

Dominator CNC

Assembly Manual

https://pwncnc.com | 479-480-4337 | support@pwncnc.com

Changes:

1/9/2026

- Fixed issues with front legs call-outs. Swapped leg D and E
- Adjusted the initial steps regarding legs assembly to be more clear and precise.

11/2026

- Adapted documentation contained in “Conversion Kit” guidance to assembly of the Dominator.
- Described essential steps in configuring the Masso Controller for service on a Dominator, including “Screen Shots” from Masso.
- Added appendices
    - “No table”
    - Rigidity Upgrade
    - Stability upgrade
- Created place-holders for appendices
    - ATC
    - Fourth Axis
- Added dimensions of Y- and number of X-extrusions for a 3x4 Dominator
- Added “Maintenance” category
- Added Sensor cable grounding
- Added images of “Slide-in” and “Drop-in” nuts
- Moved description of Sleeve-Bolt-Nut hardware to the beginning of assembly (instead of within Leg assembly section).
- Added insertion of “Slide-in” nuts to accommodate X-cable chain
- Clarified points at which bolts that had been deliberately loose during early assembly should be tightened
- Described “M” and “N” sides (in place of “right” and “left”) to accommodate user choice for monitor location
- Clarified VESA mount for “with-leg” (included) and “without leg” (not included) purchases
- Added section on Wasteboards
- Added section on Tramming
- Standardized use of (#) to describe the number of required items
- Reduced use of “passive voice”

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Table of Contents

🛠️ Welcome 1

📦 What's in the Boxes 1

🧰 Required Tools & Workspace 3

⚠️ Safety Guidelines 4

Electrical Safety 5

General Instructions 6

Legs Kit Assembly (if applicable) 7

Identifying Extrusions & Fasteners 7

Leg Assembly 8

Attaching Feet 9

Leveling 9

Attaching the Rear Brace 9

Bed Frame Assembly 10

Assembling the Base Frame 10

Attaching to Legs Kit (if applicable) 11

Squaring & Leveling the Frame 12

Linear Y Rails & Ball Screw Installation 13

Installing Y-Axis Linear Rails 13

Installing the Y-Axis Ball Screw Assembly 14

Prepare BK12's Y-Bracket 14

Installing the Rear Y Plate 14

Installing the Ball Screw Assembly 15

Installing the Front Y Plate 16

Installing the X Gantry 19

Installing the X Linear Rails 20

Preparing X Gantry Plates 21

Installing the Left Side Gantry Assembly 22

Prepare X Ball Screw Assembly 23

Installing the Right Gantry Assembly 24

Install the X Plate 25

Electronics Package 27

Motor Installation 27

Controller Orientation – Decision Point 28

Chain Bracket Assembly & Install 29

X-Chain Wiring 30

Wiring Steppers and Homing Sensors 31

Installing Limit Switches & Sensors 33

Miscellaneous devices 34

VESA Controller Mount 34

Tool Setter 35

Final Electronics Assembly 36

Grounding sensor shields 37

Z-Carriage Final Assembly 40

Installing the Z Stepper Motor 41

Software Setup & Machine Configuration 42

First Power-On Checklist 42

First Homing Attempt 43

Controller Firmware & Updates 44

Homing & Travel Limits 44

What to Expect on First Power-up 45

Axis Direction Sanity Check 46

Input/Output Configuration 47

Password 47

Homing 48

Main Spindle 49

Coordinates 49

Tool Changer 49

Axes (X, Y, Z, A and B): Steps per mm 49

Auto Tool Zero 50

Last Updated 11/2026
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Tool Database 51
Connect Masso to your wireless router 51
Using a Touch Plate 51
Masso workflow 52
Calibration & First Movement 54
Squaring & Tramming the Gantry 54
Wasteboard 55
Prepare for a wasteboard 56
Maintenance 57
Support & Resources 58
Appendix A – No table 59
Appendix B - Bed Structural Upgrade 60
Appendix C - Bed Rigidity Upgrade 61
Appendix D – Fifth Leg 62
Appendix E – Automatic Tool Changer 63
Appendix F – Fourth Axis 64

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Introduction

🛠️ Welcome

Thank you for choosing the **Dominator CNC** — a machine built for precision, power, and performance. Whether you're a seasoned maker or diving into your first advanced CNC build, this guide walks you through every step of the assembly process with clarity and confidence.

This manual includes:

- Clear step-by-step instructions
- Helpful tips and tool recommendations
- Visual references for each stage of assembly
- Safety guidance and setup best practices

We've designed the Dominator to be both rugged and refined — and putting it together should reflect that same balance. Take your time, follow the instructions closely, and don't hesitate to reach out if you need help along the way.

💬 Need support? Contact us anytime at support@pwncnc.com

📌 Checkout our Video Build Series: https://pwncnc.com/dominator-pro-build

📦 What's in the Boxes

Your **Dominator CNC machine** ships in multiple boxes. Here's what to expect:

1. 8020 Boxes — Drop-Shipped

These come from a company named, "8020":

- Aluminum extrusion profiles
- Fasteners, brackets, and hardware for frame assembly
- You may also have upgrade packages, also from 8020.

8020 provides the manufacturing and shipping infrastructure required for our Dominator machine's aluminum extrusions. We partner with them because we're a small mom-and-pop shop. If a problem arises with a drop-shipped order, PwnCNC will help you resolve it; our commitment to supporting you remains the same.

As you're receiving the Drop-Shipped packages, please compare what you received with the following list. If anything is missing, please bring it to our attention ASAP via support@pwncnc.com.

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What to look for:

Look closely at the "BOM & Quick Start Guide", where we list the dimensions for your model and parts lists for all models. We tag the components with codes. These include dates that will differ for your machine. Look over this list for the basic and optional items that 8020 should send to you.

- **Machine**
- **Legs Kit**
- **Gantry Upgrade**
- **Bed Structure Upgrade**
- **Bed Rigidity Upgrade**
- **5th Leg Upgrade**

  See https://support.pwncnc.com/kb/section/103/ for more photographs.

Find the tagged code on the packing list included with each shipment. Use the above to confirm that you've received everything ordered.

2. Electronics Package (from us).

This box includes all components needed to power and control your machine:

- CNC controller (Masso G3 Touch)
- Stepper motors (2Nm or 3Nm; with the Z stepper having an embedded brake)
- Stepper Cables
- Proximity Switches and Cables
- Power Box and cord

3. Linear Motion System (from us).

This package includes:

- Linear rails (X, Y, and Z axes)
- Ball screws (preassembled with Bearing blocks, couplers, and related motion hardware)

4. Custom Machined Components, Cable Chain Parts, & Assembly Hardware (from us).

In this box, you'll find:

- Precision-machined and in-house anodized aluminum brackets and plates
- Hardware baggies. Keep the "BOM & Quick Start Guide" handy when looking for hardware. Some parts may be in a different bag than you expect. The guide does not identify which bag contains each part, but it confirms how many of each part you should have.
- Cable Chains and Brackets

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5. Z-Carriage, Manual, and Misc. (from us).

Find the remaining machine components here:

- Z-Carriage & Z Proximity Switch Bracket
- One or more 80mm Spindle Mounts depending on your order
- Gantry LED Light and Cable
- Free Gifts and Extras
- Dominator Assembly Manual

📌 *Tip:* Before beginning assembly, unpack and verify the contents of each box against your packing list included with each shipment.

Required Tools & Workspace

Required Tools

We designed most components in this kit for ease of assembly with standard tools. You'll need:

- **Metric Hex Key Set** (Allen wrenches)
    - Custom PwnCNC hex wrenches are included in the kit
- **Open-End Wrenches or Adjustable Wrench**
- **Precision Square or Framing Square** (for aligning extrusions)
- **Digital Caliper** (for calibrating Axes, fine tuning, and confirming hardware size)
- **Rubber Mallet** (for seating extrusions or bearings gently)
- **Utility Knife or Scissors** (for opening packaging)
- **Wire Cutters or Scissors** (for cable routing or spindle connections)
- **Zip Ties, Velcro Straps or Bundle Wrap** (for additional cable management)

Recommended Workspace Setup

To assemble your machine comfortably and accurately, we recommend the following:

- A **clean, flat, and level work surface** (ideally 5'x5' or larger depending on machine size)
- Adequate **lighting** for detailed work
- Access to **standard 120V or 220V power** (depending on spindle and VFD requirements)

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- Room to move around all sides of the machine

⚠️ *Pro Tip:*
As this is a large-format machine, **assembly is easier with two people**, especially when positioning the gantry or managing long extrusions.

⚠ Safety Guidelines

Your safety is our top priority. Please review and follow the guidelines below before assembling or operating your Dominator CNC machine.

During Assembly

- **Disconnect Power:**
  Always ensure the system is **unplugged** before connecting electronics or handling wiring.
- **Use Proper Tools:**
  Only use tools recommended in this manual. Avoid makeshift tools or forcing hardware into place.
- **Secure the Workspace:**
  Assemble the machine on a **flat, stable surface** in a well-lit area free of clutter and distractions.
- **Lift with Care:**
  Some components, especially extrusions and the gantry assembly, are heavy and awkward to handle alone. Ask for assistance when needed to avoid injury.
- **Eye Protection Recommended:**
  Wear **safety glasses** when cutting zip ties, trimming cable insulation, or performing tasks that may involve flying debris.

During Operation

- **Do Not Operate Unattended:**
  Never leave your CNC machine running while unattended. Unexpected tool crashes, part shifts, or electrical issues can occur quickly.
- **Keep Hands Clear:**
  Stay clear of all moving parts during operation. Do not reach into the cutting area while the machine power is on.
- **Secure Your Workpiece:**
  Always use proper clamping to prevent materials from shifting mid-job.
- **Wear Hearing Protection:**
  Prolonged exposure to CNC operation, especially when cutting hard materials, can be loud. We recommend ear protection.

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- **Check before Each Run:**
  Inspect tool paths, bit tightness, and workholding before starting any carve.

Electrical Safety

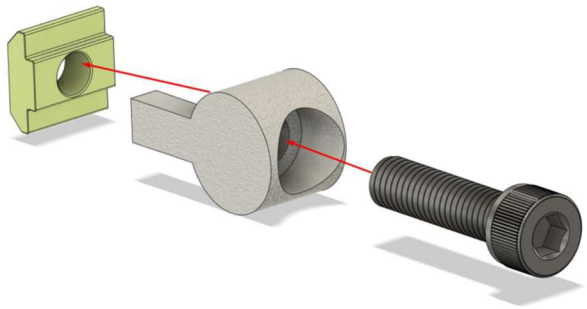
- **Respect Voltage Ratings:**
  Confirm your power setup matches the system's voltage requirements (e.g., 110V or 220V). Incorrect power may damage components or cause harm.
- **Avoid Wet Environments:**
  Keep the machine, VFD, and controller **dry and away from liquids**.
- **Use Proper Grounding:**
  Ground your spindle, controller, and VFD to avoid shock hazards or electrical interference.

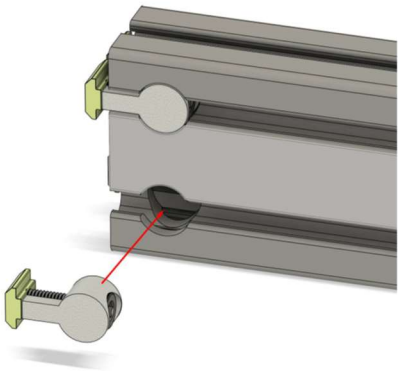
✅ *Stay alert, take your time, and if you're unsure about a step—pause and consult the manual or contact support@pwncnc.com*. Safety is key to long-term success with your CNC machine.

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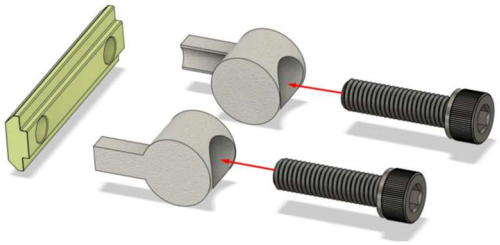
General Instructions

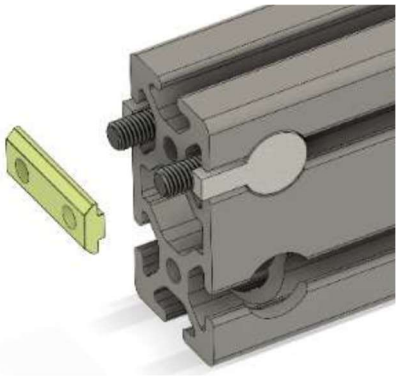
Pre-assemble anchors, bolts, and nuts where possible, and keep the connections loose until the parts are connected and square. The Dominator and its legs use very rigid aluminum extrusions secured by this hardware. Tightening a connection that is only ‘almost right’ can interfere with the alignment of later connections that depend on it. Follow the separate double-anchor procedure below where that exception applies.





An exception to the pre-assembly advice concerns “Double” anchors. For these, assemble the bolt and anchor together first, insert them into the extrusion, then loosely attach the double t-nut.





Other hardware includes various lengths of metric bolts, and sometimes the one specified in the manual is in a different bag than you expected. Keep measuring calipers handy, to know whether you’re holding an M4x30 or an M5x35.



We also use two kinds of T-nuts. These go into the extrusion channels to secure objects to the face of an extrusion. You can add “Drop-in” T-nuts without having access to the extrusion’s end. However, they fit loosely until the bolt secures them. You can only add “Slide-in” T-nuts while the extrusion end is exposed, but they hold their position more easily during assembly.

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Legs Kit Assembly (if applicable)

If your Dominator will rest on a wooden surface rather than the Legs Kit, read Appendix A first for mounting guidance. Skip Legs Kit Assembly and continue with Bed Frame Assembly.

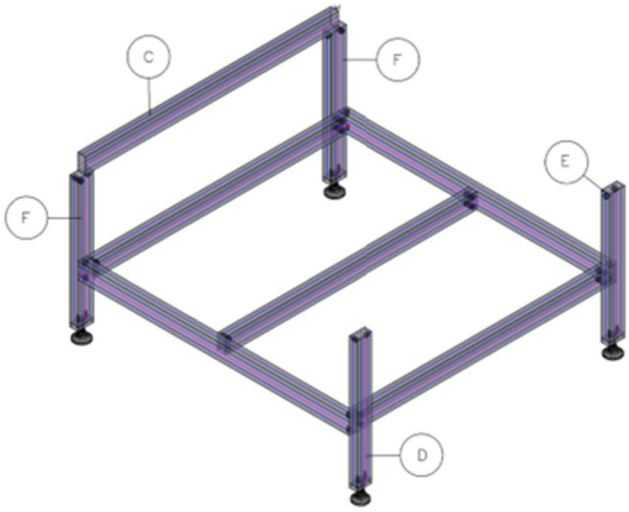
If you purchased the **Dominator Legs Kit**, begin your build here. Assembling the stand first provides a stable foundation for the rest of the machine and ensures proper alignment during frame assembly.

1. Lay out all extrusions and parts as described in the next section.
2. Pay particular attention to the orientation of each anchor hole and the direction they should point before tightening anything. *See details on the next page*.

Identifying Extrusions & Fasteners

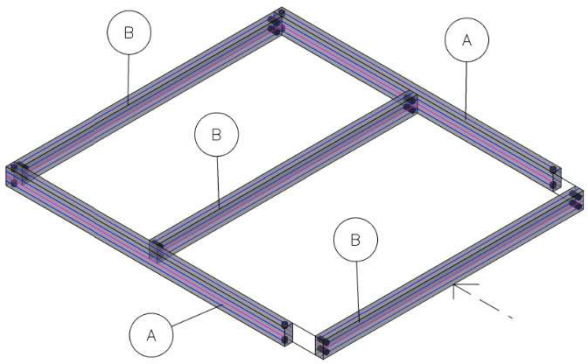
The Legs Kit includes 9 or 10 extrusions, depending on your machine size. Use these images to identify extrusion placement.

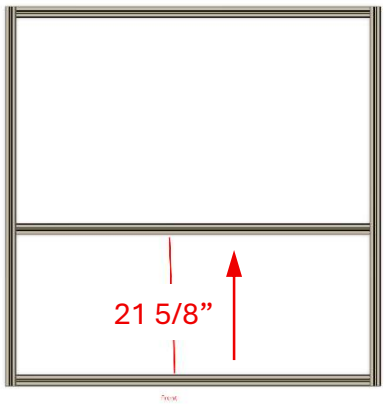
(2) A Extrusions 54 ¼”– shelf frame
(3) B Extrusions 50 9/16” w/double anchors on either side – shelf frame
(1) C Extrusion 50 9/16”
(1) D Extrusion 25 9/16”
(1) E Extrusion 25 9/16”
(2) F Extrusions 25 9/16”
(4) Feet & Plate along with various hardware



Assembling the Shelf

Start by laying out the A extrusions and B extrusions using the anchoring hardware from the 8020 packages. Attach the extrusions as follows, with a distance of 21 5/8” between the front two B extrusions. If you plan to add the 5th leg upgrade later, place two Slide-In nuts in one channel of the middle “B” extrusion, on the face pointing to the rear of the machine. See Appendix D.

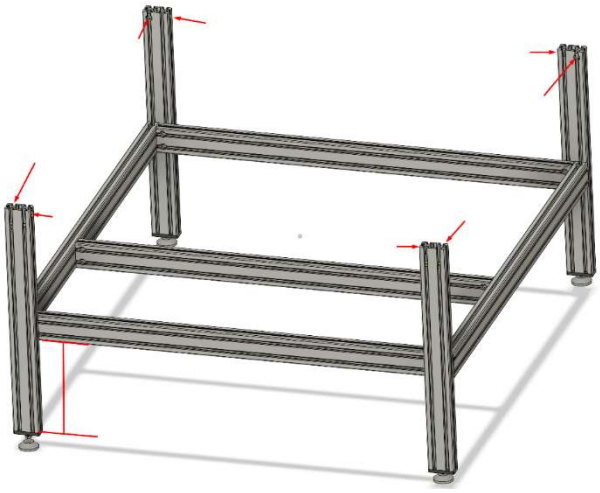




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Leg Assembly

Read the next few pages as there are several important points we'd like to make before you tackle this stage.

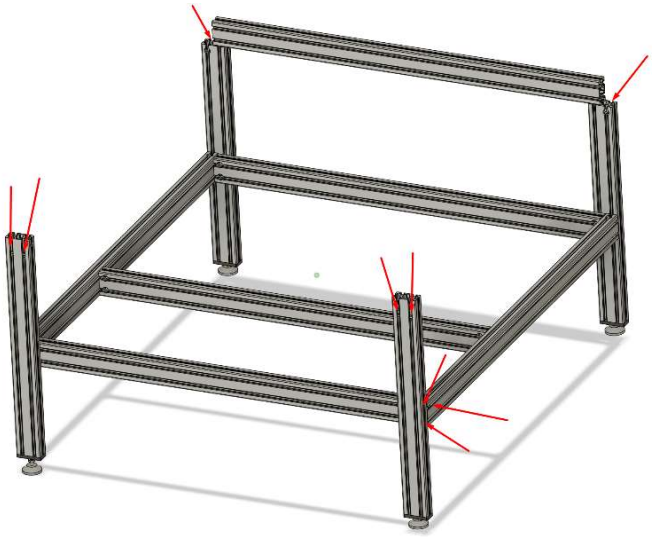


Next, you'll attach each of the four leg extrusions to the shelf-assembly with an 8" distance between the bottom of the shelf-assembly and the bottom of the leg extrusion shown below. This 8" distance will be important during leveling later.

