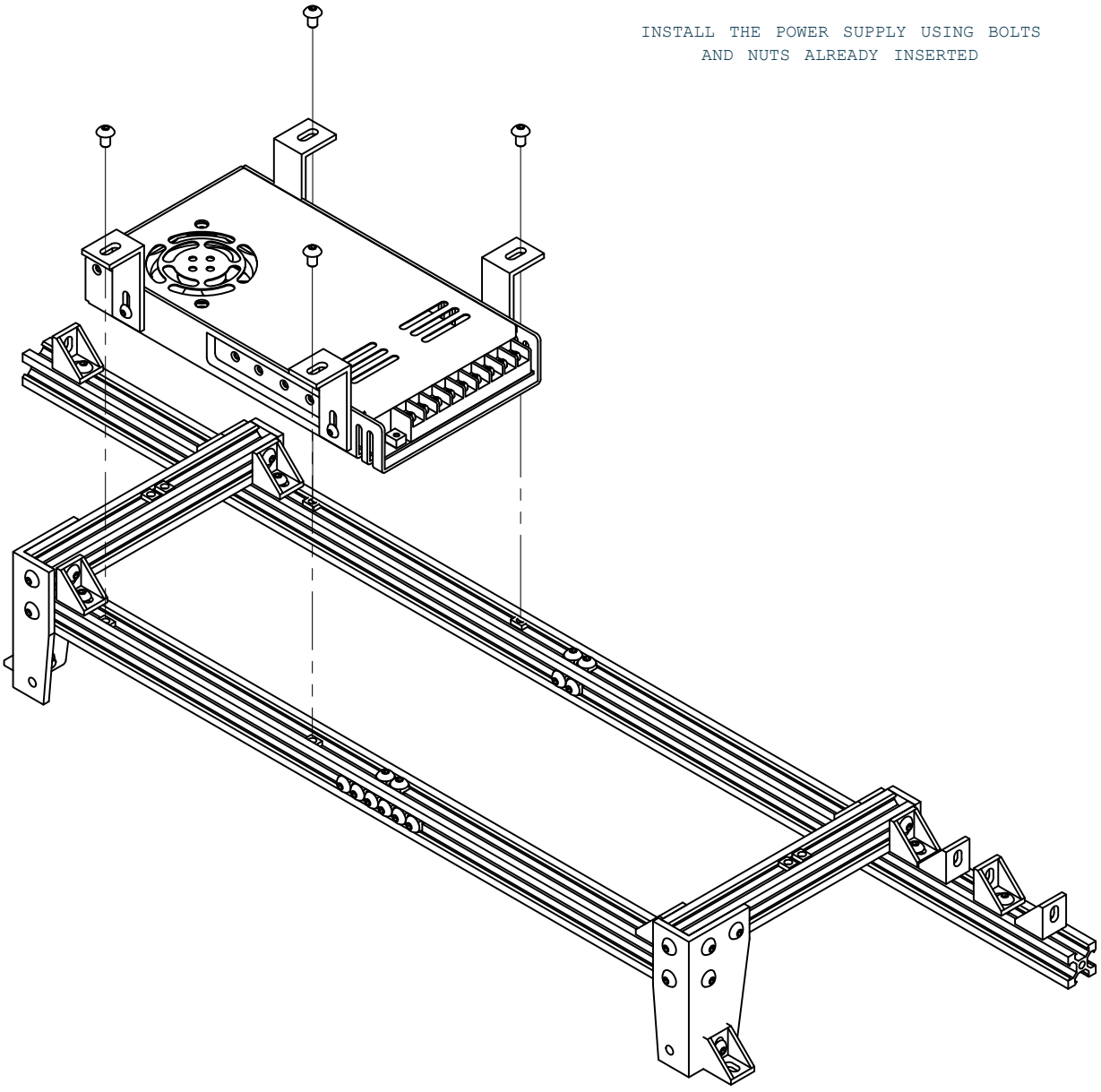
7

INSTALL THE M5P BRACKETS



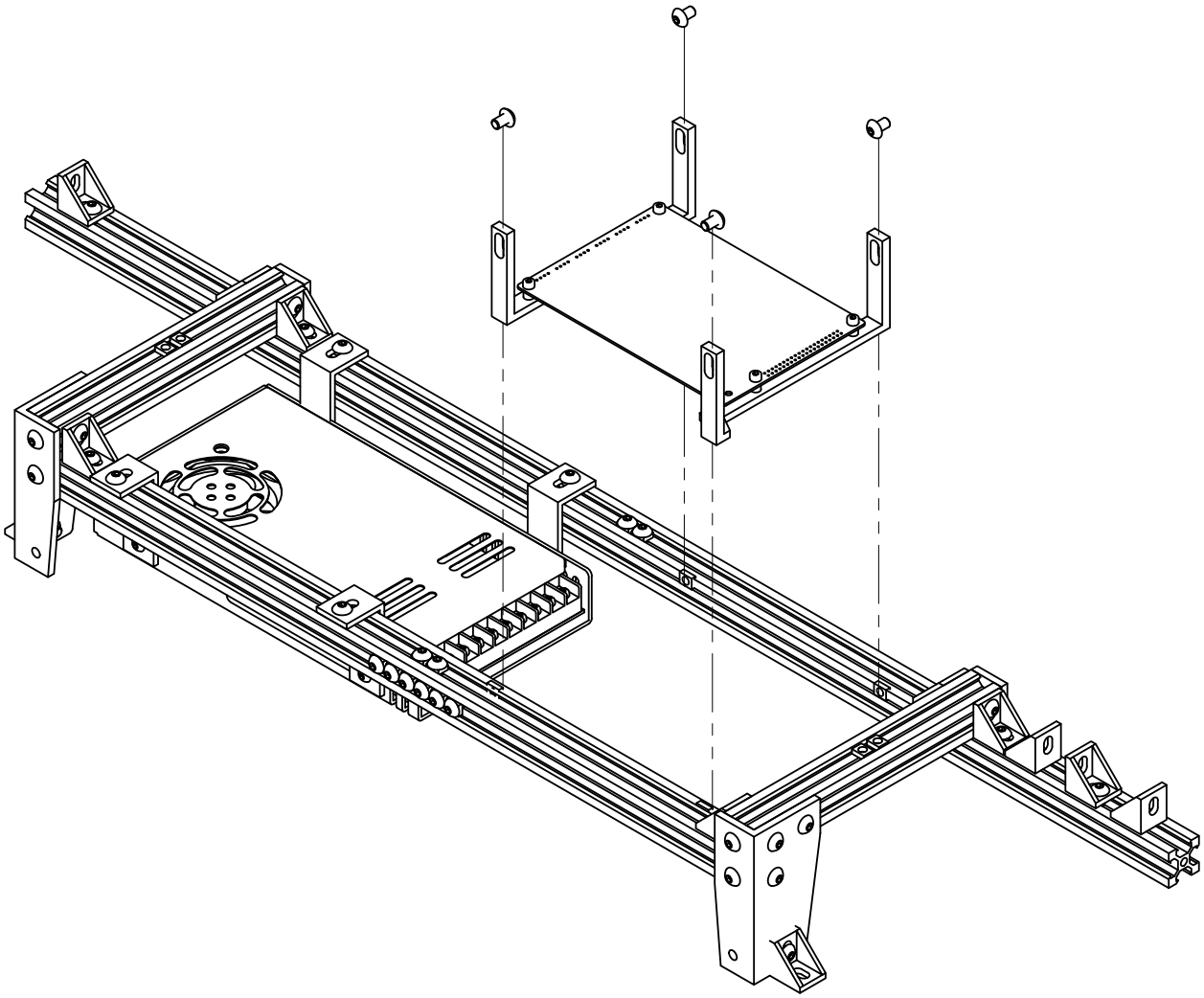
8

INSTALL THE POWER SUPPLY USING BOLTS AND NUTS ALREADY INSERTED



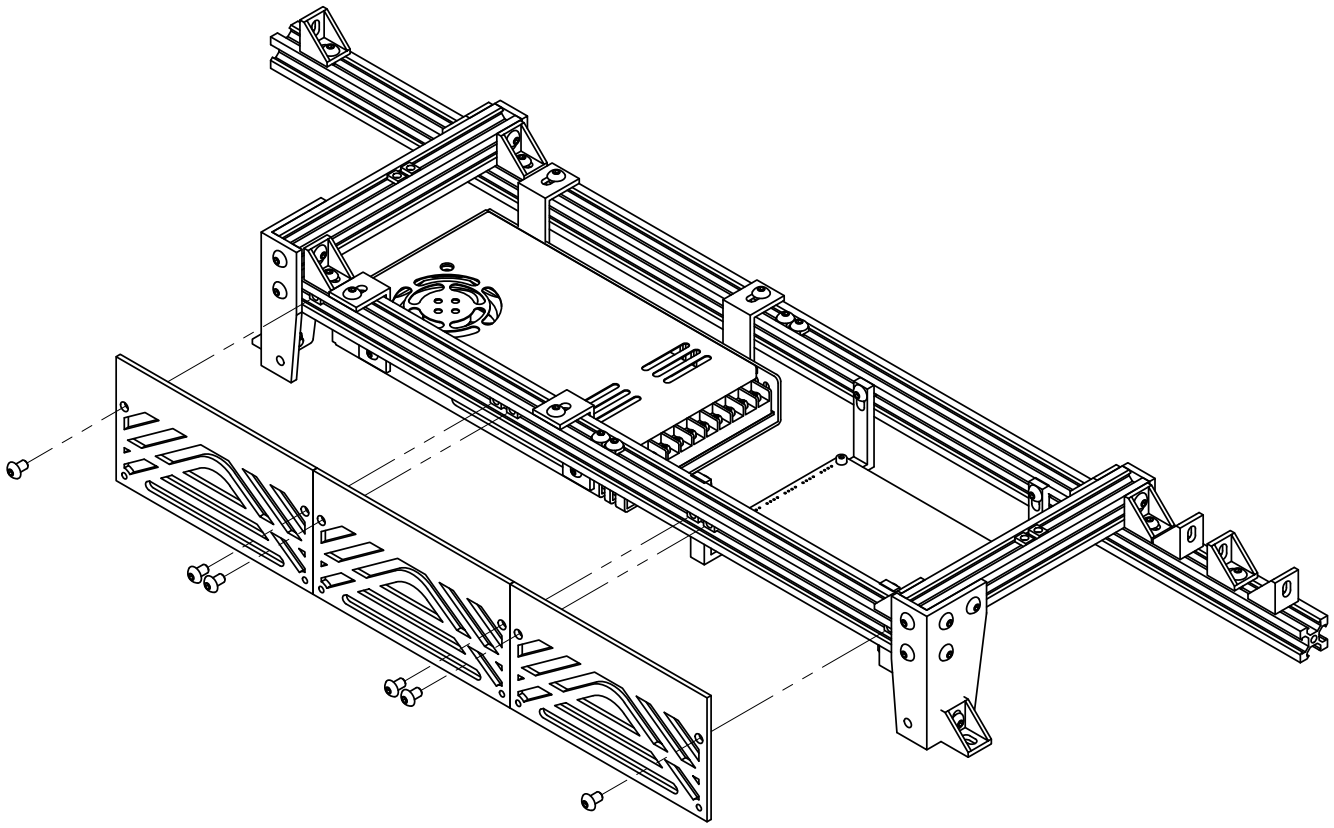
9

INSTALL THE M5P USING BOLTS AND NUTS
ALREADY INSERTED



QTY	PART
3	Front Cover Panel (0021)

