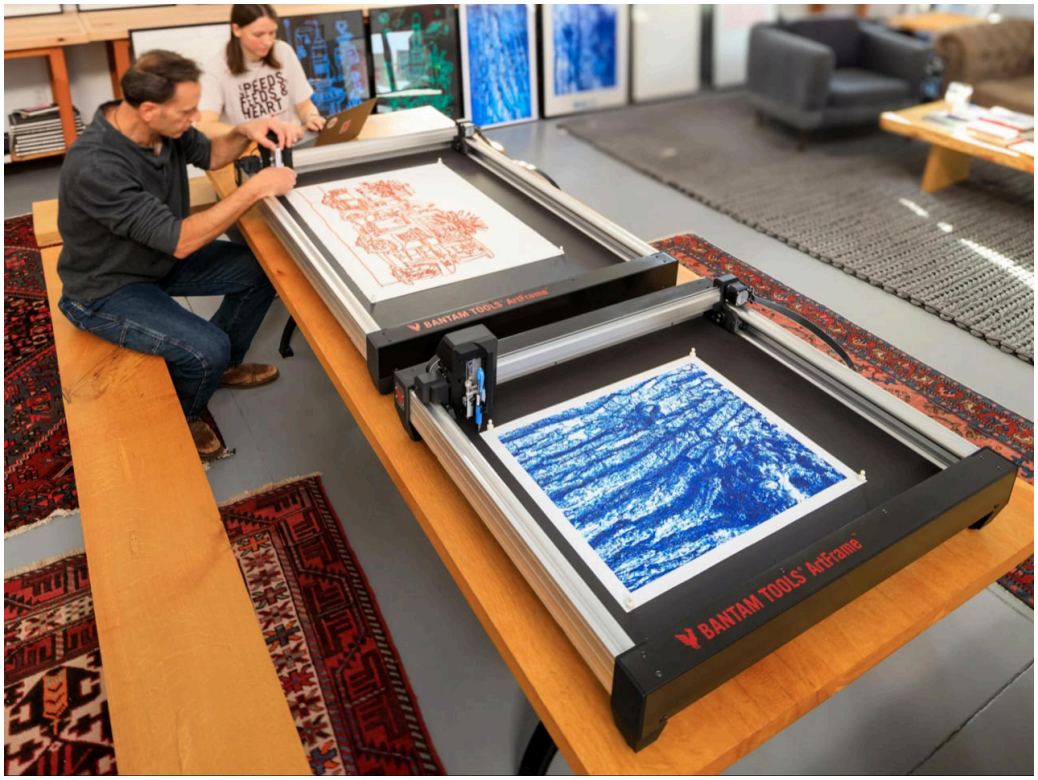
Bantam Tools ArtFrame

User Guide

Set up, operate, and maintain your ArtFrame, then turn digital artwork into drawings and paintings.



Last updated November 17, 2026

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Part I: Getting Started

0. Preliminaries

This chapter covers what this guide contains, where to start if you want to be drawing quickly, and how to reach us.

0.1 About this guide

This guide covers the Bantam Tools ArtFrame™ hardware, from safe setup and first use through tool holders, pen height, workholding, operation, and maintenance. It also introduces the Bantam Tools Studio™ workflows used to prepare drawings and paintings.

It is the guide for the whole ArtFrame family of drawing machines, so it covers the ArtFrame 1824, the ArtFrame 2436, and the ArtFrame Panorama together. Where the models differ — in footprint, drawing area, and the sheet sizes the surface holds — the difference is named in place.

0.1.1 Before you begin

1. Read §2. Safety and safe operation before powering on the machine.
2. Check the included parts in §4. Included parts and accessories.
3. Work through the Getting Started chapters to unbox the ArtFrame and run the included Welcome Plot.

> ***Note:*** The Studio chapters in this guide cover Bantam Tools Studio as the ArtFrame uses it. The separate Bantam Tools Studio guide (bantam.tools/btsguide) documents the Bantam Tools Studio Text Add-On.

Both this guide and the software are updated from time to time. The latest version of this guide is available online at: bantam.tools/afguide

0.2 Support and online resources

If you run into a problem, have a question, or are not sure whether your Bantam Tools ArtFrame™ is behaving as expected, please reach out. We're glad to help with any question, whether you're troubleshooting setup, software, files, paper and workholding, tool mounting, drawing quality, or machine operation, or working out how to do something this guide doesn't cover.

0.2.1 Contacting support

Email: support@bantamtools.com

Phone: +1-347-422-6826

Support hours: Monday through Friday, 9 am to 5 pm Eastern time, excluding holidays.

Support contact form: https://support.bantamtools.com/hc/en-us/requests/new

Discord support chat: https://bantam.tools/chat

When you call, we will connect you with the person who can answer your question if they are available, or take your number and email and get back to you. On Discord, members of the community often answer quickly as well.

0.2.2 What to include when contacting support

Please include:

- Your name and order number, if available.
- Your machine serial number, if available.
- Which ArtFrame model you have: 1824, 2436, or Panorama.
- The version of Bantam Tools Studio™ you are using.
- What you're trying to accomplish.

If something isn't working as expected, these also help:

- What happened, and what you expected instead.
- Whether you are using USB, WiFi, or the microSD card.
- The firmware version, from **Settings → Version** on the machine's display or, with the machine connected, from Studio's **Check for Updates** window; see §11.11 The Settings menu and §23.8.3 Check for Updates.
- Photos or a short video of the issue.
- Any error message shown on the machine screen or in Bantam Tools Studio™.
- Diagnostic information from Bantam Tools Studio™, which includes none of your documents. Studio offers it two ways: **Copy Diagnostics**, beside a connection error on the **MACHINE** tab, copies a short version to paste into your message; **Save Support Bundle** on the **SETTINGS** tab (⇧⌘D / Ctrl+Shift+D) saves a fuller version as a file to attach, at any time.
- If you're comfortable sharing it, your Bantam Tools Studio™ project file (`.btsp`). It holds your documents and settings along with the same diagnostic information; see §26.4 Project files.
- If the problem happens while running a G-Code file, such as from the microSD card, that file as well; project files don't include exported G-Code.

A clear photo or short video is often the fastest way for us to understand what is happening, especially for paper placement, tool mounting, drawing quality, or motion issues.

0.2.3 Software and documentation

Bantam Tools Studio™ is updated from time to time. The software checks for updates when an internet connection is available, and you can also check for updates from the **SETTINGS** tab. Inside Studio you will also find a link to our support resources.

Online resources:

- Website: https://bantamtools.com
- Support chat: https://bantam.tools/chat
- Contact support: support@bantamtools.com

0.2.4 Sharing your work

Once you have completed a drawing or a painting with the ArtFrame, we would love to see it. Seeing the work of our customers inspires us to be obsessive and caring about the work that we do.

If you'd like to share your work with others, PlotterFiles (plotterfiles.com) is the Bantam Tools community site for pen plotter artwork. There, you can upload the SVG or other source file so that others can plot it too, along with a photo of the finished piece.

If you post your work on Instagram or another social media platform, please consider tagging @bantamtools so that we can see what you made.

1. Introducing the ArtFrame

The Bantam Tools ArtFrame™ is a computer-controlled art machine that draws and paints physical artwork from digital designs, in traditional materials, at large format. This chapter covers what it does, what it works with, and how the rest of this guide is laid out.

1.1 What the ArtFrame does

The ArtFrame turns vector artwork into tool paths and follows them with whatever mark-making implement you mount on it. Pens are the usual starting point, but the machine is built for a wider range: brushes, markers, oil pastels, oil sticks, and charcoal all work, on paper, canvas, and other flat media.

We designed the ArtFrame to run in the Whitney Museum of American Art during the *Harold Cohen: AARON* exhibition, where it produced thousands of drawings. Since then we have refined the design and finished building the software. It is built to make museum-quality artwork, and we are glad to see what you make with it.



The ArtFrame 2436.

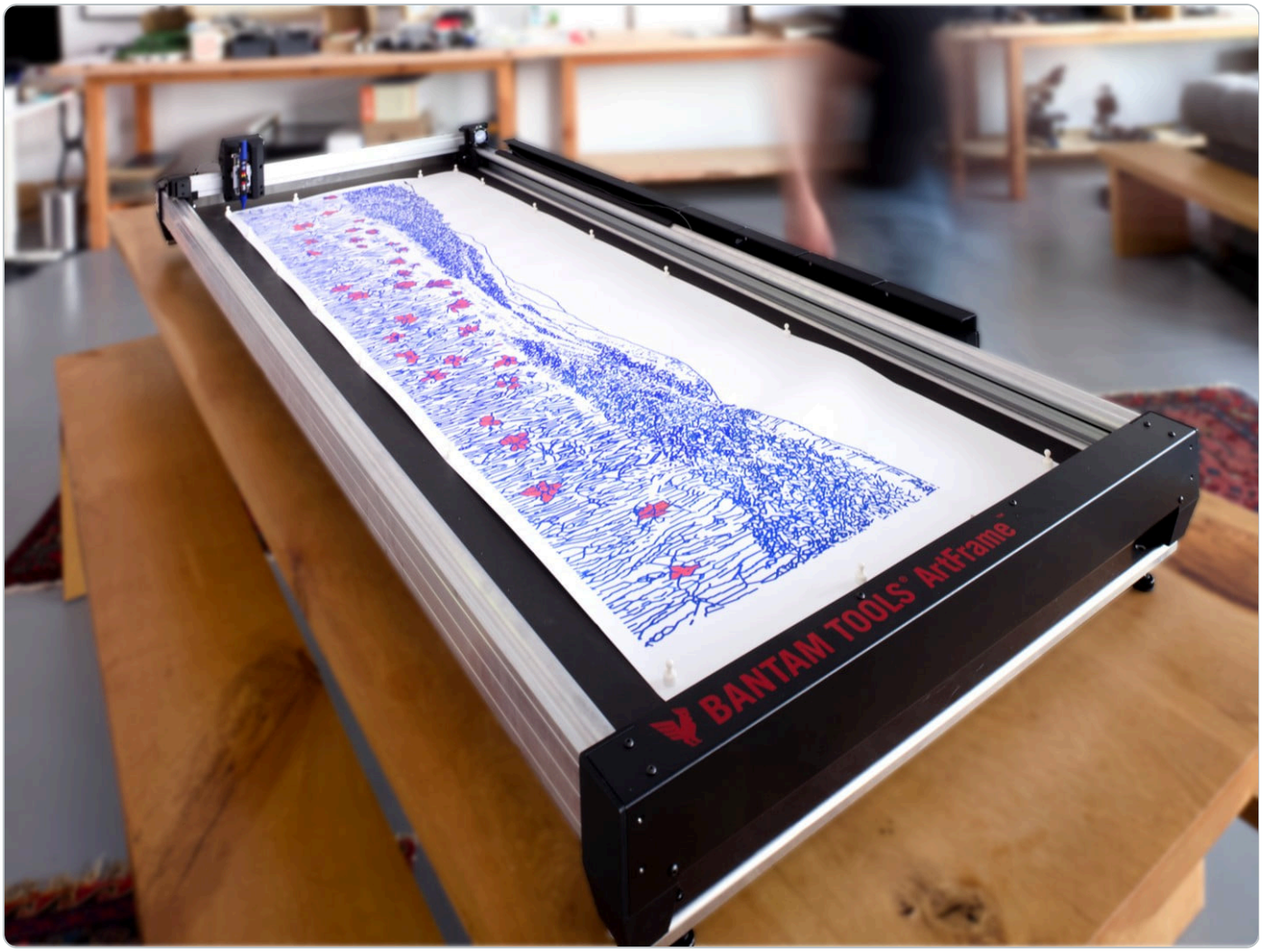
1.2 What makes it different

Compared with our other family of plotters, the Bantam Tools NextDraw™, the ArtFrame holds a consistent pen-over-paper height and gives you greater control over the vertical position of the marking tool. The belt-driven vertical stage moves the tool up and down under motor control rather than lifting it with a servo arm, which is what makes that control possible. It also means the machine can apply real, repeatable pressure, so tools that need to be pressed into the surface — brushes, soft felt tips, pastels — work as well as tools that only need to touch it.

1.3 The ArtFrame models

The ArtFrame family shares one design in three sizes. The details and appearance of parts vary slightly between models, but their function is the same.

- **ArtFrame 1824** — an 18" × 24" drawing area.
- **ArtFrame 2436** — a 24" × 36" drawing area.
- **ArtFrame Panorama** — a 24" × 72" drawing area, shipped in a custom crate.



The ArtFrame Panorama.

§21. Hardware specifications gives the full dimensions of each, and §15. Paper and workholding covers the media sizes each surface holds.

1.4 Software and connections

You prepare drawings in Bantam Tools Studio™, the software that runs on your computer. Studio opens SVG artwork, applies paper and artwork settings, assigns tools, and saves a G-Code file for the machine.

There are three ways to get that file onto the ArtFrame:

- On the included microSD card, which lets the ArtFrame run files with no computer connected. We recommend it while you are learning the machine, because it needs no connection setup.
- Over USB, a direct cable connection to your computer.
- Over WiFi, once Studio has connected the machine to your network.

§18. Sending files to your machine compares the three.

1.5 Tools and media

The ArtFrame comes with a Pilot G2 gel pen and a mirrored pen clip, mounted on the vertical slide stage. The pen clip holds a pen either straight down or at a 45° angle, and other Bantam Tools Cross-Compatible Tool Holders™ mount in the same place. See §12. Tool mounting and holders.

Work is held on a magnetic drawing surface, using the included "chess pawn" magnets or any other method that holds the medium reliably. See §15. Paper and workholding.

1.6 How this guide is organized

Getting Started, the part you are reading, takes you from unboxing to your first drawing through three walkthroughs. In the first, the ArtFrame runs the Welcome Plot from the microSD card, with no computer involved (§7. Running the Welcome Plot). Next, you prepare artwork of your own in Studio (§9. Preparing your first artwork). Finally, you send that file to the machine and draw it (§10. Sending your plot to the ArtFrame).

Working with your machine covers everyday operation in more depth: tool holders, pen height, workholding, table rails, connections, maintenance, and drawing quality. Reference collects the specifications and the Studio chapters that matter for drawing. The Appendices hold SVG templates, a glossary, and troubleshooting.

2. Safety and safe operation

Before using your Bantam Tools ArtFrame™, take a moment to review these safety guidelines. The ArtFrame is a computer-controlled machine with a large open bed, exposed rails, a powered gantry, and a carriage that moves under its own control.

Use care whenever the machine is powered on, moving, or waiting for you to load media or a tool.

2.1 Safe handling of the ArtFrame

> ⚠ **Warning:** The ArtFrame has exposed moving parts. Keep fingers, hair, clothing, jewelry, and anything else that could be caught, crushed, or tangled away from the moving carriage, the tool head, and the pinch points between the carriage and the rails.



Keep hands clear of pinch points while the machine runs.

Lifting and moving. Every ArtFrame is wide and awkward to handle, and heavy in its box. We recommend two people for unpacking any model, and for moving the ArtFrame 2436 or the ArtFrame Panorama.

Heat. The motors get warm during normal operation. This is normal, but it is helpful to be aware of it. They should not get too hot to touch.

Small parts. This product contains small parts that may pose a choking hazard to children under three years of age.

> ⚠ **Warning:** This product includes small magnets. Magnets pose choking and other hazards, and should never be swallowed or inserted into any part of the body. Keep magnets out of reach of small children.

2.2 Electrical safety

> ⚠ **Warning:** Use only the power cord supplied with the machine. To do otherwise may result in electrocution or fire.

- Turn the ArtFrame off before unplugging it or plugging it back in. Do not unplug it by pulling on the power cord.
- Do not use the ArtFrame if the power cord is damaged.
- Do not use the ArtFrame with a power supply other than the one that came with the machine.
- Do not abuse the power cord. Do not twist, bend, scrape, pull, pinch, or put a heavy object on it. Keep the cord away from heat, sharp edges, and oil.
- Always plug the machine into a grounded outlet that matches the plug. Do not modify the power cord or plug in any way.

The ArtFrame ships in US and international versions with different input voltage requirements. See §6. Connecting power before you plug the machine in.

2.3 Modification

Do not modify your ArtFrame. If you do so, it is at your own risk. Modification may result in abnormal operation that can cause injury to you or your colleagues, or damage the machine. Modifications and unsupported repairs void our warranty policy.

If your ArtFrame needs to be repaired, reach out to our support team and we will work with you to get you back up and running as quickly as possible.

2.4 ESD sensitivity

A large electrostatic discharge onto the ribbon cables during a plot does not damage the ArtFrame, but it can make the machine lose its position. If this should occur, turn the machine off and on again to recover. Dry indoor air in winter is the usual setting for this, and touching a grounded object before touching the machine helps prevent it.

2.5 General operating guidelines

Before starting a file, check that:

- The machine sits on a stable surface, or on its table rails.
- The medium is secured and lying flat.
- The tool is installed securely in its holder.
- The drawing area is clear of obstructions, including the rails.
- Your hands and any loose objects are away from the moving parts.

Stay nearby while the ArtFrame is running, especially during your first few jobs.

3. Unboxing the ArtFrame

This chapter walks you through removing the Bantam Tools ArtFrame™ from its packaging and freeing the gantry from its shipping hardware.

The ArtFrame 1824 and the ArtFrame 2436 both ship in a box with foam padding and immobilization brackets that protect the rails and components during shipping. The ArtFrame Panorama ships in a custom crate; Panorama owners should refer to information directly from our support team for uncrating, rather than the instructions below.

3.1 Preparing a space

Have a large table surface cleared and ready before you unpack the ArtFrame, so that the machine can go straight into a stable, protected location. This prevents accidental damage.

Use the footprint of your model to prepare the space:

- **ArtFrame 1824** — footprint 31.4" × 27.9" (797 × 708 mm); overall 34" × 29.87" (864 × 758.7 mm).
- **ArtFrame 2436** — footprint 31.4" × 45.9" (797 × 1165 mm); overall 34" × 47.86" (864 × 1215.7 mm).
- **ArtFrame Panorama** — footprint 31.4" × 81.26" (797 × 2064 mm); overall 34" × 83.07" (864 × 2110 mm).

Every model has a footprint larger than a typical desk. If the table you have in mind is too small, see §16. The Table Rails accessory, which describes the accessory that lets the machine's feet sit on a standard desk.

3.2 Removing the ArtFrame from the box

Like a flat-screen TV, the ArtFrame is lightweight but wide. For safety and convenience, we **strongly advise** having a **second person** help you with the initial unboxing and setup.

Remove the top of the box. The ArtFrame ships in a top-opening box. Lay the box flat on the ground, cut the straps, and lift the outer top off the box.



The bottom edge of the box (left) and the top edge (right).



The ArtFrame shipping box as delivered, with its straps on.

Remove the accessory box. The accessory box is a separate box that ships inside the main box, at the side of the machine. Set it aside; you will need the 2.5 mm hex L-wrench from it in a later step.



The accessory box, beside the machine in the shipping box.

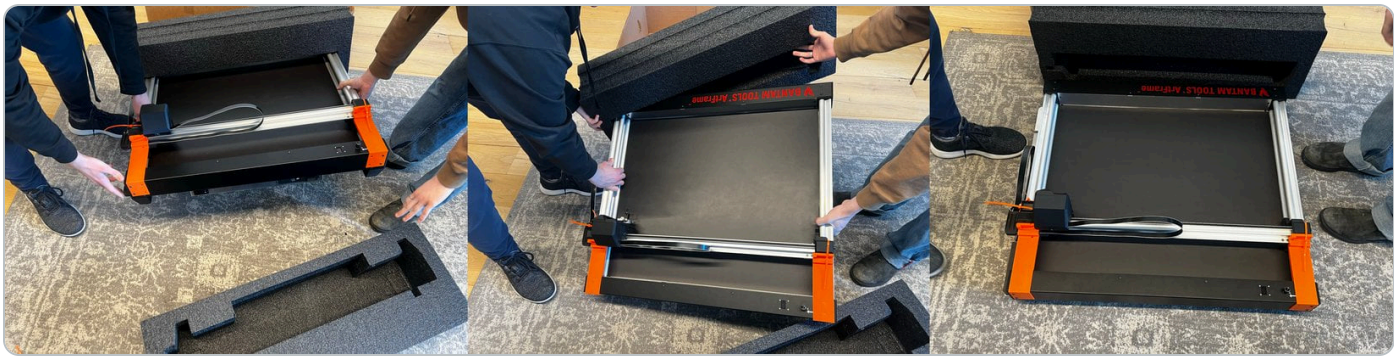
Remove the ArtFrame. Have one person stand on each side of the box. Each person grabs and lifts one of the exposed silver-colored aluminum rails on either side of the machine. You may need to press down on the box as you lift the machine out.

Take caution as you lift: the side of the ArtFrame with the gantry (the side carrying the tool head) weighs more than the other side. Slide the machine up out of the box while keeping it level.



Lift the ArtFrame out by its aluminum side rails (left), keeping it level as it comes up in its foam (right).

Remove the foam pieces. With the machine out of the box, remove the foam pieces.



Remove the foam end pieces.

Note: If you ordered the ArtFrame Table Rails accessory along with the machine, the rails are normally attached to the inside bottom of the box, under the ArtFrame. If you plan to install them, we highly recommend installing them at this stage, while the immobilization brackets are still attached. Skip ahead to §16.2 Installing the Table Rails, then return here to continue unboxing.



Table Rails in their foam roll, taped inside the shipping box.

Position the ArtFrame. Place the machine on the ground or, if you are ready to do so, move it directly to the table where it will be set up. Out of the box, the gantry is still immobilized with large orange brackets, which come off next.



The ArtFrame out of the box, with the orange shipping brackets still attached.

3.3 Removing the shipping brackets and ties

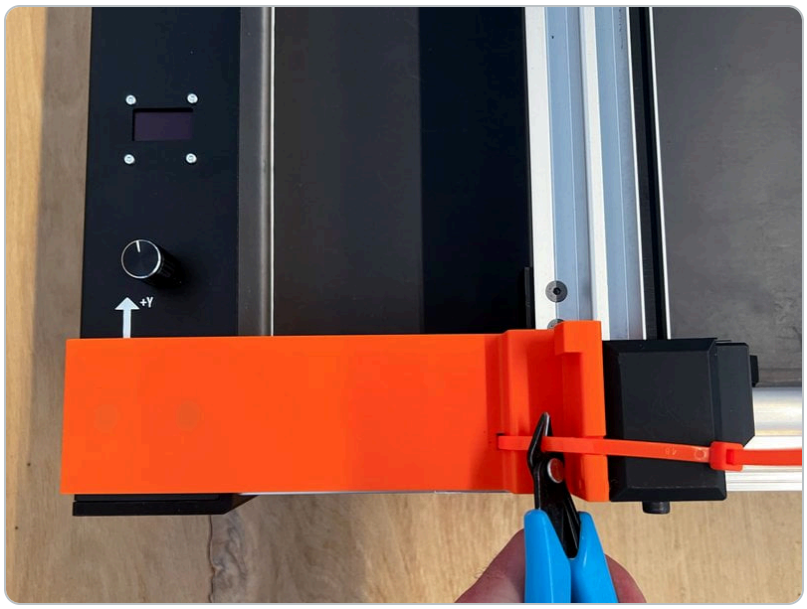
Start with the ArtFrame in its working location, out of its outer box and foam.

Identify the shipping components. On the machine, notice two orange brackets and several orange cable ties securing the components.

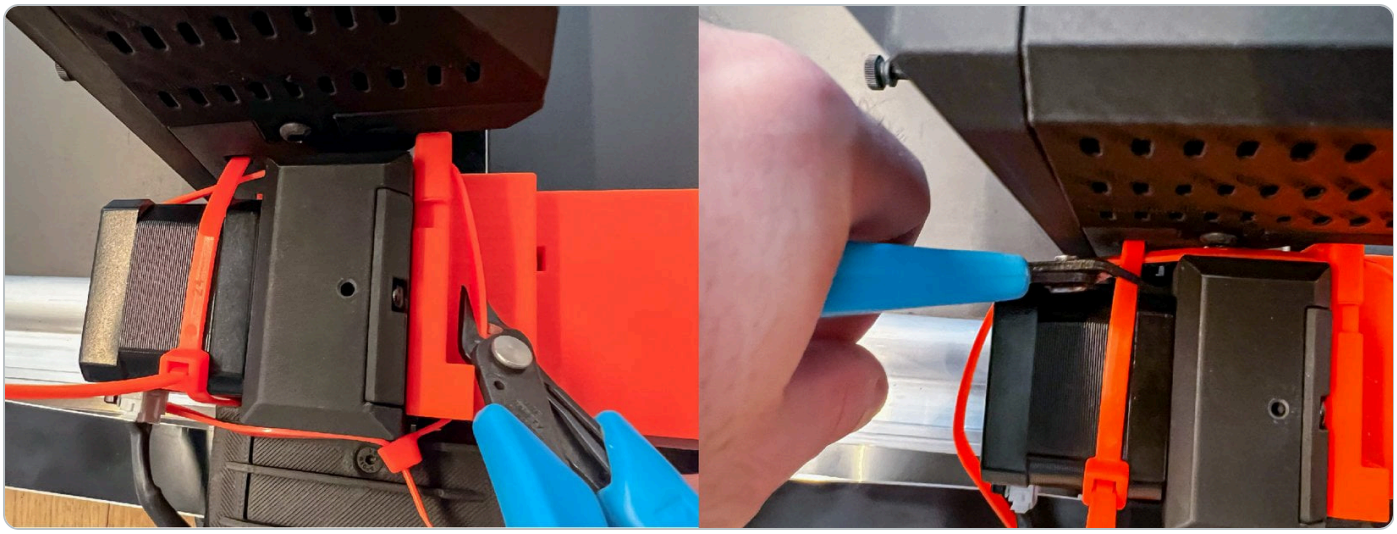


The two orange shipping brackets, with orange cable ties.

Remove the orange cable ties. Several orange cable ties together secure the gantry during shipping. Identify each one and clip it. Take care not to cut any of the nearby cables or anything else besides the orange cable ties.

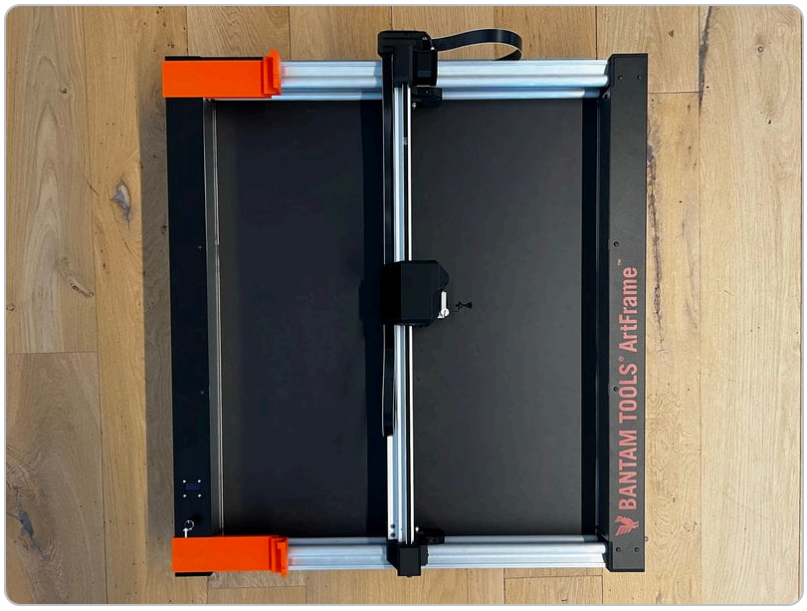


Clip each orange cable tie, taking care not to cut anything else.



Clip the ties at the gantry end, clear of the motor and its cables.

The carriage is now free to move. You can move it gently away from the brackets. Do not move it rapidly or with significant force.



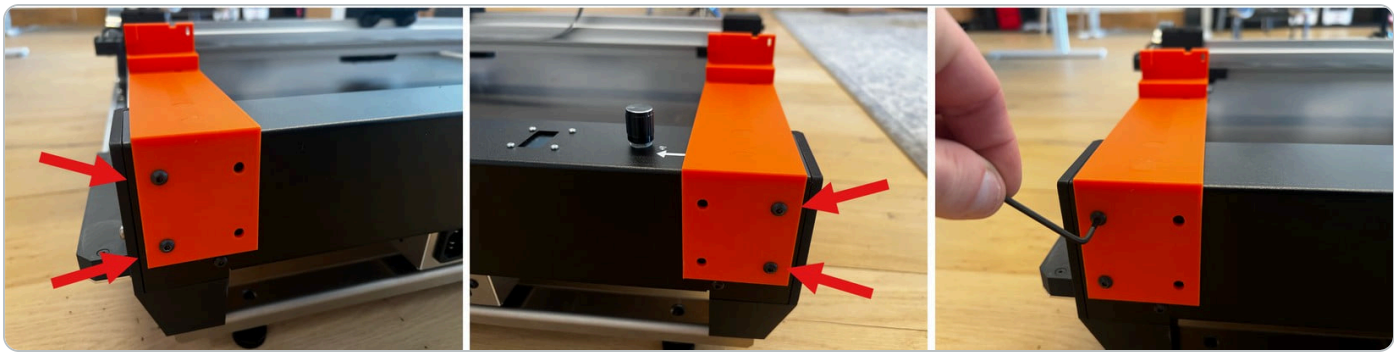
With the ties cut, move the carriage gently away from the brackets.

Remove the orange shipping brackets. Open the accessory box and locate the 2.5 mm hex L-wrench: the medium-sized wrench in the set, which fits the screws on the shipping brackets.



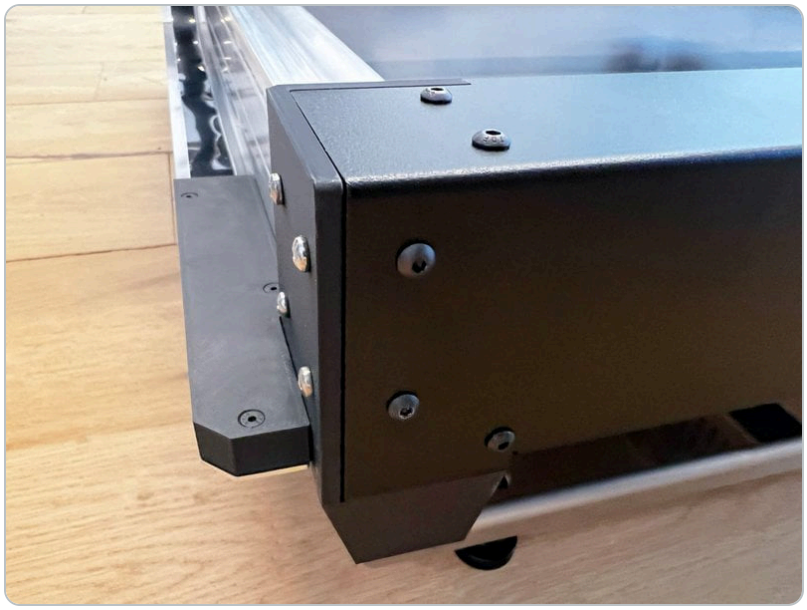
The 2.5 mm hex L-wrench.

Use the 2.5 mm hex L-wrench to remove the two screws from each of the two orange shipping brackets.



Remove the two screws from each shipping bracket.

Reinstall the screws. After removing the brackets, we recommend putting the screws back in their original holes for safekeeping.



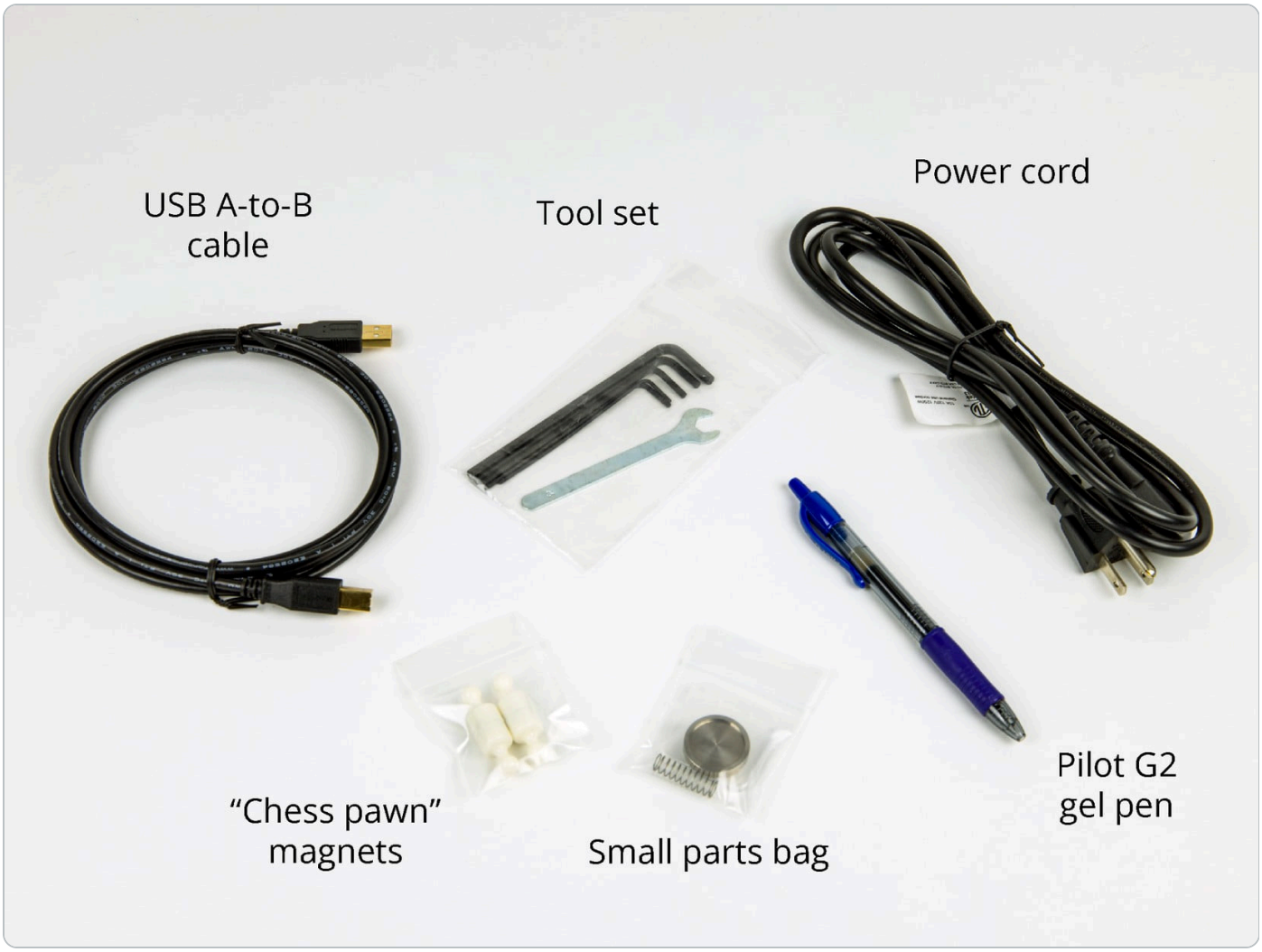
The bracket screws reinstalled in their holes.

Keep the brackets. Save the two orange shipping brackets. They are very useful if you later want to ship, transport, or move your machine, and the original packaging is worth keeping for the same reason.

With the ties cut and the brackets off, the machine is ready for power. See §6. Connecting power.

4. Included parts and accessories

Your Bantam Tools ArtFrame™ ships with the parts and accessories needed to get started. Before setting up the machine, take a moment to unpack the accessory box and confirm that you have the included items.

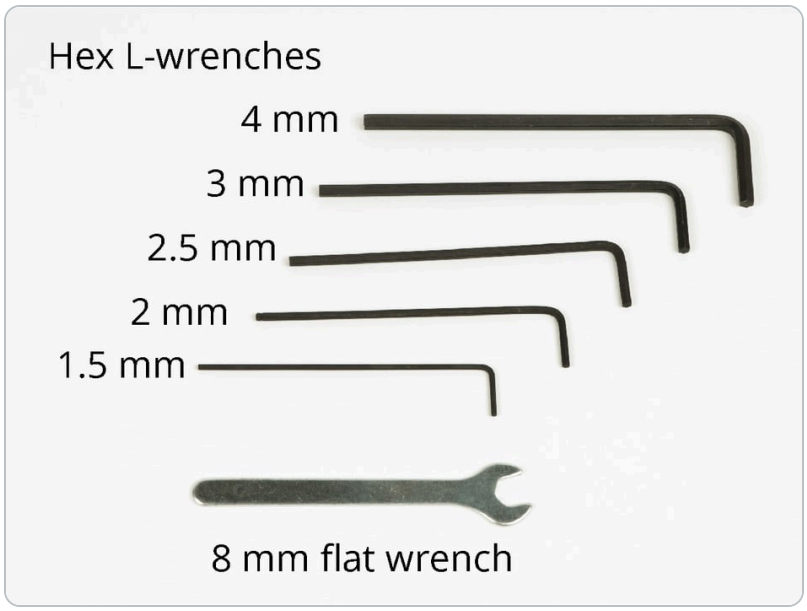


The ArtFrame accessories. Smaller parts, such as the Pen Height Setup Tool, come in a small parts bag.

4.1 Included items

- Bantam Tools ArtFrame
- mirrored pen clip, mounted on the vertical slide stage
- Pilot G2 gel pen, blue, 0.7 mm tip
- Spring Kit; see §12.3 The Spring Kit
- Bantam Tools Pen Height Setup Tool
- four "chess pawn" magnets, to hold paper down to the surface
- power cord
- USB A-to-B cable
- microSD card

- tool set:
  - hex L-wrenches: 1.5 mm, 2 mm, 2.5 mm, 3 mm, and 4 mm
  - 8 mm flat wrench



The included tool set: five hex L-wrenches and an 8 mm flat wrench.

Note: The included microSD card holds the Welcome Plot file used in the first walkthrough, §7. Running the Welcome Plot. Keep the card with your ArtFrame accessories so you can use it again later.



The small parts bag: the Pen Height Setup Tool, the heavy spring, and the microSD card with the Welcome Plot.

Set the accessories aside somewhere close by while you work through the first setup. You will need the 2.5 mm hex L-wrench to remove the shipping brackets, the power cord to turn the machine on, the microSD card to run the Welcome Plot, and the pen, the Pen Height Setup Tool, and the magnets to complete your first drawing.

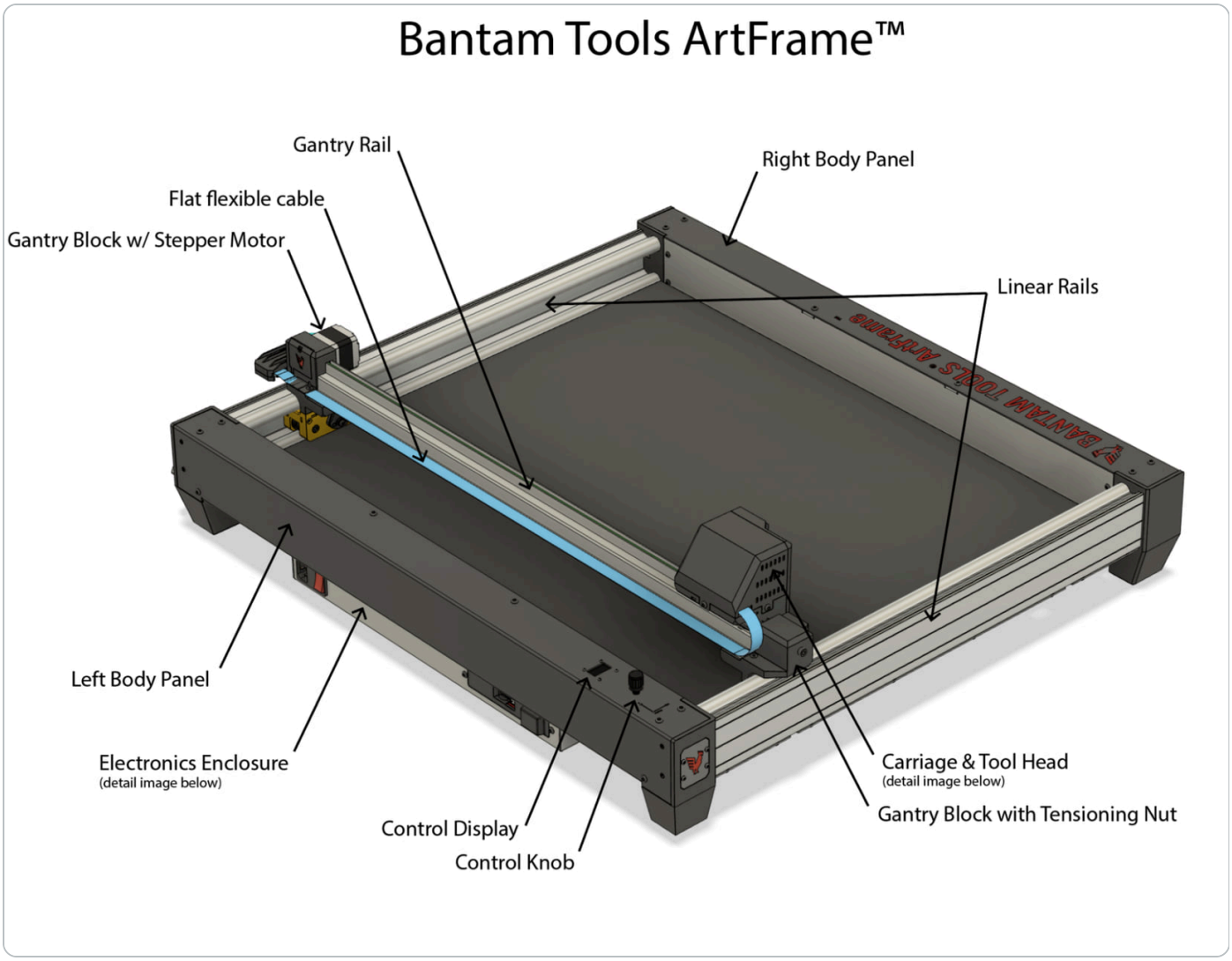
4.2 Buying more

Additional magnets and Pen Height Setup Tools are available to purchase, along with alternate tool holders, table rails, and other accessories. To learn more, visit https://bantamtools.com.

5. ArtFrame anatomy

This chapter provides reference documentation for the main parts of the Bantam Tools ArtFrame™ and where they are on the machine. We refer to these parts by name throughout the guide. The details and appearance of parts vary slightly between models, but their function is the same.

5.1 The whole machine



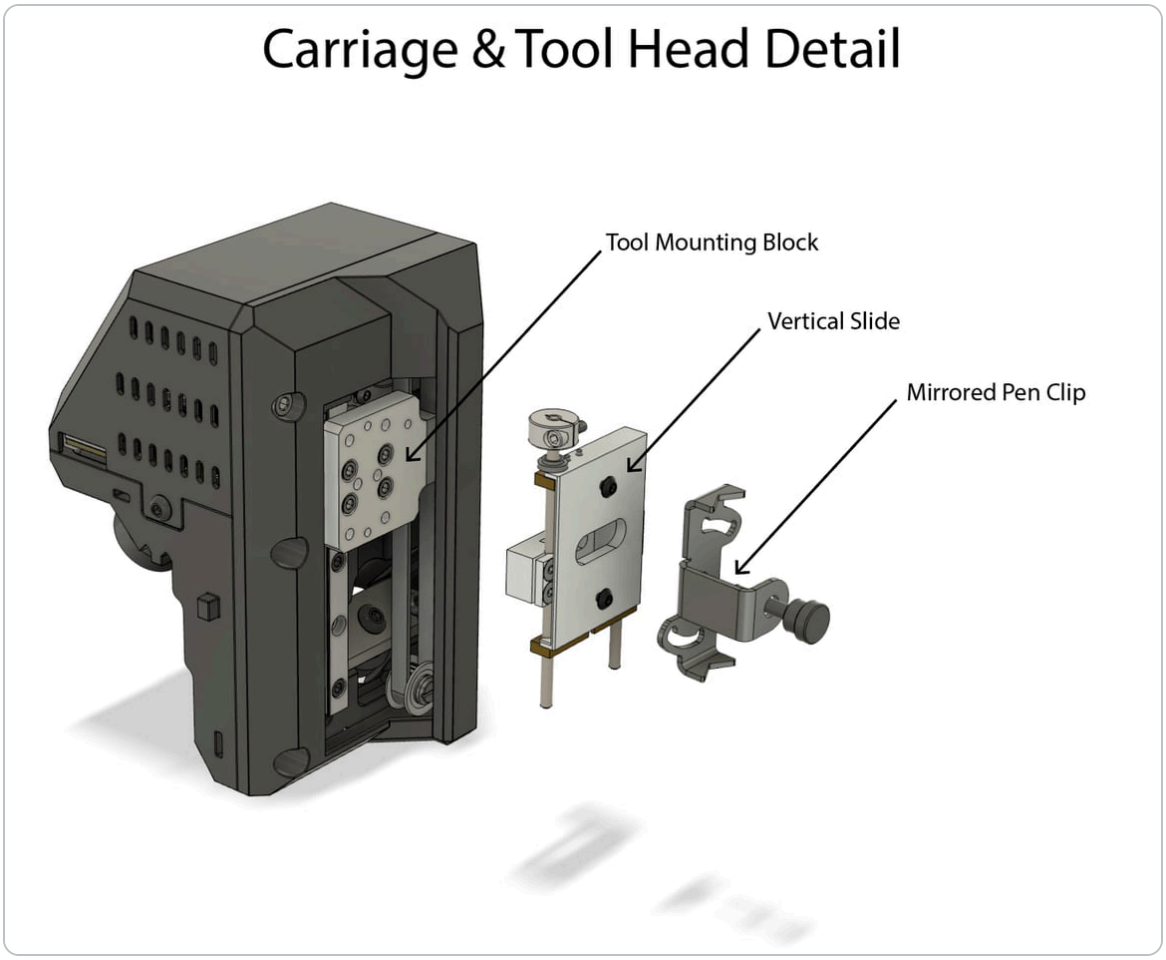
The main parts of the ArtFrame.

- **Gantry rail** — the beam that spans the bed and carries the carriage across it.
- **Gantry block with stepper motor** — the driven end of the gantry, at the left, which moves the gantry along the machine's long axis.
- **Gantry block with tensioning nut** — the opposite end of the gantry, at the right, where the belt tension is set.
- **Flat flexible cable** — the ribbon cable that runs along the gantry rail to the carriage, carrying power and signals to the tool head.

- **Linear rails** — the two rails along the sides of the bed that the gantry blocks ride on.
- **Left body panel** and **right body panel** — the two sides of the frame that carry the linear rails and hold the machine together.
- **Electronics enclosure** — the housing on the left body panel that holds the power connection, the power switch, the USB port, and the microSD card slot. See §6. Connecting power.
- **Control display** — the small display on the left body panel.
- **Control knob** — the knob beside the display, which is the machine's only control. See §11. The ArtFrame interface.
- **Carriage and tool head** — the assembly that rides along the gantry rail and holds the marking tool.

The magnetic drawing surface fills the bed between the rails. §15. Paper and workholding covers what it holds and how to secure work to it.

5.2 The carriage and tool head



The carriage and tool head, with the vertical slide and mirrored pen clip shown separated from the tool mounting block.

- **Carriage** — rides along the gantry rail and connects to the wiring.
- **Tool head** — houses the Z motor, the endstop, and the tool mounting block. The tool head is customizable, and we plan to release future tool heads that fit onto the same carriage.

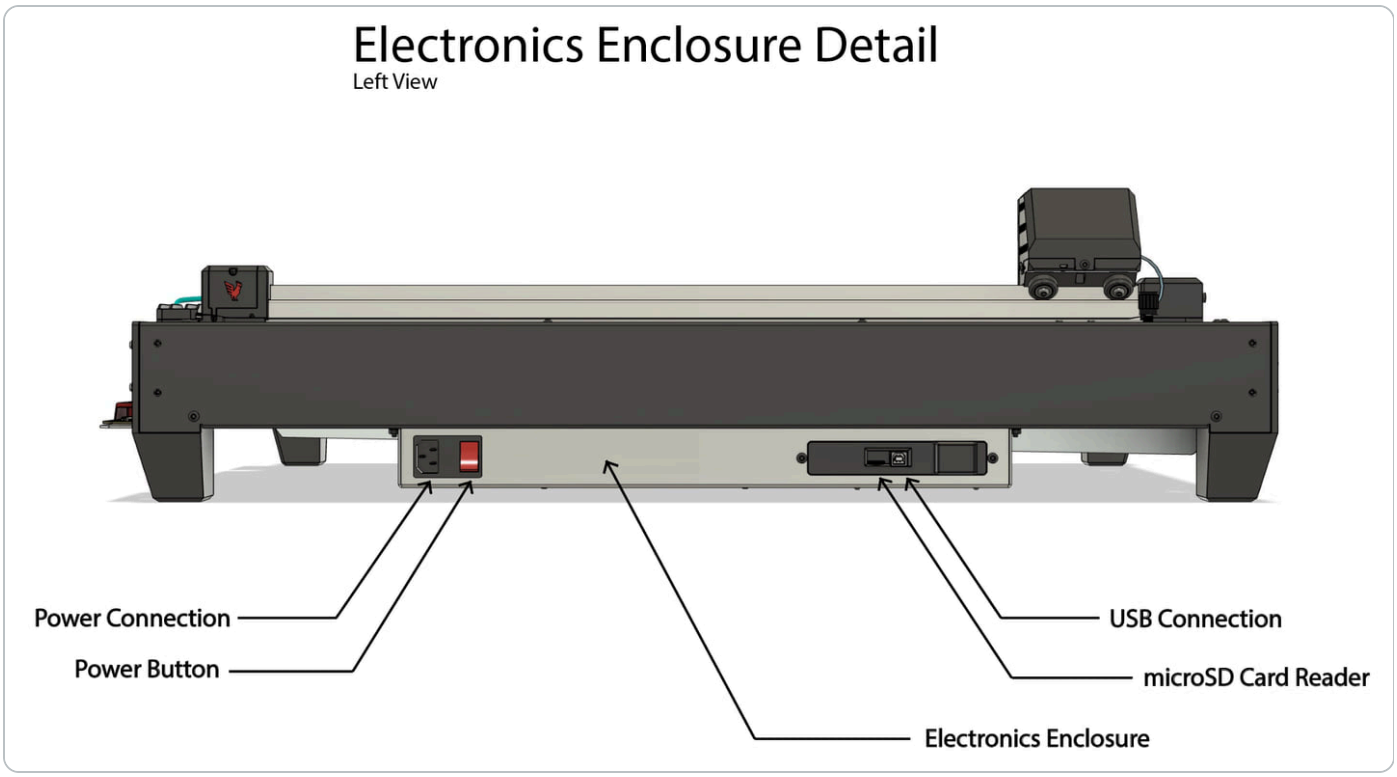
- **Tool mounting block** — the primary mounting point for tool holders and stages.
- **Vertical slide** — also called the vertical slide stage. Mounted to the tool mounting block, it converts direct pressure from the block into spring tension for the marking tool. It is similar to the vertical slide on the Bantam Tools NextDraw™.
- **Mirrored pen clip** — the tool holder included with the ArtFrame, which holds a pen either straight down or at an angle. It is mirrored relative to a NextDraw pen clip; see §12.4 Pen clip orientation for why.

Tool holders such as pen clips and strap clamps attach to the tool mounting block, to the vertical slide, or to the optional Pen Clip Rotation Stage. §12. Tool mounting and holders covers all of them.

6. Connecting power

Before the Bantam Tools ArtFrame™ can draw anything, it needs power and the included microSD card. Both connect at the electronics enclosure, and this chapter sets them up and turns the machine on.

6.1 The electronics enclosure



The electronics enclosure, with the power receptacle, power switch, USB port, and microSD card slot.

The electronics enclosure houses everything you plug into the machine:

- The power receptacle
- The power switch, next to the receptacle
- The USB port
- The microSD card slot

The control display and control knob sit on the same body panel, above the enclosure.

6.2 Connecting the power supply

> ⚠ **Warning:** The ArtFrame ships in US and international versions that have different input voltage requirements, either 100 – 127 VAC or 200 – 240 VAC. If you are not sure which your machine is configured for, consult the label on the machine. If your machine is the wrong voltage for your locale, contact support@bantamtools.com for assistance.

The ArtFrame takes power through a standard IEC 320 C13 power cord. Plug the cord into the power receptacle on the machine, then into a wall outlet.



The power cord plugged into the receptacle, beside the power switch.

Route the cord so that it will not be pulled, tripped over, or caught by the moving parts of the machine, and keep it clear of the drawing area and the rails.

6.3 Inserting the microSD card



The microSD card in its slot, next to the USB port.

Locate the microSD card in the accessory box and insert it into the slot on the electronics enclosure.

Note: The microSD slot is a friction-fit slot. To remove a card, pull it out rather than pressing it in further.

6.4 Turning the machine on

Turn the ArtFrame on with the power switch, next to the power receptacle. The display shows the startup screen briefly, then the main menu. See §11. The ArtFrame interface for what each screen shows.

Turn the machine off before unplugging power or moving it, and do not unplug it by pulling on the cord.

6.5 About the USB cable

Every ArtFrame model currently ships with a USB-A to USB-B cable. It connects the machine to your computer, so Studio can send files to it directly.

The walkthroughs in this part of the guide run files from the microSD card instead, so you do not need to connect USB yet. See §18. Sending files to your machine for the ways to send files, and §17. Power, USB, and microSD details for details on the connections themselves.

7. Running the Welcome Plot

The microSD card that comes with the Bantam Tools ArtFrame™ holds a ready-to-run file, the Welcome Plot. It is the first of three walkthroughs in this part of the guide. The ArtFrame draws it on its own, with no computer involved, which confirms that the machine arrived in good working order.

Keep the included Pilot G2 pen, the Pen Height Setup Tool, the "chess pawn" magnets, and a sheet of 8.5" × 11" (Letter) or A4 paper at hand.

7.1 Powering on

Start with the microSD card in its slot and the machine plugged in, as at the end of §6. Connecting power. Turn the ArtFrame on with the power switch next to the power receptacle.



The power switch, next to the power receptacle.

The display shows the startup screen, then the main menu.

7.2 Selecting the Welcome Plot

Select the file before you install the pen. The machine homes when the file starts, and the carriage should be free to move while it does.

Turn the control knob to the file folder icon, **Browse Files**, and press the knob to select it. The display lists the files and folders on the microSD card.



*The main menu with **Browse Files** highlighted.*

Turn the knob to highlight `welcome.gcode`, the example file preloaded on your card.



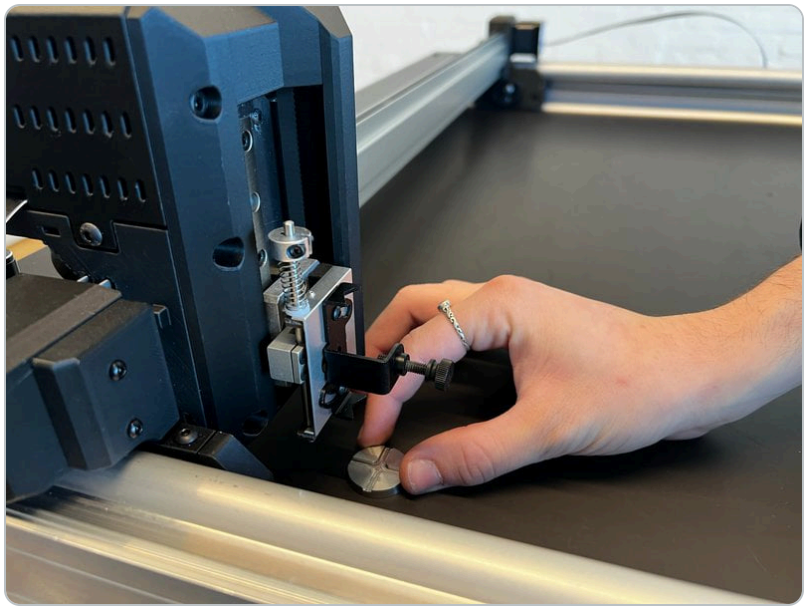
The file browser with `welcome.gcode` highlighted.

Keep your hands, the pen, and the paper clear of the machine, then press the knob to select and start the file.

The ArtFrame begins to move, performing its automatic homing sequence. After homing, it raises the tool head to the loading position and waits there. Nothing more happens until you press the knob again.

7.3 Installing the pen

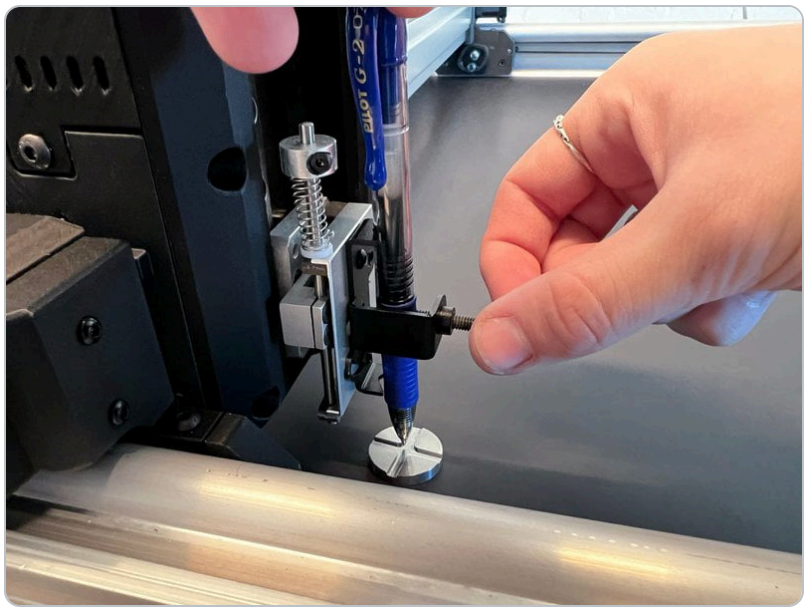
Place the Pen Height Setup Tool under the pen holder, with the cross-shaped (X-shaped) side facing up.



Place the Pen Height Setup Tool under the pen clip, cross side up.

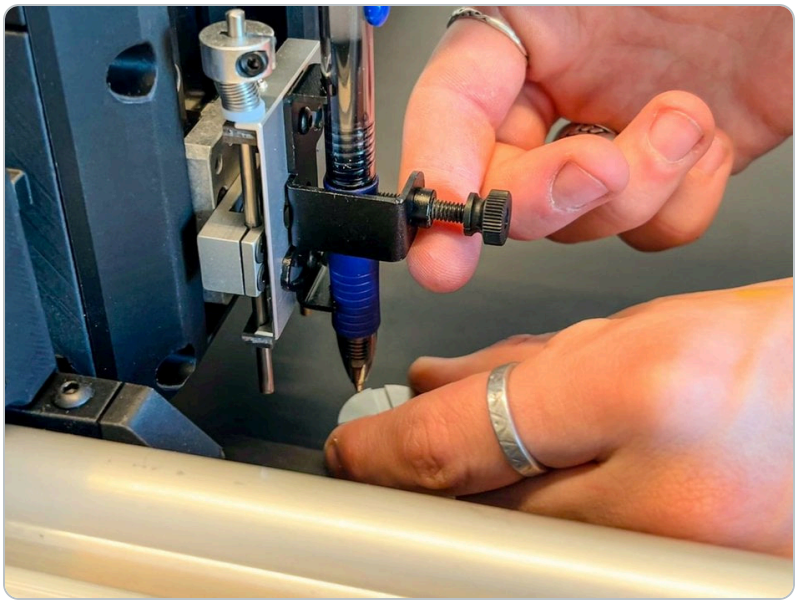
Insert your pen into the pen clip, with its tip resting in the grooves at the center of the Pen Height Setup Tool. The grooves center the pen over the tool, which sets the pen tip 3.5 mm above the surface.

Gently tighten the thumbscrew on the pen clip to secure the pen. Take care to only apply gentle force with the thumbscrew; do not tighten it more than necessary.



Rest the pen tip in the grooves, then gently tighten the thumbscrew.

Remove the Pen Height Setup Tool. You will need to lift the pen holder slightly to slide it out.



Lift the pen holder slightly and slide the setup tool out.

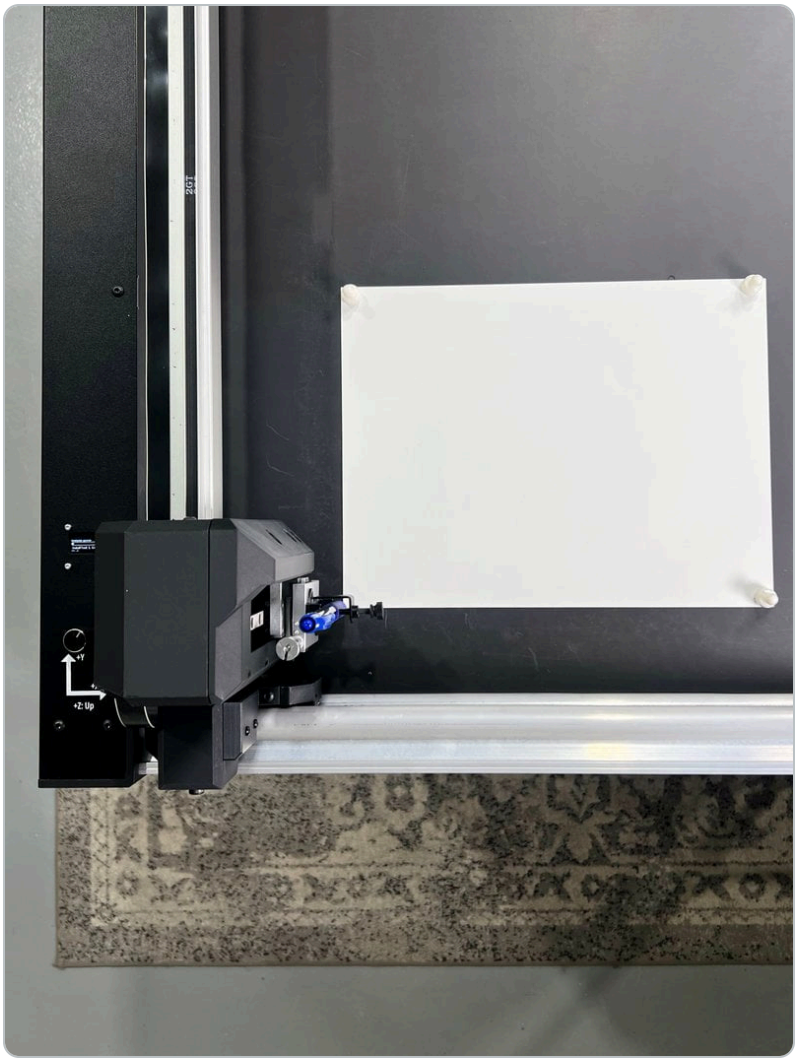
7.4 Placing the paper

Place a sheet of 8.5" × 11" (Letter) or A4 paper on the ArtFrame's drawing surface.

The Welcome Plot is designed to run in either portrait or landscape orientation, so either is fine.

Align the sheet so that its lower-left corner sits directly below the tip of the pen, and keep its edges parallel to the rails of the machine, so that the drawing is not skewed on the page.

Secure the paper with the magnets, such as the "chess pawn" magnets included with the ArtFrame. Place them clear of the area the pen will travel over.

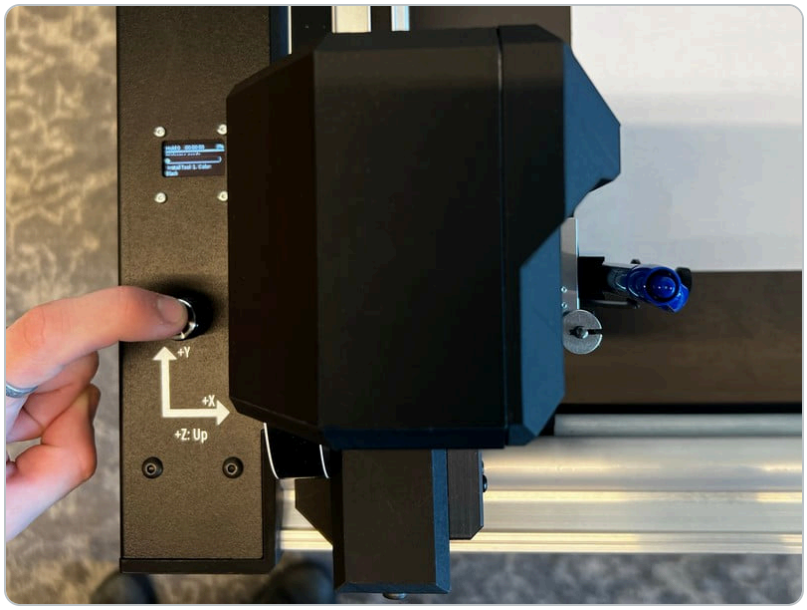


A sheet placed with its lower-left corner under the pen tip, held by the "chess pawn" magnets.

7.5 Starting the drawing

Make sure the drawing area is free of obstructions — around the paper, elsewhere in the bed, and in the rails — and that your hands are clear.

Press the control knob to begin. The ArtFrame draws the Welcome Plot.