There are two threaded holes on the "bottom" of each leg extrusion, where you will mount the footplates. Pay particular attention to the anchor holes at the top of each leg; see the image to the right with its red arrows for proper orientation.

For some folks, the rear-legs have an extra anchor in the back, ignore this since you won't use it.

Pre-placing T-Track Nuts

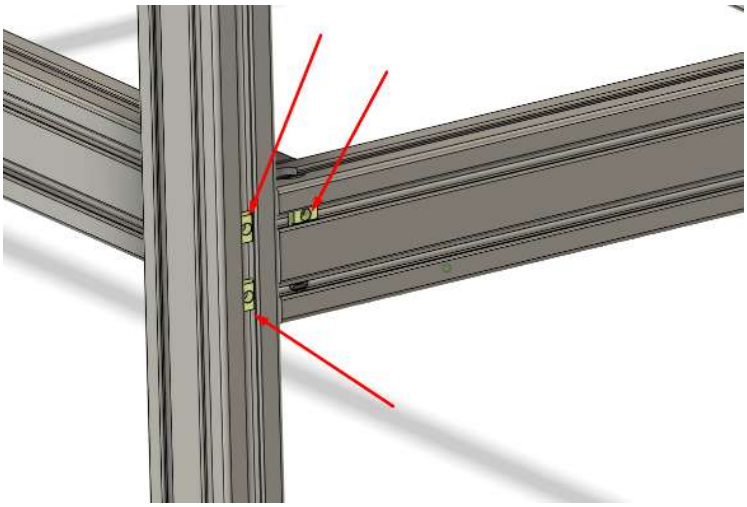


In the rear legs, two M8 Slide-in T-nuts (one on each leg) belong in the outer rear tracks.

In the front legs, place four M8 Slide-in T-nuts (two in each leg).

If you intend to mount the controller on the right, insert two in the right-side channel of the right leg. Also slide a T-nut into the A extrusion along the side

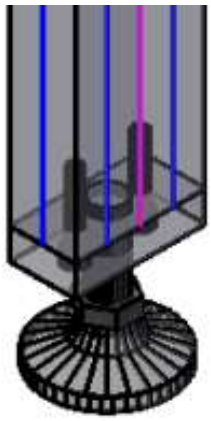




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Attaching Feet

On the bottom of each leg will be a foot-plate to which each leveling foot will mount.

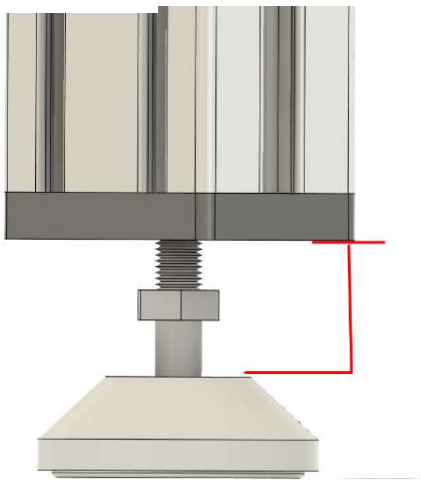


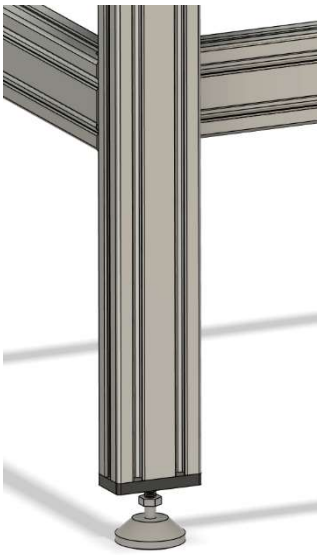
Leveling

Leveling is a critical step in setting up any CNC machine. If you've already set the shelf-to-leg distance to exactly **8"** on all four legs, you're ready to move on. Use a **leveling square** or bubble level to check the shelf and adjust each of the four **leveling feet** as needed to achieve a stable and level foundation.

Consider leaving an inch or so of threading exposed so you can easily adjust later.

Thread the nut up to the base plate to lock the leveling feet into position.





Attaching the Rear Brace

Finally, install the **horizontal rear brace extrusion** at the back of the frame.

Leave the hardware **slightly loose** for now so you can adjust the rear-brace extrusion if necessary—you'll fully tighten it **after you install and align the machine bed.**



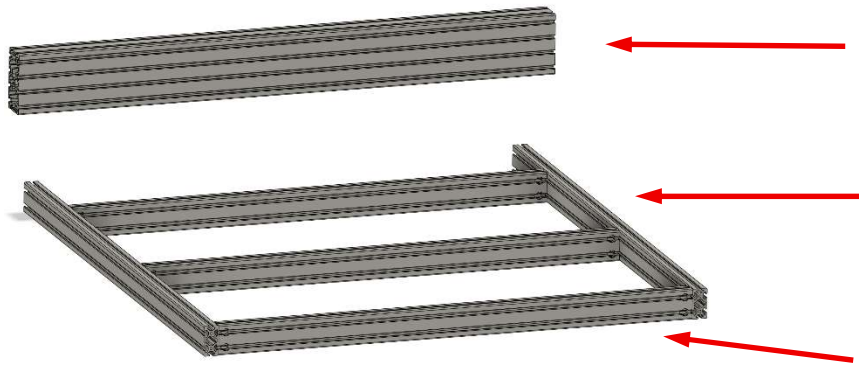
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Bed Frame Assembly

The bed frame is the foundation of your Dominator Pro CNC machine, and assembling it correctly is critical to overall performance, precision, and reliability. In this section, we'll walk you through identifying extrusion profiles, aligning components, and securing the base structure. Take your time and follow each step closely to ensure a square, level, and rock-solid frame.

Identifying Extrusions & Fasteners

For the main frame of your machine's bed, you have 5 extrusions plus one large extrusion for the gantry.



Large Gantry Extrusion:
(1pc) 57 ¼" long

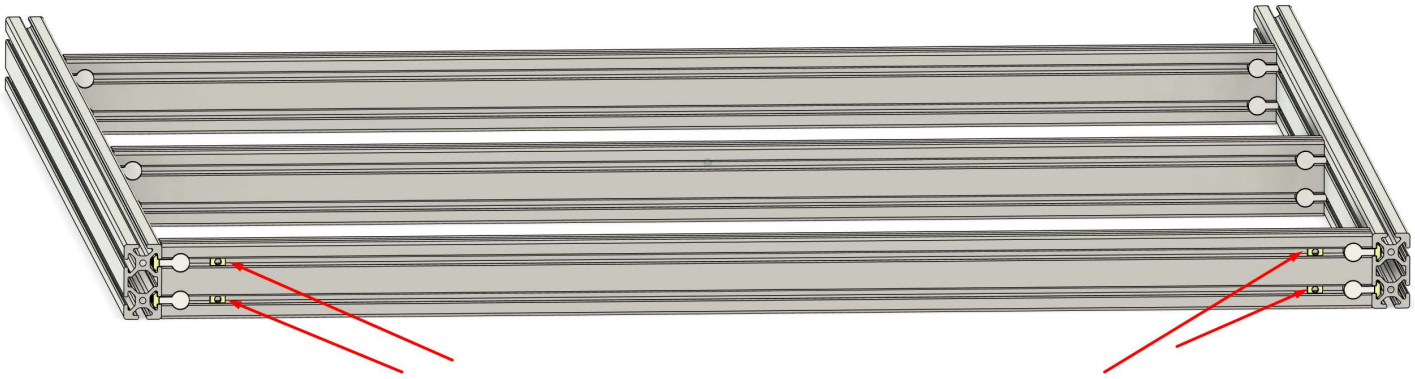
Y Extrusions:
2x4 = (2pc) 33 1/5" long
3x4 = (2pc) 45 3/8" long
4x4 = (2pc) 57 2/5" long

X Extrusions:
2x4 = (2pc) 50 9/16" long
3x4 = (3pc) 50 9/16" long
4x4 = (3pc) 50 9/16" long

Main Gantry Extrusion with M8 threaded holes on each end.
Y Extrusions – There are two M8 threaded holes on each end.
X Extrusions – There are 4 holes on both faces of the extrusion for the anchors to seat.

Assembling the Base Frame

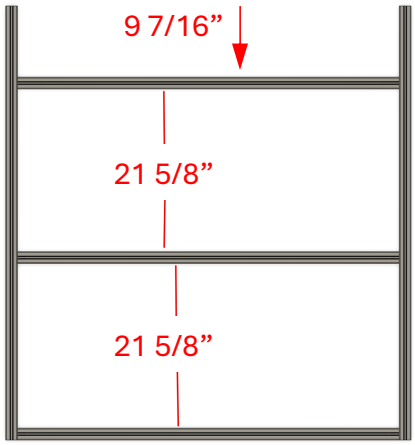
Important Note: Insert four M8 Slide-in T-Track nuts into the front machine extrusion. These will hold the "Y Front" aluminum panels in a later step. If you plan to add the Fifth Leg, add two Slide-In nuts to the upper rear-facing channel of the middle extrusion. See Appendix D.



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💡 *Pro Tip:* Consider adding three or four M8 T-nuts in the top channels of all three X extrusions, to secure your MDF bed base-layer. This will give you something to screw into when securing a wood or MDF bed.

Begin by laying out the **Y-axis** and **X-axis extrusions** and gathering the **anchor hardware** included in the 8020 packaging. Using this hardware, assemble the frame by attaching the extrusions as shown—be sure to maintain a **21 5/8" gap distance between the two X-axis extrusions** for proper spacing. If you have the Bed Structural Upgrade, see Appendix B before securing the second Y-axis extrusion.



2x4:
Distance = 20 3/5" / Rear Distance 9 7/16"

4x4:
Front Distance = 21 5/8"
Middle Distance = 21 5/8"
Rear Distance = 9 7/16"

If you have the Legs Kit, the middle X extrusion should be directly above the shelf's middle X extrusion. If you have the Rigidity Upgrade, see Appendix C.

💡 *Pro Tip:* **Do not tighten until fully assembled.** For best results, assemble and secure the extrusions on a **flat and level surface**. This ensures the frame stays properly aligned and square when tightening with the included anchor hardware.

Attaching to Legs Kit (if applicable)

If you've already assembled the **Legs Kit**, now is the perfect time to **recruit a friend** to help carefully lift and place the **machine bed frame assembly** onto the stand. Teamwork makes this step easier and ensures proper alignment without straining any components.



The **Legs Kit** includes hardware that **secures the machine bed frame to the top of each leg**. This is also the right time to **fully tighten the rear brace extrusion** to complete the base structure.

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Squaring & Leveling the Frame

With the main frame fully assembled (and attached to the **Legs Kit**, if purchased) ensure your machine is **square, level, and properly aligned**. Taking the time to do this now will improve cutting accuracy, reduce mechanical strain, and ensure smooth motion along all axes.

✅ What to Check

1. **Overall Frame Level**
    - Use a **carpenter's level or digital level** to check the bed surface.
    - Check for tilt or twist with a level across both **X-axis extrusions**, and **diagonally across the bed**
    - Adjust the **leveling feet** on the Legs or place shims under corners as needed.
2. **Cross-Frame Squareness**
    - Measure diagonally from **corner to corner** (front-left to back-right, front-right to back-left).
    - These measurements must be equal. Adjust the extrusion corners slightly until they are.
3. **X-Axis Bed Extrusion Parallelism**
    - Measure the **gap between the two X-axis bed extrusions** at multiple points along their length.
    - This spacing must match your original layout (e.g., 21 5/8"). Deviation may cause binding or misalignment in gantry motion.
4. **Front-to-Back Alignment (Y-Axis)**
    - Confirm the **Y-axis extrusions** are parallel to one another and perpendicular to the X-axis.
    - Use a framing square at each corner to verify 90° angles.

🛠 Adjustment Tips

- If you're having trouble achieving perfect squareness, **loosen the anchor hardware slightly**, make small adjustments, then retighten and recheck.
- Minor leveling issues can often be resolved by **adjusting the leveling feet** or by slightly loosening and repositioning the leg brackets before final tightening.

📌 *Note:* A well-leveled and squared frame sets the foundation for everything else—gantry travel, linear-rail installation, and eventual carving precision. Take your time here for best results.

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Linear Y Rails & Ball Screw Installation

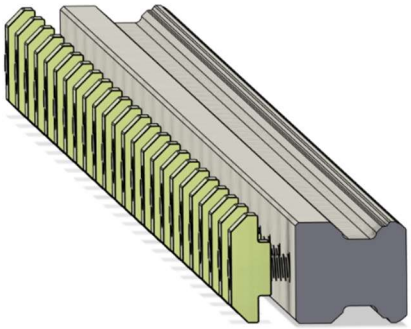
In this section, you'll assemble both the **left and right Y-axis systems**, including the **linear rail**, **ball screw**, and **front/rear Y plates**. We'll guide you through aligning and securing everything to create a smooth and stable motion system.

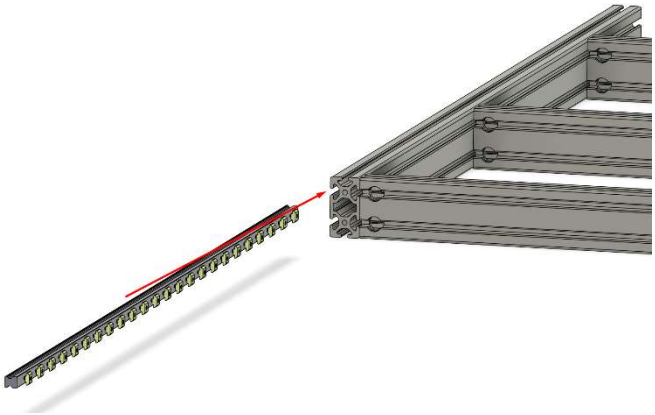
Installing Y-Axis Linear Rails

You will carry out this process on **both sides of the machine**, but for now, **focus on the left side**.

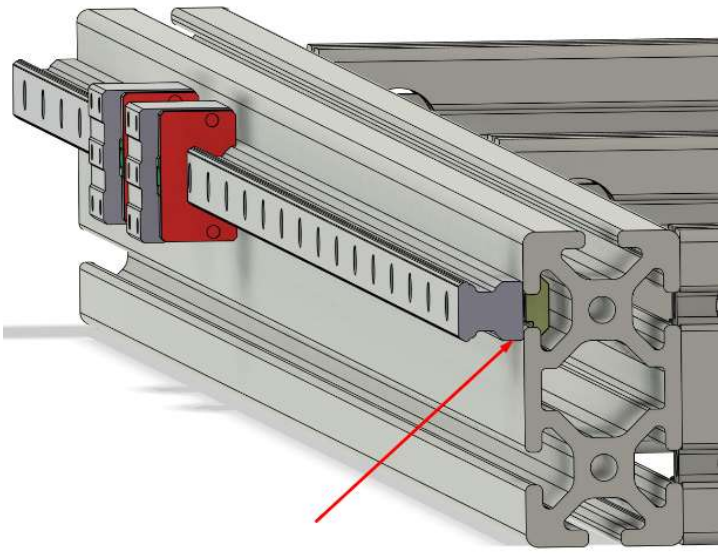
Locate one of the four **linear rails** and the hardware bag labeled **"Y Linear Rail."** Inside, you should find **M4x20 socket head screws** and **M4 T-nuts**.

Begin by inserting (1) **M4x20 screw** through one of the holes in the linear rail, then **loosely thread on (1) M4 T-nut** from the back. Repeat this process until you have filled **all holes in the rail** with screws and T-nuts. Do not tighten yet—you will complete final alignment after you position the rail.





Next, **carefully slide the linear rail assembly into the left-side extrusion**, using the **top T-track channel**. Move slowly and make sure each **T-nut aligns correctly** as you guide the assembly into place from **front to back**. Taking your time here will ensure a secure and accurate fit.



With the **linear rail now seated flush against the front face of the extrusion**, it's time to **accurately align and securely fasten** it in place.

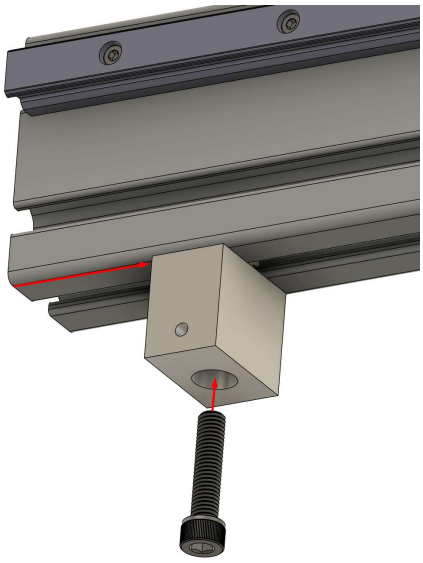
Starting at one end, ensure the rail remains straight and even along its full length. **Tighten each M4 screw gradually**, working from front to back, while double-checking that the rail stays firmly against the extrusion surface. A consistent, snug fit here is essential for smooth Y-axis motion. Be careful not to allow the bearings to slide off from the linear rail.

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Installing the Y-Axis Ball Screw Assembly

Prepare BK12's Y-Bracket

For this step, you'll need: **(1) Aluminum Bracket, (1) M8x35 Socket Head Screw, and (1) M8 T-Nut**.





If you do not have the **Legs Kit** (Left Picture), position the block **roughly 2"** from the rear end of the extrusion. Temporarily position the back of the X-rail a few inches beyond the rear edge of your table, so you can reach the M8 nut in the upcoming steps.

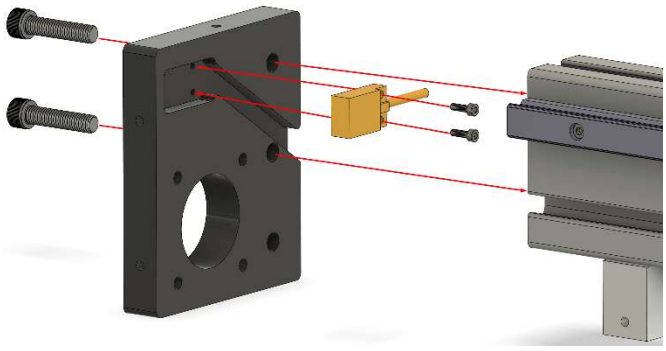
If you're using the **Legs Kit** (Right Picture), you can position the aluminum bracket **½" away from the rear**.

Thread the M8 screw into the T-nut and insert it into the extrusion but **leave it slightly loose** for now—**you'll fully tighten it in a later step**.

Installing the Rear Y Plate

The rear Y plate attaches with (2) M8x35 Socket screws, but before attaching the plate, you should pre-install the Proximity switch using (2) M3x10 Socket Screws.

The 3rd rear screw is (1) M8x25 socket and screws into the M8 t-nut you preinstalled into the rear leg.