10

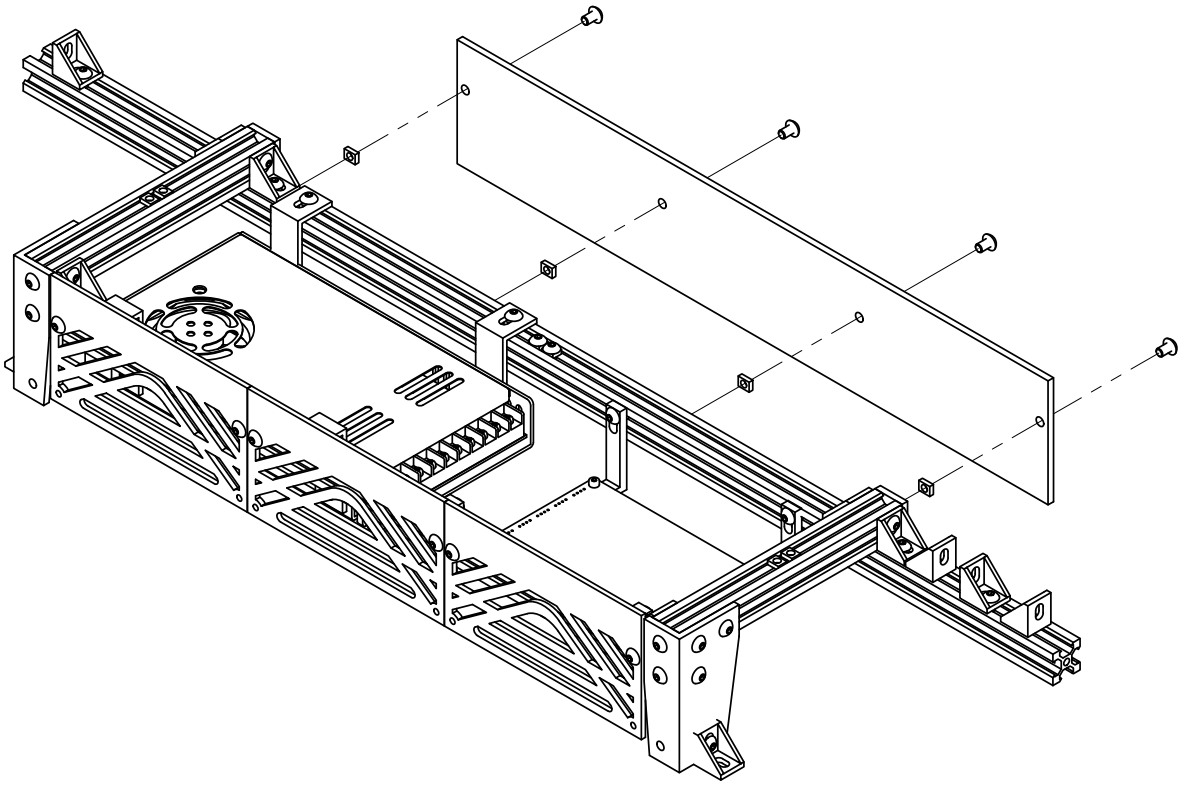


INSTALL 3 PANELS USING BOLTS AND NUTS ALREADY INSERTED

QTY	PART
1	Control Panel Back Cover

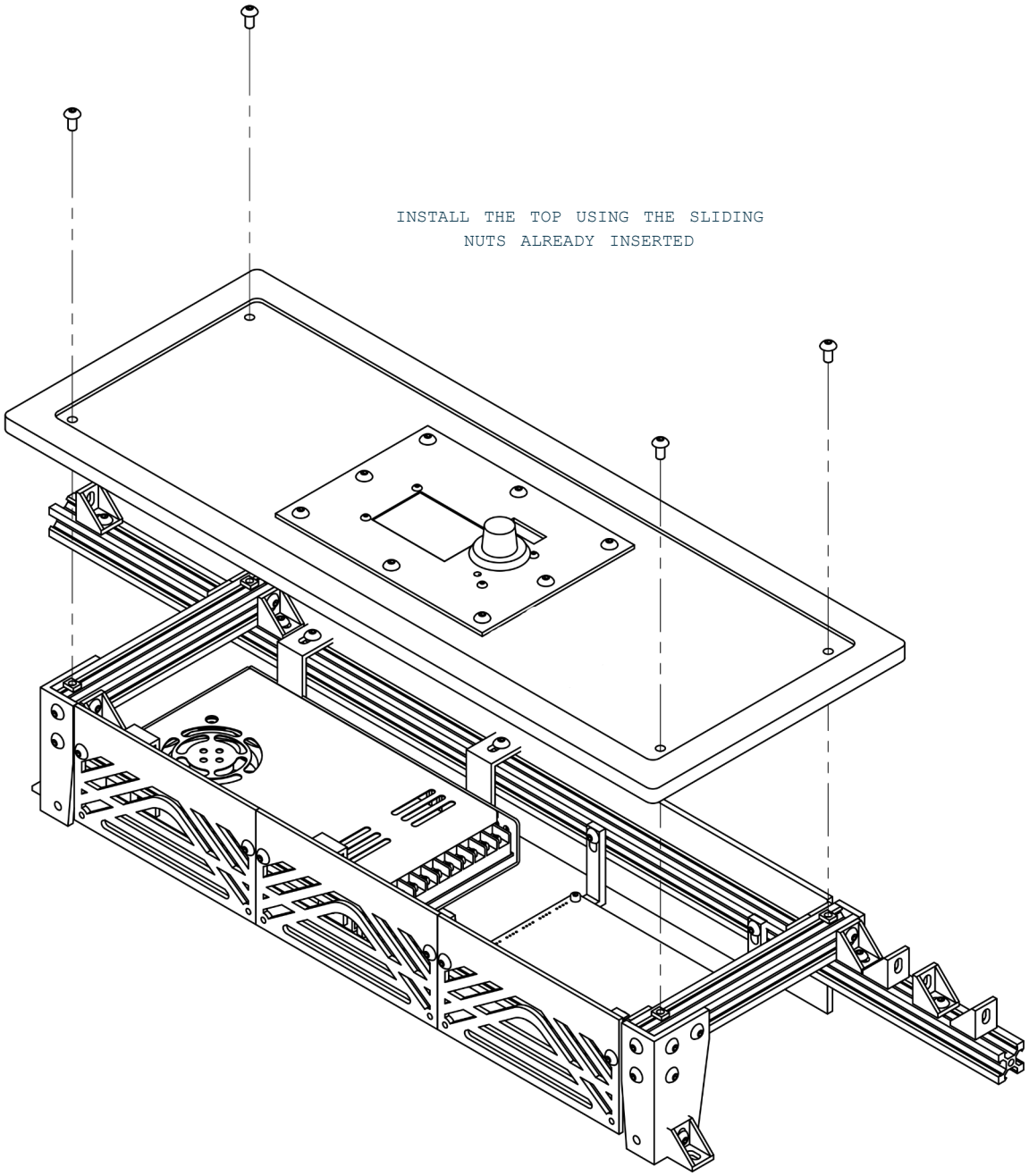
11

INSTALL THE BACK COVER USING BOLTS AND NUTS ALREADY INSERTED



QTY	PART
1	Control Panel Top Assembly
4	M5 x 16mm Hex Socket Button Head Bolts

12

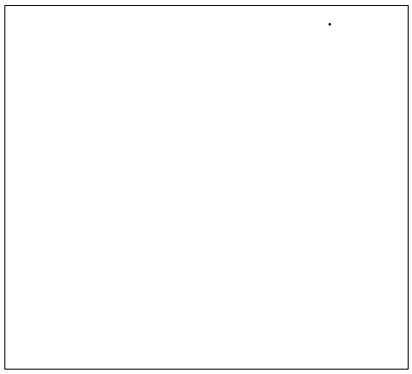


NOTES

Building and Mounting the Plotter Base

A sturdy base is essential for your Aria Art Plotter—it provides stability, reduces vibrations during operation, and ensures accurate drawings. Without a solid foundation, even minor flexing can affect precision. This section guides you through creating the base using the provided 0031_ Plotter_Base.dxf template, which includes precise hole anchor points for mounting. The base measures 982.5mm x 886mm (38.7" x 34.9"), giving ample space around the plotter's frame for cable management and artwork handling.

We recommend building or using a dedicated sturdy table to support the base. This keeps the



plotter at a comfortable working height (about 75-90cm or 29.5-35.4" from the floor) and prevents any wobbling. If you're short on space, consider a wall-mounted setup, but ensure it's reinforced.

Materials Needed

> **Base Material** (choose one based on your budget and tools):
>
> MDF (Medium-Density Fiberboard): Affordable and easy to work with; 18-25mm (0.7-1.0") thick for rigidity. Cost: Low.
>
> Laminate or Plywood: More durable and warp-resistant; 18-25mm (0.7-1.0") thick. Good for

humid environments.

Metal Sheet (Aluminum or Steel): Premium option for ultimate stability; 3-5mm (0.1-0.2") thick. Use if you have access to metalworking tools. Cost: Higher.

Fasteners:

4-6 M5 or M6 bolts/screws (length depends on base thickness; aim for 20-30mm or 0.8-1.2" penetration into the plotter feet).

Matching nuts/washers if bolting through.

Wood screws if using MDF/laminate (e.g., #10 x 25mm or 1.0").

Other Supplies:

Sandpaper (for smoothing edges).

Wood filler or edge banding (for MDF/laminate finishes).

Paint or sealant (optional, for protection and aesthetics).

Tools Needed

Jigsaw, circular saw, or CNC router (for cutting the base shape).

Power drill with bits matching your fastener size.

Measuring tape/ruler and marker.

Clamps (for holding during cutting/drilling).

CAD software or printer (to interpret the DXF file for marking holes).

Safety gear: Gloves, eye protection, dust mask.

Step-by-Step Instructions

1. **Prepare the Base Material**:

Cut your chosen material to 982.5mm x 886mm (38.7" x 34.9"). Use a straight edge or guide rail for clean, square cuts.

If using MDF or laminate, sand the edges smooth to prevent splinters. Apply edge banding or sealant for a professional finish.

For metal: Use a metal-cutting blade or send the DXF to a fabrication service for precise cutting.

2. **Mark and Drill Mounting Holes**:

Open the 0031_Plotter_Base.dxf file in CAD software (e.g., Fusion 360, Inkscape, or LibreCAD—free options work well).

Print or trace the template at 1:1 scale onto your base material. Focus on the hole anchor points—these align with the plotter's feet (from Section 5.7).

Mark the centers of all anchor points clearly.

- Drill pilot holes at each mark:
- For wood/laminate: Use a bit slightly smaller than your screws (e.g., 4mm or 0.16" for M5 screws).

For metal: Use a center punch first, then drill with a metal bit. Consider countersinking for flush mounting.

Double-check alignment: Measure distances between holes to match the plotter's foot spacing (refer to the DXF dimensions).

3. **Build or Prepare the Support Table**:

Option 1: Simple Table Build:

Use four sturdy legs (e.g., 75cm or 29.5" wooden or metal posts) attached to the base corners with brackets/screws.

Add cross-bracing between legs for stability—use 2x4 lumber or metal struts.

Ensure the table is level; adjustable feet help on uneven floors.

Option 2: Existing Table:

Mount the base to a workbench or desk using brackets. Reinforce if needed to handle the plotter's weight (~15-20kg or 33-44lbs assembled).

Pro Tip: Add rubber feet or vibration-dampening pads under the table legs to minimize noise and movement during plots.

4. **Mount the Plotter to the Base**:

Place the assembled plotter frame (from Section 5.9) onto the base, aligning the feet with the drilled holes.

Secure each foot:

- Insert bolts/screws from below the base, threading into the plotter feet.
- Use washers for even pressure and lock nuts if vibrations are a concern.
- Tighten gradually in a cross pattern (like wheel lugs) to avoid warping.

Test stability: Gently rock the plotter—if there's any flex, add more fasteners or reinforce the base.

5. **Final Checks and Finishing**:

Level the entire assembly using a spirit level; shim under the table legs if needed.

Route any loose cables along the base edges with zip ties.

Optional: Paint or finish the base to match your workspace. Add non-slip matting on top for canvas placement.

Tips and Variations

Budget-Saving Hack: If MDF warps in humid areas, laminate it with thin aluminum sheets for hybrid strength.

Advanced Upgrade: For professional use, add threaded inserts into the holes for easier removal/remounting.

Common Pitfalls: Always double-measure hole positions—misalignment can cause binding in the motion system. If your base material is thin (<18mm or 0.7"), add reinforcement strips underneath.

Customization (Larger Plotters): Scale the base larger for bigger plots, but maintain the anchor points. For portable setups, add handles or wheels to the table.

With the base complete, your plotter is now stable and ready for next step. If you encounter issues with the DXF file or cutting, check online tutorials for your specific tools or consult a local makerspace.

6. Wiring & Electrical Installation

Welcome to the wiring phase! This is where your Aria Art Plotter comes to life electrically. We'll take it slow, with clear steps and safety tips. If you're new to wiring, don't worry—we've designed this for beginners. Always double-check connections, and remember: work with power off until the final test.

Quick Tips Before Starting:

> Use color-coded wires (e.g., red for positive, black for ground) to avoid mix-ups.
>
> Label both ends of every wire (e.g., "X Motor").
>
> Test continuity with a multimeter after each harness.
>
> Total time: 2-3 hours.
>
> If something feels off, stop and review the photos/diagrams.

Safety First: Never work on AC wiring if you're unsure—consult an electrician. Use insulated tools, and wear safety glasses.

Preparing Wire Harnesses

Harnesses are pre-made cable bundles that connect components. We'll make them now for easy installation later. You'll need 22 AWG stranded wire, JST-XH connectors (included with your M5P board), a crimping tool, wire strippers, cutters, heat shrink tubing, and a multimeter.

General Harness-Making Steps (Apply to All Below)

1. Cut wires to the listed length (add 10% extra for flexibility).
2. Strip 3-5mm of insulation from each end.
3. Crimp JST-XH terminals onto the wires (match the connector housing).
4. Insert terminals into the JST-XH housing—hear a click!
5. Label each side of the harness using by writing with a pen on a piece of heath shrinking tube and attaching to the end of the wire. (Or use a cable labeler if you have one)
6. Test: Use multimeter in continuity mode to check each wire end-to-end.

Suggestion: Look for “JST-XH Connector Crimping” on Youtube. You will find very good and quick tutorials on how to do this.

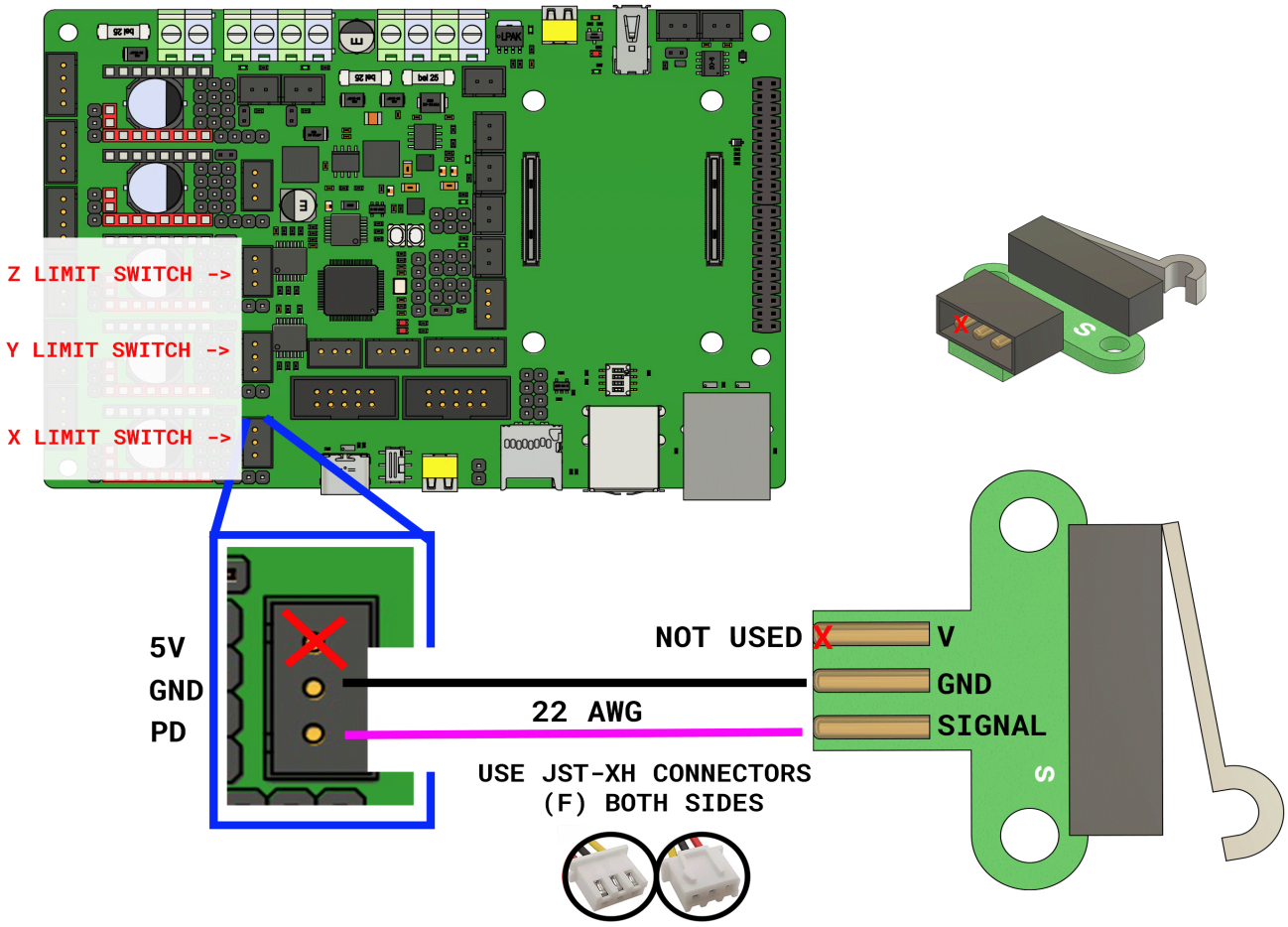
Limit Switch Harnesses (2 Wires Each: Signal & Ground)

These connect the endstops (limit switches) that tell the plotter when it's at the "home" position.
All of them: 22 AWG.