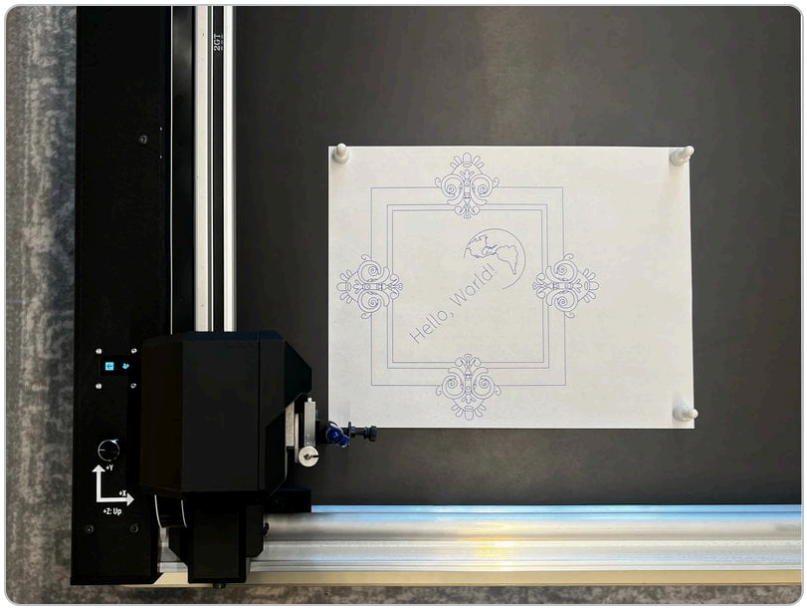
Press the control knob to start the drawing.

When the plot completes, the display shows a message that the file has finished.



The display when the Welcome Plot finishes.

Remove the paper. You now have your first drawing made with the Bantam Tools ArtFrame.



The finished Welcome Plot.

If you ran into difficulty making this first plot, see §33. Troubleshooting, and reach out to support (support@bantamtools.com) to get it sorted out.

In the next walkthrough, §9. Preparing your first artwork, you prepare artwork of your own in Bantam Tools Studio™.

8. Installing Studio

Bantam Tools Studio™ is the application you use to prepare a job and send it to your machine. This chapter covers finding your license details, downloading and installing Studio on macOS and Windows, and activating your license. You do this once, before your first job, and again whenever you move Studio to a new computer.

8.1 Finding your license details

A license for Bantam Tools Studio is included with every Bantam Tools machine.

When you purchased your machine, or purchased Studio on its own, you received an email with a download link and a license key. Find that email before you begin: activation asks for the License ID and Password it contains.

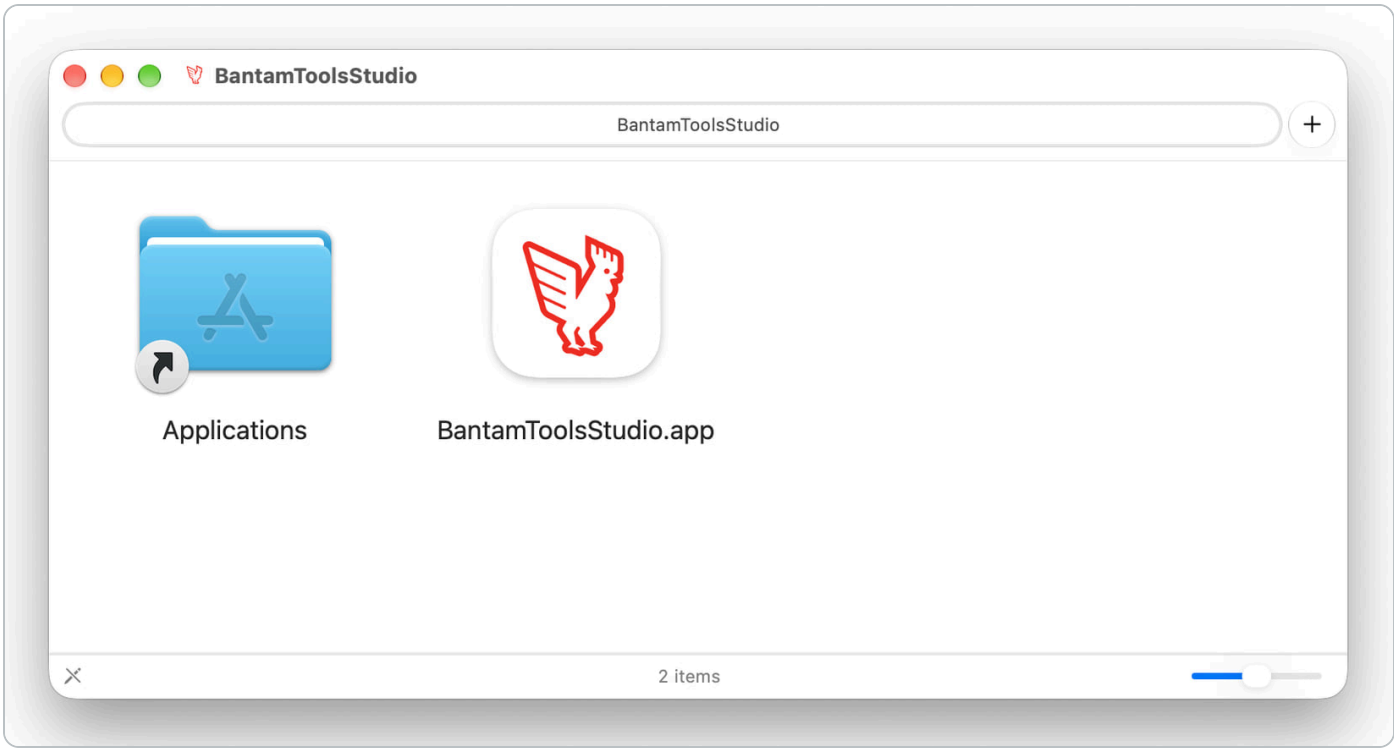
If you cannot locate that email, contact support@bantamtools.com and include your order number or machine serial number, and we can send your license details again.

8.2 Downloading Studio

Visit bantam.tools/sd to download Bantam Tools Studio. The download page offers a macOS disk image (a `.dmg` file) and a Windows installer (an `.exe` file); take the one for the computer you will be working on.

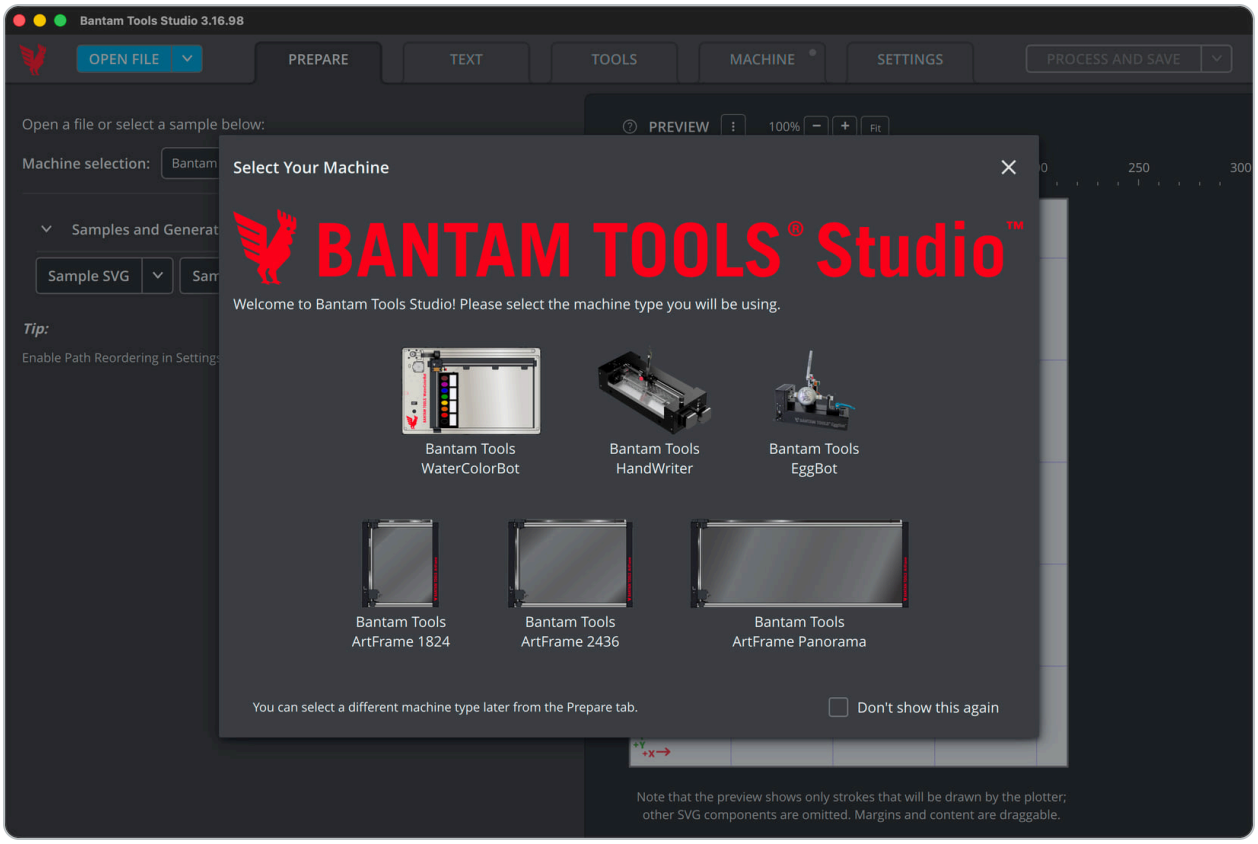
8.3 Installing on macOS

1. Locate the downloaded `.dmg` file and double-click it to mount the disk image.
2. Review and accept the End User License Agreement.
3. Drag **BantamToolsStudio** into the **Applications** folder.
4. Eject the disk image.
5. Open Bantam Tools Studio from the **Applications** folder.



*The mounted disk image: drag **BantamToolsStudio** into the **Applications** folder.*

Studio opens to the **Select Your Machine** splash screen. Choose your machine and Studio continues to its main window, with no license active yet. The splash screen has a **Don't show this again** check box; with it checked, later launches open straight to the machine you used last.



***Select Your Machine** window at startup*

8.4 Installing on Windows

1. Locate the downloaded `.exe` installer and run it.
2. Click **Next** to begin.
3. Choose an installation folder.
4. Review and accept the End User License Agreement.
5. Accept **Bantam Tools Studio** as the Start Menu shortcut name.
6. Click **Install**.
7. Click **Yes** when Windows asks whether to allow the installer to make changes, so that it can finish.
8. Click **Finish**.

The installer closes and Bantam Tools Studio appears in your Start Menu. The first time you open it, it shows the **Select Your Machine** splash screen before its main window.

To update Studio later, close it and run the newer installer, choosing the same folder. The installer asks whether to upgrade, and keeps your license and settings. When you click **Yes** to upgrade, Windows asks right away whether to allow the installer to make changes, before the **Install** step; click **Yes** there as well.

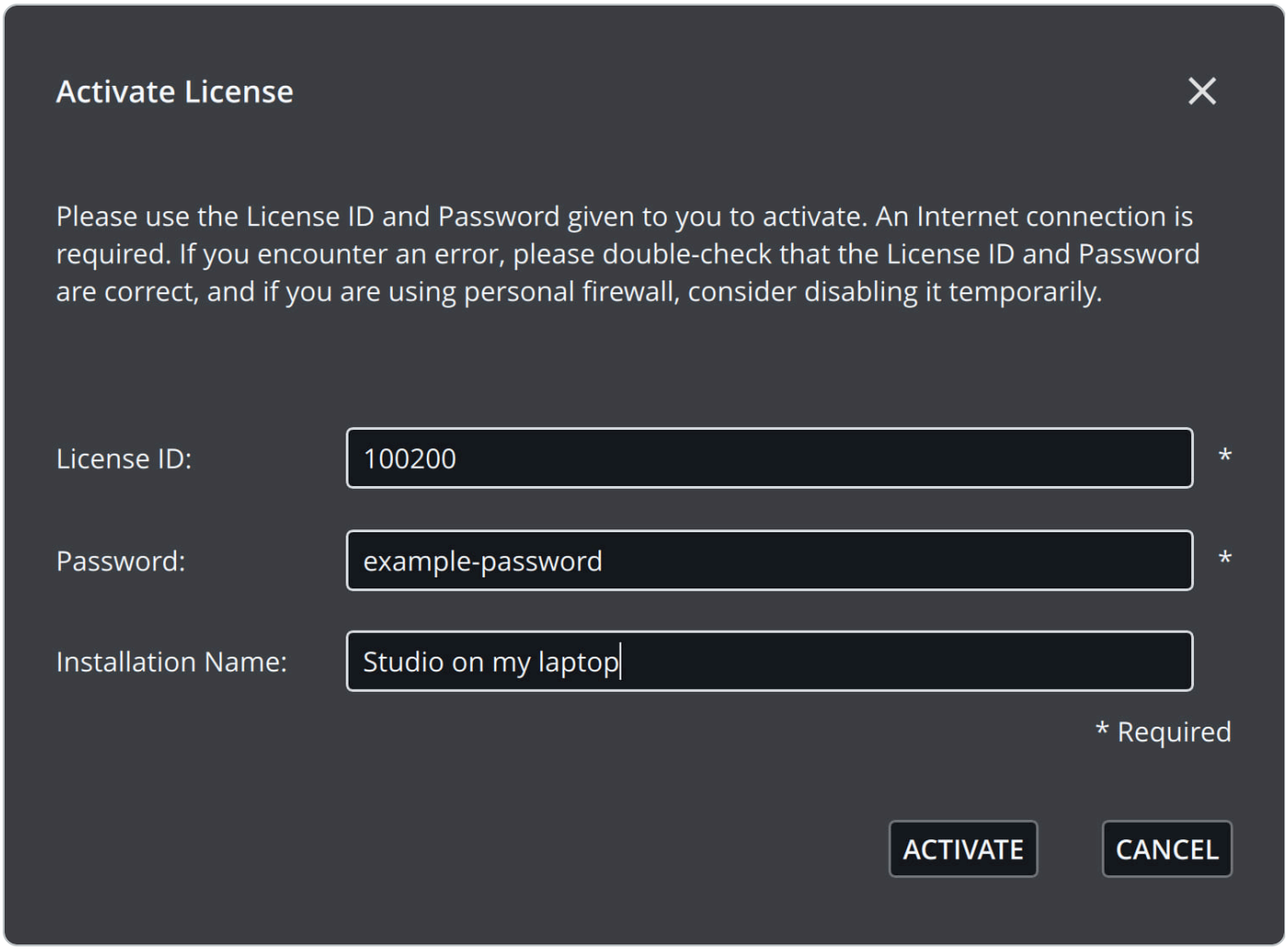
8.5 Activating your license

Studio keeps license tools in the License Manager, which you reach from the **SETTINGS** tab. Activation is per computer, so you repeat these steps on each computer you install Studio on.

1. Open Bantam Tools Studio, choosing a machine at the splash screen if it appears.

2. Select the **SETTINGS** tab.
3. Click **License Manager**.
4. Select **Activate License**.
5. Enter the License ID and Password from your license email. **Installation Name** is optional; Studio sends it to the licensing server along with the activation, as a name for this computer.

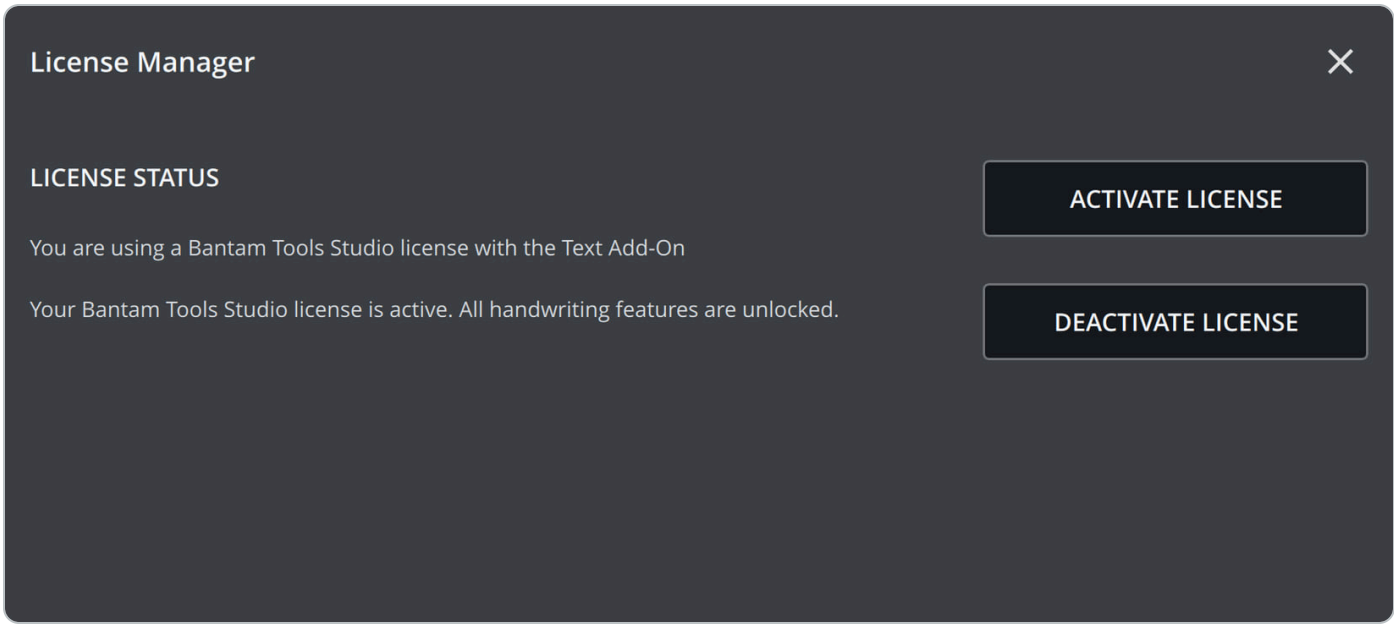
Studio confirms the activation, and the features your license includes become available.



*The **Activate License** form, with a License ID, Password, and Installation Name filled in*

> ***Note:*** Activation contacts the Bantam Tools licensing server, so a live internet connection is required. It is needed only for the initial activation; once the license is active, Studio runs without one.

From the License Manager you can also deactivate the current license, which frees it to be activated on another computer. Deactivate before you retire or hand on a computer, so that the license is available where you need it next.



License Manager *with a license active*

8.6 What your license includes

Studio includes the **TEXT** tab, for writing with the Hershey single-stroke fonts that come with it.

The Bantam Tools Studio Text Add-On adds the complete font library, signatures, Handwriting Defects, spacing and overflow controls, and Data Merge. It is a separate purchase for Bantam Tools Studio.

The Bantam Tools Studio guide describes the Text Add-On features in full.

8.7 Help with installation

If you run into difficulty installing or activating Bantam Tools Studio, email our support team at support@bantamtools.com and we can walk you through it. Include your order number or machine serial number when the trouble is with a license.

9. Preparing your first artwork

This is the second of the three Getting Started walkthroughs: an SVG file of your own, opened in Bantam Tools Studio™ and saved as a G-Code file for the Bantam Tools ArtFrame™. Studio's defaults are all a first drawing needs, so this walkthrough changes almost nothing.

Before you start, we recommend that you have already run the Welcome Plot from the included microSD card (§7. Running the Welcome Plot), so that you know the machine itself is working. Studio must also be installed and its license activated; see §8. Installing Studio.

Start with a single-color drawing. One tool keeps the setup short, and the same steps extend to multi-color work once you are comfortable.

9.1 Choosing the machine

Open Bantam Tools Studio on your computer.

At the top of the **SETUP** sub-tab, on the **PREPARE** tab, open the **Machine selection** drop-down menu and choose your model: **Bantam Tools ArtFrame 1824**, **Bantam Tools ArtFrame 2436**, or **Bantam Tools ArtFrame Panorama**.

Make this choice first. It sets the available work area, the default settings, and the way Studio generates motion. Changing it later does not convert a job that is already set up.

9.2 Opening your artwork

Click **OPEN FILE** and choose the SVG file you want to draw.

The artwork appears in the **Preview** area, and the **SETUP** sub-tab fills in with the settings for the job. §22.1 Opening files and file actions covers the rest of what the **OPEN FILE** menu can do.

9.3 Setting the paper size

In the **PAPER SETTINGS** section, choose the size of your paper from the **Standard Sizes** menu, or enter the **X/width** and **Y/height** yourself. The list is filtered to the sizes your model's work area can take.

On the ArtFrame, the paper settings describe the flat work area beneath the tool head rather than a sheet held by the machine, so the size you enter is the area the drawing is laid out in. §15. Paper and workholding covers what the magnetic surface holds and how to place a sheet on it.

9.4 Placing the artwork

Adjust the **ARTWORK SETTINGS** until the **Preview** shows the drawing where you want it on the page: scaled, centered, rotated, and inside the margins you want.

§22.5 Artwork settings documents every control in the card.

9.5 Assigning a tool

The **TOOLSET SETTINGS** section determines which group of tools is available for the job, and the **TOOL ASSIGNMENTS** list gives each color, layer, or group in your artwork a tool from that set.

For a first single-color drawing, leave **Sort Strokes by** on **Colors** and assign the same tool — a Pilot G2 pen toolset, matching the included pen — to every row.

The tool carries the settings that matter most to how the drawing comes out: the tool height, the draw depth, the feedrate, and the acceleration. §24. Studio: the Tool Library covers tools and toolsets in full, and §20. Drawing quality and speed covers how these settings affect the finished line.

For multi-color artwork, assign a different tool to each color, layer, or group. The machine then pauses between tools and prompts you to swap the pen. See §22.9 Applying tool assignments to every document for the assignment controls and §11.7 Tool-change prompts for what happens at the machine.

9.6 Checking the Preview

Look over the **Preview** before saving. It shows the strokes that will be drawn, on the page, with margins. Step through every page if you opened more than one file.

§22.12 Preview describes the Preview's controls.

9.7 Saving the G-Code

When the **Preview** looks right, click **PROCESS AND SAVE** and save the G-Code file. Studio then opens a Setup Sheet summarizing the job.

PROCESS AND SAVE writes the file to disk and sends nothing to the machine. Getting the file onto the ArtFrame is the next walkthrough, §10. Sending your plot to the ArtFrame.

For everything **PROCESS AND SAVE** can produce, see §26. Studio: exporting output.

10. Sending your plot to the ArtFrame

This is the last of the three Getting Started walkthroughs. Here you copy the G-Code file you saved in §9. Preparing your first artwork onto the microSD card, take it to the Bantam Tools ArtFrame™, and draw it. The steps at the machine are the ones you followed for the Welcome Plot; only the file is new.

10.1 Copying the file to the microSD card

Turn the ArtFrame off, then pull the microSD card out of its slot. (The slot is a friction-fit slot, so pull the card out rather than pressing it in further.)

Put the card in your computer's card reader and copy the saved G-Code file onto it. You can put the file at the top level of the card or in a folder; the machine's file browser opens folders as well as files.

Eject the card from your computer, insert it back into the ArtFrame, and turn the machine on.

> ***Aside:*** The ArtFrame can also receive files from Studio over a USB cable or over WiFi. The Getting Started walkthroughs use the card because it works everywhere, with nothing to connect or configure. §18. Sending files to your machine compares all three routes and walks through network setup.

10.2 Starting the file

Select the file before you install the pen, so that the carriage is free while the machine homes.

Turn the control knob to **Browse Files** and press it. Turn the knob to highlight the file you saved.

Keep your hands clear of the machine, then press the knob to start the file. The ArtFrame homes if it has not been homed since power-on, then raises the tool head to the loading position and waits. It does not begin drawing until you press the knob again.

10.3 Loading the pen and the paper

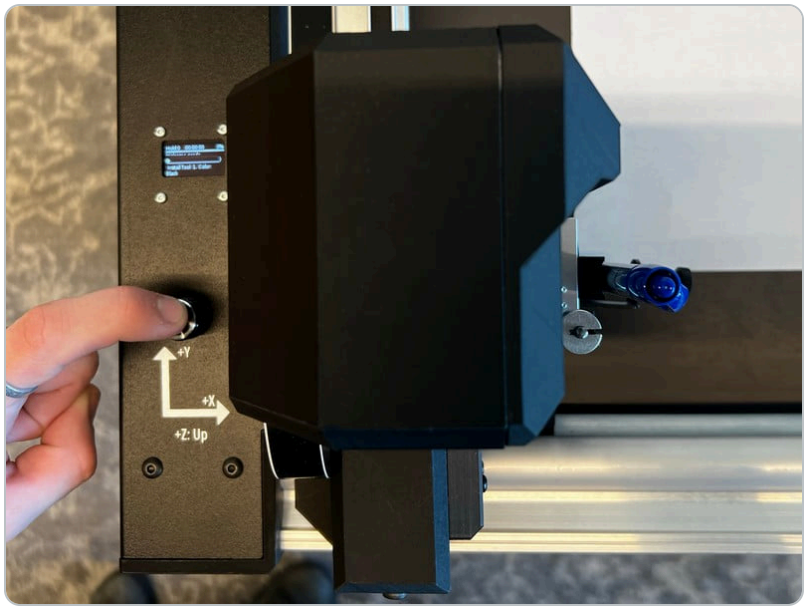
If the pen from the Welcome Plot is still installed, leave it in place; the pen does not need to come out between files. Otherwise, install it with the Pen Height Setup Tool as described in §7. Running the Welcome Plot.

Place your paper on the drawing surface with its lower-left corner directly below the pen tip, keeping its edges parallel to the rails, and secure it with magnets clear of the drawing area. §15. Paper and workholding covers placement and fixturing in more detail.

10.4 Drawing the file

Check that the drawing area and the rails are clear of obstructions, and that your hands are away from the moving parts.

Press the control knob to begin. The ArtFrame draws your artwork.



Press the control knob to start the drawing.

Stay nearby while it runs, so you can see that the paper stays put and the pen draws cleanly. To pause, press the knob briefly; the machine stops at the end of its currently queued motion. Press again to resume. To end a paused plot, press and hold the knob until the display reads that the file was canceled. See §11.6 Pausing, resuming, and canceling.

When the plot completes, the display shows a completed-file message. Remove the magnets and lift off the sheet.

10.5 Checking the result

Look over the finished drawing. It should have:

- Clean, consistent ink lines, neither faint nor skipping.
- Strokes placed where the **Preview** showed them.
- No sign that the medium shifted during the drawing.

If the lines are faint or skip, check the pen height and the draw depth, and try a slower feedrate. If the drawing is misplaced on the sheet, check that the lower-left corner of the sheet was under the pen tip and that the paper size in Studio matches the area you set up. §20. Drawing quality and speed covers the settings behind line quality, and §33. Troubleshooting covers the rest.

That completes Getting Started. The next part of this guide builds on these walkthroughs. It covers tool holders and tool mounting, pen height, workholding, table rails, connections, and maintenance.

Part II: Working with your machine

11. The ArtFrame interface

The Bantam Tools ArtFrame has a small display and an control knob, which together let you run files from the microSD card with no computer attached. This chapter describes every screen on that display and what the knob does on each one. The Getting Started walkthroughs used a few of these screens already; this is the complete reference.

The display and Bantam Tools Studio™ reach the same machine by different routes. At the machine, you browse the card, start and pause files, move through a folder of files, and change the machine's own settings. From Studio's **MACHINE** tab, over a USB cable or WiFi, you upload files and start, pause, and cancel jobs from your computer (see §25. Studio: the MACHINE tab). The display also covers two tasks that Studio does not: jogging one axis at a time, and resetting the machine's settings. Firmware is updated with an updater program or from the card (see §11.11.6 Updating the firmware). Which route suits a given job is covered in §18. Sending files to your machine.

The chapter follows the order in which you meet the screens. It begins with the knob, the startup screen, and the main menu, then covers running a file: pausing, tool changes, and what happens when a file ends. It ends with each item in the **Settings** menu, including firmware and configuration updates and the factory reset.

11.1 Control knob and display

The control knob is the only control on the display. It does three things:

- **Turn** — moves the highlight through the items on the screen.
- **Press** — selects the highlighted item. While a file runs, a press pauses it.
- **Press and hold** — cancels a paused file, and skips a file on the **Run Next** screen. Hold the knob down for about half a second before releasing it.

A short message sometimes appears over the current screen, such as **Homing before file run...** or **WiFi off**. Most of these clear on their own. A press of the knob dismisses any message still showing and does nothing else. Press again to act on the screen beneath it.

After the machine has been left alone for a while, the display dims and then shows a screensaver. Once the screensaver is showing, the first turn or press of the knob only wakes the display (see §11.11.5 Screensaver).

While Studio is sending the machine a command, the display shows **External command in progress**. While Studio uploads a file, the display shows the upload's progress. In both cases the knob does nothing until Studio finishes.

If the machine stops with an alarm, pressing the knob clears the alarm and returns the machine to its menus.

11.2 Startup screen

When you turn on the ArtFrame, the display shows the startup screen for about a second: the machine's name at the top, the Bantam Tools logo, and the installed firmware version on the bottom line (for example, **Firmware: 2.10.11**). The main menu follows.

The firmware version is also shown on the **Version** screen in **Settings**, so there is no need to catch it at startup.



Startup screen, with the firmware version on the bottom line.

11.3 Main menu

The main menu shows the machine's name at the top and three items as a row of icons, with the name of the highlighted item beneath them. Turn the knob to move between the icons, and press it to select one.

- **Browse Files** — opens the file browser, which lists the files and folders on the microSD card.



*Main menu with **Browse Files** highlighted.*

- **Home** — homes the machine. While **Home** is highlighted, **(homed)** or **(unhomed)** at the bottom right shows the machine's current state.



*Main menu with **Home** highlighted; the ArtFrame is homed.*

- **Settings** — opens the **Settings** menu of machine settings, system information, and updates.

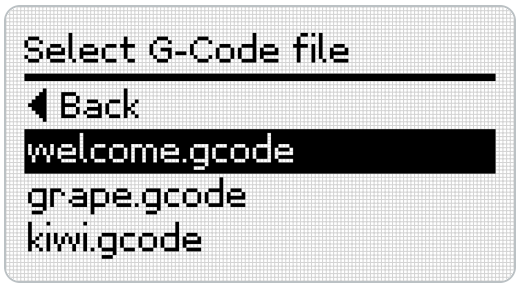


*Main menu with **Settings** highlighted.*

Running files from the microSD card starts in **Browse Files**, so that is where you spend most of your time at the machine.

11.4 Browsing and starting files

Select **Browse Files** in the main menu to open the file browser. Its screen is headed **Select G-Code file** and lists the G-Code files (`.gcode` and `.nc`) and folders on the microSD card, with ◀ **Back** at the top of the list. The first file or folder is highlighted when the list opens.



File browser with `welcome.gcode` highlighted.

Turn the knob to scroll through the list. Press the knob on a folder to open it; the heading changes to the folder's name, and ◀ **Back** in the folder returns to the folder above it. ◀ **Back** at the top level returns to the main menu.

Files and folders are listed in the order set by **"Next File" Ordering** in **Settings** (Default: **Oldest**). A file that has run to completion carries a check mark before its name; see §11.9 Completed file check marks.

If the card holds no G-Code files, the display shows **No G-Code files on microSD Card** and returns to the main menu. With no card in the slot, it shows **No microSD Card**. If the card is removed while the machine is reading it, or cannot be read, the display shows **microSD removed or unreadable** and **Reinsert and restart**: reinsert the card, then turn the machine off and on again.

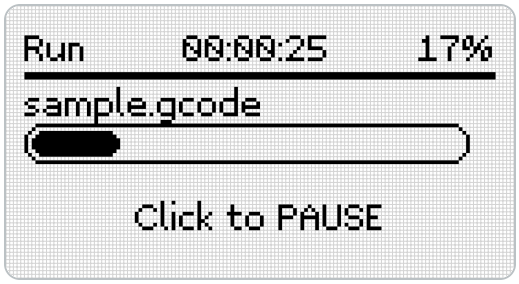
To start a file, highlight it and press the knob.

If the machine has not been homed since it was turned on, or since a file was canceled, it shows **Homing before file run...** and homes first. The file then begins. Files made in Studio begin by moving to the loading position and pausing, so that you can load the tool and the media. Once everything is loaded, press the knob to continue the file.

> ⚠ **Warning:** Keep hands, tools, media, and loose objects clear of the moving parts before you start a file, since the machine may home as soon as you press the knob.

11.5 The run screen

While a file runs, the display shows the file's name, the elapsed time and percentage complete along the top, a progress bar, and **Click to PAUSE** at the bottom. The menus are hidden until the file ends, and turning the knob does nothing.



*The run screen, with the elapsed time and percentage complete above the file name, and **Click to PAUSE** below the progress bar.*

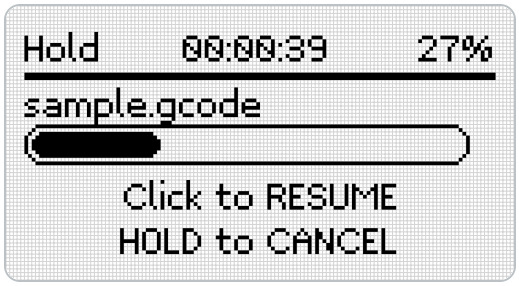
When the last move of a file is still finishing, the display may briefly show **Finishing motion queue** before the post-run screen appears (see §11.8 The post-run screen).

11.6 Pausing, resuming, and canceling

Pause the machine before you reach into it, check the media, or deal with a pen or brush problem.

Press the knob while a file runs to pause it. The display shows **Pause requested...** and then **Pausing, please wait...** while the machine stops and lifts the tool clear. Wait for the next screen before pressing the knob again.

Once the machine has stopped, the display shows **Click to RESUME** and **HOLD to CANCEL**, and the elapsed time stops counting.



*A paused file, offering **Click to RESUME** and **HOLD to CANCEL** below the progress bar.*

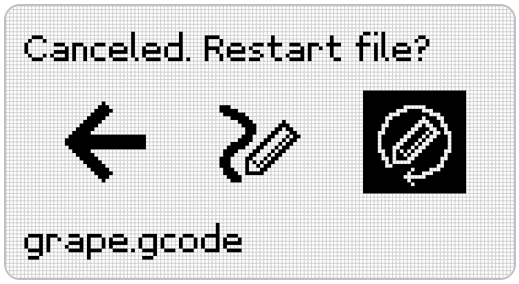
To resume, press the knob. The display shows **Resuming...**, and the file continues from where it paused.

To cancel, press and hold the knob for about half a second, then release it. The file stops for good. Canceling also clears the machine's homed state, since the abrupt stop may have lost its position. The next file you start therefore homes first.

The same **Click to RESUME** and **HOLD to CANCEL** screen appears whenever a file pauses itself, such as at the loading position. A file can instead supply its own instruction for a pause (see §11.7 Tool-change prompts). The knob works the same way at every pause.

After a cancel, the display shows the post-run screen with the restart icon highlighted. Its heading reads **Canceled. Restart file?**, and the canceled file's name is on the bottom line. Press the knob to run the file again *from the beginning*, not from where it stopped. Turn the knob to the back arrow instead to return to the file list.

A canceled file does not get a check mark.



After a cancel, the display offers to restart the file.

11.7 Tool-change prompts

A file can pause for a tool change and put the instruction for that change on the display, in place of **Click to RESUME** and **HOLD to CANCEL**. A multi-tool file from Studio, for example, pauses with **Install** followed by the name of the next tool from the tool library, and later changes may first pause with **Remove this pen**. Studio's **MACHINE** tab shows the same instruction while the machine waits.



*A tool-change pause, with the file's instruction — here **Install Black G2-0.7** — in place of **Click to RESUME**.*

Follow the instruction, then press the knob to continue. Press and hold to cancel, as at any pause.

> ***Aside:*** If you write or edit G-Code by hand, a comment placed before an `M0` pause sets the text shown during that pause:
>
> - `(## message)` — shows `message` at the next pause.
> - `( Install Tool: message )` — shows the whole comment text, beginning with `Install Tool`, at the next pause. The colon is optional.
> - `( Toolchange message )` — shows the whole comment text, beginning with `Toolchange`, at the next pause.
>
> An instruction longer than 64 characters is cut off and ends with "...". The instruction clears on its own when the file resumes.

11.8 The post-run screen

When a file ends, remove the finished piece from the machine. The display shows the post-run screen, a row of up to three icons. The heading above them and the line of text below them change with the highlighted icon.

- **Back arrow** — returns to the file list, in the folder the file ran from. Its heading shows how the file ended and how long it took: **Completed in**, **Canceled at**, or **Elapsed time**, followed by the time.
- **Run Next** — starts the next file in the same folder. Its heading reads **Run Next (HOLD to skip)**, and the line below names the next file. This icon appears only when the folder holds another file without a check mark, and only while ✓ **Completed files** is on.

- **Run Again** — runs the file that just ended again, from the beginning. Its heading reads **Run Again** (or **Canceled. Restart file?** after a cancel), and the line below names the file.

Which icon is highlighted when the screen appears depends on how the file ended:

- The file completed and the folder holds another file to run: **Run Next**.
- The file completed and no other file is waiting: the back arrow.
- The file was canceled, or stopped because of a G-Code error: **Run Again**. A file stopped by a G-Code error also shows the **Canceled. Restart file?** heading.
- The file ended unexpectedly (described below): **Run Next** if it is offered, otherwise the back arrow.

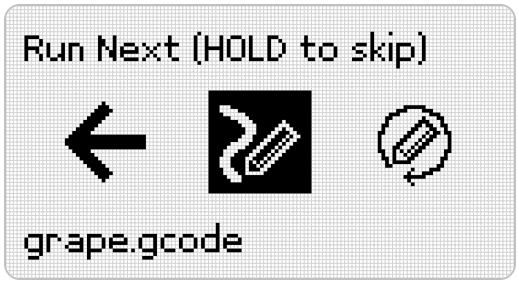
If a file ends partway through a line, as happens when a copy to the card or a USB upload was cut short, the display shows **File ended unexpectedly** until you press the knob. **Run Again** is not offered for that file, and the file is not marked complete.

A file that ends cleanly but has no end-of-program command (`M2` or `M30`) shows **File ended without end marker** until you press the knob. That file is still marked complete.

11.8.1 Running files from a folder

When you run a folder of files, the machine offers to continue to the next file as each one finishes.

The post-run screen opens with **Run Next** highlighted, and the name of the file it will run is on the bottom line.



***Run Next** highlighted after a file finishes, naming the next file.*

Load fresh media, then press the knob to choose **Run Next**.

The machine homes if it needs to, then moves to the loading position and pauses. Press the knob again to start the next file.

Run Next chooses the first file in the folder, in the order set by **"Next File" Ordering**, that has no check mark, skipping the file that just ran. It never leaves the folder, so files in other folders, including folders inside this one, are not run.

To skip the upcoming file without running it, press and hold the knob on **Run Next** for about half a second. The machine marks that file complete and shows **Skipping (marking ✓)** with its name for a few seconds. **Run Next** then names the file after it, or disappears if none are left.

> *Important note:* Choosing **Run Next** also marks the file that just ended as complete, if it is not marked already. This happens however that file ended: after a cancel, a G-Code error, or an unexpected end, **Run Next** marks the file complete even though it did not finish. **Run Next** then never runs that file again, so a batch can finish with that piece missing. To leave the file unmarked, return to the file list and start the next file from there instead.

If you turn to the back arrow while other files remain, the bottom line reads **Return to file list**, and the heading shows how long the file took.



*The back arrow while other files remain, with **Return to file list** on the bottom line and the time the file took above.*

When every file in the folder carries a check mark, the post-run screen opens with the back arrow highlighted, and the bottom line reads **All files complete!**.

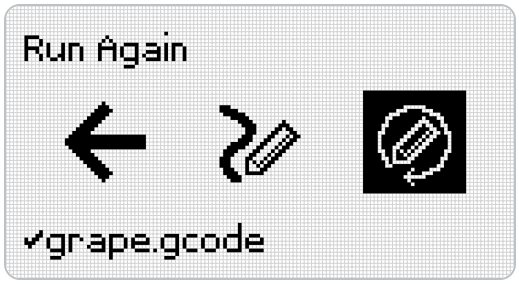


*The back arrow once every file in the folder is complete, with **All files complete!** on the bottom line.*

11.8.2 Running a file again

To run the same file again, turn the knob to **Run Again** and press it.

Run Again is useful when a pen or brush runs dry partway through, when the wrong media was loaded, or when you want another copy.



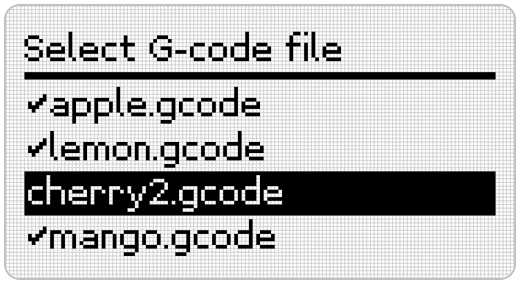
***Run Again** highlighted, naming the file it will run.*

As with any file, the machine homes first if it needs to, then moves to the loading position and pauses.

11.9 Completed file check marks

The ArtFrame keeps track of which files have run to completion by adding a check mark to the start of each completed file's name on the microSD card. The setting that controls this is **✓ Completed files** in **Settings** (Default: on).

A completed file carries a small check mark before its name in the file list. The marks show at a glance which files are done, so you can pick up where you left off.



Completed files marked with check marks in the file list.

The mark is part of the file's name, so it stays with the card and survives turning the machine off. The same marks appear in Studio's file list and on your computer, as a ✓ at the start of the name.

When you start a file that carries a mark, the machine removes the mark before the file begins and adds it again only if the file completes. A file canceled partway through is left unmarked.

To clear a mark by hand, rename the file on your computer and delete the ✓ from the start of its name.

11.9.1 Turning check marks off

Select **✓ Completed files: ON** in **Settings** to turn marking off; the row then reads **✓ Completed files: OFF**. Select it again to turn marking back on. The change takes effect at once and is kept when the machine is turned off.

While marking is off, the machine adds no new marks and removes none, so marks already on the card stay where they are. **Run Next** is not offered while marking is off, since it depends on the marks to know which files remain.

11.10 Homing from the main menu

Home is the machine's starting place, the position every move is measured from. Homing is how the machine finds it: the machine moves the toolhead until it reaches a position it can sense, and from then on it knows where the toolhead is.

Select **Home** in the main menu to home the machine. The top line of the display reads **Homing...** until homing finishes.

The ArtFrame also homes on its own when it needs to, such as when you start a file after power-up or after a canceled file. **Home** lets you home whenever you choose, such as before jogging.



*Main menu with **Home** highlighted; the ArtFrame is unhomed.*

> ⚠ **Warning:** Before the machine homes, whether from **Home**, from **Jog mode**, or at the start of a file, keep hands, tools, media, and loose objects clear of the moving parts.

11.11 The Settings menu

Select **Settings** in the main menu to open machine settings, system information, and updates. You do not need to change any settings before running your first file. If you are troubleshooting, support may ask you to read information from this menu.



*The **Settings** menu.*

The menu shows four rows at a time; turn the knob to scroll. Its rows, in on-screen order:

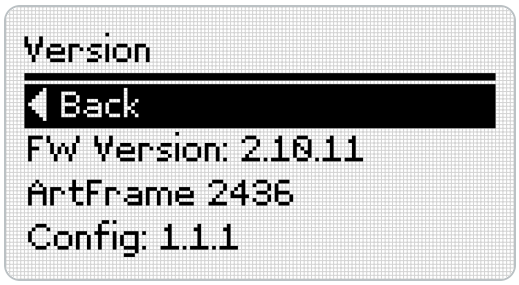
- **◀ Back** — returns to the main menu.
- **Version** — shows the firmware version, the machine's name, the configuration version, and other system information.
- **Jog mode** — moves the machine one axis at a time.
- **WiFi Status** — shows the machine's network connection. This row appears only while WiFi is on.
- **Turn WiFi ON** or **Turn WiFi OFF** — turns the machine's WiFi on or off.
- **✓ Completed files: ON** or **✓ Completed files: OFF** — turns completed-file check marks on or off.
- **"Next File" Ordering** — sets the order of the file list and of **Run Next**.
- **Screensaver** — sets how long the machine waits before it dims the display and shows a screensaver.
- **Update Config File** — installs a configuration file from the microSD card.
- **Update Firmware** — installs firmware from the microSD card.
- **Reset Factory Settings** — returns the machine's stored settings to their defaults.

✓ Completed files is described in §11.9 Completed file check marks. The other rows each have a section below.

11.11.1 Version

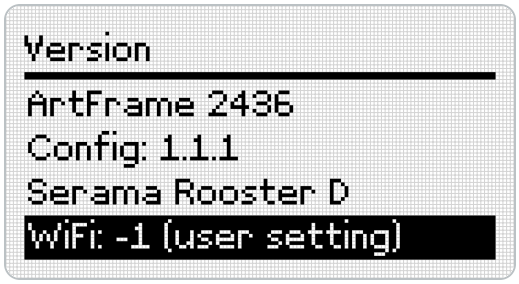
Version opens a list of system information:

- **FW Version:** the installed firmware version.
- The machine's name, as set by its configuration file.
- **Config:** the version of the installed configuration file.
- The name of the machine's controller board.
- **WiFi:** the WiFi mode set by the configuration file, such as **WiFi: -1 (user setting)**.



*The **Version** screen.*

Scroll down for the board and WiFi rows, which are below the first screen. Select ◀ **Back** to return to **Settings**.



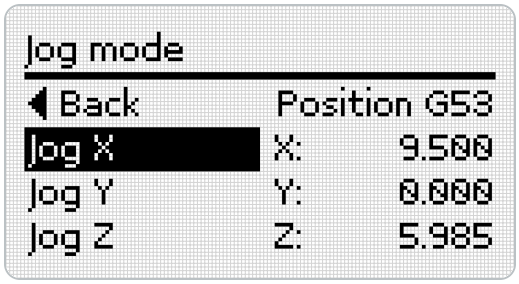
*The **Version** screen scrolled down to the **WiFi** row.*

These are the numbers to have at hand when you contact support, and to check after updating the firmware or the configuration file.

11.11.2 Jog mode

Jog mode moves one axis of the machine at a time with the knob, which is to say it "jogs" the machine. Use it to move the carriage to a position by hand without a file, for example to check alignment. Studio has no jog controls, so the display is the only place to do this.

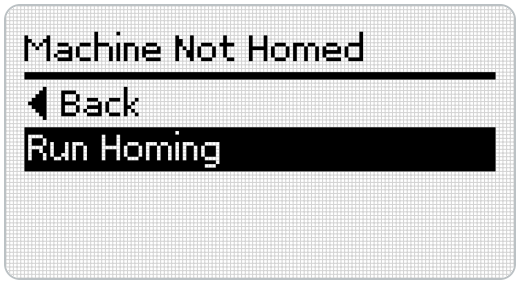
Select **Jog mode** in **Settings**. The screen is headed **Jog mode** and lists ◀ **Back** and one row for each axis: **Jog X**, **Jog Y**, and **Jog Z**. Beside the list, **Position G53** shows where each axis is, in machine coordinates.



***Jog mode**, with the position readout beside the axis list.*

Turn the knob to an axis row, then press the knob to start jogging that axis.

If the machine has not been homed, the display shows **Machine Not Homed** instead, with ◀ **Back** and **Run Homing**. Select **Run Homing** to home the machine and return to **Jog mode**, or ◀ **Back** to return without homing. Jogging needs a homed machine, so that it knows where the ends of travel are.



***Jog mode** asks to home an unhomed machine first.*

Turn the knob to move the axis. Each step of the knob moves X or Y by 1 mm and Z by 0.5 mm, and the heading reads **Jog mode - moving -** while the machine moves. The axis stops at the end of its travel.

Press the knob again to stop jogging. The knob then scrolls the list again. Choose another axis, or select ◀ **Back** to return to **Settings**.

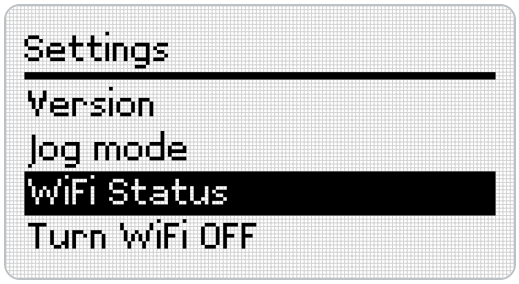
Jogging also stops on its own when a file starts (one sent from Studio, for example) or when another screen takes over the display. Any turn of the knob that the machine had not yet acted on is dropped, so the machine does not move afterward.

> ⚠ **Warning:** The machine moves as soon as you turn the knob while jogging. Keep hands and loose objects clear of the moving parts.

11.11.3 WiFi on and off

The WiFi rows control the machine's WiFi radio from the display. Putting the machine on a network in the first place is done from Studio; see §18.6 Putting your machine on a network.

Select **Turn WiFi OFF** to turn WiFi off. The display shows **WiFi off**, and the machine leaves the network at once. It stays off, including after the machine is turned off and on, until you turn it back on.



*While WiFi is on, **Settings** shows **WiFi Status** and **Turn WiFi OFF**.*

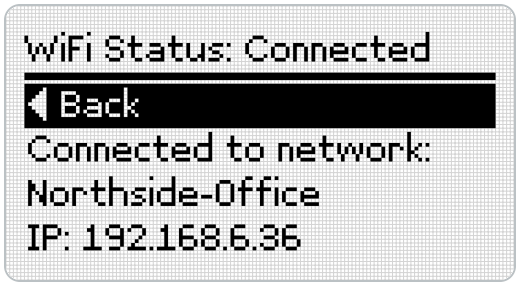
Select **Turn WiFi ON** to turn WiFi back on. The display shows **Restarting to enable WiFi**, and the machine restarts and rejoins the network it was set up for.



*While WiFi is off, **Settings** shows **Turn WiFi ON**.*

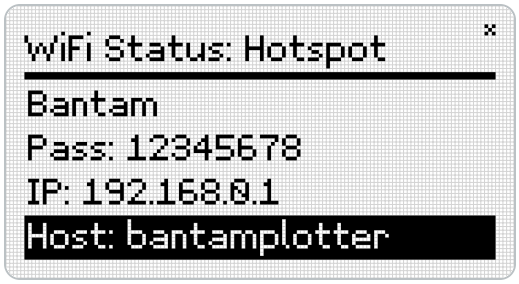
While WiFi is on, **WiFi Status** shows the connection:

- When connected to a network, the screen is headed **WiFi Status: Connected** and shows the network's name, the machine's IP address (**IP**), and its host name (**Host**).



***WiFi Status** while connected to a network.*

- When the machine is running its own hotspot, the screen is headed **WiFi Status: Hotspot** and shows the hotspot's name, its password (**Pass**), the machine's IP address, and its host name.
- When the machine is not connected, the screen is headed **WiFi: Not connected** and shows the network it is trying to join.



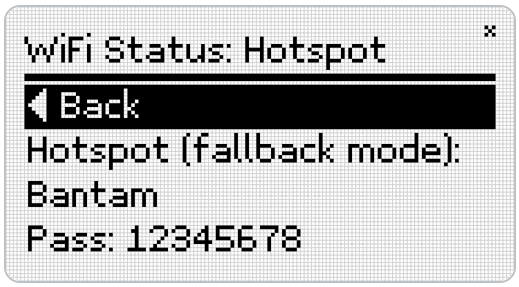
WiFi Status *in hotspot mode, scrolled down to the IP address and host name.*

The IP address shown here is the one to enter with **Enter IP** in Studio when a scan does not find the machine.



WiFi Status *scrolled down, with the IP address above the host name.*

When the machine is set up to join a WiFi network but has not joined it, or has lost its connection, a small **x** appears at the top right of the display. This includes when it falls back to running its own hotspot.

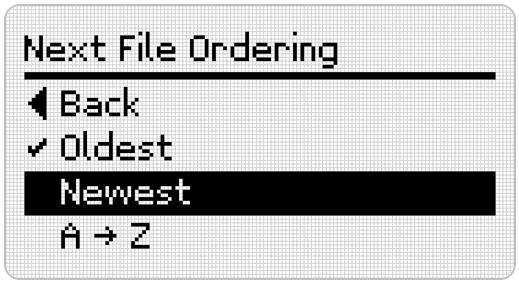


The ***x*** *at the top right after the machine falls back to its own hotspot.*

11.11.4 "Next File" Ordering

"Next File" Ordering sets the order in which **Run Next** works through a folder, and the order of files and folders in the file browser. The screen is headed **Next File Ordering**. The current choice carries a check mark:

- **Oldest** — oldest file first, by the date the file was last changed. (Default)
- **Newest** — newest file first.
- **A → Z** — alphabetical by name.
- **Z → A** — reverse alphabetical by name.



"Next File" Ordering*, with* ***Oldest*** *chosen.*

Turn the knob to an order and press the knob to choose it. The check mark moves to your choice, which takes effect at once and is kept when the machine is turned off. Select ◀ **Back** to return to **Settings**.

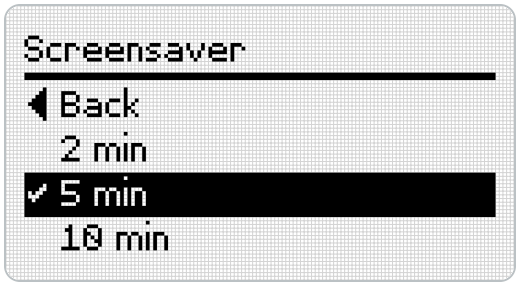
The date orders use each file's modification date as the card records it. If your file names are numbered in the order you want, **A → Z** follows the names instead. Name order compares character by character, with capital letters before lowercase, so number files with leading zeros: `file02` sorts before `file10`, where `file2` would sort after it.

11.11.5 Screensaver

When the machine is left alone, the display dims and then shows a screensaver: a small pattern that drifts across an otherwise dark screen. This protects the display, which can wear unevenly if it shows the same screen for a long time.

Screensaver sets how long the machine waits before the screensaver appears. The screen is headed **Screensaver**. The current choice carries a check mark:

- **2 min**
- **5 min** (Default)
- **10 min**
- **15 min**
- **30 min**
- **60 min**
- **Never** — the display does not dim, and the screensaver does not appear.



***Screensaver**, with **5 min** chosen.*

Turn the knob to a time and press the knob to choose it. The check mark moves to your choice, which is kept when the machine is turned off. Select **◀ Back** to return to **Settings**.

The time counts from the last time you used the knob. The display dims in two steps on the way to the screensaver: slightly at half the chosen time, and deeply one minute before the screensaver appears. (At **2 min** the two steps fall together, so the display dims deeply after one minute.)

Turn or press the knob to bring the display back to full brightness. While the display is only dimmed, that turn or press also does what it normally does. Once the screensaver is showing, the first turn or press only wakes the display; turn or press again to act on the screen beneath it. Inserting a microSD card wakes the display too, as does any message that appears on it.

The display stays at full brightness while a file runs. While a file is paused, the display dims, but the screensaver does not appear.

11.11.6 Updating the firmware

The firmware is the software that runs on the machine's controller. Updates fix problems and add features, so it is worth keeping it current.

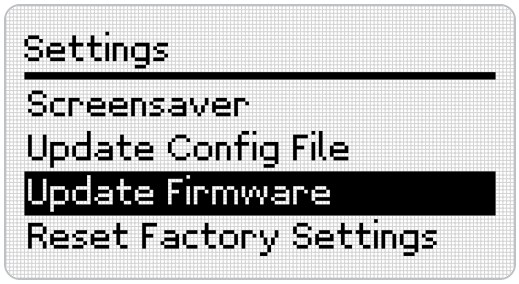
The usual way to update is with a firmware updater program, which runs on your computer and updates the machine over a USB cable. The updater program is available online (bantam.tools/fw). Download the updater on your computer, connect the machine to the computer with a USB cable, and run the updater. The updater has separate controls for installing firmware and for updating the configuration file. Installing firmware takes a single button press, because the firmware is the same for every machine. The configuration file is covered in §11.11.7 Updating the configuration file; when you update both, update the firmware first.

Firmware can instead be installed at the display, from a file on the microSD card, using **Update Firmware** in **Settings**. The rest of this section describes that route. The firmware file is a single file whose name ends in `.bin`. It is on the same download page as the updater programs (bantam.tools/fw).

Copy the file to the microSD card, at the top level or in a folder. You can also upload the file from Studio's **MACHINE** tab with **Upload File** (see §25. Studio: the MACHINE tab), then install it at the display.

Put the card in the machine, and turn the machine on if it is off.

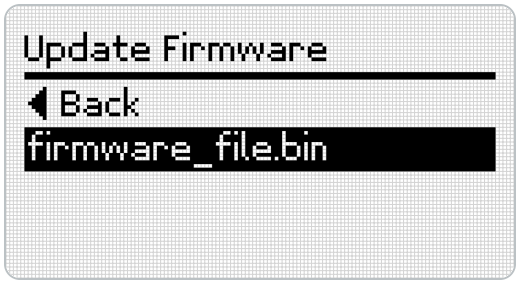
Select **Update Firmware** in **Settings**.



Update Firmware *highlighted in* ***Settings****.*

The screen is headed **Update Firmware** and lists the firmware files and folders on the card, with ◀ **Back** highlighted. If there are none, the display shows **No firmware files on microSD Card** and returns to **Settings**.

Turn the knob to the firmware file and press the knob. There is no confirmation step: the update starts at once, and the display shows **Updating Firmware** and **Plotter will restart...**.



Update Firmware *with a firmware file highlighted.*

When the update is complete, the machine restarts on its own. Do not turn it off or remove the card during the update.

If the file cannot be installed, the display shows **Update failed** and the reason, such as **File too large** or **Not a valid firmware file**. The message clears after a few seconds, and the machine keeps its current firmware.

An update usually takes less than a minute. If **Updating Firmware** is still on the display after several minutes, the update has not completed: turn the machine off and on again, then repeat the update.

If updating from the microSD card still does not work, the firmware updater program for macOS or Windows (bantam.tools/fw) installs the same firmware over a USB cable, and usually resolves the problem.

After the restart, the startup screen shows the new firmware version, which you can also check under **Version**. The update replaces the firmware only; the configuration file and the machine's settings are unchanged.

Important note: Install only firmware that Bantam Tools has released for your machine. Flashing firmware other than a released version for your machine may leave the machine non-functional. If an update does not complete or the machine does not restart normally, please contact technical support and we can walk you through the recovery.

Some files record the latest firmware version. If you start one on a machine with older firmware, the display shows **Firmware update available now at: bantam.tools/fw** for about two seconds, and the file runs normally.

11.11.7 Updating the configuration file

The configuration file describes the machine to its firmware, including the model name, motor configuration, networking details, as well as speed and travel limits. The usual way to update it is with a firmware updater program on your computer (see §11.11.6 Updating the firmware). In the updater, select your machine type from the menu, then use the control for updating the configuration file. When you are installing firmware as well, install it first, whichever route you use.

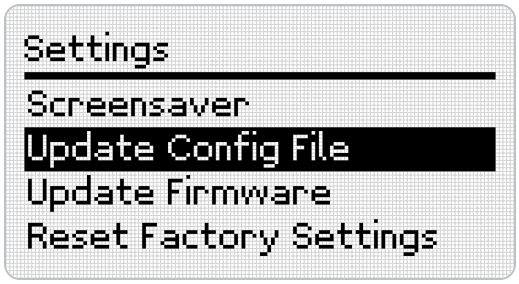
A configuration file can instead be installed from the microSD card, using **Update Config File** in **Settings**. The new file replaces the machine's current configuration, whatever the new file is named. The file for your machine and model is a single file whose name ends in `.yaml`, also on that download page (bantam.tools/fw).

The ArtFrame shipped with two revisions of its controller board, and each takes its own configuration file. Look at the top sheet metal: a machine with a storage location for the pen height setup tool is a Rev D machine and takes the Rev D file; a machine without it is a Rev B and takes the Rev B file. Installing the wrong one describes the machine incorrectly to its firmware.

Copy the file to the microSD card, at the top level or in a folder. You can also upload the file from Studio's **MACHINE** tab with **Upload File** (see §25. Studio: the MACHINE tab), then install it at the display.

Put the card in the machine, and turn the machine on if it is off.

Select **Update Config File** in **Settings**.



Update Config File *highlighted in* ***Settings****.*

The screen is headed **Update Config** and lists the configuration files and folders on the card, with **◀ Back** highlighted. If there are none, the display shows **No config files on microSD Card** and returns to **Settings**.

Turn the knob to the configuration file and press the knob. There is no confirmation step: the display shows **Updating Config File** and **Plotter will restart...**, and the machine restarts with the new configuration.



***Update Config** with a configuration file highlighted.*

If the file cannot be installed, the display shows **Update failed** and the reason, such as **Cannot open file** or **File is empty**, and the machine keeps its current configuration. The exception is **Config may be incomplete**, which stays on the display until you press the knob: the update stopped partway through writing the new configuration, so the current one is no longer whole. Repeat the update, or install the configuration file with the firmware updater program (bantam.tools/fw).

A configuration update usually takes a few seconds. If **Updating Config File** is still on the display after a minute, the update has not completed: turn the machine off and on again, then repeat the update.

If updating from the microSD card still does not work, the firmware updater program for macOS or Windows (bantam.tools/fw) updates the configuration file over a USB cable, and usually resolves the problem.

After the restart, check the configuration version on the **Version** screen, next to **Config**.

> *Important note:* Install only a configuration file that Bantam Tools has released for your machine and model. A configuration file for a different machine, or an edited one, can make the machine move incorrectly or stop working.

11.11.8 Factory reset

Reset Factory Settings returns the settings stored on the machine to their defaults. It is rarely needed. Use it when support suggests it, or when the machine's stored settings are in a state you cannot otherwise undo.

A factory reset changes:

- **Network settings** — the WiFi network name and password, and whether WiFi is on. A machine that was on your network leaves it, and has to be set up again from Studio (see §18.6 Putting your machine on a network).
- **Display settings** — **✓ Completed files** returns to on, **"Next File" Ordering** returns to **Oldest**, and **Screensaver** returns to **5 min**.
- **Every other setting the firmware stores**, including stored coordinate offsets, which return to their defaults.

A factory reset does not change the firmware, the configuration file, or anything on the microSD card, including the check marks on completed files.

Select **Reset Factory Settings** in **Settings**. The screen is headed **Confirm** and offers **Cancel Factory Reset**, which is highlighted, and **Confirm Factory Reset**.

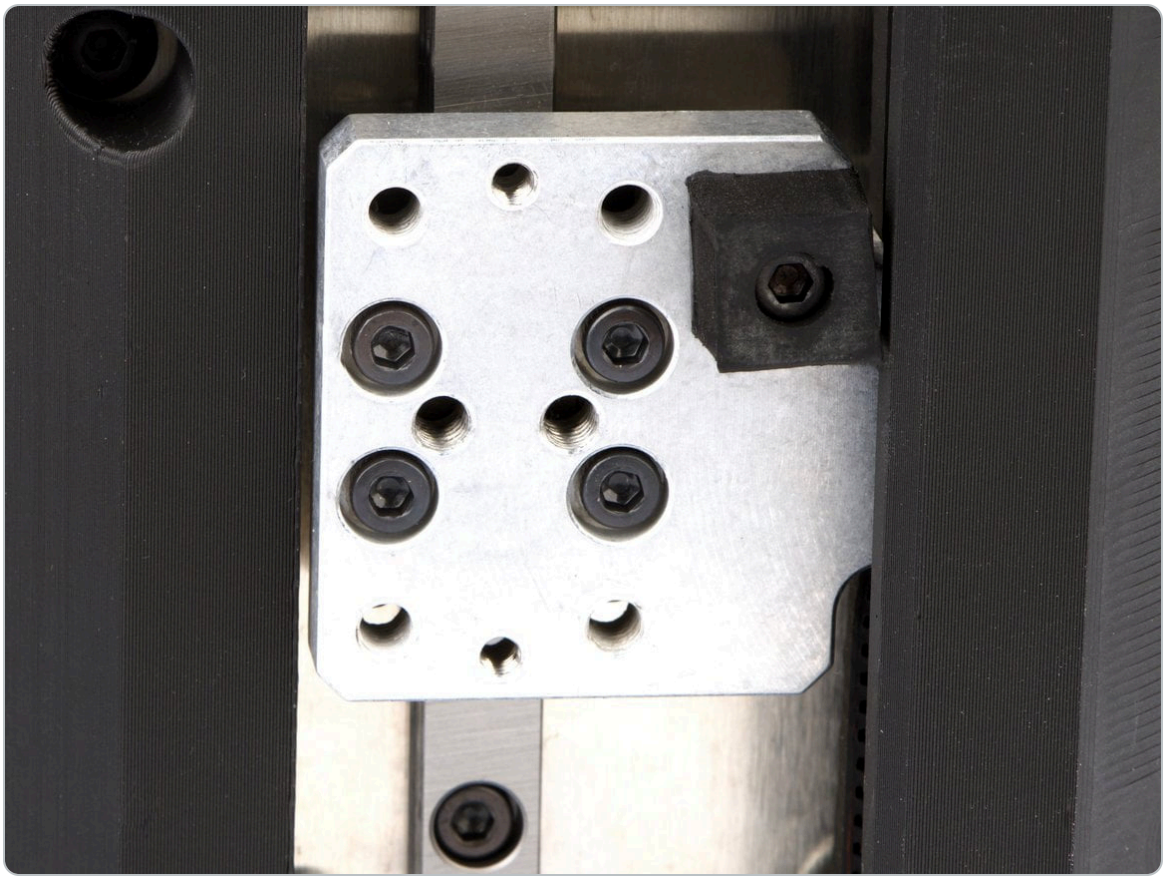
To back out, press the knob on **Cancel Factory Reset**, which returns to **Settings**.