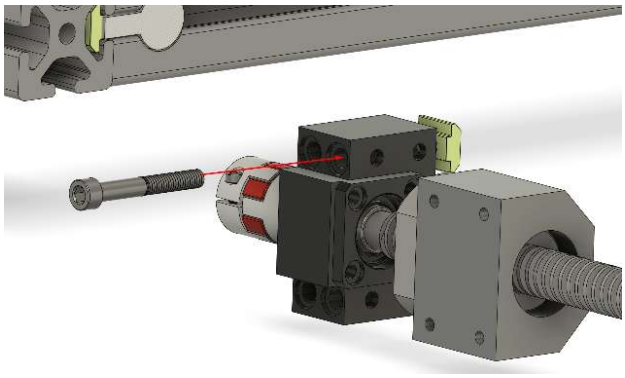
Run the proximity switch wire down the groove so it exits on the inside of the extrusion. We will attach a cable in a later step.

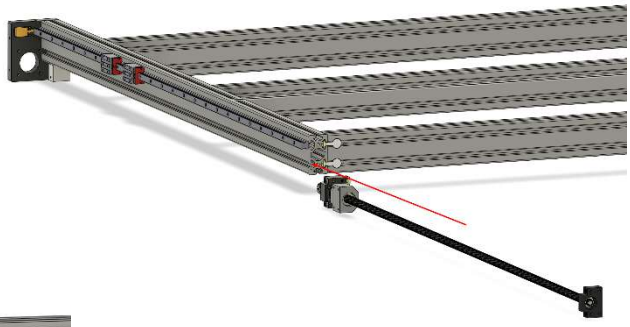
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Installing the Ball Screw Assembly

The **ball screw assembly** comes mostly pre-assembled for your convenience. To begin:

1. Attach the Flexible Jaw Shaft Coupling to the free end of the Ball Screw. (It's the silver cylinder with red plastic in the center). The two ends differ in diameter, and each grips a shaft (motor on one side, Ball Screw on the other) without either shaft entering the red plastic at the center.
2. Insert **(1) M6x40 socket head screw** into the hole shown below and **loosely thread an M6 T-nut** onto the opposite side.
3. Slide the **T-nut into the lower T-track** of the **Y-axis extrusion**, then guide the entire ball screw assembly **toward the rear** of the machine.
4. Align the **front bearing block (BF12)** so that it sits **flush with the front edge** of the machine.





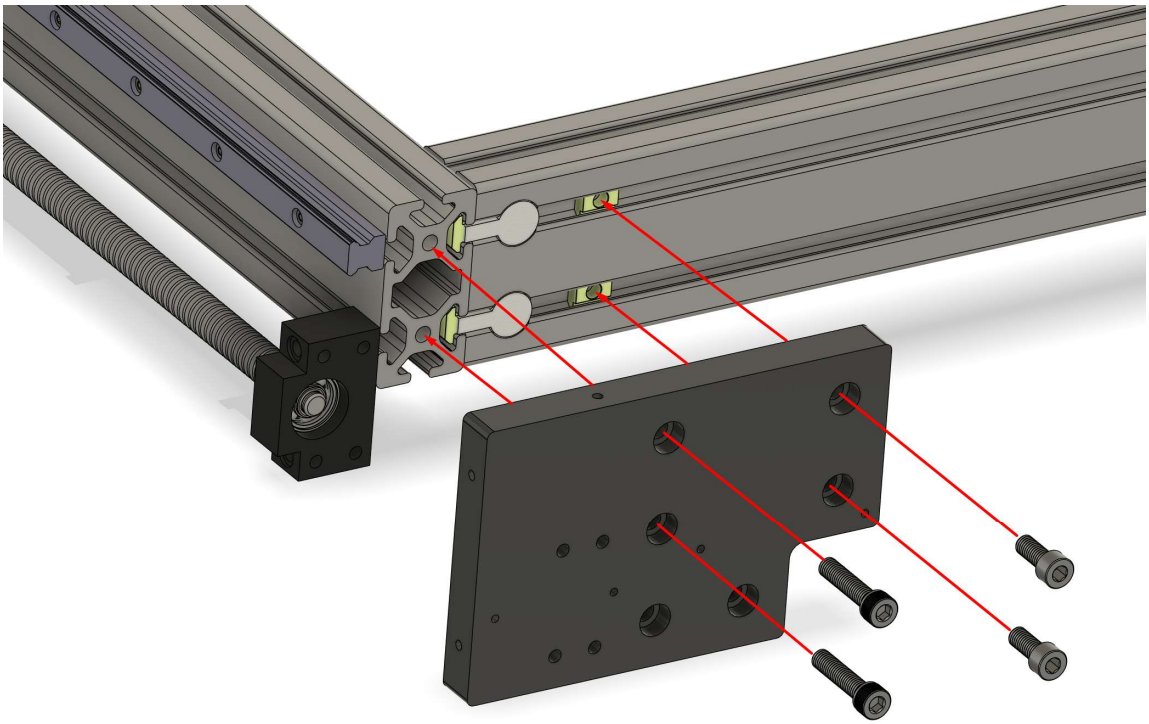


Once in position, have a **friend hold the ball screw in place** while you proceed with installing the **Front Y Plate** in the next step.

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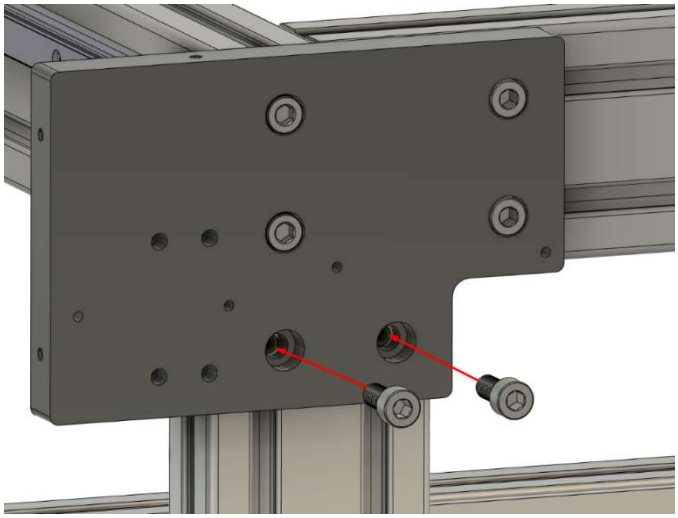
Installing the Front Y Plate

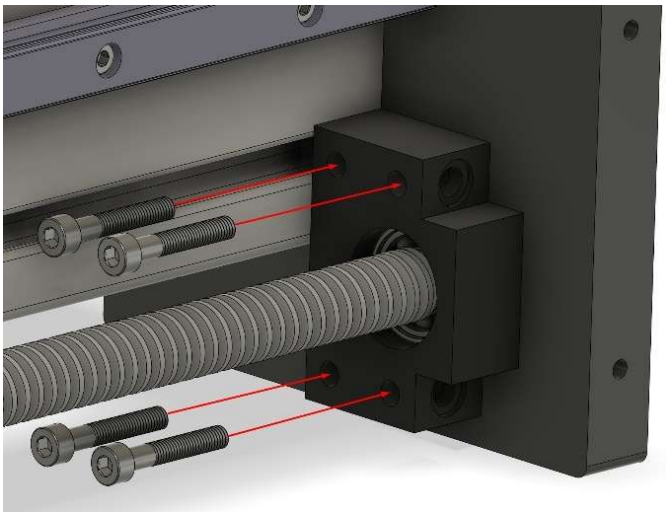
Loosely attach (2) M8x35 Socket screws into the Y extrusion and (2) M8x20 Socket screws + (2) M8 T-Nuts.



If you have the Legs kit or the Rigidity Upgrade, you'll use additional (2) M8x20 Socket screws and (2) M8 T-Nuts to secure the plate to the legs assembly as follows:

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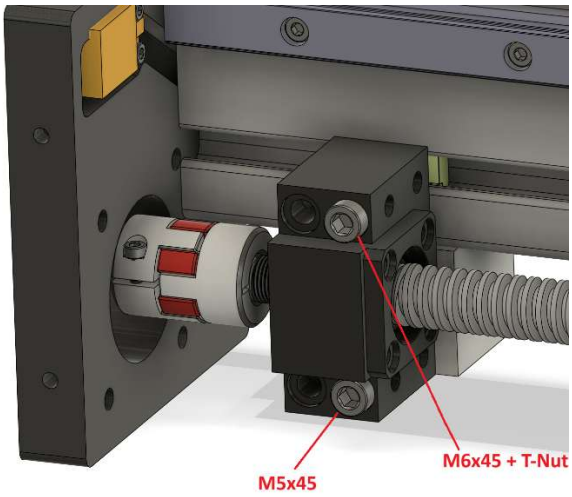


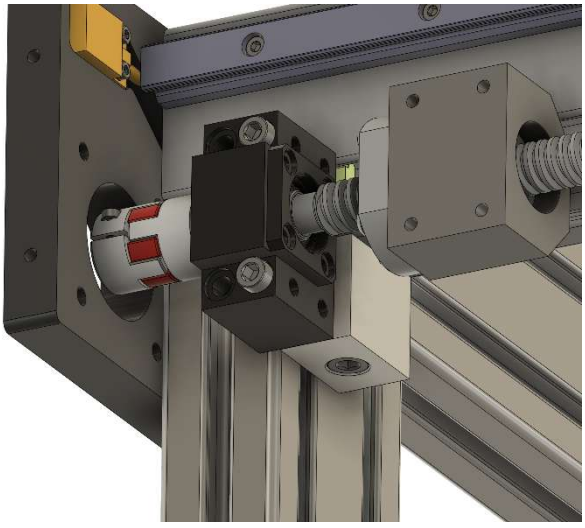


If you have the Stability Upgrade with legs, these additional (2) M8x20 screws and nuts will attach as shown. If you have the Stability Upgrade without legs, position the front Stability extrusion flush with the front of the X-extrusion. Then secure these two additional screws to the front of the Stability extrusion.

Next, we'll need to finish securing the BF12 bearing block with **(4) M5x25 Socket Screws** to the front Y plate like the image to the right.

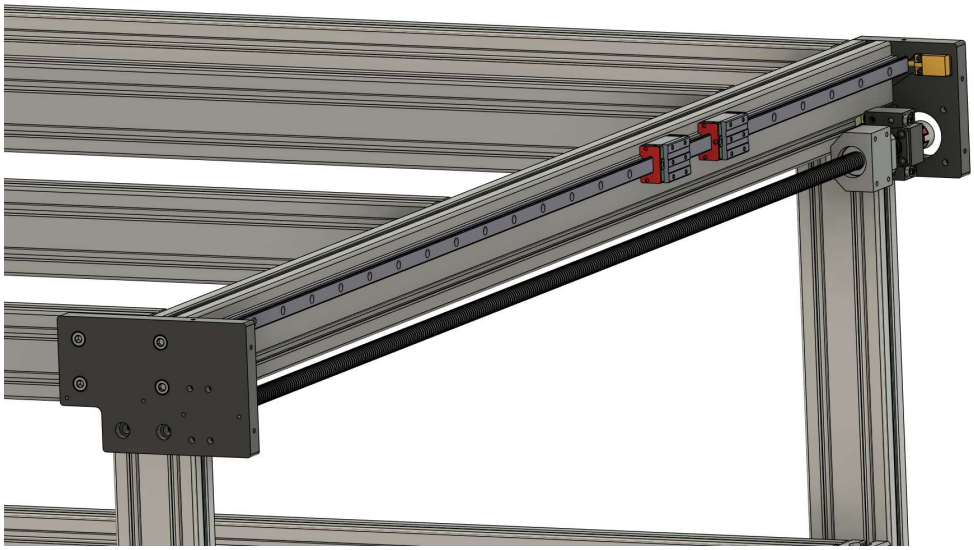
The final step in securing the ball screw assembly is to use (1) **M5x40 socket head screw** to attach the **rear side of the BK12 bearing block** to the **BK12 Y-bracket** that you installed earlier. Ensure the alignment is correct before tightening the screw to securely lock the assembly in place.





To complete the Y-axis assembly, **repeat the same steps** on the **right side** of the machine. Follow the same process for installing the **linear rail, ball screw assembly, and related hardware** to mirror the left-side setup. Be sure to maintain alignment and spacing for smooth and accurate motion.

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Level Set #1: Great Progress!

Take a moment to step back and admire your work—you've reached a **major milestone** in the assembly of your Dominator CNC machine! Getting the **base frame, legs-kit, Y-axis rails, and ball screws** assembled is no small task, and you're well on your way to a precision-built system.

This is a great time to **pause, regroup, and double-check** your work before moving on to the next phase.

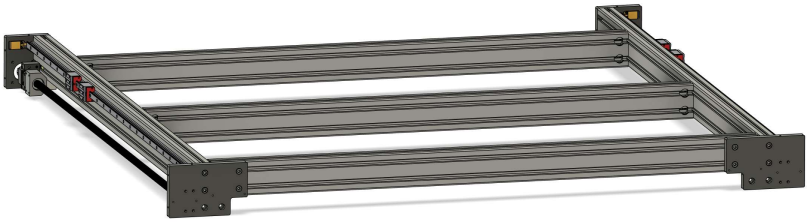
🔍 **Suggested Checklist before Continuing:**

- ✅ Confirm that the Y-axis linear rails and rear BK12 bearing-block fastening are tight. Leave all four Y plates and the remaining ball-screw assembly connections slightly loose for the later alignment steps.
  ✅ Visually inspect the **entire lower frame**—is everything square and level?
- ✅ Recheck the **diagonal measurements** to confirm squareness.
- ✅ **Tighten any bolts** in the legs or machine extrusions that you left slightly loose during earlier steps.
- ✅ Ensure the **Y-axis linear rails** are flush and secure against the extrusion.
- ✅ Confirm you have properly aligned and seated the **ball screw assemblies**.

Take a break, grab a drink, and pat yourself on the back—you've earned it!
When you're ready, let's move on to installing the **gantry system** and bringing this machine to life.

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Without Legs:

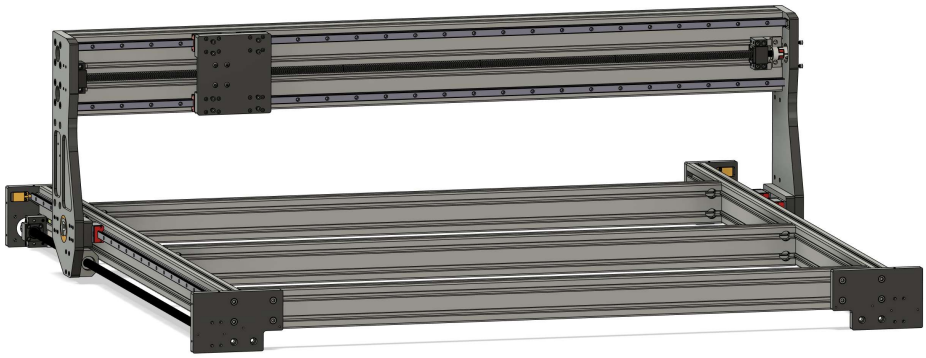


With Legs:



Installing the X Gantry

With the Y-axis assemblies complete, it's time to move on to one of the most important parts of your Dominator CNC build: the **X Gantry installation**. This step involves **preparing and assembling the main gantry extrusion** along with the **left and right gantry plates** that ride along the Y-axis.



⚠️ **This step requires two people**

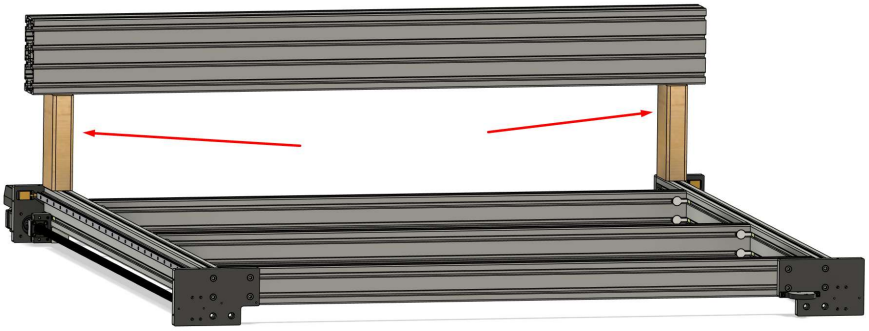
The X gantry is large and heavy, and proper alignment is crucial. Having a second set of hands will make the process safer, easier, and more accurate.

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Take your time and follow each instruction carefully. Check that every component is seated correctly, but fully tighten its fasteners only when the instructions tell you to do so. Several connections must remain slightly loose for later alignment. Once this section is complete, your Dominator will start to take shape!

🪵 Pro Tip: Use Temporary Support Blocks for Easier Installation

We recommend cutting two **2x4 blocks to exactly 7 15/16"**. Place them on top of the Y extrusions to **support the weight of the X gantry** during installation, easing the alignment of the two gantry plates.

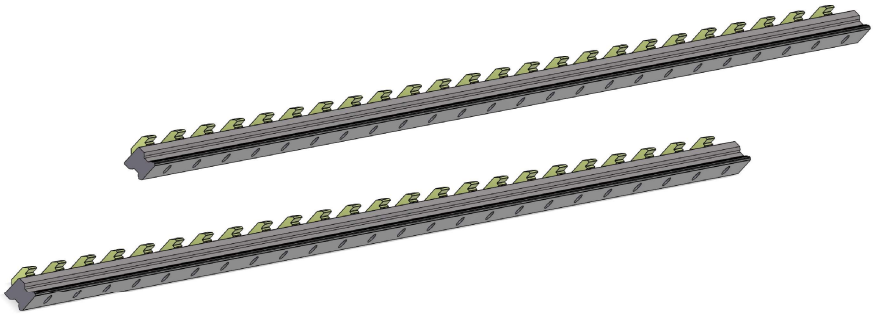


🛏️ Planning to Install Your Bed Surface Now?

If you're adding your **¾" MDF wasteboard** at this stage (recommended dimensions: **50" wide x 48" deep**), be sure to **reduce the height of your 2x4 blocks by ¾"** to account for the added thickness of the bed. This keeps your gantry support height consistent.

Installing the X Linear Rails

Installing the two **X-axis linear rails** follows the same process as the Y-axis rails. Begin by **inserting all M4x20 socket head screws** into the mounting holes along each rail. Then, **loosely thread an M4 T-nut** onto each screw. Once all screws and T-nuts are in place, the rails will be ready to slide into the X extrusion's T-track channel for positioning and final alignment.

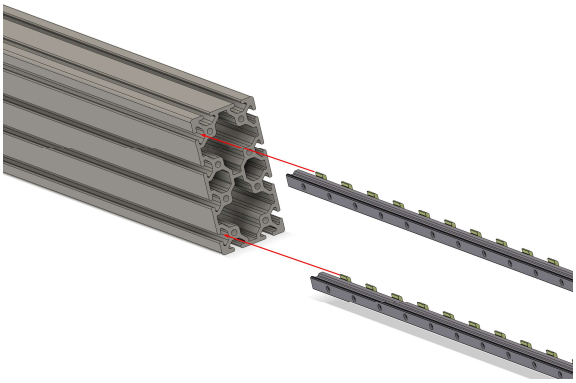


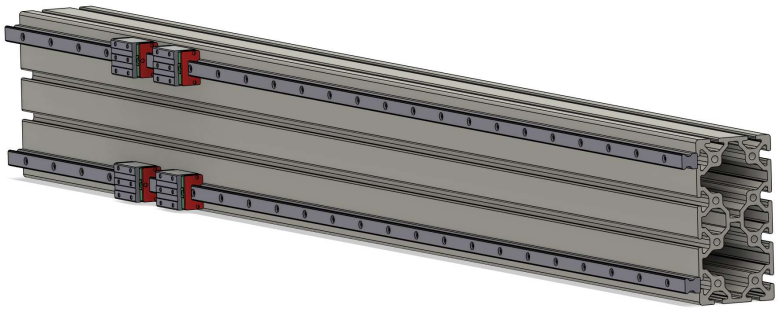
Next, **slide each X-axis linear rail assembly** into the **front face of the gantry extrusion.** Make sure you have aligned all **T-nuts** within the tracks:

- Install **one rail in the top T-track channel**
- Install **the other rail in the bottom T-track channel**

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Move slowly and guide each rail when sliding it into place, confirming that each T-nut slides smoothly into place. Taking your time during this step will help ensure a precise and secure fit.