Switch	Length	Wires	Colors (Suggested)	Connector (Both Ends)
X Limit	100"	Signal, Ground	White (signal), Black (ground)	JST-XH 3-pin (use pins 1 & 2; pin 3 empty)
Y Limit	53"	Signal, Ground	White, Black	JST-XH 3-pin
Z Limit	100"	Signal, Ground	White, Black	JST-XH 3-pin

Wiring Details:

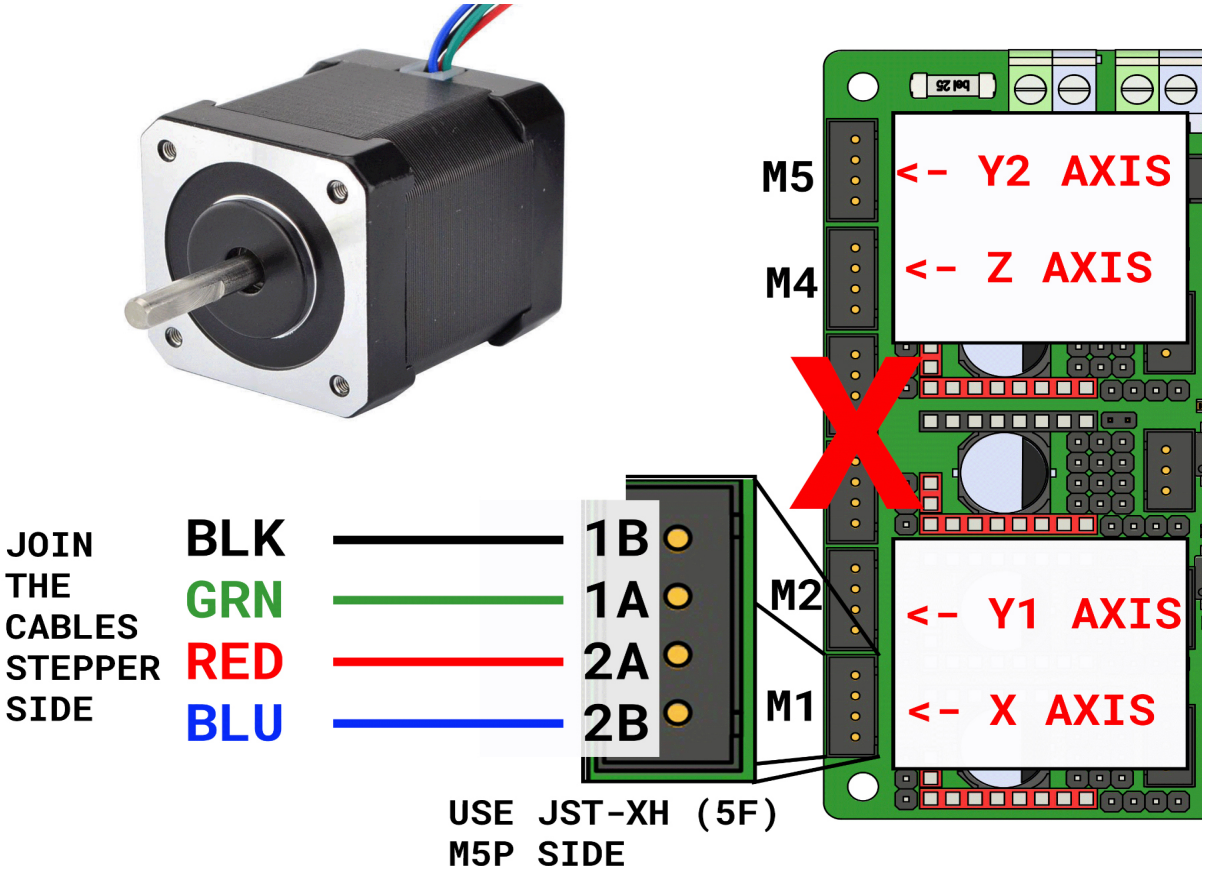
> On the switch: Connect white to the right pin (signal), black to center (ground). Left pin unused.
>
> On the M5P board end: White to PD pin (signal), black to center (ground).



Stepper Motor Harnesses (4 Wires Each)

These power the motors that move your plotter. NEMA 17 motors have 4 leads: two coils (A1/A2 and B1/B2). Wire order matters for direction— we'll test and swap if needed later. **All of them: 22 AWG.**

Motor	Length	Wires	Colors (Suggested)	Connector (Board End)	Motor End
X Stepper	100"	Coil A1/A2, B1/B2	Green/Black (A), Blue/Red (B)	JST-XH 4-pin	Direct to motor pins splice or Use 4P JWF-VSLE (Recommended)
Y1 Stepper (Left)	100"	Same	Same	JST-XH 4-pin	Same
Y2 Stepper (Right)	65"	Same	Same	JST-XH 4-pin	Same
Z Stepper	100"	Same	Same	JST-XH 4-pin	Same



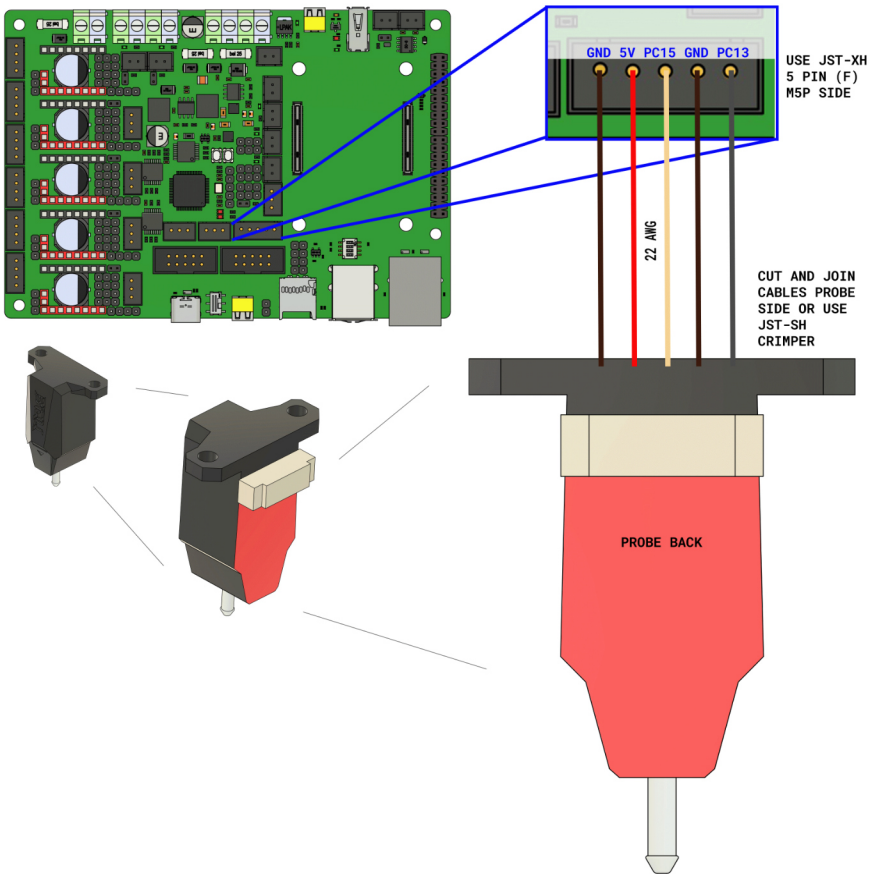
Wiring Details (Standard NEMA 17 Pinout):

> Motor pins (from left to right, facing connector): A1 (Green), A2 (Black), B1 (Blue), B2 (Red).
>
> Board end: Match the M5P motor port pins as shown in diagram
>
> Twist wires loosely to reduce interference.
>
> If your motor wires are different colors, identify coils with a multimeter (continuity between A1/A2 and B1/B2).

Probe Harness (5 Wires)

For the BIQU MicroProbe that senses surfaces. **22 AWG.**

Component	Length	Wires	Colors (Suggested)	Connector (Board End)	Probe End
MicroProbe	100"	5 leads (from probe kit)	As per probe (usually color-coded)	JST-XH 5-pin	Splice to probe cable or use 6P JWF-VSLE (Recommended)



Wiring Details:

Cut the probe's original cable and splice to your harness.

Match colors: Follow probe manual (typically: Red VIN, Black GND, White signal, etc.).

Test all 5 wires for continuity.

Crimping JWF-VSLE connectors (If Used)

These connectors are 2.0mm pitch, waterproof (IPX7), and commonly used in automotive and industrial applications for 26-22 AWG wires. Here's a step-by-step process:

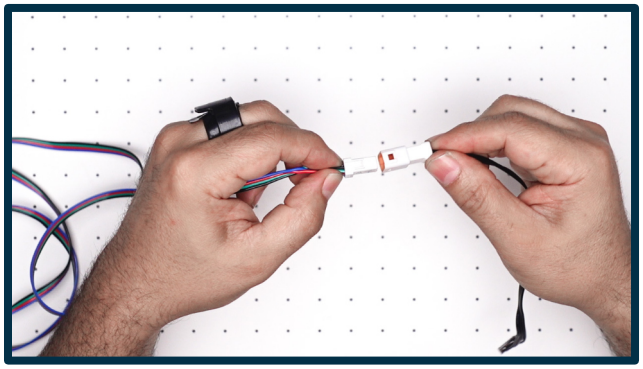
Tools and Materials Needed

> **JST JWPF-VSLE connecto**r: Includes male (e.g., 02T-JWPF-VSLE-S) and female (e.g., 02R-JWPF-VSLE-S) housings, terminals, and seals.
>
> **The specified wire on each of the harnesses**
>
> **Crimping tool**: A ratcheting crimper like the iCrimp IWS-3220M (0.03-0.52mm², 32-20 AWG) or JST WC-JWPF for precise crimping. The ones used for the JST-XH will work.
>
> **Wire stripper**: For stripping 3-4mm of insulation.

Step-by-Step Guide

1. Prepare the Wire:

> Use the side of the wire as indicated on the harness tables.
>
> Use a wire stripper to remove 3-4mm (1/8 inch) of insulation from the end, exposing the bare wire strands. Avoid damaging the wire strands.



2. Crimp the Terminal:

> JST JWPF terminals are small metal crimp contacts with two sets of wings: one for the bare wire and one for the insulation.
>
> If the terminals come in a strip, snap or cut them off individually. Trim any excess metal for a clean fit.
>
> Insert the stripped wire into the terminal: the bare wire goes into the smaller wings, and the insulation sits in the larger wings.
>
> Using a ratcheting crimper (e.g., iCrimp IWS-3220M or JST WC-JWPF), crimp the terminal. The crimper will fold both sets of wings in one motion, securing the wire and insulation. Ensure the crimp is tight but not crushing the insulation.

3. Insert the Terminal into the Connector Housing:

> Run the wire through the rubber seal and connector housing from the rear before crimping, if the seal is pre-installed in the housing.
>
> Insert the crimped terminal into the appropriate slot in the JWPF-VSLE housing (male: 02T-

JWPF-VSLE-S; female: 02R-JWPF-VSLE-S, for a 2-pin connector). Ensure the terminal clicks into place, engaging the housing's locking mechanism.

Note: Some users report female terminals may be too long to fully engage the locking clip. Double-check the terminal's fit and apply gentle force if needed, ensuring a secure connection without damaging the housing.

4. Assemble and Test:

Repeat for all wires and terminals needed (e.g., 4 or 6 pins, depending on the connector).

Mate the male and female connectors, ensuring the inter-housing lock engages for a waterproof seal.

Test the connection for continuity and secure fit. Tug gently on the wires to confirm the terminals are locked in place.

Troubleshooting

Terminal Insertion Issues: If terminals don't lock, ensure they are properly aligned and not bent. Female terminals may require extra force but avoid damaging the housing

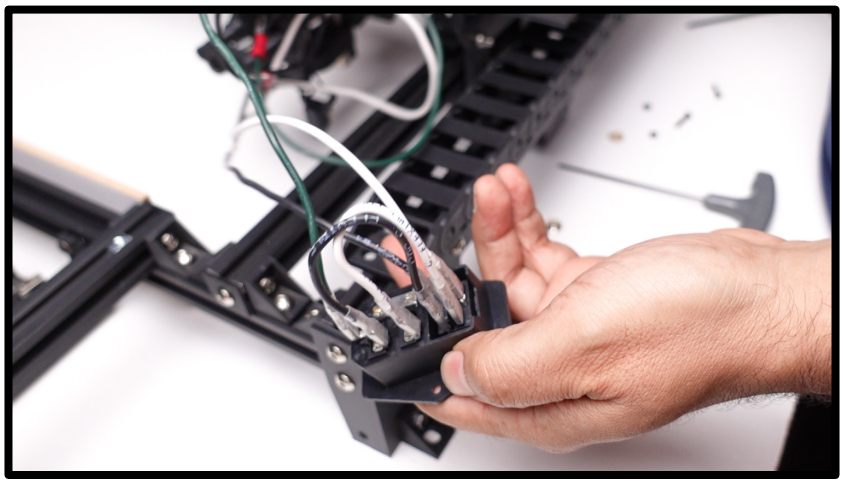
Poor Crimps: If the crimp is loose, re-crimp with a better tool or adjust pliers carefully. Test by tugging the wire gently.

Bent Pins: Inspect terminals before crimping; discard any bent ones, as they may not fit properly.

For further details, refer to JST's official JWPF connector documentation. TIP: Youtube has very good tutorials on how to do this.

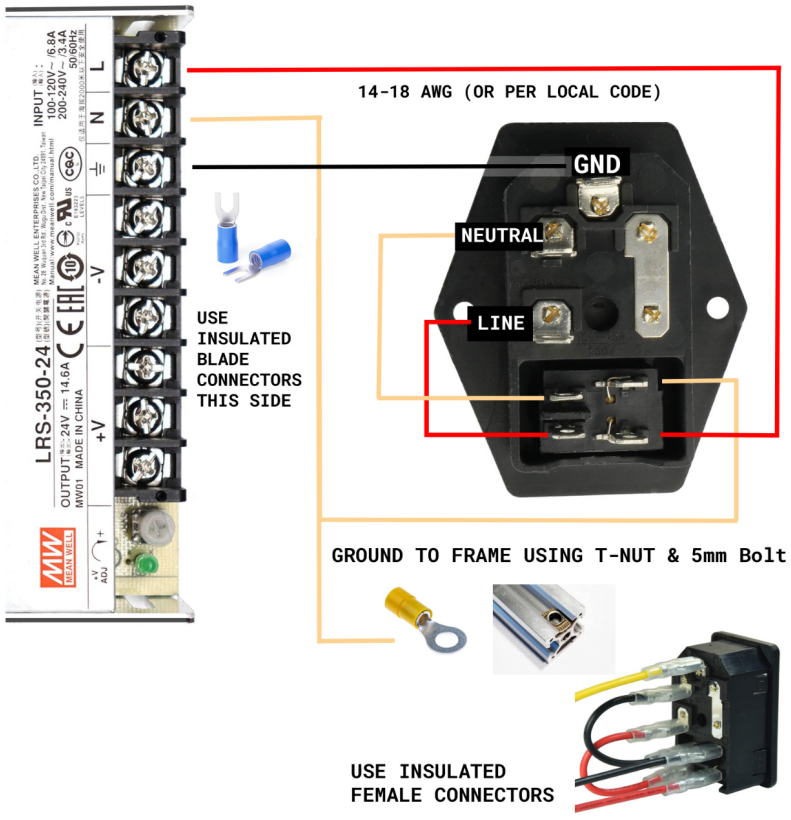
AC Power Connections (Safety First!)

Warning: AC can be dangerous. Unplug from wall until complete. Use 14 -18AWG wire for AC, 18 AWG for DC.
Highly Recommended: Watch the Wire Harness and Wiring Videos first.



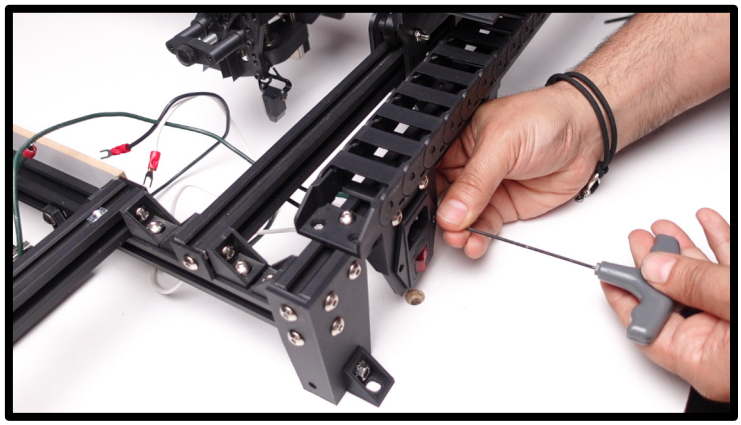
Cut and install connector to these 6 wires:

Description	Length	Wires	Colors (Suggested)	Connector (Start)	Connector (End)
Neutral to Switch AC-01A	4"	18 AWG	Black	Insulated Blade	Insulated Blade
Line to Switch AC-01A	4"	18 AWG	White	Insulated Blade	Insulated Blade
AC-01A Ground	18”	18 AWG	Green	Insulated Blade	Fork
AC-01A Neutral	18”	18 AWG	Black	Insulated Blade	Fork
AC-01A Line	18”	18 AWG	White	Insulated Blade	Fork
Frame to Ground	8”	18 AWG	Yellow or Green	Ring Terminal	Fork



Wire and installing the Power Socket

1. Make sure you cut and install the connectors on all the cables needed.
2. Mount AC-01A socket in panel using bracket #0018.
3. Check 10A fuse is installed.
4. **Verify ground** connection point.