To reset, turn the knob to **Confirm Factory Reset** and press the knob. The machine resets its settings and restarts.

12. Tool mounting and holders

The Bantam Tools ArtFrame™ is designed to work with any number of different tool holder configurations, and offers flexible mounting stages to support them. This chapter covers the two mounting stages on the tool head, the pen clip that ships with the machine, and the alternate tool holders available for it.

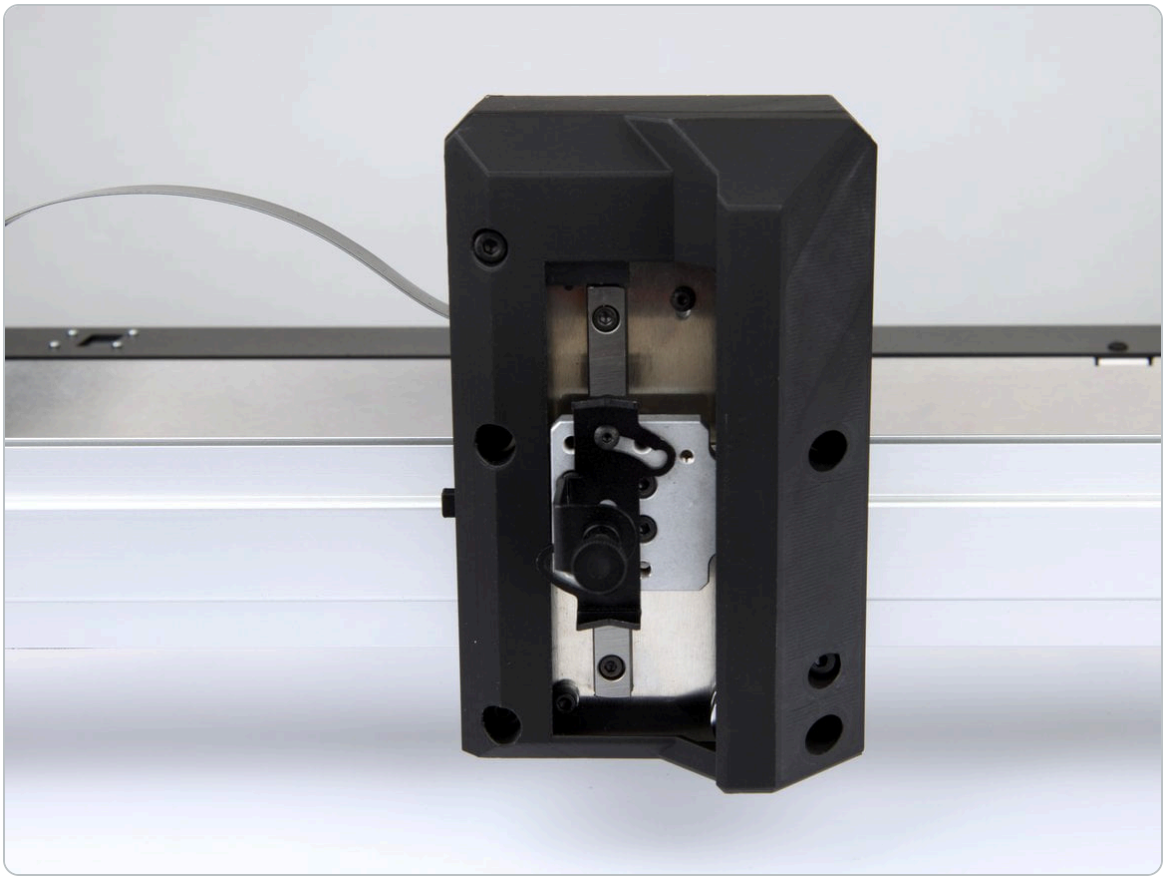
12.1 The tool mounting block



The tool mounting block.

The tool mounting block is the primary mounting point on the tool head. Mounting a tool directly to it gives that tool direct pressure from the Z stage, which is what you want for tools that work by being compressed against the surface: brushes, soft felt-tip markers, and consumables such as oil pastels, oil sticks, and charcoal.

Any of our Bantam Tools Cross-Compatible Tool Holders™ mounts directly to the tool mounting block.

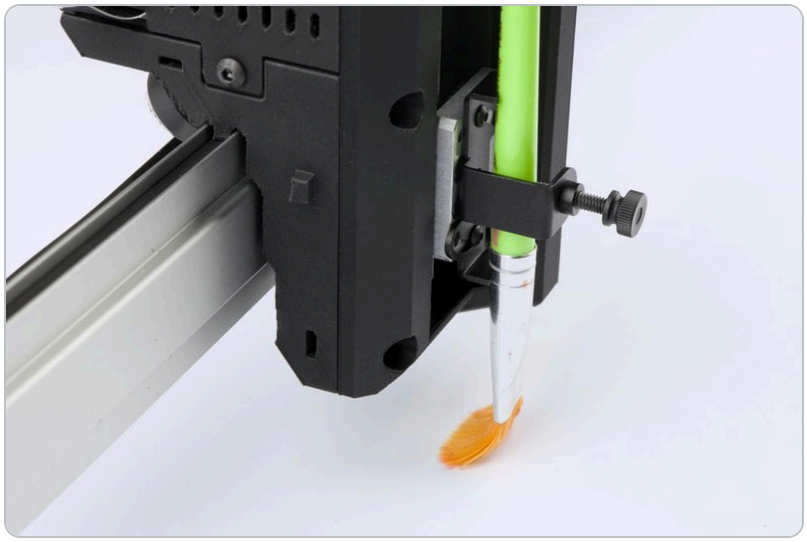


A pen clip mounted directly to the tool mounting block.

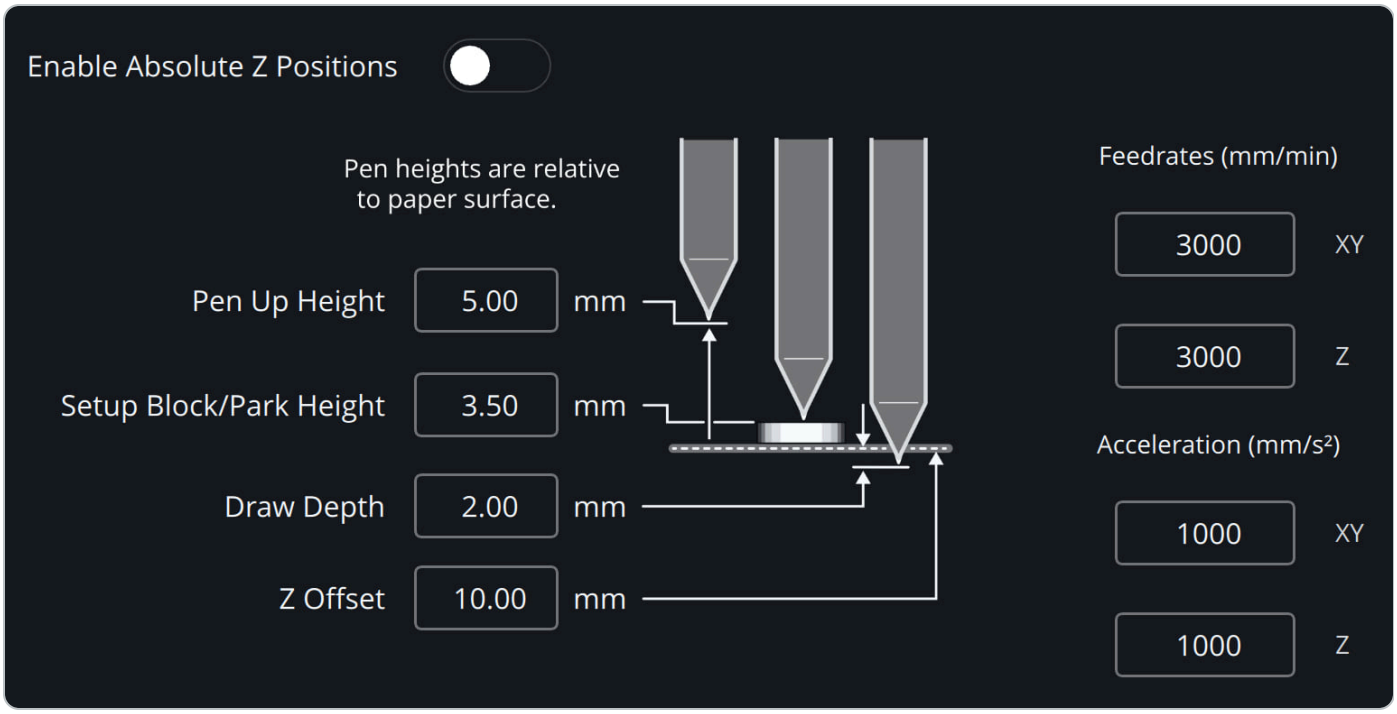
The ArtFrame ships with the vertical slide stage installed on the block, which is what we recommend for general pen plotting. To understand what the vertical slide does, it helps first to understand how the tool mounting block behaves on its own.

How Draw Depth works on the block. Set the tool height to 3.5 mm using the Pen Height Setup Tool. In Bantam Tools Studio™, match that with a **Setup Block/Park Height** of 3.5 mm in the tool's settings. Then set **Draw Depth** to 2 mm.

With that setup, the machine presses the tool 2 mm into the surface: **Draw Depth** is taken up by the tool's own give, relative to the mounting block height. A brush's mark depends on how far its bristles compress, which makes the fixed block the right mount for it; a brush has no **Draw Depth**, and you set its compression when you install it, by how far you lower it onto the Pen Height Setup Tool (see §14.7 Setting the setup height). A pen has far less give, so we recommend the vertical slide for pens.



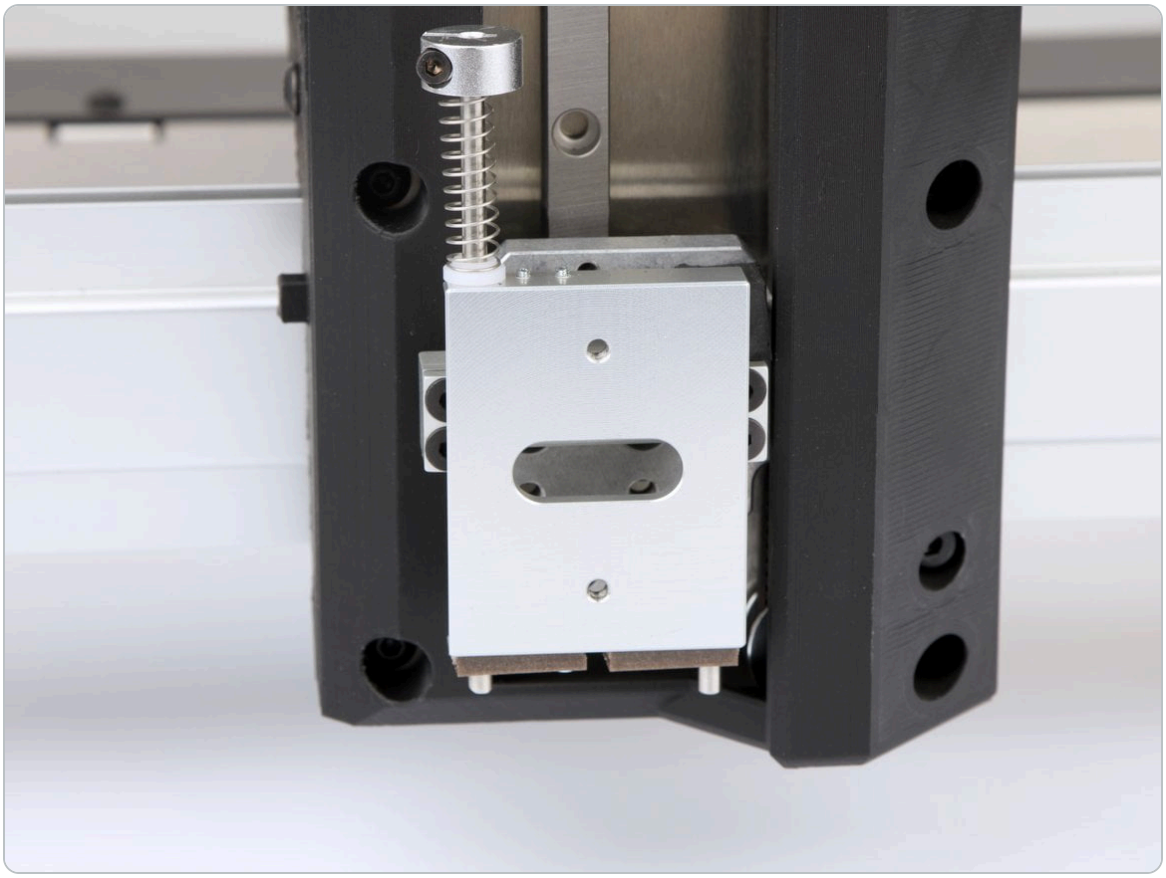
A brush mounted directly to the tool mounting block.



*A pen tool's settings, with **Setup Block/Park Height** and **Draw Depth**.*

See §14. Setting up pens and brushes for the pen and brush settings in Studio.

12.2 The vertical slide stage



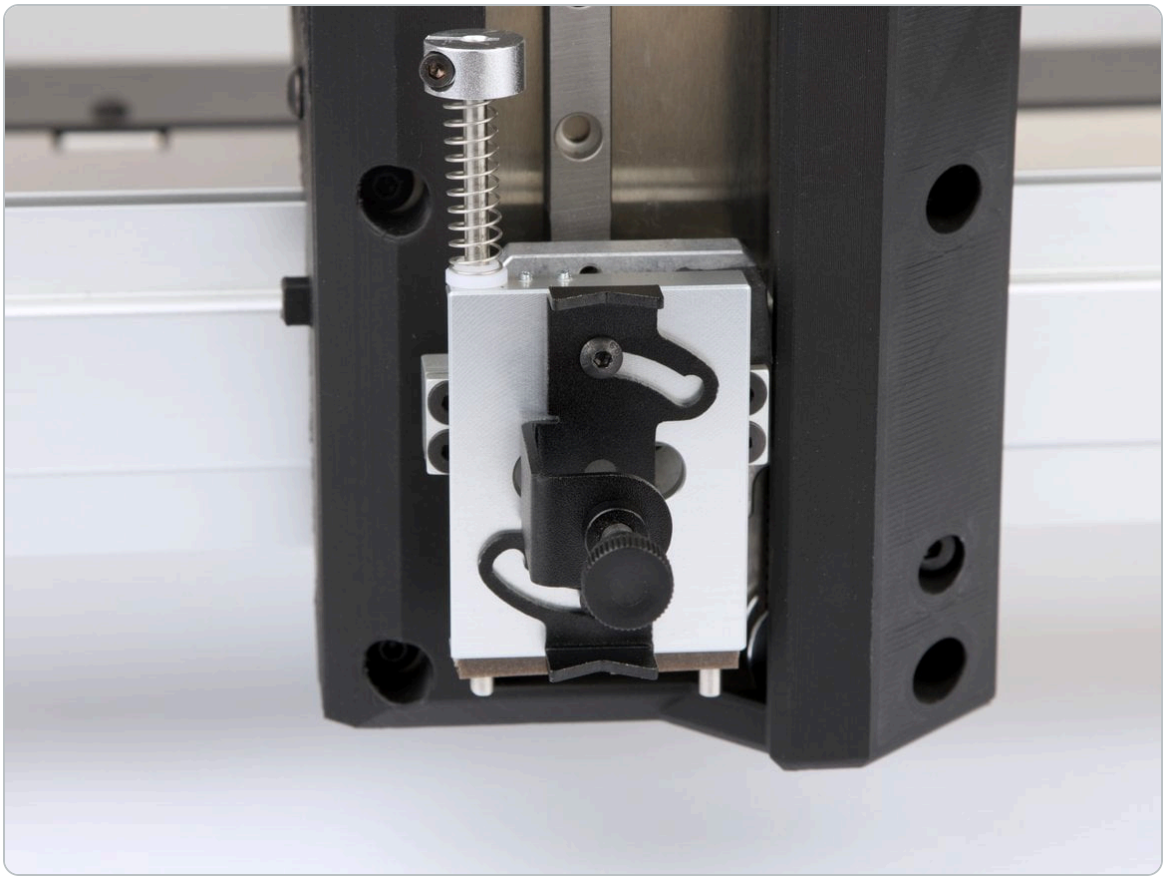
The vertical slide stage on the tool mounting block.

The vertical slide stage comes pre-attached to the tool mounting block, and is the right choice for general pen plotting. When a regular pen is installed in a pen clip mounted on the vertical slide with a spring fitted, **Draw Depth** is translated into spring tension rather than direct pressure.

Since the spring can be adjusted by raising or lowering the shaft collar, and by choosing between the light and heavy springs, we refer to spring tension in terms of **Draw Depth**. Instead of compressing the tool, the pen stops at the surface and the spring compresses by the **Draw Depth** distance, applying additional pressure at the pen tip. This is particularly useful for ballpoint and gel pens.

With a setup height of 3.5 mm, which matches the Pen Height Setup Tool, and a **Draw Depth** of 2 mm in Studio, the spring compresses by 2 mm after the tool block has traveled a total of 5.5 mm.

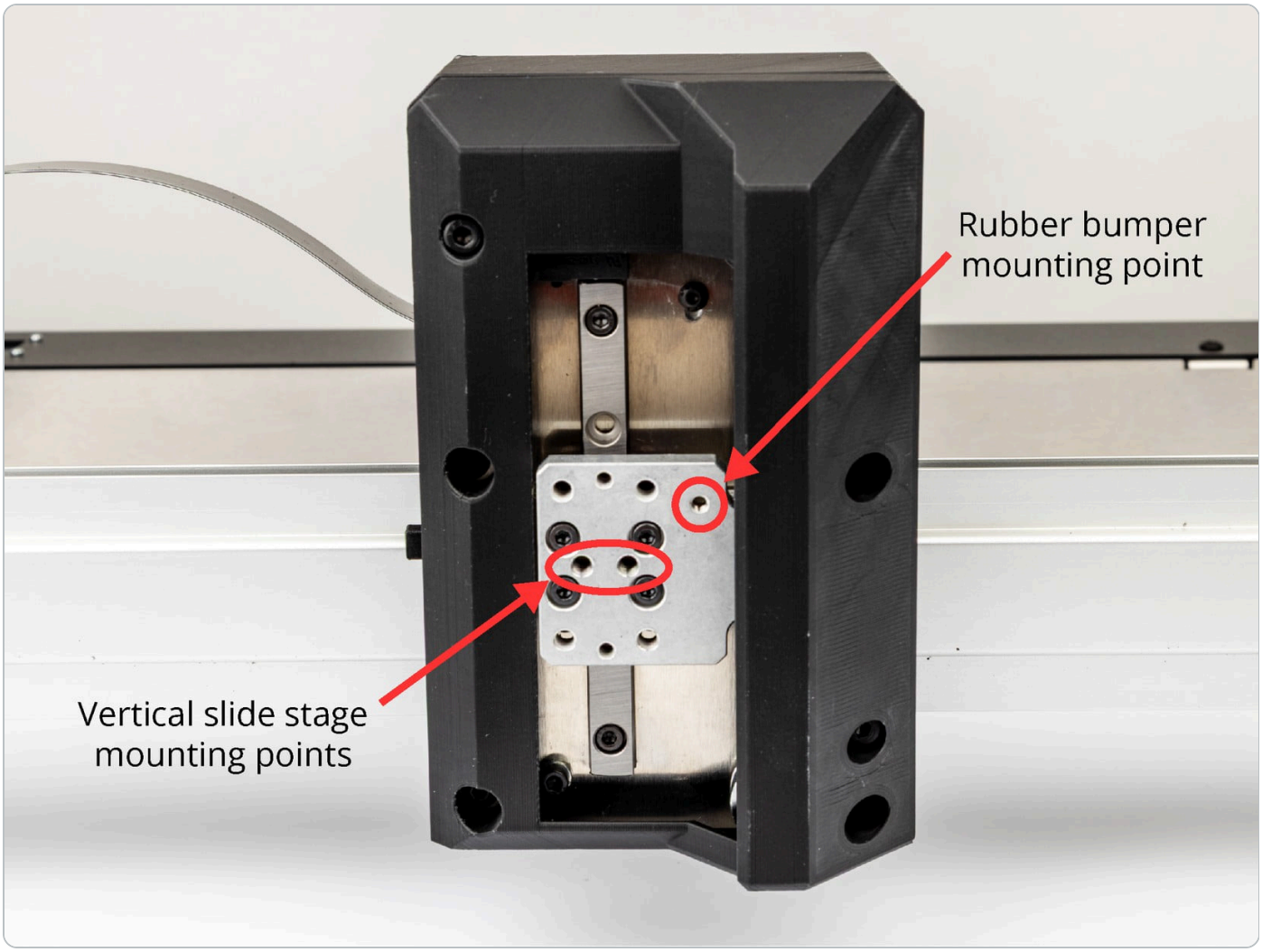
As with the tool mounting block, any of the Bantam Tools Cross-Compatible Tool Holders™ can be mounted to the vertical slide stage.



The pen clip mounted on the vertical slide stage.

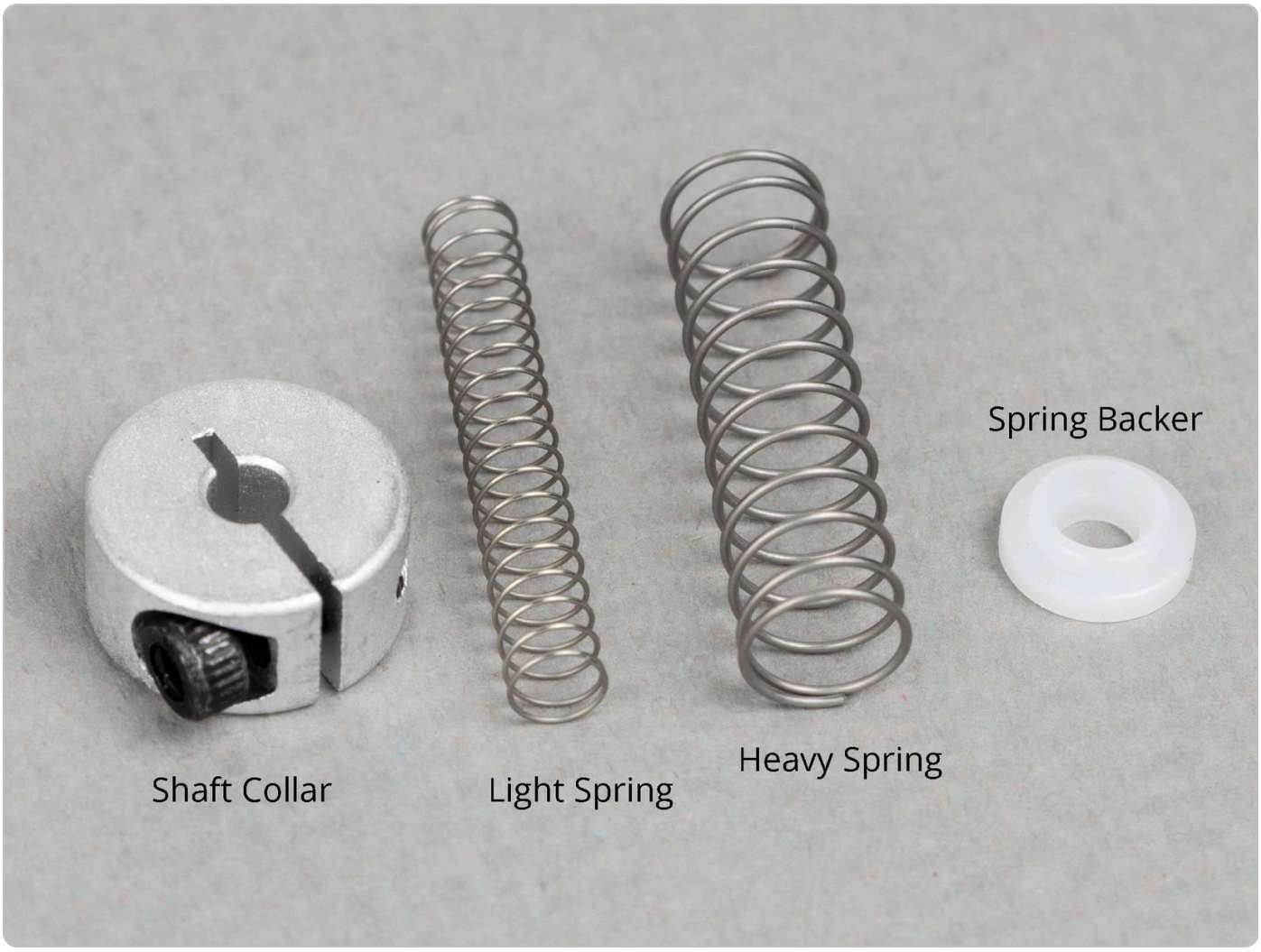
12.2.1 Installing or removing the vertical slide stage

When installing or removing the vertical slide stage, keep track of the **rubber bumper** and reattach it before reinstalling the stage.



With the vertical slide stage removed: its mounting points and the rubber bumper mounting point.

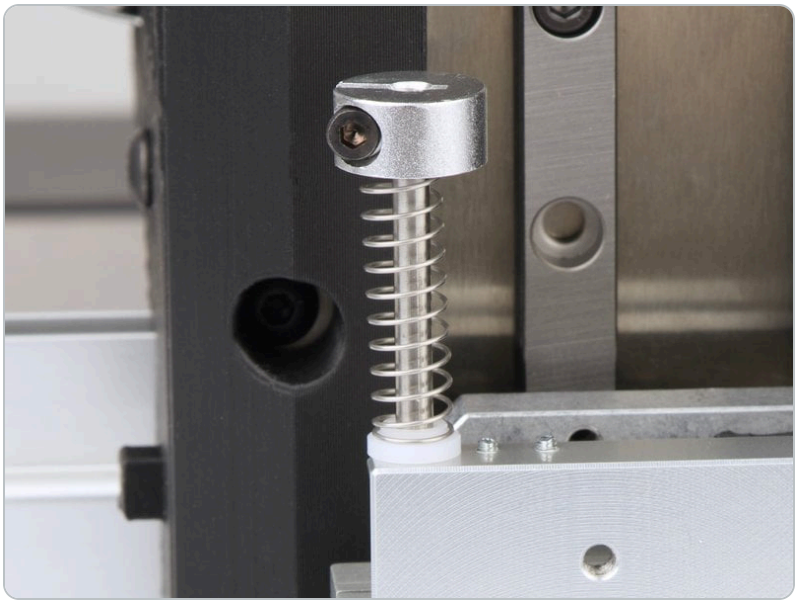
12.3 The Spring Kit



The Spring Kit: shaft collar, light spring, heavy spring, and Spring Backer.

The vertical slide stage with the Spring Kit converts draw depth into spring tension, as described above. When installed, the Spring Kit applies downward pressure on the pen as it draws. Instead of forcing the pen through the surface, the spring compresses, which makes it a good fit for marking implements that need a consistent force.

There are four parts to the Spring Kit: a **Shaft Collar**, a **Light Spring**, a **Heavy Spring**, and a machined plastic piece called the **Spring Backer**. Springs wear out over time. Replacement springs, like most parts of the machine, are available as service parts through Bantam Tools support.



A spring installed between the shaft collar and the Spring Backer.

The heavy spring gives about twice the force of the light spring, and is intended for pens that need increased force, such as traditional ballpoint pens. The light spring applies a gentler force, which suits gel pens and other types that write best at low pressure. If you are just getting started, either spring is a reasonable choice. You can always switch later if you want less or more downforce.

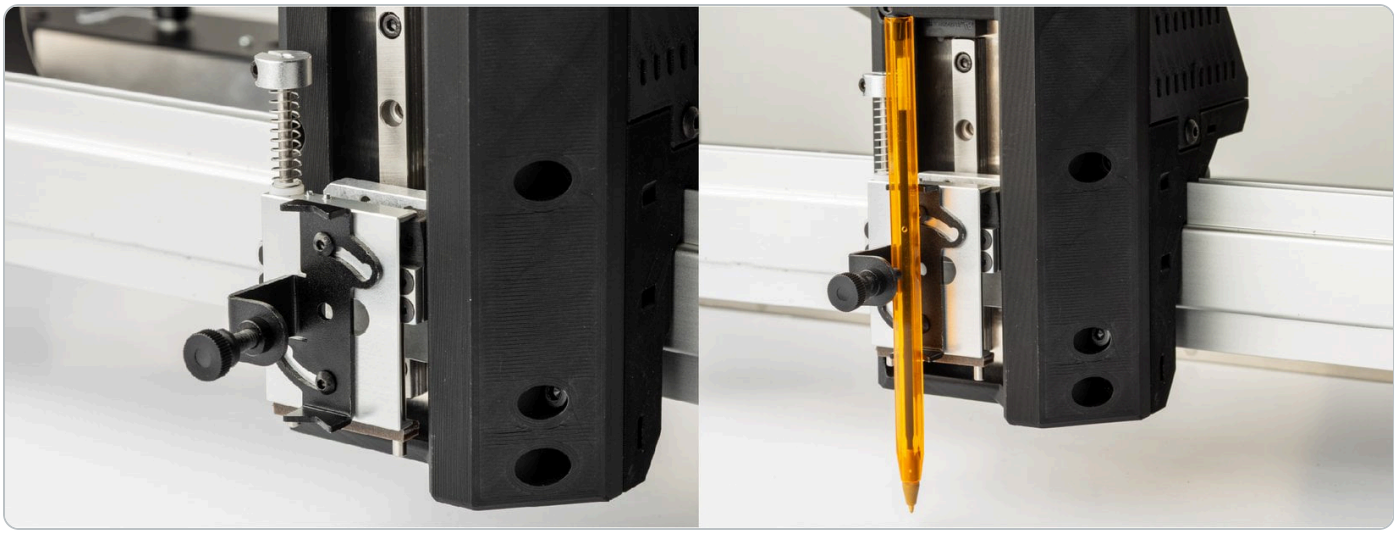
12.3.1 Installing the Spring Kit

1. Home the machine, so that the vertical slide stage sits safely above the work surface; see §11.10 Homing from the main menu.
2. Place the Spring Backer over the shaft that extends above the vertical slide stage, smooth side down, with the ridge on top.
3. Place a spring over the shaft and the Spring Backer. The light spring sits inside the raised ridge; the heavy spring sits around it.
4. Slip the Shaft Collar over the end of the shaft and tighten it with the 2 mm hex L-wrench. Its height sets how much the spring is compressed before the pen meets the paper. With the collar's top flush with the top of the shaft is a good place to start; set it lower to begin with the spring slightly compressed, for more force from the first contact.

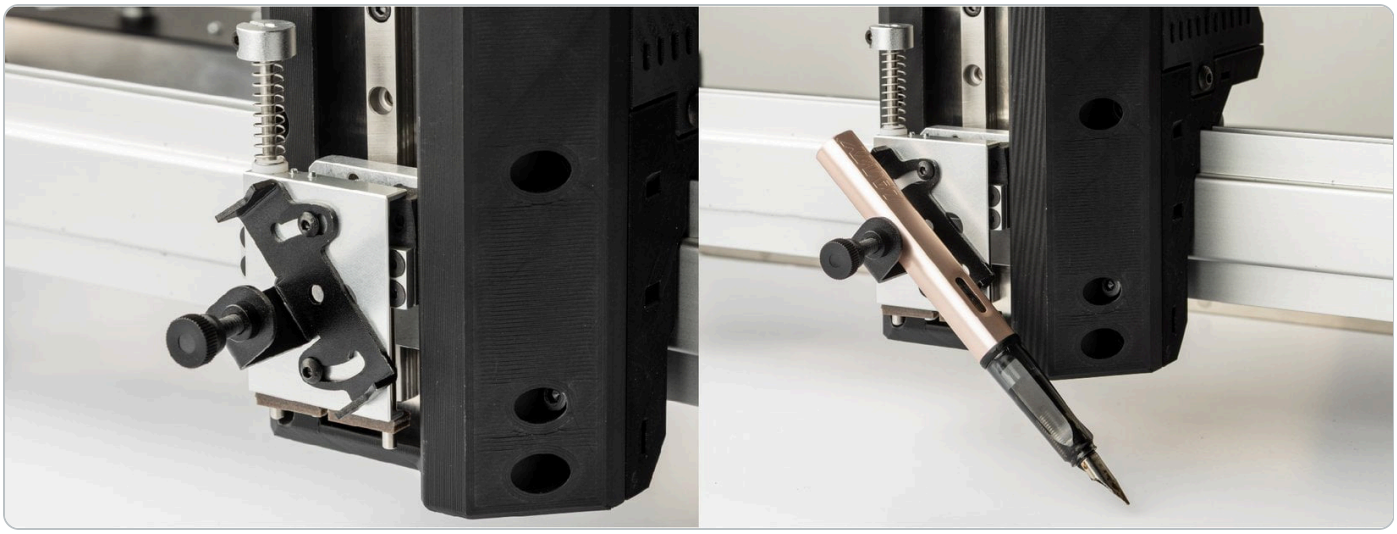
> ⚠ **Warning:** Never let the spring compress to a solid. A fully compressed spring stops the vertical slide stage from sliding freely, which can jam the pen into the drawing surface, and it can damage the spring or other parts of the machine. If you lower the Shaft Collar or increase **Draw Depth**, make sure the spring still has room to compress.

12.4 Pen clip orientation

The pen clip can be attached in two different orientations: vertical, which points the pen straight down, or diagonal, which holds the pen at a 45° angle to the paper. Which to use mostly depends on what type of pen you are using.



The pen clip in the vertical position, empty (left) and holding a ballpoint pen (right).



The pen clip in the diagonal position, empty (left) and holding a fountain pen (right).

The vertical position is generally the best choice for technical pens, for pens that require pressure such as ballpoints, and for multi-color plots. The diagonal position is generally the best choice with fountain pens or other pens that write better at an angle.

To switch between the orientations, loosen (but do not remove) the two small screws. Lift the pen clip slightly, then rotate it to the other position. Lower it back down and tighten the two screws.

Take care to only apply gentle force with the thumbscrew; do not tighten it more than necessary.

> ***Note:*** The mirrored pen clip included with the ArtFrame is designed differently from Bantam Tools NextDraw™ pen clips. It is mirrored so that, with the clip in the angled position that suits fountain pens, the pen angles away from the home position rather than toward it.

12.5 Alternate tool holders

The belt-driven vertical Z stage offers stability, control, and flexibility, and the robust build of the ArtFrame means you can use large tools and apply significant pressure. The accessories below are Bantam Tools Cross-Compatible Tool Holders™, which fit the ArtFrame and our other art machines.

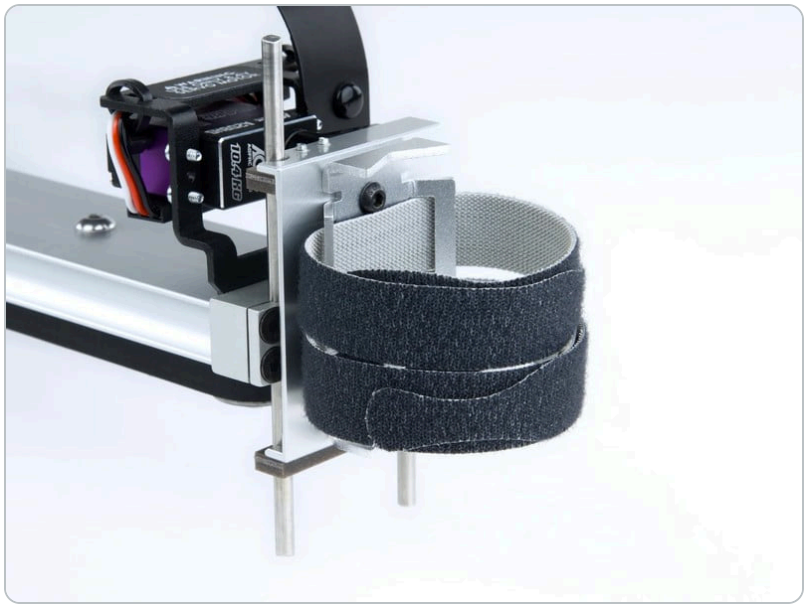
- **XL Pen Clip** — holds larger-barreled pens and markers than the standard clip, and is available at bantam.tools/xlpc. Use it in the vertical orientation: unlike the included clip, it is not mirrored, so an angled pen would tilt toward the home position, where there is little room.
- **Italic Pen Adapter** — holds italic and calligraphy pens at a fixed angle, and is available at bantam.tools/ipa.
- **Strap clamp** — straps down larger and irregular tools that no clip holds, and is available at bantam.tools/amsc.
- **Pen Clip Rotation Stage** — holds a pen clip at any angle over a 90° range, set to within 1°, and is available at bantam.tools/pcrs.
- **Heavy Duty Pen Clip** — holds pens and markers about 4 – 22 mm (0.16" – 0.87") in diameter, and is available at bantam.tools/hdpc.



The XL Pen Clip.



The Italic Pen Adapter.



The strap clamp.

All five are available from Bantam Tools at https://bantamtools.com.

For other tool-holding applications, see the support documentation for the accessory in question.

13. Pen height setup

Every tool the Bantam Tools ArtFrame™ draws with has to be installed at a known height, so that the height in the tool's settings matches the height on the machine. The Pen Height Setup Tool is what makes that height repeatable.

13.1 The Pen Height Setup Tool



The Pen Height Setup Tool, showing both sides: the cross-shaped indent (right) and the recessed flat face (left).

The Pen Height Setup Tool sets pens, markers, brushes, and other implements at a consistent 3.5 mm above your paper.

The tool is a disk of 300-series stainless steel, 25.4 mm (1") in diameter and 4.5 mm thick overall. One side carries a milled X-shaped guide, whose grooves center the tool's tip and also help you align your page. The other side offers an alternative round, flat surface, which suits larger mark-making implements.

The 3.5 mm figure is the thickness at the center of the cross, where a pen tip rests — not the overall thickness of the disk.

> ***Note:*** Replacement Pen Height Setup Tools are available from Bantam Tools at bantam.tools/phst.

13.2 Installing a tool at height

Start with the machine at the loading position. Files made in Studio begin by homing, raising the tool head, and pausing there so you can install the tool; see §11. The ArtFrame interface.

Place the Pen Height Setup Tool on the drawing surface under the tool holder, cross side up.

Insert the pen into the pen clip with its tip resting in the grooves at the center of the cross. Let the pen sit naturally in the clip.

Tighten the thumbscrew on the pen clip just enough to hold the pen securely. Take care to only apply gentle force with the thumbscrew; do not tighten it more than necessary.

Remove the Pen Height Setup Tool, lifting the pen holder slightly to slide it out.

At this moment, the pen tip is at X = 0, Y = 0 and 3.5 mm above the paper, because the setup tool is 3.5 mm thick at its center. That is also the position the lower-left corner of your paper goes under; see §15. Paper and workholding.

For a larger implement whose tip will not sit in the grooves, use the flat round side of the disk instead.

The tool's setup height in Studio has to match the height you set here; see §14.7 Setting the setup height.

14. Setting up pens and brushes

You set how the Bantam Tools ArtFrame™ handles each pen and brush: how high it lifts between strokes, how it meets the paper, how fast it moves, and what it does at a tool change or a refill. These settings belong to each tool, in the Tool Library of Bantam Tools Studio™.

Every tool starts with one physical step: installing it with its tip resting on the Pen Height Setup Tool. The tool's setup height is the thickness of that tool, so that you know the distance between the pen and your paper; the tool's other heights are measured from the paper.

For installing a tool at height, see §13.2 Installing a tool at height.

The preset toolsets are tuned for the ArtFrame; choose the one that matches your pens or brushes, and use it as it is. This chapter explains their settings, and how to tune a tool of your own.

14.1 Setting up a new pen

1. In the Tool Library, find the preset tool that matches your pen. If it matches, use it as it is. To change its settings, first copy it into a toolset of your own, so your changes are kept; see §24.8 Copying and moving tools.
2. For a tool of your own, check that its setup height is 3.5 mm, the thickness of the Pen Height Setup Tool; see §14.7 Setting the setup height.
3. Mount the pen on the vertical slide for most pens, with a spring from the Spring Kit (see §12.3.1 Installing the Spring Kit), or on the tool mounting block for soft felt-tip markers (see §12.1 The tool mounting block).
4. Assign the tool to your artwork, save the G-Code, and send it to the ArtFrame; see §9.5 Assigning a tool and §10. Sending your plot to the ArtFrame.
5. Start the file. When the ArtFrame waits at the loading position, install the pen on the Pen Height Setup Tool, and press the control knob to continue; see §13.2 Installing a tool at height.
6. If the line needs work, tune the tool on scrap paper; see §14.13 Tuning a pen or brush.

A tool of your own keeps its heights and speeds for every future job.

14.2 Setting up a brush for painting

1. Choose a brush toolset; §14.5 Preset toolsets lists them, and §28.5 Loaded vs. balanced and §28.6 Wet vs. scraped explain how they differ. If one suits you, use it as it is.
2. Choose your palette; see §28.9 Palette selection. On a palette of your own, assign each brush its palette locations; see §28.8.1 Assigning palette locations to a tool.
3. Mount the brush on the tool mounting block, removing the vertical slide stage if it is fitted; see §12.1 The tool mounting block and §12.2.1 Installing or removing the vertical slide stage.
4. Assign each brush to a color, layer, or group, save the G-Code, and send it to the ArtFrame; see §28.3 Basic painting usage.
5. Fill the palette with paint and water to match the brushes' locations, and wet each paint pan with a few drops of water.
6. Start the file. When the ArtFrame waits at the loading position, install the brush on the Pen Height Setup Tool, and press the control knob to continue; see §13.2 Installing a tool at height.

7. If the brush presses too hard or too lightly, reinstall it with a lighter touch or more bend on the setup tool; if it picks up too much or too little paint, adjust its **Paint dip offset**. See §14.7 Setting the setup height and §14.13 Tuning a pen or brush.

A brush of your own keeps its heights and palette locations for every future painting.

14.3 Plotting with several pens

At each pen change, the ArtFrame moves to the loading position, and the display names the next pen; see §11.7 Tool-change prompts. Remove the old pen, place the Pen Height Setup Tool, install the new pen, and press the control knob to continue.

To get a stop with the tool still raised, so you have room to remove the old pen and place the setup tool, turn on **Pause before lowering pen to install height**; see §14.12 Tool changes and refills. **Minimize Toolchanges** reduces the number of pen changes (see §22.11.1 Minimize Toolchanges), and the Setup Sheet lists the pens in the order they are used (see §26.5 Setup Sheet).

14.4 Replacing a pen during a long plot

A large plot can use up a pen before it finishes. On your own copy of the tool, set **Refill Mode** to **Refill by Distance**, and enter a **Refill Distance**. When the pen has drawn that far, the ArtFrame stops at the loading position. Install a fresh pen on the Pen Height Setup Tool, and press the control knob; the plot continues where it stopped.

When you pause a plot (see §11.6 Pausing, resuming, and canceling), the pen waits at its setup height by default, with room to reinstall it; see §14.10 Parking during a pause.

14.5 Preset toolsets

The ArtFrame has six preset toolsets:

- For pens: **Pilot G2**, for gel pens, and **Micron - 0.5/0.8**, for felt-tip pens.
- For brushes: **Loaded Brush (Wet)**, **Loaded Brush (Scrape at Paint)**, **Balance Pigment (Wet)**, and **Balance Pigment (Scrape at Basin)**. They differ in how each brush takes up paint before a stroke; see §28. Painting with brushes.

Pilot G2 is selected to start with.

14.6 Pens and brushes

A tool's **Tool Category** is **Pen** or **Brush**. The category decides how the tool meets the paper, and which settings the tool editor shows:

- A pen draws with its tip pressed into the paper, to its **Draw Depth**.
- A brush paints at its **Painting height**, dipping into water and paint along the way. Brushes add dip offsets, and a **Tool Macro Setup** section where you assign each brush its palette locations; see §28.8.1 Assigning palette locations to a tool.

The **Tool Type** menu in the **Metadata** section also sets the category: **Paintbrush** makes the tool a brush, and **Ballpoint**, **Fountain**, **Gel**, **Felt Tip**, and **Calligraphy** make it a pen.

14.7 Setting the setup height

For a pen, set the setup height (**Setup Block/Park Height**, as it reads by default) to the thickness the tip rested on when you installed it: 3.5 mm with either side of the Pen Height Setup Tool. That tells the machine where the paper is. When the pen draws, the machine lowers it past the paper by its **Draw Depth**, compressing either the pen itself or a spring in its holder, depending on how the pen is mounted. See §12. Tool mounting and holders for the two ways to mount a pen.

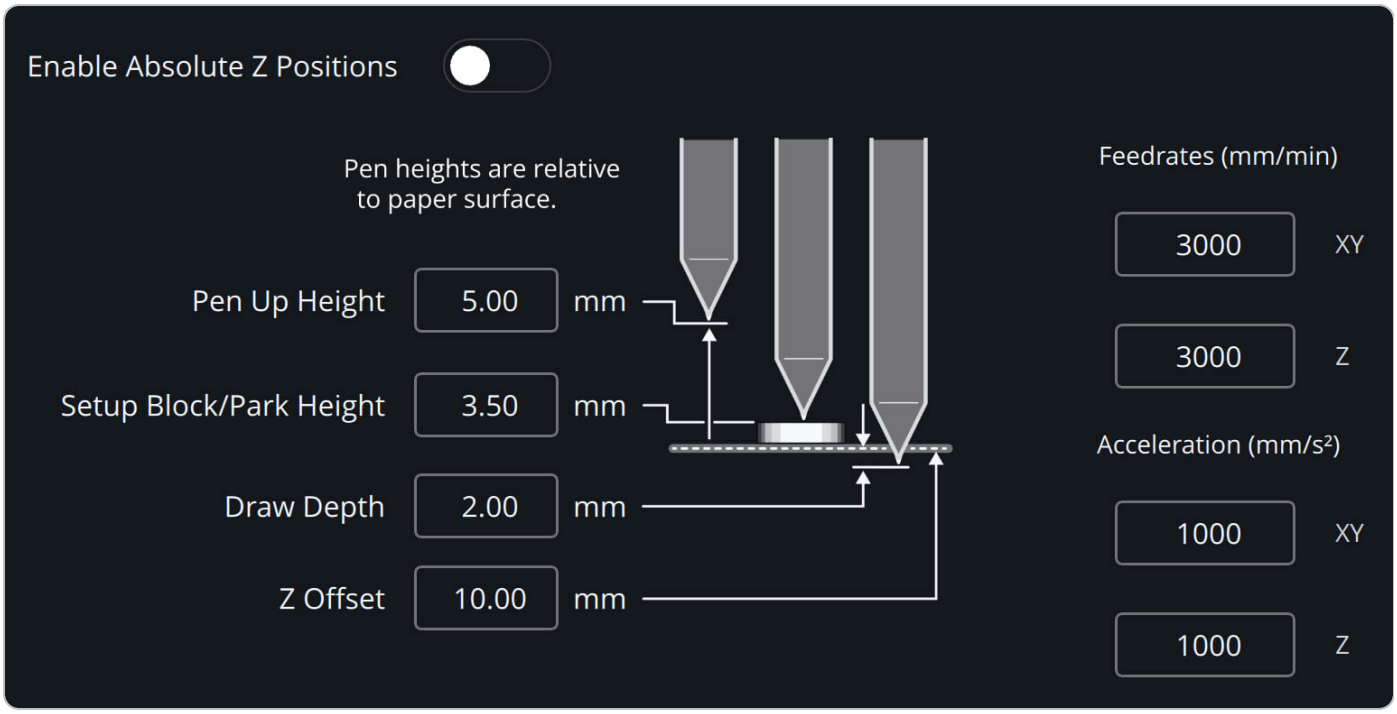
A brush has no **Draw Depth**. You set how firmly it meets the paper when you install it: lower the brush onto the Pen Height Setup Tool as far as you want it to press against the paper later. A light touch on the tool gives a light touch on the surface, and bristles that bend against the tool bend the same way against the surface. The brush presets add a little more: they paint slightly lower than the height you installed the brush at, so the bristles deflect a bit farther against the paper than they did on the tool.

14.8 Pen heights

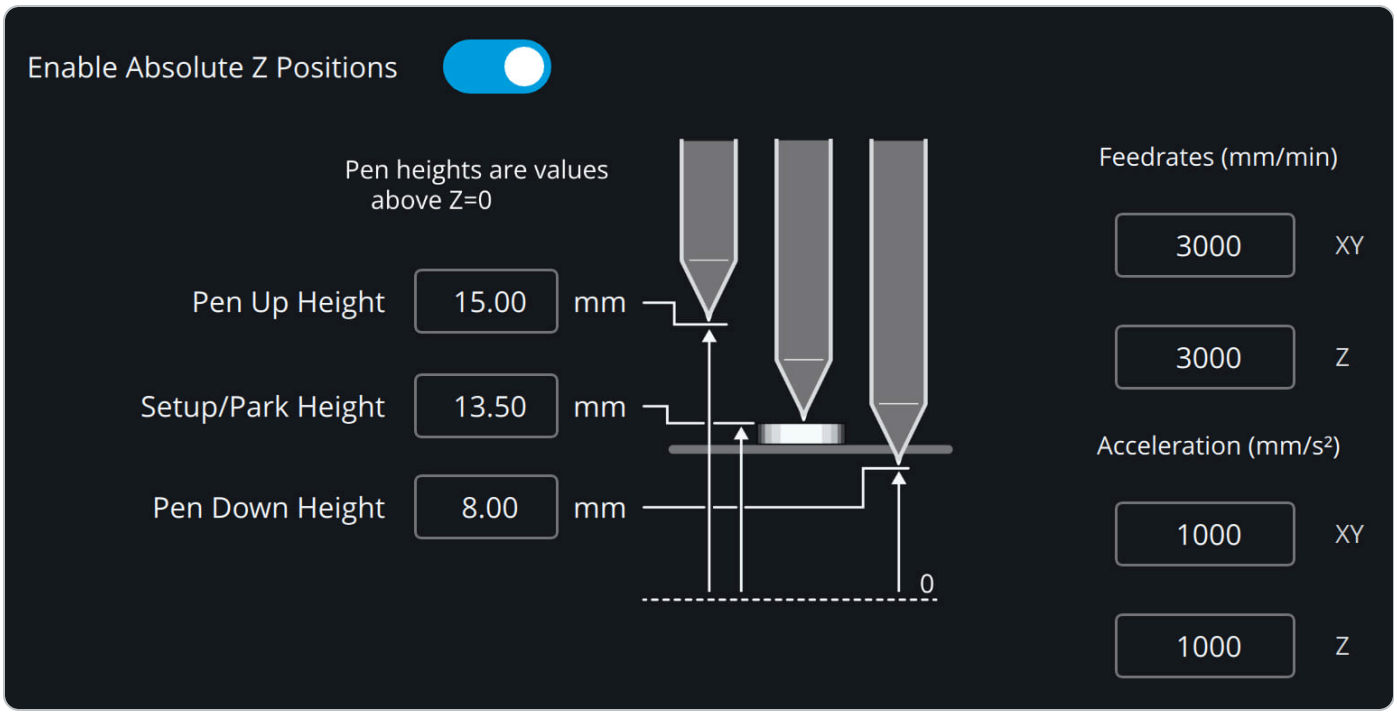
A pen's heights are distances from the paper:

- **Pen Up Height** — how far above the paper the pen lifts to travel between strokes. A lower value saves time on every lift; too low, and the pen can drag across the paper.
- **Setup Block/Park Height** — the setup height, which is also where the pen waits when you pause a job; see §14.7 Setting the setup height.
- **Draw Depth** — how far past the paper surface the pen travels while it draws.
- **Z Offset** — a calibration value that moves all of the pen's heights up or down together.

With **Enable Absolute Z Positions** on, in **Tool Settings**, the same heights show as positions on the ArtFrame's Z axis instead: **Pen Up Height**, **Setup Height**, and **Pen Down Height**, where the tip meets the paper. **Z Offset** is hidden. The setting applies to every tool and changes only how heights are shown, never what is stored. (Default: off)



Tool Settings *for an ArtFrame pen, with relative heights*



Tool Settings *for an ArtFrame pen, with* ***Enable Absolute Z Positions*** *on*

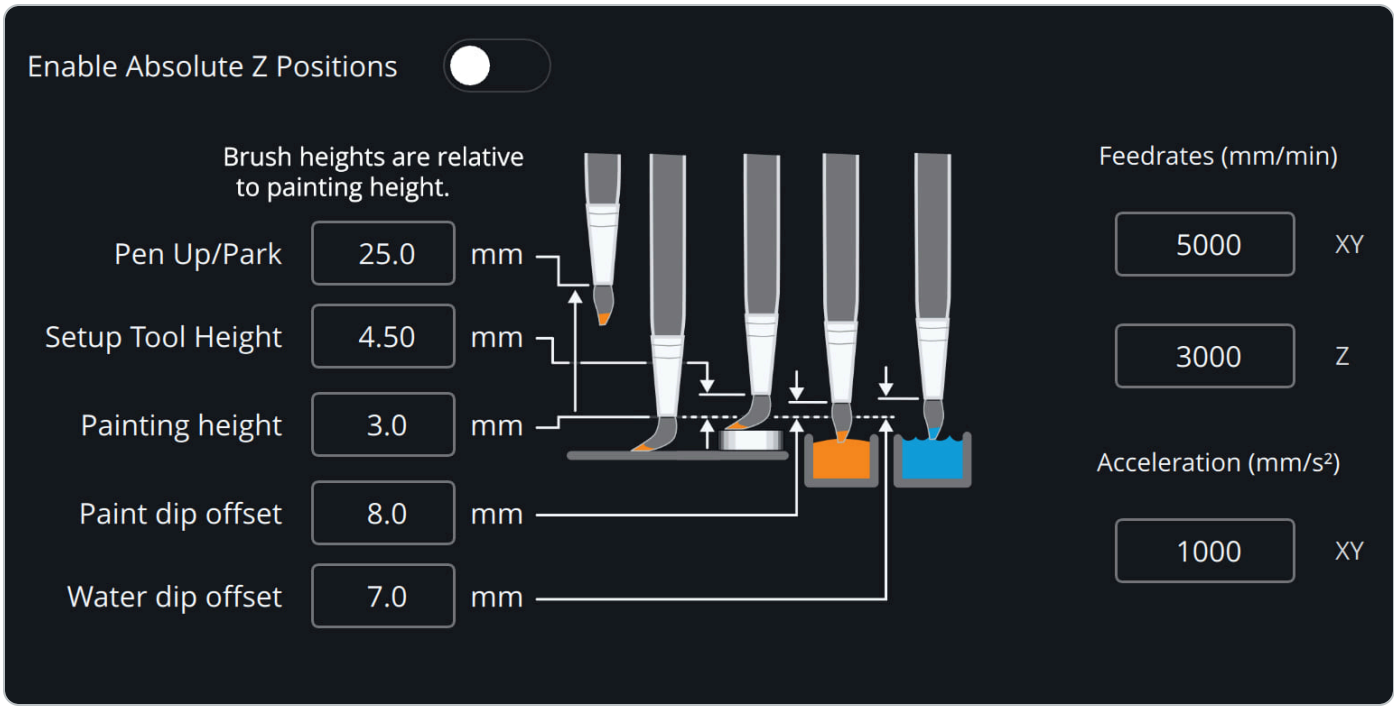
These are the names with **Pen Parking Height** at its default; two of them change with that setting (see §14.10 Parking during a pause).

14.9 Brush heights

A brush's heights are measured from its **Painting height**, where the brush sits on the ArtFrame's Z axis while it paints. In the order **Tool Settings** shows them:

- **Pen Up/Park** — how far above the painting height the brush lifts to travel between strokes. The brush also waits here when you pause a job.
- **Setup Tool Height** — the setup height for a brush; see §14.7 Setting the setup height.
- **Painting height** — the painting height itself.
- **Paint dip offset** and **Water dip offset** — how far from the painting height the brush goes to dip into paint and into water. A negative value reaches below the painting height.

With **Enable Absolute Z Positions** on, all five show as positions on the Z axis: **Pen Up/Park**, **Setup Height**, **Painting height**, **Paint dip height**, and **Water dip height**. Changing **Painting height** there moves only the painting height; the brush's other heights stay where they are.



Tool Settings *for an ArtFrame brush, with relative heights*

14.10 Parking during a pause

The parking height is where the tool waits when you pause a job, lifted clear of the paper until you resume. For a pen, choose that height with **Pen Parking Height**, in **G-CODE GENERATION OPTIONS** on the **PREPARE** tab's **OPTIONS** sub-tab:

- **Setup/Install** parks the pen at its setup height, with room to reinstall a pen during the pause. (Default)
- **Pen-up travel** parks the pen at its travel height, for a quicker, lower park.

The field that holds the parking height adds "Park" to its name: **Setup Block/Park Height** (**Setup/Park Height** with absolute heights) or **Pen Up/Park Height**.

A brush always parks at its travel height, **Pen Up/Park**, whatever this setting says.

14.11 Speed and acceleration

- **Feedrates (mm/min): XY** is how fast the tool moves while it draws or paints; **Z** is how fast it lifts and lowers.
- **Acceleration (mm/s²): XY** controls how quickly the tool speeds up and slows down while drawing; lower values give crisper motion, and higher values shorten the job. Pens also have **Z**, for lifting and lowering: lower values set the pen down more gently. Brushes show **XY** only.

Both are whole numbers. A tool that draws cleanly at a moderate speed may skip when it moves faster than its ink or paint can keep up.

14.12 Tool changes and refills

- **Hold Position on Tool Change**, on each tool, makes the ArtFrame stop for that tool when a job switches to it: it moves to the loading position, lowers to the tool's setup height, and pauses so you can install the tool. Every preset tool has it on; a tool you create from scratch starts with it off, and the ArtFrame goes on without stopping. The first tool in a job always gets this stop.
- **Pause before lowering pen to install height**, in **G-CODE GENERATION OPTIONS** on the **PREPARE** tab's **OPTIONS** sub-tab, adds a stop to each tool change after the first. The ArtFrame pauses with the tool raised, so you can remove the previous tool and place the Pen Height Setup Tool, and lowers to the setup height when you resume. (Default: off)
- **Refill Mode:** The ArtFrame's large drawing area can use up a pen partway through a single plot, so refills are especially useful here. The pen presets are set to **No Refills**; set a **Refill Distance** to have the ArtFrame stop before a pen runs dry. When the pen has drawn that far, the ArtFrame lifts it, moves to the loading position, and pauses so you can put in a fresh pen, then continues where it stopped. The brush presets refill by distance: the brush visits the palette locations assigned in its **Tool Macro Setup**, then returns to where it left off; see §28. Painting with brushes.

14.13 Tuning a pen or brush

Tune a tool on scrap paper, starting from the preset closest to it:

1. Copy the tool into a toolset of your own, or duplicate its toolset.
2. Draw a short test, such as a few lines or shapes like the ones in your artwork.
3. Change one setting at a time, and draw the test again after each change.
4. When the result looks right, save your changes. Export the toolset to keep a backup.

Match what you see to the setting most likely to fix it:

- **A pen drags or leaves marks between strokes:** raise **Pen Up Height**.
- **Jobs feel slow, with long lifts:** lower **Pen Up Height**, as long as the pen still clears the paper.
- **Pen lines are light, skipping, or broken:** increase **Draw Depth** a little, or reduce the **XY** feedrate so the ink can keep up.
- **A pen catches the paper, or its lines wobble:** reduce **Draw Depth**, or reduce the **XY** feedrate.
- **Blobs at the start or end of strokes:** adjust the tool's **Pen Landing & Lift** settings; see §24.7 Pen Landing & Lift.
- **A brush barely marks the paper:** reinstall it with its bristles pressed a little farther onto the Pen Height Setup Tool.

- **A brush smears, or its bristles splay:** reinstall it with a lighter touch on the setup tool.
- **Paint goes on too thin:** lower **Paint dip offset** so the brush dips deeper, or refill more often.
- **Paint goes on too heavily:** raise **Paint dip offset**, or refill less often. For more on paint load, see §28.10 Testing and calibrating painting tools.

15. Paper and workholding

The Bantam Tools ArtFrame™ draws on whatever you lay on its magnetic work surface. This chapter covers where to place the medium, how to hold it down, and what sizes each model takes.

15.1 Positioning paper or other medium

When the tool is at the home position, the lower-left corner of your paper goes directly underneath the tool's tip.

Because pens and mark-making implements vary in size, diameter, and shape, each type of implement has a slightly different effective home location. Set the tool height first (see §13. Pen height setup), then place the paper under the tip that is actually installed.

Take care as you place the paper to keep it parallel to the edge of the drawing surface, so that your drawing is not skewed on the page.

15.2 Fixturing work on the magnetic surface

The ArtFrame has a metalized rubber surface that magnets stick to. Place magnets outside the area the tool travels over, so that nothing collides during the plot.

You can also hold work down by other means, such as tape, a clipboard, or anything else that positions and secures the medium reliably. For tape on the rubber surface, we recommend 3M blue painter's tape; other tapes can damage the surface.

> ⚠ **Warning:** Do not use masking tape. Regular masking tape contains a chemical that will mar the surface of the metalized rubber. Other tapes and adhesives may have this problem as well.

15.2.1 Using the magnetic surface

The ArtFrame ships with a magnetic work surface that lets you position paper, or your preferred medium, in place.

Choose magnet locations that will not interfere with the travel of the tool. A typical approach is to place magnets at the corners of the paper, offsetting the one nearest the home position so that the tool does not collide with it on its way home.

We make several magnet products for this:

- **"Chess pawn" magnets** — four ship with the machine; more are available at bantam.tools/cpm
- **Hold Down Magnet and Clip Set** — magnets with clips, for holding heavier or curling media, available at bantam.tools/hdmc

> ⚠ **Warning:** Keep magnets away from small children. Magnets pose choking and other hazards, and should never be swallowed or inserted into any part of the body.

15.2.2 The Flexible Setup Magnets accessory



Flexible setup magnets forming a corner, with the Pen Height Setup Tool at the notch.

The Flexible Setup Magnets accessory is another way to align paper in place. Two of these magnetic strips are placed against the corners of your paper for consistent, reproducible alignment. The magnets include a notch that fits the Pen Height Setup Tool at the very corner of the paper, so the tool height and the paper corner are registered together. The Flexible Setup Magnets are available at bantam.tools/fsm.

15.3 Paper sizes

Paper of any size works on the ArtFrame; the machine draws within its drawing area. The magnetic surface holds media up to these sizes:

- **ArtFrame 1824** — drawing area 18" × 24"; the magnetic surface takes media up to 25" × 29".
- **ArtFrame 2436** — drawing area 24" × 36"; the magnetic surface takes media up to 29" × 43".
- **ArtFrame Panorama** — drawing area 24" × 72"; the magnetic surface takes media up to 29" × 78".

When using paper larger than the drawing area, take the margins around the outside of the drawing area into account when you center the sheet.

The drawing area is the machine's full travel. The area a given job uses is set in Studio's paper settings; see §22. Studio: the PREPARE tab.

16. The Table Rails accessory

The Bantam Tools ArtFrame Table Rails let an ArtFrame stand on a desk narrower than its footprint. The rails span the desk, and the machine's feet sit on the rails rather than on the table.

16.1 Whether you need them

Compare your table against the footprint of your model:

- **ArtFrame 1824** — footprint 31.4" × 27.9" (797 × 708 mm); overall 34" × 29.87" (864 × 758.7 mm).
- **ArtFrame 2436** — footprint 31.4" × 45.9" (797 × 1165 mm); overall 34" × 47.86" (864 × 1215.7 mm).
- **ArtFrame Panorama** — footprint 31.4" × 81.26" (797 × 2064 mm); overall 34" × 83.07" (864 × 2110 mm).

If the table you plan to use is narrower than the footprint, the Table Rails let the machine's feet reach past it onto the rails. The rails are available from Bantam Tools at bantam.tools/aftr.

> ***Tip:*** If you ordered the Table Rails with your machine, install them during unboxing, while the orange immobilization brackets are still holding the gantry. The machine is easier to handle then, and you only lift it once. See §3. Unboxing the ArtFrame.

16.2 Installing the Table Rails

Locate the included hardware. The Table Rails kit includes four M8 × 8 mm screws. If you ordered the rails with the ArtFrame, they ship in a foam roll secured inside the same box as the machine, attached to the inside bottom of the box under the ArtFrame.