Once you position both rails and **seat them flush** against the extrusion, **gently turn each screw until it begins to tighten**, then **back off ¼ turn**. This will hold the rails loosely in place for alignment.

⚠️ **Important:**
Accurate alignment of the X-axis rails is critical. You'll need to install the **X Carriage** before final tightening to ensure alignment of both rails.
Also, take care not to let any **bearing blocks slide off the rails**—they can be difficult to reinsert without disassembly.

Preparing X Gantry Plates

To achieve the correct spacing for the X gantry, you'll need to install **spacer plates** onto each gantry plate.

Start with the **left gantry plate**, and gather the following hardware:

- (1) **Spacer plate**
- (4) **M5x30 socket head screws**

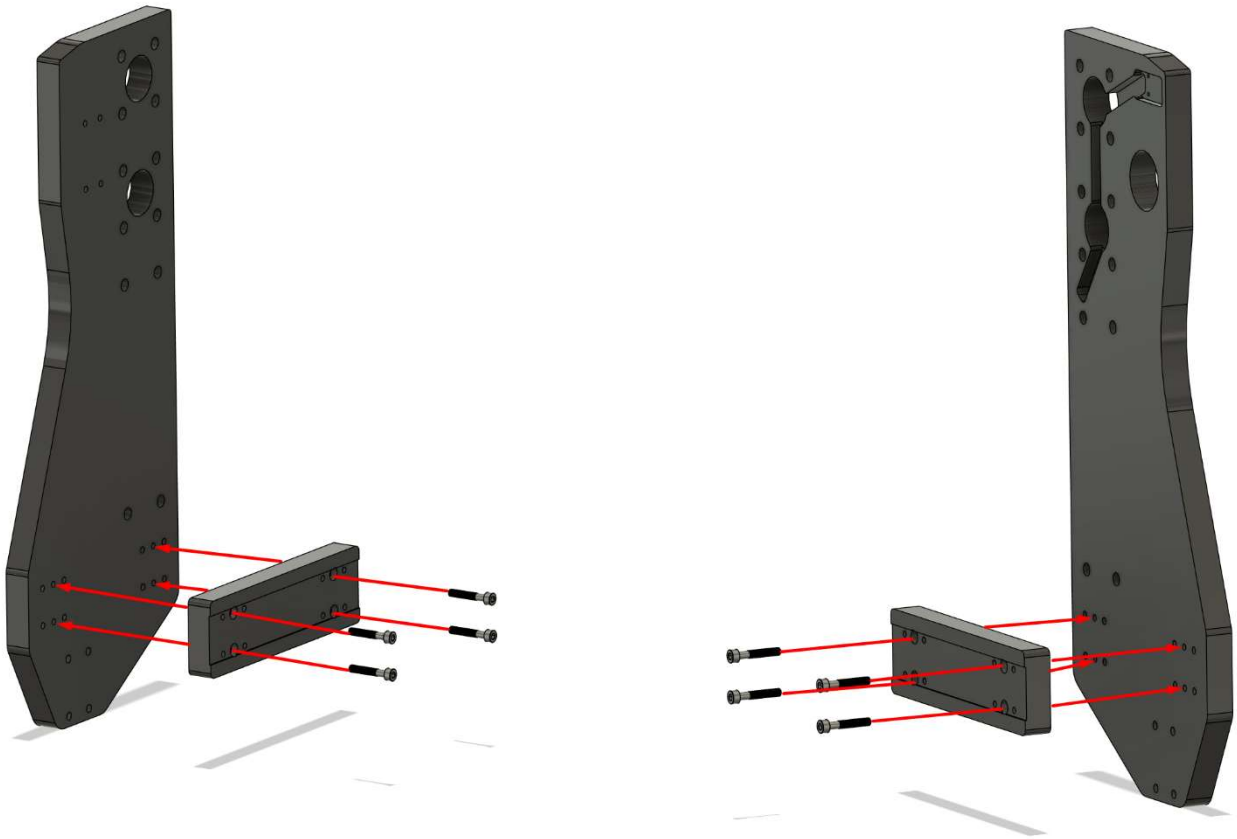
Secure one proximity sensor in its position on the inner face of the right Gantry Plate. Bring the free wire through the top hole, where it will be accessible after assembly of the Gantry.

Align the spacer plate with the designated holes on the gantry plate, then secure it using the M5 screws. The groove should be facing away from the inside gantry face. **Do not overtighten**, as you could strip the aluminum. Tighten the screws just snug enough to hold everything in place.

💡 **Pro Tip:**
Apply a small amount of **blue Loctite (thread-locker)** to each screw before tightening to help **prevent vibration from loosening hardware over time**. It's especially useful for components that you won't adjust frequently.

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Once complete, **repeat this process on the right gantry plate** using the same components. This step ensures proper clearance and alignment when mounting the gantry to the Y-axis plates.

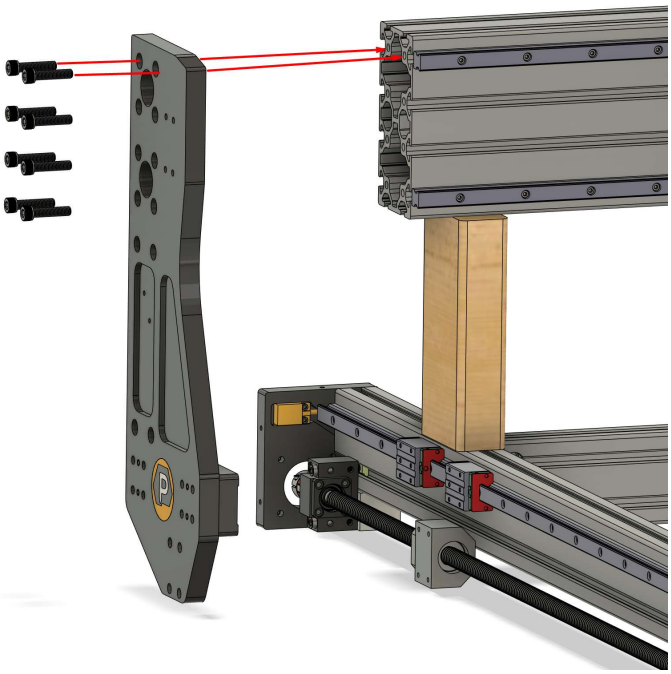


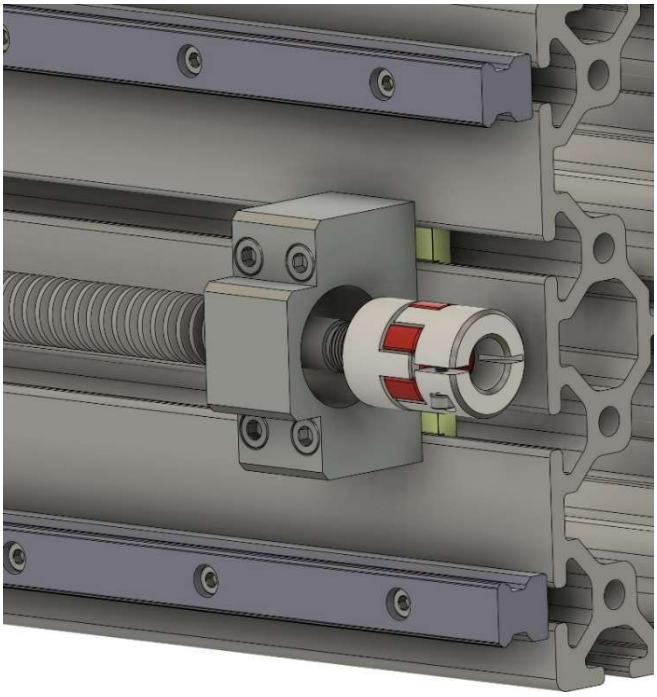
Installing the Left Side Gantry Assembly

With the gantry supported on blocks above the machine bed frame, position the **left gantry plate assembly** against the side of the gantry.

Use **(8) M8x35 socket head screws** to attach the plate to the gantry extrusion. **Do not fully tighten** the screws yet. Keeping the plate slightly loose will allow for proper alignment in the next few steps.

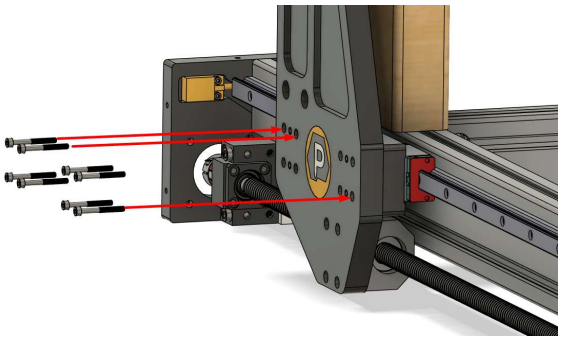
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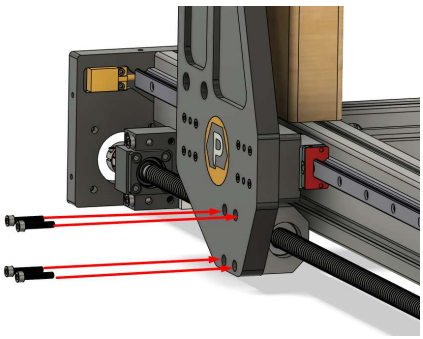




Next, take **(8) M4x35 socket head screws** and install them through the **left gantry plate** into the **linear rail bearing blocks**.

Tighten each screw just enough to hold the bearing blocks securely in place—**leave them loose for now**.





Now, insert **(4) M5x25 socket head screws** through the **gantry plate** into the **ball screw coupler**.

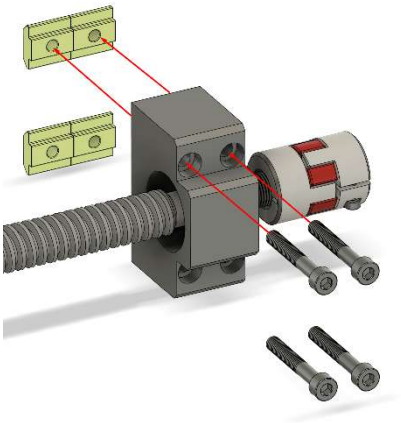
Ensure the screws are properly aligned with the coupler's threaded holes. Also leave them slightly loose. This links the motion of the Y-axis ball screw directly to the gantry, enabling synchronized movement.

Prepare X Ball Screw Assembly

Four custom Slide-in T-nuts allow the Block 12 Bearing Block to secure to the Gantry extrusion. Use two more of these nuts to secure the opposite bearing block to the same slots in the Gantry. Use (6) M5x35 socket screws for these six nuts.

These custom T-nuts are either included with the X screw assembly or pre-installed onto the blocks. Consider the hardware baggy parts a free extra.

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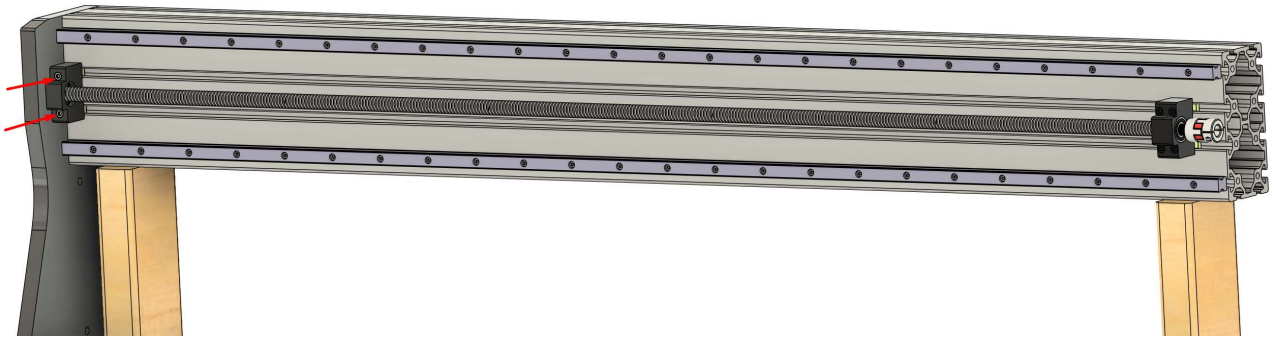
Attach the Flexible Jaw Shaft Coupling to the right end of the Ball Screw.

Slide the T-nuts into the extrusion's T-slot and loosely thread the screws into place. **Leave them slightly loose for now**—you'll tighten them later once the X-axis ball screw is fully aligned.

Finish pre-assembling the x-ball screw by installing the included hardware and twisting the t-nuts onto the ends. This will make it easy to slide the ball screw assembly onto the gantry face. Carefully position the t-nuts into the two middle t-tracks of the gantry.

Slide the whole screw assembly fully into place and bump the floating block (non-coupler side) up against the left gantry plate using the two screws.

Leave these screws slightly loose for now—this will allow for final alignment adjustments in the next steps.



Installing the Right Gantry Assembly

You'll need the following hardware:

- **(8) M8x35 socket head screws** (for attaching the plate to the gantry extrusion)
- **(8) M4x35 socket head screws** (for securing the linear rail bearing blocks)
- **(4) M5x25 socket head screws** (for connecting to the ball screw coupler)

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- Place (2) M5 Slide-in T-nuts into the rear slot on the top of the Gantry before attaching the Right Gantry plate. These will later secure the X cable chain.

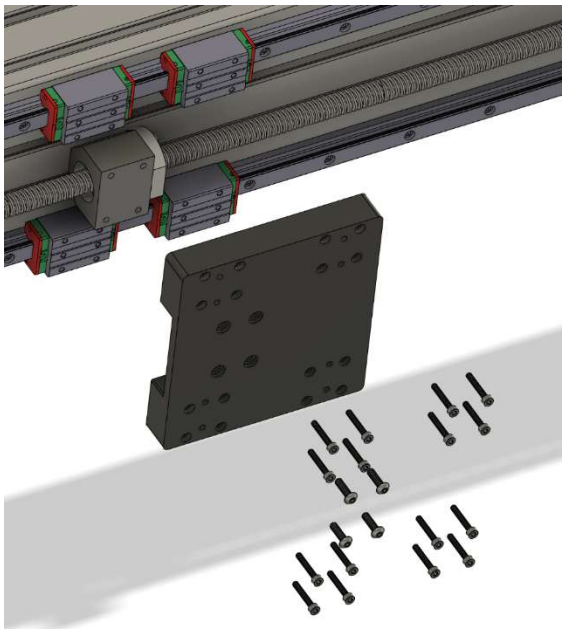
Attach the plate using the screws listed above but **leave all fasteners slightly loose** for now. We'll perform final alignment and tightening in the upcoming steps.

Install the X Plate

Grab your X-Plate and hardware bag and begin assembly.

You should find **(16) M4x25 Socket** screws for you to attach all four X bearing blocks with the X-Plate. You'll then use **(4) M5x16 Button** screws to attach the screw coupler to the backside of your X-Plate.

Be sure to align the X plate such that the 4-coupler screw-holes are on the left side.



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Level Set #2: More Great Progress!

Take another moment to step back and admire your work—you are now finished assembling the main mechanical components of your new Dominator CNC machine.

This is a great time to **pause, regroup, and double-check** your work before moving on to the next phase.

🔍 **Suggested Checklist before Continuing:**

- ✅ Visually inspect the **entire machine**—is everything square and level?
- ✅ **Tighten any bolts** that you left slightly loose during earlier steps.

Once again take a break, grab a drink, and pat yourself on the back—you've earned it!
When you're ready, let's move on to installing the **stepper motors and wiring**.

Without Legs:



With Legs:



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Electronics Package



If you purchased a **Dominator with the electronics package**, this section applies to your build.

It includes:

- A fully wired **Masso G3 Touch controller**
- **PwnCNC Power Box** containing a 36v Power Supply
- (4) **Closed-loop stepper motors** (2Nm or 3Nm options)
    - The **Z-axis motor** includes an **integrated electronic brake** for added safety
- (4) **Proximity limit switches** for accurate homing and travel limits
- **Pre-made wiring harnesses** for plug-and-play installation
- **LED Gantry Light + Cable**

The following pages provide a step-by-step walkthrough for installing these parts onto the **Dominator mechanical assembly** you've just completed. Each step makes the process easy to follow.

Motor Installation

To start out you'll want to identify each of the four stepper motors. You can find them in the large box with our logo on the top. It will contain 4 stepper motors with the Z stepper being the larger one as it contains an integrated brake. Take note of the cover orientation in the images.





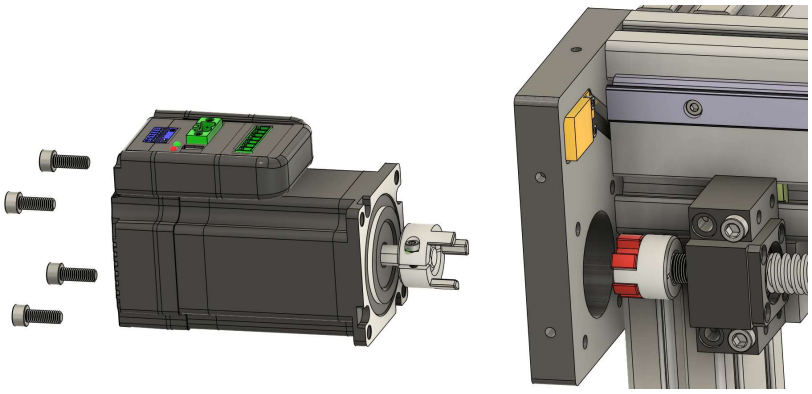




Y Stepper Installation

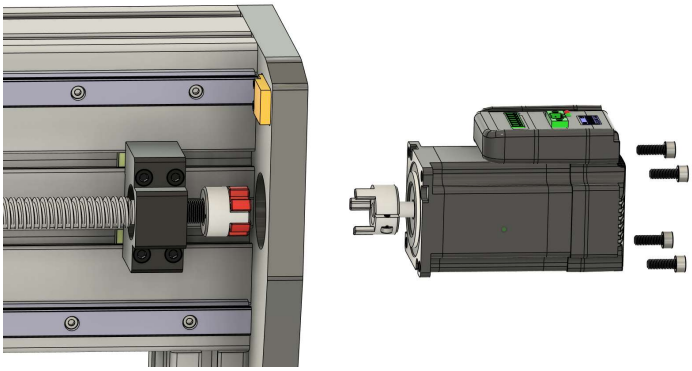
The first step is to locate a stepper and the **(4) M5x14mm socket head screws**. Next, separate the coupler and attach half to the stepper shaft securely. Next, using the M5 screws, attach the motor to the rear Y plate. (Repeat on the other side)

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X Stepper Installation

Repeat these steps for the X stepper:



Controller Orientation – Decision Point

It's now time to decide on which side of your machine you'd like your Controller. We designed the Dominator to allow you to install the controller on either the left or right side. The side you choose is the side you'll want to start routing your wires.