Wiring the Power Supply

Connect the AC-01 AC Input Side (Line Voltage) to the power supply:

1. **Route the 3 Cables** Go through the bottom of the extrusions to get to the power supply. You will bundle these with the harnesses later.
2. **Connect to power supply using fork connectors**:
    - `L (Line/Hot) > L terminal`
    - `N (Neutral) > N terminal`
    - `Ground symbol > Ground terminal`
    - `Ground symbol > Top T-Nut on frame. Tighten the bolt so it removes paint and gets contact to the frame`
3. **Tighten securely** - loose connections cause fires! DO NOT CONNECT POWER YET.
4. **Test for continuity** - Use multi meter, make sure there are no shorts!

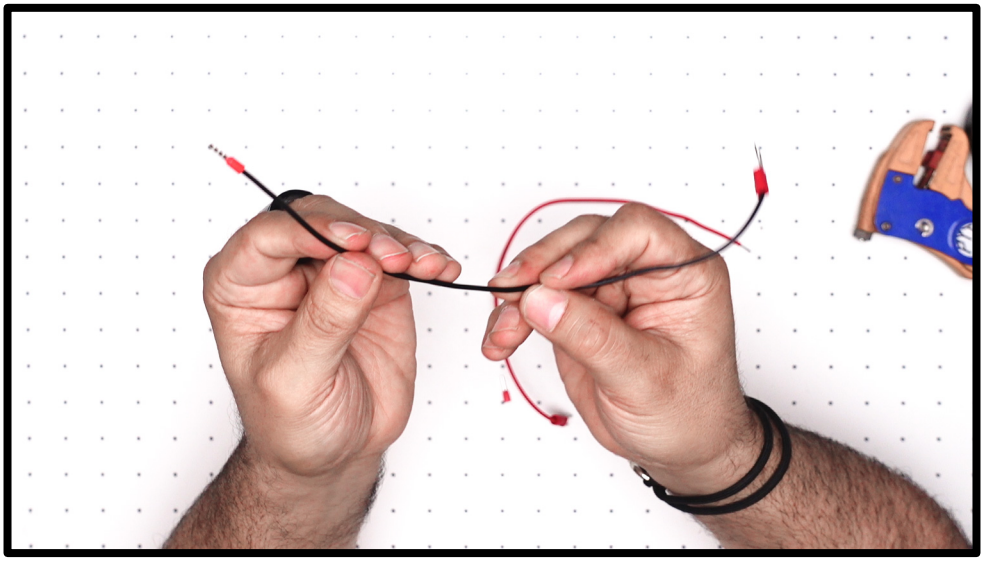
Connect the Power Supply to the M5P.

Cut and install connectors to the following wires:

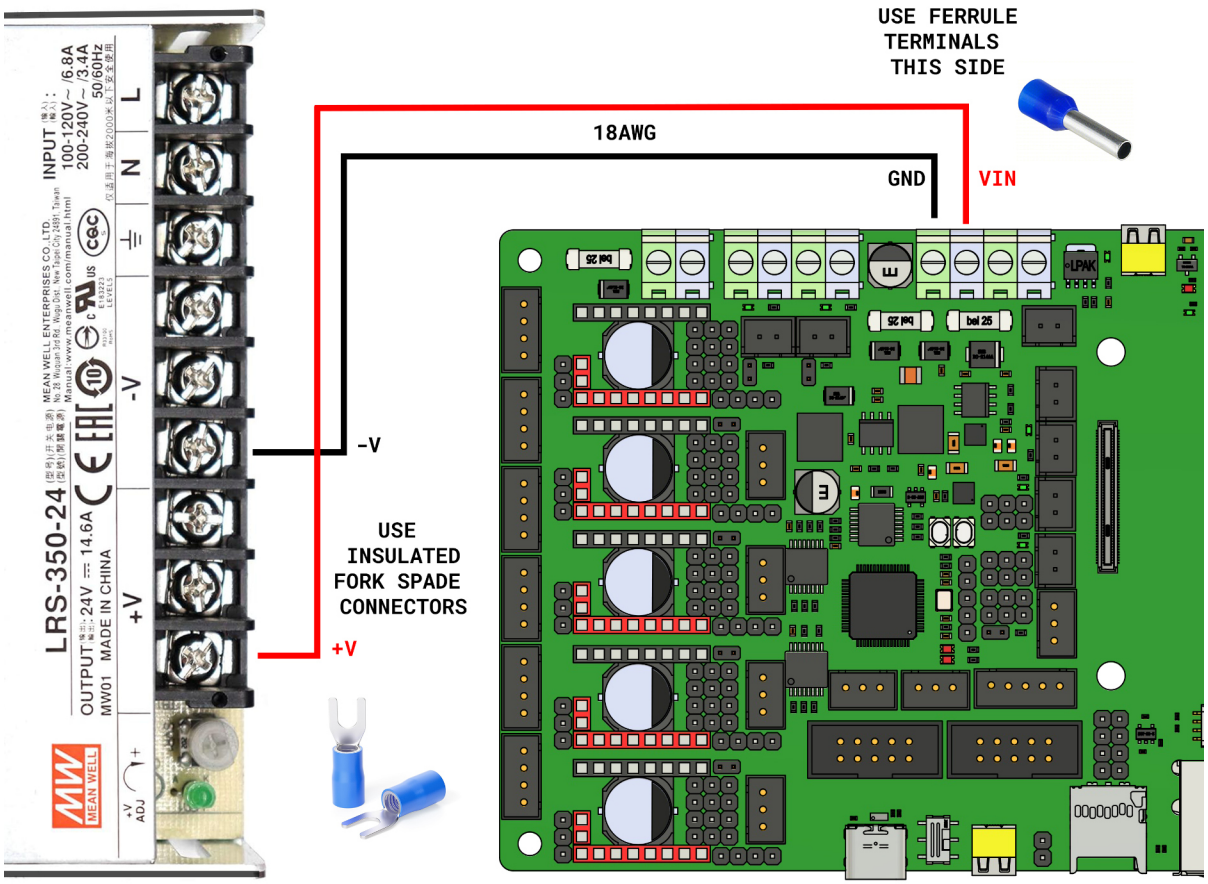
Wire the DC Output Side (24V):

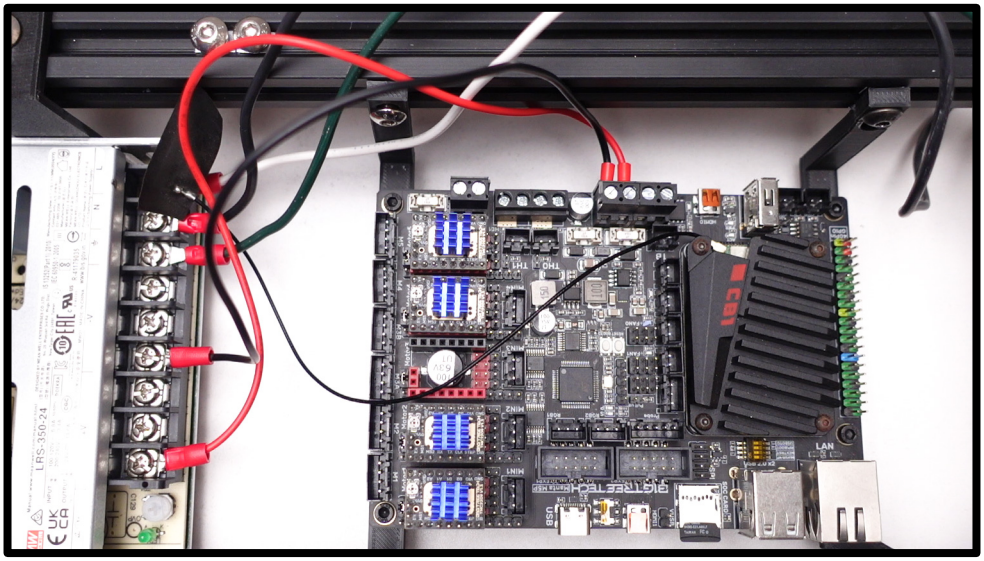
Description	Length	Wires	Colors (Suggested)	Connector (Start)	Connector (End)
Power Supply 24V (-) to M5P GND	9"	18 AWG	Black	Fork	Ferrule Terminal
Power Supply 24V (+) to M5P VIN	9"	18 AWG	Red	Fork	Ferrule Terminal

- **Connect to power supply**:
    - `V+ > +24V terminal`



    - `V- > -24V/GND terminal`
- **Connect to M5P**:
    - `V+ > VIN+ terminal`
    - `V- > GND terminal`
- **Tighten securely** - loose connections cause fires!
- **Test for continuity** - Use multi meter, make sure there are no shorts!


USE FERRULE
TERMINALS
THIS SIDE
18AWG
GND
VIN
-V
USE
INSULATED
FORK SPADE
CONNECTORS
+V
LRS-350-24
OUTPUT 24V 14.6A
MADE IN CHINA
MEAN WELL
-V
+V
L
N

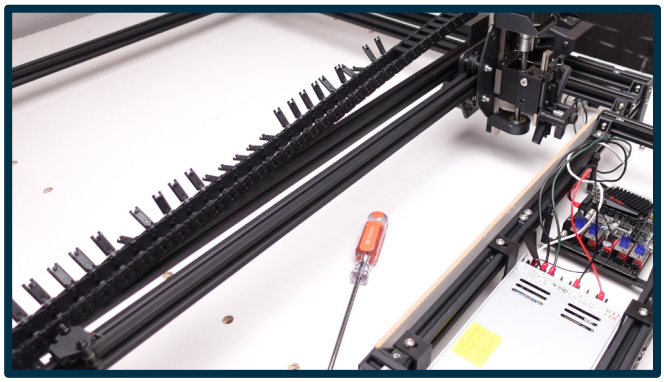


NOTES

Routing and Installing Harnesses

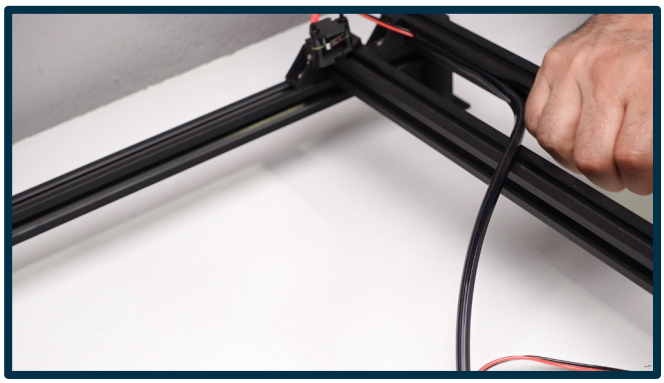
Now we'll route the harnesses through the frame. Use zip ties for neatness—avoid tight bends.
TIP: Review the video on wiring for detailed instructions.

Preparation



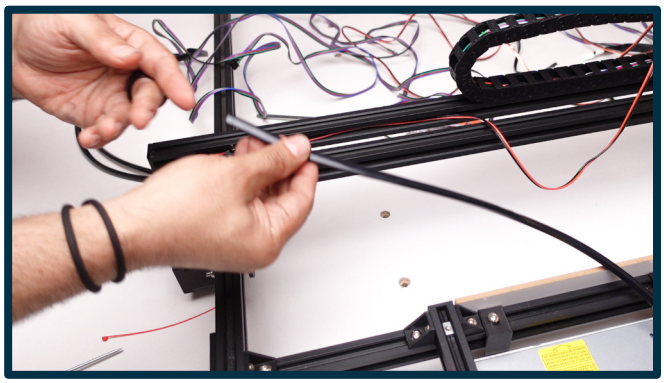
1. Unfasten the bottom side of the drag chains on both the X & Y axis.
2. Unclip all the drag chain Crossbars using a small flat screws (x & y)
3. Make one harness bundles: **Bundle A:** Z, X, Probe and Limit Z harnesses.
4. Leave Y1, Y2 and Limit X & Y harnesses separate.

Y-Axis Limit Switch Routing



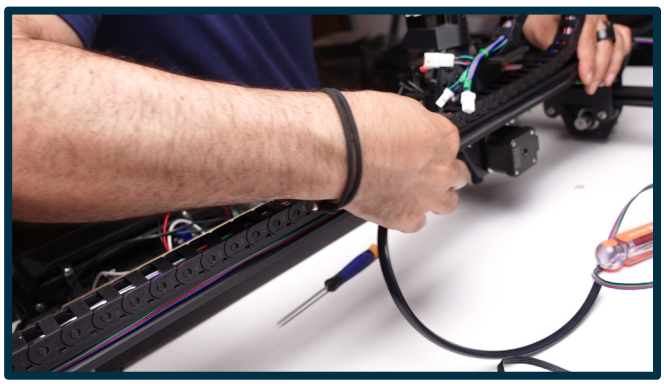
1. Start at Y limit switch.
2. Route through the **Y Chain Extrusion Support Back Slot**. Cover with Profile Flat Seal (Viewing the video is highly recommended)
3. Leave the other end lead to be routed with other bundles

X-Axis Limit Switch Routing



1. Start at X limit switch.
2. Route through the **X Chain Extrusion Support Front Slot**. Cover with Profile Flat Seal
3. Leave the other end lead to be routed with other bundles

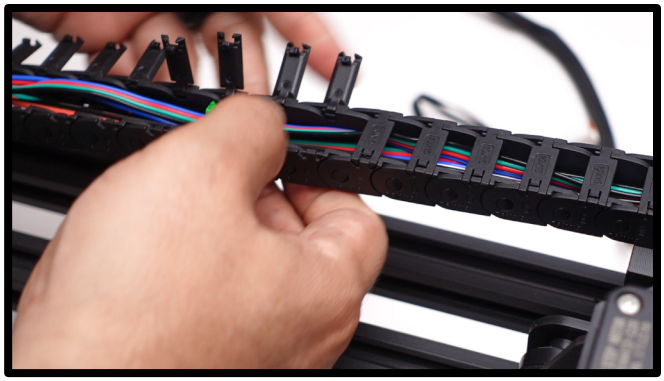
Y1 Stepper Motor Routing



1. Start at Y1 Stepper motor. Here is where having the **JWPF-VSLE** connector is convenient.
2. Route through the **X Chain Extrusion Support Back Slot**. Cover with Profile Flat Seal
3. Leave the other end lead to be routed with other bundles

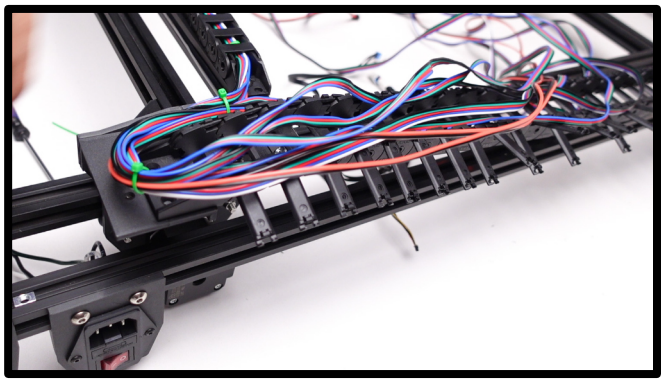
Bundle A Routing (Probe, Z Limit Switch, Z & X Stepper)

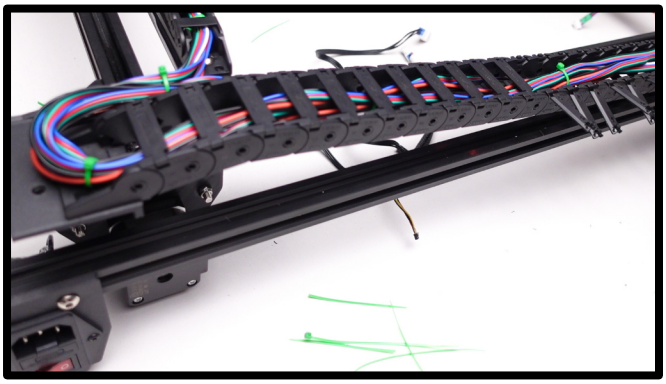
1. Start at the Y drag chain end.
2. Feed/Lay all harnesses through large Y drag chain (R28 15x30mm). Tie the harnesses every 8 inch approximately. Close the crossbars.
3. Re position Y drag chain and fasten. Leave cables for now to route with Bundle A.