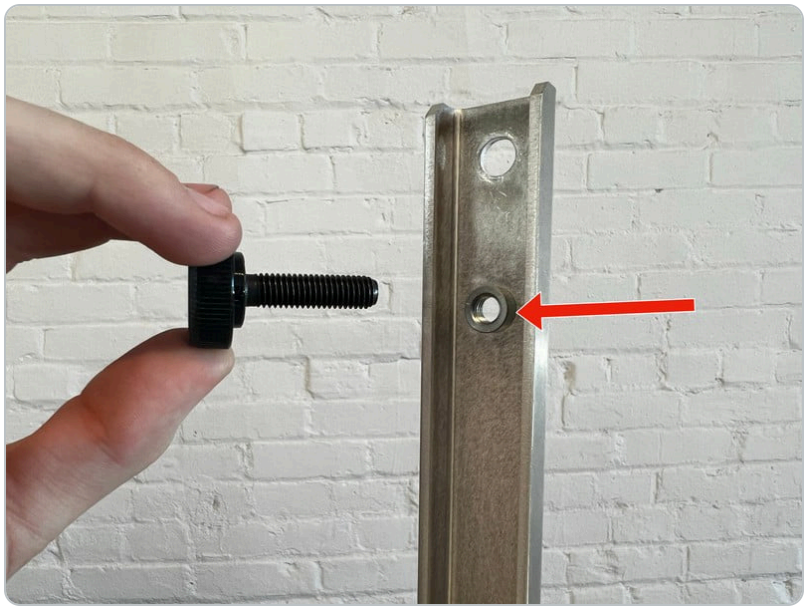
The Table Rails and their four M8 × 8 mm screws.

Remove the feet. Unscrew the four feet from the ArtFrame, twisting each one to the left.



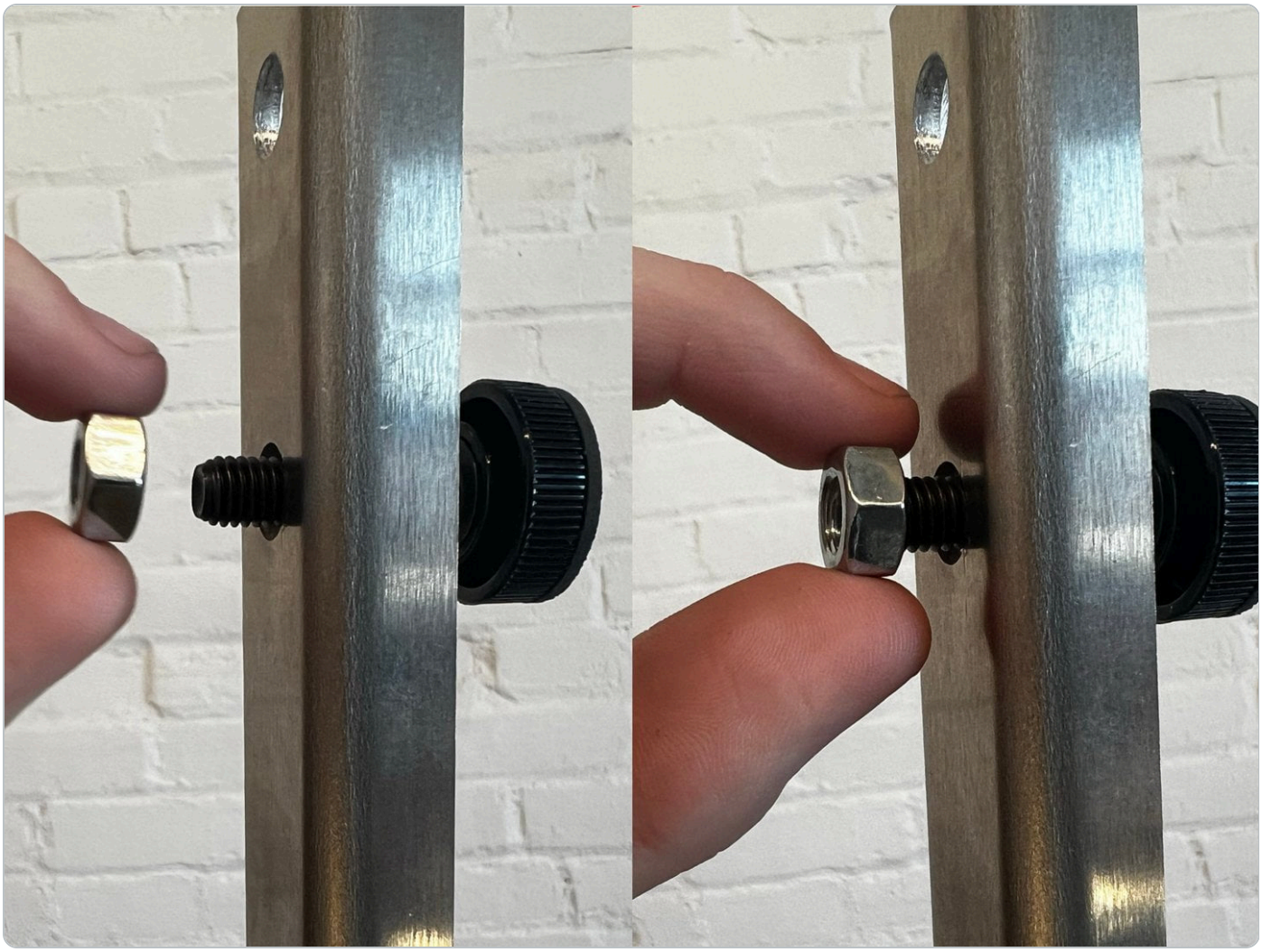
Unscrew each foot, turning it to the left.

Attach the feet to the rails. Screw each foot you removed into the inner side of a Table Rail, from the underside.

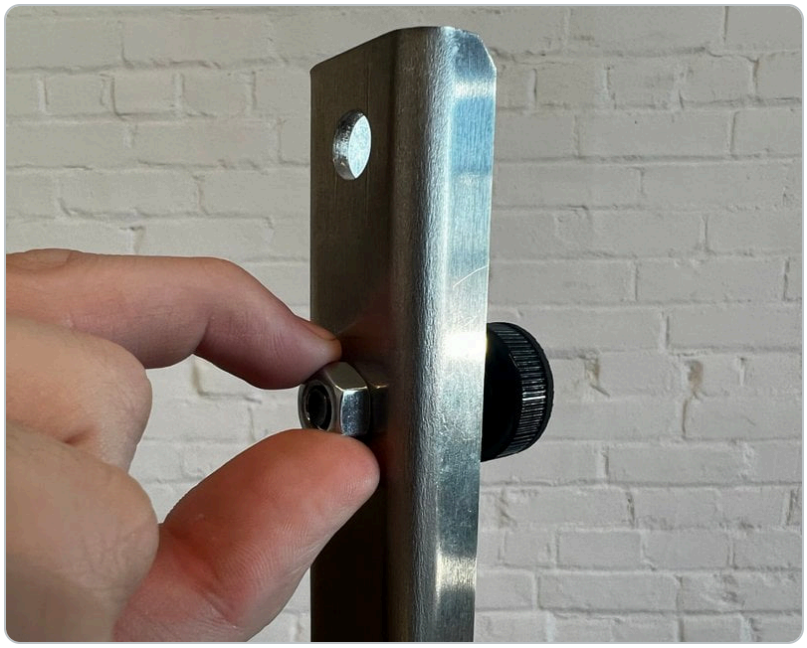


Screw the foot into the threaded hole on the inner side of the rail.

Use the provided hex nuts to secure each foot in place. Hand-tighten the hex nuts to ensure stability.



Start the hex nut on the foot's thread.

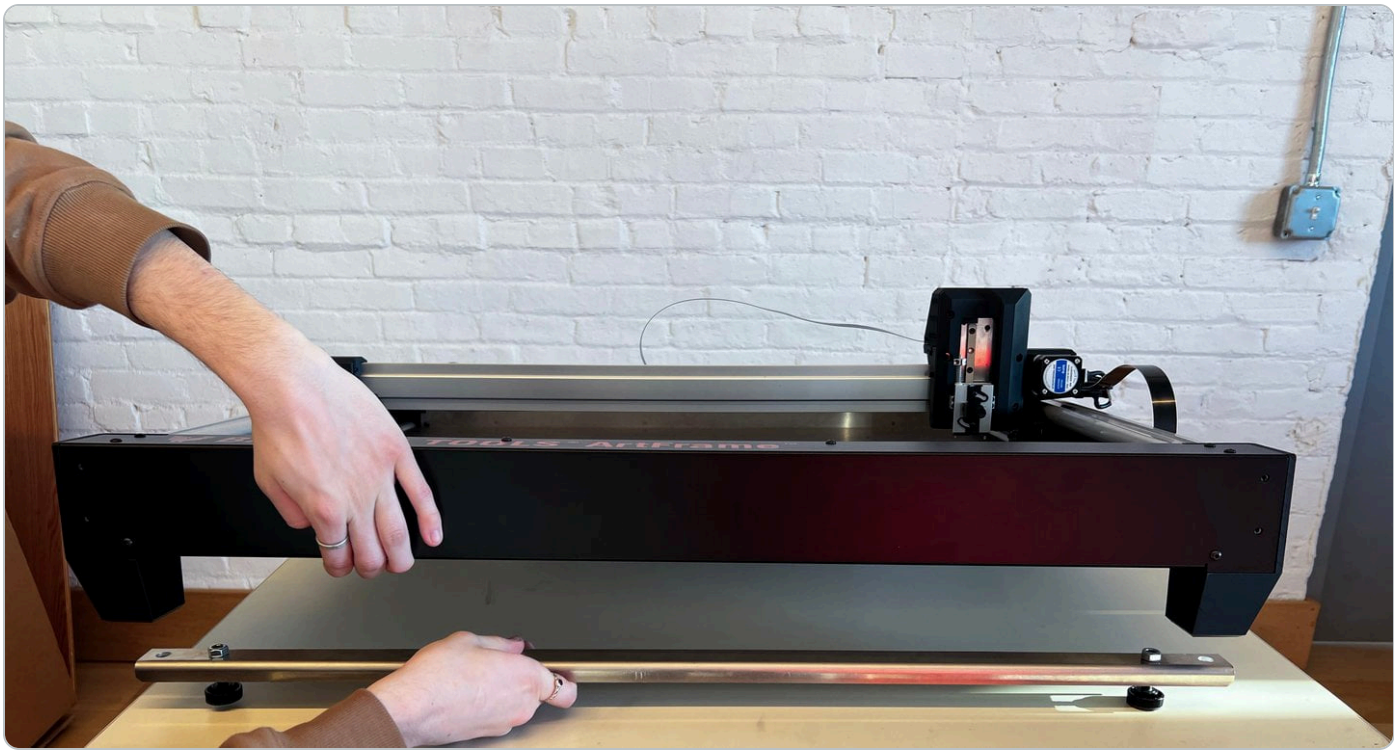


The hex nut hand-tightened against the rail.

Repeat for all four feet.

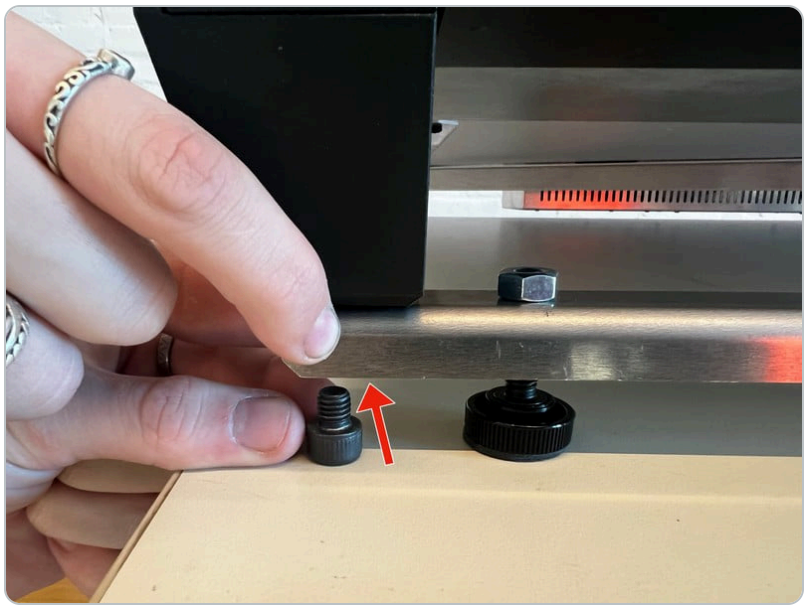
16.3 Installing the table legs

Carefully lift the ArtFrame along one of its black sides and place one of the table legs beneath it.

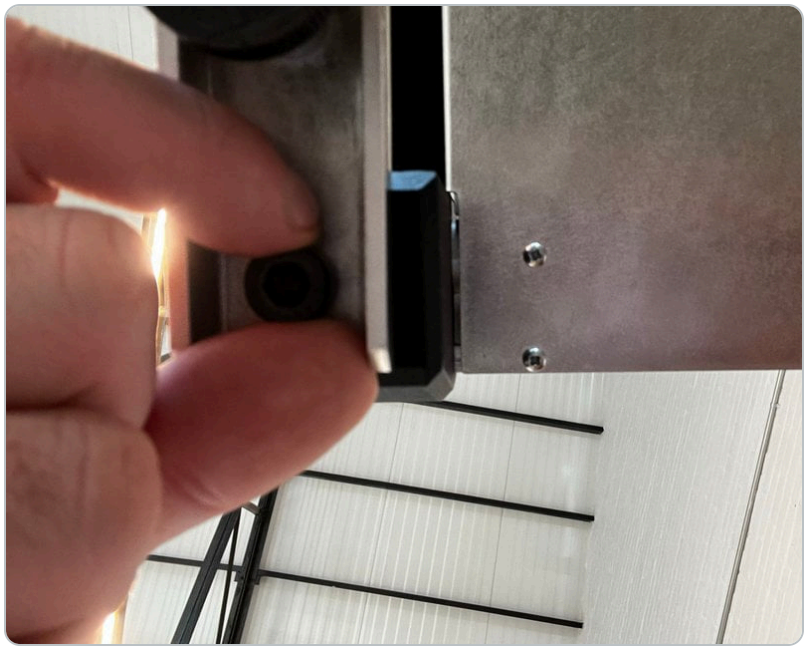


Lift one side of the ArtFrame and slide the rail into place beneath it.

Secure each leg to its original position on the ArtFrame using the included M8 × 8 mm screws. Hand-tighten them, to avoid over-tightening.



Secure each leg with an M8 × 8 mm screw, tightened by hand.



The screw goes up through the rail into the leg.

Repeat on both sides, securing all four M8 × 8 mm screws by hand.

With the machine standing on its rails, check that it sits level and does not rock before you run a file.

17. Power, USB, and microSD details

The Bantam Tools ArtFrame™ can run files from the included microSD card, or receive files directly from Bantam Tools Studio™ over USB or WiFi. This chapter provides reference documentation for the physical connections on the machine and when each one applies.

Every connection is on the electronics enclosure, on the left body panel: the power receptacle, the power switch, the USB port, and the microSD card slot. First-time setup is in §6. Connecting power.

17.1 Power

The ArtFrame takes power through a standard IEC 320 C13 power cord, the same connector used by most desktop computers and monitors. The power switch is next to the receptacle.

> ⚠ **Warning:** The ArtFrame ships in US and international versions with different input voltage requirements, either 100 – 127 VAC or 200 – 240 VAC. If you are not sure which your machine is configured for, or which setting is needed in your region, consult the label on the machine, or contact sales (sales@bantamtools.com) to check. Running a machine on the wrong supply voltage can damage it.

Use only the power cord supplied with the machine. Turn the machine off before unplugging it, and hold the plug rather than pulling on the cord. Do not use the machine if the cord is damaged.

Route the cord so that it will not be pulled, tripped over, or caught by the moving parts, and keep it clear of the drawing area and the rails.

17.2 USB

Every ArtFrame model ships with a USB-A to USB-B cable. The machine end is USB-B, sometimes called a printer-style connector.

If your computer has only USB-C ports, use a USB-B to USB-C cable.

To connect, plug the USB-B end into the ArtFrame and the other end into your computer. Studio can then detect the machine and send files to it directly. See §18. Sending files to your machine for the upload workflow and §25. Studio: the MACHINE tab for the controls. The same cable connects the firmware updater when you update the machine; see §11.11.6 Updating the firmware.

17.3 WiFi

WiFi lets you send files to the ArtFrame without a USB cable. Setup is handled through Bantam Tools Studio™: once the machine is on your network, Studio uploads files to it over WiFi. WiFi can also be switched on and off at the machine, in the **Settings** menu.

See §18.6 Putting your machine on a network for the setup walkthrough, and §11.11 The Settings menu for the machine-side control.

17.4 microSD

The microSD card slot is on the electronics enclosure. It is a friction-fit slot: to remove a card, pull it out rather than pressing it in further.

The card that ships with the machine is ready to use and holds the Welcome Plot. Running files from the card needs no computer connection at all, which is why the Getting Started walkthroughs use it.

See §18. Sending files to your machine for copying files to the card and running them, including folders of files, and §18.3 About microSD cards for formatting, choosing, and caring for a card.

18. Sending files to your machine

Whatever you prepare in Bantam Tools Studio™ leaves the computer as a G-Code file: a plain text file holding the moves the machine will make. There are three ways to get that file onto the machine, and they differ only in how the file travels. Once it arrives, the machine runs it the same way in all three cases.

- **microSD card** — copy the file to the card at your computer, then put the card in the machine.
- **USB cable** — connect the machine to your computer and upload the file from Studio.
- **WiFi** — put the machine on your network and upload the file from Studio without a USB cable.

This chapter compares the three, then covers each one in turn, and ends with how to put your machine on a network. For every control on the **MACHINE** tab that the USB and WiFi routes use, see §25. Studio: the MACHINE tab.

18.1 Which route to use

We recommend learning the microSD card route first. It gets your machine running on day one with nothing to configure, so you can confirm the machine itself is set up and working before adding a network or a cable to the picture. A card reader and a card are the whole dependency. When a file is on the card, the file is on the machine.

WiFi can be the most convenient route once your machine is settled in place. The machine joins a 2.4 GHz network, Studio finds it there, and files travel with no USB cable and no card handling — the machine can live across the room, and several people on the network can send to it.

USB sits between the two. It depends on nothing but a cable, the same as the card, and it lets Studio upload, start, pause, and cancel a job without your leaving the computer. The machine has to sit within a cable's length of the computer, and the cable has to stay put while the job runs.

Each route at a glance:

- **microSD card:** Works anywhere, with no connection to configure. You walk a card between the computer and the machine.
- **USB:** Direct and fast, with full control of the machine from Studio. Ties the machine to one computer, within cable reach.
- **WiFi:** No cable and no card to carry. Needs a network that lets your computer and the machine reach each other.

Which route suits you depends on where the machine sits and what your network allows. Most owners end up using more than one — a card for a machine set up away from the desk, USB when tuning a job and re-running it repeatedly. You can change routes at any time; nothing about a job is specific to how it traveled.

18.2 Sending files on a microSD card

The machine reads G-Code files from a microSD card and runs them with no computer attached. The card that shipped with the machine already holds the welcome file, and it is also where your own work goes.

1. In Studio, generate and save the G-Code file for your job.
2. Turn the machine off, then remove the card. (You can also swap the card with the machine on, once it is idle: no file running, and no upload or file change under way from Studio.)
3. Put the card in your computer's card reader and copy the file onto it.
4. Eject the card from your computer and put it back in the machine.
5. At the machine, open the file browser, scroll to the file, and press the control knob to start it.



The microSD card slot on the electronics enclosure.

The machine moves to its loading position and waits for you to load the tool and the media.

Browsing the card at the machine — opening folders, running a folder of files one after another, Run Again, and the check marks that mark completed files — is covered in §11. The ArtFrame interface, which documents every menu on the machine itself.

18.2.1 Keeping files in folders

A folder groups related files so the machine can run them in sequence. Copy the whole folder onto the card and the machine treats it as a set, offering to continue to the next file as each one finishes.

18.3 About microSD cards

The machine reads microSD cards formatted with the FAT32 file system, sometimes called MS-DOS (FAT). The card that ships with the machine is ready to use as it comes, and so are new cards of 32 GB and smaller; a larger card works once you reformat it as FAT32. Formatting erases everything on the card, so move anything you want to keep off it first.

Buy microSD cards from a seller you trust. Counterfeit cards, sold under the names of reputable brands, hold far less than their labels say; they appear to work normally, then lose or corrupt files as they fill. Reformatting clears ordinary file errors, but a counterfeit card fails again as it fills, so replace a card that loses or corrupts files.

Keep the card with the machine's accessories when it is not in the machine. Avoid bending it, touching its metal contacts, or leaving it loose on a work surface.

18.4 Sending files over USB

A USB cable connects the machine directly to your computer, and Studio then uploads files and drives the machine without anything in between.

Your machine uses a USB-B connection — the squarish connector sometimes called printer-style. Use a USB cable with USB-B at the machine and USB-A at the computer, or a USB-B to USB-C cable if your computer has

only USB-C ports.

To send a job over USB, connect the cable at both ends, open the **MACHINE** tab in Studio, and click **Connect**. Studio favors USB automatically when your machine is available on it. Once the connection row reads **USB Serial**, upload the file with **Upload File** and start it with **Begin Selected**, or send the job straight from the Setup Sheet after processing it. The full set of controls is in §25. Studio: the MACHINE tab.

Files uploaded over USB land on the machine's microSD card, exactly as if you had copied them there yourself, so they stay on the machine after the job and after a power cycle.

18.5 Sending files over WiFi

To send over WiFi, the machine has to be on the same network as your computer; see §18.6 Putting your machine on a network. After that, connect from the **MACHINE** tab with **Scan for Plotters**, or with **Enter IP** if the scan finds nothing, and upload as you would over USB.

The machine joins 2.4 GHz networks. Most routers broadcast 2.4 GHz and 5 GHz under a single name, and the machine uses the band it supports; where a router names the two separately, give the machine the 2.4 GHz name.

Studio checks every WiFi upload against the size it sent. If the machine's microSD card is full, Studio reports that there is not enough free space for the file: delete files from the card and try again. If the file arrives incomplete, the machine rejects it and Studio says so; send the file again.

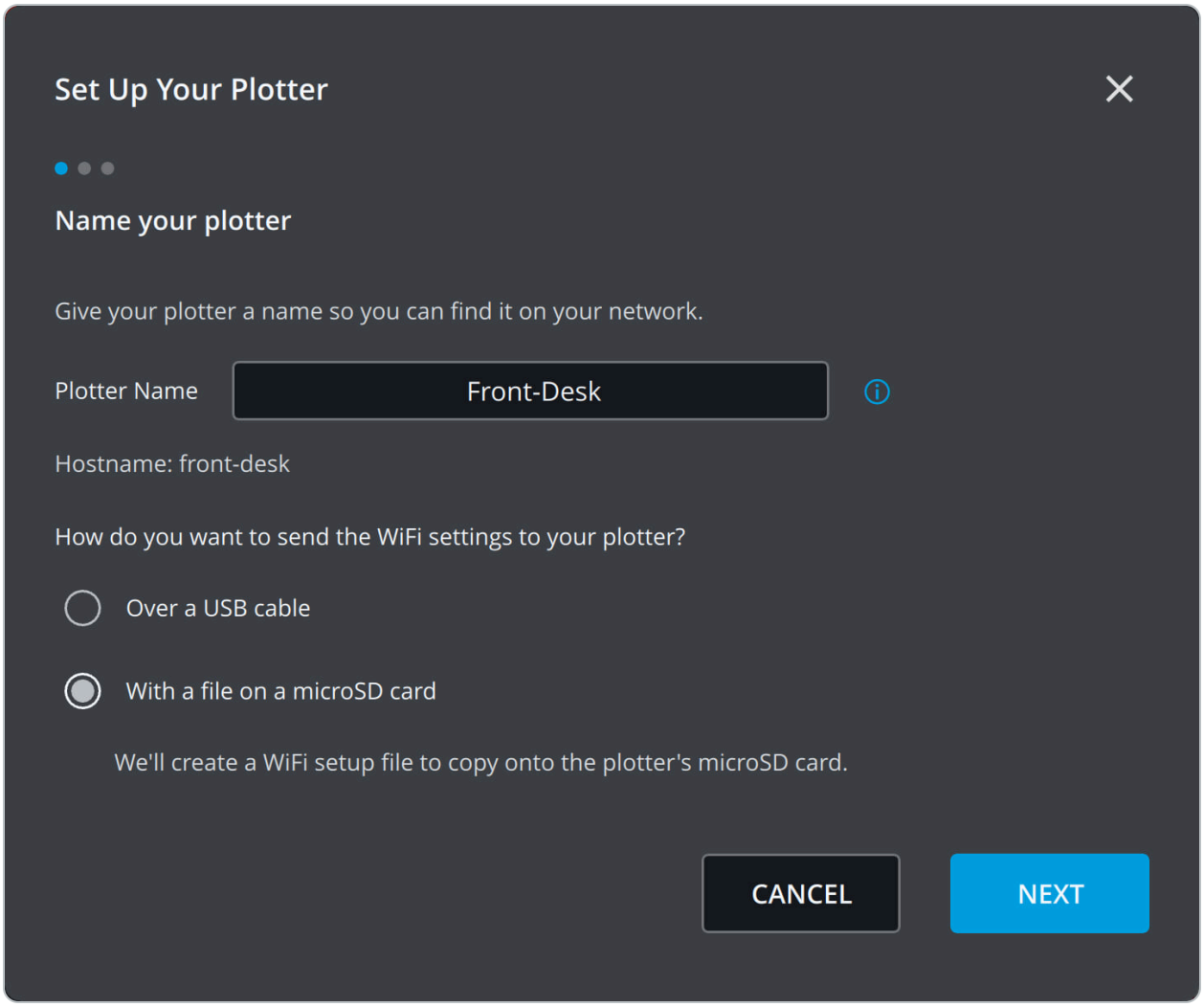
Some networks cannot carry your machine at all. The machine needs a network with a password; networks without one, or that ask for a user name, are not supported. A network that asks you to sign in, whether on a browser page or with your own user name and password, has no way to ask a machine for either. Many networks at businesses, academic institutions, and secure facilities are also set up to keep devices like these off them. On those networks, send files over a USB cable or on the microSD card.

18.6 Putting your machine on a network

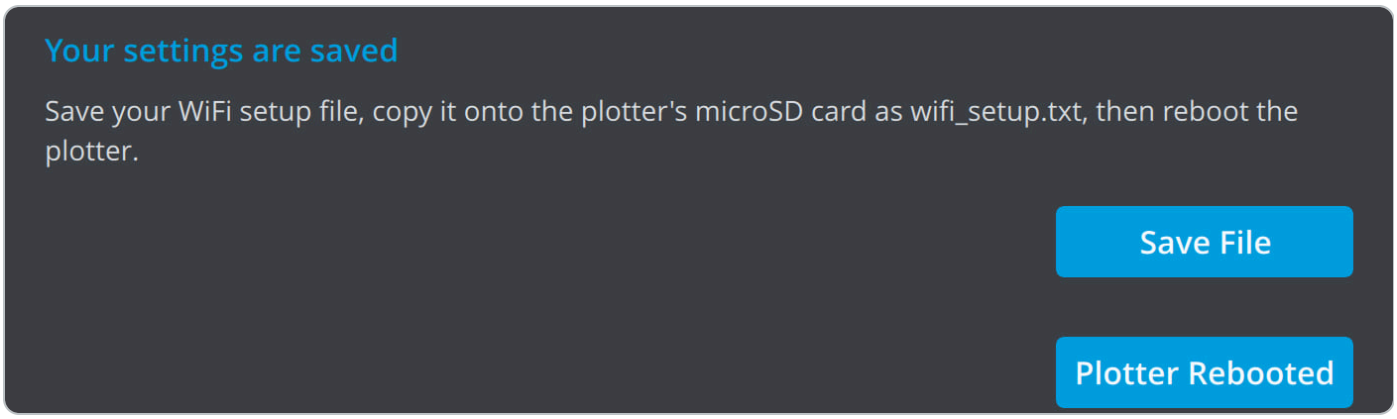
A machine joins a network once it knows the network's name and password. Studio's **Set Up Your Plotter** dialog collects both and delivers them to the machine, either over a USB cable or in a file on the machine's microSD card.

1. Open the **MACHINE** tab, click **Connect**, and choose **Setup New Plotter**.
2. Enter a **Plotter Name** you will recognize later, especially if you own more than one machine.
3. Choose how to send the WiFi settings: **Over a USB cable** or **With a file on a microSD card**. Over USB, connect the machine with a USB cable; **NEXT** appears once Studio finds it.
4. Enter the **WiFi Name (SSID)** and **WiFi Password** for the network the machine should join, and continue.
5. Over USB, Studio writes the settings to the machine directly. Click **Reboot Plotter** to restart the machine on your network.
6. With a microSD card, click **Save File** and save the setup file, then copy it onto the machine's microSD card as `wifi_setup.txt`. Put the card back, restart the machine, and click **Plotter Rebooted**.

If the machine's firmware is too old to receive WiFi settings over USB, the first page reads **Firmware update required.** Update the firmware, then reconnect the machine.



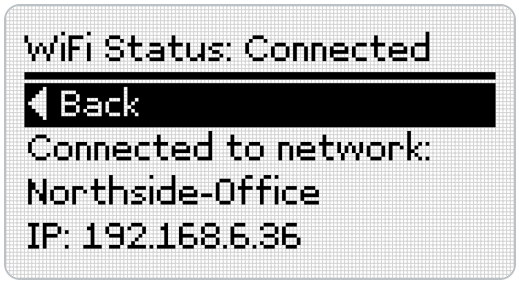
*The first page of the **Set Up Your Plotter** dialog, with **With a file on a microSD card** chosen*



*The card route's last step: **Save File**, then **Plotter Rebooted** once the machine has restarted*

Studio then looks for the machine on your network, and the machine appears the next time you **Scan for Plotters**. If it does not, choose **Enter IP address manually** and enter the machine's address.

The machine shows its own address on its display, under **WiFi Status**; see §11. The ArtFrame interface. Studio also shows it beside each machine in the **Plotters on network** list, and beside the name of a machine it is already connected to over WiFi.



WiFi Status *on the machine's display, showing its IP address.*

> ***Note:*** Network settings live on the machine, not in Studio, and they survive a power cycle. When the network's name or password changes, run setup again — the machine has no way to learn the new password on its own.

For a description of every control in the dialog, see §25.4 Setting up a new plotter.

19. Maintenance

The Bantam Tools ArtFrame™ needs very little routine maintenance. How much it needs depends on the type and amount of use, but an occasional wipe-down of the magnetic surface and the rails, to remove dust and buildup, is enough to keep the machine running well over long periods.

Turn the machine off before cleaning, inspecting, or moving it.

19.1 Maintaining the magnetic work surface

Wipe the magnetic surface periodically with a clean, dry cloth, or one lightly dampened with water. The cloth should be damp, not wet.

> ⚠ **Warning:** Do not use any cleaners on the work surface. Solvents and household cleaners can damage or degrade the metalized rubber over time.

The same caution applies to adhesives: masking tape mars the surface, and other tapes may as well. See §15.2 Fixturing work on the magnetic surface.

19.2 Cleaning the rails and the machine

Dust, paper fibers, and ink residue build up on the linear rails and the gantry rail over time. Wipe them with a clean, dry, lint-free cloth.

> ***Note:*** The X and Y rails and their bearings are intended to run dry. Never oil or grease them. Oil or grease holds dust against the rail, which wears it faster than dust alone. The vertical slide stage runs on plain bearings and is never lubricated either.
> The linear slide that carries the tool mounting block is a standard recirculating ball-bearing slide. It can be lubricated with a grease made for small linear ball-bearing slides. Do not lubricate the vertical slide stage.

Do not spray cleaners directly onto the machine. Do not use solvents, abrasive cleaners, or compressed air near the electronics, the motors, or the display.

Keep the area around the machine clear of loose paper, tools, pens, and cables that could interfere with the carriage or fall into the rails.

19.3 Tool holders and springs

Check that the tool is seated correctly and that the thumbscrew is tightened just enough to hold it. Do not overtighten; it can damage the pen body and makes the pen harder to remove.

If ink builds up around the pen tip or the pen clip, remove the tool and wipe the area with a clean, dry cloth.

Springs in the Spring Kit wear out with use. A spring that no longer returns the vertical slide crisply, or that gives noticeably less downforce than it used to, should be replaced. Contact support for replacement springs. See §12.3 The Spring Kit and §0.2 Support and online resources.

19.4 Cables and connectors

Inspect the power cord, the USB cable, and their connectors periodically. Do not use the machine if a cable, plug, or connector appears damaged.

The flat flexible cable that runs along the gantry to the carriage is part of the machine. Keep it clear of the drawing area and do not pull or crease it. If it is damaged, contact support rather than replacing it yourself.

19.5 Moving and storing the machine

Keep the original packaging and the two orange shipping brackets. They are what you need to move the machine safely. Before transporting the ArtFrame, reinstall the brackets to immobilize the gantry, and have a second person help with the lift.

When the machine is not in use, keep it in a clean, dry location, and cover it if you can, to keep dust off the surface and the rails.

19.6 Service and repairs

Do not modify the ArtFrame or attempt unsupported repairs. Unsupported modifications can cause abnormal operation, damage the machine, or create a safety hazard, and they void the warranty.

If your ArtFrame needs service, contact Bantam Tools support. We will help you troubleshoot the issue and determine the best next step. See §0.2 Support and online resources.

20. Drawing quality and speed

Good line quality on the Bantam Tools ArtFrame™ is a combination of tool quality, medium, and the settings you use. This chapter explains the settings that matter most — feedrate and acceleration — and how to tune them for the artwork you are making.

The settings themselves live in the tool editor in Bantam Tools Studio™; see §14. Setting up pens and brushes.

20.1 Rapid rate and feedrate

There are two separate speed settings that apply when the machine runs G-Code.

Rapid rate is the maximum velocity of G0 moves, where the tool is not engaging the drawing surface. On the ArtFrame it is preconfigured at 40,000 mm/min, and it is not a setting you change.

Feedrate is the maximum velocity of G1, G2, and G3 moves, where the tool is engaged with the surface and drawing. It is configurable in Studio when generating your G-Code.

The two are independent of each other, so the machine can travel as quickly as possible whether it is drawing or moving between strokes.

Their limits are:

- **XY feedrate:** up to 40,000 mm/min.
- **Z feedrate:** up to 50,000 mm/min.
- **XY acceleration:** up to 2,000 mm/s^2 while drawing, 3,000 mm/s^2 for rapid moves.

20.2 Preset toolsets

The ArtFrame's six preset toolsets are listed in §14.5 Preset toolsets. Each is named for the tool it was tuned around, and the differences between them are about the tool, not about quality.

All six start from moderate motion settings, well inside the machine's limits, so speed and precision are yours to tune.

Acceleration trades drawing time against precision: lower values give a crisper line, higher values finish the job sooner. Feedrate trades the same way.

20.3 Pen type and ink flow

Each pen has a maximum speed at which it can consistently deploy ink. For ballpoint pens, a feedrate of 10,000 mm/min is a good rule of thumb. For more unusual tools, experimentation is the way to find the best speed for the result you want.

Brush pens, for instance, may struggle at high speeds, as ink flow lags behind the motion and the line comes out uneven. Adjust speed and acceleration to suit the characteristics of the tool in the holder.

20.4 Media

The ArtFrame draws on paper, canvas, and other media as you see fit, and each surface has a speed that suits it. A smooth surface takes higher speeds; slow down on a rough one to hold the line where you want it.

20.5 Line length and acceleration

The best settings depend on the nature of the artwork.

For files composed of many short moves, acceleration matters more to the finished time than feedrate does: the machine never reaches its top speed, so raising that top speed changes nothing. For files composed of long sweeping strokes, feedrate is what governs.

20.6 Curves and smoothness

The ArtFrame uses G0 through G3 commands for motion. G2 and G3 define arcs the machine executes directly, rather than as a long series of short line segments.

Arcs make smaller files and smoother motion than the equivalent run of short line segments, and Studio writes them when **Use Curves** is on. See §30. Using your own G-Code for the commands the controller supports.

20.7 Testing and iteration

Treat the settings above as your starting point, then tune them to the pen, the surface, and the result you want.

Run test passes, look at the result, and identify what to improve. Adjust speed and acceleration by about ±500 at a time; small changes often produce the clearest, most readable differences. Testing not only tunes the settings but also shows you how the variables interact, which is what lets you get the best out of a particular pen and paper combination.

Keep a note of what worked. A tool in the Tool Library is the natural place to store it: a tuned tool carries its feedrate, acceleration, and heights with it into every future job. See §24. Studio: the Tool Library.

Part III: Reference

21. Hardware specifications

This chapter collects the Bantam Tools ArtFrame™ physical, electrical, and performance specifications in one place. Figures are given in millimeters with inches in parentheses, except for media sizes, which lead with their inch dimensions.

The motion figures below are the limits set in the machine's factory configuration.

21.1 Physical dimensions

ArtFrame 1824: overall 864 × 758.7 mm (34" × 29.87"); footprint 797 × 708 mm (31.4" × 27.9").

ArtFrame 2436: overall 864 × 1215.7 mm (34" × 47.86"); footprint 797 × 1165 mm (31.4" × 45.9").

ArtFrame Panorama: overall 864 × 2110 mm (34" × 83.07"); footprint 797 × 2064 mm (31.4" × 81.26").

Height: 279.6 mm (11.0") on every model.

Weight: 13.2 kg (29.0 lb) for the ArtFrame 1824, 16.6 kg (36.7 lb) for the 2436, and 26.3 kg (58 lb) for the Panorama.

See §16. The Table Rails accessory for the accessory that lets these footprints sit on a smaller desk.

21.2 Drawing area and travel

Each model's travel on its three axes:

Model	X travel	Y travel	Z travel
ArtFrame 1824	458 mm (18")	610 mm (24")	60 mm (2.36")
ArtFrame 2436	915 mm (36")	610 mm (24")	60 mm (2.36")
ArtFrame Panorama	1,829 mm (72")	610 mm (24")	60 mm (2.36")

21.3 Media and work surface

Maximum media size: the magnetic work surface is larger than the drawing area, and holds media up to 25" × 29" on the 1824, 29" × 43" on the 2436, and 29" × 78" on the Panorama.

Minimum media size: none. Anything the magnets hold can be drawn on.

Media thickness: up to 25.4 mm (1").

See §15. Paper and workholding for placement and fixturing.

21.4 Tool holding

Included tool holder: mirrored pen clip, mounted on the vertical slide stage.

Included pen: Pilot G2 gel pen, blue, 0.7 mm tip.

Pen barrel diameter: up to 16 mm (5/8") in the included pen clip, and 12 – 25.4 mm (1/2" – 1") in the XL Pen Clip.

Setup height: 3.5 mm, set with the cross side of the Pen Height Setup Tool. The tool is a 300-series stainless steel disk, 25.4 mm (1") in diameter and 4.5 mm thick overall.

See §12. Tool mounting and holders and §13. Pen height setup.

21.5 Performance

Maximum rapid rate (XY): 40,000 mm/min, preconfigured and not user-adjustable.

Maximum feedrate (XY): 40,000 mm/min.

Maximum feedrate (Z): 50,000 mm/min.

Acceleration (XY): 2,000 mm/s^2 while drawing, 3,000 mm/s^2 for rapid moves.

Acceleration (Z): 10,000 mm/s^2.

Homing seek rate: 4,000 mm/min on X and Y, 1,600 mm/min on Z.

Basic motor step size: 0.0125 mm on X and Y.

See §20. Drawing quality and speed for how these settings affect the finished line.

21.6 Electrical

Input: 100 – 127 VAC or 200 – 240 VAC, depending on whether the machine is the US or the international version. The label on the machine states which.

Connector: IEC 320 C13 power inlet, with a power switch beside it.

Use only the power cord supplied with the machine. See §2. Safety and safe operation.

21.7 Connectivity

USB: USB-B on the machine. The included cable is USB-B to USB-A.

WiFi: 2.4 GHz networks, using WPA2 or WPA3 security. Enterprise networks that sign you in with a user name and password are not supported.

microSD: FAT32-formatted cards.

See §17. Power, USB, and microSD details.

21.8 Environment

Operating environment: indoors, at normal office temperature and humidity.

21.9 Controller and firmware

Controller: Bantam Tools Serama Rooster™ controller board, in two revisions. A machine whose top sheet metal has a storage location for the pen height setup tool is a Rev D machine, with a Rev D board; a machine without it is a Rev B. The distinction matters when you install a configuration file, because each revision takes its own; see §11.11.7 Updating the configuration file.

Firmware: Bantam Tools Serama firmware, based on FluidNC. The installed version is shown on the startup screen and on the **Version** screen in the machine's **Settings** menu. Update it with the firmware updater program for macOS or Windows (bantam.tools/fw); see §11.11.6 Updating the firmware.

G-Code: see §30. Using your own G-Code for the coordinate system, the homing sequence, and the commands the controller supports.

22. Studio: the PREPARE tab

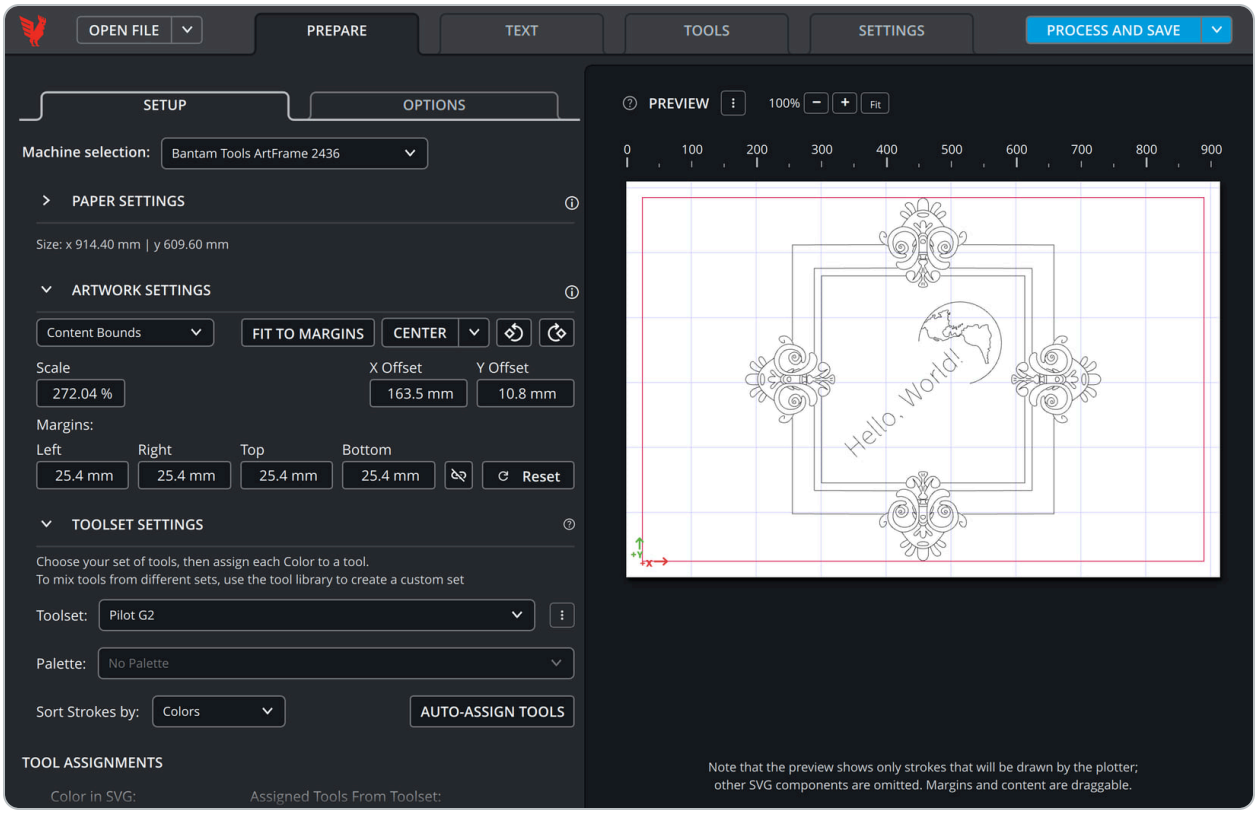
This chapter documents every control on the tab: what each one does and when to change it.

The **PREPARE** tab is where you set up a job before processing, saving, or sending it to a machine. It is the main workspace for choosing the machine, defining the paper or work area, placing the artwork, assigning tools, setting path processing and G-Code behavior, and checking the result in the **Preview**.

The tab is divided into four areas:

- **SETUP:** Machine selection, paper settings, artwork settings, toolset settings, and tool assignments.
- **OPTIONS:** Path processing options and G-Code generation options.
- **Preview:** A visual representation of the strokes that will be plotted.
- **PROCESS AND SAVE:** The button that generates output from the prepared job.

This section is reference material: it describes every control on the tab, in the order the tab presents them, rather than walking a job from start to finish.



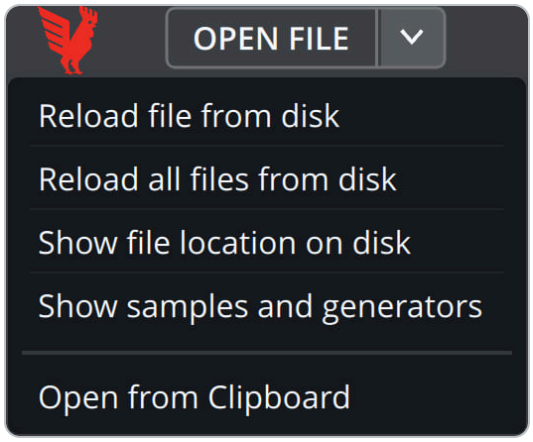
*The **PREPARE** tab: **SETUP**, **OPTIONS**, the **Preview**, and **PROCESS AND SAVE***

Tip: Hover over any setting in Bantam Tools Studio™ to see a short description of what it does.

22.1 Opening files and file actions

The **OPEN FILE** button sits in the upper-left corner of the Studio window. Click **OPEN FILE** and choose the source file you want to prepare.

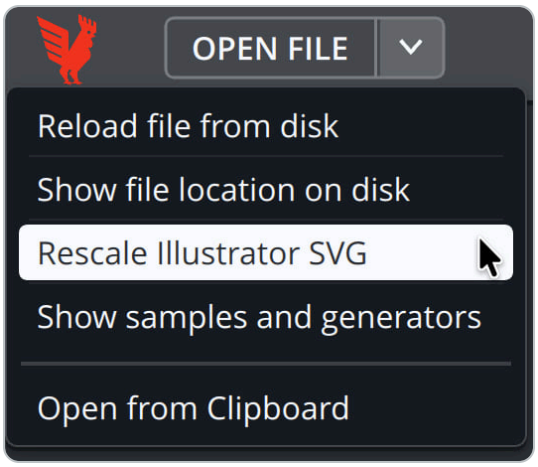
You can also choose more than one. Select several SVG files in the dialog and Studio opens them together: each becomes a page you step through in the **Preview** area's page navigator, and one **PROCESS AND SAVE** writes output for every one of them. A batch is all SVG files or all text files (`.txt` or `.rtf`), and an image file opens on its own. Some of the Setup controls then belong to the page in front of you and the rest to the whole job — see §22.2 What belongs to one document and what belongs to all.



*With several files open, the menu adds **Reload all files from disk***

The chevron beside **OPEN FILE** opens a menu of additional file actions. Some items appear only when they apply, as noted below:

- **Reload file from disk:** Reloads the currently open file from its saved location, and keeps your tool assignments, plotting order, placement, and handwriting variation. Colors and layers that are new in the file get tools automatically. Use this after editing the source file in another program.
- **Reload all files from disk:** Rereads every file at once when you have opened several. The item appears only then, and with a single file open, **Reload file from disk** is the one to use.
- **Show file location on disk:** Opens the folder containing the current file.
- **Rescale Illustrator SVG:** Some Adobe Illustrator files do not correctly encode the document size, and open in Studio at three-quarters of their intended size. If that happens, choose this command to correct it; in a multipage document it applies to every page. A saved project keeps the correction, but opening the file again on its own does not. To have Studio correct such files automatically as they open, see §23.1 Program options.
- **Show samples and generators:** Opens Studio's included samples and generator resources.
- **Open from Clipboard:** Creates a new job from supported clipboard content, such as SVG or PNG, depending on what is available.



***OPEN FILE** menu with **Rescale Illustrator SVG** available*

> *Tip:* If you are iterating between Studio and another design program, **Reload file from disk** updates the Preview without your reopening the file each time.

22.1.1 File types Studio opens

OPEN FILE opens these kinds of file:

- **SVG artwork** (`.svg`): opens on the **PREPARE** tab, ready to plot. Several SVG files open together as a batch.

- **Images** (`.png`, `.jpg`, `.jpeg`, `.bmp`, `.gif`): open in the Image Processor, which turns a picture into strokes, one image at a time. See §29.2 Opening the Image Processor.
- **Bantam Tools Studio project files** (`.btsp`): restore a saved session, with its documents, tool assignments, and settings, one project at a time. See §26.4.1 Opening a project.

With the Bantam Tools Studio Text Add-On, Studio also opens text documents (`.txt` and `.rtf`) and CSV data files for Data Merge; see §27.5 About the Text Add-On.

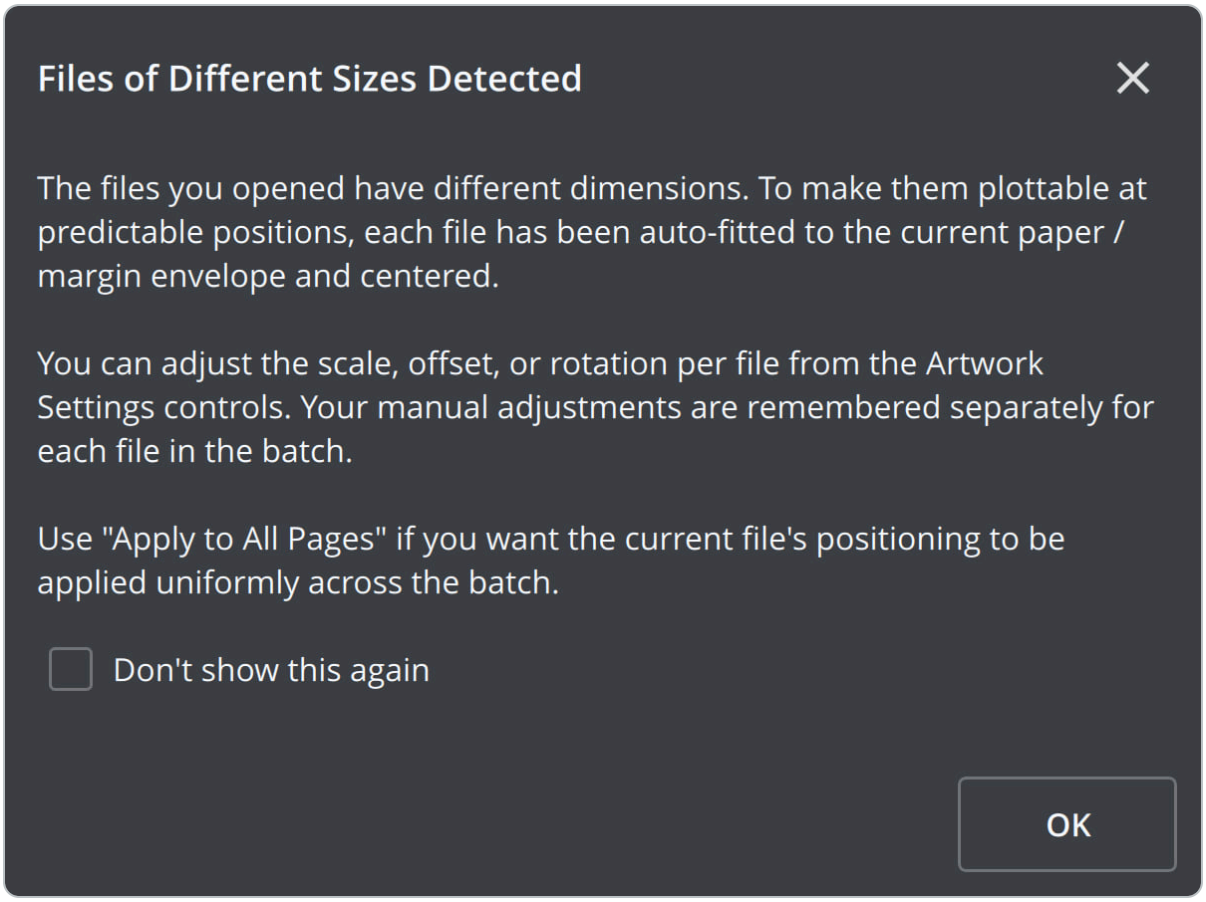
One open takes one kind of file: SVG files, one image, or one project. Choosing a mix brings up a **Mixed File Types** message, and nothing opens.

Content copied from another program, such as SVG artwork or an image, opens with **Open from Clipboard** instead.

22.1.2 When files have different sizes

The files you open together need not share a size. When they do not, Studio fits each one to the current paper and margins on its own and centers it there, so that every page starts somewhere predictable rather than wherever its own coordinates happen to put it. Rotation returns to 0° for each file as part of that fit.

A **Files of Different Sizes Detected** dialog tells you this has happened. It appears once for the whole batch, and dismissing it with **OK** is all it asks of you. The fit is a starting point, not a lock: adjust the scale, offsets, or rotation of any page afterward and Studio remembers the change for that file alone. See §22.2 What belongs to one document and what belongs to all.



*The **Files of Different Sizes Detected** dialog*

Select **Don't show this again** in the dialog to stop it appearing on later opens.

22.2 What belongs to one document and what belongs to all

You can open several documents at once, and Studio shows them as pages you step through in the Preview. When you do, some Setup controls belong to the page you are looking at and the rest belong to the whole job. The division is fixed; it does not change as you switch pages.



The page navigator steps between open documents

These belong to this page alone, and every open document keeps its own:

- **Scale**, **X Offset**, and **Y Offset**
- Rotation
- The **Rescale Illustrator SVG** correction
- The list of colors, layers, or groups Studio detected
- The plotting order of that list

These are shared, and changing one changes it for every open document at once:

- Paper size, including the result of **Use Document Size**
- The paper offsets, **X Offset** and **Y Offset**
- Margins
- The selected toolset
- The tool assigned to each color, layer, or group

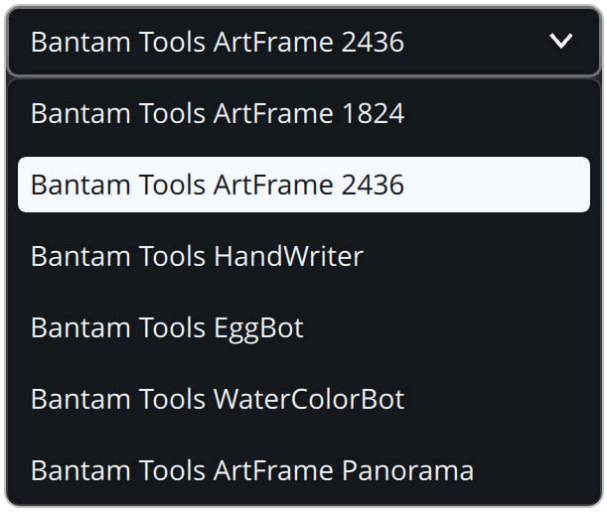
Switching pages therefore changes what Artwork Settings and Tool Assignments show you, and leaves Paper Settings, the margins, and the toolset exactly as they were.

Two commands, both called **Apply to All**, copy settings across every page: §22.6 Applying positioning to every document copies placement, and §22.9 Applying tool assignments to every document copies tool assignments.

22.3 Machine selection

The **Machine selection** drop-down menu, at the top of the **SETUP** sub-tab, sets the machine target for the current job. The choice affects the available work area, the default settings, machine-specific behavior, and the way Studio generates motion, so make it before you set up the rest of the job.

Select your model, **Bantam Tools ArtFrame 1824**, **Bantam Tools ArtFrame 2436**, or **Bantam Tools ArtFrame Panorama**, from the menu.



*The **Machine selection** menu*

When you change the model, these settings return to that model's defaults: the toolset, the margins, the pen parking height source, the grouping-by-color setting, and the Z heights, feed rates, and accelerations. The paper size menu lists only the sizes the model can take; your paper size is kept if it fits, and replaced if it does not. Your artwork and its scale and position are untouched.

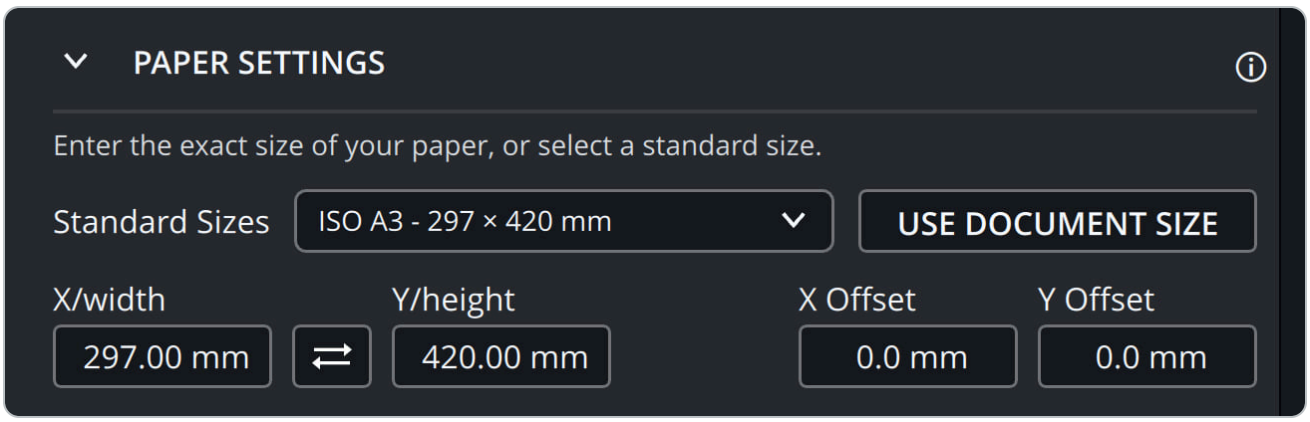
22.4 Paper settings

The **Paper Settings** section defines the work area for the job. There is one work area, shared by every open document; see §22.2 What belongs to one document and what belongs to all.

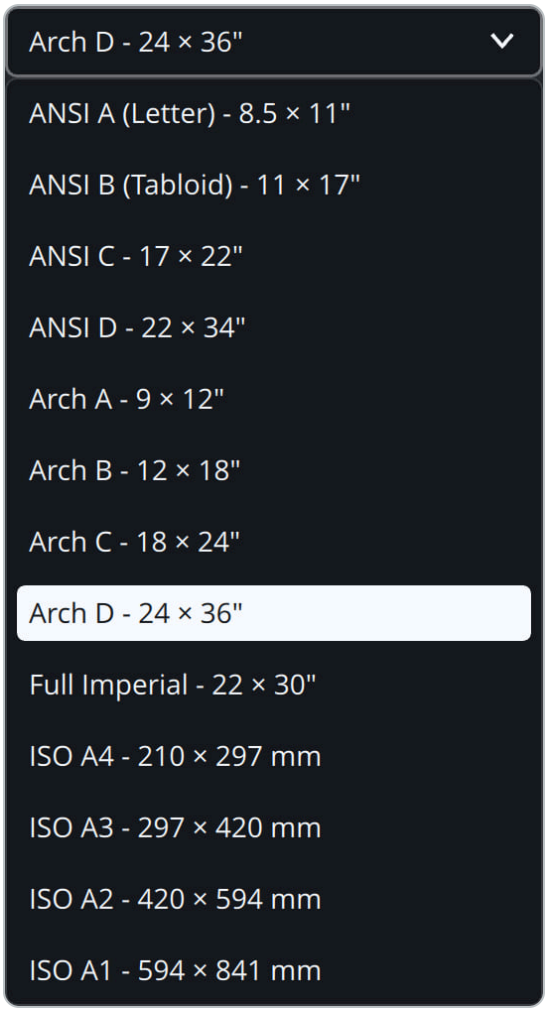
On ArtFrame this represents the flat work area beneath the toolhead.

The controls are:

- **Standard Sizes:** Choose from the standard US and ISO paper sizes your machine can take. The list is filtered to the sizes that fit its work area in either orientation, so it changes with the machine.
- **Use Document Size:** Set the paper size to match this page's original document size.
- **X/width and Y/height:** Set the X and Y dimensions of the work area. Studio brings a size outside your machine's range to the nearest size it can take, and shows a message saying so.
- **Switch Axis:** Swap the X and Y values.
- **X Offset and Y Offset:** Set where the paper sits relative to the machine's origin.



*The **PAPER SETTINGS** section*



***Standard Sizes** lists only sizes the machine can take*

Use Document Size reads the size of the document on the page you are viewing, but the paper size it produces is the shared one, so that page's size becomes the paper size for every open document. It also returns the scale to 100% and the artwork offsets to zero for that page alone; the other pages keep the scale and offsets they had.

X Offset and **Y Offset** move the paper, and everything drawn on it, relative to the machine. A larger **X Offset** moves the paper to the right in the Preview, and a larger **Y Offset** moves it up; the plotted output moves by the same distance on the machine. Neither value can be negative. Like the paper size, the paper offsets are shared by every open document.

The paper offsets do not move artwork on the paper. For that, use the **Offsets** fields in Artwork Settings, which belong to each page separately and can be negative; see §22.5 Artwork settings.

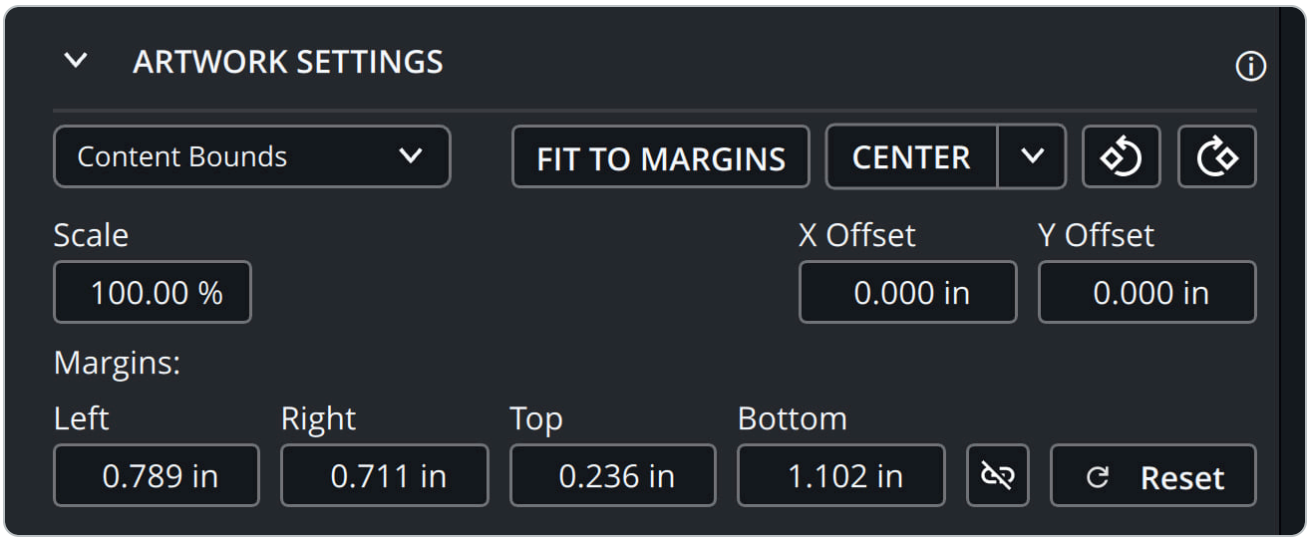
Both paper offsets start at zero, except with a brush toolset and a palette selected: Studio then sets **X Offset** from the palette's width and position, and updates it when you change the palette. Once you enter an **X Offset** or **Y Offset** value yourself, Studio stops adjusting it until you select a different machine or restart Studio.

The width, height, and offset fields accept arithmetic and unit suffixes, such as `8 1/2` or `6 in + 3 mm`. See §22.5 Artwork settings, under Entering dimensions.

> *Tip:* Units can be selected on the **SETTINGS** tab, but you can also press ⌘U (Ctrl+U on Windows) to switch between millimeters and inches at any time.

22.5 Artwork settings

The **Artwork Settings** section controls how Studio interprets, scales, and positions the loaded artwork.



*The **ARTWORK SETTINGS** section for an SVG document*

22.5.1 Content bounds and document bounds

When **Content Bounds** is selected, Studio calculates the edges of the artwork from the objects in the file. Extra empty space in the document canvas or viewBox is ignored. (Default)

When **Document Bounds** is selected, Studio uses the original canvas or viewBox dimensions to position and scale the content.

This choice affects fitting, centering, scaling, and offsets.

22.5.2 Fit to Margins

Click **FIT TO MARGINS** to scale the document or its contents to fit inside the paper size and margins.

The command changes the scale and, depending on your settings, the offsets. It does not change the paper size or the margins themselves.