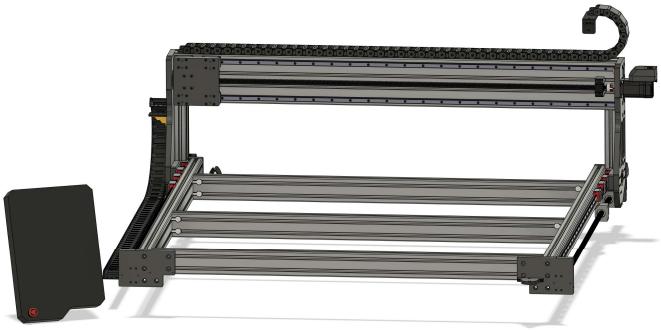
We refer to 'right' or 'left' for parts whose position is mandatory. We refer to 'M-side' (where your monitor will be) and 'N-side' (where your monitor is not) if the choice is yours. This page shows both options, but the illustrations on the following pages show 'right' as 'M'.

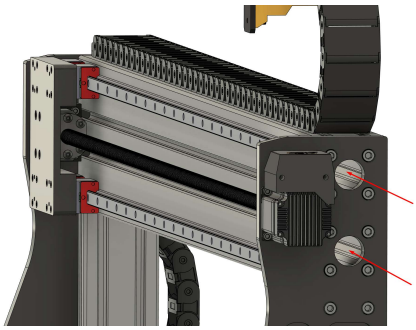
Right Side Controller Orientation – take note of the cable chain routing with all wiring exiting on the right-side Y chain.



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Left Side Controller Orientation – again take note of cable chain routing and all wires exiting on the N-side Y chain. Also note that the X motor is still on the right side, and its cable will need to pass through the extrusion using one of the two holes in either gantry plate.

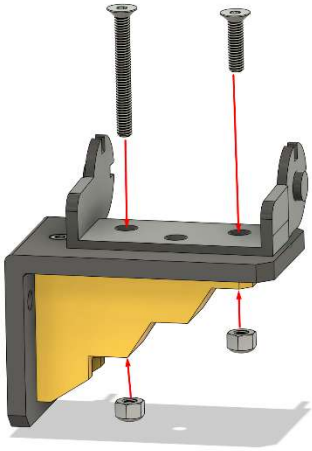


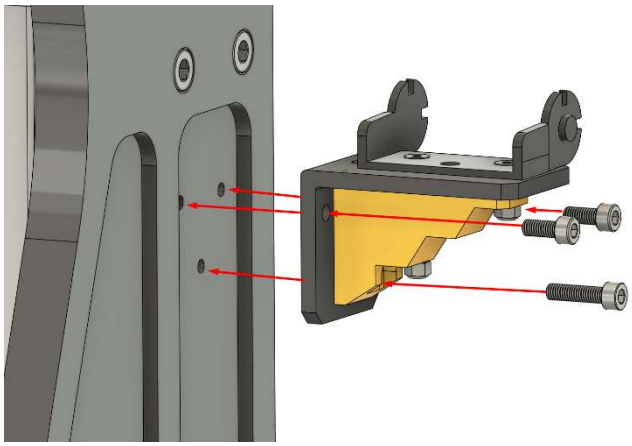


Chain Bracket Assembly & Install

Y Chain Bracket

Orient the "Male" cable-chain end with its ears pointing toward the rear of the machine. This orientation is the same whether your M-side is left or right, and the bracket will attach on M-side. Detach the "Male" end from one cable chain and attach it to the shorter 3D-printed bracket using (1) M4x35 Triangle screw, (1) M4x15 Triangle screw, and (2) M4 Lock Nuts.





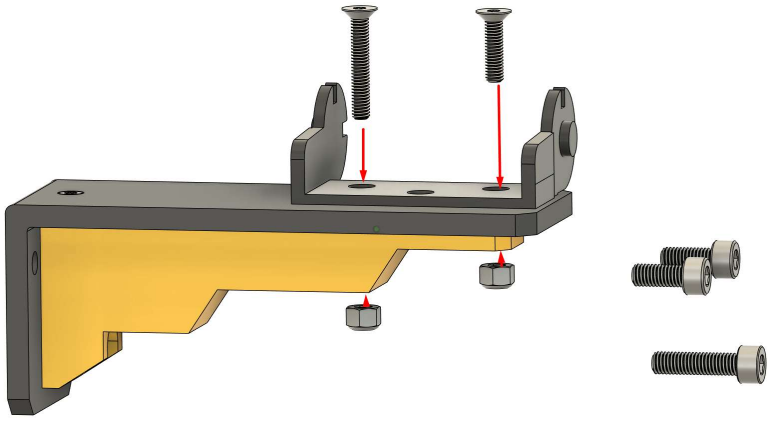
Next attach the Y-Chain bracket assembly to the M-side gantry plate using **(2) M5x12 Socket and (1) M5x20 Socket** screws.

We will attach the rest of the Y cable chain in a later step… for now we just need to know where to guide our wires and this bracket with end is perfect.

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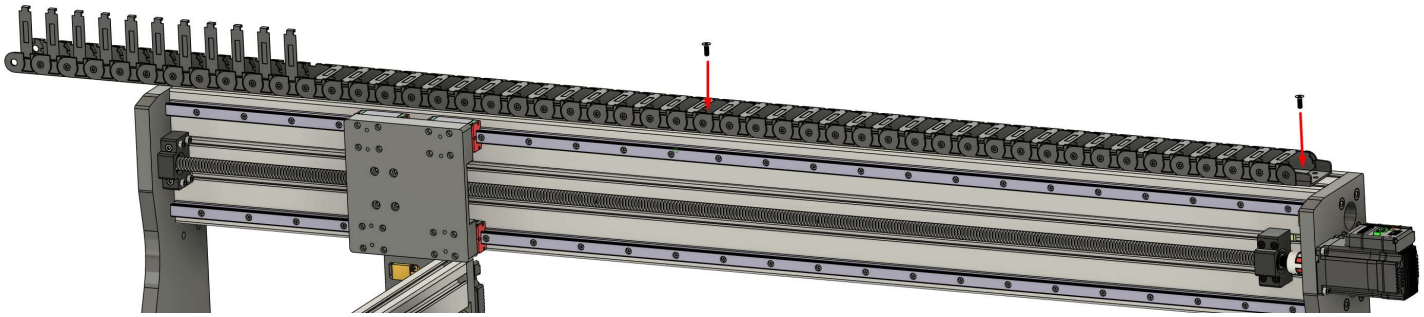
X Chain Bracket

The X chain is similar in that you'll attach the "Male" end of the cable chain to the bracket, but this time using **(1) M4x25 Triangle, (1) M4x15 Triangle, and (2) M4 Lock Nuts**. Also, while you will need **(2) M5x12 Socket screws** and **(1) M5x20 Socket screw** later during installation, just set this assembly aside for now.



X Chain Installation

Now it's time to install and open up the X cable chain. It will sit along the top-side of the large gantry extrusion and attach using the two M5 T-Nuts you installed previously along with **(2) M5x14 Triangle screws**.



The cable chain should bump up close to the M-side gantry plate. The open links shown above overhang the N-side. Place the M5 triangle screw in the middle; it's roughly halfway or 750mm from the right side. (Optional but advised: Use a ¼" drill bit to open a hole in one of the chain-links near the 750mm mark.)

Lastly… start opening the chain so you can have easy access for running the various wires.

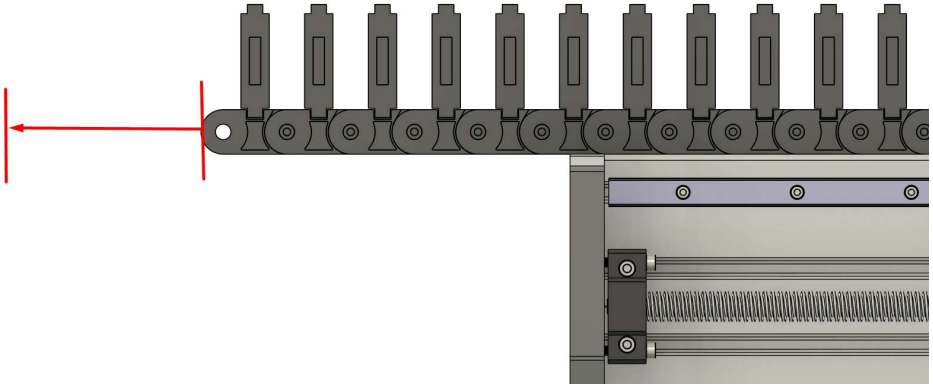
X-Chain Wiring

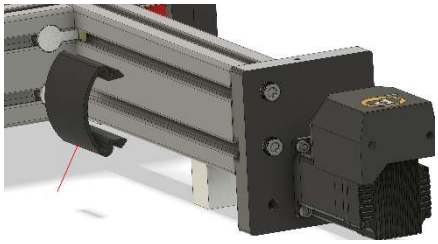
With the chain fully open you can start laying out your wires that will be contained within. On the N-side of the X chain that is hanging past the left gantry, be sure your wires are sticking past the end of the chain.

- Z Motor Cable - 15" past end of cable chain.

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- Z Proximity Cable – 0”, this cable should come right to the end of the cable chain.
- Spindle Power Cable – 23” w/Z-Chain Upgrade
- Coolant Tubes (for water-cooled spindles) – 36” w/Z-Chain Upgrade
- ATC Motor Sensor Cable (if applicable) – 24”
- Pneumatic Tubes (if applicable) – 36”





💡 *Pro Tip:* Place painters’ tape on each cable or tube at the appropriate inch mark as you’re laying the cables into the X chain. This will help keep them aligned prior to closing up the X-Chain.

Wiring Steppers and Homing Sensors

It’s time to start wiring up your X, Y, and B stepper cables and proximity switches. We attached the phoenix connectors to each cable. Connect those to each motor and route cables. The covers are tight, so run the wiring as in the photograph.

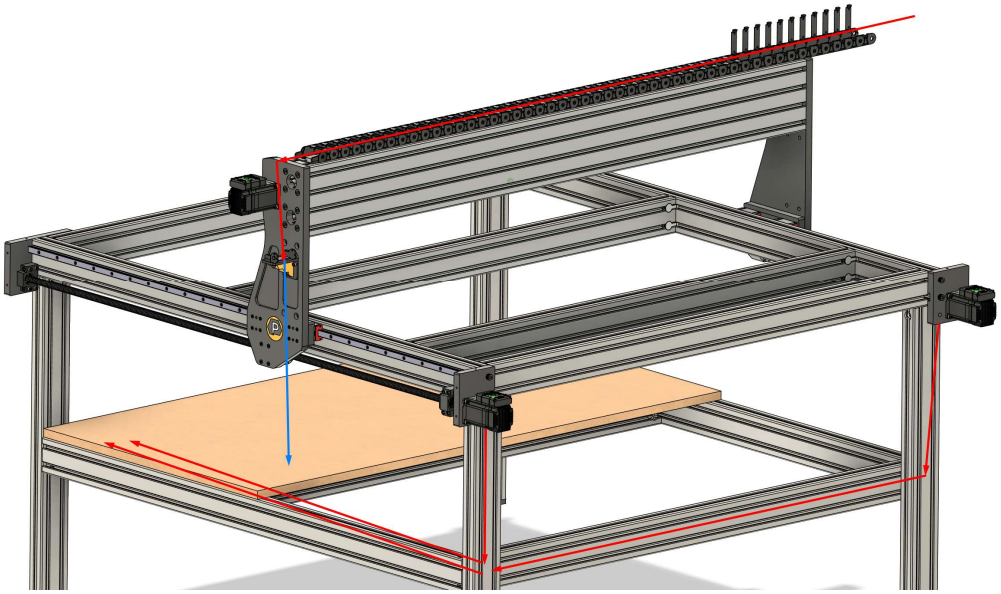


💡 *Pro Tip:* As you are running the stepper cables through cable chains and along extrusions, we have included special 3d printed snap-in wire covers. This will allow you to route your wiring in an extremely clean way. If you’d like more, we have them available on our website as well as their maker-files for those wanting to print in custom colors.

Run your cables/tubes along the X-chain and down alongside the Y-Chain bracket. The Y steppers should go down the legs and along the lower shelf.

It will be a bit messy at this stage with wires everywhere. But remember to label each cable/tube as you place it so you can identify each at the time you’re ready to hook everything up.

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Level Set #3: Electrical Progress!

By now, all spindle cables, air tubes, and signal wires should rest within the X-axis drag chain.

🔍 **Suggested Checklist before Proceeding:**

- ✅ **Y and B stepper motors** are securely mounted to the rear Y plates, with couplers installed.
- ✅ **X stepper motor** is mounted to the right-side gantry plate, with coupler installed.
- ✅ **X, Y, and B stepper motor cables** are connected to their respective motors.
- ✅ **X, Y, and B proximity sensor cables** are connected and routed neatly.

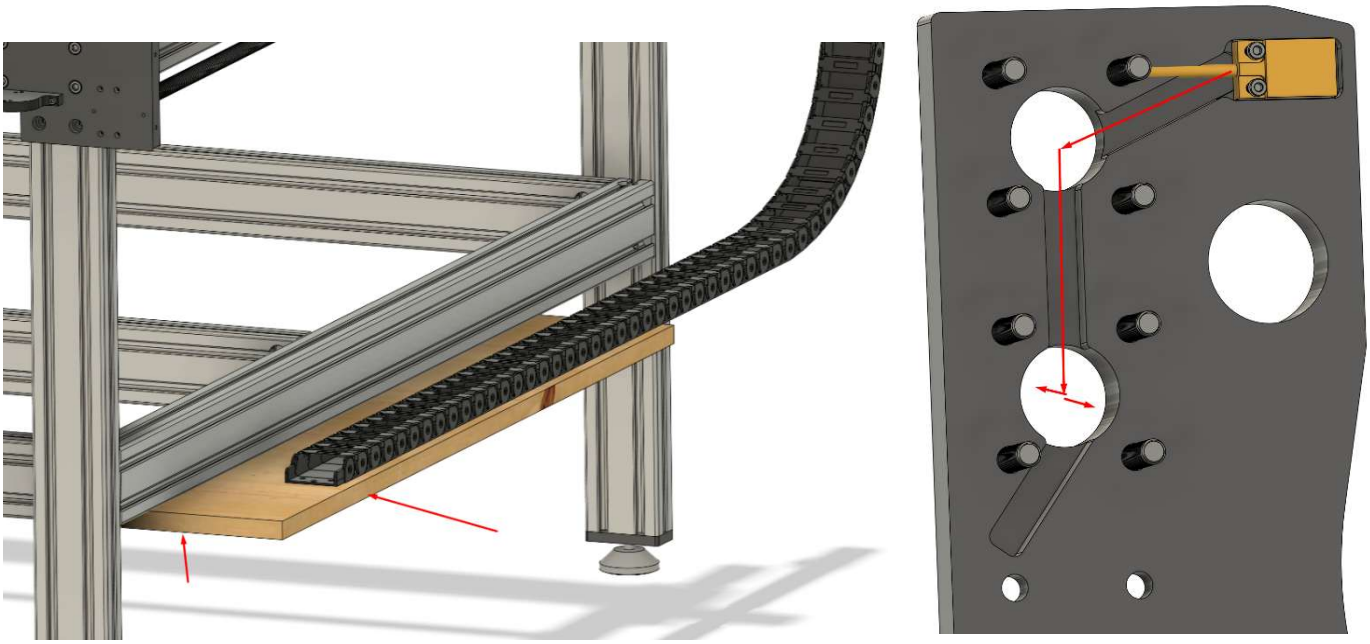
Y Chain Installation

For those who **do NOT have the Leg-Kit**, **simply screw the Y chain** down to your table top. The Y-chain carries the spindle cable, air line, cooling line(s), and the Z and X motor power and sensor cables. Route the Y and B motor power and sensor cables parallel to the chain but outside it, and secure and/or cover them. Gather these lines near the Power Box, then use the inventory in “Final Electronics Assembly” to distinguish connections to the Power Box from those to the controller.

For those **WITH the Leg-Kit** secure a small piece of wood using hardware included with the “Extras” baggy. Attach it to the under-side of the lower-shelf extrusion like this:

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With the Legs Kit, the Y-chain carries all the contents of the X-chain plus the Y and B motor power and sensor lines. Gather the cables near the Power Box and follow “Final Electronics Assembly” for their individual Power Box and controller connections.



Installing Limit Switches & Sensors

Proximity switches (aka “Limit Switches”) tell your machine that a moving part has gone as far as it dares to go. The switches are activated when metal comes within about 1/8” of the switch. The four proximity switches all are “top-triggering” style. You will embed the X and both Y switches directly into the Right Gantry Plate and Both Rear Y plates respectively.

X Limit Switch

The X switch runs through the right-side gantry plate. Use the channels to route the wire down into either inner gantry holes. If your controller is on the left side, you’ll need to run the X limit switch through the gantry as you did the X stepper cable. If it’s on the right side, then simply exit one of these two holes to go immediately into the Y cable chain.

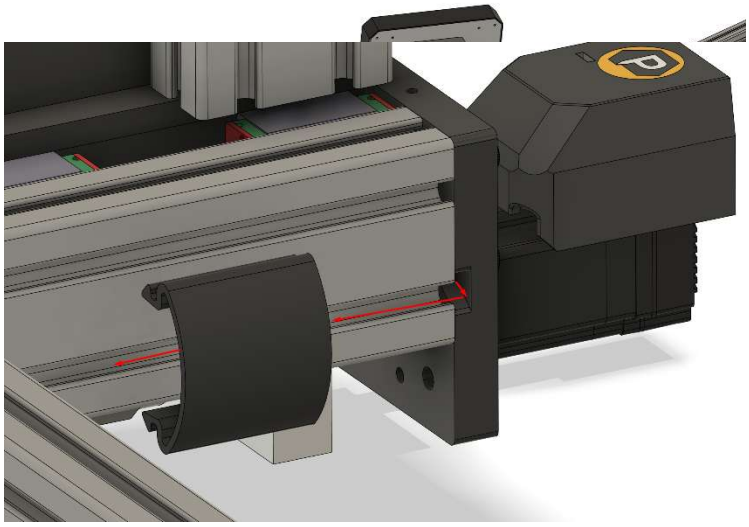
Y Limit Switches

Both Y switches also have channels in the Y Rear plates for routing their short wires before plugging into the longer limit switch cable. The channel meets up with the extrusion’s t-track.

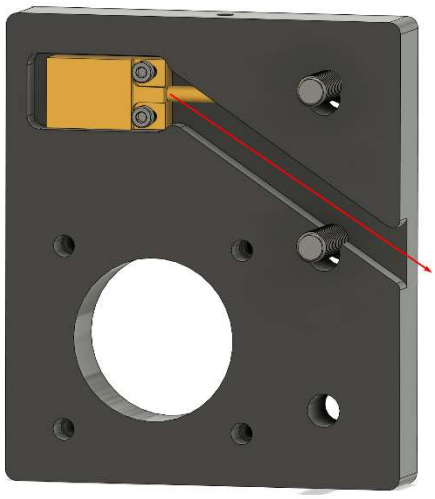
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Z Limit Switch

For now, route the Z stepper cable and Z limit-switch cable through the X cable chain. Install the Z switch later using the Z Proximity Switch instructions in Z-Carriage Final Assembly.