Bundle Routing (All Harnesses)

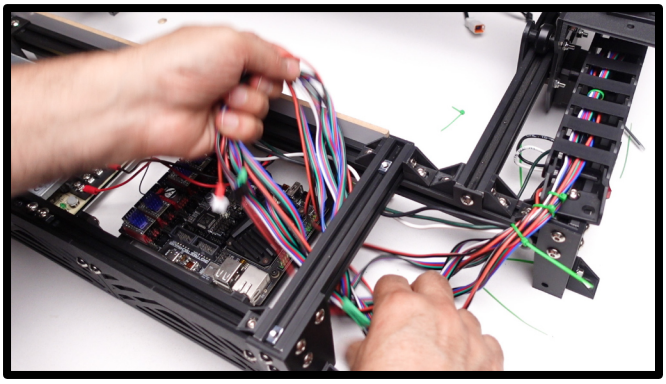
1. Connect the Y2 harness to the stepper motor and route to join with other cables.
2. Join the Bundle A, Y1, Y2 & X Limit Switches at the Drag Chains intersection.
3. Feed/lay harnesses through large Y drag chain (R28 15x30mm).
4. Tie the complete bundle every 8 inches approximately. Close the crossbars, and position and fix in place the drag chain to its original position

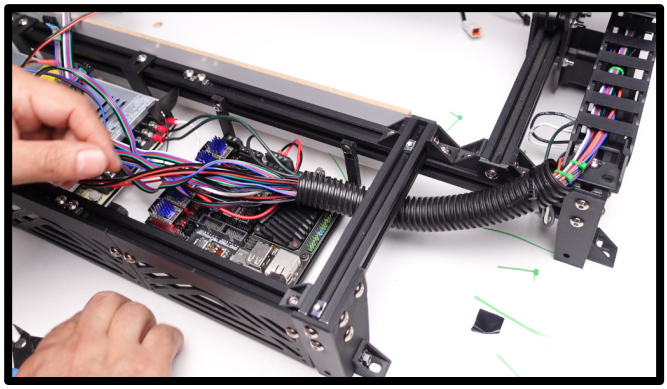


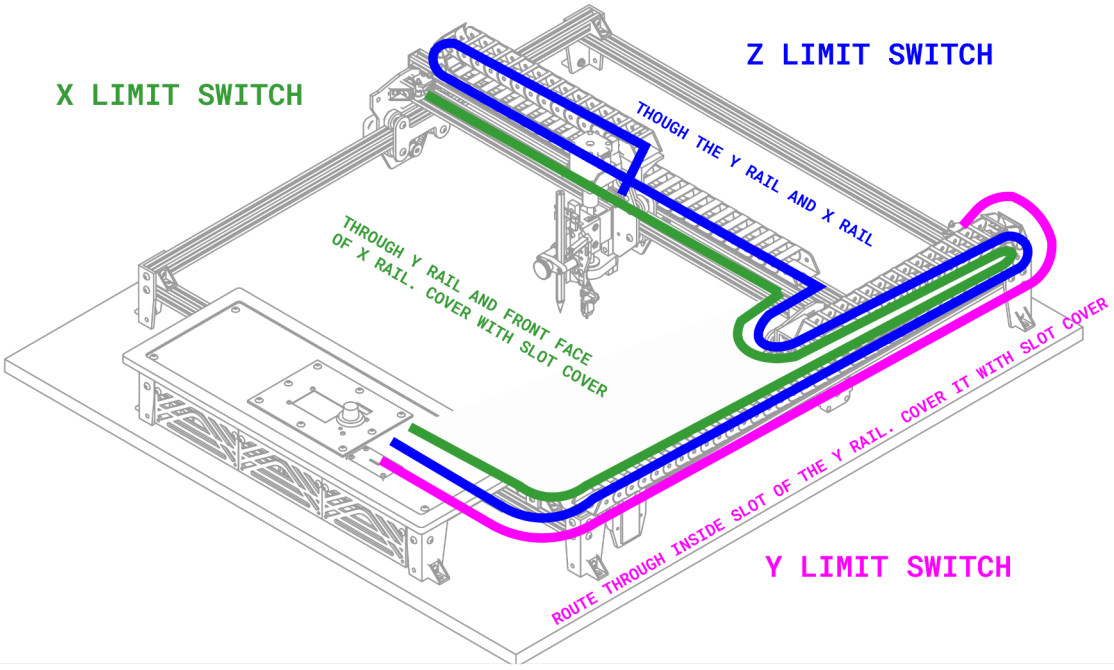


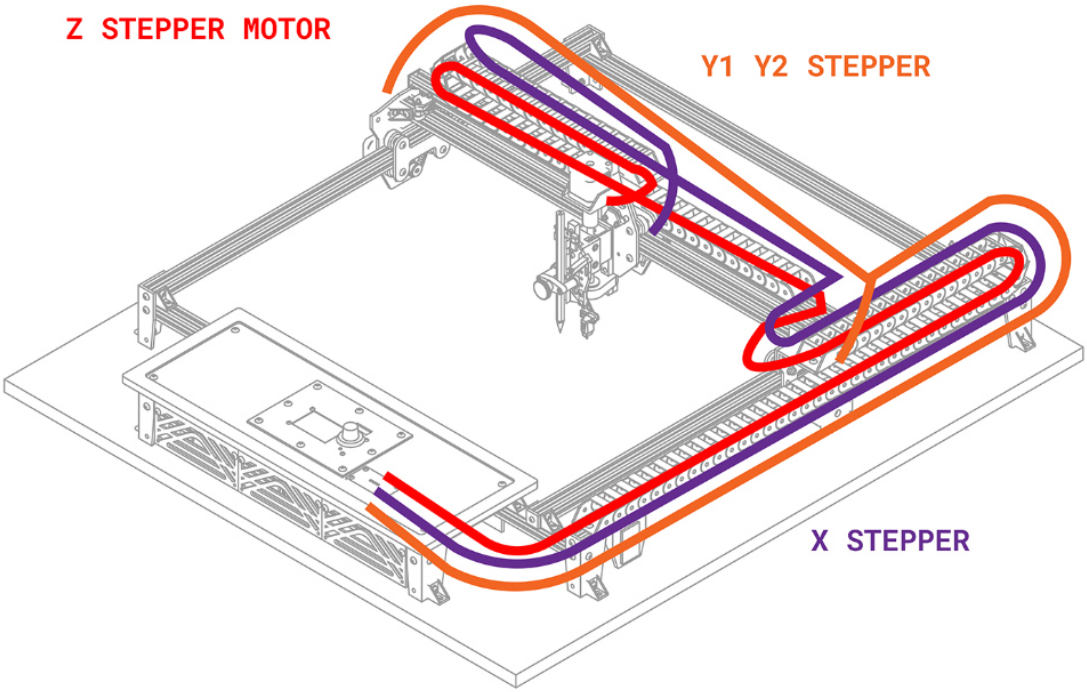
Connect to the M5P and Cable Management

1. Bundle the AC Cables with the wire harnesses.
2. Use the Split Wire Looming Tubing and ties to route the cables around and back to the Board. Make sure there is no cable touching the heath sink or any component. Use ties and any other method to achieve this. Make sure you also fasten the Power Supply to M5P cables.
3. Use diagrams above to connect the cables to the M5P.





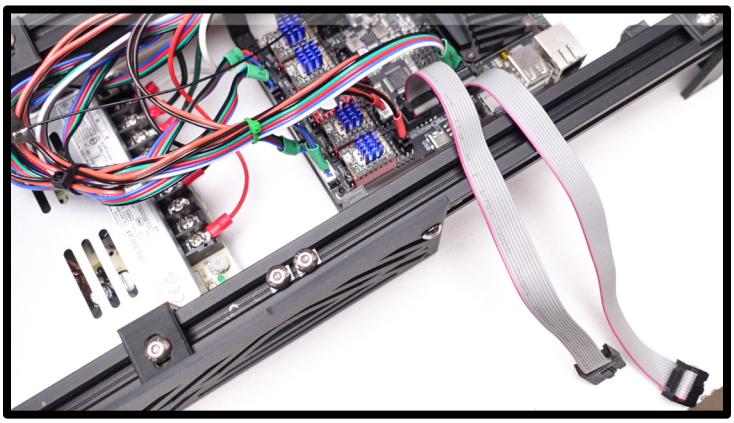

X LIMIT SWITCH
Z LIMIT SWITCH
THOUGH THE Y RAIL AND X RAIL
THROUGH Y RAIL AND FRONT FACE OF X RAIL. COVER WITH SLOT COVER
ROUTE THROUGH INSIDE SLOT OF THE Y RAIL. COVER IT WITH SLOT COVER
Y LIMIT SWITCH


Z STEPPER MOTOR
Y1 Y2 STEPPER
X STEPPER

Install the Control Panel Top

Display Connections

Mini12864 LCD Screen:



> Connect ribbon cable to EXP1 and EXP2 ports to the M5P.
>
> Route cable away from power wires.

USB Connections

> **Seeeduino Xiao**: USB-C to USB-A M5P USB port.
>
> **SD CARD READER NOT SUPPORTED ON**
>
> **THIS VERSION**

Grounding Requirements

Critical grounding points:

> Power supply chassis > control panel
>
> Control panel > main frame
>
> Use star grounding pattern
>
> Verify continuity between all ground points

Pre-Power Checklist

Before connecting AC power:

> All connections tight and secure
>
> No exposed conductors
>
> Ferrule terminals properly crimped
>
> Correct wire gauges used
>
> Fuse installed in AC socket
>
> Ground continuity verified
>
> No shorts between L, N, and Ground
>
> Control panel closed and secured

Tie up: After wiring, tidy things up by tying the cables in place. Use Split Wire Loom from the control panel to the Y Rail Train. Ties for everything else. If you have expanded sleeving, use where appropriate (on the probe wires specially)

Great job—you're wired up! If issues arise, check connections or refer to troubleshooting in Section 10.

Expanding the plotter size

If you want to make a bigger printing area for your plotter, you can do this using the table below. You can add inches, or use the guide to upgrade to a set number. Take care that you have the space to mount the plotter if you expanded, it takes a larger space to mount the machine. We do not recommend going larger than 40” x 40”

This table applies to the Harnesses:

Expand to	Apply to Harness	Length to Add (mm)	Length To Add (inches)	Notes
Per inch	ALL	26 mm	1 in	You will also need to add to **the wire harnesses, VIEW CUTTING SECTION FOR Extrusion Covers and update the printer.cfg file in Klipper** to account for new size. Additionally, you will need to add same amount to the **Y and X timing belts. Buy additional drag chain to match sizes also**
24 x 24	Same	102 mm	4 in	Same
30 x 30	Same	254 mm	10 in	Same
40 x 40	Same	508 mm	20 in	Same

7. Controller & Firmware Setup

This section guides you through programming the **Seeeduino Xiao** (for OLED display communication) and configuring the **BIGTREETECH Manta M5P** mainboard with CB1 compute module (for running Klipper firmware). We'll use official tools and resources to keep things straightforward. Estimated time: 1-2 hours.

Important Safety Notes:

> Work on a static-free surface to avoid damaging components.
>
> Double-check all connections before powering on.
>
> If you're new to firmware flashing, practice on non-critical devices first.
>
> Backup any existing data on your computer or SD cards.

Required Materials:

> Computer (Windows, macOS, or Linux)
>
> Micro-USB cable (for Seeeduino Xiao)
>
> MicroSD card **(at least 8GB**, Class 10 or higher) and card reader
>
> SD card **(at least 8GB**, Class 10 or higher) and card reader or Micro SD with adapter, for firmware compilation
>
> Internet connection for downloads

Programming the Seeeduino Xiao

The Seeeduino Xiao handles communication with the OLED display via USB. We'll use Arduino IDE to upload the custom sketch (`ariav1_Xiao_oled.ino`). Download this sketch from the AriaV1 files package (available at CodeAgents.com/AriaV1 or your provided download link).

1. Install Arduino IDE:

Download from the official site: https://www.arduino.cc/en/software (free, ~200MB).

Install and launch the IDE.

2. Add Seeed SAMD Board Support:

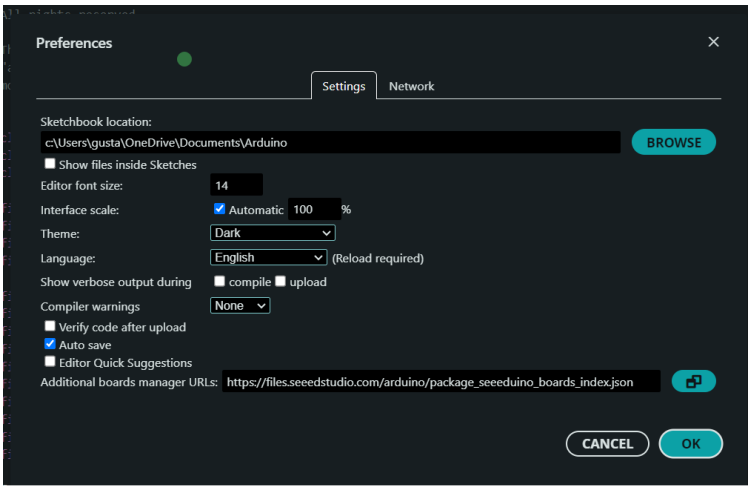
In Arduino IDE, go to **File > Preferences**.

In "Additional Boards Manager URLs," add: https://files.seeedstudio.com/arduino/package_seeeduino_boards_index.json.

Click OK.

Go to **Tools > Board > Boards Manager**.

Search for "Seeed SAMD" and install "Seeed SAMD Boards" (by Seeed Studio).



3. Connect the Seeeduino Xiao:

Plug the Xiao into your computer via Micro-USB.

In Arduino IDE, select **Tools > Board > Seeed SAMD Boards > Seeed XIAO SAMD21**.

Select the correct port under **Tools > Port** (e.g., COM3 on Windows; look for "Seeed XIAO" in the list).