22.5.3 Setting an exact size

An SVG document carries a page size of its own along with its contents, and Studio scales that drawing onto your paper. **Scale** works in percent, so an exact width or height comes from setting up the space the artwork fills, or from a ratio. There are several ways, and the one to use depends on what you start with:

- **Fit to the margins.** Set the margins so the space between them is the size you want, then click **FIT TO MARGINS**. The artwork keeps its proportions and grows or shrinks until it meets the nearer pair of margins. For a design 150 mm wide on US Letter paper (215.9 mm wide), enter `(215.9 - 150) / 2` in the left and right margin fields; they accept arithmetic, as described in §22.5.10 Entering dimensions. Keep the top and bottom margins far enough apart that the width is what limits the fit.
- **Draw it at size.** If the document was made at its final size in a design program, click **Use Document Size**: the paper takes the document's size and the scale returns to 100%, so the artwork plots at the size it was drawn.
- **Size the page, not the drawing.** Set the paper to exact dimensions and select **Document Bounds**: fitting then scales the document's whole canvas, empty space included, so artwork lands where the design file placed it on that page.
- **Scale by a ratio. Scale** is the factor applied to the artwork, and it accepts arithmetic, so a known ratio goes straight in: to take a drawing 120 mm wide to 150 mm, enter `(150 / 120) * 100%`.

Whichever method you use, the bounds choice decides what is measured: **Content Bounds** sizes the drawn objects, and **Document Bounds** sizes the canvas. See §22.5.1 Content bounds and document bounds.

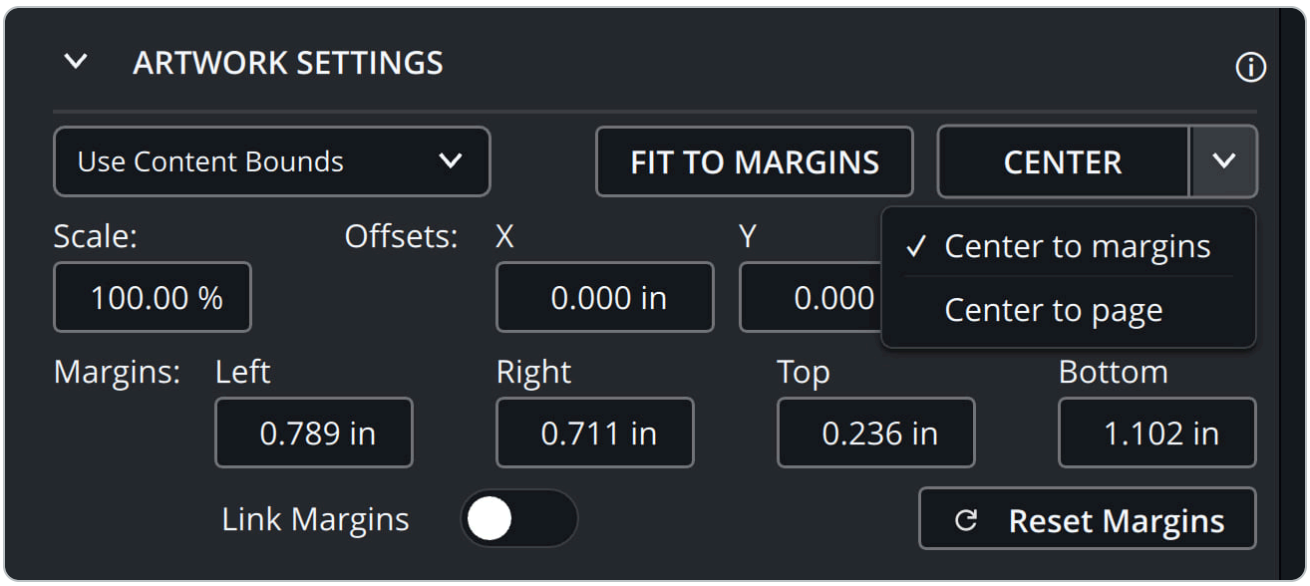
22.5.4 Center

Click **CENTER** to center the content inside the margins.

CENTER is a split button. Its chevron opens a menu with two choices:

- **Center to margins** — centers the content within the margins, the same as clicking the button.
- **Center to page** — centers the content on the whole sheet, ignoring the margins.

Studio remembers the choice and uses it when it re-centers artwork for you, such as after you change the paper size. Clicking the **CENTER** button itself switches back to centering within the margins.



*The **CENTER** menu*

Tip: Double-click the artwork in the Preview area to center it and fit it to the margins in one step.

22.5.5 Scale

The **Scale** control displays the scaling factor applied to the artwork as a percentage. For an SVG document you can enter a value to override the calculated or default scale.

To set an exact width or height instead of a percentage, see §22.5.3 Setting an exact size.

22.5.6 Offsets

The **X Offset** and **Y Offset** controls shift the artwork horizontally and vertically. You can move artwork by dragging it in the Preview area or by entering values directly.

22.5.7 Rotation

The two rotation buttons, at the right end of the first row of **ARTWORK SETTINGS** after **CENTER**, rotate artwork counterclockwise or clockwise by 90°.

22.5.8 Margins

Margins define areas at the edges of the paper or work area where nothing is drawn. Artwork outside the margins is shown in red and is cropped when the job is processed.

You can enter margin values or drag margins in the Preview area. Drag a corner of the margin outline to move the two margins that meet there at once; corners can't be dragged while the margins are linked. Margins are shared in the same way paper size is: one set of four values, applied to every open document.

Reset, to the right of the margin fields, returns all four margins to the defaults for your machine. It does not change the paper size, the scale, or the artwork offsets.

22.5.9 Linking margins

The chain-link button between the margin fields and **Reset** links the four margins. Linking sets all four to the largest of them, and from then on, changing one margin changes all four. The chain is whole while the margins are linked and broken while they are not; click it again to unlink them.

22.5.10 Entering dimensions

Every dimension field in Artwork Settings and Paper Settings, and the palette offsets in Tool Settings, accepts arithmetic. Type an expression and press Return or Enter, or click elsewhere, and Studio replaces it with the result. Only the result is kept.

- Add, subtract, multiply, divide, and group with parentheses: `(2 + 3) * 10`.
- Mixed numbers, with a space between the whole number and the fraction: `8 1/2`.
- A number with no unit takes the unit shown in the box. A unit after a number converts it: `1 in` in a millimeter field becomes 25.4 mm, and `25.4 mm` in an inch field becomes 1 in.
- Units can be mixed in one expression: `6 in + 3 mm`.

Length fields accept `mm`, `cm`, `in`, `ft`, and `pt`. Percent fields, such as Scale, accept `%`, and a bare number is read as a percent, so `4/3` means 1.33% rather than 133%; write `(4/3) * 100%` for a ratio.

Put a space before a unit, and it applies to everything before it: `10 / 2 mm` is 5 mm, and `1/8 in` is an eighth of an inch.

The Up and Down arrow keys step the value by 1 mm or 1/16 in, and by 10 mm or 1 in with Shift held. The first press lands on a round value. Escape abandons an edit and restores the previous value.

A rejected entry outlines the field in tangerine and keeps what you typed so that you can correct it. Hover over the field, or leave the cursor in it, to read the reason, for example "Value is out of range."

For the accepted units and worked examples, see §31.2 Dimension entry reference.

22.5.11 Undoing layout changes

Undo (⌘Z / Ctrl+Z) and **Redo** (⇧⌘Z / Ctrl+Shift+Z or Ctrl+Y) step back and forth through layout changes in the Preview. They are also the first two items in the **Edit** menu, which names the step each will reverse, such as **Undo Fit and Center**. Each of these is one step:

- Double-clicking the artwork to fit and center it.
- Dragging the artwork, or changing **Scale**, **X Offset**, or **Y Offset**.
- Rotating, **Fit to Margins**, **Center**, and the choice of bounds.
- **Text overflow** on the **TEXT** tab.
- Paper size, orientation, and **Use Document Size**.
- Margins: a typed value, a dragged margin, linking or unlinking the margins, and **Reset**.

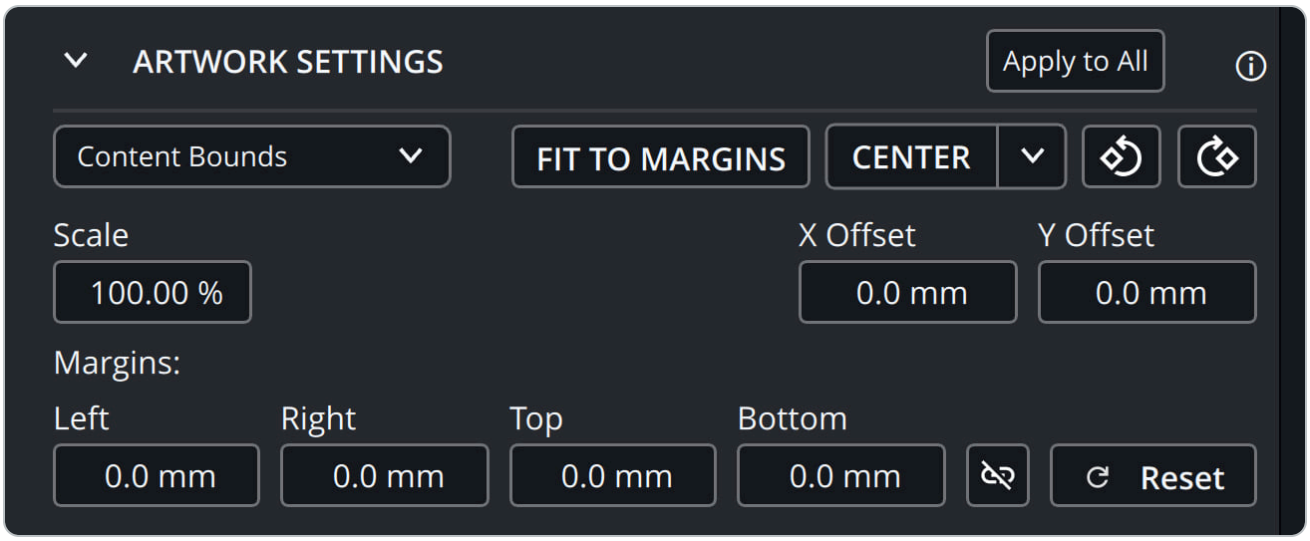
Each page keeps its own history of up to 50 steps. Paper and margin changes apply to every page, and **Undo** reverses whichever change came last. While a field still holds your typing, ⌘Z / Ctrl+Z undoes the typing; after Return or Enter, it undoes the layout change. Deleting a tool or toolset, and other changes outside the layout, cannot be undone.

The history clears when you open a document or project, apply a profile, change machine, or use **Apply to All** for positioning (see §22.6 Applying positioning to every document) or **Reset All** in **SETTINGS**.

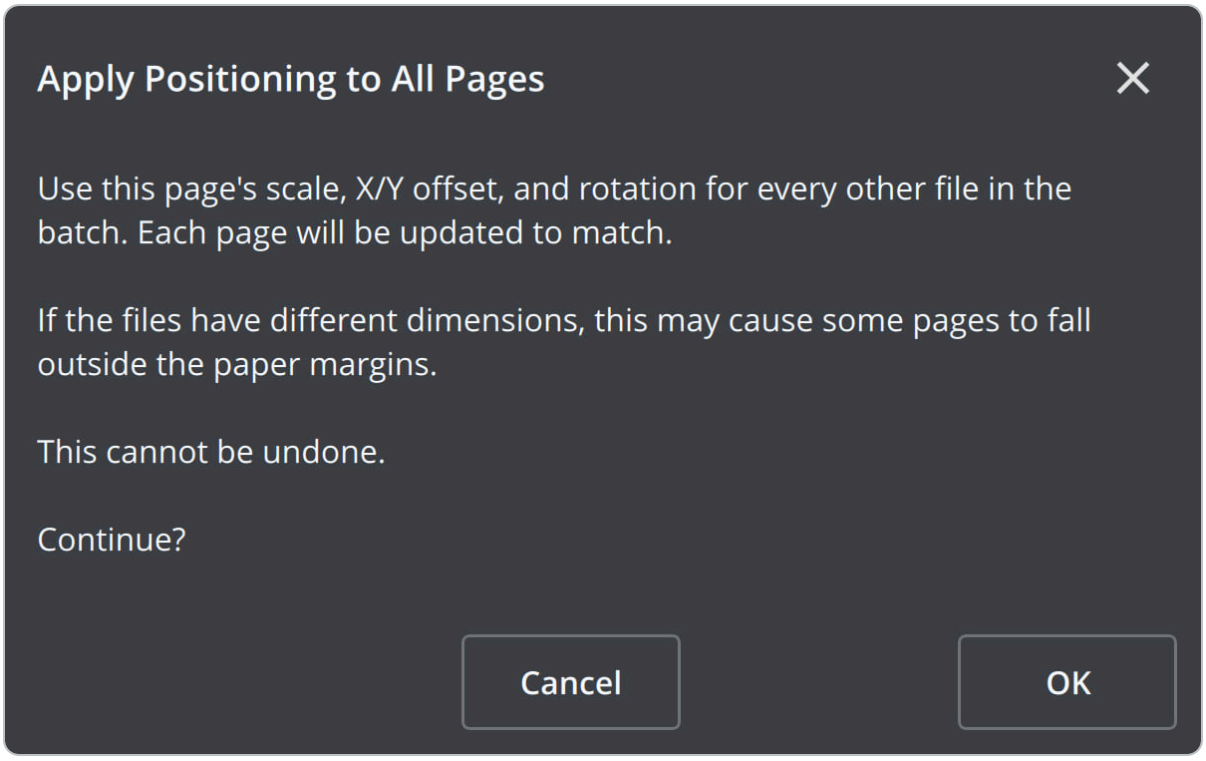
22.6 Applying positioning to every document

Scale, offsets, and rotation belong to the page you are looking at, so setting them once does not set them everywhere. **Apply to All**, at the right of the **ARTWORK SETTINGS** header, is how you make one page's placement the placement for all of them. The button appears only while more than one document is open.

Click **Apply to All** to copy this page's scale, X offset, Y offset, and rotation onto every other open document, replacing the values those pages had. This cannot be undone, and it clears the undo history. Tool assignments and plotting order are left alone.



Apply to All *appears when several documents are open*



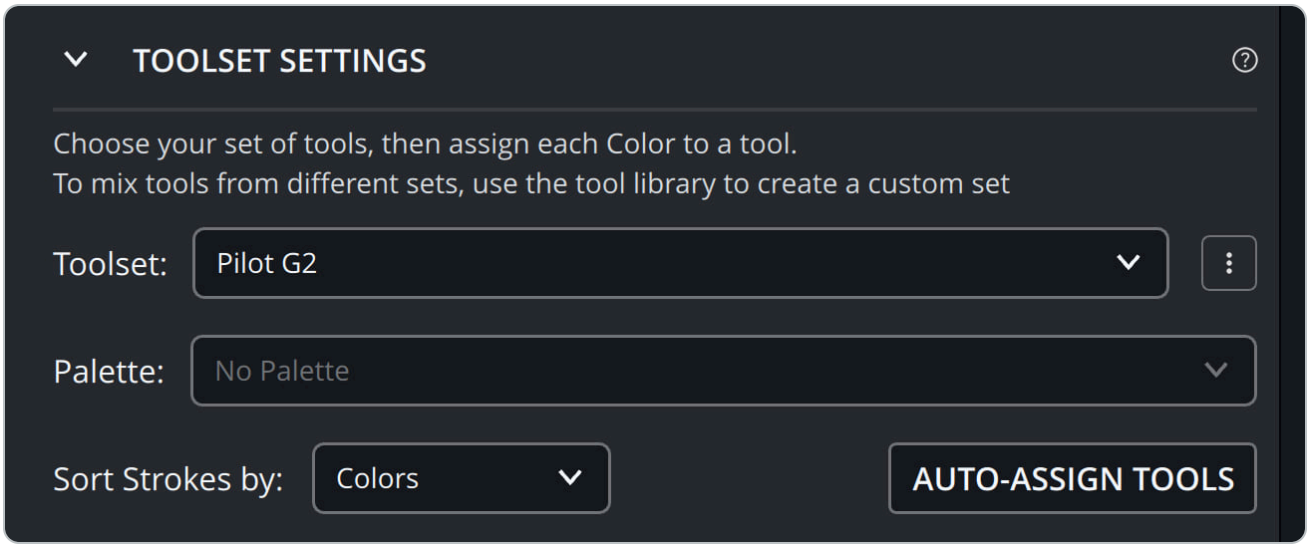
The confirmation before positioning is copied

One scale and one pair of offsets suit pages of the same size. On a page of a different size, the copied placement can carry artwork past the margins, where the Preview draws it in red and processing crops it.

22.7 Toolset settings

The **Toolset Settings** section, lower in the **SETUP** sub-tab, determines which group of tools is available for the job.

A **toolset** is a saved collection of tools and their settings. Every job draws its tools from the toolset selected here, so a job that uses several pens or brushes needs a toolset that holds all of them; see §24. Studio: the Tool Library.



*The **TOOLSET SETTINGS** section*

22.8 Tool assignments

The **Tool Assignments** section shows the colors, layers, or groups Studio detected in the page shown in the Preview and lets you assign a tool to each one.

The **Sort Strokes by** menu offers:

- **Colors:** Groups strokes based on stroke color. This is best for most projects. (Default)
- **Layers:** Uses the layer structure from your design software.
- **Groups:** Uses structural groupings from the SVG file.

Once sorted, each detected color, layer, or group can be assigned a tool from the selected toolset.

A layer whose name begins with `%` is a **documentation layer**, and Studio leaves it out of the file it works with: its contents are never read, so the layer is not listed here, takes no tool, and is not drawn. That is the place to put a safe area box, fold lines, crop guides, or notes to yourself, which you want to see in your editor and never want on the page. It applies however you are sorting — a documentation layer is dropped before Studio looks for colors or groups, so nothing inside one appears under any sorting method.

When a file has more than 100 colors, layers, or groups of the kind you are sorting by, a **Large Number of Groupings Detected** dialog asks how many to load:

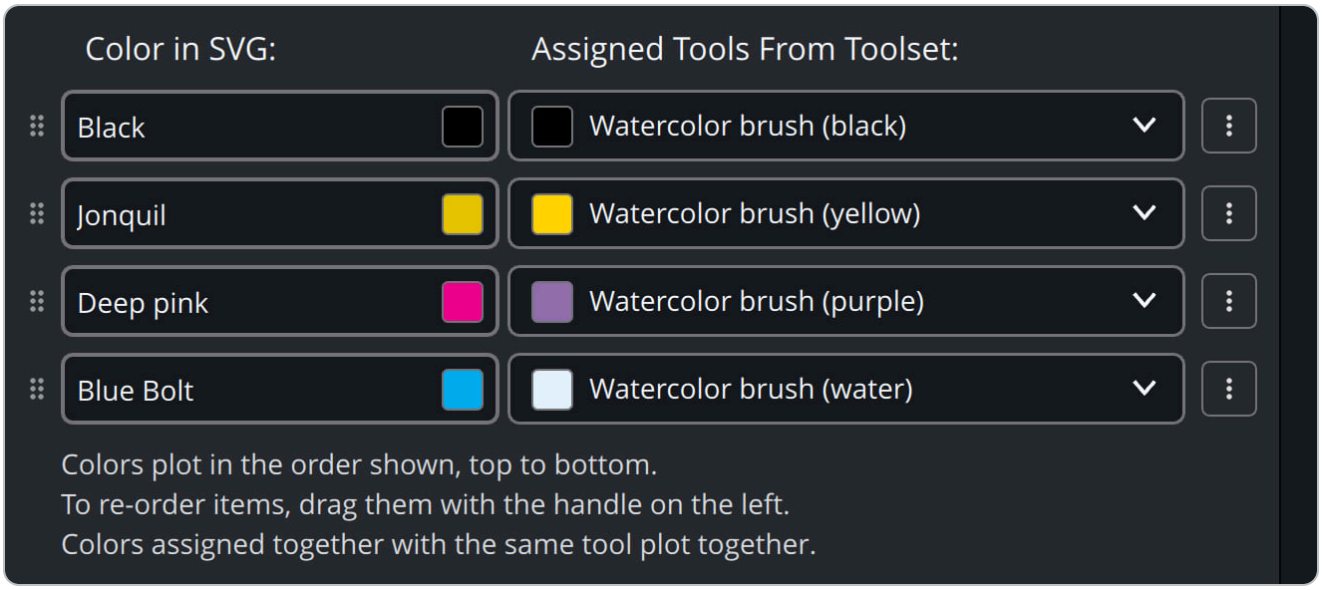
- **Limit to 100** — keeps the first 100 and merges the rest into a single entry named Other.
- **Load All** — loads up to 512, the most Studio supports. Past that, the rest are merged into Other, and a **Grouping Limit Reached** message tells you so.

When several files are opened together, Studio limits each one to 100 without asking.

You can assign tools with the drop-down menus, or use **AUTO-ASSIGN TOOLS** when it is available. Each drop-down menu also offers **None; skip this task**, which leaves that color, layer, or group out of the plot.

Click the name of a row to hide it. The name is struck through, its strokes disappear from the Preview, and its tool changes to **None; skip this task**. Click the name again to show it and bring back the tool it had.

A row set to **None; skip this task** or hidden stays that way when you reload the file, change toolsets, or save and reopen a project. Assigning a tool to the row brings it back, and **AUTO-ASSIGN TOOLS** brings back every row.



*The **TOOL ASSIGNMENTS** list with brush tools assigned*

Once a row has a tool, the gear button at the end of the row opens a **Tool Options** menu:

- **Assign this tool to all** — assigns the row's tool to every color, layer, or group in the list.
- **View/Edit Tool** — opens the tool in the Tool Library.
- **View/Edit Toolset** — opens the tool's toolset in the Tool Library.

For a tool that uses painting macros, the menu also lists **Macro Locations**, the palette locations that tool uses for **Prime/Wash**, **Pre-Refill**, **Refill**, and **Post-Refill** on the current palette.



*The **Tool Options** menu for a brush tool, with **Macro Locations***

Drag the handles on the left side of the tool assignment list to change plotting order. The order belongs to this page alone.

Colors, layers, or groups assigned to the same tool plot together without stopping for a tool change.

Tool assignments are shared by name: assigning a tool to “black” assigns it to “black” in every open document. To draw the same color with two different pens, prepare and process those documents separately. See §22.2 What belongs to one document and what belongs to all.

For more about creating, editing, duplicating, and saving tools and toolsets, see §24. Studio: the Tool Library.

22.9 Applying tool assignments to every document

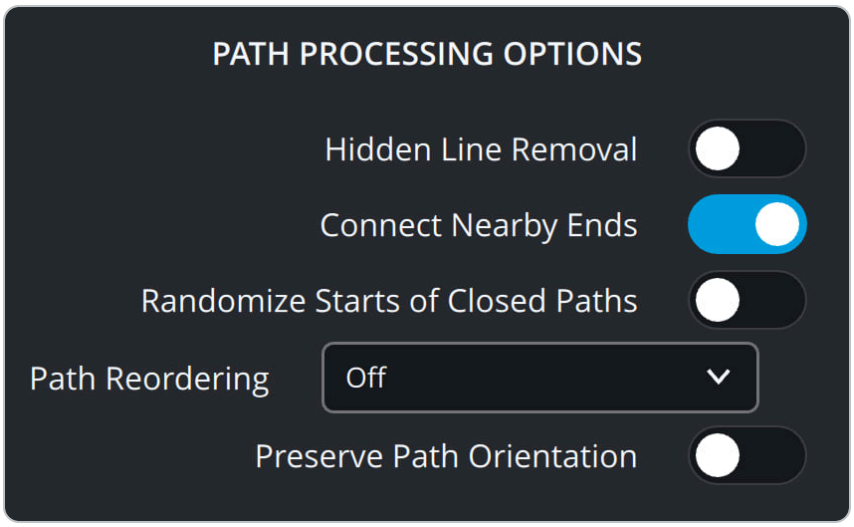
Apply to All, at the right of the **TOOL ASSIGNMENTS** header, brings the rest of the job into line with the page you are looking at. The button appears only while more than one document is open.

Click **Apply to All**. Studio asks you to confirm in an **Apply Tool Assignments to All Pages** dialog, and on **OK** it sets every color, layer, or group that appears on some other page but not on the page shown in the Preview to **None; skip this task**, then gives every other page this page's plotting order. Names that this page does not have keep their existing relative order and fall to the end of the list. This cannot be undone.

Apply from the page with the richest set of colors, so that the fewest assignments are lost.

22.10 Path processing options

The **OPTIONS** sub-tab controls how Studio processes paths and generates G-Code, and it is divided into two sections. **PATH PROCESSING OPTIONS**, the first of them, affect how Studio prepares the source geometry before it generates machine motion.



PATH PROCESSING OPTIONS *on the* ***OPTIONS*** *sub-tab*

22.10.1 Hidden Line Removal

Hidden Line Removal plots only what is visible. (Default: off) When it is on, Studio processes the paths that have a stroke applied and are not hidden behind filled objects, so overlapping shapes, filled areas, and construction geometry covered by another object are left out of the plot rather than drawn through the shapes on top of them.

With it off, Studio processes every path in the file as plottable motion, treating each as stroked and unfilled whatever its appearance in a design program.

For example, with Hidden Line Removal off, a line behind a filled shape still plots, because the underlying path exists in the SVG. With it on, Studio removes the hidden portion, so the output matches the visual appearance of the artwork more closely.

Hidden Line Removal adds processing time, most noticeably on files with many objects, and it can change the direction individual paths are drawn in. Leave it off for artwork with no overlaps, and for calligraphic or brush work, or any application where the path direction should be preserved.

22.10.2 Connect Nearby Ends

Connect Nearby Ends joins path endpoints that are close together. (Default: on)

It closes tiny gaps where paths nearly meet, which saves pen lifts and keeps lines continuous. Each path is drawn from its start to its finish. Two paths join most simply where one path's finish meets the next path's start. Where two paths finish at the same point, or start at the same point, Studio can still join them by reversing one of the two, so the joined path is drawn in a single direction. It does this automatically unless **Preserve Path Orientation** is on.

22.10.3 Randomize Starts of Closed Paths

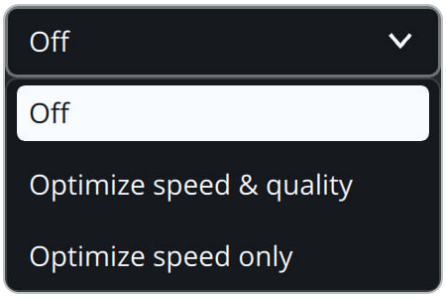
Randomize Starts of Closed Paths changes the start position of closed shapes. (Default: off)

This spreads the start marks of closed paths around, so they do not stack in one place in repeated patterns, circles, or generative artwork.

22.10.4 Path Reordering

Path Reordering controls how Studio optimizes stroke order. Reordering paths can reduce travel moves and shorten plotting time.

- **Off** — keeps the path order from the SVG file.
- **Optimize speed & quality** — balances pen-up travel distance against how evenly strokes are spread across the work area, which reduces visible artifacts from strokes clustering in one region. (Default)
- **Optimize speed only** — chooses the order with the least total pen-up travel, however the strokes are distributed.



*The **Path Reordering** menu*

Choose **Off** when the exact stroke order matters for your artwork.

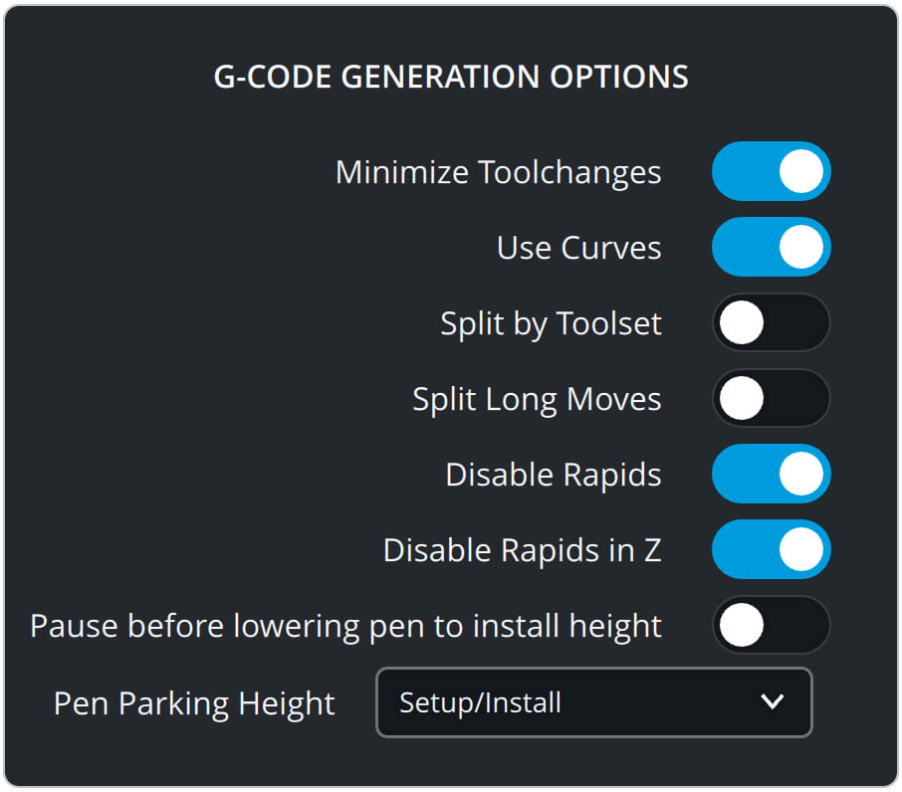
22.10.5 Preserve Path Orientation

Preserve Path Orientation keeps paths moving in the direction defined by the source file. (Default: off) It is unavailable while **Hidden Line Removal** is on.

Turn it on for calligraphic and brush strokes, and for any work where the direction of drawing changes how a stroke looks. With it off, Studio is free to reverse a path to shorten the pen-up travel before it, or to connect it to a nearby end. With it on, **Connect Nearby Ends** joins only paths whose directions already line up, so some nearby ends may stay unconnected.

22.11 G-Code generation options

G-CODE GENERATION OPTIONS, the second half of the **OPTIONS** sub-tab, affect how Studio writes the final machine instructions.



G-CODE GENERATION OPTIONS

22.11.1 Minimize Toolchanges

Minimize Toolchanges groups operations to reduce the number of times the machine stops for a tool change. (Default: on)

This is most useful on multi-color and multi-tool jobs, where it cuts the number of stops. Leave it off when the original order of operations is what you want.

22.11.2 Use Curves

Use Curves allows Studio to generate arc moves where appropriate. (Default: on)

When it is on, Studio fits arcs to the curves in the SVG and writes them as G2 or G3 arc commands, rather than as many short line segments.

> ***Aside:*** Turn this off when the G-Code goes to a machine or post-processing tool that does not handle arc commands, since every curve is then written as short line segments it can read.

22.11.3 Split by Toolset

Split by Toolset creates separate output files for each color, layer, or group, depending on the selected sorting method. (Default: off)

Turn it on to run separate files by hand, to control tool order yourself, or to prepare multi-tool jobs for microSD.

The setting applies to the whole job rather than to one page, so with several documents open every page is split. Three documents that each use four pens produce twelve per-tool files, alongside the main output file for each document. For how Studio names the files it writes, see §26.7 Output file names.

22.11.4 Split Long Moves

Split Long Moves divides long moves into smaller segments. (Default: off)

Shorter moves let the machine respond sooner when you pause it. Artwork with many long moves produces a larger G-Code file.

22.11.5 Disable Rapids

Disable Rapids replaces rapid pen-up travel moves with controlled feedrate moves. (Default: on)

Travel moves then run at a controlled feedrate rather than the machine's fastest speed, so they are slower but more predictable.

22.11.6 Disable Rapids in Z

Disable Rapids in Z disables rapid vertical movement when lifting and lowering the pen or tool. (Default: on)

Tool-up and tool-down moves then run at a controlled feedrate. **Disable Rapids** already includes them, since it turns off rapid moves on every axis.

22.11.7 Pause before lowering pen to install height

Pause before lowering pen to install height adds a stop to each tool change. (Default: off) When it is on, a tool change pauses with the tool still raised, so you can remove the previous tool and place the Pen Height Setup Tool; resume to lower the tool to its setup height and install the next one. The first tool in a job goes straight to its install height without this pause.

22.11.8 Pen Parking Height

Pen Parking Height controls how high the pen retracts when a plot is paused.

- **Pen-up travel:** Parks the pen at the normal travel height, for quicker resumes.
- **Setup/Install:** Parks the pen at the height used to install the tool, which makes the tool easier to adjust, replace, or inspect during a pause.

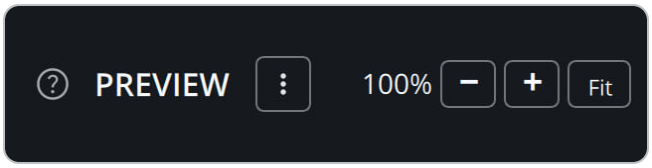
22.12 Preview

The **Preview** shows the strokes that will be plotted. It does not show unsupported SVG elements, such as raster images that cannot be plotted as paths.

The Preview includes rulers, zoom controls, the work area, margins, and a visual representation of the generated strokes. Click in the Preview to give it keyboard focus, then zoom and pan from the keyboard. §31.1 Keyboard shortcuts lists the keys and mouse gestures.

The Preview controls are:

- **Zoom percentage:** Shows the current zoom level.
- **Zoom out / Zoom in:** Changes the preview zoom.
- **Fit:** Fits the visible work area into the Preview.
- **?:** Opens a window listing the Preview's keyboard shortcuts and mouse controls.
- **Preview menu:** Opens additional rendering options.
- **Page navigator:** Appears below the Preview whenever the job runs to more than one page, as it does when several files are opened at once. The inner arrows step a page at a time, the outer arrows jump to the first or last, and typing a number goes straight there.



*The **Preview** toolbar*

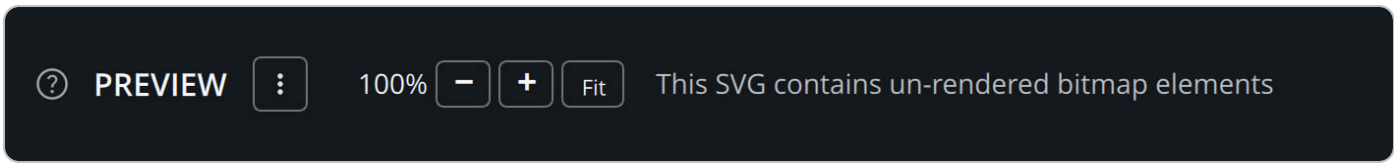


*The Preview's keyboard and mouse controls, from **?***

While a page is still being drawn, a line above the page navigator reports **Rendering…** or **Updating…**.

A status line in the Preview's toolbar, to the right of **Fit**, reports on the job as a whole. It shows an error that stops the job from being prepared; otherwise how many pages have rendered so far; otherwise a warning that

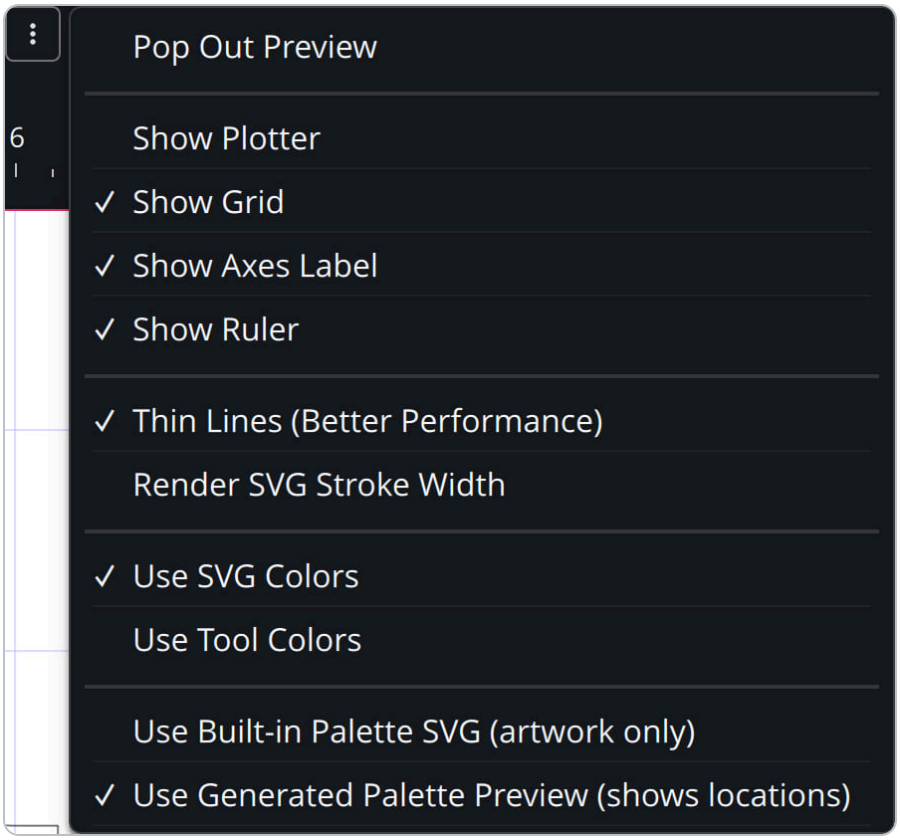
the document contains text or bitmap elements Studio does not draw. When there is nothing to report, the line is hidden.



The status line reports on the job as a whole

The **Preview menu**, the three-dot button beside the **Preview** title, controls how the preview is displayed:

- **Pop Out Preview:** Opens the preview in a separate window. While it is open, the main window shows a **DOCK PREVIEW** button that returns the Preview to the main window; closing the separate window does the same.
- **Show Grid:** Shows or hides the grid. (Default: on)
- **Show Axes Label:** Shows or hides the X/Y axis label. (Default: on)
- **Show Ruler:** Shows or hides the ruler. (Default: on)
- **Thin Lines (Better Performance):** Displays paths with thin preview lines for better performance. (Default: on)
- **Render SVG Stroke Width:** Displays SVG stroke widths in the preview. (Default: off)
- **Use SVG Colors:** Displays colors from the original SVG. (Default: on)
- **Use Tool Colors:** Displays colors from the assigned tools when available. (Default: off)
- **Show Plotter:** Draws the machine in the preview. Shown for ArtFrame only. (Default: on)
- **Use Built-in Palette SVG (artwork only):** Displays the built-in palette SVG when available. (Default: off)
- **Use Generated Palette Preview (shows locations):** Displays the generated palette preview when available. (Default: on)

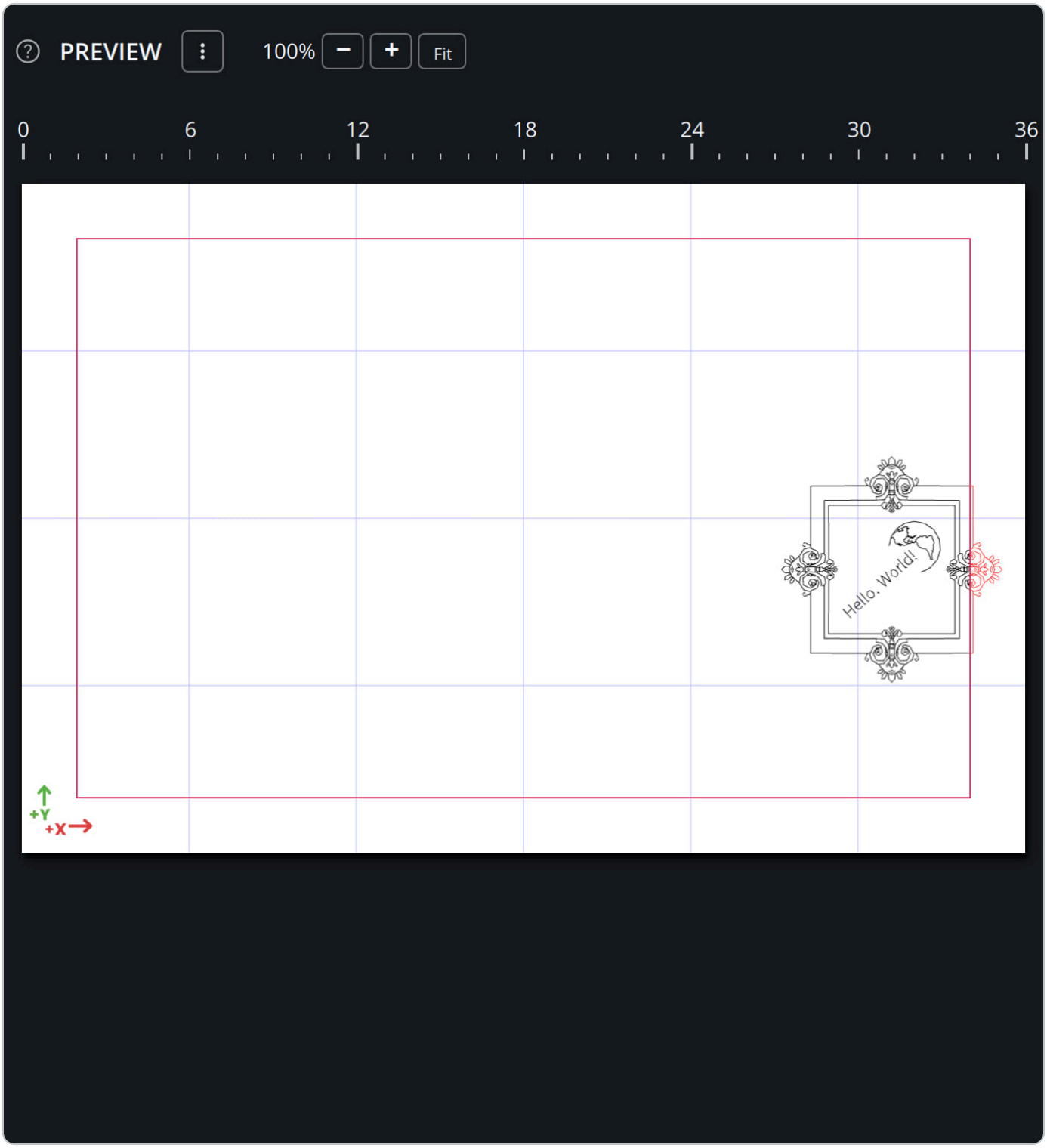


*The **Preview** menu*



DOCK PREVIEW *returns a popped-out Preview to the main window*

Margins and content are draggable in the Preview. Artwork outside the margins is shown in red and is cropped when processed.



Strokes outside the margins are drawn in red and cropped

The Preview shows the motion the machine will make: each stroke it will draw, and the travel between strokes. It leaves out anything the machine does not draw, such as fills, and it shows paths rather than how ink or paint will look on the paper.

22.13 The PROCESS AND SAVE button

When the job is ready, click **PROCESS AND SAVE** to generate output from the current Setup and Options.

The **PROCESS AND SAVE** button sits in the upper-right corner of the Studio window. Clicking the button itself processes the current job using the default output behavior; its chevron opens a menu of other save formats.

Processing creates output from the current machine selection, the **SETUP** sub-tab, the **OPTIONS** sub-tab, the tool assignments, and the previewed paths. It does not send anything to a machine: the output is written to disk, and uploading is a separate step.

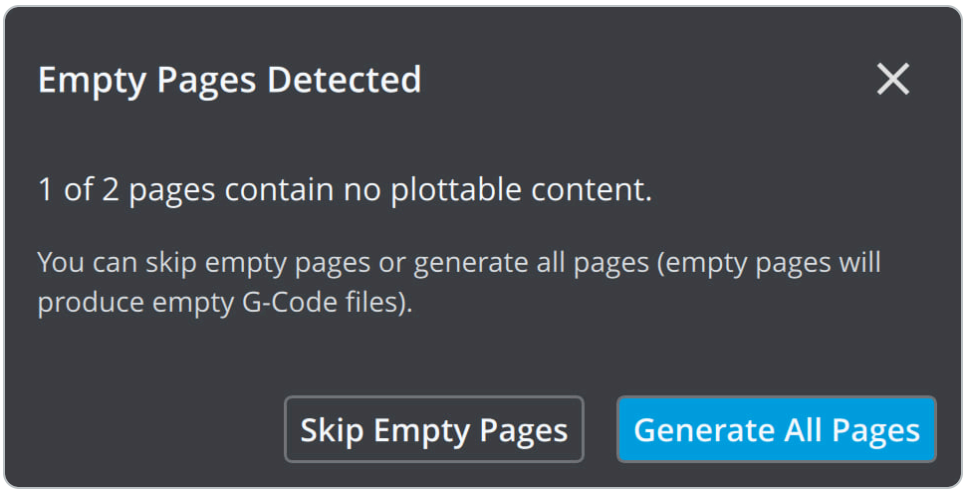
For everything **PROCESS AND SAVE** can produce — G-Code, SVG, Plob, the Setup Sheet that follows a G-Code export, and the Split by Toolset option — see §26. Studio: exporting output.

For connection and upload workflows, see §18. Sending files to your machine.

22.13.1 Empty pages in a batch

With more than one document open, Studio checks the pages for plottable strokes before it asks you where to put the output. When it finds pages that have none, an **Empty Pages Detected** dialog reports how many of how many, and warns that empty pages produce empty G-Code files. Two buttons carry you forward from it, and both go on to the folder picker:

- **Skip Empty Pages** — writes nothing for those pages. The batch produces fewer files than you have documents, and the ones it produces keep their own names.
- **Generate All Pages** — writes a file for every page, empty ones included. Each empty page's file is valid and contains no motion.



*The **Empty Pages Detected** dialog*

23. Studio: the SETTINGS tab

The **SETTINGS** tab holds global Bantam Tools Studio™ preferences, machine limits, machine-control preferences, help links, downloads, support links, and license tools. Studio keeps its settings between sessions, and most you set once and rarely revisit. This chapter documents each of them, in the order the tab presents them.

The **SETTINGS** tab is organized into several areas:

- **PROGRAM OPTIONS:** General Studio behavior and workflow preferences.
- **MACHINE OPTIONS:** Machine-specific size limits.
- **MACHINE CONTROL:** Connection and upload behavior.
- **HELP & REFERENCE:** Documentation, downloads, tools, and support links.
- **Bottom controls:** Reset, reload presets, update check, About, and License Manager.

23.1 Program options

The **PROGRAM OPTIONS** section holds general Studio behavior settings.

23.1.1 Display Units

Display Units toggles Studio between inches and millimeters. (Default: Inches)

Pressing ⌘U (Ctrl+U on Windows) switches units at any time.

23.1.2 Fit To Margins Also Centers

Fit To Margins Also Centers centers the artwork after fitting it to the available margin area. (Default: off)

23.1.3 Fit To Margins On Load

Fit To Margins On Load scales newly opened artwork to fit within the available margin area. (Default: off)

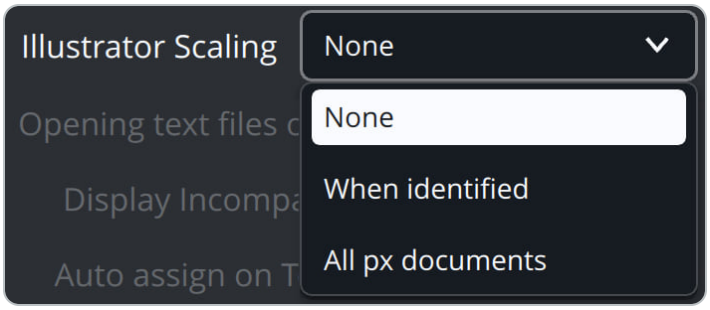
23.1.4 Center On Load

Center On Load centers newly opened artwork in the available work area. (Default: off)

23.1.5 Illustrator Scaling

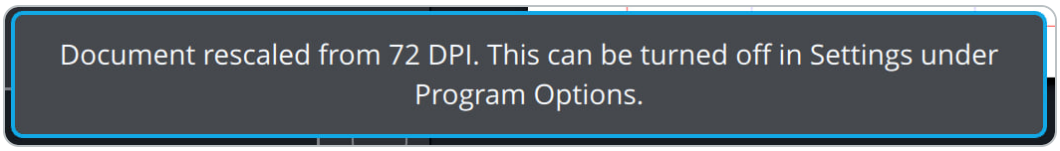
Some Adobe Illustrator files do not correctly encode the document size, and open in Studio at three-quarters of their intended size. **Illustrator Scaling** sets when Studio corrects those files automatically as they open.

- **None** — corrects nothing automatically. Any open document can still be corrected by hand; see §22.1 Opening files and file actions. (Default)
- **When identified** — corrects files that identify themselves as Illustrator exports.
- **All px documents** — also corrects files that carry no such identification. This can misscale correctly sized files from other programs, so it suits a workflow that is almost entirely Illustrator files.



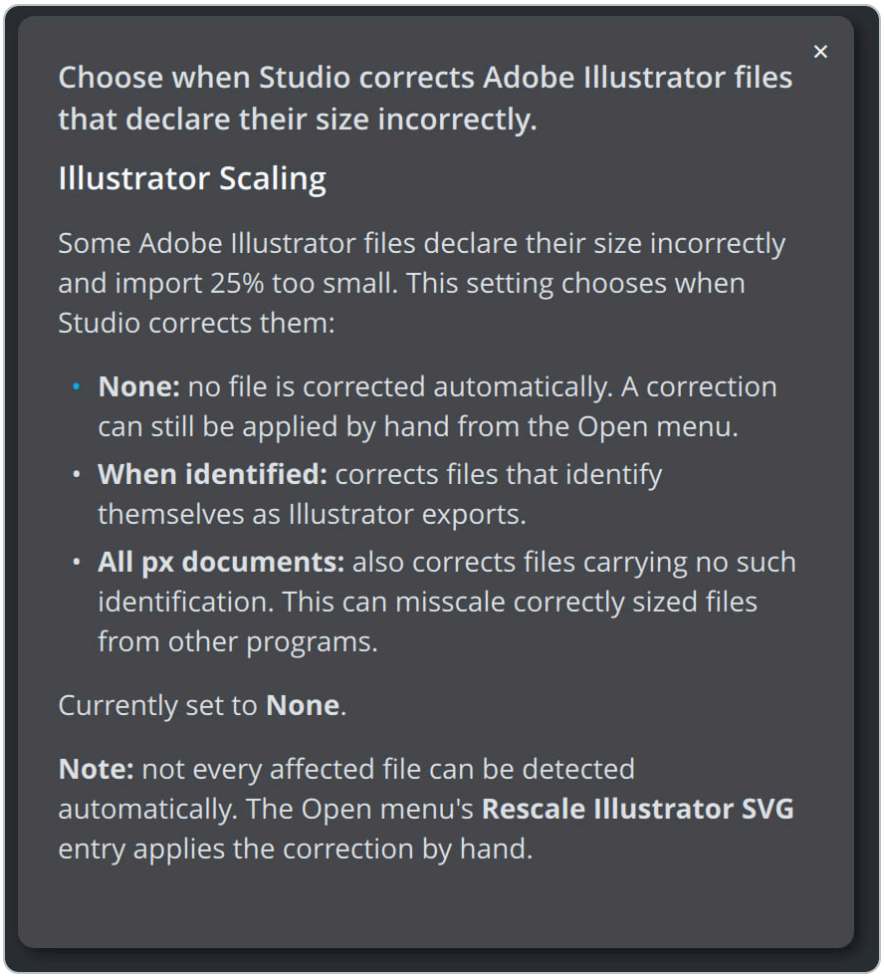
***Illustrator Scaling** menu open*

When Studio corrects a file as it opens, a notification says so and names this setting, where the automatic correction can be turned off. Opening several files at once gives one notification, with a count.



Notification after Studio corrects a file as it opens

To keep a file at its intended size from the start, set up the Illustrator document in physical units such as inches or millimeters, and export it with **File → Export → Export As** rather than **Save As**: choose the SVG format, check **Use Artboards**, and under **Styling** choose **Presentation Attributes**.



*Hover help for the **Illustrator Scaling** setting*

23.1.6 Auto assign on Toolset change

Auto assign on Toolset change updates tool assignments when you switch toolsets. (Default: off)

Switching from one pen toolset to another, for instance, maps the detected colors to the default tools in the new toolset, apart from rows you have set to **None; skip this task** or hidden.

23.1.7 Use the saved toolset in Prepare

Use the saved toolset in Prepare also selects a toolset on the **PREPARE** tab when you save it in the Tool Library. (Default: off) Checking **Use this toolset in Prepare** in the save confirmation turns this on.

23.1.8 Precision

Precision controls how closely generated paths follow the source geometry. (Default: 0.05 mm)

A smaller value preserves more detail, at the cost of larger files and longer processing. A larger value simplifies and smooths paths and processes faster, at the cost of detail.

23.1.9 Pre-generate next queued job

Pre-generate next queued job lets Studio prepare the next queued job in advance. (Default: on)

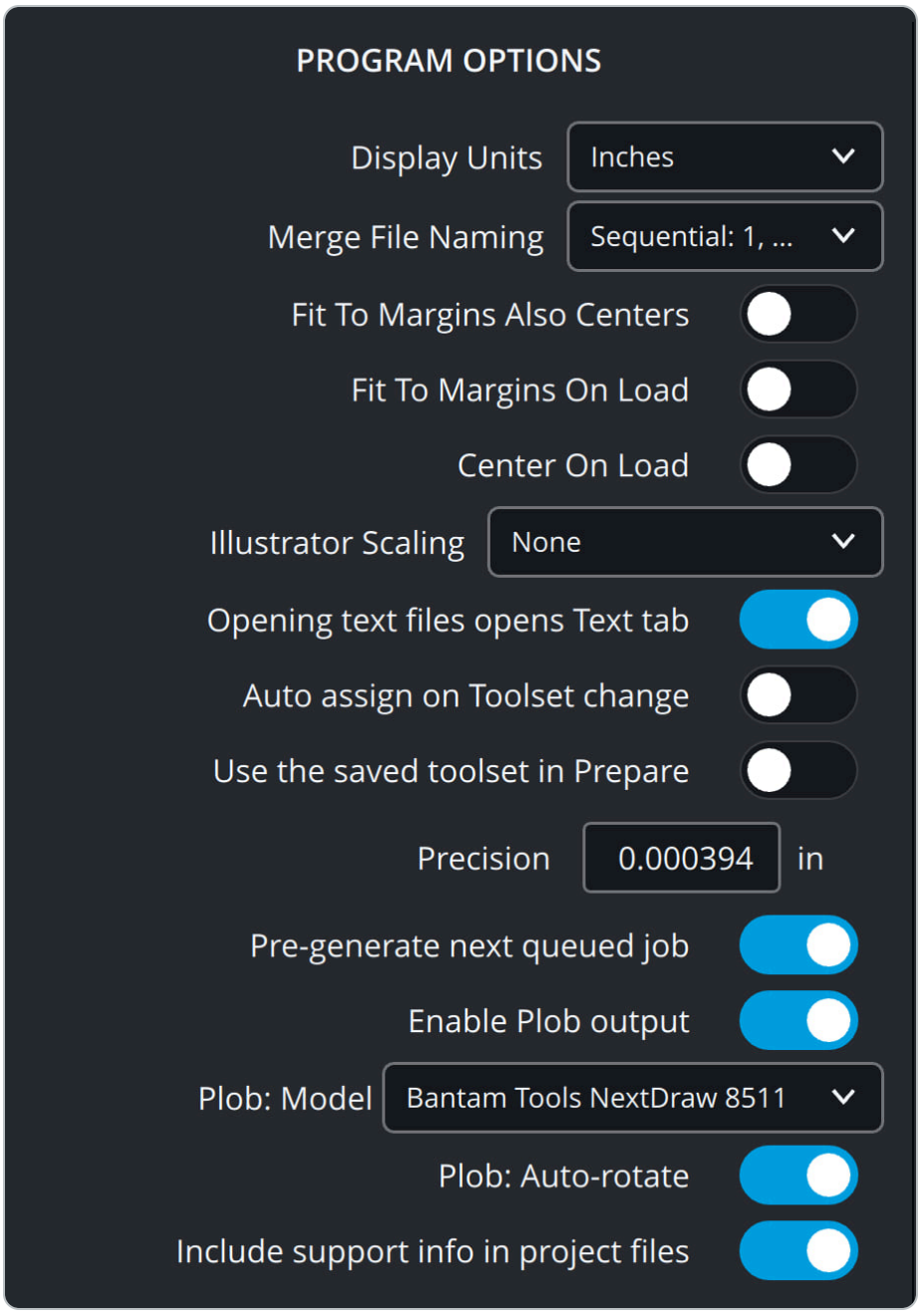
This helps automated or high-volume queues move more smoothly.

23.1.10 Enable Plob output

Enable Plob output adds a **Save as Plob** option to Studio. (Default: off)

Plob, short for "Plot Object," is a highly specialized kind of SVG file, processed in advance for fast plotting workflows. Turning this setting on reveals a **Plob** sub-group with two additional options:

- **Plob: Model** — the AxiDraw or NextDraw model the Plob file is prepared for, recorded in the file. (Default: Bantam Tools NextDraw 8511)
- **Plob: Auto-rotate** — rotates the artwork to best fit the target machine's work area. (Default: on)



***PROGRAM OPTIONS** with **Enable Plob output** on, showing the **Plob** rows*

For more about Plob and how to export one, see §26. Studio: exporting output.

23.1.11 Include support info in project files

Include support info in project files saves a small, redacted diagnostic record inside every project file, so Bantam Tools support can diagnose a problem from a project file you send. (Default: on) The record holds app and system versions, recent activity, and recent log lines; passwords, Wi-Fi network names, and your user name are removed. Projects you save after turning it off don't carry the record. See §26.4 Project files.

23.2 Machine options

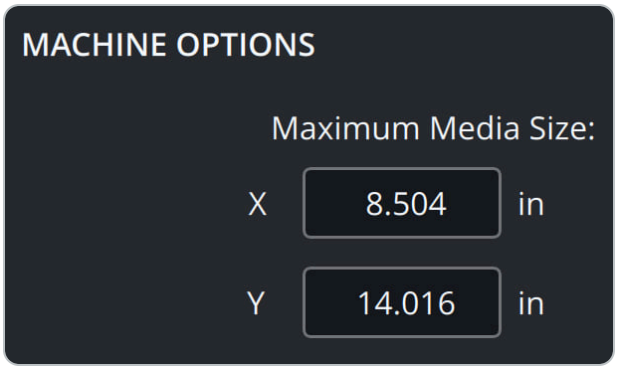
The **MACHINE OPTIONS** section holds machine-specific limits.

23.2.1 Maximum Media Size

Maximum Media Size defines the maximum X and Y work area for your machine.

It keeps Studio from generating output beyond the safe drawing area, so a job that would run past the edge is caught before it reaches the machine. It does not change the document size or the margins; those live on the **PREPARE** tab.

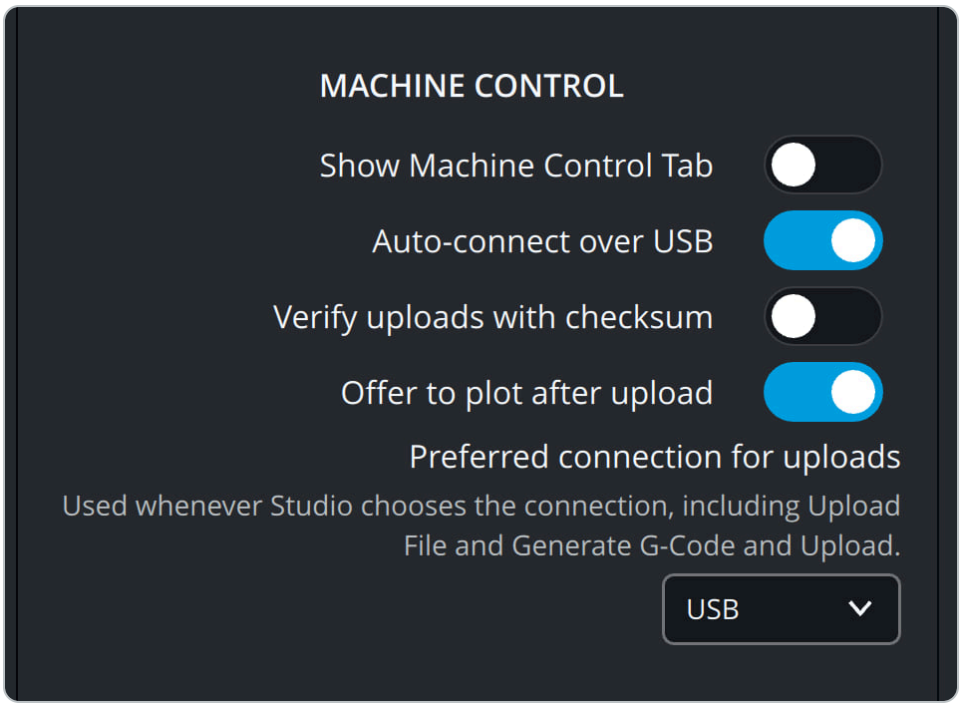
Change these values only for a special setup.



Maximum Media Size *fields*

23.3 Machine control

The **MACHINE CONTROL** section holds the settings for connecting to a machine and uploading files to it.



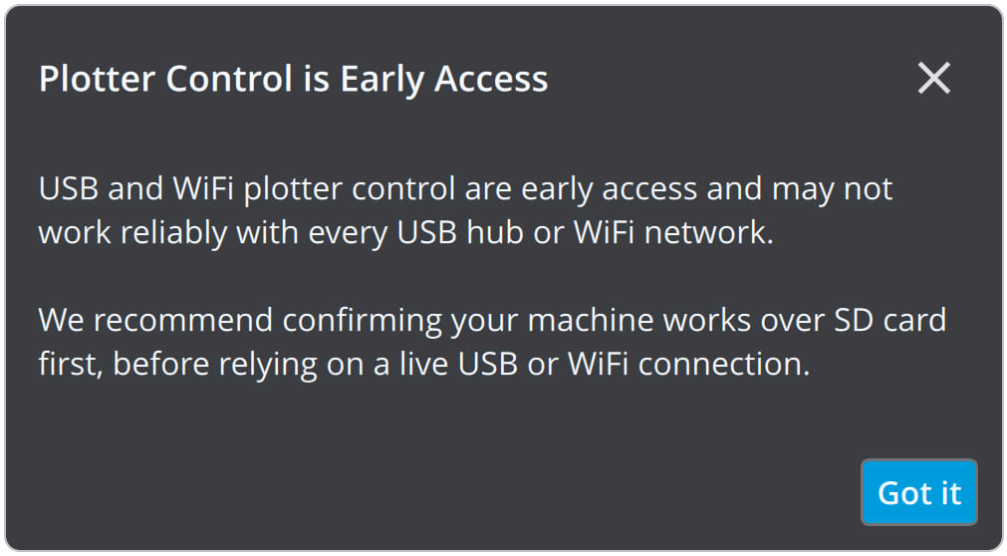
*The **MACHINE CONTROL** settings*

23.3.1 Show Machine Control Tab

Show Machine Control Tab shows or hides the **MACHINE** tab, where you connect to a machine, control it directly, browse the files stored on it, and manage the upload queue. (Default: off) §25. Studio: the MACHINE tab covers the tab itself.

The setting governs more than the tab. With it off, the actions that send a job straight to a machine are unavailable as well: **Generate G-Code and Upload** on the **File** menu is grayed out, and the Setup Sheet omits its upload actions. Moving G-Code to your machine on a microSD card needs none of this, so the setting can stay off.

Turn this setting on once your machine is up and running from the microSD card. A USB or WiFi connection then adds convenience to a machine you already know works. Studio gives the same advice the first time you turn the setting on, in a dialog titled **Plotter Control is Early Access**.



*The advice Studio shows the first time you turn on **Show Machine Control Tab***

23.3.2 Auto-connect over USB

Auto-connect over USB has Studio connect to a machine over USB as soon as one is detected. (Default: on)

With it off, connecting is a deliberate act: the **Connect** button on the **MACHINE** tab.

23.3.3 Verify uploads with checksum

Verify uploads with checksum has Studio confirm, after each upload over USB, that the file on the machine matches the file Studio sent. (Default: off) Uploads over WiFi are always checked against the size Studio sent, whether or not this is on.

It adds a brief verification step after each USB upload completes.

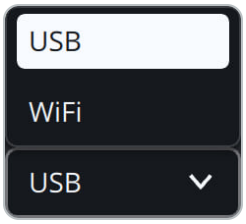
23.3.4 Offer to plot after upload

Offer to plot after upload keeps the upload dialog open when a G-Code file finishes uploading, with a **Plot Now** button. (Default: on) With it off, the dialog closes with an "Upload complete" message. Checking **Don't show this again** in the dialog turns this off.

23.3.5 Preferred connection for uploads

Preferred connection for uploads sets which connection **Upload File** and **Generate G-Code and Upload** use:

- **USB** (Default)
- **WiFi**

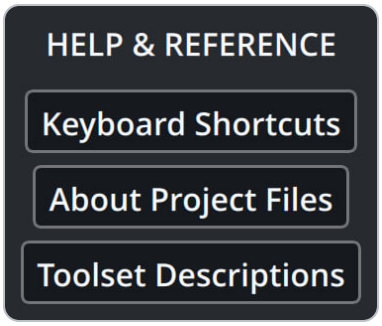


*The **Preferred connection for uploads** menu*

If that connection isn't available, Studio uses the other one and says so, as in **Upload falling back to USB — plotter unreachable on WiFi.** For connection and upload workflows, see §25. Studio: the MACHINE tab.