If you are installing a spindle or ATC, install those other accessories while you have the X cable chain open.





Miscellaneous devices

This section covers installation of important accessories.

VESA Controller Mount

The Masso G3 Touch controller has a VESA 100mm mounting ability. If you bought the Legs Kit, we included the perfect VESA arm which allows for awesome wire management as well as lots of articulation control.

You will also have a steel 90-degree mounting bracket. Install this on the side of one leg giving you a surface on which to attach the VESA articulating arm mount. Utilize some of the “Extra” hardware for attaching this to the legs.

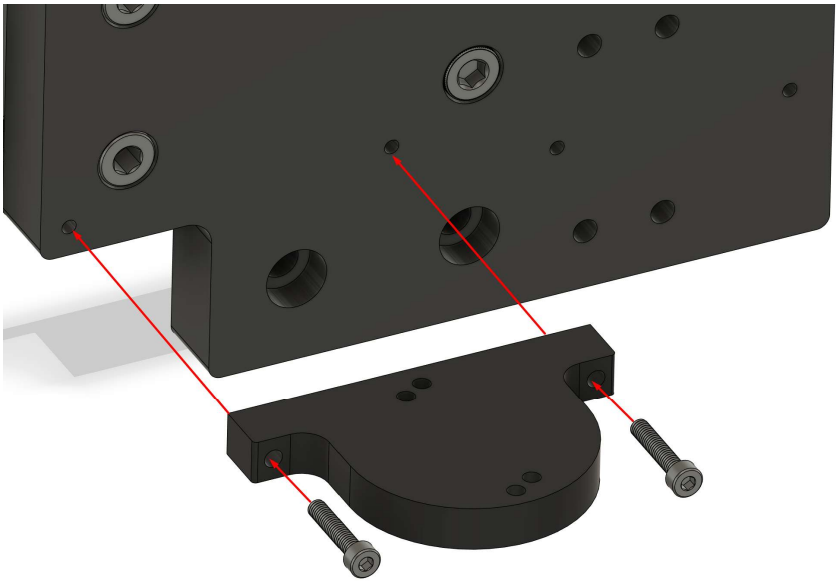
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If you do not have the Legs Kit, you may choose to buy and install a VESA stand or an articulating arm. You can secure either to the table surface.

Tool Setter

We've included a tool-setter pad which makes installation easy. Mount the pad on either the left or right side of your machine utilizing two holes on either front Y plates with M4x16 bolts.





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Final Electronics Assembly

At this point all the cables should lie near or around your preferred controller location. At the end of the Y cable chain the "dual" cables will split. Some of the connectors will go up and behind the controller while others will go to the Power Box (PB). See the inventory below for details.

You should have the following cables exiting the Y cable chain:

1. Y Axis (Y Right) stepper cable (splits into two, one goes to power box, other to controller)
2. B Axis (Y Left) stepper cable (splits into two, one goes to power box, other to controller)
3. X Axis stepper cable (splits into two, one goes to power box, other to controller)
4. Z Axis stepper cable (splits into two, one goes to power box, other to controller)
5. Y Proximity (to power box)
6. B Proximity (to power box)
7. X Proximity (to power box)
8. Z Proximity (to power box)
9. Gantry LED (to power box)
10. Additionally, you may have multiple tubes and wires related to Spindles, ATC's, and other items.

The Power Box (PB) is best located 2-4 feet away from the controller. Typically, this will be on a near-by shelf or close to the Y cable chain. You'll be turning the CNC on/off via the power switch on the right side of the PB, so keep it handy.

Plugging everything together should be simple as our conversion kit components are well-labeled.

Feel free to plug everything together but wait on the AC power until the Z carriage assembly is complete.

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Grounding sensor shields

Before working on cable shields or cabinet connections, disconnect power as required in Safety Guidelines. This appendix describes an example with eight sensor cables and a ninth connection for the Masso console; confirm which cables and connections apply to your build before proceeding. If you cannot identify a connection or are unsure how the instructions apply, stop and contact PwnCNC support.

You've heard that you should "ground" your cable shields. But why? What does that mean? How do you do it? Where do you get the materials?

Your motor wires (spindle and stepper power lines) not only send power, but they also create a magnetic field around themselves. If they're near to, and parallel with your sensor wires (as in a cable chain), the sensor wires convert some of that magnetic field back into electricity. The problem is that the electricity is random and purposeless. Folks call it "noise". If the noise fools your sensors into thinking the machinery isn't where it's supposed to be, you can experience errors. To prevent that, you can send that electricity to a place where it won't bother anybody: the ground.

You want a wire to touch the shield (which surrounds each sensor cable) near the place where the cable begins (the Power Box or the Masso console). The other end of your wire connects to a bar where unwanted products from several cables pass to the ground. Since it's easier to use the "Ground" wire on the electrical grid, most folks do that. But connect just one wire to each sensor's cable shield. Attaching two can make things worse.

McMaster-Carr is one of many sources. Their part numbers are:

- Wire, 22 AWG, stranded. Green insulation (50 feet) 8054T13
- Tape, self-fusing, silicone, 1" (10 feet) 7643A57
- Grounding bar, 12 holes 2450K14





Remove a window of black rubber insulation from your cables. The good news is that you're cutting ***to*** (not ***through***) a woven sheet of metal, so you won't harm the sensor wires under the shield if you're gentle. I chose a spot 3 cm from the end and 3/8" wide. Use a sharp blade (new utility- or X-acto-blade). Make very shallow cuts while you bend the cable away from your cut. If that doesn't already expose the layer beneath, make more shallow cuts until it does. The traction of your bend stresses the insulation, saving you from risky deep cuts. Extend around your cable. Then do the same thing 3/8" away and remove the material between the cuts.

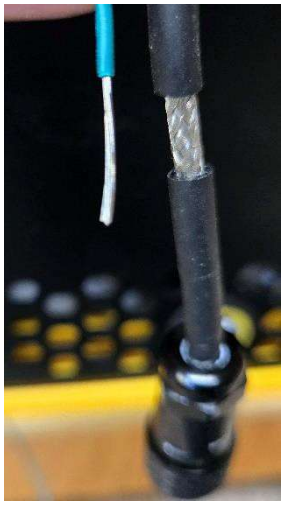
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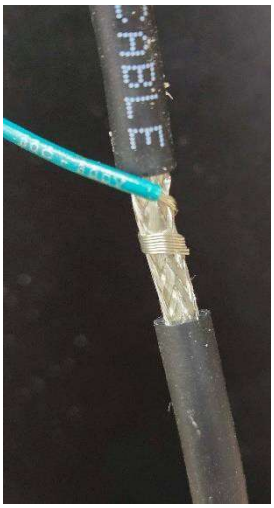


Your cable shield might show up as soon as you remove the rubber. But some PwnCNC cables have a layer of paper between the rubber and the shield. Remove that paper from the 'window' you just made.



Prepare nine (9) pieces of your 22 AWG wire, making lengths that will reach your control cabinet and the ground bar within it.



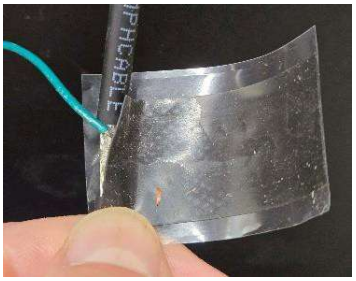


Strip 3/4" of insulation off one end of your drain (green) wire, then wrap the strands around the shield you just exposed. (Soldering is not necessary.)

Cover the windows and their connections with silicone electrical tape. Cut lengths of about 2" and wrap one length around each cable window with its shield wire inside.

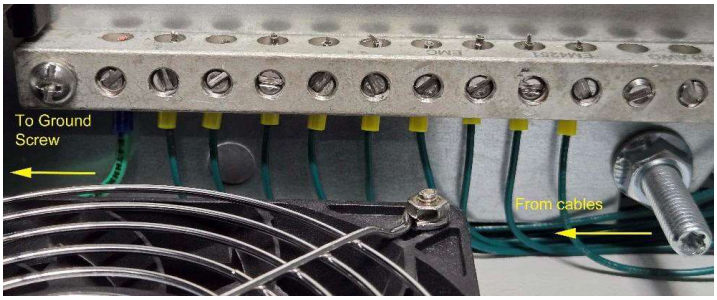


This stuff sticks firmly to itself, making it difficult to adjust what you've wrapped. However, it doesn't stick to anything else. You must stretch it tightly, but you can't do that until you've gone around the cable once.



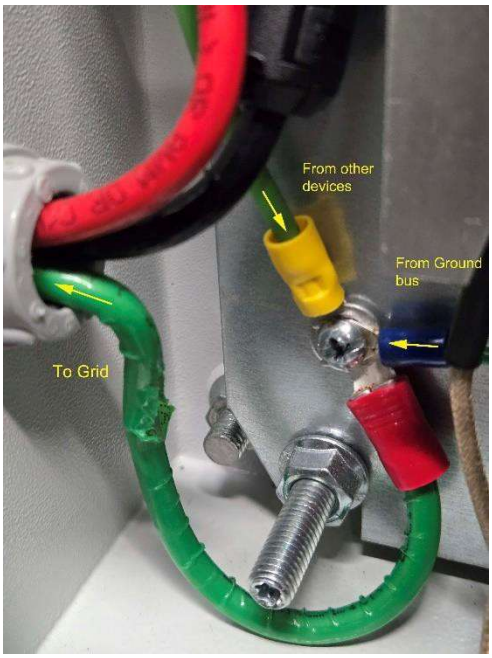


Repeat this process for all eight sensor wires. Your ninth wire will ground your Masso console and the metal to which it's attached. That ninth wire doesn't disperse a magnetic field. It discharges static electricity from your body, which you can dump into the system when you touch the console. Solder or crimp a Y-connector or ring-connector to the 22 AWG wire, then secure it to one of the screws that mounts your console to its stand.



Within your control cabinet, secure the Ground Bus bar by screwing it to the back plate. Secure one end of a 14 AWG wire in one of the holes in the Bar. This end should have a ferrule, so that all its strands are in contact with the bar.

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Run the nine wires into your control cabinet. Put a ferrule on each and secure each to one hole in the ground bar. As is true for ground bars anywhere, you only use one wire per hole.

The other end of your 14 AWG wire should have a Y-connector or ring-connector, which you screw to the post where you already have your main ground wire connected. That main ground wire goes back to the grid, grounding everything in your cabinet that attaches to it.

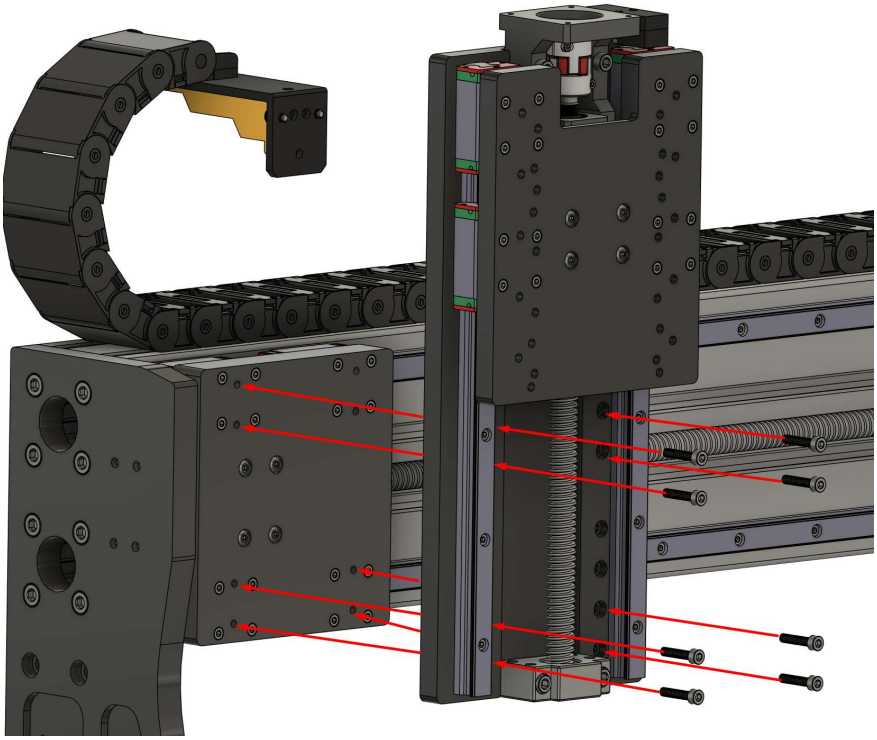
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Z-Carriage Final Assembly

The Z-Carriage is a vital component of your machine.

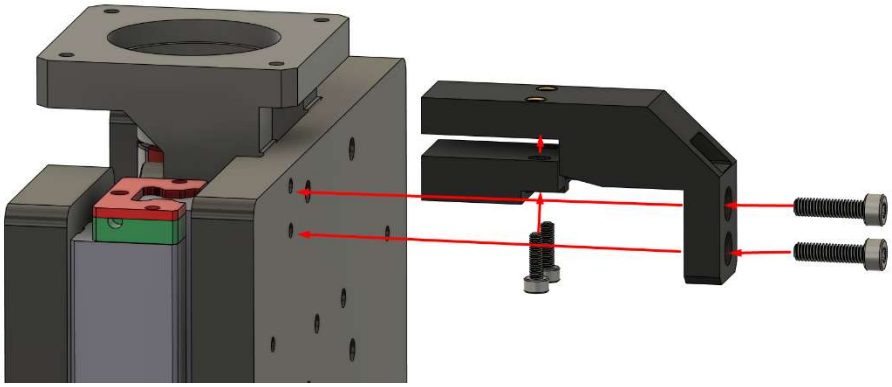
Mounting Z-Carriage

The Z-Carriage is held onto the X plate by **(8) M5x20 socket screws**. After assembly is complete, you will perform a calibration step called "Tramming". In that step you may need to place shims (washers), sometimes as thin as 0.001", between the Z-carriage and the mounting plate. These screws are the locations where those shims will go. There are several holes available depending on your desired z-capacity requirements. For maximum z-clearance, use the bottom two holes in each of the four mount groupings as shown below:



Z Proximity Switch

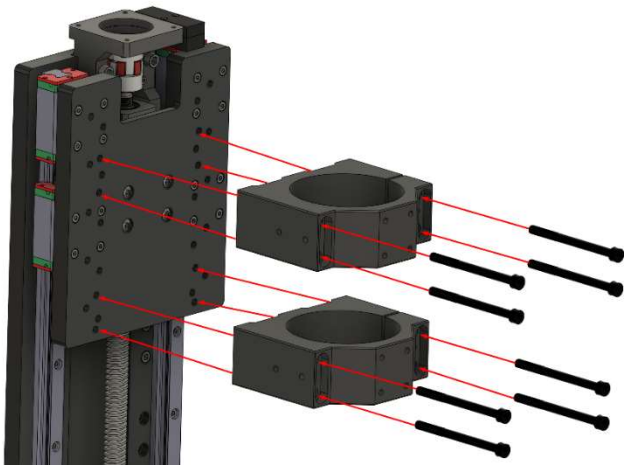
Mount the z proximity switch onto the top "shoulder" of the z-carriage utilizing **(2) M4x16 socket screws**. The switch itself lies in the 3d printed bracket, secured with **(2) M3x14 socket screws**. This arm attaches to holes in the rear of the carriage.



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Installing the Z Stepper Motor

Attach the z-stepper motor at the top of the Z-carriage housing. We recommend facing the stepper cover to the M-side so it's out of the way of any wiring that comes out of the X cable chain up and over/around the stepper motor itself. Use **(4) M4x14 socket screws** to secure the motor to the motor housing atop the Z carriage.



Installing the Spindle Mount(s)

Attaching the spindle mounts will depend on what kind of spindle you're installing. We can mount two of our spindle mounts onto the Z plate as shown below. By default, these are 80mm spindle mounts, but 65mm is available. We also have a variety of mounting holes for square spindles.



You are now ready to attach the X-chain bracket assembly that you made on page 31. Complete the attachment of power cables to their Y, B, X and Z motors and sensor cables for these four axes. Secure your spindle's lines for power and (as required) for cooling, purge air or ATC air. Adjust the length of lines and cables to allow full range of motion as the gantry moves along the X, Y and Z axes.

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Software Setup & Machine Configuration

First Power-On Checklist

Normal, Abnormal, and When to Stop: Read before powering on for the first time.

The first power-on can feel stressful. Here is **what to expect**, **what's normal**, and **what should make you stop immediately**.

Before You Apply Power

Do a quick visual check:

- All stepper motors are plugged in
- All connectors are fully seated
- No loose ferrules or exposed conductors
- Homing switches are mounted but **not actively triggered**
- Nothing is mechanically binding
- Grounding is connected or planned

If anything feels rushed, stop and fix it now. First power-on is not the time to "see what happens."

Powering On: What You Should See on the Masso Controller

- The Masso Touch screen powers on normally
- No error messages immediately on boot
- The interface loads to the main screen

This confirms the controller and power supply are healthy.

Stepper Motors

- Motors may energize with a slight "click" or resistance
- Z-axis motor brake may audibly release
- Motors should **not move** on their own

Indicator Lights

- Closed-loop stepper motors may show green or steady status LEDs
- No flashing alarm lights

If all motors show alarms immediately, stop and recheck wiring and grounding.

Sounds You May Hear (Normal)

- A faint hum from energized steppers
- A brief relay click inside the controller
- Cooling fans turning on

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Sounds That Are NOT Normal (stop immediately)

- Grinding or binding sounds
- Repeated clicking from motors
- High-pitched squealing
- Rapid on/off cycling

These indicate mechanical or wiring issues that you must correct before continuing.

First Homing Attempt

Before jogging any axis far, run a **homing cycle**. What should happen:

- Axes move slowly toward homing switches
- Each axis triggers its switch and backs off slightly
- Machine settles into a known home position

If an axis moves the wrong direction, stop immediately. Do not “see what happens.”

Errors That Are Acceptable (Initially)

Some errors are normal during first power-on and setup:

- Homing fails due to switch alignment
- Axis alarms due to misconfigured direction
- Limit switch triggers if mounted too close

These are configuration or mounting issues, not hardware failures.

Errors That Are NOT Acceptable. Stop if you see:

- Multiple motor alarms at once
- Alarms immediately on boot
- Motors energizing but not releasing
- Smoke, smell, or heat buildup
- Errors that persist after power cycling

Continuing past these can cause permanent damage.

Before Your First Cut, confirm:

- Homing completes successfully
- Jogging works in all directions
- Axis directions match expectations
- No alarms during idle movement
- Spindle control works as expected

Only after this should you move on to cutting material.

When to Pause and Ask for Help

- You’re unsure whether behavior is normal
- An alarm keeps returning
- Something feels “off” but you can’t explain why

Catching issues early prevents expensive fixes later.

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Controller Firmware & Updates

Part of the Dominator's power lies in our use of Masso controllers. Diverse industries worldwide use Masso controllers, bringing you broad experience. As Masso responds to technological improvements, they issue "firmware" updates.