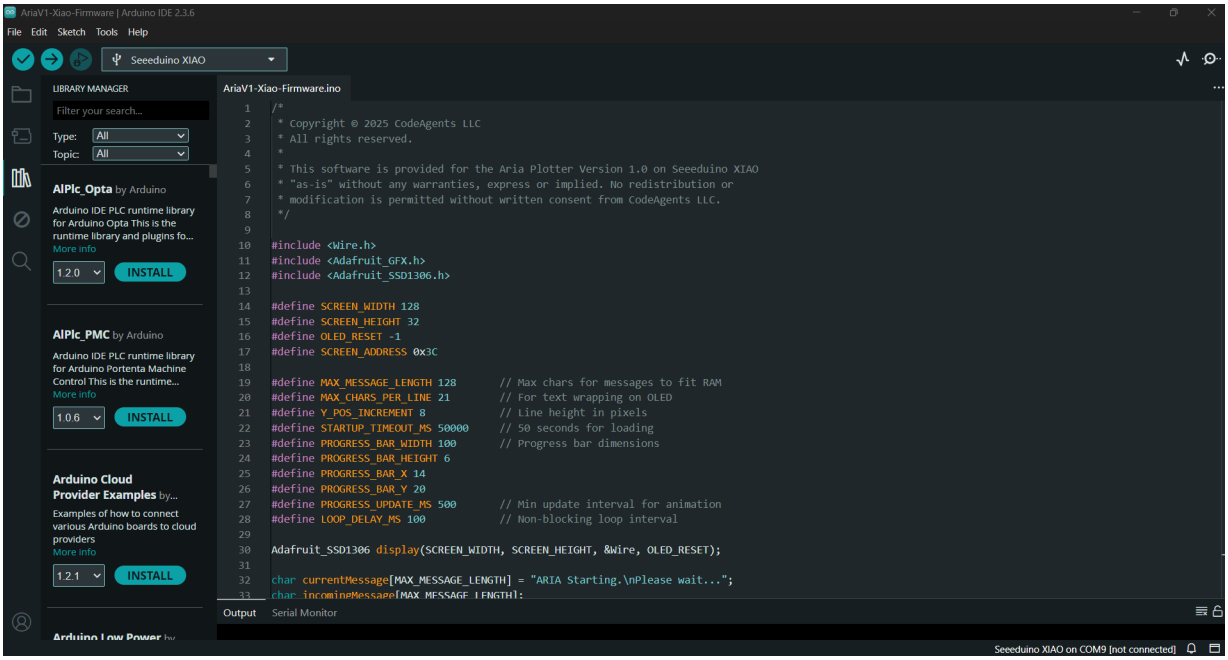
4. Open and Upload the Sketch:

Open the ariav1_oled.ino file in Arduino IDE.

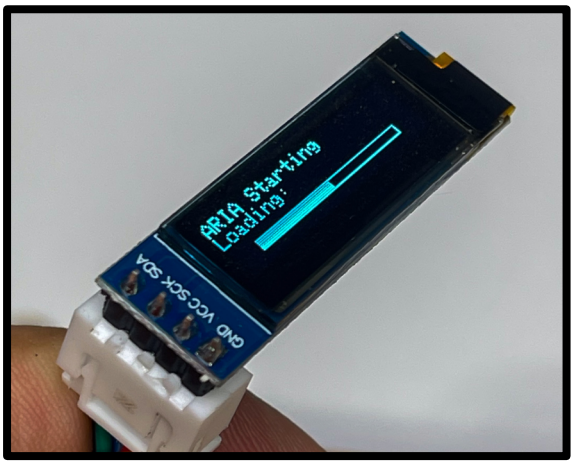
Click **Verify** (checkmark icon) to compile – fix any errors if prompted.

Click **Upload** (right arrow icon). The board will flash; wait for "Done uploading."

If it fails (e.g., port not found), double-tap the reset button on the Xiao to enter bootloader mode (LED fades in/out), then retry.



5. Test the Upload:



The Xiao's onboard LED should behave as per the sketch. It will display the loading Aria message with the progress bat running.

Disconnect and set aside – we'll connect it later in wiring.

Troubleshooting:

No port detected? Install drivers from Seeed: https://wiki.seeedstudio.com/XIAO_SAMD21/.

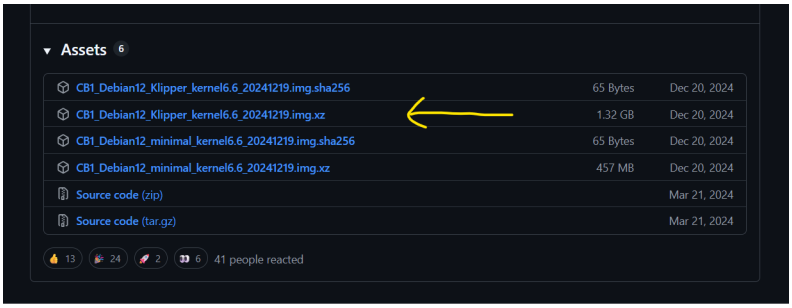
Upload error? Ensure the board is in bootloader mode (double-tap reset).

Reference: Official Seeed guide – https://wiki.seeedstudio.com/XIAO_SAMD21/.

Configuring the BIGTREETECH Manta M5P

The Manta M5P uses Klipper firmware with the CB1 module. We'll flash a pre-built OS image, set up networking, compile MCU firmware, and configure for AriaV1.

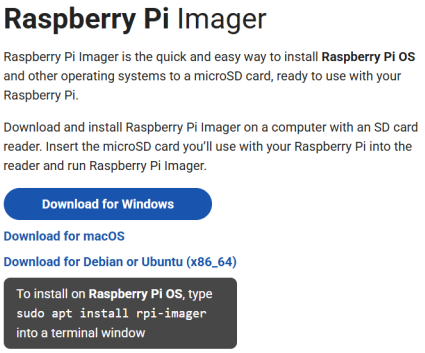
1. Download Required Files:

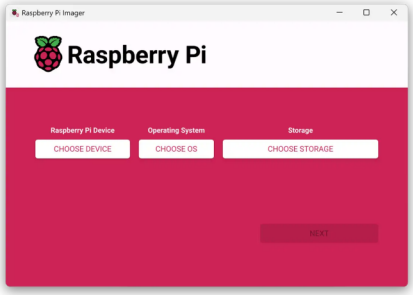


OS Image: From BIGTREETECH GitHub (https://github.com/bigtreetech/CB1/releases). Download the latest "Klipper Version using CB1" (e.g., CB1-Debian11-Klipper-xxxx.img.xz).

AriaV1 Config Files: From your files package – printer.cfg, ariav1_macros.cfg, ariav1_macros_screen.cfg, and oled_communications.py.

Tools: Raspberry Pi Imager (**https://www.raspberrypi.com/software/**) or balenaEtcher (**https://www.balena.io/etcher/**).





2. Burn the OS to SD Card:

Insert MicroSD into your computer.

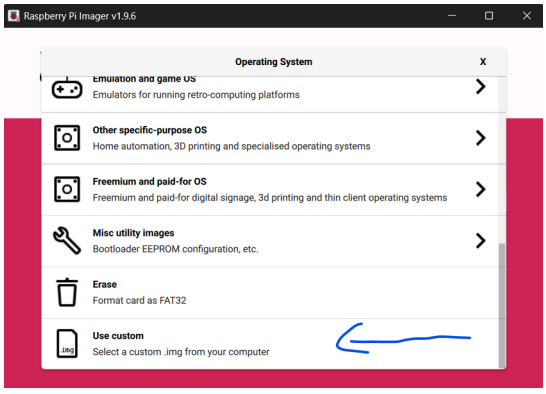
Open Raspberry Pi Imager.

Choose OS: Select "Use custom" and pick the downloaded .img.xz file.

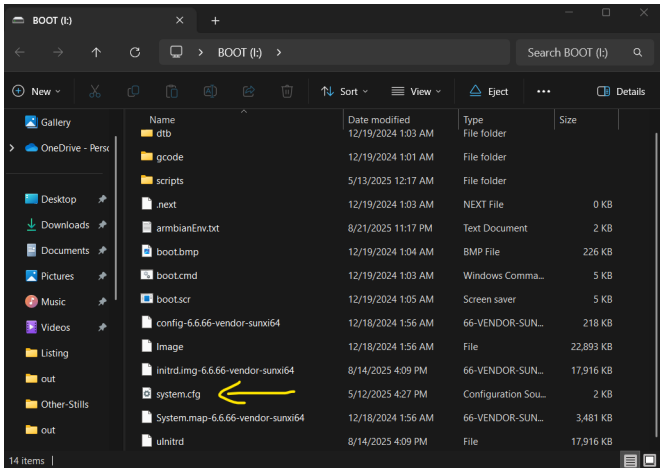
Choose Storage: Select your MicroSD card.

Click "Write" (this formats the card – back up data first).

Wait for completion (5-10 minutes).



3. Set Up WiFi Credentials (Optional – Skip for Ethernet):



We need to connect the plotter to your network in order to remote manage and configure. To do this:

Eject and re-insert the SD card.

Open the boot partition (FAT32, labeled "BOOT" or similar).

- Edit **system.cfg** (use Notepad or TextEdit):
- Change the host name to : **ARIA-ART-PLOTTER**
- Replace WIFI-SSID="WIFI-SSID" with your WiFi name (e.g., WIFI-SSID="MyNetwork").

```
#---------------------------------------#
check_interval=5        # Cycle to detect whether wifi is connected, time 5s

eth=end0        # Ethernet card device number
wlan=wlan0      # Wireless NIC device number

hostname="ARIA-ART-PLOTTER"

########################################
# System time zone setting, default Time zone: Etc/UTC (UTC, +0000)
# More settable time zones can be viewed by running the command: timedatectl list-timezones
#TimeZone="Asia/Shanghai"

########################################
## klipperScreen Target Screen
## ks_src: "HDMI-1", "TFT35"
#ks_src="HDMI-1"

## ks_angle: Rotation angle
##       normal: 0; inverted: 180;
##       left: 90; right: 270;
#ks_angle="normal"

########################################
## wifi name
WIFI_SSID=
## wifi password
WIFI_PASSWD=

########################################
# BTT-PAD7 (ON/OFF)
BTT_PAD7="OFF"
# touch vibration effects
TOUCH_VIBRATION="OFF"
# touch sound effects
TOUCH_SOUND="OFF"
# Automatic brightness adjustment
```

- Replace PASSWORD="PASSWORD" with your WiFi password.

Save and eject safely.

4. Initial Boot and SSH Connection:

Insert SD card into Manta M5P's CB1 slot.

Power on the board (connect 24V PSU – red LED should light).

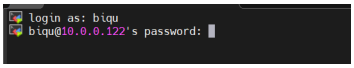
Wait 1-2 minutes for boot.

Find the IP: Check your router's device list (look for "BTT-CB1" or similar). Or use **Angry IP Scanner (https://angryip.org/)** to scan your network.

Install MobaXterm **(https://mobaxterm.mobatek.net/)** for SSH.

In MobaXterm: New Session > SSH > Remote host: [IP address] > OK.

Login: Username **biqu**, Password **biqu**.

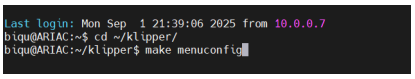


5. Compile MCU Firmware:

In SSH terminal, run:

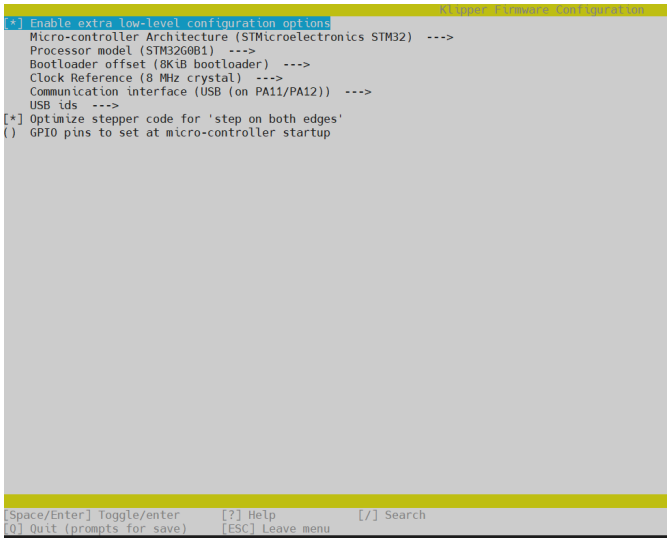
cd ~/klipper/

make menuconfig



Set options (use arrow keys/space to select):

Enable extra low-level configuration options: [*]



- Micro-controller Architecture: **STM32**
- Processor model: **STM32G0B1**
- Bootloader offset: **8KiB bootloader**
- Clock Reference: **8 MHz crystal**
- Communication interface: **USB (on PA11/PA12)**

Press Q to quit, save when prompted.

Run: make (compiles firmware – takes 1-5 minutes).

Download **klipper.bin** from **~/klipper/out/** using MobaXterm's file browser.

6. Flash MCU Firmware:

Rename **klipper.bin** to **firmware.bin**.

Copy to a new **blank** MicroSD (FAT32 formatted).

Insert into Manta M5P's MCU SD slot (not CB1). NOTE: **The one on the bottom of the M5P**, not the one you are using for the firmware

Power cycle or reset – firmware flashes automatically (**file renames to FIRMWARE.CUR on success**).

We will need the ID's for the CB1 and the Xiao in step 8. To get them login using SSH again and run **ls /dev/serial/by-id/**

– **Note the IDs** (e.g., usb-Klipper_stm32g0b1xx_...). Copy to notepad, or write down.

7. Upload the oled_display.py:

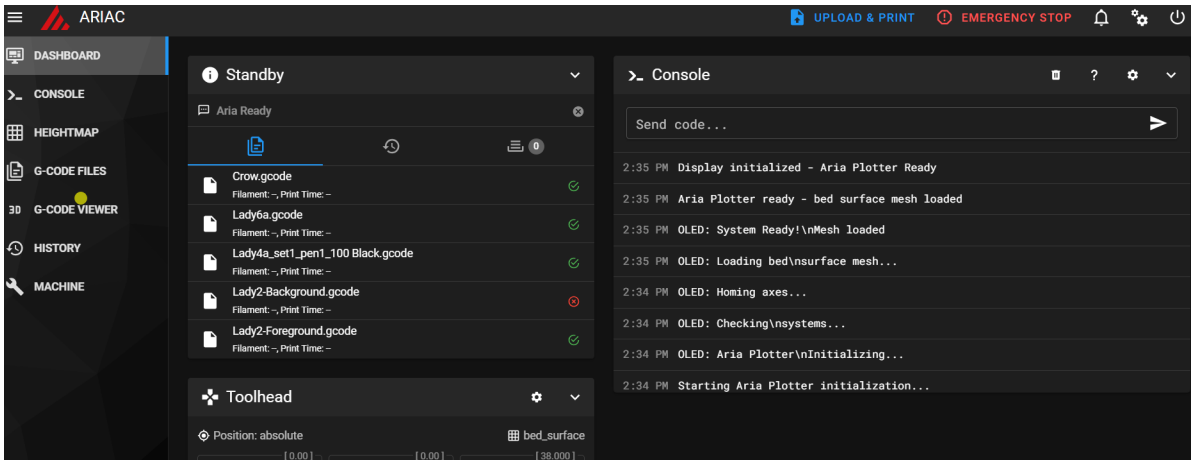
In MobaXterm: New Session > SSH > Remote host: [IP address] > OK.