23.4 Help and reference

The **HELP & REFERENCE** section links to built-in help, documentation, downloads, tools, and support resources.



***HELP & REFERENCE** buttons*

23.4.1 Keyboard Shortcuts

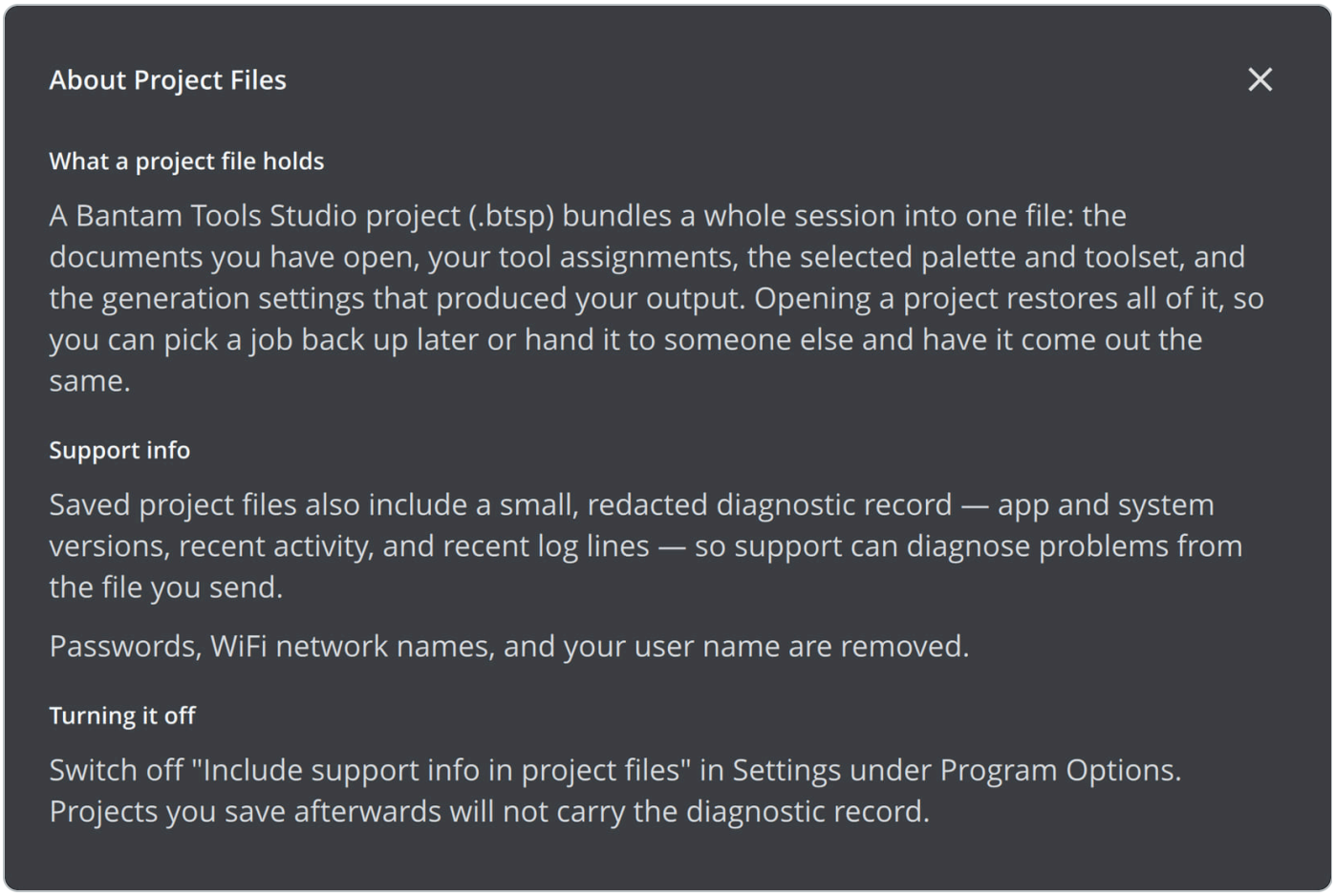
Keyboard Shortcuts shows common keyboard shortcuts for Studio. The same list, with the macOS and Windows forms side by side, is in §31.1 Keyboard shortcuts.



***Keyboard Shortcuts** window*

23.4.2 About Project Files

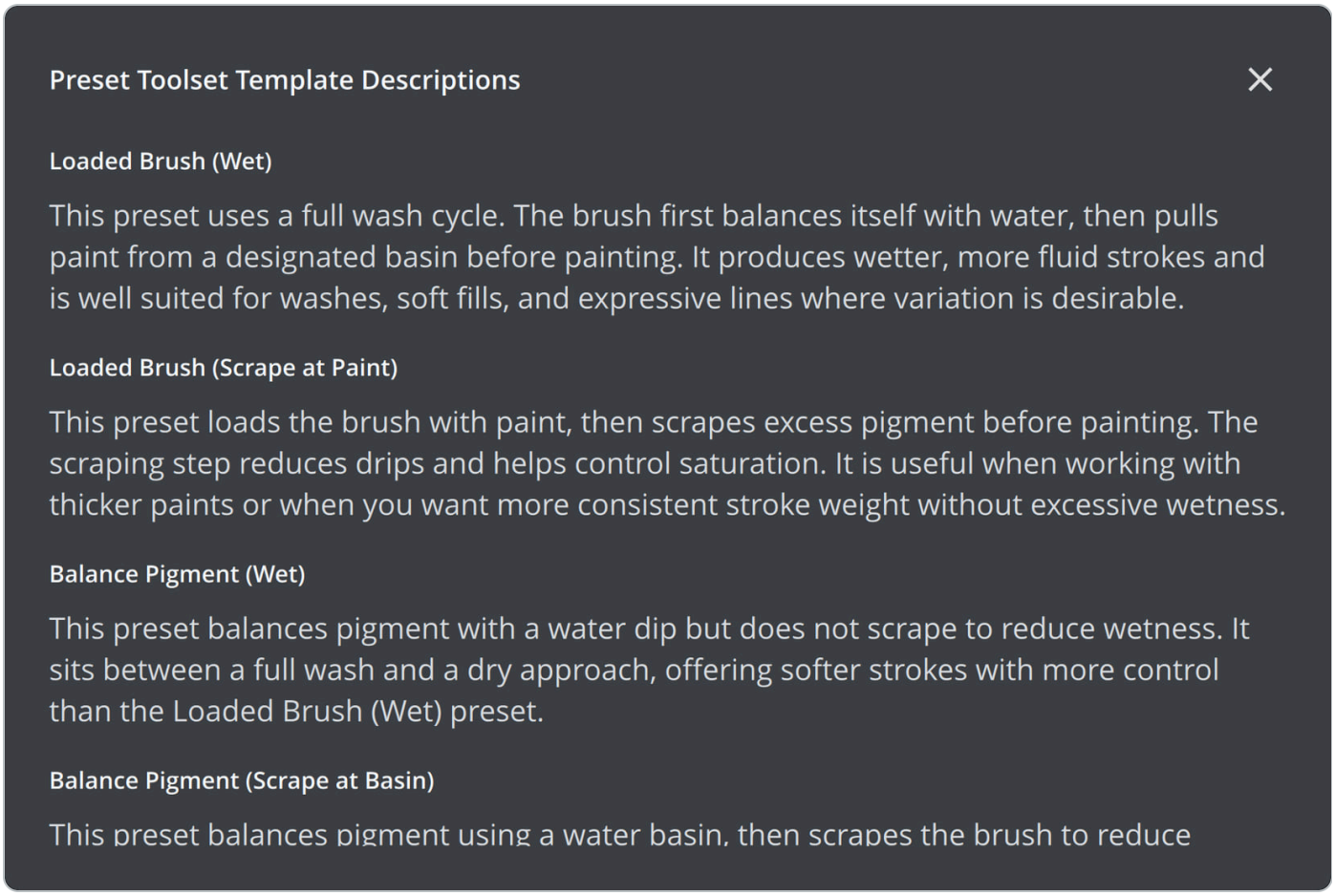
About Project Files explains what a project file (`.btsp`) holds, the support information saved inside it, and how to turn that off. See §26.4 Project files.



About Project Files *window*

23.4.3 Toolset Descriptions

Toolset Descriptions provides reference information about the included toolsets.



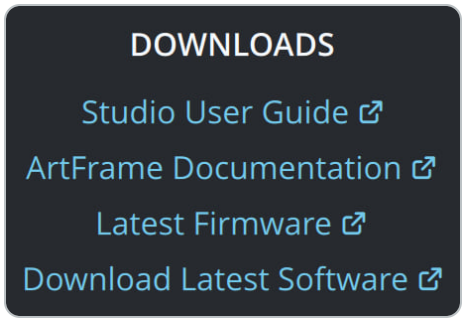
Preset Toolset Template Descriptions *window*

23.5 Downloads

The **DOWNLOADS** section links to documentation and software resources. Each label ends in ↗ because the link opens a web page in your browser.

The links are:

- **Studio User Guide** ↗ — the Bantam Tools Studio guide.
- **ArtFrame User Guide** ↗ — this guide.
- **ArtFrame Documentation** ↗ — the ArtFrame documentation page.
- **Latest Firmware** ↗
- **Download Latest Software** ↗



DOWNLOADS *links on ArtFrame*

These links reach the current documentation, the current firmware, and the latest Studio download.

23.6 Tools

The **TOOLS** section links to related Bantam Tools utilities.

23.6.1 Image Processor

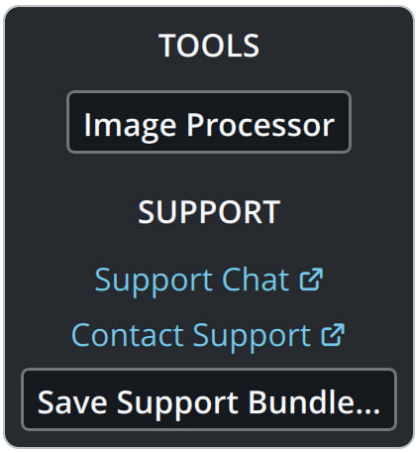
Image Processor opens the Bantam Tools Image Processor™ in its own window. It converts a photograph or other raster image into an SVG file of strokes, ready to draw or paint. With no image loaded yet, the window opens with a sample image.

23.7 Support

The **SUPPORT** section links to the routes for getting help.

The links are:

- **Support Chat** — the Bantam Tools community chat (bantam.tools/chat).
- **Contact Support** — the Bantam Tools support site (bantamtools.com/support).
- **Save Support Bundle...** — saves a diagnostic bundle to send to support (⇧⌘D / Ctrl+Shift+D).



***TOOLS** and **SUPPORT** sections*

Please use these links for help with installation, licensing, machine setup, connection issues, or output quality.

23.8 Bottom controls

The bottom of the **SETTINGS** tab holds additional global controls.



*Bottom controls of the **SETTINGS** tab*

23.8.1 Reset All Settings

RESET ALL SETTINGS restores Studio settings to their defaults: program options, path generation options, layout, and machine settings, which take the defaults for the machine currently selected. Your Tool Library is not affected. Studio asks you to confirm before it resets anything.

It is the way back to a clean configuration when preferences have drifted into a confusing state.

Holding **Option** (Mac) or **Alt** (Windows) while clicking **RESET ALL SETTINGS** performs a factory reset, which returns Studio to its on-install state. It clears everything Studio stores except your license activation:

- Every setting and program option

- Every custom tool, toolset, and palette, leaving only the built-in presets
- Every saved settings profile, leaving only the built-in defaults
- Custom colors

Studio then restarts to the machine-selection splash screen.

> ***Important note:*** A factory reset cannot be undone. Export any custom toolsets you want to keep before you use it; see §24. Studio: the Tool Library.

23.8.2 Reload Tool Presets

RELOAD TOOL PRESETS reloads the factory tool presets, and leaves your own tools and toolsets alone. Use it to return the built-in presets to their factory values.

23.8.3 Check for Updates

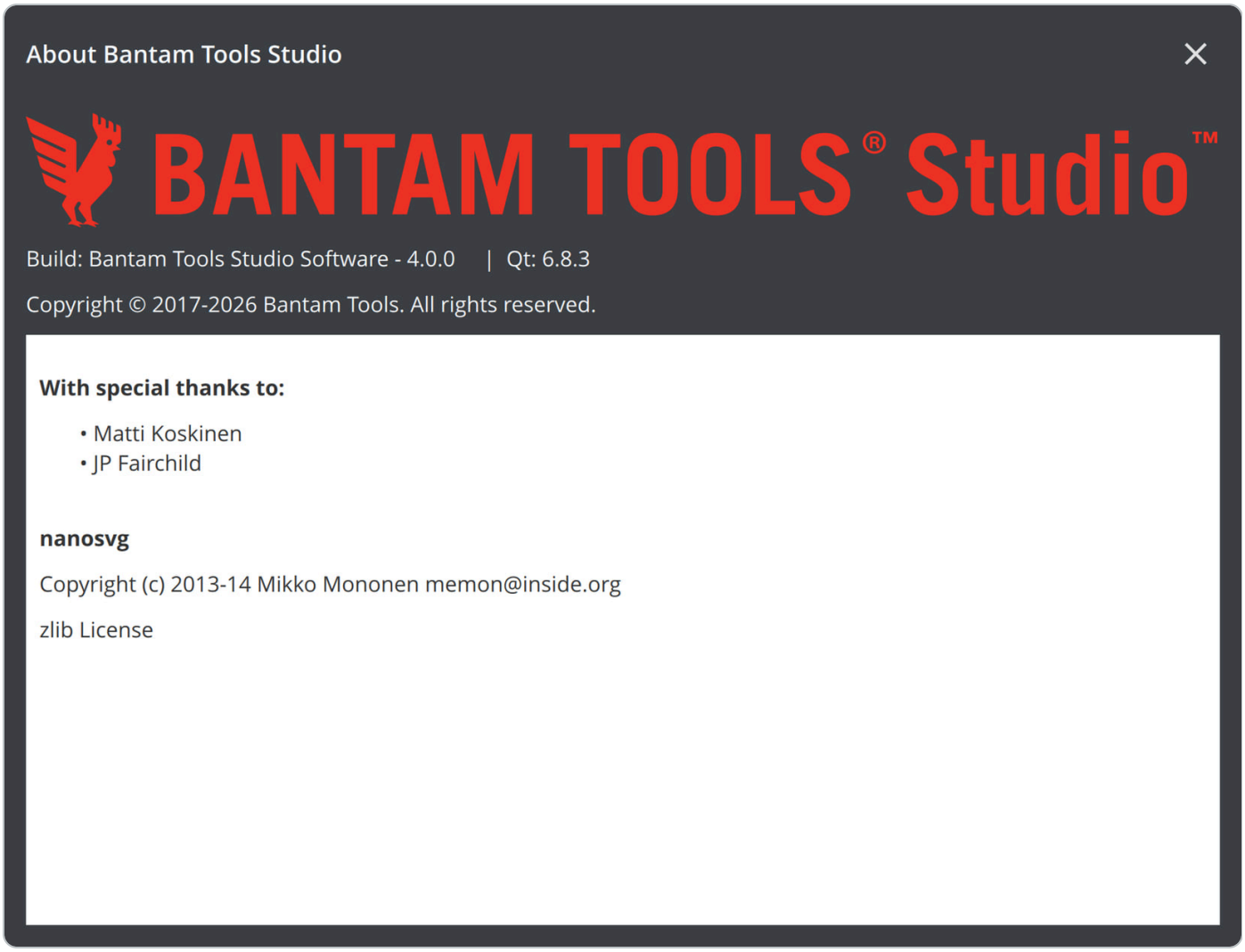
CHECK FOR UPDATES checks online for the latest version of Studio and opens the **Update Bantam Tools Studio** window. The window shows **Your version** and, when a newer version is available, **Newest version** along with links to its release notes and its download.

Below that, the **Plotter Firmware** section shows **Latest firmware**, the newest machine firmware this version of Studio knows of, and **Your plotter**, the firmware version of the machine you are connected to, marked **(via USB)** or **(via WiFi)**. With no machine connected, it reads **Connect a plotter to see its firmware version**. When the connected machine's firmware is older than the latest, the section adds **Firmware update available**, with a link to the firmware download page (bantam.tools/fw); see §11.11.6 Updating the firmware.

Studio also checks once shortly after it starts, and opens this window on its own when a newer version is available.

23.8.4 About

ABOUT shows version and application information.

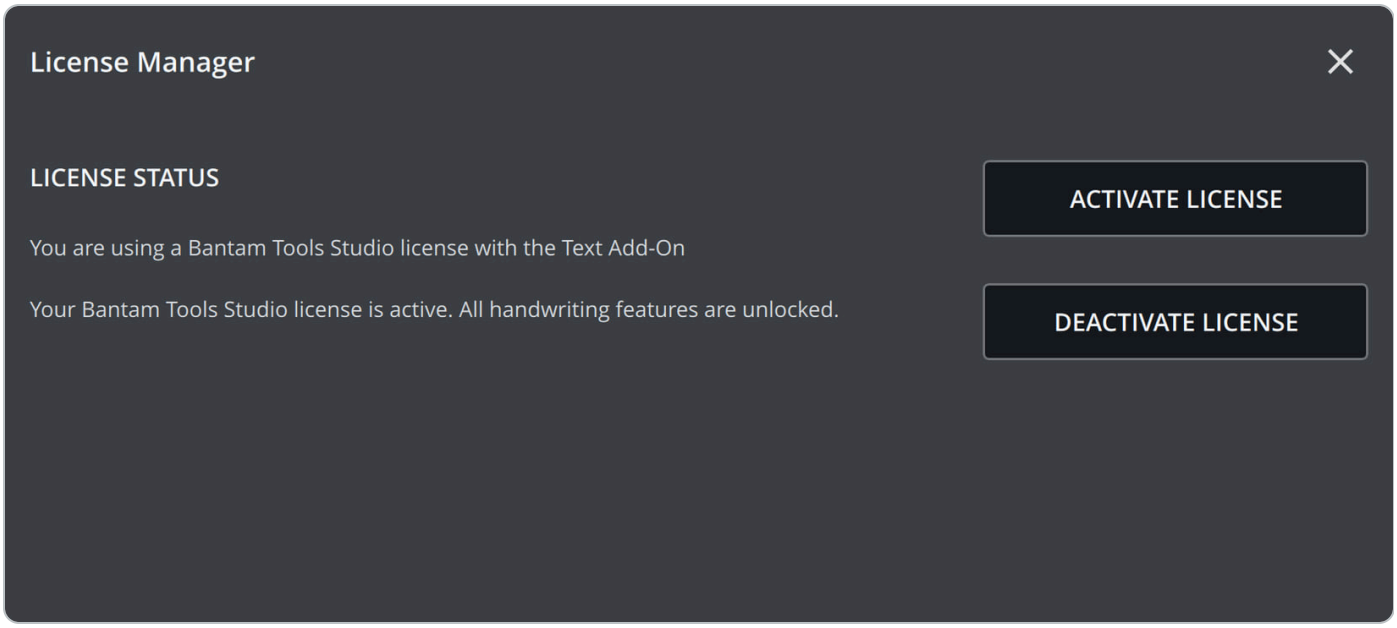


About Bantam Tools Studio *window*

23.8.5 License Manager

LICENSE MANAGER opens the license tools for activating, deactivating, or checking your Studio license.

It is where a new computer is activated, and where access to licensed features is managed.



License Manager *window with an active license*

24. Studio: the Tool Library

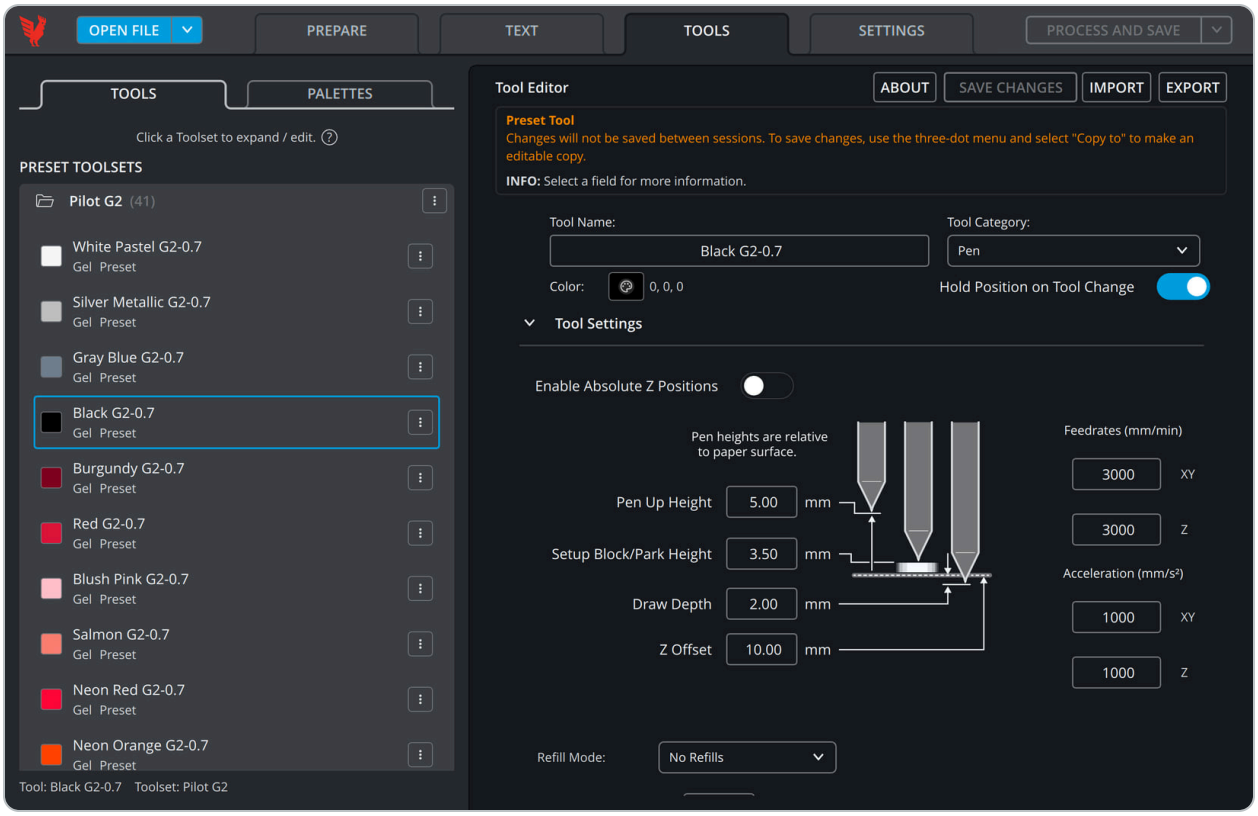
The **Tool Library**, in Bantam Tools Studio™, is where you look through your tools, choose them, and create your own — the pens and brushes your ArtFrame holds — along with the settings for drawing with each one. Open it from the **TOOLS** tab (⌘3 / Ctrl+3), or from the **View** menu.

- A **tool** is one physical pen or brush, plus its settings: how high it lifts, how it reaches the paper, how fast it moves, and what it does when it needs a refill or a change.
- A **toolset** is a named collection of tools. Every job draws its tools from the toolset that is selected when you process and save it, both in a project file and in every export. A job that uses several pens or brushes needs a toolset that holds all of them.

The preset toolsets are tuned for your machine and for the tools we recommend, and are ready to use as they are. To change one, copy it into a toolset of your own.

Editing a tool changes what it does the next time it is used. Choosing which tool draws which part of your artwork happens on the **PREPARE** tab.

A small line at the top of the tool list — "Click a Toolset to expand / edit." — is your reminder that toolsets are collapsible; click one to reveal the tools inside it. A status line at the bottom of the tool list also shows which tool and toolset are currently selected.



TOOLS** tab with the **Black G2-0.7** tool open in the **Tool Editor

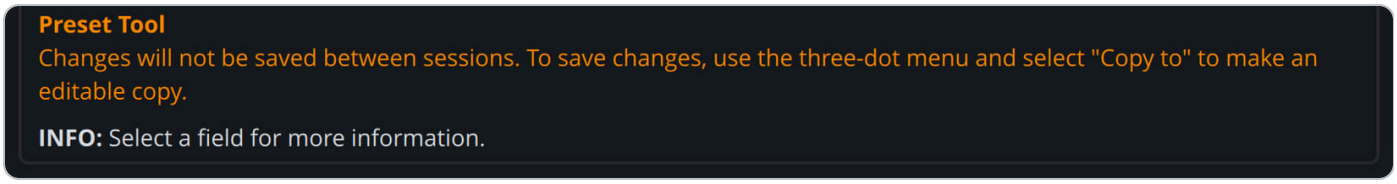
24.1 Preset and user toolsets

The tool list is organized into three sections:

- **PRESET TOOLSETS** — toolsets Bantam Tools built and tuned for you.
- **USER TOOLSETS** — toolsets you have created or duplicated.
- **UNGROUPED TOOLS** — tools that are not currently filed into any toolset.

UNGROUPED TOOLS is also a catch-all: put tools there and you can use them together, if you want every one of your tools available all the time. Toolsets keep each job's choices clear, though. For example, you might keep one toolset of gel pens in different colors, another of fiber-tip markers, and one for each set of paints.

You can change a preset tool's fields and plot with the result, but changes to preset toolsets and their tools are not saved: the values revert when you quit Studio. Selecting one shows a banner reading "Preset Tool" or "Preset Toolset" that says so. To keep your changes, use **Copy to**, in the three-dot menu, to make an editable copy.



The banner on a preset tool

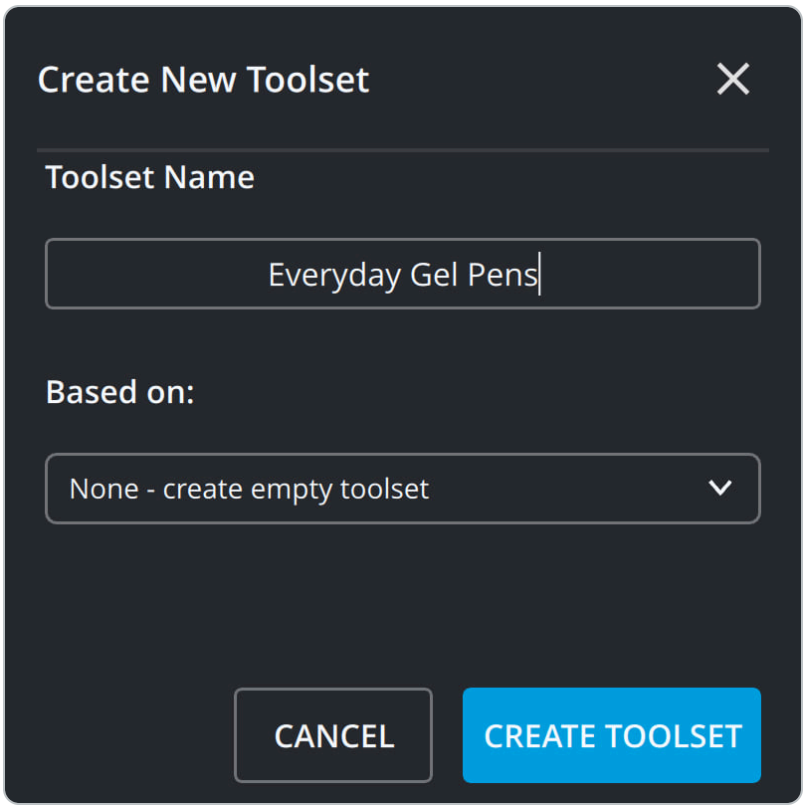
The ArtFrame's preset toolsets are listed with its other pen and brush settings; see §14.5 Preset toolsets.

24.2 Creating and duplicating toolsets

To start a new toolset, click **Create new toolset** under User Toolsets. The **Create New Toolset** dialog asks for:

- **Toolset Name**
- **Based on:** Choose **None - create empty toolset**, or pick any existing user or preset toolset to start from a copy of it.

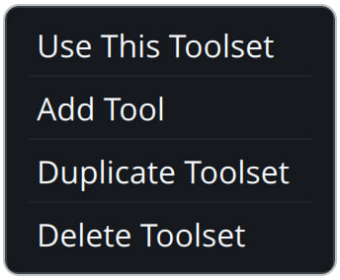
Click **CREATE TOOLSET** to finish, or **CANCEL** to back out. The new toolset appears under USER TOOLSETS, selected and ready to edit.



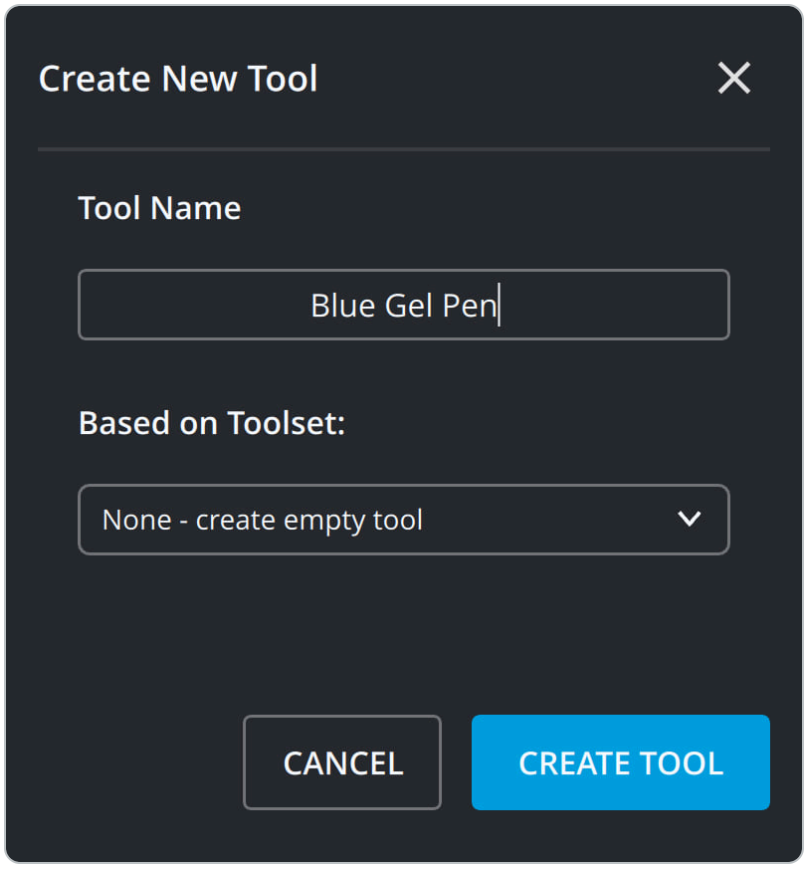
*The **Create New Toolset** dialog*

Clicking the menu button on a toolset gives you:

- **Use This Toolset** — makes it the active toolset for the current job.
- **Add Tool** — adds a new tool to that toolset. A small dialog lets you name the new tool and optionally base its starting settings on another toolset.
- **Duplicate Toolset** — copies the toolset, including preset toolsets.
- **Delete Toolset** — available for user toolsets only.



The menu on a user toolset



***Add Tool** opens the **Create New Tool** dialog*

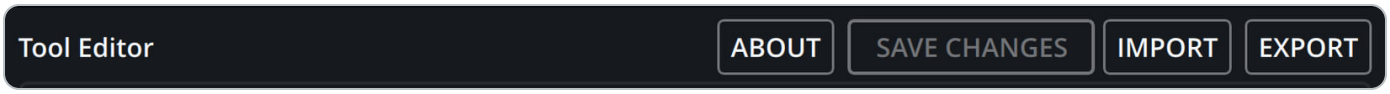
We recommend duplicating a preset rather than building a toolset from scratch, since the preset's heights and feedrates are already close to correct for the tool it was tuned around; start empty only when your tool has nothing in common with any preset.

Name new toolsets clearly so they are easy to identify later. Useful names might include the tool type, material, machine, or workflow.

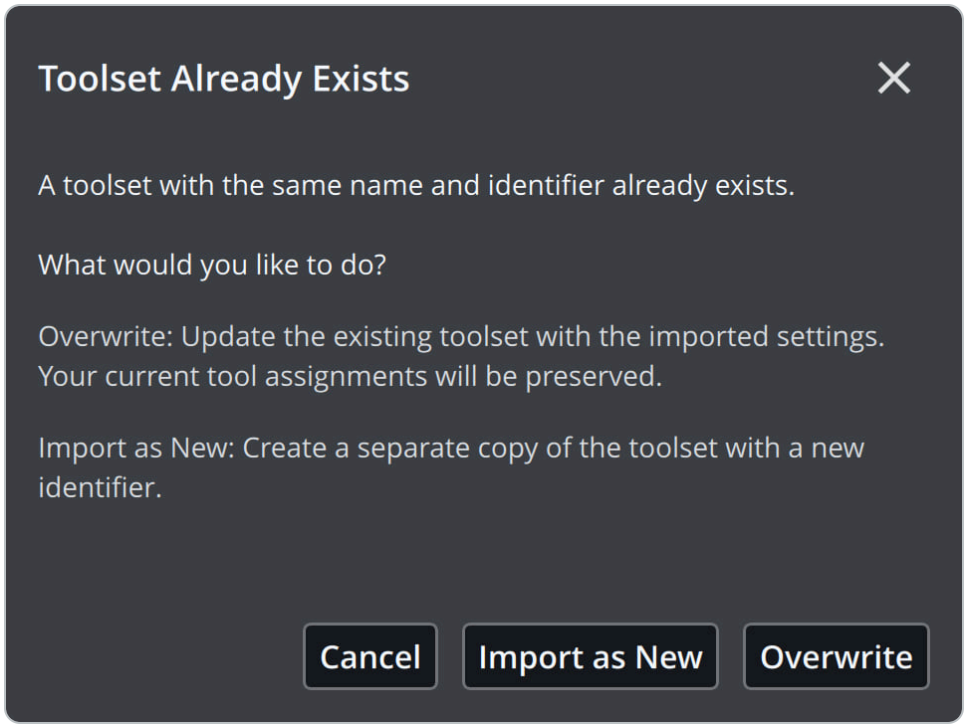
24.3 Importing and exporting toolsets

The editor header shows four buttons: **ABOUT**, **SAVE CHANGES**, **IMPORT**, and **EXPORT**. **SAVE CHANGES** and **EXPORT** stay grayed out until a tool or toolset is selected.

- **IMPORT** brings in a JSON file containing a previously exported tool or toolset. An **Import from JSON** dialog first asks what the file holds: click **TOOL** or **TOOLSET**, then choose the file.
    - **For a tool,** an **Import Tool** dialog asks where to store it. Choose **Main Library (No Toolset)** or a toolset from the list, then click **IMPORT**.
    - **For a toolset,** if a toolset with the same name and identifier already exists, Studio asks whether to **Overwrite** it (keeping your current tool assignments) or **Import as New** (create a separate copy with a new identifier).
- **EXPORT** becomes available once you select a tool or toolset, and saves it as a JSON file. When the export finishes, **Open File Location** shows the saved file.



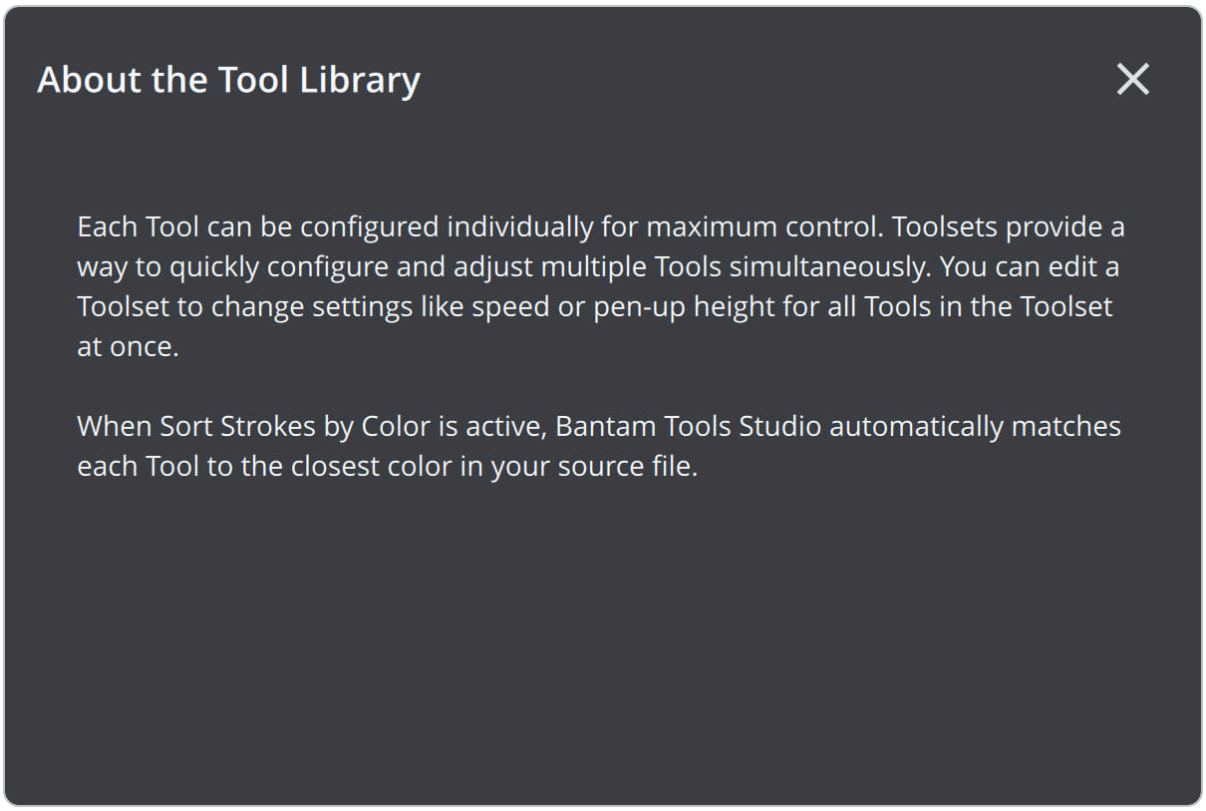
The editor header buttons



*Importing a toolset that already exists: **Overwrite** or **Import as New***

An exported JSON file holds a toolset's tuned settings outside Studio, so it can back up a custom toolset before a software update, move your pens to another computer, or give a teammate the same calibration.

ABOUT opens a short explainer covering how tools and toolsets relate: toolsets let you adjust settings like feedrate or pen up height across every tool in the set at once, and when Sort Strokes by Color is active, Studio automatically matches each tool to the closest color in your source file.



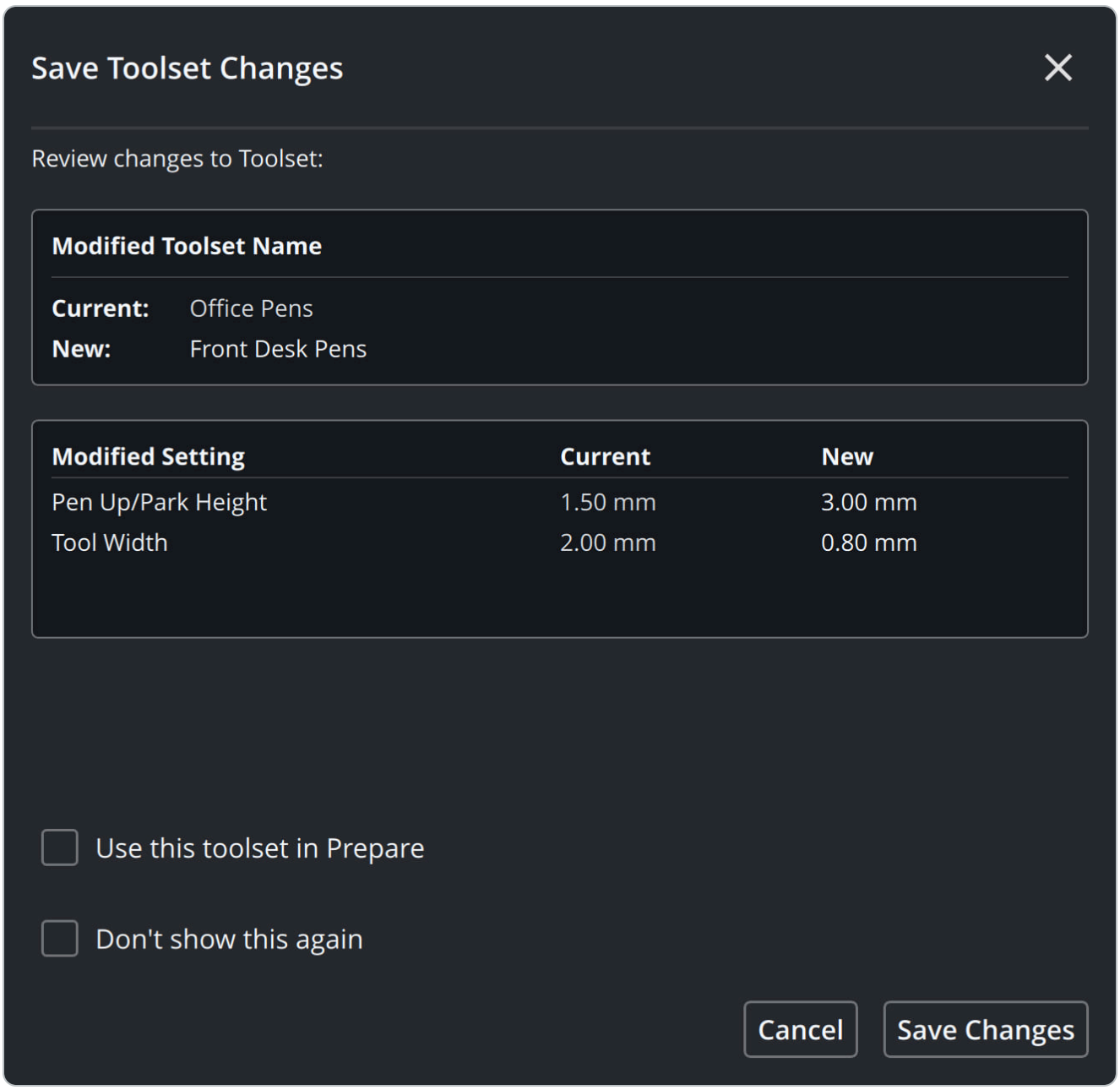
*The **About the Tool Library** dialog*

24.4 Editing a whole toolset

Select the toolset itself, rather than a tool inside it, to edit settings shared across every tool in that set. For example, you can raise every tool's feedrate at once while leaving each tool's individual pen heights untouched.

If the tools in a toolset currently have different values for a field, that field shows "Various" until you enter a new value — at which point the new value applies to every tool in the set. Leaving a "Various" field alone is safe: it is not a value, and nothing is written to the tools underneath it.

Click **SAVE CHANGES** before leaving the page. A confirmation lists each changed setting's current and new value before the changes are applied. Checking **Don't show this again** in it saves later changes without the list. If the toolset is not the one selected on the **PREPARE** tab, the confirmation also offers **Use this toolset in Prepare**, which selects the toolset there once it is saved. Your choice is remembered for later saves. Hold ⌥ (Option) while your pointer is over the button (Alt on Windows) to change it to **REVERT**, which discards your pending edits instead of saving them.



The confirmation before a toolset's changes are saved, listing each setting's current and new value

If you leave a tool or toolset with unsaved edits, a separate **Unsaved Changes** prompt asks what to do with them. Checking **Don't show this again (always discard)** in that prompt discards unsaved edits without asking from then on.

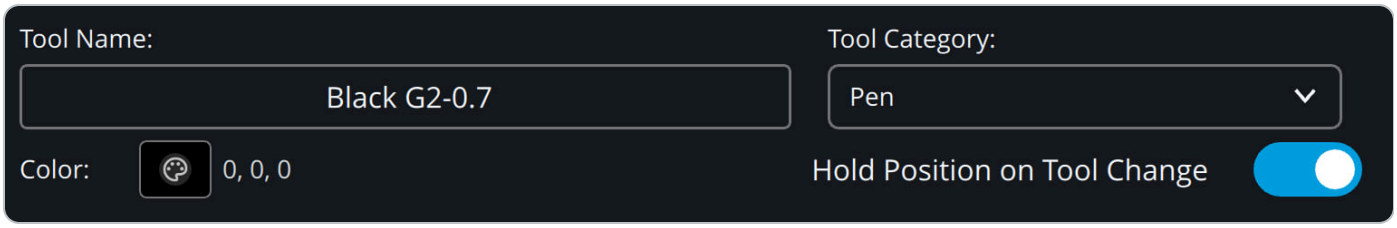
24.5 Editing an individual tool

Select a tool to edit its settings. For example, you can rename the tool, change its color, or have the machine pause for it at a tool change:

- **Tool Name:** The name shown in the tool list and on the **PREPARE** tab.
- **Color:** Used to match colors in your source file for automatic tool assignment; otherwise, it is informational only. Changing it does not change the ink or paint the tool carries, and it does not restrict

which strokes the tool can draw.

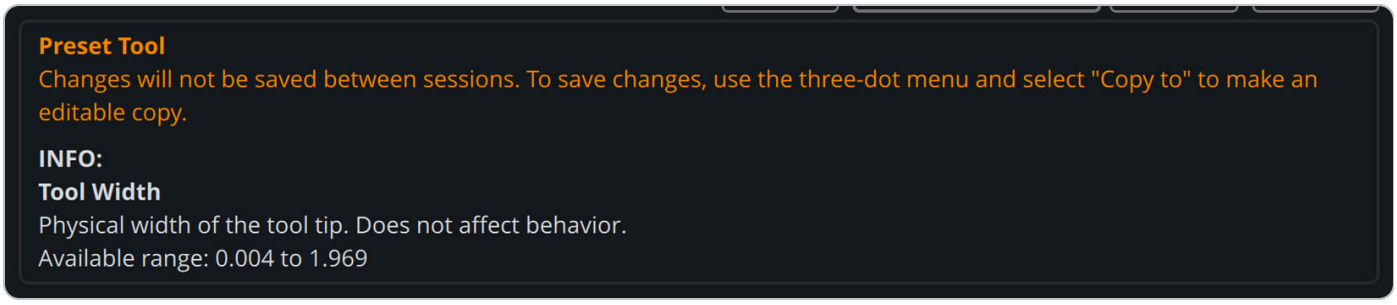
- **Tool Category: Pen** or **Brush**. It decides which height settings the tool shows; see §14.6 Pens and brushes.
- **Hold Position on Tool Change:** When enabled, the machine stops at a tool change so you can install or swap the tool by hand. See §14.12 Tool changes and refills.



*A tool's **Tool Name**, **Tool Category**, **Color**, and **Hold Position on Tool Change***

The rest of a tool's settings, including its heights, speeds, and refills, are in its **Tool Settings** section. The heights and speeds are covered with the ArtFrame's other pen and brush settings; see §14. Setting up pens and brushes.

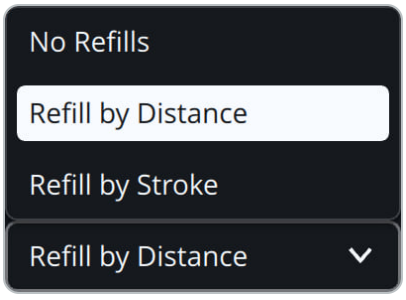
Tip: Click or hover over any field to see a short description of what it does at the top of the panel.



Clicking a field describes it at the top of the panel

Refill Mode, also in **Tool Settings**, sets whether and how often the tool stops to refill:

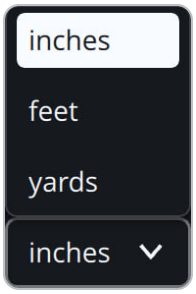
- **No Refills**
- **Refill by Distance** — the field reads **Refill Distance**: how far the tool draws before it refills, where 0 turns refills off. The refill comes at that exact distance, wherever it falls: at the start, the middle, or the end of a stroke. Afterward, the tool returns to the point where it stopped and continues the stroke.
- **Refill by Stroke** — the field reads **Refill After Strokes**: how many strokes the tool draws between refills. Refills come only between strokes, so a stroke is never interrupted, however long it is.



*The **Refill Mode** menu*

A units menu beside **Refill Distance** chooses whether the distance is shown in mm or m, or in inches, feet, or yards. The menu changes only how the distance is displayed, not the distance itself.

What a refill does, and when it is useful, depends on the machine; see §14.12 Tool changes and refills. A tool you create with **Add Tool** starts at **Refill by Distance**, with a distance of 600 m.



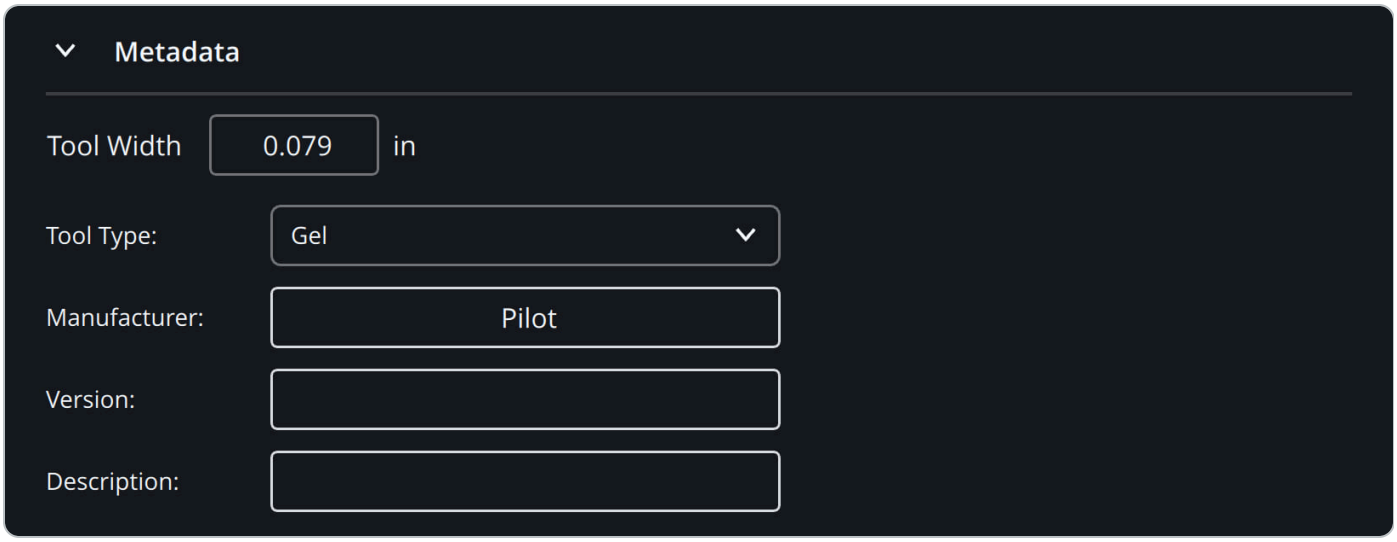
*The units menu beside **Refill Distance***

24.6 The Metadata section

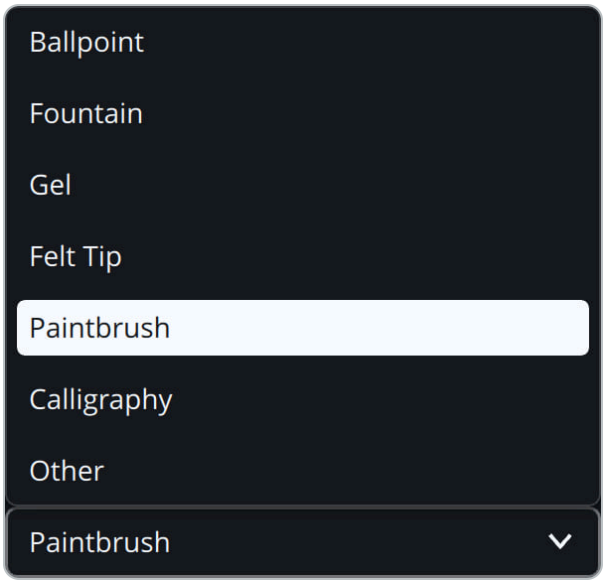
The **Metadata** section starts collapsed. Click it to expand a few descriptive fields:

- **Tool Width**
- **Tool Type:**
  - **Ballpoint**
  - **Fountain**
  - **Gel**
  - **Felt Tip**
  - **Paintbrush**
  - **Calligraphy**
  - **Other**
- **Manufacturer:**
- **Version:**
- **Description:**

Apart from **Tool Type**, these fields do not change how a tool plots. **Tool Type** also sets **Tool Category**: **Paintbrush** makes the tool a brush, and the other types, apart from **Other**, make it a pen. Tool Width and Tool Type help you sort and identify tools at a glance; Manufacturer, Version, and Description are notes for your own reference.



*The **Metadata** section, expanded*



*The **Tool Type** menu*

24.7 Pen Landing & Lift

The **Pen Landing & Lift** section, below **Tool Settings**, shapes how the tool meets and leaves the paper:

- **Lead Angle:** Controls the approach angle as the pen enters and exits a stroke, from 30° to 90°. A value of 90° means the pen drops straight down (off); lower values create a shallower approach that can reduce ink blobs at the start and end of a stroke.
- **Approach Above Paper**, **Slow Past Contact**, and **Touchdown Speed** control **soft touchdown**. The pen drops quickly to the **Approach Above Paper** height, moves at the slower **Touchdown Speed** through contact to **Slow Past Contact** below the paper, then goes quickly the rest of the way to **Draw Depth**. Slowing only around contact reduces bounce without slowing the whole move. An **Approach Above Paper** of 0 turns soft touchdown off. Touchdown Speed must be below the tool's fast feed to have any effect, and a warning appears beside it when it is not.

- **Soft Lift:** slows the pen at the top of the lift, away from the paper. With soft touchdown on, it also lifts the pen off the paper at Touchdown Speed. Some presets turn it on.



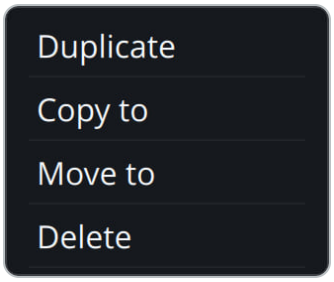
*The **Pen Landing & Lift** section*

Start from the preset values. Make the move gentler — a higher **Approach Above Paper**, a slower **Touchdown Speed**, or turning on **Soft Lift** — when you see blobbed stroke ends, a visible bounce, or noise at the top of the lift. Each step costs a little plotting time.

24.8 Copying and moving tools

Open the menu button on a tool row for:

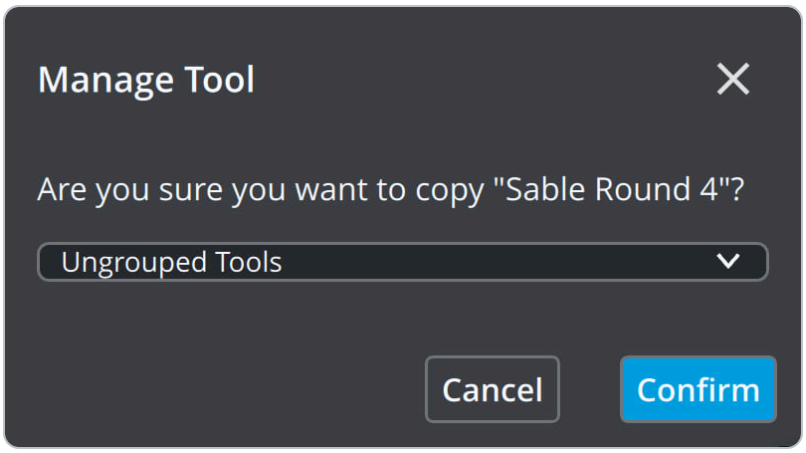
- **Duplicate**
- **Copy to**
- **Move to**
- **Delete**



The menu on a tool row

Duplicate, **Move to**, and **Delete** are available only for custom (user-created) tools. **Copy to** works on any tool, including presets — it is how you make an editable copy of a preset tool without disturbing the original.

Choosing **Copy to** or **Move to** opens the **Manage Tool** dialog, where you pick a destination from a list of your toolsets. **Ungrouped Tools** is always listed, if you just need a place for the tool.



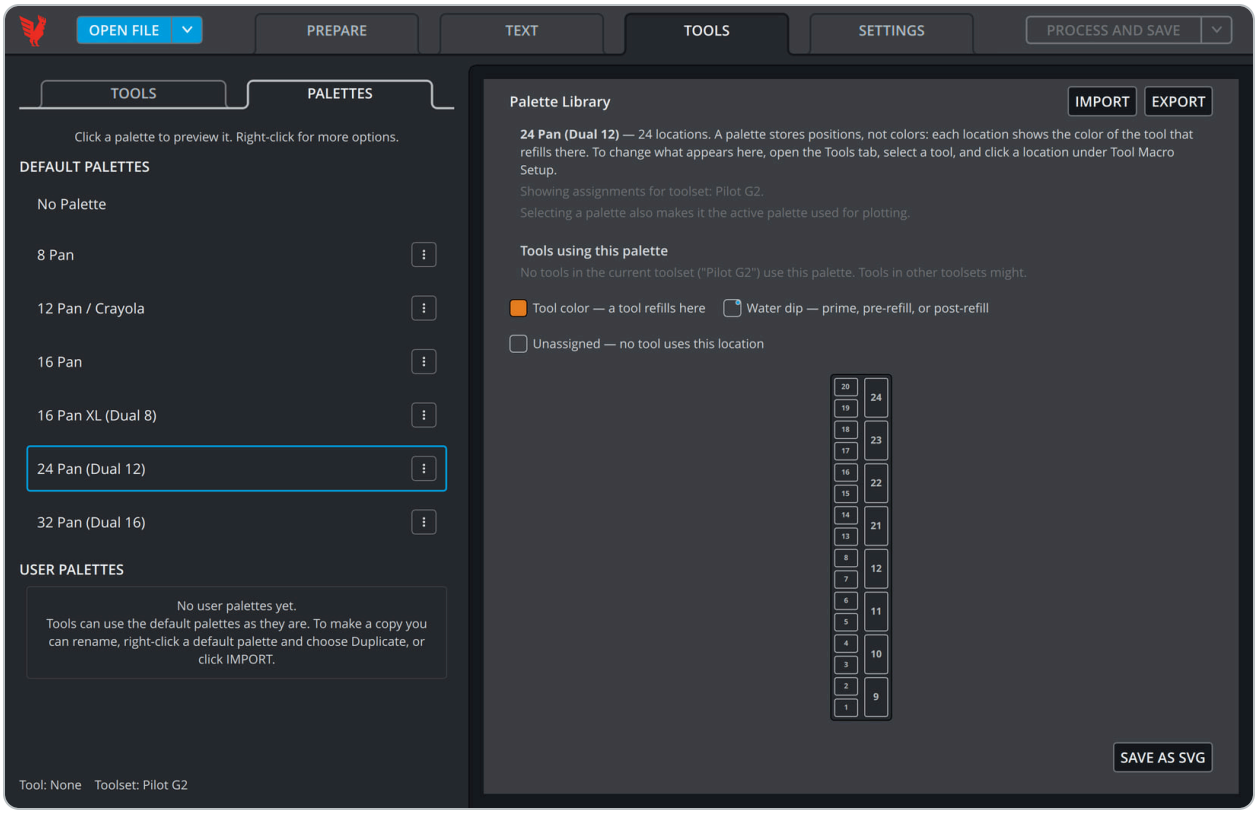
*The **Manage Tool** dialog, with the destination selector*

Copying leaves the original tool in place and adds a copy at the destination; moving removes the tool from its current toolset and files it under the destination instead. Neither one changes the tool's settings, and neither affects a job you have already processed.

24.9 The PALETTES tab

The **PALETTES** tab lists your palettes. Use it to preview, copy, import, and export them.

A palette is the tray of numbered wells, holding paint and water, that a brush visits between strokes. A palette in Studio records where each numbered location sits, not what is in it. Tools supply the rest: each brush tool is told which locations it refills, primes, and washes at, and a location takes on the color of the tool that refills there. Those assignments belong to the tools, and are set in each tool's **Tool Macro Setup**. See §28.8.1 Assigning palette locations to a tool.



*The **PALETTES** tab, with the **24 Pan (Dual 12)** palette selected*

24.9.1 Default and user palettes

The list on the left has two sections:

- **DEFAULT PALETTES** — palettes built into Studio, which cannot be renamed, deleted, or replaced. They are **No Palette**, **8 Pan**, **12 Pan / Crayola**, **16 Pan**, and the dual palettes **16 Pan XL (Dual 8)**, **24 Pan (Dual 12)**, and **32 Pan (Dual 16)**.
- **USER PALETTES** — palettes you have duplicated or imported. You can rename, delete, and replace these.

Click a palette to preview it. Selecting a palette also makes it the active palette used for plotting, the same palette chosen by the **Palette** menu on the **PREPARE** tab and the palette menu in **Tool Macro Setup**. Selecting a palette does not assign any tool to it; a brush still dips where its own macros say it dips. On ArtFrame, with a brush toolset, the paper offset moves to make room for the palette; see §22. Studio: the PREPARE tab.

Right-click a palette, or click its menu button, for more actions; see §24.9.3 Duplicating, renaming, and deleting palettes.

24.9.2 The palette preview

The right side of the tab, titled **Palette Library**, shows the selected palette:

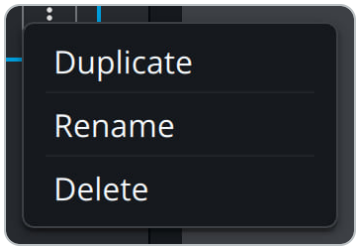
- **Summary:** The palette's name and number of locations, and the toolset whose assignments are shown.
- **Tools using this palette:** Each tool in the current toolset that uses the palette, with the locations it uses, such as "refills at 3, washes at 11." Tools in other toolsets may also use the palette, and are not listed.
- **Legend and preview:** A diagram of the palette's numbered locations. A location shows the color of the tool that refills there, a water-dip marker if a tool only primes or washes there, or an empty outline if no tool uses it.

Hover over a location to see which tools use it and for what.

To see a different toolset's assignments, select that toolset on the **TOOLS** tab, then return to **PALETTES**.

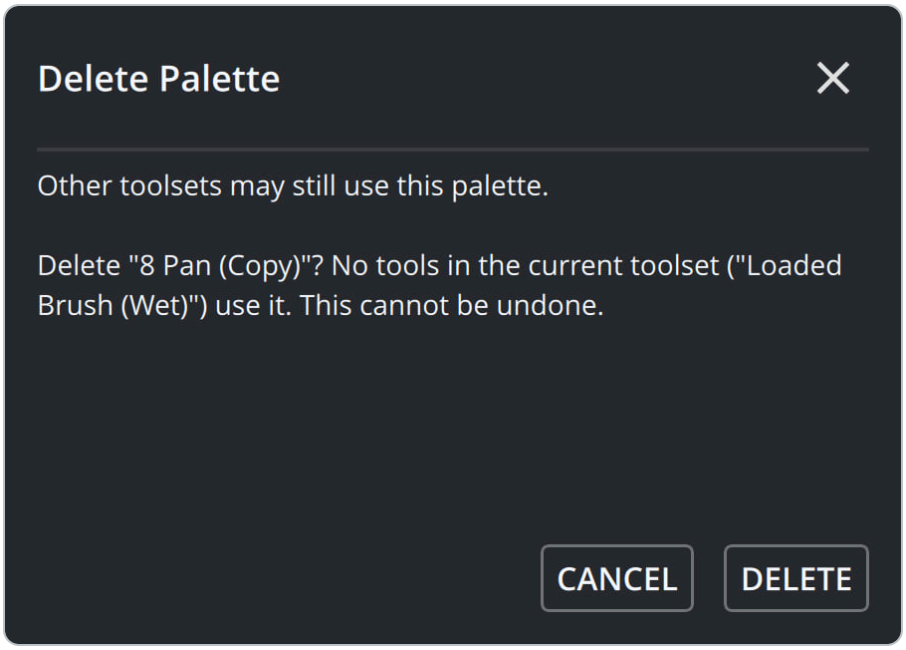
24.9.3 Duplicating, renaming, and deleting palettes

The menu for a default palette offers **Duplicate**. The menu for a user palette offers **Duplicate**, **Rename**, and **Delete**.



The menu on a user palette

- **Duplicate:** Copies the palette into **USER PALETTES** with "(Copy)" added to its name, and selects the copy. Duplicate a default palette to get one you can rename.
- **Rename:** Opens the **Rename Palette** dialog. Enter a new **Palette Name** and click **RENAME**. Tool assignments are unaffected, since tools follow the palette itself rather than its name.
- **Delete:** Opens the **Delete Palette** dialog, which reports how many tools in the current toolset use the palette. Click **DELETE** to delete it.



*The **Delete Palette** dialog, naming the palette and the tools that use it*

Important note: Deleting a palette cannot be undone, and tools that used it lose their locations for it. Export a palette you may want back before you delete it.

A copy starts with every location unassigned. Tool assignments point at one specific palette and do not follow a duplicate, so after duplicating, select each tool on the **TOOLS** tab and assign its locations on the copy.