You will receive updates through your connection to the "MyWorkshop" portal. With your purchase, we notify Masso that you're an authorized user of the equipment they made. From your home computer, you will download the desktop application ("Masso Link") from their download page:

MASSO Link Software

In your search-bar, type docs.masso.com.au and navigate to the Masso Link software.

Homing & Travel Limits

"Homing" refers to moving the machine's spindle/router carriage to a location as near to the X, Y and Z proximity sensors as possible. This typically means the rear-right corner of the Dominator, with the Z carriage at its highest point.

Proximity sensors only know to report that metal is nearby (activated) or not (inactive). They have no idea how wide or deep your Dominator is. When all of them are activated, the machine position (by definition) is X=0, Y=0, Z=0. You will tell the Masso Controller how far from XYZ=0 the machine can travel. That task is among those in the upcoming section, **Input/Output Configuration**, p.47.

What can go wrong?

If a proximity sensor isn't working or if its cable isn't passing its message along, the motor will try to move even when it can't. It will stall, and the Controller will stop asking it to try. The same thing will happen if binding makes the effort too difficult. Although you'll get an error warning, no damage occurred.

You can tell that the proximity sensor is "alive" by holding a piece of metal close to it. Its red LED will light. You can tell that the sensor is being "heard" by the Controller if its state (on the Controller's F1 screen) changes from "Low" to "High". Test these with a bit of aluminum foil. Place it in a spot that keeps the sensor activated while you go look at the Controller for the red label, "High" next to the name of the sensor concerned. (Repeat at the other sensors, but don't leave it there when you finish).

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This image shows Masso's display when two things went wrong. First, the X-sensor is active (metal hasn't backed off). Second, the X-motor tried to move more than it was able to. This might occur if you gave an order to move to a position that is further to the right than "Home" (which isn't possible).



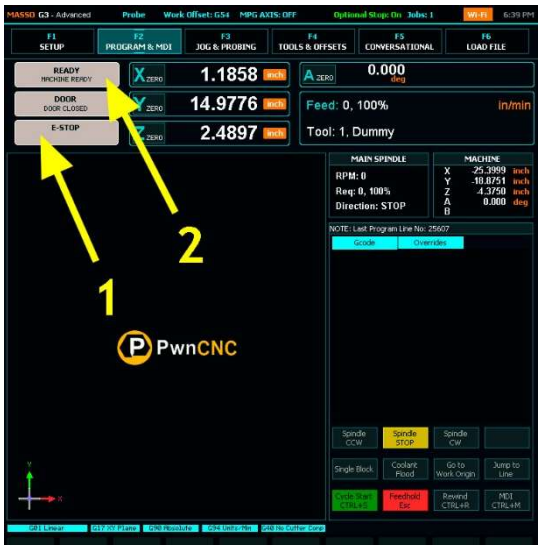
What to Expect on First Power-up

On first power-up, a few things are normal and expected:

- The Masso Touch boots normally
- The machine does **not** move on its own
- Motors may feel stiff or locked when powered
- No axes should be actively driving yet

If anything moves immediately on power-up, stop and power down.

Before You Press "Home"



The first screen you see on the Masso Controller will have three "buttons" in the upper left. Every time you turn it on, Masso requires you to press and reset the red E-stop button (beneath the screen) to affirm that it's working. When you then double-press the "Ready" button, the "Homing" sequence will start. But before you do:

- Watch our video: [Pre-Flight Checklist: Verifying Your Masso Control System Before Homing - PwnCNC] (enter in your browser: **https://support.pwncnc.com/kb/article/599-pre-flight-checklist-verifying-your-masso-control-system-before-homing/**)

- Make sure **nothing can crash**
- Remove tools, clamps, and workpieces
- Move the gantry and Z axis roughly to the middle of travel
- Keep one hand near the E-Stop

This gives every axis room to move in either direction safely.

First Homing Cycle: What Should Happen

When you press **Home** (double-press "Ready") you should see:

- One axis moves slowly toward its homing switch

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- The axis stops when the switch is detected
- The axis rebounds (moves toward its prior location) slightly
- The next axis repeats the process

This continues until all axes are “Homed”. The motion should be: Slow, Controlled, Predictable

Stop Immediately If You See:

Hit E-Stop or power down if:

- An axis moves **away** from its switch at speed
- An axis keeps moving after contacting the switch
- An axis slams into a hard stop
- Motors growl, chatter, or stall loudly
- The gantry twists during homing

Do not “let it finish and see what happens.” Stopping early prevents damage.

Axis Direction Sanity Check

Masso’s F3 screen allows you to move the spindle carriage (aka “Jogging”). After homing completes successfully, do **not** jog far yet. Perform a simple direction check with **small** increments only.



On the X Axis:

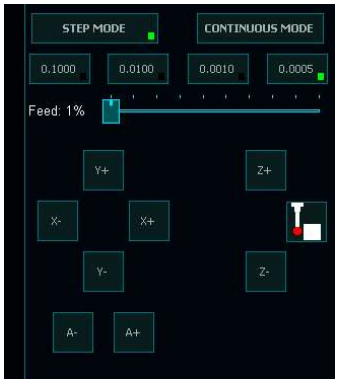
- Jog -X
- Machine should move to the **Left**

On the Y Axis:

- Jog -Y
- Machine should move **towards you** (toward the front)

On the Z Axis:

- Jog -Z
- Z should move **down**ward towards the table



The “Jog” screen (left) has two modes. In “Step” mode (see green LED in the corner of the button) each touch of an X, Y or Z (+ or -) will move the machine by the distance of the button just beneath the mode choices. Here, the button for 0.0005 is active. That motion will be hard for you to detect by eye. Bigger movements occur with the other buttons.

Sometimes you want to go a long way, and don’t want to hit a button repeatedly. Choose “continuous” mode and hold the desired button for axis and direction. The flashing red LED reminds you that it’s risky to leave it in that mode.

If an Axis Moves in the Wrong Direction

This is common on first setup and **not a failure**. Do not swap motor wires. Do not rewire anything.

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Simply:

- Reverse the axis direction in Masso settings
- Re-test with small jogs

Do Not Jog to Extremes Yet

- Do not jog to full travel
- Do not probe
- Do not run g-code
- Do not mount the spindle yet

The goal here is **basic correctness**, not full operation.

What Success Looks Like

You are ready to move on when:

- Homing completes cleanly every time
- Each axis moves in the expected direction
- Small jogs behave predictably
- No alarms or stalls occur

When to Pause and Ask for Help

Stop and contact support if:

- Homing fails repeatedly
- An axis refuses to move
- Directions cannot be corrected in software
- You're unsure whether behavior is normal

Input/Output Configuration

In this section you will teach your Masso Controller:

- Your Dominator's dimensions
- Where you want to locate the spindle for certain tasks
- How to ensure that your instruction to move a certain distance results in exactly that movement

Open the "Setup" screen (F1). You will see a "Password" field.

Password

We leave the **Masso Admin password blank.** When prompted for the "admin" password: Leave **that field empty** (Press Enter). No password is required, but you can set one yourself after installation. However, until you do press "Enter", Masso won't let you change any information on the set-up screen.

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We ship the controller this way so you can access settings immediately, without the risk of being locked out during install or troubleshooting. If you choose to set an Admin password later, be sure to **record it somewhere safe**. If you forget a password, recovery may require reconfiguration.

If you are unsure whether a password has been set or are unable to access Admin functions, contact Support.

After you clear the Password box, you can review the Set-up screen:

In the left column are topics for which you may have to add information or confirm what's already there. Every Dominator has X, Y, Z and B axes, but not everyone has an A (rotary) axis.

Notice that in the middle column, the "Status" of every row is "Low" except E-stop. This is the normal condition. Except for E-stop, a "High" status indicates that an error occurred.



General Settings

This has to do with the way your screen will display the information (landscape or portrait).

Homing

In the "Homing" convention used in this manual, the sensor reference position is XYZ=0. The "Pull off" setting tells Masso how far to move away after finding that reference. The example shown uses 0.1". Check that the sensors are inactive after the pull-off move. This avoids beginning the next homing cycle with a sensor still activated if the machine has remained in its previous end position.



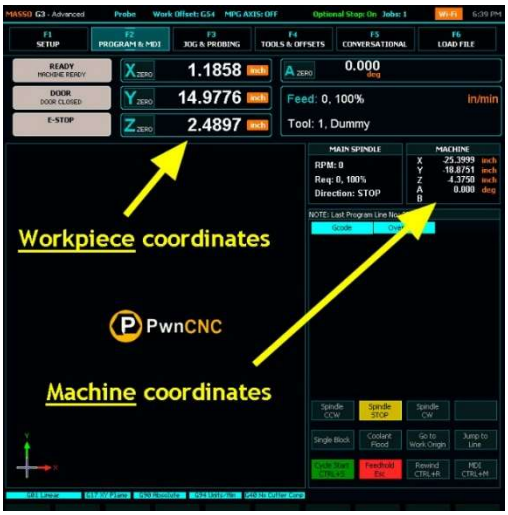
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Main Spindle

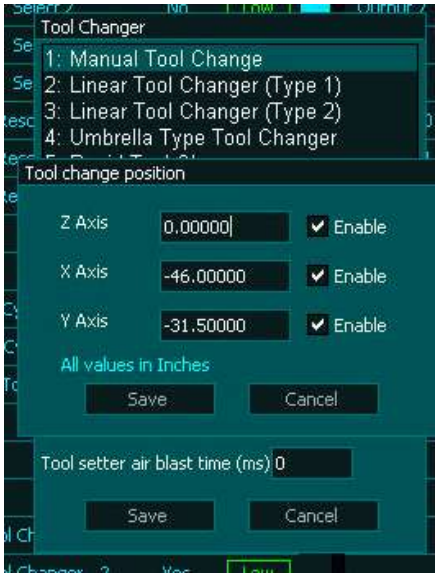
Ensure that the settings here are compatible with the guidance from your spindle's manufacturer.

Coordinates



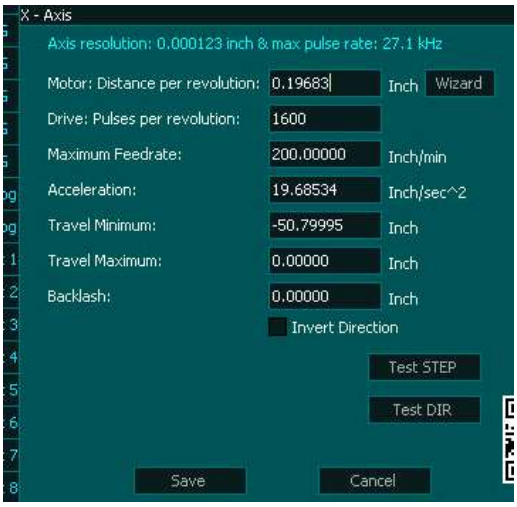
Look again at the F2 screen and notice two sets of coordinates. The difference will matter in the upcoming screens. Workpiece coordinates describe the ***distance*** to whatever spot you told Masso to use when starting your toolpath, and that changes. Machine coordinates are the ***distance*** between the spindle location and the place you called "Home". Regardless of your project or the spindle position, the "Home" location does not change. Since you will always be to the left and front of "Home" this will always be a negative number.

Tool Changer



Masso supports more than one way to change tools. The "Manual Tool Change" dialog lets you choose the location where you want to perform tool changes. Notice that the numbers here are negative. Masso considers anything to the left of, and closer to you than XYZ=0 to be a negative number. In the example, (a 36" x 50" work surface) the tool changer is 46" left of "Home" (which is 4" right of the left machine edge). The spot is 4.5" away from the front machine edge, which is 31.5" away from "Home".

Axes (X, Y, Z, A and B): Steps per mm



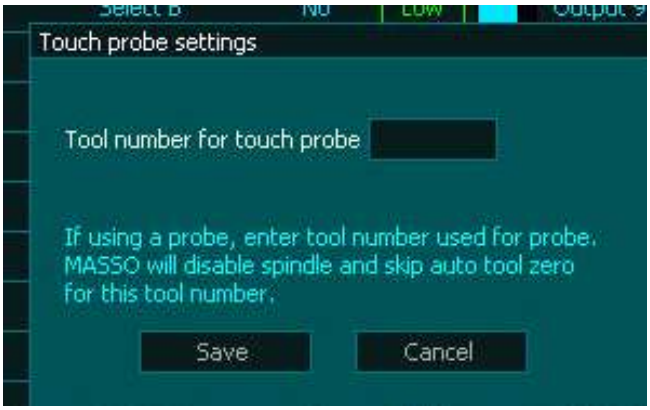
The X, Y and Z axes are similar, so we'll just describe X. The B axis will automatically match whatever you require for the Y axis. The A axis is for rotary movements. Set the parameters desired. Common choices for maximum travel rate and acceleration are 200 inches/min and 20 inches/sec^2, respectively.

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Travel Maximum will be 0 (Home). The Minimum will be a negative number that you set. The machine will not try to move beyond your limit, nor will it alarm when that limit stops it. But if you set a limit it can't reach, then it will alarm when it tries. Move the machine as far as you want it to go, notice what the machine coordinates are and enter them as your limit.

The dialog displays the calculated stepper movement required for one inch of travel, labeled "Resolution." To recalculate it with the Wizard, place an extended tape measure on the bed where it will not be moved or bumped. Note the exact starting position of the bit's tip. Move the spindle—not the tape—as far as you can in the desired direction, then determine the distance between the starting and ending positions. Enter that measured travel when the Wizard asks; it will recalculate the resolution.

Touch Probe



If you don't use a device specifically made for defining positions, then this box doesn't matter to you. This box is not for the bit you use for probing, nor the Tool Setter nor the Touch Plate. If you DO use an actual Probe, give it a number and a place in your tool list (typically Tool 1).

Auto Tool Zero



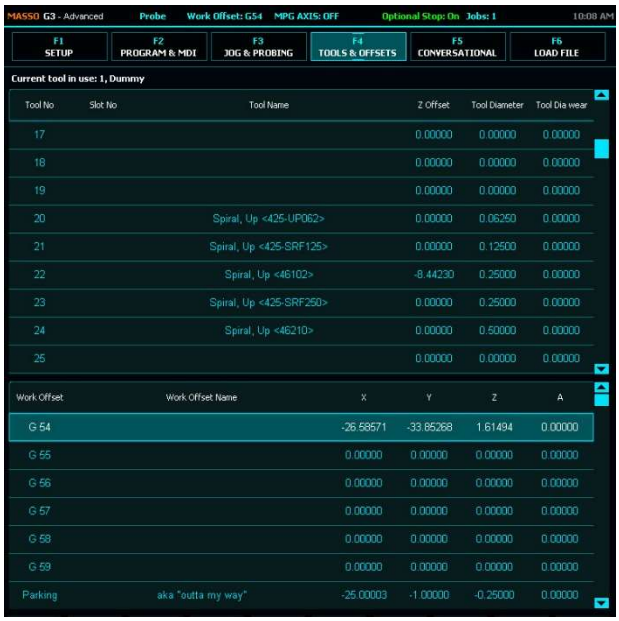
If you check the first box and not the second, then Masso will check each bit at your Tool Setter to confirm its length at the proper time. If you don't (and are using Manual Changes) forgetting to make a trip to the Tool Setter could ruin your project.

But Masso needs to know where your Tool Setter is. "Jog" until the bit is centered over the Tool Setter and write down the machine coordinates. Enable (check) the two boxes next to the X and Y position lines and enter the positions you wrote down.

During tool-length checking, Masso approaches the Tool Setter rapidly, then slows for the final part of the movement. Set the transition height using your longest bit: lower it until it remains a reasonable distance above the Tool Setter, record the machine Z coordinate, and enter that negative number as the Z safe distance. Allow for drills, which are often much longer than mills. The Tool Zero feedrate, in inches/min, is the slower downward speed used after reaching the height you entered.

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Tool Database



Develop a tool-numbering system and use the same numbers in Masso and your CAD/CAM software. Each bit needs a number, especially when a single toolpath uses multiple tools. On the F4 screen, double-click a line to open the tool dialog and enter the bit name. Enter the cutter's diameter in the diameter field; for a V-bit, the example value may be 0.001, and the controller also accepts 0.00". Masso measures tool length at the Tool Setter and revisits it at each change to update that value, accounting for differences in how the bit is mounted.

Tool number 1 is special. You can choose any bit for this number, but Masso assumes it is a sensitive probe, and prevents any bit assigned to this number from spinning.

Connect Masso to your wireless router

- Navigate to the F2 or F3 screen page.
- Tap the Wi-Fi icon at the top right.
- When Masso finds available routers, choose yours and add your password.
- Tap "Connect".
- Thereafter, Masso will connect spontaneously, and indicate success with an orange background behind the term, "Wi-Fi".

Using a Touch Plate

The Tool Setter tells Masso how high the end of a tool is. The Touch Plate (image on the right) tells Masso where your workpiece "origin" is. When you insert each tool, it visits the Tool Setter before proceeding. But a single use of the Touch Plate suffices for each project (unless you move the workpiece).



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Open F3, the Jogging and Probing screen. On the right side, press the probe icon circled in yellow in the illustration. This opens the probing dialog shown to the left; the two added arrows identify the controls used in the following steps.

You can use a straight mill as a probe, but not a V-bit. Let's suppose you have one with a 0.25" diameter already installed. Notice that the dialog box thinks you do (and change that box if you don't). Notice also the word, "Probe" at the very top of the screen. After attaching the Touch Plate magnet to the spindle collet, touch the bit with the plate. If the word "Probe" changes from a blue color to green, you're ready to continue.

"Jog" until the tip of the bit is down inside the Plate's circle. Notice the yellow block with a red dot in its center (see arrow). Touch that icon, and the Dominator will move in four directions until it has touched the inner surface of the Plate's circle in four places. It will move to the center of the circle. It needs to know how far the circle center is 'offset' from the actual corner of your project. If you've entered that value (-0.11810" for the PwnCNC Plate in both X and Y dimensions) it will know where that corner is (and will remember that until you change it).

Raise the bit until it's above the Touch Plate and jog until a flat part of the Plate is beneath the bit. Press the red dot in the center of the black square (see second arrow) and the bit will descend until it touches the plate, then rise a little. Masso also needs to know how far the workpiece lies beneath the surface it just found (the Z-offset). That is 0.3922" (10 mm) for the PwnCNC Plate. Once completed, put the Plate away.

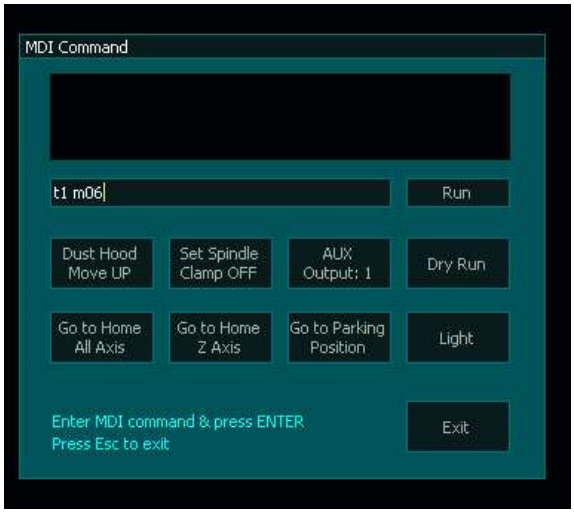
Masso workflow

Once you've configured Masso to understand your Dominator, how do you make this all work? One concept is so important that we'll say it before anything else: **Never change a bit until Masso instructs you to do so**.