Login: using: **biqu** / **biqu**

Upload the **oled_display.py** to **~/klipper/klippy/extras/** folder using MobaXterm

8. Configure Klipper:

In a browser in your computer,, go to [IP address] (e.g., 192.168.x.x) – access Fluidd/ Mainsail interface.



Go to Machine Section. Select the root drop-down: config. Upload to "Configuration Files": **printer.cfg** (replace existing), **ariav1_macros.cfg**, **ariav1_macros_screen.cfg**,

Edit printer.cfg:

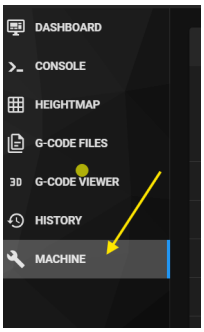
```
# MCU Configuration MANTA M5P CB1
[mcu]
serial: /dev/serial/by-id/usb-Klipper_stm32g0b1xx_1B00530011504D5930363820-if00

# OLED Display configuration
[oled_display]
serial_port: /dev/serial/by-id/usb-Seeed_Seeed_XIAO_M0_E85C0F8B503058414E2E3120FF0F0916-if00
baud_rate: 115200
timeout: 1.0
```

- Update MCU serial: serial: /dev/serial/by-id/[your ID from step 6]
- Update Xiao USB: Find and set the serial port for OLED (run ls /dev/serial/by-id/ again after connecting Xiao via USB-A).

Restart Klipper via interface.

9. Update Klipper to Latest Version:



Go to Machine section on MainSail

Update All Components in the Update Manager. NOTE: Follow any instructions that Klipper firmware will require. You may have to re-compile the firmware described in section 5 again if required

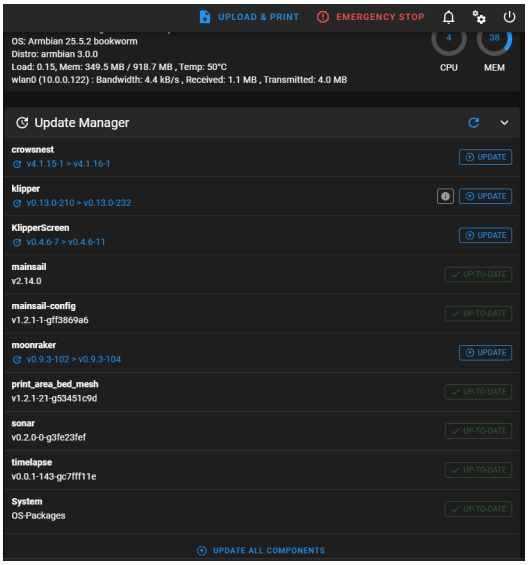
Troubleshooting:

No IP? Use Ethernet or check WiFi config.

Use Reference Manuals: Provider PDFs (Manta M5P & CB1 User Manuals) have information for advanced debugging.

OLED not displaying information? Make sure you uploaded the oled_display.py in step 7

Support: Check BIGTREETECH forums or AriaV1 community for help.



If issues persist, power off and re-check connections.

8. First Power-Up and Initial Tests

Congratulations on completing the mechanical and electrical assembly! This section guides you through safely powering on your Aria Art Plotter for the first time. Follow these steps carefully to verify basic functionality before moving to calibration in Section 9.

Safety Checklist Before Powering On

Before connecting power, run through this quick checklist to minimize risks:

> **Inspect Wiring:** Double-check all connections for loose wires, shorts, or exposed conductors. Ensure the AC power socket fuse is installed (10A rating) and the power supply is securely mounted.
>
> **Clear the Area:** Remove any tools, debris, or obstructions from the plotter's moving parts. Keep hands and objects away from the gantry, belts, and Z-axis.
>
> **Grounding and Environment:** Confirm the plotter is on a stable, dry surface. Use a grounded outlet to prevent electrical hazards. Avoid damp or dusty areas.
>
> **Emergency Ready:** Have the power switch accessible for quick shutdown. Keep a fire extinguisher nearby, and ensure you're wearing PPE (gloves, safety glasses).
>
> **Firmware Confirmation:** Verify that Klipper firmware was successfully installed and configured in Section 5, with the MicroSD card inserted in the extension cable.
>
> **No Tool Installed:** Ensure no drawing tool is loaded in the pen holder to avoid accidental marks or damage during initial movement.

If anything seems off, revisit Section 7 for wiring or Section 6 for mechanical checks.

Step-by-Step Power-On Sequence

> 1. **Connect the Power Cord:** Plug the AC cord into the rear socket on the control panel. Connect the other end to a grounded wall outlet. Do not flip the power switch yet.
> 2. **Initial Boot-Up:** Flip the power switch to ON. The OLED display should start initially.
> 3. **Monitor the Displays:**
>
> - The 0.91" OLED I2C display will cycle through startup messages: "Aria Plotter Initializing...", "Checking systems...", "Homing axes...", "Loading bed surface mesh...", and finally "System Ready! Mesh loaded".
> - **After 2 minutes approximately**, The Mini12864 LCD will show a boot sequence, transitioning to an amber/orange backlight (RGB LEDs indicating ready state)

Automatic Initialization: The system runs a delayed startup sequence:

- Axes home automatically (you'll hear motors moving to their endstops).
- The bed surface mesh loads by default.
- If successful, the LCD shows "Aria Ready" and the main menu appears.

Verify Basic Operation: From the LCD menu (using the encoder knob):

- Navigate to "Control" > "Home All" to confirm smooth homing without grinding or skipping.
- Check "Tool Setup" > "Pen Up" and "Pen Down" (without a tool installed) to ensure Z-axis movement.

Listen for unusual noises; motors should run quietly thanks to TMC2209 drivers.

The entire sequence should take 2-4 minutes. If the plotter doesn't respond, immediately power off and check troubleshooting in Section 10.

What to Watch For on First Boot

Normal Indicators:

- Smooth, quiet motor homing (X, Y, Z axes move to endstops without hesitation).
- Displays show clear, progressing messages without freezing.
- No unusual smells, sparks, or excessive heat from components.

Warning Signs:

- Error messages on the LCD/OLED (e.g., "No tool reference set!"—normal if no tool is loaded yet).
- Grinding noises: May indicate belt tension issues; power off and adjust per Section 6.
- No display illumination: Check power supply voltage (should be 24V) and connections.
- Failed homing: Endstops might need adjustment; refer to Section 9 for calibration.

Success Confirmation: Once ready, the menu shows options like "Print," "Tool," and "Calibrate." You're now set for tool loading and testing in the next section.

If everything checks out, proceed to Section 9 for calibration. If issues arise, note any error messages for easier troubleshooting.

9. Calibration for Perfect Results

Once your Aria Art Plotter is fully assembled and powered on (as covered in Section 8), calibration ensures accurate drawing on various surfaces. This section guides you through the process step by step. Always work in a well-lit area with a stable surface, and ensure the plotter is powered off before making physical changes.

Detailed Calibration Process

Calibration involves creating a bed mesh for surface compensation, setting up the tool, and selecting the appropriate mesh type (bed surface for direct drawing or canvas pressure for mounted artwork).

1. **Prepare the Plotter**:

   Power on the plotter and confirm the LCD displays "Aria Ready" (from the startup sequence).

   Clear the bed of any debris. For bed surface calibration, ensure no canvas is mounted. For canvas work, mount your artwork securely—the canvas pressure mesh is pre-configured and ready to use out of the box.

   Home all axes: From the LCD menu, go to **Main > Control > Home All**. This automatically loads the selected mesh.

2. **Calibrate the Bed Surface Mesh**:

   This creates a compensation profile for the bare bed (ideal for paper or flat media).

   From the LCD: **Main > Calibrate > Bed Surface**.

   The plotter will probe multiple points (9x9 grid) using the MicroProbe. Stay clear during probing— it takes 5–10 minutes.

   Once complete, the mesh saves as "bed_surface". The LCD shows "Bed calibration complete!".

   Tip: If errors occur (e.g., probe failure), check probe deployment and clean the bed. Retry after homing.

3. **Tool Calibration**:

   Load the tool: **Main > Tool Setup > Load Tool**. The plotter moves to bed center (Z=27.5mm). Insert your tool (e.g., pen or pencil) with the 9mm puck for reference height.

   Confirm: **Main > Tool Setup > Tool Loaded**. This sets the tool reference Z and defaults to "Pen-Other" type.

   Select surface mesh: For bare bed, **Main > Tool Setup > Set to Bed**. For canvas, **Main > Tool Setup > Set to Canvas** (uses the pre-set universal paraboloid mesh for consistent pressure).

Running Your First Test Drawings

Test patterns verify calibration and tool setup. Start with small tests on scrap paper or canvas. Use the LCD menu (**Main > Test**) for all patterns.

1. **Basic Square Test**:

Draws a 10x10 cm square centered on the bed.

Select: **Main > Test > Draw Square (10x10) cm**.

Observe: Check for straight lines and consistent pressure. If skewed, re-home and retry.

2. **Canvas Size Tests**:

These outline standard art sizes (centered outlines only—no fill).

8x10 in: **Draw 8x10 in**.

9x12 in: **Draw 9x12 in**.

11x14 in: **Draw 11x14 in**.

20x16 in: **Draw 20x16 in**.

Full bed: **Draw Full Bed**.

3. **Grid Test**:

Draws a 200x200mm grid (6 horizontal/vertical lines, 40mm spacing).

Select: **Main > Test > Grid**.

Ideal for checking uniformity across the bed.

4. **Post-Test Checks**:

Inspect lines for skips (low pressure), bleeding (high pressure), or waviness (mesh issues).

Adjustments for Optimal Performance

Fine-tune based on test results. Make small changes and re-test.

1. **Pressure Adjustments**:

Use mechanical thum screw to loosen or tighten pressure.

Too heavy (tearing): **Main > Pressure > Select Pressure** (10 Options).

2. **Mesh and Surface Tweaks**:

If uneven: Re-calibrate bed mesh or toggle types.

Disable auto-mesh on home if testing without: **DISABLE_AUTO_MESH** via console.

3. **Common Optimizations**:

If vibrations: Tighten belts/extrusions.

For accuracy: Re-home if changing surfaces.

Save configs: After adjustments, power cycle to persist changes.

Your plotter is now calibrated! For real artwork, convert files to G-code (tools like Inkscape with extensions or DrawingBotV3) and print using MainSail Web Interface from your computer.

Currently printing from the plotter is not possible. (Check the repository for updates). If tests fail consistently, refer to Section 10 for troubleshooting.

NOTES

10. Troubleshooting Guide

If your Aria Art Plotter isn't performing as expected after assembly, this guide covers common issues related to the build process and basic operation. Start by double-checking your assembly against Sections 6-7 and running the calibration steps in Section 9. Always unplug the power before inspecting or adjusting components to ensure safety (review Section 2 if needed). If an issue persists, note that our support is limited to clarifying these instructions, correcting documented errors, or providing updates for component changes—see Appendix B for details. We do not troubleshoot individual builds, custom modifications, or issues specific to third-party hardware like the BIGTREETECH Manta M5P (refer to manufacturer resources for those).

Common Issues and Fixes

We've organized these by category for quick reference. For each, try the fixes in order, then test the plotter with a simple pattern from Section 9.

Mechanical Problems

Issue: Axes bind or move unevenly (e.g., grinding noises or resistance). Fixes:

- Check wheel alignments on the gantries (Sections 6.3-6.5)—loosen eccentric spacers and readjust for smooth rolling.
- Ensure GT2 belts are tensioned evenly (not too tight or loose); use a finger press to check for slight give.
- Verify linear rails are clean and lubricated lightly with dry lubricant; remove any debris from fabrication.

Issue: Pen holder doesn't lift/lower properly. Fixes:

- Inspect the Z-axis lead screw and nut for alignment (Section 6.2)—reassemble if bent or obstructed.
- Confirm the rubber band or spring tension on the pen holder (Section 6.1); replace if stretched.
- Test Z-motor movement manually (power off) to ensure no binding in the flexible coupling.

Issue: Frame wobbles or feet slip. Fixes:

- Tighten all M5 screws on the frame and feet (Sections 6.7 and 6.9) using the recommended torque—avoid over-tightening to prevent stripping.
- Level the plotter on a flat surface; add rubber pads under feet if needed for grip.

Electrical and Wiring Problems

Issue: No power or display doesn't light up. Fixes:

- Verify AC connections and fuse in the power socket (Section 7.3); replace fuse if blown (10A rating).
- Check all JST-XH connectors for secure seating (Section 7.1)—reseat if loose.
- Ensure the power supply is outputting 24V (use a multimeter if available); cycle power after unplugging for 30 seconds.

Issue: Motors don't respond or make unusual noises. Fixes:

- Confirm stepper motor wiring matches the diagrams (Section 7.2)—swap phases if reversed.
- Check for loose harnesses in the drag chains; secure with zip ties to prevent pulls.
- Run a homing sequence from the LCD (Section 8) to test each axis individually.

Issue: Limit switches or probe not triggering. Fixes:

- Test switch continuity with a gentle press (power off); adjust brackets (Sections 6.1 and 6.3) for proper contact.
- Inspect probe wiring for crimps or breaks (Section 7.1); replace damaged cables.

Operation and Drawing Problems

Issue: Inaccurate drawings or skipped steps. Fixes:

- Recalibrate Z-compensation and mesh (Section 9); ensure the MicroProbe is clean and mounted squarely.
- Check tool pressure settings—start with "Light" for tests and adjust based on media.
- Verify GT2 pulleys are secure on motor shafts; tighten set screws if slipping.

Issue: Firmware errors on boot (e.g., LCD shows warnings). Fixes:

- Reload firmware via SD card (Section 5); ensure files are from the official download.
- Clear any bed mesh data and re-probe the surface.

If these don't resolve the problem, document the exact symptoms (e.g., error messages, photos) before seeking further help.

Frequently Asked Questions

> **Why is my plotter not homing correctly?** Homing relies on limit switches—ensure they're wired per Section 7 and not obstructed. Run a manual test by moving axes slowly to trigger points.
>
> **What if a 3D printed part breaks during assembly?** Reprint using the STL files (Section 4), or consider metal alternatives for durability. Check tolerances with calipers before reuse.
>
> **How do I handle overheating motors?** This can occur from high current—ensure good airflow. Reduce speed in test runs.
>
> **Can I modify the plotter for larger sizes?** Yes, Modifications are at your own risk and we do not recommend going over 40x40 inch specs for best results. See Appendix B for prohibited uses.
>
> **What if components arrive damaged?** Contact your supplier for replacements; we don't handle sourcing or repairs (Appendix B).
>
> **How often should I check belts and screws?** After first use and every 10-20 hours—tighten as part of maintenance (Section 11).

For more FAQs, visit aria-art.com—updated regularly based on user feedback.

Community Support Resources

While we focus on instruction clarifications, the DIY community can offer peer advice for build variations or advanced tips. Always cross-reference with this manual to avoid conflicts.

> **Official Aria Forum**: Join discussions at Aria-Art.com—share photos of your setup for community input (no official troubleshooting).
>
> **Klipper Firmware Community**: For general firmware questions, check docs.klipper3d.org or the Klipper Discord—search for "art plotter" setups.
>
> **BIGTREETECH Resources**: For hardware-specific issues (e.g., M5P board), visit bigtreetech.github.io or their forums—we don't provide support here.
>
> **General DIY Forums**: Reddit communities like r/CNC, r/3Dprinting, or r/DIY for similar projects. Search for "drawing robot troubleshooting."
>
> **YouTube Tutorials**: Look for "@aria_art_plot" or similar CNC drawing machines—verify against our specs.