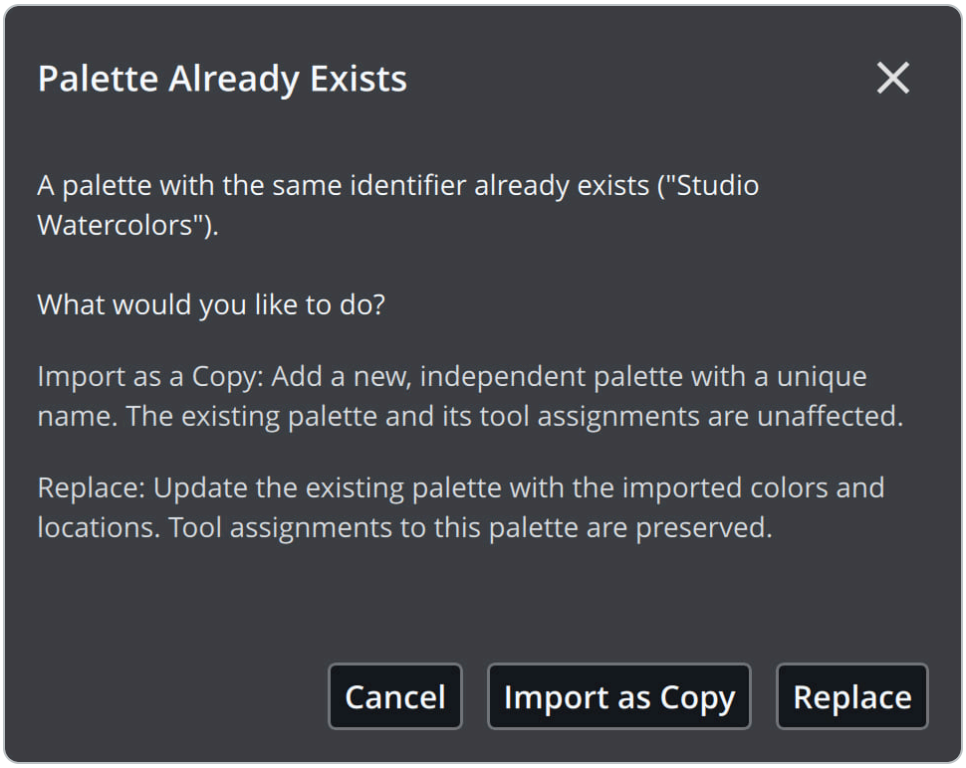
24.9.4 Importing and exporting palettes

The **IMPORT** and **EXPORT** buttons, at the top of the preview, move palettes in and out of Studio as JSON files, to back up a palette or share it with another computer.

- **EXPORT:** Saves the selected palette as a JSON file, named after the palette. The file holds the palette's name and location positions. Tool assignments are not included, since they belong to the tools.
- **IMPORT:** Adds a palette from a JSON file to **USER PALETTES**. Tools that already point at that palette, such as tools imported from the computer the palette came from, show their locations at once; otherwise, assign locations to your tools afterward. If a different palette already has the same name, the imported one takes that name with a number added, such as **16 Pan (1)**.

If the imported palette is one Studio already has, a **Palette Already Exists** dialog asks what to do:

- **Import as Copy** — adds a new, separate palette with a unique name. The existing palette and its tool assignments are unaffected.
- **Replace** — updates the existing palette with the imported locations, and keeps the tool assignments that point at it. Offered only when the existing palette is a user palette.



*The **Palette Already Exists** dialog*

For a palette without its own artwork, a **SAVE AS SVG** button below the preview saves the preview diagram as an SVG file: the palette's numbered locations, drawn to size, without tool colors.

24.10 Testing tool settings

Two features make testing settings quicker:

- **Change every tool at once.** Select a toolset, rather than a tool inside it, and a setting you change applies to every tool in the set: to slow every tool down together, for example. See §24.4 Editing a whole toolset.
- **Compare settings in one job.** Tools in the same toolset can have different settings. In a toolset of your own, duplicate a tool a few times and give each copy a different value, such as a different speed. Make a test drawing with a few rows of short lines, each row in its own color, and assign each copy to one of the colors. A single job then draws them side by side for comparison. See §24.8 Copying and moving tools and §22.9 Applying tool assignments to every document.

To match what you see to the setting most likely to fix it, see §14.13 Tuning a pen or brush.

25. Studio: the MACHINE tab

The **MACHINE** tab (⌘4 / Ctrl+4) is where you connect Bantam Tools Studio™ to a machine, control it directly, browse the files stored on it, and manage the jobs Studio has queued for it. This chapter documents every control on the tab, in the order the tab presents them. For the practical question of which of the three routes — microSD card, USB, or WiFi — to use for a given job, see §18. Sending files to your machine.

The tab is hidden by default, so turn it on before you connect a machine for the first time:

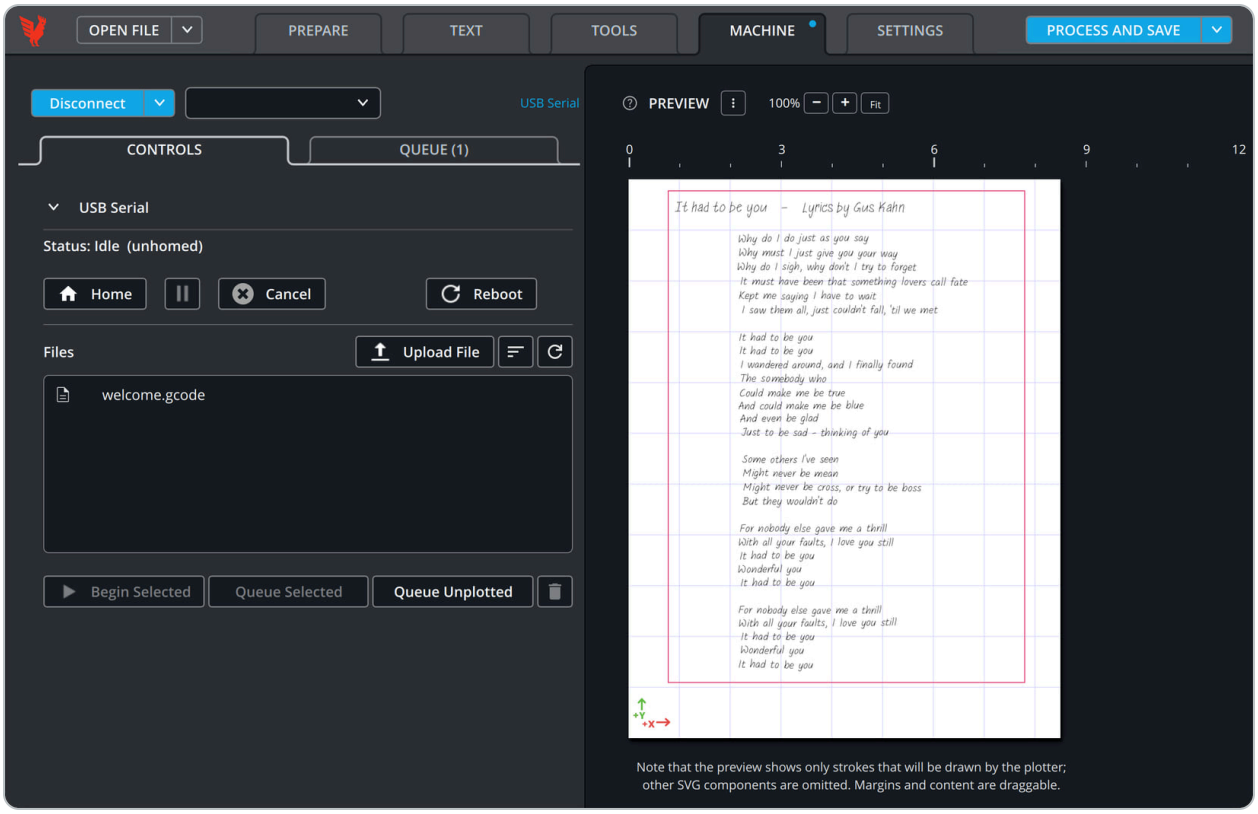
Settings → Machine Control → Show Machine Control Tab

A small colored dot overlays the **MACHINE** tab label itself: blue means a machine is connected, tangerine means Studio is connecting, and gray means no machine is connected. The dot stays visible no matter which tab you're viewing, so you always know your connection status at a glance.

Below the connection row, the tab splits into two sub-tabs:

- **CONTROLS:** Connection status, machine controls, and the files stored on the machine.
- **QUEUE:** Jobs waiting to be generated, uploaded, or plotted, plus any that failed and need attention. Once at least one job is queued, the label becomes **QUEUE (*n*)**.

The Preview stays visible on the right side of the window in either sub-tab, so you can still see the current job while you connect, upload, or manage the queue.



***MACHINE** tab with a plotter connected over USB*

25.1 Connecting to a machine

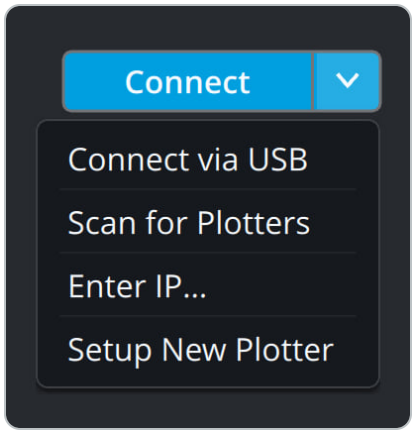
At the top of the **MACHINE** tab, a **Connect** split button offers four ways to reach a machine:

- **Connect via USB** — connects to a machine attached directly to your computer with a USB cable.
- **Scan for Plotters** — searches your WiFi network and opens a small results popup. While scanning, it reads **Scanning for plotters…**; if nothing turns up, it reads **No plotters found. Make sure your plotter is powered on and connected to the same network.** Click a discovered machine in the popup to connect to it.
- **Enter IP…** — reveals a manual IP address field (placeholder `192.168.1.100`) so you can connect by address directly.
- **Setup New Plotter** — opens the **Set Up Your Plotter** dialog, which adds a new machine to your WiFi network; see §25.4 Setting up a new plotter.

Clicking the **Connect** button itself, rather than opening its menu, favors USB: if a machine is available over USB, Studio connects to it directly; otherwise it falls back to WiFi, using the manual IP field if you've entered one. While Studio is connecting, the button area shows a spinner and a **Cancel** button so you can back out.

Once connected, **Connect** is replaced by a **Disconnect** split button, whose own menu still offers **Setup New Plotter** so you can add another machine without disconnecting first. Beside it, Studio shows the connection type — **USB Serial** or **WiFi** — and a drop-down menu listing any other machines discovered on your network.

If Studio can't reach a machine, or a connection problem persists, an error line reading **BT-<*code*> — <*summary*>** appears beneath the connection row, with **Try Again** and **Copy Diagnostics** buttons. **Try Again** repeats the attempt without changing anything; for an error that needs a step at the machine first, such as **BT-205**, the message says what to do. **Copy Diagnostics** puts the full error text on the clipboard, which is what Bantam Tools support will ask you for. When one of these errors closes the connection, the line moves to the top of the **CONTROLS** sub-tab, above **Plotters on network**.



***Connect** menu on the **MACHINE** tab*

25.2 Connecting over USB

To connect over USB:

1. Connect the machine to your computer with a USB cable.
2. Open the **MACHINE** tab.
3. Click **Connect**, then choose **Connect via USB** — or click **Connect** alone, since USB is favored automatically when available.

The connection row then shows **USB Serial** and the machine's status, and the machine controls become active.

25.3 Connecting over WiFi

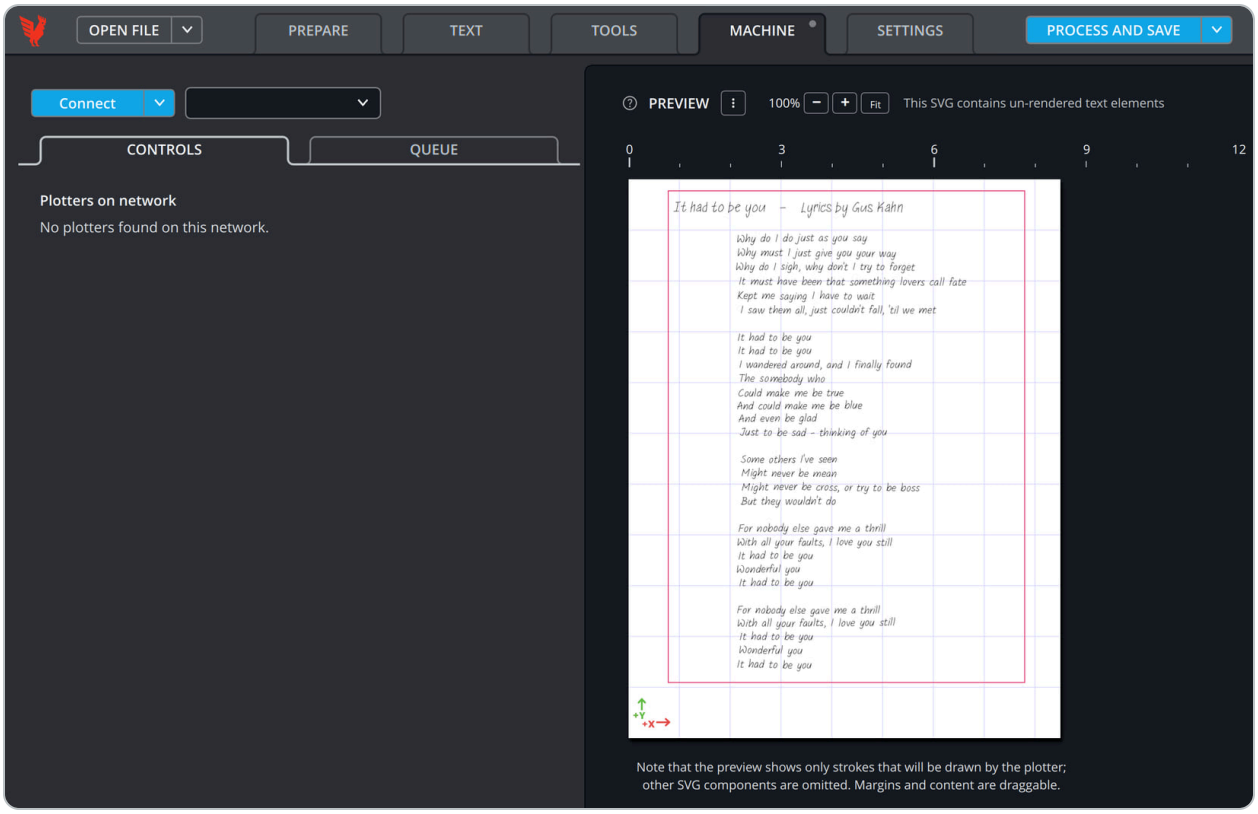
To connect over WiFi:

1. Open the **MACHINE** tab.
2. Click **Connect**, then choose **Scan for Plotters**.
3. Select the machine from the results.

The popup closes and the connection row shows **WiFi** with the machine's status.

If no machine is connected yet, the **CONTROLS** sub-tab shows a **Plotters on network** list of every machine Studio has discovered, each with its own **Connect** button — a quicker path than opening the scan popup. If nothing turns up, it reads **No plotters found on this network.** Confirm the computer and the machine are on the same WiFi network, then try again.

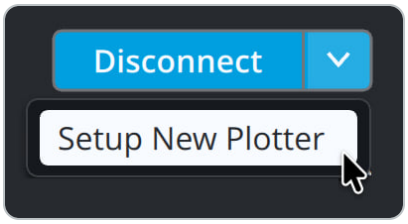
You can also skip discovery entirely and choose **Enter IP** from the **Connect** menu to connect by address. That is the route to use on a network whose devices cannot see each other's discovery traffic, since the address works even where the scan finds nothing.



***MACHINE** tab with no plotter connected*

25.4 Setting up a new plotter

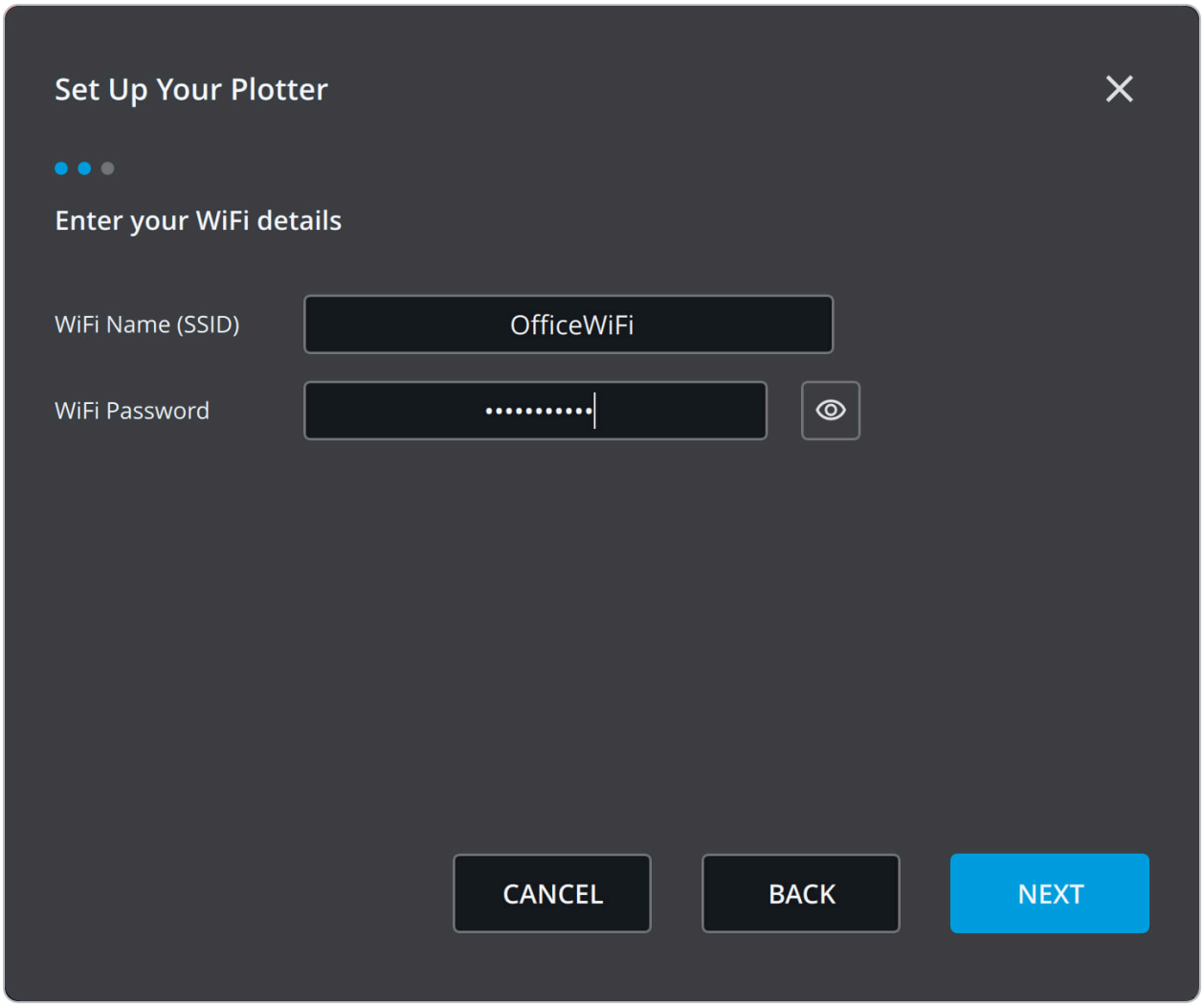
Setup New Plotter, on both the **Connect** and **Disconnect** menus, opens the **Set Up Your Plotter** dialog, which gives a machine the settings it needs to join a WiFi network. For the walkthrough, and for choosing between delivering the settings over USB or on a microSD card, see §18.6 Putting your machine on a network. The dialog's controls:



Setup New Plotter *on the* ***Disconnect*** *menu*

- **Plotter Name** — a name to recognize the machine by later, especially if you own more than one.
- **WiFi Name (SSID)** and **WiFi Password** — the network the machine joins.
- **Over a USB cable** and **With a file on a microSD card** — on the first page, how Studio delivers the settings: over USB, or in a setup file for the machine's microSD card.
- **Reboot Plotter** — restarts the machine so it picks up the WiFi settings just written to it, and waits while it comes back. Offered when the machine is connected over USB.
- **Switch to USB** — offered when Studio cannot find the machine on the network after setup. It closes the dialog and returns you to connecting over USB.
- **Enter IP address manually** and **Use This Address** — connect to the machine by address when discovery does not find it.

Note: Setup configures the machine's network settings; it does not move any of your work onto the machine. Files still travel by microSD card, USB, or WiFi upload afterward.



*WiFi step of the **Set Up Your Plotter** dialog*

25.5 Machine controls

Once connected, the **CONTROLS** sub-tab shows a status line reading **Status** followed by the machine's current state, such as **Idle**, **Plotting**, **Paused**, or **Alarm**. The status line adds **(homed)** or **(unhomed)** while the machine is Idle or in an Alarm state, so you know whether to home it before the next plot.

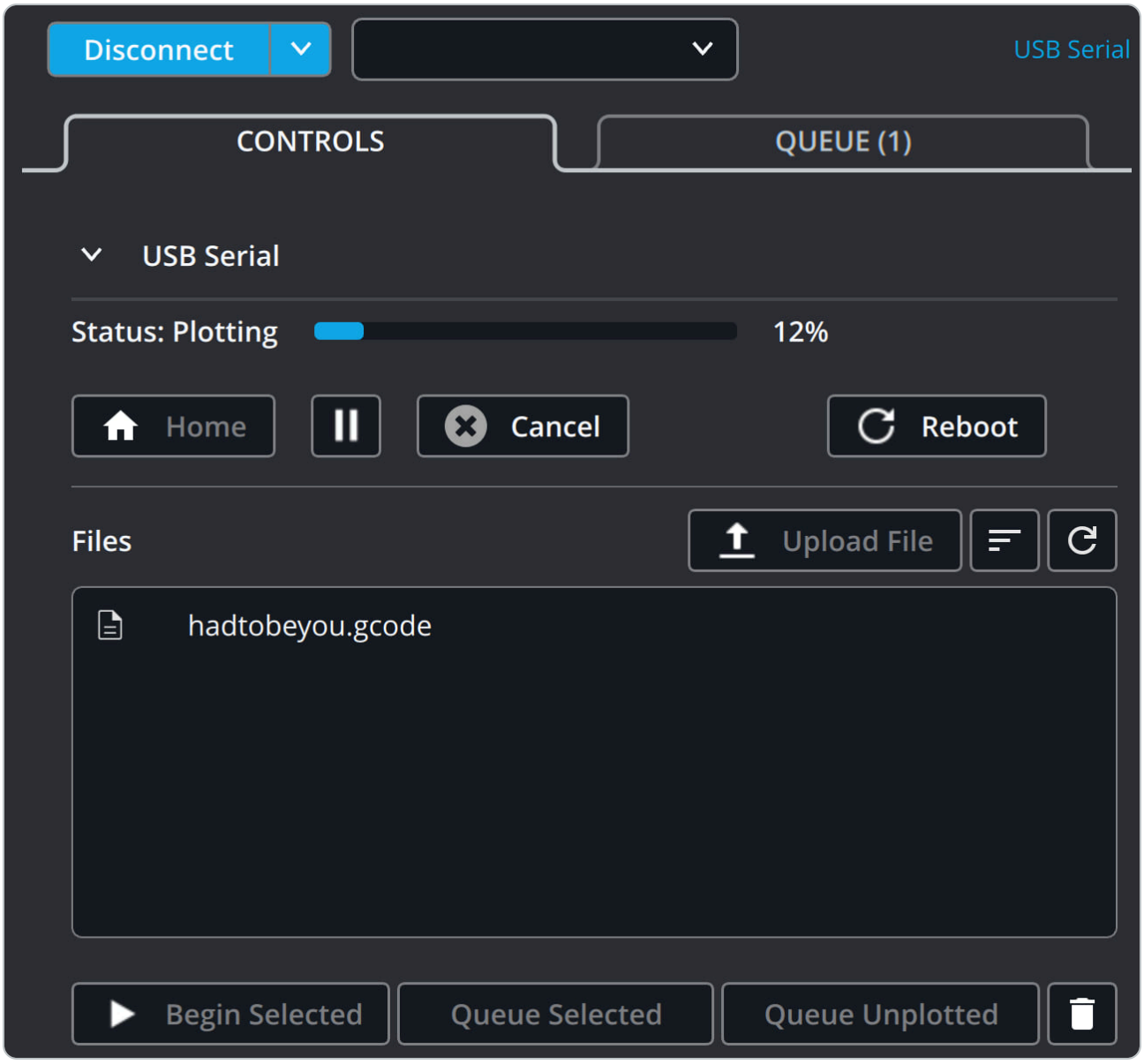
The available machine controls are:

- **Home** — moves the machine to its home position to establish a reference point. Enabled only when the machine is Idle and has no upload in progress.
- The pause button (a pause icon) — pauses the plot in progress. Enabled only while the machine is plotting.
- **Continue** — takes the pause button's place while a plot is paused, and resumes plotting from the paused position.
- **Cancel** — cancels the current job and returns the machine to Idle.
- **Reboot** — restarts the machine's controller board.
- **CLEAR ALARM** — appears beside the status line only while the machine is in an Alarm state. Resolve whatever triggered the alarm, then click **CLEAR ALARM** to return the machine to Idle.

Studio has no jog controls — it does not drive the machine's motors manually, one step at a time.

While a job is plotting, a progress bar and percentage appear beside the status line. When the machine goes a few seconds without reporting its progress, a short segment sweeps along the bar in place of the fill, and the percentage gives way to the time elapsed since the plot began, such as **12:05**. While a plot is paused, the bar holds its last position and the percentage is hidden.

If the machine pauses mid-job for a pen or tool change — a multi-tool job, for example — the instruction the machine itself is showing (such as which pen to install next) appears in orange beneath the status line, marked with a pen glyph. It stays there until you make the change and click **Continue**.



***CONTROLS** sub-tab during a plot, with its progress bar*

25.6 Files stored on the machine

Below the machine controls, the **Files** section lists what's stored on the machine's microSD card — G-Code files and folders, including any Studio has organized into subfolders. A check mark next to a file means the machine

has already plotted it. This is the same list, and the same set of check marks, that the machine's own display shows; §11. The ArtFrame interface covers browsing and running those files at the machine.

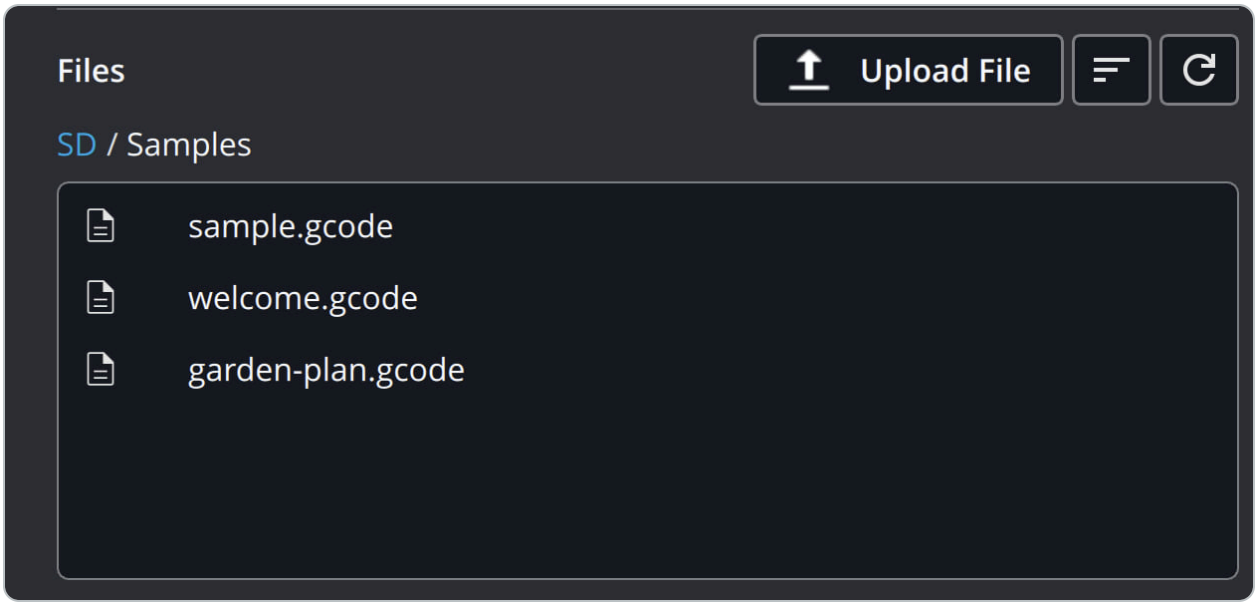
In the **Files** header:

- **Upload File** — uploads a file from your computer to the machine's microSD card. Studio supports G-Code, configuration, firmware, and other file types here.
- The sort button sorts the list **A → Z**, **Z → A**, or in **Firmware Order** (the order the machine itself reports). Its menu also has **Show Plotted Files**: turn it off to hide files you have already plotted. (Default: on)
- The refresh button reloads the list.

A check mark beside a file's icon shows that the machine has already plotted it. Hidden files, whose names start with a period, and the system folders `System Volume Information` and `$RECYCLE.BIN` are not listed.

Click a file to select it. Shift-click selects a range of files, and ⌘-click (Ctrl-click on Windows) selects or deselects a single item. Right-click a file for **Begin Plot** or **Delete**; right-click a folder for **Delete Folder**.

Click a folder to open it. Inside a folder, its path, such as **SD / Samples**, appears above the list; click **SD**, or any folder in the path, to go back up.



*The **Files** list inside a folder, with its path above*

Along the bottom of the file list:

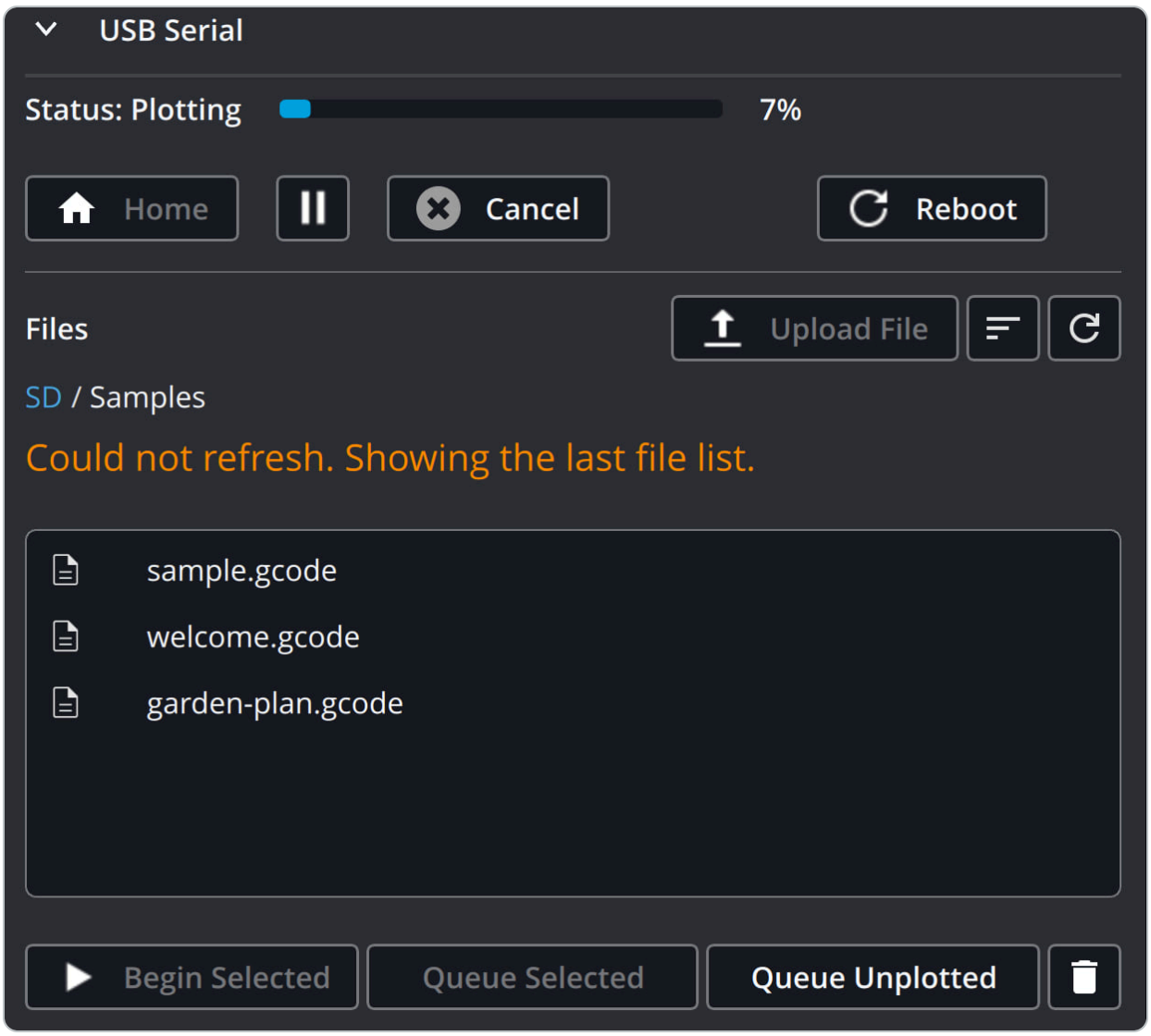
- **Begin Selected** — starts plotting the selected G-Code file directly from the machine's microSD card, one file at a time.
- **Queue Selected** — adds the selected files to the queue (see §25.8 The queue). It works on files at the top level of the card.
- **Queue Unplotted** — adds every file on the microSD card that hasn't been plotted yet to the queue (see §25.8 The queue). Available only when connected over USB. The files plot in the order shown in the **Files** list.
- A trash-icon button deletes the selected files or folder.

While a job is plotting, **Home**, **Upload File**, **Begin Selected**, the trash-icon button, the right-click **Delete** and **Delete Folder** items, and the refresh button are unavailable. **Queue Selected** and **Queue Unplotted** stay

available, so you can add files to the queue while the machine plots.

A note above the file list reports on the listing itself, and shows nothing while the list on screen is current. It reads:

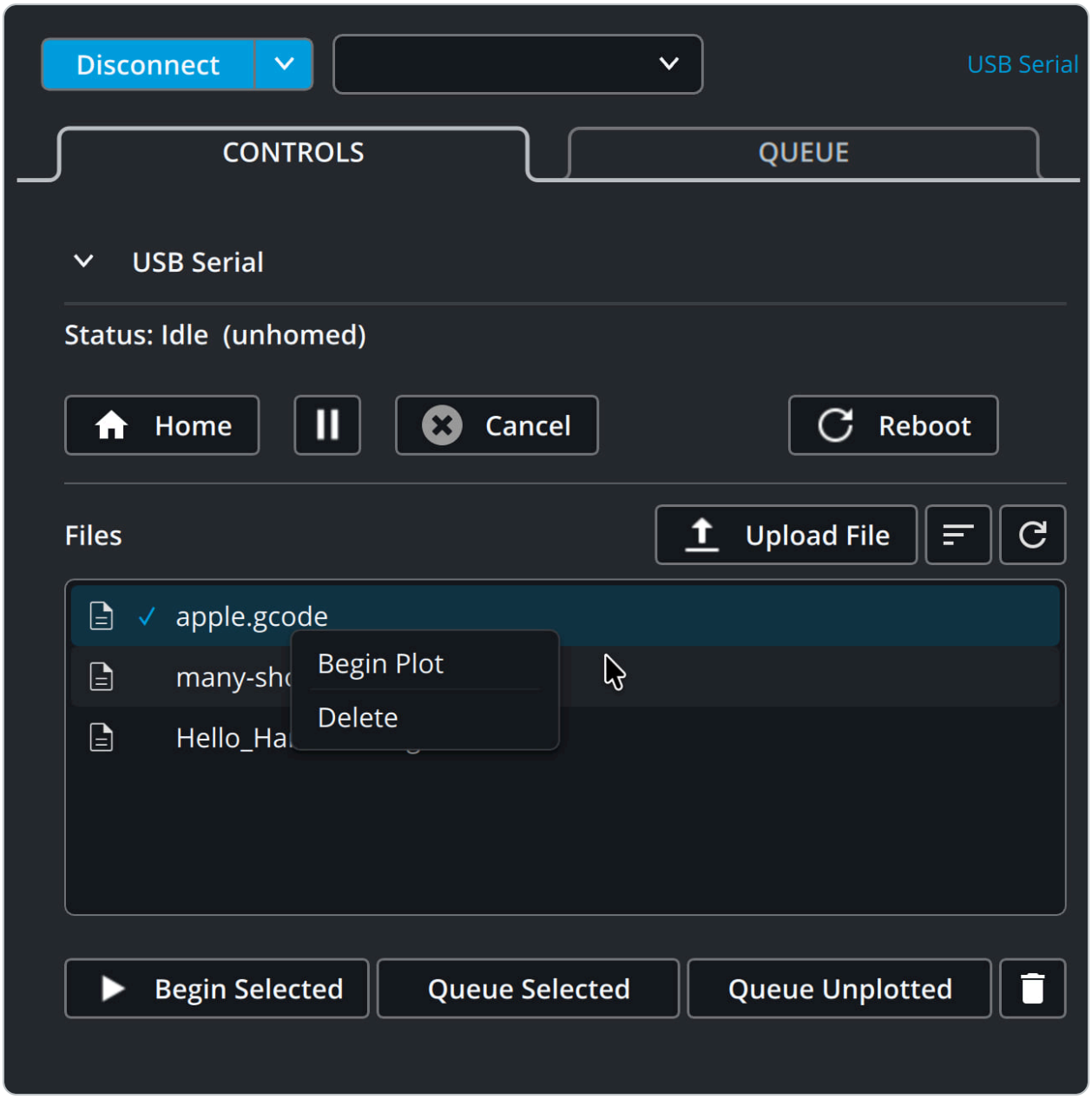
- **File list not loaded yet.** — after connecting, before Studio has listed the card for the first time.
- **Loading the file list…** — while a listing is under way and there is nothing to show yet. A refresh of a list already on screen keeps the rows in place and shows no message.
- **The card is empty.** — the listing finished and the card holds no files.
- **All files here are plotted. Turn on Show Plotted Files to see them.** — when **Show Plotted Files** is off and every file in the folder is plotted.
- **Could not load the file list.** — in orange, when a listing fails and there is no earlier list to show.
- **Could not refresh. Showing the last file list.** — in orange, when a refresh cannot complete. The rows from the last successful listing stay in the list, and the next successful refresh replaces them and clears the note.
- **The file list refreshes when the plotter is idle.** — when Studio tries to list the card while the machine is plotting. The list refreshes on its own when the plot ends.
- **Folder contents are unavailable. This plotter's firmware can only list the top level of the card.** — in orange, inside a folder, when the machine's firmware lists only the top level of the card. With that firmware, a separate orange line above the note reads **This file listing may be incomplete.**



***Files** section inside a folder, showing the last file list after a refresh could not complete*

If no machine is connected, this area reads **Connect to a plotter to manage files.**

> ***Note:*** Completed plots stay on the machine, so you can review or re-plot them from the **MACHINE** tab without removing the microSD card.



*Right-click menu for a file in the **Files** list*

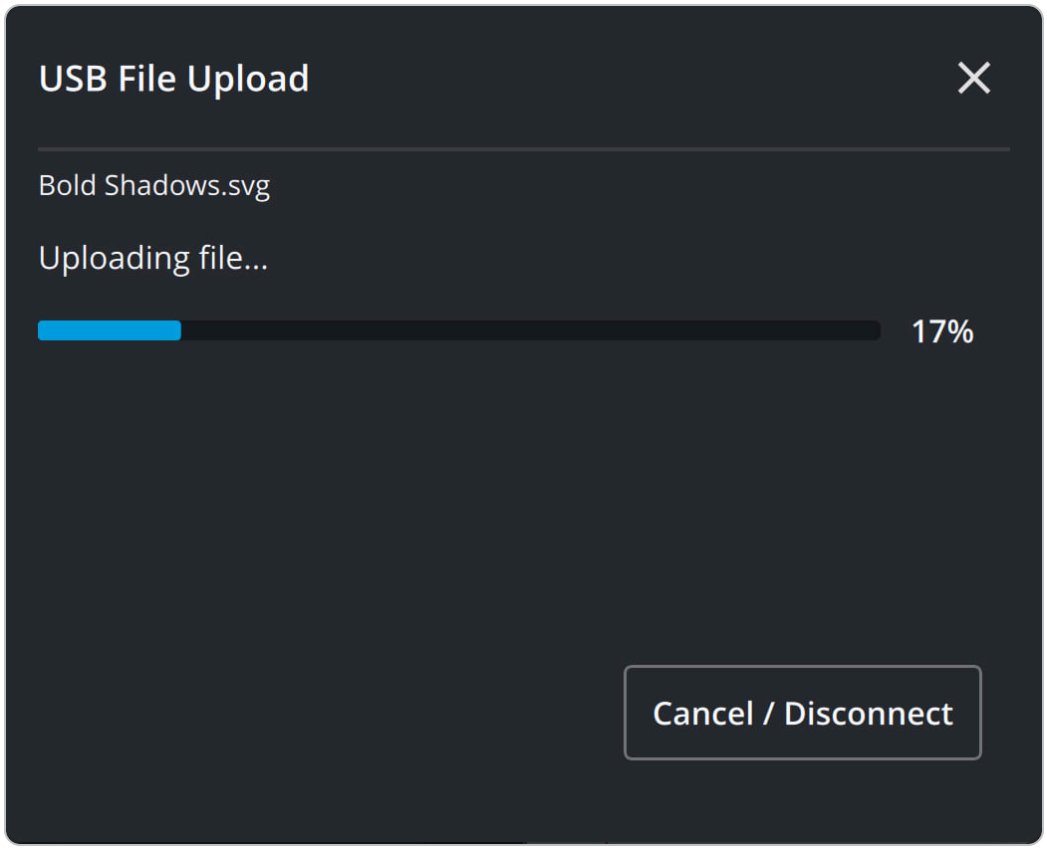
25.7 Uploading a generated job

There are a few ways to get a job onto a connected machine:

- From the **MACHINE** tab's Files section, click **Upload File** to send an existing file from your computer.
- After processing a job from the **PREPARE** tab, use the chevron menu on the Setup Sheet's button for **UPLOAD VIA USB** or **UPLOAD VIA WIFI**.
- Choosing **Generate G-Code and Upload** from the **File** menu generates the G-Code and uploads it over the connection you have, USB or WiFi, without a separate upload dialog. The job then waits on the plotter as **On plotter — press Plot to start**. With no connection available, it waits in the **STUDIO QUEUE** as **Ready to upload**; send it later with the row's **USB** or **WiFi** button. With several files open it generates all

of them but queues only the first for upload; the Setup Sheet's **UPLOAD ALL VIA USB** and **UPLOAD ALL VIA WIFI** send the rest.

Once you choose a file, **Upload File** opens a **USB File Upload** or **WiFi File Upload** dialog, using the connection set by **Preferred connection for uploads** (see §23.3.5 Preferred connection for uploads). The dialog shows the file's name, a message such as **Uploading file…**, and a progress bar with a percentage. Its **Cancel** button stops the upload. During a USB upload the button reads **Cancel / Disconnect**, since stopping a USB transfer also disconnects the machine. When a G-Code file finishes uploading, the dialog reads **Upload complete.** and offers **Plot Now**, which starts the file right away, and **Close**. Other files close the dialog with an "Upload complete" message. If the upload could not be verified, the dialog says so. See §23.3.4 Offer to plot after upload.



***USB File Upload** dialog partway through an upload*

A **WiFi** upload option is available when the machine is reachable over WiFi. **USB** upload stays available without an active connection: the queue holds the job and sends it once the machine is connected, which **Auto-connect over USB** (on by default) does as soon as the machine comes online. Both depend on **Show Machine Control Tab**; with it off, Studio does not look for a machine at all.

25.8 The queue

The **QUEUE** sub-tab, headed **STUDIO QUEUE**, tracks every job Studio is generating, uploading, or waiting to plot — jobs you've queued yourself and jobs Studio received automatically. A **Clear All Failed** button appears whenever there are failed jobs to clean up.

Just below the header is the **Auto Start Plot** toggle. When on, Setup Sheet and queue uploads that finish and are verified start plotting automatically, and so do files queued from the machine's microSD card. When off, they wait on the plotter until you press **Plot**. (Default: off) **Upload File** never starts a plot on its own; its dialog offers **Plot Now** instead. An upload that finishes as **On plotter — not verified** waits for you to press **Plot**. The line beneath the toggle is a reminder of that: **Applies to Setup Sheet and queue uploads, not Upload File.**

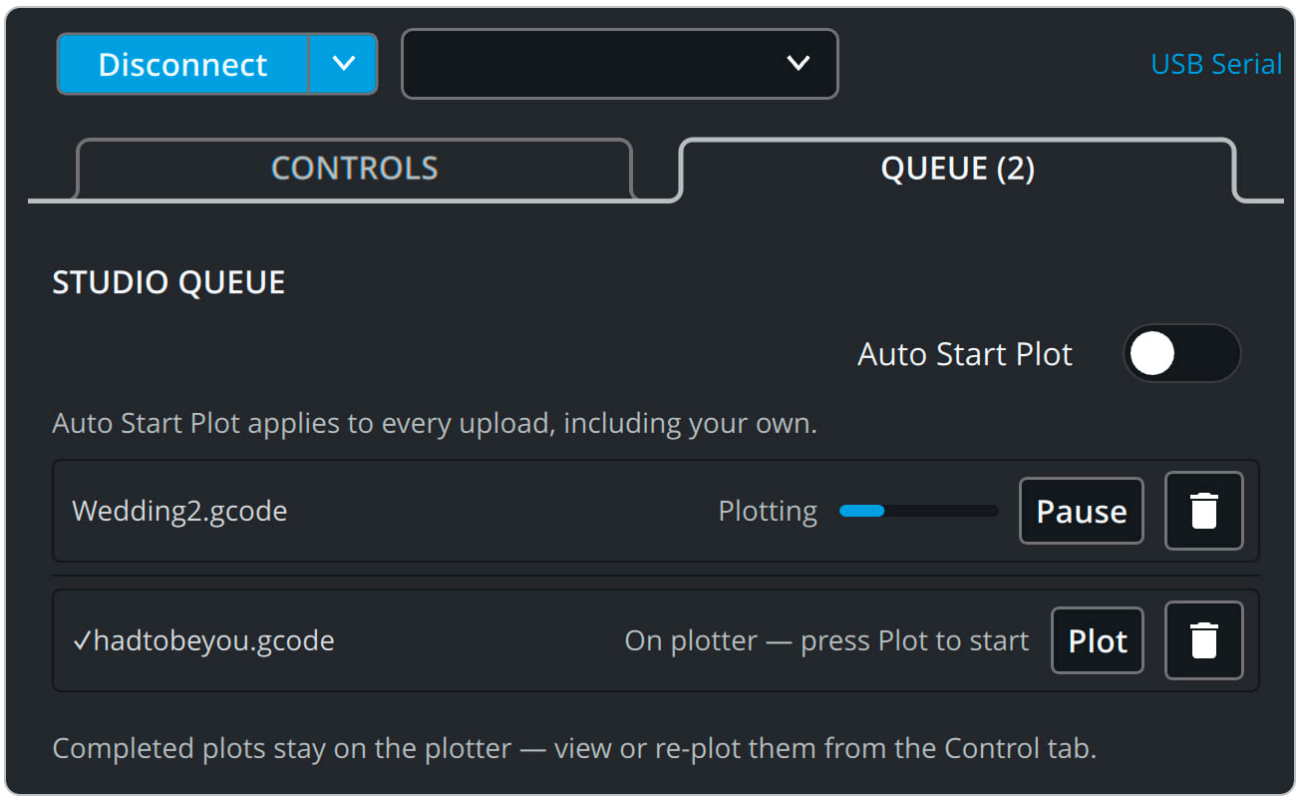
When one or more jobs are ready to upload, **Upload All Ready via USB** and **Upload All Ready via WiFi** buttons appear so you can send every ready job over a connection at once instead of one at a time.

25.8.1 Job rows

If the queue is empty, it reads **No jobs queued. Send work from Studio to start.** Otherwise, the active job appears first, followed by any pending jobs, then a **FAILED** section for jobs that need attention.

Each row shows the job's name and its status:

- **Queued**
- **Waiting — Studio busy**
- **Generating G-Code…**
- **Ready to upload**
- **Connecting to plotter**
- **Uploading…**
- **Sent to plotter — finalizing…**
- **On plotter — press Plot to start**
- **On plotter — not verified; press Plot to start**
- **Plotting**, or **Plotting — <*machine status*>** when the machine reports a state other than plotting or idle, such as **Plotting — Paused** or **Plotting — Homing**
- **Done**
- **Cancelled**
- **Failed**



*Active job plotting, with **Pause** on its row*

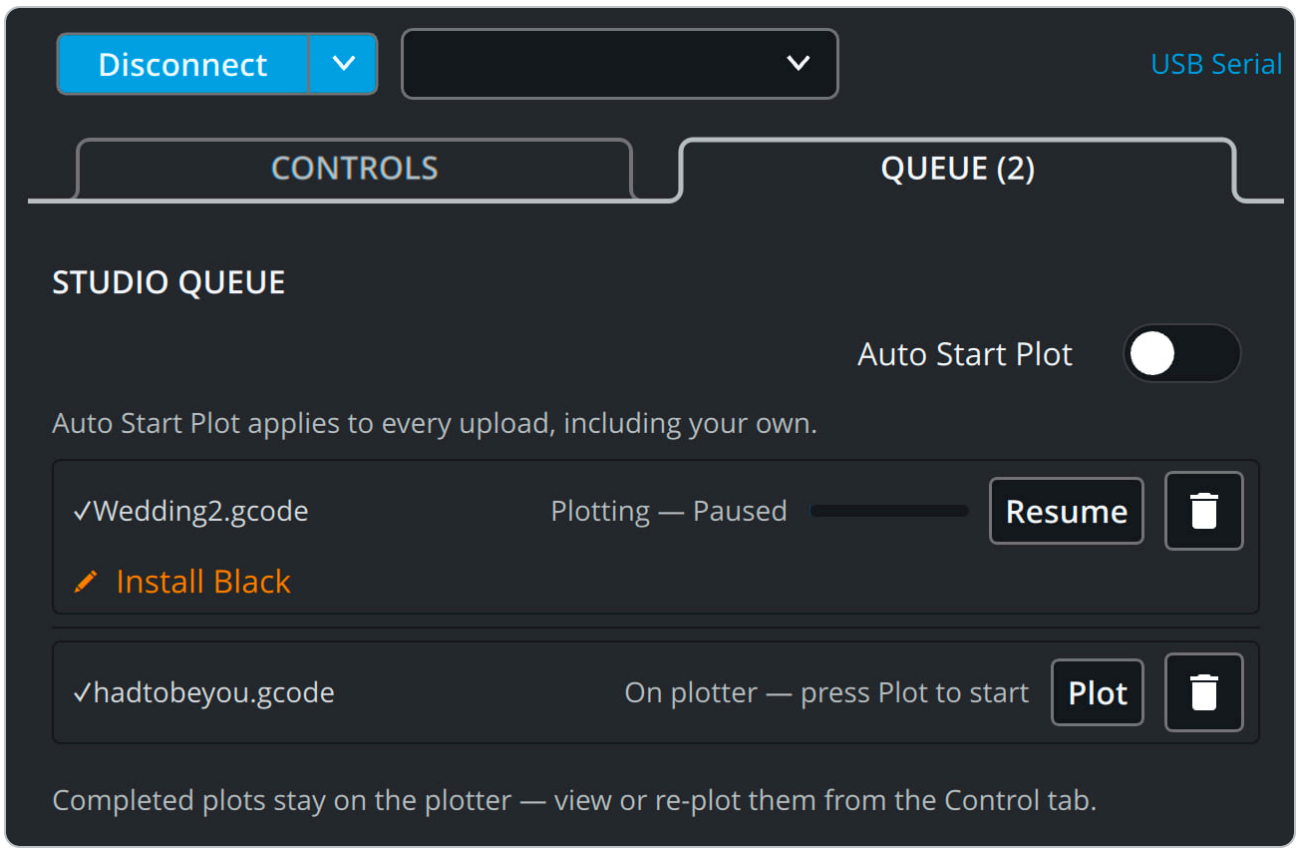
Depending on a row's state, you may see:

- **USB** / **WiFi** buttons to upload a ready job over a specific connection.
- **Plot Now** for a queued job waiting its turn, or **Plot** for a job already sitting on the machine, waiting for you to start it.
- **Pause** while the active job is plotting, **Resume** while it is paused, or **Clear Alarm** while the machine is in an Alarm state. These do the same as the matching controls in the **CONTROLS** sub-tab.
- **Retry** and **Dismiss** for a failed job.
- A trash-icon button to cancel a job and remove it from the queue.

A failed row says why beneath the job name, and what to check before you try again. Studio never sends a plot to the machine a second time on its own. When it cannot confirm that a plot started, the row reads **Could not confirm whether this plot ran. Check the plotter and the card before retrying.** Look at the sheet before you click **Retry**, so the same page is not plotted twice.

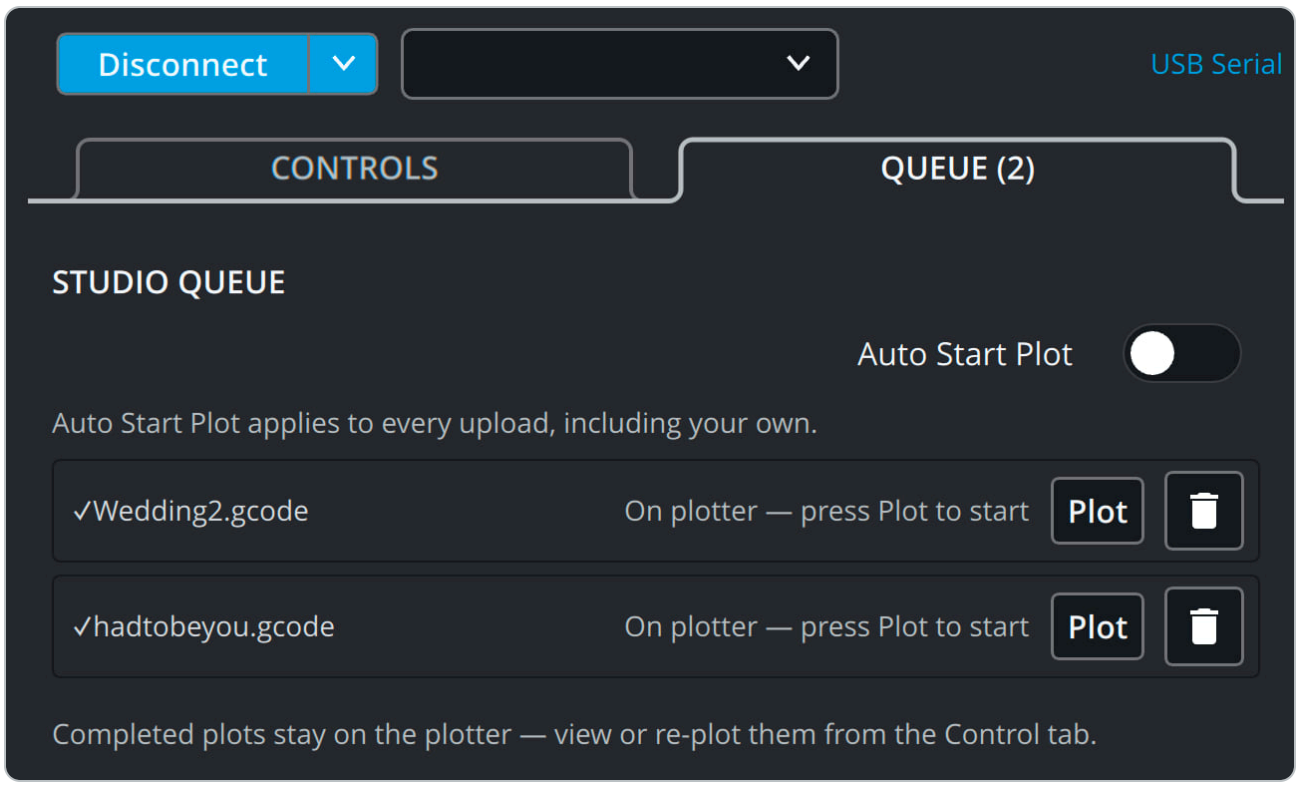
If you quit Studio while a job is plotting, Studio does not plot it again when you reopen it. The row is checked against the machine when Studio reconnects, and if the outcome is unclear, it asks you to check the sheet before retrying.

When the machine pauses for a pen or tool change, the active row shows the machine's instruction in orange beneath the job name, marked with a pen glyph. Make the change, then click **Resume**.



Active job paused for a pen change, with its instruction beneath the row

A hint below the active and pending rows reminds you: **Completed plots stay on the plotter — view or re-plot them from the Control tab.**



QUEUE** sub-tab with two jobs reading **On plotter — press Plot to start

25.8.2 Queue warnings

An orange, outlined banner can appear at the top of the **MACHINE** tab — above both the CONTROLS and QUEUE sub-tabs — whenever the queue hits a condition that needs your attention: a full queue, an unusually large backlog, jobs waiting on a machine connection, or saved jobs that couldn't be restored. Resolve the condition it describes — connect a machine, clear some jobs, and so on — and the banner clears on its own.

26. Studio: exporting output

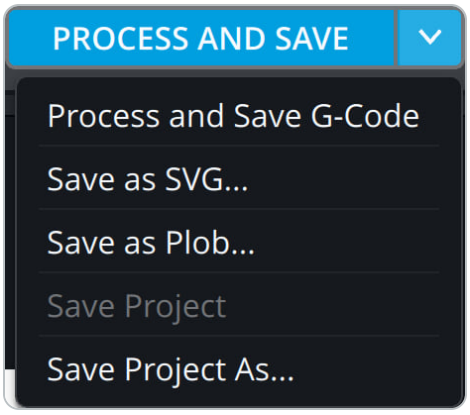
Use this chapter when you need a file other than G-Code for a machine, or want to know what a Setup Sheet or a project file records.

Every export in Bantam Tools Studio™ starts from the **PROCESS AND SAVE** button in the upper-right corner of the window. Click the button itself to run its default action, or open its chevron menu to choose another format. This chapter covers everything that button and its menu produce — G-Code, SVG, and Plob, plus **Save Project** and **Save Project As** — along with the Setup Sheet that follows a G-Code export and the **Split by Toolset** option that can turn one job into many files.

26.1 Process and Save G-Code

Process and Save G-Code is the default action of the **PROCESS AND SAVE** button. Click the button, or choose **Process and Save G-Code** from its chevron menu, and Studio processes the current job and saves a machine-ready `.gcode` file.

This is the output path you will use most, and the right choice when you want to copy a file to a microSD card, upload it to a connected machine, or keep a machine-ready copy for later.



*The **PROCESS AND SAVE** chevron menu*

Processing uses the current machine selection, the Setup and Options panels, your tool assignments, and the paths shown in the Preview, so the file reflects the job exactly as you have arranged it — see §22. Studio: the PREPARE tab for how those are set up.

The same G-Code output is available from the **File** menu, as **Save G-Code File** (⌘↩ / Ctrl+Enter), and you can generate and upload in one step with **Generate G-Code and Upload** — see §25. Studio: the MACHINE tab.

Once the file is written, Studio opens a Setup Sheet summarizing the job; see §26.5 Setup Sheet, below.

26.2 Save as SVG

Choose **Save as SVG** from the **PROCESS AND SAVE** chevron menu to save the processed artwork as an SVG file rather than as G-Code.

The file carries the job as you arranged, scaled, and processed it, which makes it the format to reach for when the artwork is going back into a drawing program, or to someone who has no use for a machine-ready file.

Save as SVG is available whenever Studio can process the job.

26.3 Plob

Plob, short for "Plot Object," is a highly specialized kind of SVG file. The processing work is already done inside the file, so Studio can send a Plob straight to a machine with no further preparation. Use it when you want a file prepared in advance for one specific machine, ready to go with no extra processing step. A Plob is saved as an ordinary SVG file, with `_plob` before the extension (`card_plob.svg`), so it opens anywhere an SVG does, such as Inkscape.

Save as Plob appears in the **PROCESS AND SAVE** chevron menu only after you turn on **Enable Plob output** in Settings. See §23.1 Program options.

Because a Plob is prepared for a particular machine, two settings in Settings' Plob group shape the export:

- **Plob: Model** — the target machine model the file is prepared for.
- **Plob: Auto-rotate** — rotates the artwork to best fit that machine's work area.

26.4 Project files

A project file (`.btsp`) bundles a whole session into one file: the documents you have open, your tool assignments, the selected palette and toolset, and the generation settings that produced your output. Opening a project restores all of it, so you can pick a job back up weeks later, or hand it to a colleague and have it come out the same.

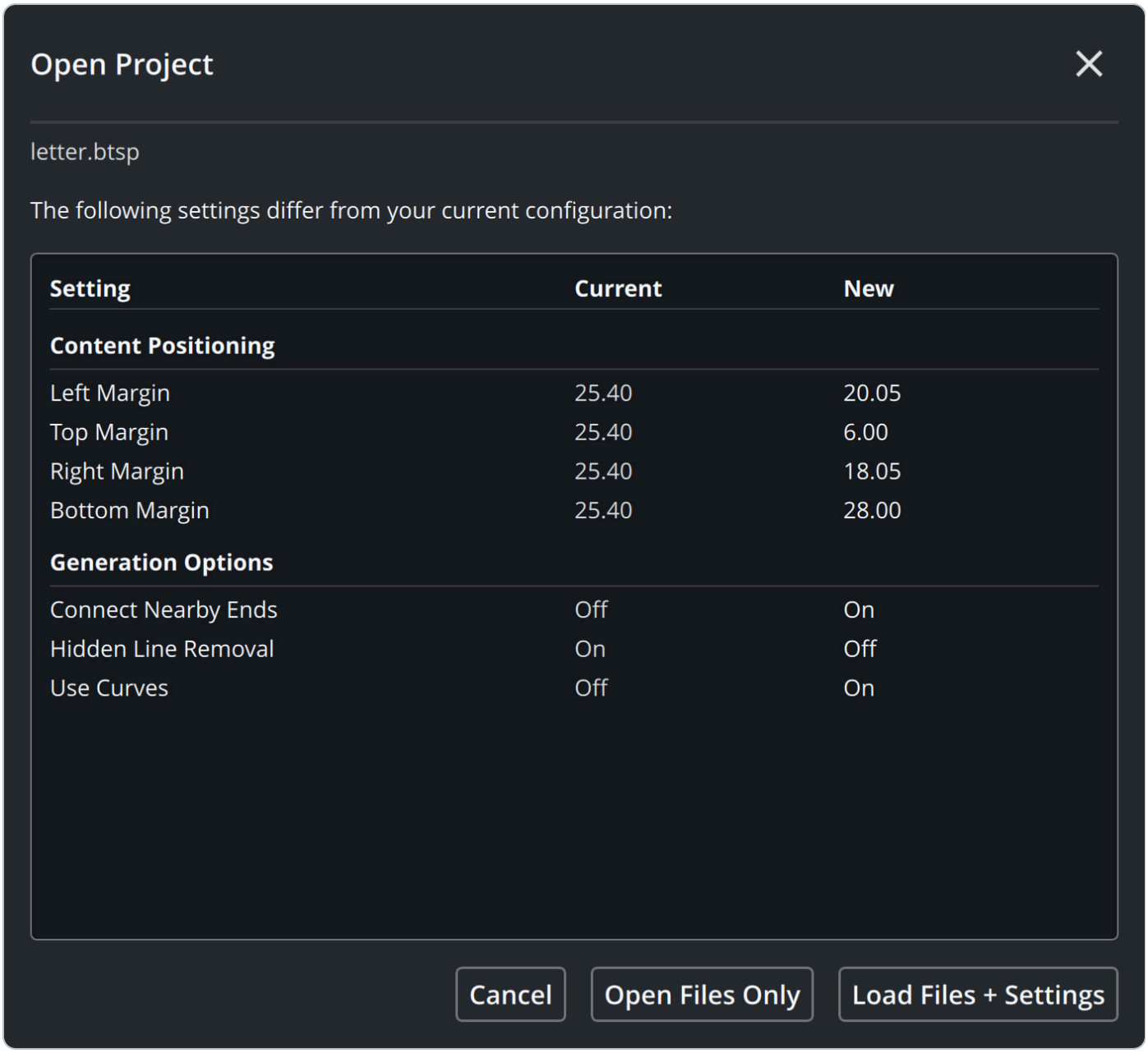
Save a project from the **PROCESS AND SAVE** chevron menu or the **File** menu, and open one from the **File** menu:

- **Save Project As...** (⇧⌘S (Shift-Command-S) / Ctrl+Shift+S) — saves the session to a new project file.
- **Save Project** (⌘S / Ctrl+S) — saves your changes to the project you opened or last saved.
- **Open Project...** (⇧⌘O / Ctrl+Shift+O) — opens a project file.

26.4.1 Opening a project

If the project's settings match your current ones, it opens without asking. If they differ, an **Open Project** dialog lists each setting that differs, with your value beside the project's value, and offers three choices:

- **Load Files + Settings** — opens the project's documents and applies its settings.
- **Open Files Only** — opens the documents and keeps your current settings.
- **Cancel** — leaves everything as it was.