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1. Create a toolpath with your CAD/CAM software (e.g. VCarve, Fusion 360, etc.).
2. Turn on your Masso Controller. Complete the Homing sequence (which will include a visit to the Tool Setter). If the bit in place has the number of (is the same as) the first one in your toolpath, great. If it isn't, you will get an instruction to change it later. Be sure that a USB stick is in the port beneath the controller
3. At your computer, open the application called "MASSO Link". Drag the desired toolpath into the MASSO Link. Return to your CNC.
4. Open the F6 Screen. Find the toolpath of interest and click on "Load File"
5. Tell Masso where your workpiece 'origin' is, either:
    a. By eye: position the bit at the workpiece origin (X, Y and Z) then click the blue X, Y and Z in the Workpiece Coordinates box on the Masso Screen. Each should then register "0".
    b. With a Touch Plate (see **Using a Touch Plate**, p. 51)
6. Press "Rewind" then "Cycle Start"
7. If your first tool is in place, the toolpath actions will begin. If not, Masso will tell you to change to the required bit. When you next hit Cycle Start (after the change) it will revisit the Tool Setter then move to a "ready" position. Hit "Cycle Start" once again when ready to cut.
8. If your toolpath includes tool changes, Masso will bring the spindle to the change location you created and tell you to change tools. Again, after you hit "Cycle Start" it will visit the Tool Setter before returning to a spot above the Workpiece origin. Another "Cycle Start" order resumes your toolpath.
9. Upon completion of the toolpath, you could turn everything off. If, however, you want Masso to instruct you to place a probe or dummy bit in the spindle, then open the "MDI" screen (button to the right of "Rewind"). At the screen, to the left of the "Run" button, enter the letter "T", the number of the bit (e.g. "1"), a space, and the code, "M06". When you press "Run", Masso will tell you to replace the bit with Tool 1 (so you may do so).





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Calibration & First Movement

We described setting the distance that the machine will move with the rotation of each stepper motor in "**Axes (X, Y, Z, A and B): Steps per mm**", p. 49

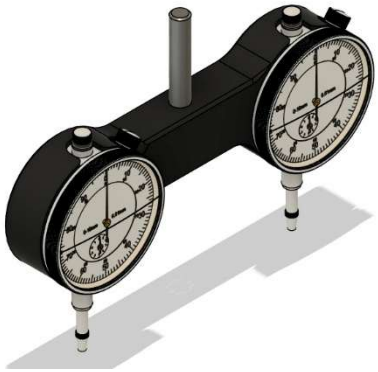
We covered Jogging & Axis Verification in "**Axis Direction Sanity Check**", p. 46

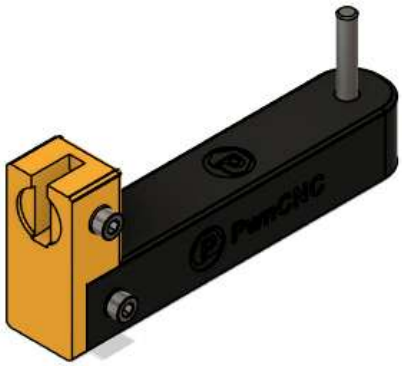
Squaring & Tramming the Gantry

Tramming aligns the spindle so that it points directly down at the flat plane supporting your workpiece. Begin with the temporary flat surface described below. After tramming, follow "Prepare the wasteboard for use" in the "Wasteboard" section to surface the work area.

Begin with a temporary flat surface. Though fragile, glass is very flat. Sheets of Delrin™ (acetal) are both flat and firm. MDF is not fragile but lacks the consistency of other products.

You next want an indicator that keeps a constant distance from your spindle as it travels in a circle. The wider that circle is, the more easily you can detect a tilt. If the device tip only touches the flat surface at one point yet is above that surface elsewhere on the circle, then the spindle is not vertical.







Pictured above are our "Tramming Master", "Tramming Arm Pro" and "Tramming Arm". For the latter two you will also need a tool to measure very thin gaps (such as a set of "feeler gauges").

Lower the device while secured in the spindle, rotating (manually) until it lightly touches anywhere in the circle of rotation. Now rotate away by 180 degrees and measure the gap between the indicator and surface. If the diameter of a Tramming circle is 10", then the "variation per inch" is whatever you measured, divided by 10. (Use your device's diameter as the denominator). In a high-precision, metal-milling CNC (over a 10" span) the gap should be < 0.001". That calculates as <0.0001"/inch. For a hobbyist, a gap of 0.002–0.004" (over a 10-inch span) will give easily sand-able lines when using wide bits or in pocketing toolpaths.

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Consider your circle as the face of a clock, with the “6” closest to you. If the gap is at 12 o’clock, then the spindle tip (closest to the bed) is further from you than its base (where the power connects). If at 3 o’clock, then the base stands further left than the tip. Typically, the high and low points are diagonal to your axes, requiring adjustment in both directions.

Due to the location of bolts with which the Dominator secures a spindle, you must solve any tilt that exists in the forward-backward direction first. By inserting washers with known thicknesses at the locations of either the upper or lower spindle mount screws, you change the tilt in this axis. When buying such washers, look for thicknesses of 0.001 to 0.002 inches. A tiny change can make a big difference.

Once the first axis is satisfactory, loosen the screws to allow tiny changes in the left-right axis. Keeping the screws partly tight and tapping with a rubber mallet lets you make such tiny changes. When the difference between your lowest and highest points on the circle is within the tolerance you want, secure the screws tightly and check one more time.

At our support center we have a video that you might appreciate: How to Tram your CNC Machine - PwnCNC (or enter this in your search bar): https://support.pwncnc.com/kb/article/29-how-to-tram-your-cnc-machine/

Wasteboard

A wasteboard is the surface beneath your workpiece. When a toolpath drills or cuts fully through a project, it also cuts the surface beneath it. Over time the surface becomes uneven, making it more difficult to secure workpieces or to keep them flat during work.

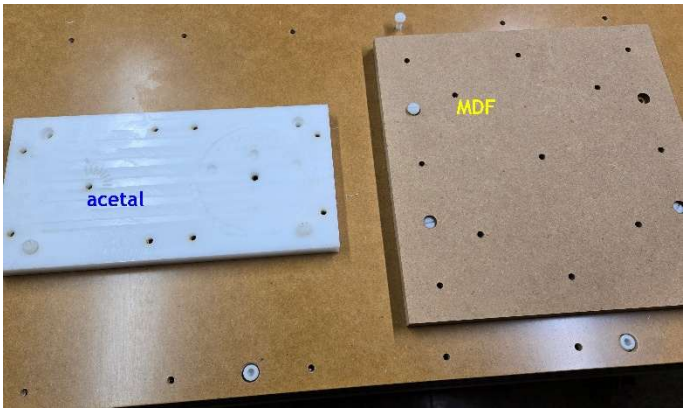
Videos of the “ideal” wasteboard abound on YouTube. Your preference will depend on the projects you make, so in this manual we’ll limit our remarks to broad descriptions of choices and the features that matter to a Dominator.

Wasteboard materials and features



MDF is the most common wasteboard material. It is inexpensive and easily machined but will not tolerate liquids such as lubricants. MDF does not hold a threaded bolt well but threaded (metal) inserts can give it that ability. **Acetal** is a plastic, available in generic forms, but widely known by the name Delrin™. Acetal is very flat and stable, available in thicknesses suitable for a wasteboard. It is unaffected by lubricants and is easily machined. It can even be threaded to hold bolts.

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We need to keep projects still while the Dominator machines them. For folks who find tape and superglue sufficient, a simple flat surface is enough. Others want to press down on their projects, so they lay T-track in grooves within their wasteboard, then clamp the project with T-bolts. A third style is side-gripping, with cams or wedges that bear against the project edges. These wasteboards benefit from holes that accept 'dogs' along one or more edges and devices on the opposite side to push them against the 'dogs'. A fourth style uses threaded holes in the wasteboard, allowing the waste sections of a project to be bolted down until cut free at completion. Of course, combinations for all of these exist.

Prepare for a wasteboard

The Dominator requires a means to hold the wasteboard flat and motionless, regardless of the material from which it's made. We suggest placing Slide-In T-nuts into the upper channel of your X-extrusions before you secure the Y- extrusions that block access to these channels. You might also consider T-nuts in each X- extrusion for the same reason. If you decide later that you want to add T-nuts, the "Drop-In" type is an excellent option.

Next, consider the risk of a cutter striking the bolt that holds the wasteboard down. You have steel M8 bolts, but you can also find plastic ones, which will not damage a tool. If you counter-bore the hole in which the bolt will go, you can set the bolt head below the surface, making it even less likely to suffer impact. Be sure to leave at least ¼" of wasteboard material below the head for strength.

Prepare the wasteboard for use

Surface a newly installed wasteboard with a pocketing toolpath using a wide mill. Prepare the toolpath for the largest width and length possible on your Dominator, with at least 40% overlap between passes and a shallow cut depth. Set Z=0 at the wasteboard surface and (for example) a 0.01" cut depth. After running the toolpath, inspect for low spots where no material was removed. If any remain, reset Z=0 at the new surface height and repeat until the entire area has been milled. Shallow repeated passes limit the material removed. Inspect for ridges between passes as well; they reveal how well you trammed the spindle.

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Maintenance

Task	Frequency
Clean linear rails & ball screws	Daily
Check spindle collet & nut	Before every job
Verify air pressure & filters	Weekly
Tighten motor & drive hardware	Monthly
Lubricate rails (X, Y, Z, B)[1]	Monthly
Back up Masso configuration	Quarterly

[1] For lubrication, we suggest [product name to be inserted here]

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Support & Resources

Contacting PwnCNC Support

We are here to help. You can:

- email us at support@pwncnc.com
- call 479-480-4337
- Read the extensive library at our Support Center https://support.pwncnc.com

Helpful Links & Community

For community help and interaction visit our social websites:

- User Forums https://forum.pwncnc.com
- Facebook Users Group: https://www.facebook.com/groups/pwncnc
- YouTube Channel: https://www.youtube.com/pwncnc

Masso

Masso's website offers training and has greater depth about your controller than we can maintain here.

Cheating

When asking an AI assistant about your CNC, name the controller and describe the task before asking the question. For example: "In Masso, when I want to change a bit, will it check the length on the Tool Setter?" Treat the answer as a starting point, not an instruction to operate the machine. So, for a question such as this one, you must check any answer about tool-length measurement or the M06 command against Masso's documentation. AI can make mistakes; if an answer conflicts with this manual or remains unclear, contact support.

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Appendix A – No table

This appendix covers mounting your Dominator on your own supporting surface instead of the Legs Kit. It explains mounting hardware, surface preparation, and vibration cushioning. The instructions assume that the supporting surface will accept bolts or screws.

“Gussets” can attach to the side of either your X-extrusions or the Rigidity Upgrade (if you chose that). The gussets are 40 mm tall and 40 mm deep. Their vertical surface attaches to your extrusions with a bolt & T-nut set (“Gusset fastener” below). For a Dominator that’s four feet wide we suggest three gussets for each X-extrusion or Rigidity Upgrade extrusion.

You should bolt or screw the horizontal surface of the gusset down to your tabletop. For solid wood, a 5/16” lag screw or an M8 lag screw will suffice. Manufactured products (MDF or plywood) may not hold screws well enough. For these, or for torsion box tops, we suggest M8 bolts. When using bolts, you will access the underside, where you need a large washer (28 mm diameter) and a nut. For a torsion box, however, you must prevent the bolt from crushing the box. Buy aluminum tubing with an inner diameter of 0.334” or greater. Cut aluminum tubes slightly shorter than your box thickness and insert one tube to span the gap between the torsion box top and bottom for each gusset.



Part sources:

McMaster-Carr (www.mcmaster.com)

- Aluminum rod, 36” #89965K357
- Bolt, M8, 1.25 mm thread # depends on length
- Nut, M8, 1.25 mm thread # 91290A470
- Washer, 28 mm # 98363A113
- Gusset #5537T937

8020 Online (www.8020.net)

- Gusset #40-4332
- Gusset fastener #75-3422

Your Dominator must be flat and square, as must be the surface on which you secure it. First, adjust your table until its top is flat. If it has “low spots” in places that support your Dominator base, cut pieces of shim material to produce a truly flat bed. McMaster-Carr sells such material as “Shim Stock” (various thicknesses).

To prevent vibration in your dominator from turning your wooden table into a musical instrument, you should dampen the connection. You want a rubber that does not compress under the load. McMaster-Carr sells 4” x 36”, adhesive-backed strips. Of the various sheets available, the desired hardness is available as item #5652N133. Cut and fit to cushion the full length of each extrusion that bears against your table.

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Appendix B - Bed Structural Upgrade

The Bed Structural Upgrade (BSU) consists of five (5) extrusions that have the same width and thickness as the X- and Y-extrusions. Like the X- and Y-extrusions, the faces of the BSU extrusions have holes to accept anchors and use M8x30 bolts.

All five Bed Structural Upgrade extrusions are of the same length, which determines the spacing between the X extrusions. Most users install this upgrade during the initial build. In that case, Slide-in or Double Slide-in T-nuts may be easier to use, but insert them before the second Y extrusion closes access to the tracks. To add the upgrade later without dismantling the X and Y extrusions, use Drop-in M8 T-nuts. You will still need to loosen the X-extrusion connections and slide those extrusions to the spacing determined by the upgrade members.

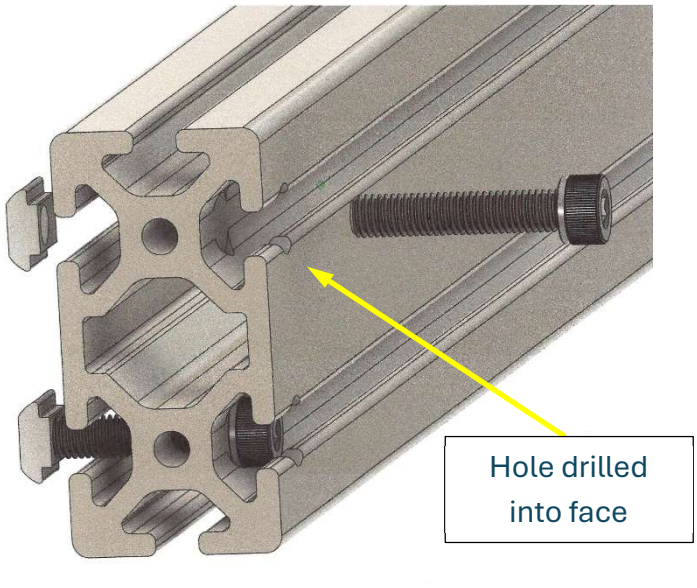
We suggest placing three BSU extrusions between the front and middle X-extrusions, and two between the middle and rear X-extrusions. The distances are not critical. For the “front three” we centered one, and placed the other two about 390 mm to each side (15.5”). For the “rear two” we placed one 300 mm from each side (12”).



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Appendix C - Bed Rigidity Upgrade

Although there are drilled holes in one face of the Bed Rigidity Upgrade (BRU), they don't receive anchors (which the other extrusions use). These holes enable you to secure a bolt through the face and into a T-nut embedded in the channel of the adjacent extrusion.



When you have completed assembly of the X- and Y- extrusions (with or without the five Bed Structural Upgrade extrusions) and all parts are square and flat you're ready to add the BRU, intending that it does not change that squareness. Tighten the connections in your main bed frame before starting this upgrade. However, you will want to confirm that what was square before is still square.

Turn your assembled Bed Frame upside down. For a 3x4 or 4x4 Dominator, your BRU will have three extrusions. Begin with the center BRU extrusion. Place two T-nuts ("Drop In" or "Slide In") within the bottom slot on each of the Y-extrusions (which now face up). Loosely run M8x30 bolts through the ½" drilled holes in the BRU extrusion and into these nuts. Slide the BRU extrusion to your preferred location. Repeat this process for the rear and front BRU extrusions. If you will use the Leg Assembly, the positions of the center and rear BRU extrusions aren't critical. We suggest locating them where they add support to the nearest X-extrusion. If, however, you will secure the Dominator to a table surface, watch that the BRU extrusion's position gives you a satisfactory place to secure the gussets later.

The front BRU extrusion can't rest directly under the front X-extrusion if you use the Leg Assembly. Choose a position at least 40 mm further back (the depth of a leg). Keep this extrusion (like the others) square to the table.

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Appendix D – Fifth Leg

An optional “Fifth Leg” supports the center of a Dominator, further reducing deflection or vibration of material as it undergoes machining.

After the legs kit is assembled attach the “ears” at the mid-point of the Fifth Leg to the “B” extrusion. Do so with M8 bolts and the Slide-In nuts placed within the channel on the rear-facing surface of the extrusion. If Slide-In nuts were not placed in the channel (typical for addition of a Fifth Leg to an already-assembled Dominator), Drop-In nuts will perform equally well.

Once the Bed has been assembled and placed on the legs, secure the upper end of the Fifth Leg by using M8 bolts through the holes drilled in the top of the leg and into Slide-In nuts in the upper channel on the rear-facing surface of the middle X-extrusion.

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Appendix E – Automatic Tool Changer

An Automatic Tool Changer (ATC) retrieves a tool that you have prepared and rests within its collet until called for by your Toolpath. Each collet holding a different bit is attached to a special "cone-like" fitting that matches a receiver on your spindle. When the toolpath calls for a particular bit, Masso must know where the fitting with the desired bit sits.

The ATC uses compressed air to open and close mechanical connectors. Once closed, the connection is secure for the demands of the spindle and Dominator, and the air stands ready for the next instruction to remove or install another fitting.

Our Support Center provides articles concerning ATC installation. If you are viewing this manual on your computer, click on the red text. If reading a print version you may enter the blue text in your computer's search bar:

- **Pneumatics Enclosure (PE) - PwnCNC** | https://support.pwncnc.com/kb/article/448-pneumatics-enclosure-pe/
- **Programming of ATC in Masso - PwnCNC** | https://support.pwncnc.com/kb/article/460-programming-of-atc-in-masso/
- **Required Air-Compressor / Air-Dryer Details - PwnCNC** | https://support.pwncnc.com/kb/article/406-required-air-compressor-air-dryer-details/
- **ATC Motor Installation - PwnCNC** | https://support.pwncnc.com/kb/article/558-atc-motor-installation/
- **Wiring the ATC Control Inlet to Masso G3 - PwnCNC** | https://support.pwncnc.com/kb/article/286-wiring-the-atc-control-inlet-to-masso-g3/
- **Understanding ATC Motor Connections - PwnCNC** | https://support.pwncnc.com/kb/article/447-understanding-atc-motor-connections/
- **Tool Rack Options & Installation - PwnCNC** | https://support.pwncnc.com/kb/article/557-tool-rack-options-installation/

You will also find helpful videos:

ATC Installation Video - PwnCNC | https://support.pwncnc.com/kb/article/458-atc-installation-video/eo - PwnCNC.

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Appendix F – Fourth Axis

A Fourth Axis in this manual refers to an optional device with its own stepper motor that rotates the material as directed within a toolpath. Comparable to, but separate from the “X”, “Y” and “Z” axes, we refer to this axis as “A”.

This appendix has not yet been completed

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