Remember, community advice is unofficial; test changes carefully. For instruction updates or errors, contact us via Appendix C. With patience, most issues resolve to simple adjustments—happy plotting!

11. Ongoing Care

Congratulations on completing your Aria Art Plotter! With proper care, it will provide years of reliable service for your creative projects. This section outlines simple routines to keep it running smoothly, plus tips for replacements and enhancements. Aim to perform maintenance monthly or after every 50 hours of use—whichever comes first. Always power off and unplug before any work.

Regular Maintenance Routine

Follow this step-by-step checklist to maintain peak performance. It takes about 30-45 minutes and uses basic tools from your original kit.

> **Clean the Frame and Rails**: Wipe down the aluminum extrusions and linear rails with a soft, dry cloth to remove dust and debris. For stubborn residue, use isopropyl alcohol on a microfiber cloth—avoid abrasive cleaners. Inspect for loose screws and tighten with a hex key if needed (torque to 2-3 Nm for M5 fasteners).
>
> **Lubricate Moving Parts**: Apply a light machine oil or silicone lubricant to the lead screw, wheels, and pulleys. Wipe away excess to prevent buildup. For the Z-axis, add a drop of oil to the brass nut every few months.
>
> **Check Belts and Chains**: Inspect GT2 belts for wear, fraying, or slack—adjust tension by loosening pulleys and repositioning. Examine drag chains for cracks or binding; replace if they don't move freely.
>
> **Electronics Inspection**: Dust off the mainboard, drivers, and power supply with compressed air (keep fans spinning freely). Verify all connections are secure and look for signs of overheating, like discoloration.
>
> **Probe and Sensor Calibration**: Run a quick Z-probe test via the LCD menu to ensure accuracy. Clean the MicroProbe tip with a soft cloth and recalibrate if offsets have shifted (refer to Section 9 for steps).
>
> **Tool Holder Care**: Remove any pen residue from the holder and bracket. Test the pressure control mechanism by cycling through light/medium/firm settings—lubricate the thumb screw if it sticks.
>
> **Firmware Updates**: Check CodeAgents.com/AriaV1 quarterly for firmware revisions. Update via SD card following the process in Section 5, then retest basic functions.
>
> **Storage Tips**: If not using for extended periods, cover with a dust sheet in a dry, temperature-controlled space (avoid humidity above 60%). Remove batteries from any remotes or add-ons.

Log your maintenance in a notebook, noting dates and any observations—this helps spot patterns early.

Sourcing Replacement Parts

Over time, components like belts or wheels may wear out. Use this guide to find compatible replacements without hassle. Always match specs exactly to avoid compatibility issues.

> **Common Wear Items**:
>
> - GT2 Belts and Pulleys: Source from electronics suppliers like Amazon or AliExpress—search for "GT2 6mm wide belt" and ensure 2mm pitch.
> - Delrin Wheels and Eccentric Spacers: Look for "V-Slot 24mm Delrin wheels" with 5mm bore; buy sets of 12 for spares.
> - Limit Switches and Probe: Replace with identical models (e.g., B07PCN6T6F for switches, BIQU MicroProbe V2.0). Test before installing.
> - Fasteners: Stock up on M5/M3 screws and nuts from hardware stores—refer to the BOM quantities as a guide.
>
> **Electronics Replacements**: For boards like the Manta M5P or TMC2209 drivers, order from BIGTREETECH's official site or authorized resellers. Verify versions match (e.g., V1.0 for Manta).
>
> **3D Printed Parts**: Reprint using your original STL files if damaged—use durable materials like PETG. For metal alternatives, laser cut from 3mm aluminum via online services.
>
> **Where to Buy**: Start with the suppliers noted in Section 3 (e.g., Amazon for motors, AliExpress for rails). For hard-to-find items, check maker communities or contact us via Appendix C for recommendations. Budget $20-50 per replacement, depending on the part.
>
> **Coming Soon**: Visit aria-art.com for information on our DIY complete kit with most common parts availability

If a part fails prematurely, document it with photos and check troubleshooting in Section 10 before replacing.

Potential Upgrades and Customizations

Enhance your Aria for bigger projects or specialized art styles. These are optional and may require basic mods—test thoroughly after changes.

> **Larger Drawing Area**: Scale up to 40x40 inches by extending aluminum profiles, wire harness, drag chains and belts (visit Cutting an Wiring section for details). Update firmware dimensions in Klipper config and recalibrate.
>
> **Tool Expansions**: Add a rotary attachment for cylindrical drawings or a laser module for etching—source compatible Klipper add-ons and integrate via USB. Custom holders can be 3D printed for brushes or stamps.
>
> **Smart Features**: Install a Raspberry Pi camera for remote monitoring via the web interface. Enable WiFi on the CB1 for wireless file transfers.
>
> **Aesthetic Customizations**: Paint the frame or laser-etch designs on panels. Swap the LCD for a larger touchscreen if you're comfortable with wiring changes.
>
> **Software Tweaks**: Customize macros in Klipper for new pressure levels or tool types—download community scripts from forums. Always backup your config first.

For advanced mods, join online CNC artist groups for ideas and support. Remember, customizations may affect stability, so start small and refer back to calibration steps. Enjoy evolving your Aria into the ultimate creative tool!

NOTES

Appendix A: Detailed Technical Specifications

The Aria V1 Art Plotter is engineered for precision and ease of use, blending robust mechanical design with advanced electronics. Below are the full specs to help you understand its capabilities and plan your builds or upgrades. For assembly details, refer to Sections 5-9; for parts, see Section 3.

Overview

This CNC drawing machine excels at converting digital files into physical art using tools like pens, pencils, and brushes. Its silent operation and customizable features make it ideal for detailed work in workshops or studios.

Drawing Area & Precision

Usable Drawing Area: 500mm × 500mm (20" × 20") for the standard build—scalable with adjustments to extrusions and belts (see cutting and wiring section for frame assembly).

Z-Axis Travel: 38mm to accommodate various tools and enable pressure control.

Positioning Accuracy: Enhanced by mesh compensation for surface irregularities.

Supported Canvas: Up to 20x20 inches.

Tool Angles: 90 degrees for perpendicular drawing; 55 degrees optimized for fountain pens or angled tools.

Mechanical Design

Frame Construction: Built from 2020 V-slot aluminum extrusions for stability and modularity.

Motion System:

- Dual Y-axis motors for balanced, vibration-free movement.
- MGN9 linear rails (200mm and 100mm lengths) on the Z-axis for smooth sliding.
- T8 lead screw (150mm) with brass nut and flexible coupling for precise vertical control.
- 24mm V-wheels (12 total) with eccentric spacers for adjustable X/Y tension.

Drive Mechanism: GT2 timing belts (10ft total, 6mm wide, 2mm pitch) with 20-tooth pulleys.

Fabrication Options: Mix of 3D-printed parts (e.g., brackets, holders) and optional metal-cut components (e.g., plates) for added durability—details in Section 3.

Electronics & Control

Main Controller: BIGTREETECH Manta M5P V1.0 (32-bit ARM Cortex-M0+) for high-speed processing.

Compute Module: BIGTREETECH CB1 V2.2 with heatsink for reliable performance. Seeeduino Xiao for driving the OLED Screen

Stepper Drivers: 4x TMC2209 V1.3 for quiet, efficient motor control (X, dual Y, Z).

Motors: 4x NEMA 17 steppers for accurate positioning.

Power Supply: Mean Well LRS-350-24 (24V, 350W) with AC socket and fuse for safe operation.

Sensors & Probes: BIQU MicroProbe V2.0 for auto-leveling; limit switches for homing.

Displays: Dual Mini12864 V2.0 LCD (RGB backlit) and 0.91" OLED for status monitoring.

Firmware: Klipper-based with custom macros—installation in Section 5.

Connectivity: WiFi/Ethernet via CB1, USB; optional wireless upgrades.

Advanced Features

Intelligent Tool Management

Supported Tools: Pens, pencils, brushes, drypoint etchers, stamps—easy swaps with the pen holder assembly (Section 6.1).

Pressure Levels: Hardware using spring knob, Software by 10 settings (Light to Firm) via Z-axis control for maximum control.

Dual Surface System

Bed Mesh Compensation: Maps and adjusts for any irregularities in the drawing surface.

Canvas Mesh: Specialized mode for mounted canvases, ensuring even pressure without damage. Uses paraboloid compensation. Must print at center of bed.

Artist-Friendly Interface

Custom Menus: Simplified LCD navigation focused on creative tasks, not technical jargon.

Presets: Test patterns for common sizes to speed up setup and media fixing guide.

Calibration Tools: Built-in probes and macros for fast homing (Section 9).

User Experience

Setup Process

1. Load your tool using the 9mm reference puck for accurate positioning.
2. Choose compensation mode (bed or canvas) via the interface.
3. Select pressure level based on your medium.
4. Load and start files directly from the LCD, web interface, or SD card.

5. Supported Workflows

File Handling: Convert SVGs or vectors to G-code for import—sample patterns included.

Multi-Session Drawing: Pause/resume with tool changes for complex projects.

For performance tweaks or expansions, consult Section 10 for troubleshooting or community resources. If scaling the build, adjust specs accordingly while maintaining safety standards from Section 2.

Appendix B: Legal Notices & Disclaimers

Hardware License: CERN-OHL-S-2.0 (CERN Open Hardware Licence Version 2 - Strongly Reciprocal). All hardware designs, including assembly instructions, STL files (34 files), DXF files (9 files), and Bill of Materials are licensed under CERN-OHL-S-2.0.

Documentation License: CC BY-SA 4.0 (Creative Commons Attribution-ShareAlike 4.0 International). All documentation, including this assembly guide, video tutorials (14 videos), and safety instructions.

Software/Firmware License: GNU GPLv3 (Klipper firmware) and Open Source. Arduino code, Klipper configuration files (3 CFG files), and Python supporting files follow their respective open-source licenses.

Terms of Use

Permitted Use: These instructions are licensed for personal, non-commercial, and commercial use. You may build devices to sell, provided you comply with the license terms. You may modify and improve the designs. You may share modifications with the community under the same licenses. You may print and distribute copies of documentation with proper attribution.

Attribution Requirements: When sharing, manufacturing, or distributing devices or documentation, you must: Provide clear attribution to the Aria Art Plotter project and CodeAgents LLC. Link to the original project repository: https://github.com/gustavomayoral/aria_art_plot. Include copies of or links to the applicable licenses. Document any modifications made. Any modifications or derivatives of this hardware or documentation must be shared under the same licenses (CERN-OHL-S-2.0 for hardware, CC BY-SA 4.0 for documentation).

Disclaimer of Liability

Build at Your Own Risk. IMPORTANT: Building this device involves inherent risks. By downloading, or using these instructions, you acknowledge and accept full responsibility for: Personal safety during construction and operation. Property damage that may occur during building or use. Electrical hazards associated with AC power connections. Mechanical hazards from moving parts and sharp tools. Tool-related injuries from required construction tools.

No Warranty: These instructions are provided "AS-IS" without warranty of any kind, either expressed or implied, including but not limited to: Accuracy or completeness of information. Fitness for a particular purpose. Successful completion of the build. Performance of the finished device.

Limitation of Liability: Under no circumstances shall CodeAgents LLC be liable for any: Direct, indirect, incidental, or consequential damages. Personal injury or property damage. Loss of time, money, or materials. Failure to complete the build successfully.

Electrical Safety Warning

DANGER - HIGH VOLTAGE: This project involves 120V/240V AC electrical connections which can cause: DEATH by electrocution, FIRE from improper wiring, SERIOUS INJURY from electrical shock.

Requirements: Qualified electrician recommended for all AC electrical work. Local electrical codes must be followed. Proper electrical permits may be required in your area. Ground fault circuit interrupter (GFCI) protection recommended. If you are not qualified to work with AC electricity, hire a professional electrician.

Builder Responsibilities

Compliance: You are solely responsible for ensuring your build complies with: Local building codes and regulations. Electrical safety codes. Import/export restrictions on electronic components. Any applicable safety standards in your jurisdiction.

Skill Requirements: This is an advanced project requiring: Experience with 3D printing and tolerances. Basic electronics and wiring skills. Mechanical assembly experience. Ability to troubleshoot technical problems. Access to proper tools and workspace.

Component Sourcing: You are responsible for sourcing all components and materials. Component specifications may change; verify current availability. Some components may not be available in all countries.

Electronic components may be subject to export restrictions.

Intellectual Property

Open Source Components: This project incorporates open-source software and hardware designs: Klipper firmware - GNU GPLv3 License. BIGTREETECH hardware - Used per manufacturer specifications. Standard hardware - Commercially available components.

Original Work: Original instruction content, custom macros, and assembly innovations are proprietary to CodeAgents LLC and shared with the community under the licenses specified above.

Revision and Updates

Instructions may be updated to reflect component changes or improvements. No obligation to provide updates to previous purchasers. Check aria-art.com for current version information. Version history is maintained in Appendix D. The community is encouraged to contribute improvements, report issues, and share modifications through the GitHub repository.

Export Notice

Electronic components and technical documentation may be subject to export control regulations. The purchaser is responsible for compliance with all applicable laws.

Community and Support

Project Resources:

Website: https://aria-art.com/

GitHub Repository: https://github.com/gustavomayoral/aria_art_plot

YouTube Channel: https://www.youtube.com/channel/UCnQa72-AxMts5epgoNxnCvQ

Printables: https://www.printables.com/@aria_art_3610199

Social Media: @aria_art_plot (X, Instagram, Threads)

What We Provide: Clarification of instruction content. Corrections to documented errors. Updates for component changes. Community forum for shared knowledge.

What We Don't Provide: Troubleshooting individual builds. Component sourcing assistance. Modification or customization advice. Repair or replacement of damaged components.

Community Contributions: We encourage the community to: Share build experiences and modifications. Report issues via GitHub. Contribute improvements through pull requests. Help other builders in community forums. Document alternative component options.

By downloading and using these instructions, you acknowledge that you have read, understood, and agree to be bound by these terms and disclaimers.

Appendix C: Contact Information

For questions about these instructions, updates, or general inquiries, reach out through the channels below. We're committed to helping you succeed with your Aria build, but please note our support scope (as outlined in the Legal Notices in Appendix B): we provide clarifications on content, error corrections, and component updates. For build-specific troubleshooting, check Section 10 or community resources.

Company Contact

> **Creating Company Name**: CodeAgents LLC
>
> **Creator Name:** Gustavo Mayoral
>
> **Website**: aria-art.com (Download files, check updates, and access resources)

Online Resources

> **Firmware & File Downloads**: Available at website and github below
>
> **Version Updates**: Monitor aria-art.com for revisions (see Appendix D for history)

Community Support

Join fellow builders for tips, mods, and shared experiences:

Website: https://aria-art.com/

GitHub Repository: https://github.com/gustavomayoral/aria_art_plot

YouTube Channel: https://www.youtube.com/channel/UCnQa72-AxMts5epgoNxnCvQ

Printables: https://www.printables.com/@aria_art_3610199

Social Media: @aria_art_plot (X, Instagram, Threads) Visit website for updates.

If your issue involves third-party components (e.g., BIGTREETECH hardware), contact their support directly via their websites. Thank you for letting them know you are building the Aria Art Plotter!. We're excited to see what you create—share your artwork on our community pages!

Appendix D: Manual Revision History

This appendix tracks changes to the Aria Art Plotter Assembly Instructions manual. We update the document as needed to reflect improvements, component changes, or clarifications. Check CodeAgents.com/AriaV1 for the latest version before starting your build.

Version	Date	Changes Made
1.0	09/01/2025	Initial release of the manual, including full assembly instructions, BOM, and appendices.