Open Project *dialog listing the settings that differ*

If the project was saved for a different machine than the one you have selected, a **Machine Type Mismatch** dialog appears first:

- **Switch Machine** — switches to the project's machine, then continues as above.
- **Open Files Only** — opens the documents on the machine you have selected, without the project's settings.
- **Cancel** — leaves everything as it was.

Studio opens projects saved by earlier versions. Each project also records the file format it was saved in, and a version of Studio older than that format does not open it: it reports "This project requires Bantam Tools Studio X or later", naming the version that saved the project.

When some of a project's documents cannot be loaded, the rest open anyway and a **Some files failed to load** message lists the ones that did not; those appear as placeholders.

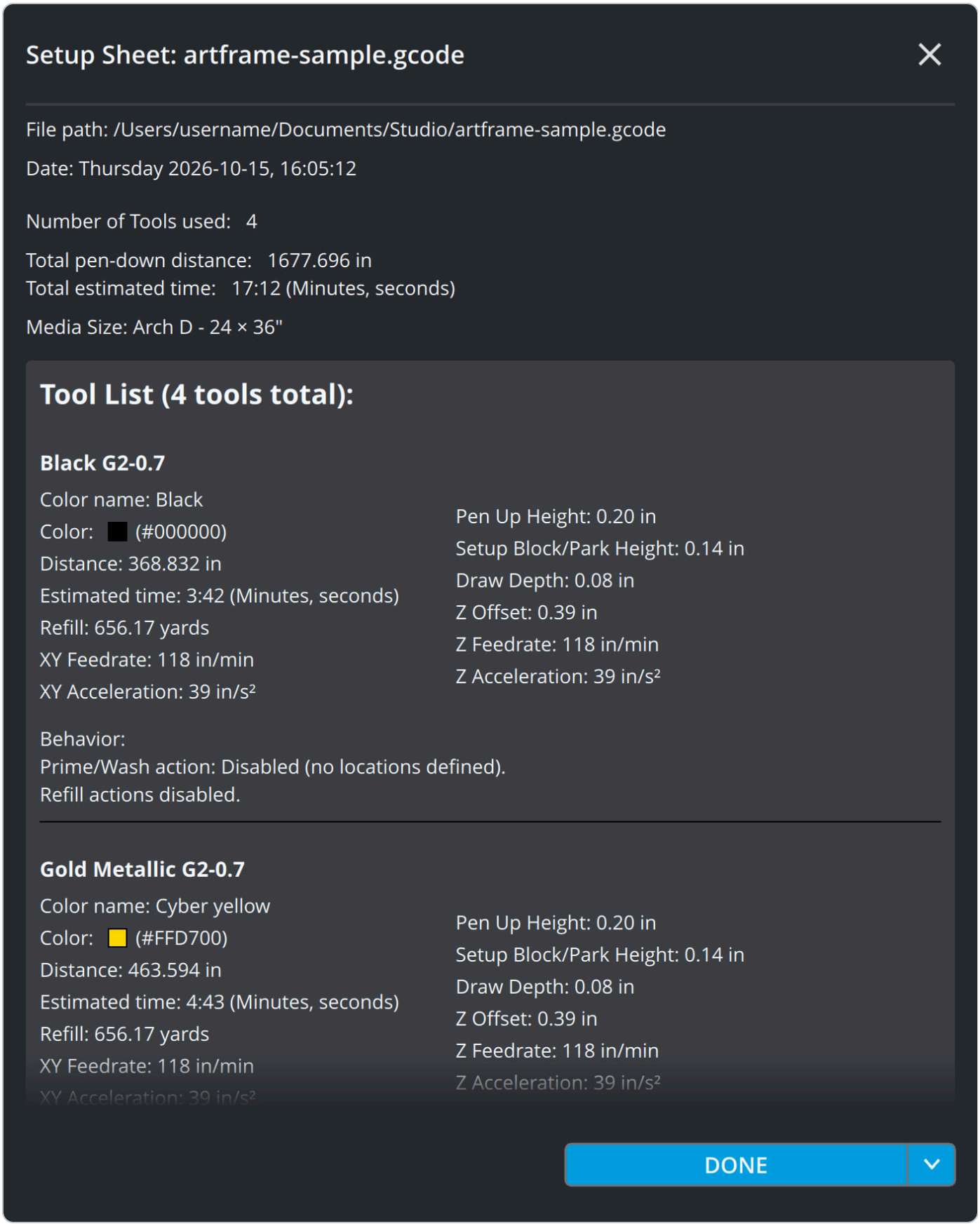
26.4.2 Support info in project files

Saved project files include a small, redacted diagnostic record. It holds your app and system versions, a list of recent activity, and recent lines from the log, so that Bantam Tools support can diagnose a problem from a project file you send. Passwords, Wi-Fi network names, and your user name are removed before the record is written.

To leave the record out of the projects you save from now on, turn off **Include support info in project files**; see §23.1 Program options. Turning it off changes nothing in project files you have already saved. **About Project Files**, on the **SETTINGS** tab, summarizes the same information.

26.5 Setup Sheet

After you process a G-Code job, Studio opens a Setup Sheet: an on-screen summary of the job that you can review before you start, and save as a PDF to print or keep with the job. When the job produced more than one output file, the window is titled **Batch Setup Sheet** and summarizes the whole run.



The Setup Sheet for a single job

The Setup Sheet can include:

- File path
- Date
- Number of tools used, and the number of tool installations when a tool is installed more than once
- Total pen-down distance
- Total estimated time
- Media size — its standard size name or, for a custom size, its dimensions and whether it is landscape or portrait
- Tool list
- Tool colors
- Each tool's height settings, under the names its Tool Settings uses
- Each tool's feedrates and acceleration
- Each tool's refill settings
- Operations list
- **Bantam Tools Studio Settings:** — a read-only summary of the settings behind the job: machine type, artwork scale, offsets, and rotation, margins, toolset, and the path processing and G-Code generation options

The total pen down distance and the estimated time are the two figures worth reading every time: together they tell you how long the job will take before you commit to plotting it.

If Studio finds a problem while generating the job — a move outside the machine's acceptable bounds, say, or a job with almost nothing to draw — the sheet lists it under **WARNINGS**. Click **Copy** to copy the warning text, which is the quickest way to paste it into a message to support.

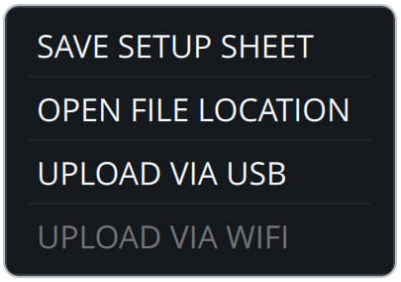
The button at the bottom of the Setup Sheet is a split button. It shows one action, **DONE** at first, and keeps the rest in its chevron menu. Choosing an action from the menu also makes it the button's action until you quit Studio, so a step you repeat on every job, such as uploading over USB, becomes a single click.



***DONE** button on the Setup Sheet, with its menu chevron*

The actions are:

- **DONE** — closes the Setup Sheet. Nothing is saved, and nothing is lost: the G-Code file was written when the job was processed.
- **SAVE SETUP SHEET** — for a single document, saves the sheet on screen as a PDF. The suggested file name matches the G-Code file, with a `.pdf` extension.
- **SAVE BATCH SETUP SHEET** — takes the place of **SAVE SETUP SHEET** when the job produced more than one file. It saves the batch summary as a PDF: the date, the number of files, the total pen down distance and estimated time, the tools used across the batch, and a table with one row per file. The suggested file name is `batch_setup_sheet.pdf`, in the G-Code output folder. It does not save a sheet for each individual file.
- **SAVE SETUP SHEET PER FILE** — appears only for a batch. Choose a folder, and Studio writes one setup sheet PDF into it for each G-Code file in the batch, named like that file with `_setup` added: `logo.gcode` gets `logo_setup.pdf`.
- **OPEN FILE LOCATION** — reveals the generated G-Code file, selected in a Finder window on Mac or an Explorer window on Windows.
- **UPLOAD VIA USB**, or **UPLOAD ALL VIA USB** for a batch — uploads the generated file or files to the connected machine over USB. It is always available: if no machine is connected yet, the Queue holds the upload and sends it once a machine comes online over USB.
- **UPLOAD VIA WIFI**, or **UPLOAD ALL VIA WIFI** for a batch — uploads over WiFi. It is available when a machine is reachable over WiFi.

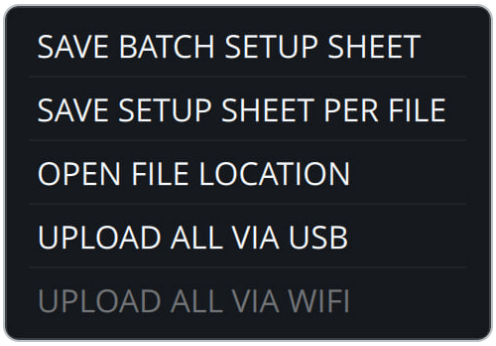


Setup Sheet menu for a single file

The two upload actions appear only when **Show Machine Control Tab** is enabled:

Settings → Machine Control → Show Machine Control Tab

With it disabled, the menu holds the save and open actions alone. For more on connecting and uploading, see §18. Sending files to your machine.



Setup Sheet menu for a batch of files

26.6 Split by Toolset

When **Split by Toolset** is enabled in the **PREPARE** tab's Options panel, Studio writes a separate G-Code file for each color, layer, or group, alongside the main output file. Reach for it on a multi-tool job when you want

manual control over the order of work — running each color as its own pass rather than letting Studio interleave tool changes.

The setting applies to the whole job rather than to one page, so with several documents open every page is split and the file count multiplies quickly. See §22.11.3 Split by Toolset for the detail, and §26.7 Output file names, below, for how the split files are named.

26.7 Output file names

When a job produces one output file, the file takes the name you enter in the save dialog. When several files are opened together, each output keeps its own source file's name, and the files go into the folder you choose when the batch starts. Two files with the same name, opened from different folders, produce a single output file, and the second replaces the first.

Data Merge and multipage documents, which add a suffix to each file name, come with the Bantam Tools Studio Text Add-On; the Bantam Tools Studio guide describes them.

A Plob's name ends in `_plob.svg`: `card_plob.svg`.

For **Split by Toolset**, Studio puts the per-tool files in a folder of their own, created beside the main output file and named for it without the extension, and names each one for the color, layer, or group it holds, numbered in the order it is drawn or painted: `1-Black.gcode`, `2-Red.gcode`. Where the tool's name differs from the grouping's, it follows after an underscore. In a batch, each document gets its own folder, named for that document's output file.

27. Studio: the TEXT tab

This chapter documents the TEXT tab section by section. Several of its controls require the Text Add-On, and the chapter ends with a section about what the add-on adds.

The **TEXT** tab is where Bantam Tools Studio™ turns words into strokes a pen can draw. You need it whenever a job carries text: a title on a drawing, a date in the corner, a caption under a diagram, or a signed letter. What follows is reference documentation for each card on the tab.

27.1 The TEXT tab at a glance

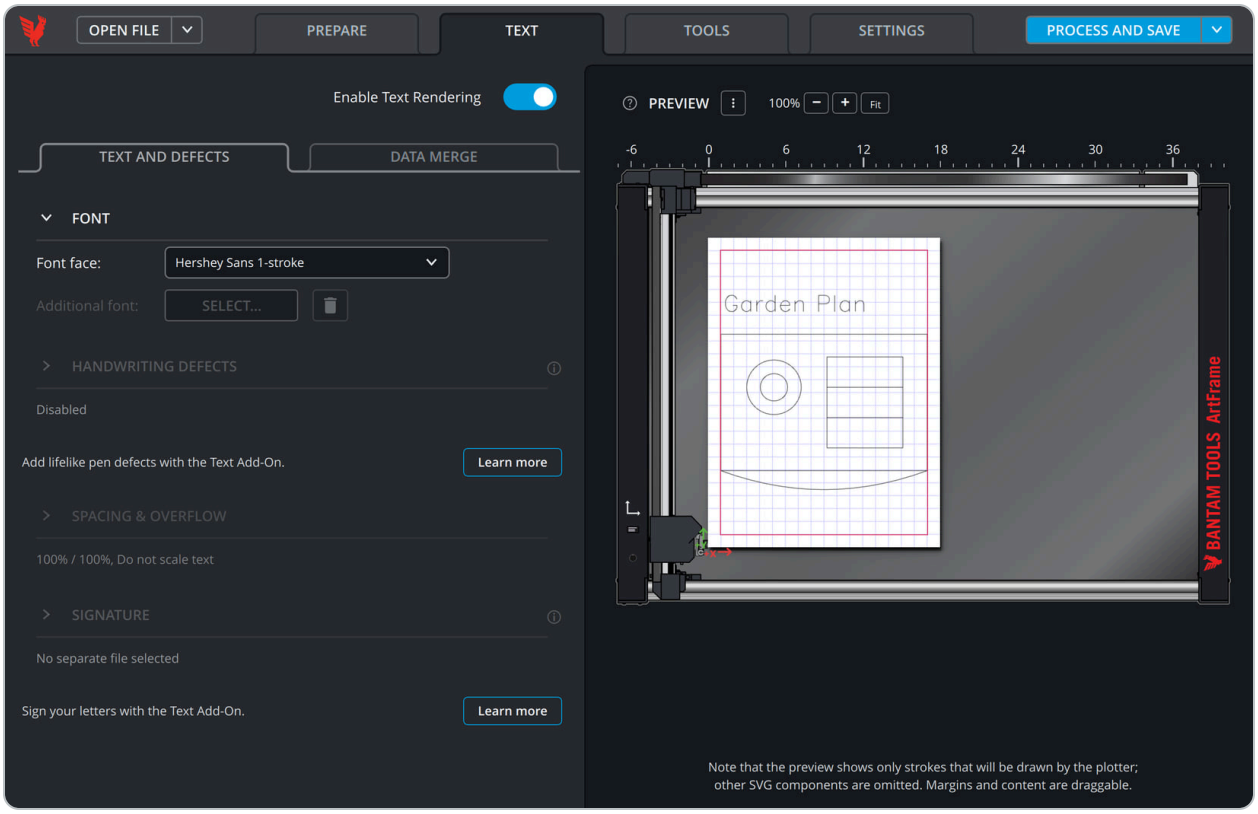
At the top left of the tab, the **Enable Text Rendering** toggle turns text rendering on and off. (Default: on)

Below the toggle, two sub-tabs divide the controls. **TEXT AND DEFECTS** holds everything about how the writing looks, and **DATA MERGE** holds the tools that fill a template from a CSV file. **TEXT AND DEFECTS** is selected the first time you open the tab, and Studio remembers which of the two you were last on.

TEXT AND DEFECTS carries four collapsible sections, in this order down the tab:

- **FONT** — chooses the font face and, for a text document, the font size. Its header summarizes the current selection.
- **HANDWRITING DEFECTS** — adds controlled, deliberate irregularity to the writing so it reads as a hand rather than a machine. Its header reads **Disabled**, or **Enabled** with the overall level, as in **Enabled, 20%**.
- **SPACING & OVERFLOW** — sets letter and word spacing, and what happens when the text does not fit the space it has.
- **SIGNATURE** — loads a signature file and sets the size it is drawn at. Its header names the loaded file without its extension, or reads "No separate file selected".

Apart from **Font face**, these controls are part of the Bantam Tools Studio Text Add-On, and are grayed out otherwise.



***TEXT** tab with an SVG drawing loaded*

27.2 What text rendering does

A pen has no way to set type. When text rendering is on, Studio replaces the text in your document with the paths a pen draws to write it, and those paths are what the machine follows.

The fonts Studio writes with are single-stroke fonts. They are not regular computer fonts, such as the TrueType (`.ttf`) and OpenType (`.otf`) fonts installed on your computer.

It is easy to assume otherwise, because on screen even a handwriting-style TrueType or OpenType font looks like it is made of strokes. A **t** and an **x** each look like two strokes crossing, and an **O** looks like one loop. They are not. In a regular computer font, the **t** and the **x** are each a single complicated closed outline, and the **O** is two closed outlines, one inside the other. The shape you see is the space between the edges, filled in, which is why these are also called **outline fonts**. There is nothing in the file that describes the line down the middle of a letter, which is the one thing a pen needs.

A single-stroke font stores that centerline instead. The pen travels each letter once rather than tracing its edge and filling the inside, which is what makes writing practical on a plotter, and why the letters come out as line work rather than as solid shapes.

The **Preview** area shows those strokes, which is why text on the **TEXT** tab looks thinner and plainer than the same words in a design program or a word processor. Studio is showing you machine motion, not a picture of finished ink. The tool and the paper decide how heavy the finished line looks.

Two single-stroke fonts are included: **Hershey Sans 1-stroke** and **Hershey Script 1-stroke**. Choose between them with **Font face**, in the **FONT** section.



*A title written in **Hershey Sans 1-stroke***



*The same title in **Hershey Script 1-stroke***

The words themselves reach Studio in the document you open: text placed in an SVG file by an editor such as Inkscape or Adobe Illustrator.

Text rendering sets how the words are drawn, not what they say. Nothing on the **TEXT** tab edits the text itself — to change the wording, change the document and open it again.

With the toggle off, Studio passes the document through untouched. Nothing converts the words into strokes, so the job carries the rest of the artwork and none of the writing. That is the setting to check first if a drawing plots correctly but arrives with its title missing.

Turning **Enable Text Rendering** off does not discard your setup. Studio leaves your settings exactly as you left them, so turning the toggle back on restores the document without a second pass through the sections. You can use it freely to compare a drawing with and without its writing.

27.3 Writing text in an SVG file

In an SVG file, the writing is one part of a larger drawing: a title, a date in the corner, a caption, an edition number on a print in a series, a label on a diagram, a short quote. It is also how you see what Studio does with text, and how the two included Hershey fonts look on paper.

Place the text in your artwork in an SVG editor such as Inkscape or Adobe Illustrator, save or export the file as an SVG, and then:

1. Open the SVG file in Bantam Tools Studio.
2. Go to the **TEXT** tab and turn on **Enable Text Rendering**.
3. Confirm the font in the **FONT** section header.
4. Go to the **PREPARE** tab and confirm the page setup, along with the scale and position of the artwork on the page.
5. Confirm the toolset and the tool assignments, so the writing is drawn with the tool you mean it to be drawn with.
6. Check the **Preview**. The writing appears as the strokes the tool will follow.
7. Click **PROCESS AND SAVE**.

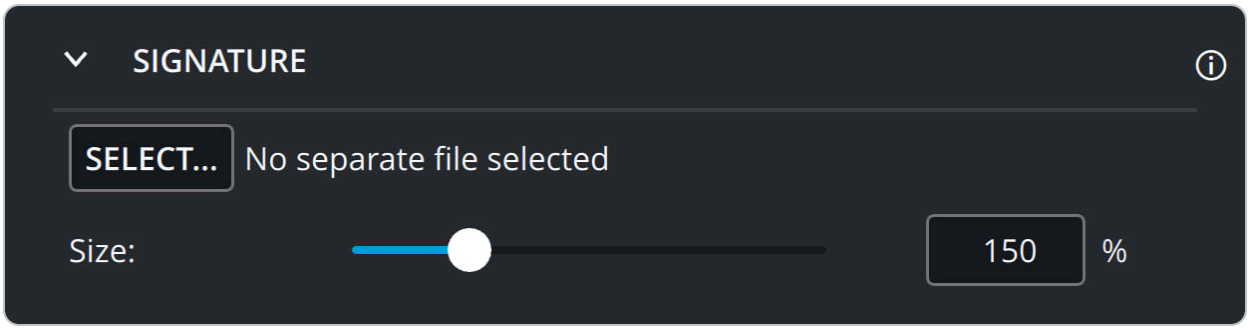
Studio generates the job from the document as the **Preview** showed it, writing and artwork together.

27.4 Signatures

A signature is real handwriting that Studio draws wherever you ask for it. It can come from a signature file you load, or from the font you write in.

To sign a document:

1. Open the **SIGNATURE** section.
2. Click **SELECT** and choose your signature file. Studio accepts `.svg` and `.zip` files.
3. Set **Size** with the slider or the field beside it. The range is 50% to 500%, measured against normal text height, so 100% draws the signature at the size of the surrounding writing.
4. In the text of your document, put `{{sig}}` where the signature belongs.



*The **SIGNATURE** section before a file is loaded*

Studio draws the signature in place of `{{sig}}`, at the size you set, and the section header changes from "No separate file selected" to the name of the file you loaded, with the extension dropped: `MySignature.svg` reads as `MySignature`. If the file cannot be used, Studio says so and leaves the section empty rather than accepting a signature it cannot draw.

The usual place for `{{sig}}` is on its own line after a closing:

```
Warmly,
{{sig}}
```

Size is measured against the writing, not against the page, so a signature keeps its proportions when the rest of the document is scaled to fit. Set it a little larger than 100% if you want the signature to read as a signature rather than as another line of text, and check the result in the **Preview** before committing a batch to paper.



The signature drawn in place of `{{sig}}`

Use the trash button beside the file name to clear a loaded signature. The section returns to "No separate file selected", and `{{sig}}` falls back to the font's signature. If the font has none, Studio reports a **Signature issue**.

27.4.1 Signatures included in a font

Some fonts include a signature, and some also include an alternate signature and initials. Fonts made in Bantam Tools Font Maker for iPad include whichever of these you wrote. A signature command draws each one:

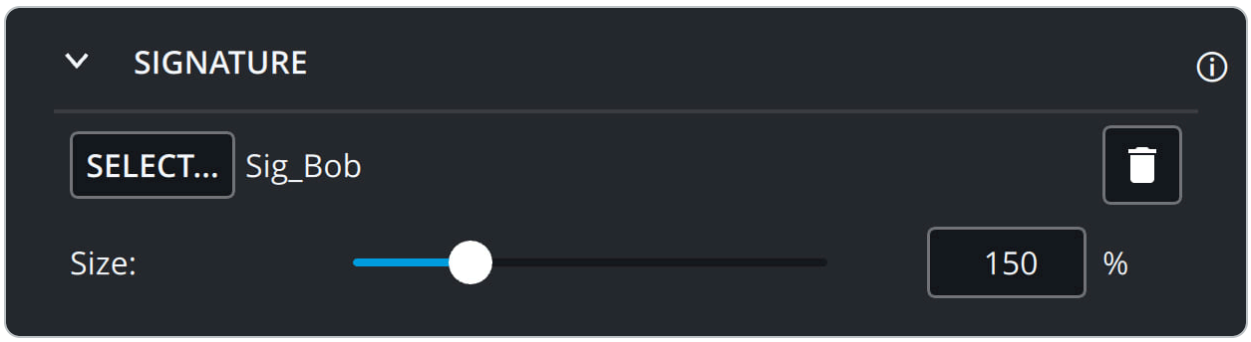
- `{{sig}}` draws the loaded signature file, or the font's signature when no file is loaded.
- `{{sigalt}}` draws the font's alternate signature.
- `{{siginit}}` draws the font's initials.

A CSV file is *never* required for `{{sig}}`, `{{sigalt}}`, or `{{siginit}}`; they work in any document.

`{{sigalt}}` and `{{siginit}}` always come from the font; a loaded signature file replaces `{{sig}}` only. **Size** applies to all three.

If the font cannot supply what a signature command asks for, such as `{{siginit}}` in a font without initials, Studio does not generate the job. **PROCESS AND SAVE** reads **Signature issue**, and the **CSV DATA PREVIEW** section on the **DATA MERGE** sub-tab names the command and the font; the section appears for this even when Data Merge is off. Choose a font that includes it, load a signature file (for `{{sig}}`), or remove the command.

> ***Tip:*** For the best result, use a clean `.svg` made from a real signature rather than a traced photograph of one. Bantam Tools Font Maker for iPad produces this kind of file, and the support article on capturing handwriting and signatures, in the Bantam Tools support section online, covers the process end to end.



***SIGNATURE** section with a signature file loaded*

27.5 About the Text Add-On

Every copy of Bantam Tools Studio writes the text an SVG document already carries, in the two included Hershey fonts. That is enough for a title or a caption on a page you designed yourself. The Bantam Tools Studio Text Add-On unlocks the rest of the **TEXT** tab, and each of its pieces answers a job the base license cannot do:

- **Text files** — opens `.txt` and `.rtf` files, the route to take when the words come from a word processor, an email, or a notes app rather than from a drawing. Text copied from another application opens the same way, from the clipboard.
- **The full font library** — gives you faces beyond the two Hershey fonts, for when the document's tone matters as much as its content.
- **Custom SVG font support** — writes in a single-stroke SVG font you supply, such as your own handwriting made into a font with Bantam Tools Font Maker for iPad, or a commercial face from Quantum Enterprises. Studio has built-in support for the Quantum Enterprises Scriptalizer service, which varies the letterforms of compatible fonts as Studio writes.
- **Signatures** — draws your signature, from a signature file or a font that includes one, wherever your document calls for it. See §27.4 Signatures.
- **Handwriting-like defects** — adds small random variations of the kinds found in real handwriting: rows that are not quite level, letters that sit a little high or low, spacing that opens and closes. Use them when a page should read as written rather than as typeset, and reroll the variation for a fresh draw before committing a page to paper.
- **Multipage documents** — flows a long document onto as many pages as it needs, which turns a multi-page letter into one job rather than a manual split. Letter and word spacing and the overflow controls decide how the text fits each page.
- **Data Merge** — fills one template from a CSV file and produces one document per row, which is the difference between writing 200 notes and setting up one. Merge fields also work in a designed `.svg` template, so a personalized batch can carry letterhead and artwork.

The Text Add-On is a separate purchase for Bantam Tools Studio. Visit bantamtools.com/text for more information.

The Bantam Tools Studio guide describes the Text Add-On features in full.

28. Painting with brushes

This chapter covers painting with brushes and palettes: how painting differs from drawing with a pen, the painting toolsets and tool macros, palettes, and how to test a painting tool.

28.1 What painting means

Painting is plotting with a brush. The machine follows the paths you define exactly as it does with a pen. What changes is that the tool carries paint: the brush returns to a palette to reload, and the materials have a say in the mark it leaves.

The machine moves the brush precisely and repeatably. Where the brush goes, how fast it moves, and how often it returns to the palette to reload all come from your artwork and the brush's settings.

That repeatability is what makes the physical side workable. Paint flows, water spreads, paper absorbs, and brushes change character as they move. Because the motion underneath is the same every time, you can run a file again and see how a change in speed, stroke order, or refill behavior shows up on the paper. Each run carries its own character, which is part of the medium.

Artwork is defined by SVG paths, and the Preview shows the motion those paths produce — where the brush travels and in what order — so you can check the plan before any paint reaches the paper. The painting itself emerges as the machine works.

To make paint-ready SVG artwork from a photograph, use the Image Processor; see §29. Studio: the Image Processor.

You define paths, stroke order, speed, and refill behavior, and the materials do the rest.

28.2 Key painting concepts

When painting, several concepts become more important than they are in pen plotting.

28.2.1 Stroke and sort order matter

Earlier strokes can wet the paper or deposit pigment that later strokes interact with. The order of colors, layers, or groups matters on the paper and on the brush itself.

Small amounts of pigment can remain on the brush between strokes and refills. Painting from lighter to darker pigments often produces more predictable results, especially in automated workflows where the machine is not paused for tool changes.

28.2.2 Speed affects saturation

Slower motion keeps the brush in contact with the paper longer, usually depositing more paint and producing darker strokes. Faster motion reduces contact time, producing lighter strokes with less pigment transfer.

Speed also changes how water and pigment spread. Slower strokes encourage pooling, blending, and softer edges, while faster strokes give drier marks with sharper transitions. Painting tools therefore usually run slower than pen tools.

28.2.3 Refilling is intentional

Returning to the palette is part of the painting process, not an interruption. How and when a tool refills affects saturation, consistency, and how a layer develops over time.

Each brush tool has its own **Refill Mode** setting, with three choices: **No Refills**, **Refill by Distance**, or **Refill by Stroke**. **Refill by Distance** returns the brush to the palette each time it has painted a set distance, wherever that falls: at the start, the middle, or the end of a stroke. After the refill, the brush returns to the exact point where it left off and continues the stroke. **Refill by Stroke** refills only between strokes, before every stroke that the **Refill After Strokes** count comes around to, so each stroke is painted in one pass however long it is. See §24.5 Editing an individual tool for the full field description.

The two refill modes trade consistency for character. **Refill by Distance** keeps the paint load even. **Refill by Stroke** lets long lines thin out as they go, which looks more like a hand-painted mark. Shorter refill distances, or fewer strokes between refills, give more even strokes, and longer ones let the paint fade and evolve across a layer.

Refills also change the palette itself over a long painting. Dipping in water before every refill carries water into the paint and gradually dilutes it, while letting a pan dry out partway through a layer makes the strokes that follow darker and more saturated.

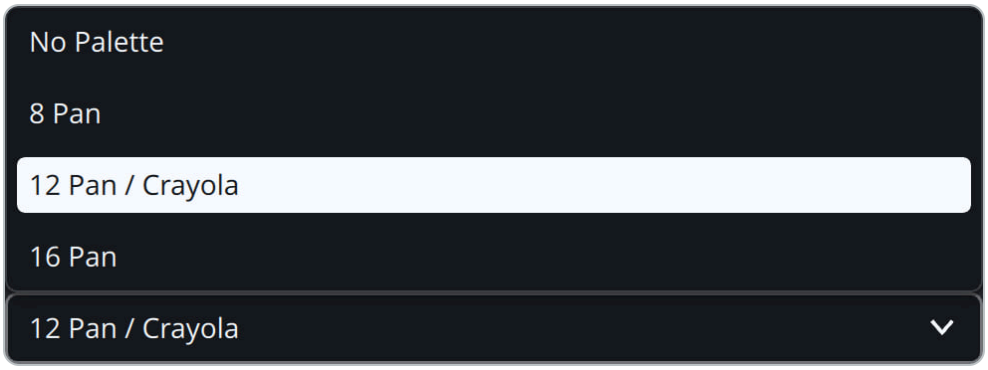
Different toolsets manage refill behavior differently. Some use water before or after pigment. Some scrape excess paint. Some allow pigment to evolve over repeated strokes.

28.3 Basic painting usage

To begin a painting workflow:

1. Select the appropriate machine.
2. Open an SVG file.
3. Set paper size and margins.
4. Select a painting toolset.
5. Select a palette layout.
6. Assign tools to colors, layers, or groups.
7. Preview the motion.
8. Generate and send the job.

Painting behavior is enabled when a palette layout is selected. Selecting WaterColorBot loads a default **12 Pan / Crayola** palette automatically: eight paint pans in one column, for a Crayola watercolor set, and four water basins beside them, but you can pick a different layout, such as **8 Pan** or **16 Pan**, from the palette selector. The selected toolset and palette layout together determine the macro behavior used during painting.



***Palette** menu with **12 Pan / Crayola** selected*

28.4 Toolsets for painting

A painting toolset is more than a list of colors. It defines a reusable painting system.

A toolset may include:

- Brush motion settings
- Travel/Park Height (WaterColorBot's brush travel-clearance field)
- Refill behavior
- Palette interaction
- Water dips
- Paint dips
- Scraping behavior
- Tool change behavior

Preset painting toolsets provide starting points for common watercolor workflows. They can be used as provided or duplicated and modified.

28.5 Loaded vs. balanced

A loaded brush goes directly from paint to paper, carrying the maximum amount of pigment.

A balanced brush returns to water after loading with paint, adjusting the pigment-to-water ratio before painting.

Balancing helps control saturation, consistency, and repeatability.

28.6 Wet vs. scraped

A wet brush goes straight to the paper after being loaded or balanced, retaining excess moisture and pigment.

A scraped brush is lightly wiped on the edge of the palette to remove excess paint and water.

Scraping helps prevent drips, pooling, and unintended bleed.

Wet-versus-scraped differences come from the brush's tool macros and how it loads paint.

28.7 Preset painting toolsets

The ArtFrame has four preset painting toolsets, one for each combination of loaded or balanced, and wet or scraped. Each holds a brush tool for each of eight paint colors, plus a water tool. Use one as it is, or copy it into a toolset of your own and change it. (See §23.4.3 Toolset Descriptions for the same summaries inside Studio.)

28.7.1 Loaded Brush (Wet)

This preset uses a full wash cycle: when the tool starts, the brush washes in each of the four water basins, and before each refill it rinses in water basin 10, then loads paint and goes straight to the paper. It produces wetter, more fluid strokes and suits washes, soft fills, and expressive lines where some variation is welcome.

28.7.2 Loaded Brush (Scrape at Paint)

This preset loads the brush with paint, then scrapes off excess pigment before painting. Scraping reduces drips and gives more consistent stroke weight without excess wetness.

28.7.3 Balance Pigment (Wet)

This preset balances pigment with a water dip but does not scrape to reduce wetness. It sits between a full wash and a drier approach, offering softer strokes with more control than Loaded Brush (Wet).

28.7.4 Balance Pigment (Scrape at Basin)

This preset balances pigment with a water dip, then scrapes the brush to reduce moisture before painting. It produces more controlled strokes and helps limit pooling or bleeding on lighter paper.

28.7.5 Watercolor brush (water)

Most preset toolsets also include a tool named **Watercolor brush (water)**. It paints with water only, for wet-on-wet effects. Keep **Hold Position on Tool Change** enabled for this tool (see §24.5 Editing an individual tool) and confirm the water is clean before starting a new color, layer, or group. For wet-on-wet painting, turn **Hold Position on Tool Change** off for the color tools that follow the water, so that the machine goes on to paint while the water layer is still wet.

28.8 Tool Macro Setup

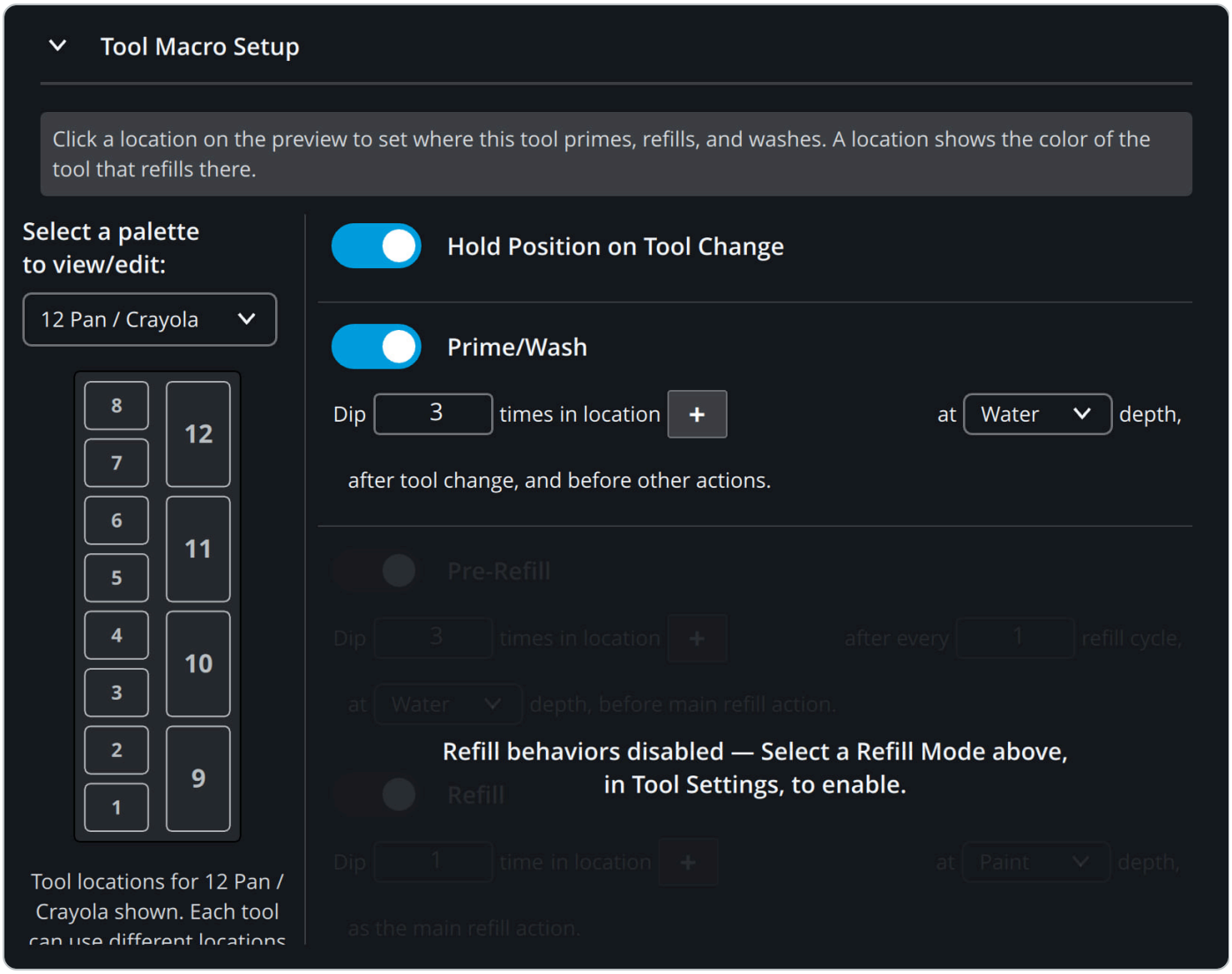
Tool Macros define how a brush tool interacts with the palette before, during, and after painting: where it dips, how many times, how deep, and how often. Each brush tool has its own macros, set in the **Tool Macro Setup** section, below **Tool Settings** when you select the tool in the Tool Library. The section appears on ArtFrame and WaterColorBot, for brush tools. See §24. Studio: the Tool Library.

There are four macro stages, each run at a different point in painting:

- **Prime/Wash:** Runs once after each tool change, before the first stroke. The brush dips, normally in water, to wet its bristles and rinse off any earlier color.
- **Pre-Refill:** Runs just before a refill. The brush dips, normally in water, so that it does not carry old color into the paint.

- **Refill:** The main paint pickup. When a refill is due, the brush travels to its paint location, dips, and returns to where it left off.
- **Post-Refill:** Runs just after a refill. The brush dips, normally in water, for example to thin freshly loaded paint to an even consistency.

A refill is due according to the tool's **Refill Mode**: after a set distance or a set number of strokes; see §24.5 Editing an individual tool. Each refill runs its stages in order: Pre-Refill, then Refill, then Post-Refill. With **Refill Mode** set to **No Refills**, only Prime/Wash can be used, and the other three stages are grayed out with the message "Refill behaviors disabled."

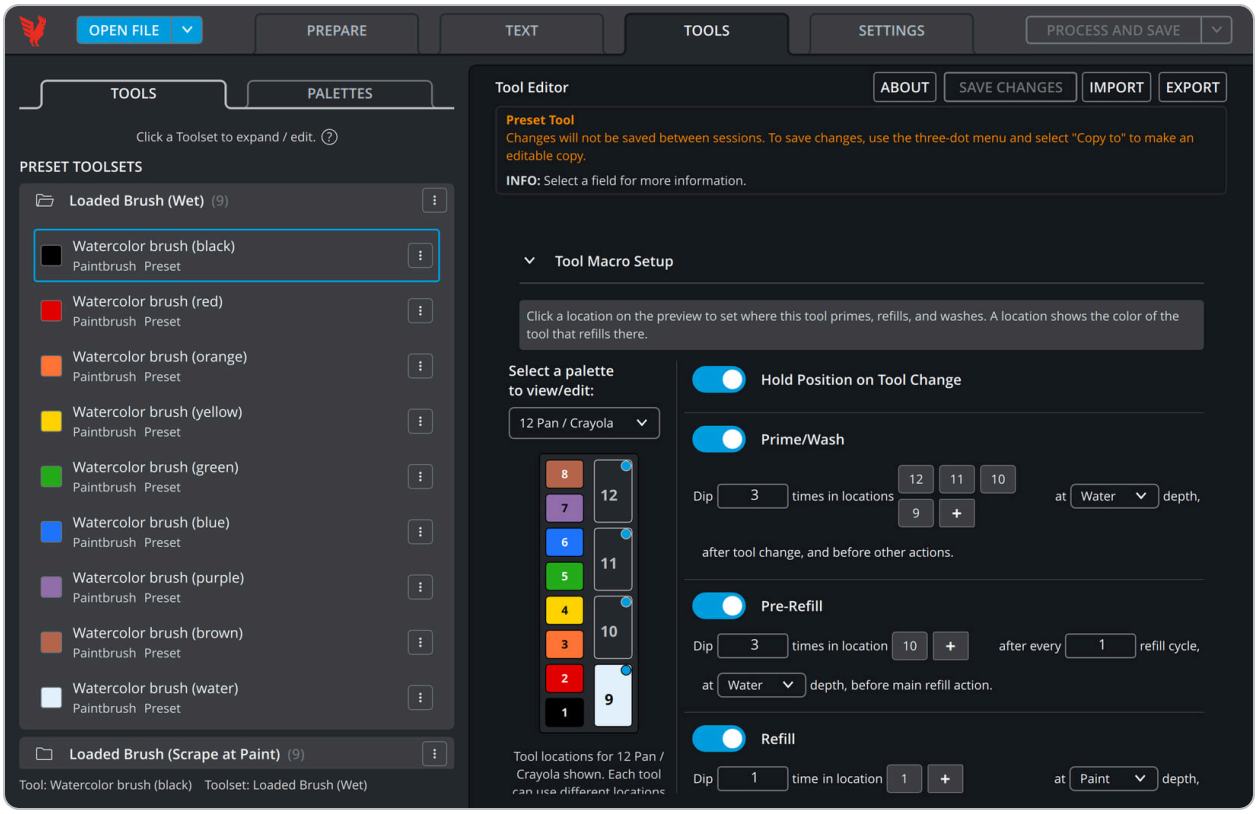


Tool Macro Setup *for a brush tool set to* ***No Refills****: only Prime/Wash is available*

Painting with a tool therefore has two phases. The tool starts with Prime/Wash, once. It then repeats a loop of painting and refilling (Pre-Refill, Refill, Post-Refill, then paint) until its strokes are done, without returning to Prime/Wash.

The stages are not limited to plain rinses. A Pre-Refill that dips in a second color mixes paint on the brush, and running it only every few refills builds a gradual shift in color across a layer. A stage can use several locations, for mixing, balancing, or blending.

Aside: Think of Tool Macros as choreography. The order and frequency of dips, refills, and returns define the behavior of the brush over time. Two tools can use the same brush and the same paints and still paint very differently, because a tool describes a behavior as much as a brush.



Tool Macro Setup *section for a WaterColorBot brush tool*

28.8.1 Assigning palette locations to a tool

A palette's wells are numbered locations. You choose which locations each tool uses for each stage, to match the paint and water you put in them. Assign them with the palette preview on the left of the **Tool Macro Setup** section:

1. Open the Tool Library (⌘3 / Ctrl+3) and select a brush tool. Select the tool itself, not its toolset, since locations are set one tool at a time.
2. Choose a palette from the **Select a palette to view/edit** menu. Studio shows that palette's numbered locations, and makes it the active palette for plotting.
3. Click the location that holds this tool's paint, and choose **Use for Refill**.
4. Click the location that holds water, and choose **Use for Prime/Wash**. Choose it again for **Use for Pre-Refill** or **Use for Post-Refill** if the tool should rinse there too.
5. Check each stage's settings on the right of the card, described in §28.8.2 Stage settings.
6. Click **SAVE CHANGES**.

The preview then shows the paint location filled with the tool's color, and the water location marked as a water dip. The same numbers appear in each stage's row of location boxes.

Clicking a location opens a menu:

- **Use for Refill**, **Use for Prime/Wash**, **Use for Pre-Refill**, and **Use for Post-Refill:** Add the location to that stage. A check mark shows the stages that already use it; choosing a checked item removes the location from that stage.
- **Clear from this tool:** Removes the location from every stage of this tool.



The menu a palette location offers, with a check mark on each stage already using it

One location can serve several stages, such as a single water well used for Prime/Wash, Pre-Refill, and Post-Refill. A stage can also use several locations, which the brush visits in the order they are listed, dipping the stage's repeat count at each.

Each stage's row of numbered boxes offers the same changes by number. Click a box and choose **Edit** to type a different location number, or **Delete** to remove it, and click **+** to add a location by number. The range of valid numbers is shown as you type.

The preview colors each location by how the tools in the current toolset use it:

- **Tool color:** A tool refills there, and the location shows that tool's color. When two or more tools refill at the same location, it shows bands of each color, and hovering over it warns that the tools will dip in the same well.
- **Water dip:** A tool uses it for Prime/Wash, Pre-Refill, or Post-Refill, but none refills there.
- **Unassigned:** No tool uses it, and it shows as an outline.

Hover over a location to see which tools use it and for what. Changes appear in the preview after you click **SAVE CHANGES**.

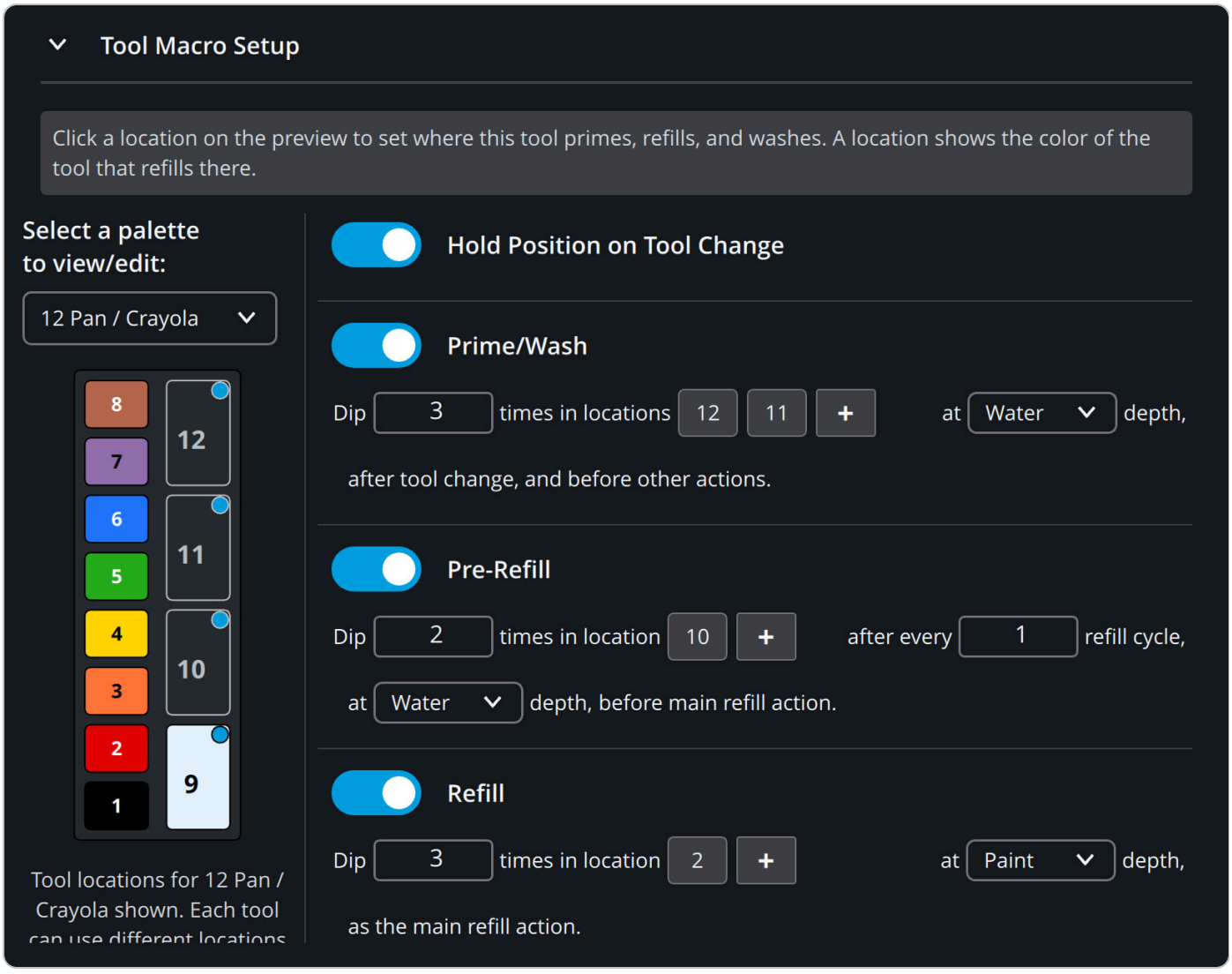
> ***Note:*** With a toolset selected rather than a single tool, the preview shows the combined locations of every tool in the toolset, and locations cannot be changed. Select an individual tool to change where it dips. Changes to a preset tool last until you quit Studio; to keep them, use **Copy to** to make an editable copy first. See §24.8 Copying and moving tools.

28.8.2 Stage settings

Each stage on the right of the **Tool Macro Setup** section reads as a sentence, such as "Dip 2 times in location 4 at Water depth, after tool change, and before other actions." Its parts are:

- **On/off switch:** Turns the stage on or off. Turning a stage on sets it to one dip and, if it has no locations yet, to location 1, so check its locations afterward.
- **Repeat count:** How many times the brush dips at each location of the stage, from 1 to 99.

- **Locations:** The numbered boxes described in §28.8.1 Assigning palette locations to a tool.
- **Refill cycles:** For **Pre-Refill** and **Post-Refill**, how often the stage runs, from 1 to 999: "after every 1 refill cycle" runs it with every refill, and "after every 3 refill cycles" with every third. (Default: 1)
- **Depth:** How deep the brush dips:
  - **Water:** The tool's **Water dip offset**. (Default for Prime/Wash, Pre-Refill, and Post-Refill)
  - **Paint:** The tool's **Paint dip offset**. (Default for Refill)
  - **Other:** A custom depth for this stage alone, entered in a field that appears beside the menu, measured above the paper surface: a positive value is above it and a negative value below. With **Enable Absolute Z Positions** on, the field takes an absolute height instead.



*The **Balance Pigment (Scrape at Basin)** tool, whose stages dip at several locations*

The water and paint dip depths are set in the tool's **Tool Settings** section, so changing them there changes every stage that uses them. See §14.9 Brush heights.

Hold Position on Tool Change, at the top of the card, is the same setting as in **Tool Settings**.

Stage settings, like locations, are saved with **SAVE CHANGES**.

28.9 Palette selection

Studio uses one active palette at a time. The palette menu in **Tool Macro Setup**, the **Palette** menu on the **PREPARE** tab, and the palette you select on the Tool Library's **PALETTES** tab all set that same palette, so choosing one in any place changes it in the others. See §24.9 The PALETTES tab.

A tool stores its locations separately for each palette. The same tool can refill at location 3 on the **12 Pan / Crayola** palette (WaterColorBot's default) and at location 5 on the **16 Pan** palette, and switching palettes switches between them. A tool's repeat counts, refill cycles, and depths are the same for every palette.

When preparing a job, only one toolset and one palette layout are used for that job.

28.10 Testing and calibrating painting tools

Run a simple and short test pattern first.

Favor strokes long enough to pull the brush across the paper, not only tiny dabs, unless dabs are the intended effect.

Observe how paint loads, how strokes evolve, and how refills affect consistency.

Tune in this order: brush compression first, then refill rhythm, then macro counts and intervals. Each step changes how much paint reaches the paper, so settling the mechanical one first keeps you from compensating for it in software.

Brush compression is how far the bristles press against the paper. You set it when you install the brush: lower it onto the Pen Height Setup Tool as far as you want it to press against the paper later. A light touch on the setup tool gives a light touch on the paper, and bristles that bend against the setup tool bend the same way against the surface, with a little extra from the brush presets. If strokes are overly wet, spread too much, or buckle the paper, reinstall the brush with a lighter touch; if they skip or look dry, with more bend. Once you find a position you like, note how the bristles flex at that height, or mark the brush shaft, so you can set it up the same way again.

Adjust **Travel/Park Height** if the brush drags or lifts more than necessary during travel moves. A higher travel height reduces the risk of dragging a wet brush across the paper; it affects how clean the painting is, not the look of individual strokes.

Watch the paper. Buckling, pooling, bleeding, dry strokes, and uneven pigment are all useful feedback:

- **Buckling or pooling:** Too much water or paint is reaching the paper. Refill less often, reduce repeat counts, or add a Post-Refill dip in water to temper the pigment.
- **Dry or faint strokes:** Too little is reaching the paper. Refill more often, increase repeat counts, or remove water dips that dilute the load.
- **Strokes that darken over a layer:** The paint pan is drying out. Refresh it, or dip in water more often.

Before starting, wet each paint pan with a few drops of water so that the first strokes load properly.

Run the same test twice before changing anything. Minor variation between runs is expected; a large difference usually means something in the setup changed, such as the brush position or the water level.

Save known good configurations as new tools or toolsets.

> ***Tip:*** Run the same SVG with several tool variations and compare results side by side. This is one of the fastest ways to understand how small changes affect the final painting.

29. Studio: the Image Processor

The Bantam Tools Image Processor™ turns a photograph or other raster image into an SVG file of brush strokes that Bantam Tools Studio™ can paint or plot. This chapter walks through converting a first image, then provides reference documentation for each part of the Image Processor window. You need it if you want to start from a picture rather than from vector artwork.

29.1 What the Image Processor does

A raster image (a PNG or JPEG file, for example) is a grid of colored pixels. A machine cannot follow pixels, so Studio cannot plot one directly. The Image Processor bridges that gap: it reduces the image to a small set of paint or pen colors, then lays down strokes of a chosen brush width to reproduce it, and saves those strokes as an SVG file with one layer per color.

It offers three ways of building the picture from strokes, called render modes:

- **Paint Stripes:** Parallel stripes, one brush width wide, that change color as they cross the image. Fast and predictable, with a graphic look. (Default)
- **Paint Shapes:** Flat regions of color, in the manner of paint-by-numbers, each outlined and filled.
- **Paint Shades:** Loose, overlapping strokes that follow the forms in the image, building shades by layering translucent paint.

Each is described in §29.5 Render modes.

The output is meant for painting on WaterColorBot™ or ArtFrame™ with brushes, or for plotting with broad markers: it builds the picture by filling areas with strokes rather than by tracing outlines. Its optional Detail Trace layer adds outlines on top; see §29.7 Detail Trace.

The Image Processor works at a resolution tied to the paper size, resizing the image to about one pixel per millimeter of the printable area whatever the resolution of the original. Larger paper gives a proportionally larger grid. Images with clear shapes and good contrast reproduce best.

29.2 Opening the Image Processor

The Image Processor opens in its own window, separate from the main Studio window. There are four ways to open it:

- **From the SETTINGS tab:** Click **Image Processor** in the **TOOLS** section. If no image is loaded yet, the window opens with a sample image of a parrot already processed, so that you have something to experiment with.
- **By opening an image:** Click **OPEN FILE** (⌘O / Ctrl+O) and choose an image.
- **By dropping an image:** Drag an image file from Finder or File Explorer onto the Studio window.
- **From the Samples and Generators section:** Click **Sample Image** to open the parrot sample.

If the Image Processor is already open, the new image replaces the one it was showing.

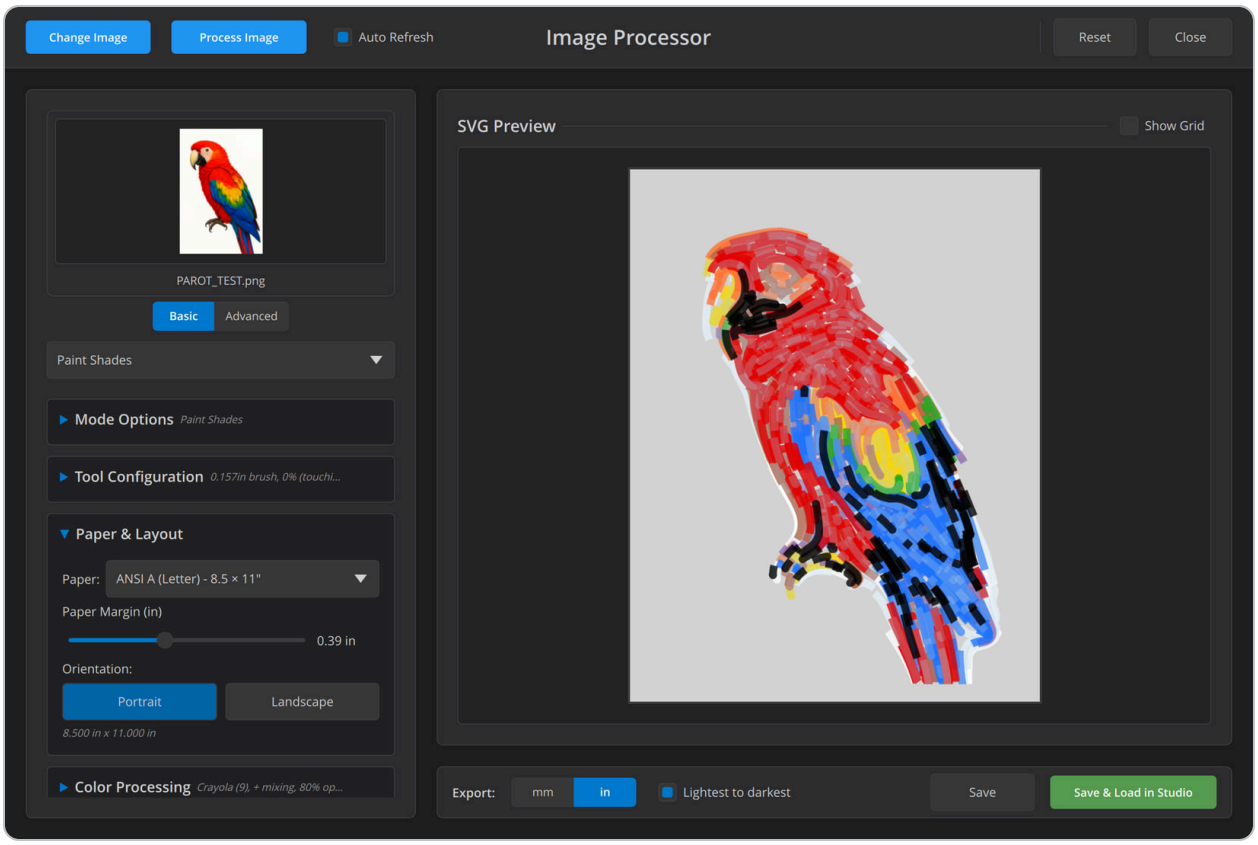
The Image Processor accepts PNG, JPEG (`.jpg` or `.jpeg`), BMP, and GIF files, one at a time. A GIF opens as a still image. Files larger than 50 MB are refused, and images larger than 4,096 pixels on a side are scaled down as they load, which loses nothing given the processing resolution described above.

29.3 Converting your first image

The quickest route from a photo to a painting uses the default settings and changes only what matters most: the paint colors and the brush.

1. Open your image in the Image Processor, as described above. It processes the image at once, using **Paint Stripes**, a 4 mm brush, and the Crayola palette, and shows the result under **SVG Preview**.
2. Choose a render mode from the menu below **Basic** and **Advanced**. **Paint Shades** suits most photographs.
3. Expand **Paper & Layout** and set **Paper** to the paper you will paint on. The Image Processor matched the orientation to the image when it loaded.
4. Expand **Color Processing** and set **Palette** to the paints you have.
5. Expand **Tool Configuration** and set **Stroke Width** to the width of the mark your brush makes.
6. Look over the preview. Each change reprocesses the image after a short pause, so you can compare settings as you go.
7. Click **Save & Load in Studio**, and choose a name and folder for the SVG file. Studio closes the Image Processor and opens the SVG on the **PREPARE** tab.

The artwork is now an ordinary SVG job, with one color for each paint in the Tool Assignments list. Choose a painting toolset, assign tools, and preview the motion as for any other job; §29.12 Painting Image Processor artwork covers the points particular to Image Processor output.



The Image Processor, with the parrot sample processed in Paint Shades

29.4 The Image Processor window

The window has four areas:

- **Header bar:** Loading an image, processing, and resetting, across the top.
- **Settings panel:** On the left, a thumbnail of the source image, the **Basic**/**Advanced** switch, the render mode menu, and the settings sections.
- **SVG Preview:** In the center, the processed result drawn on the paper.
- **Export bar:** Below the preview, the units and save controls; see §29.11 Saving the artwork.

29.4.1 Header bar

- **Load Image:** Opens an image file. Once an image is loaded, the button reads **Change Image**.
- **Process Image:** Processes the image with the current settings. It appears once an image is loaded.
- **Auto Refresh:** Reprocesses the image automatically about half a second after you change a setting. (Default: on)
- **Reset:** Returns every setting in the Image Processor to its default. It keeps the loaded image.
- **Close:** Closes the window. The image and settings are kept until you quit Studio, so reopening the window picks up where you left off.

Turn off **Auto Refresh** when each run takes long enough to interrupt your work, such as with a large paper size and a fine brush. The preview then keeps showing the last result, and a banner reads "Settings changed, process image to see result" until you click **Process Image**.

29.4.2 Basic and Advanced

The **Basic** and **Advanced** switch at the top of the settings panel controls how much of the panel is shown. (Default: Basic)

Advanced adds two things: the color and brightness sliders in **Image Adjustments**, and the **Detail Trace (Pen Layer)** section. Every other setting is the same in both views.

The switch changes what is shown, not what is used. Adjustments or a Detail Trace layer set up in **Advanced** stay in effect after you switch back to **Basic**.

29.4.3 Settings sections

The settings below the render mode menu are grouped into sections that start collapsed. Click a section's title to expand or collapse it. A collapsed section shows a one-line summary of its settings beside the title, such as "Letter, 10.0 mm margin," so you can check them without expanding anything.

The sections are, in order:

- **Image Adjustments** — orientation, fit, and color corrections to the source image; see §29.6 Image Adjustments.
- **Mode Options** — the settings of the selected render mode; see §29.5 Render modes.
- **Detail Trace (Pen Layer)** — an optional outline layer, in **Advanced** only; see §29.7 Detail Trace.
- **Tool Configuration** — brush width; see §29.8 Tool Configuration.
- **Paper & Layout** — paper size, margin, and orientation; see §29.9 Paper & Layout.
- **Color Processing** — the palette and how white areas are treated; see §29.10 Color Processing.

The thumbnail at the top of the panel shows the source image with its rotation, flips, and color adjustments applied, and the file name below it.

29.4.4 SVG Preview

The **SVG Preview** draws the processed strokes on a sheet the shape of the selected paper, at the colors and opacity they carry in the SVG file. It is a picture of the artwork, not a motion preview: it does not show plotting order or travel, which you review in Studio after loading the file.

- **Show Grid:** Draws a grid over the preview with cells one brush width across. It shows the scale of the brush against the image. (Default: off)

If you change the paper size or orientation while **Auto Refresh** is off, the sheet turns gray and reads **Paper Size Changed**, since the previous result no longer fits it. Click **Process Image** to fill the new sheet.

29.4.5 Processing time

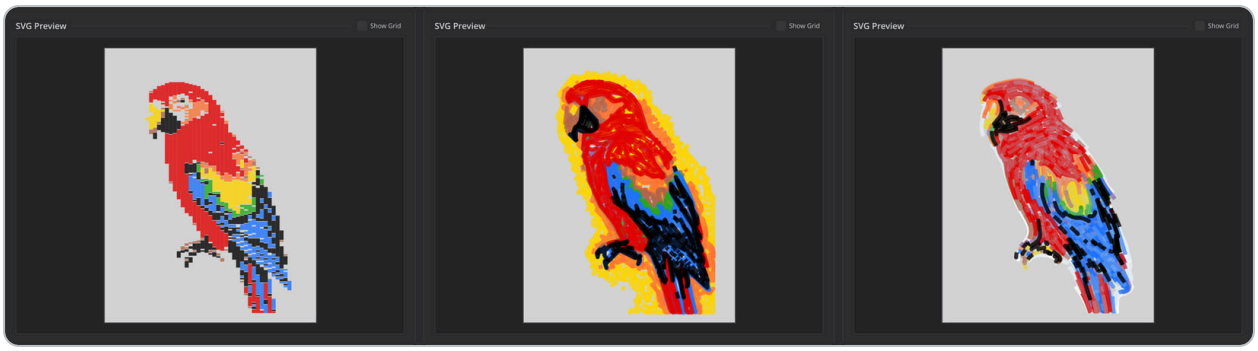
While the image is processing, a **Processing** dialog shows the current stage and a progress bar, with a **Cancel** button.

Before a run that it expects to take more than about 30 seconds, the Image Processor asks first, with a **Long Processing Time** dialog. It gives the estimated time, a complexity rating, and the number of grid cells to process. Click **Proceed** to start processing, or **Cancel** to leave the preview as it was.

The estimate grows with the printable area and shrinks with the square of the brush width, and **Paint Shades** takes about three times as long as **Paint Stripes**. For example, 18" × 24" (Arch C) paper with 10 mm margins in **Paint Shades** is estimated at 57 seconds with a 2 mm brush, but 14 seconds with a 4 mm brush, which does not ask at all. To shorten a run, use a wider brush or a smaller paper size.

29.5 Render modes

The render mode menu, below **Basic** and **Advanced**, sets how the Image Processor builds the picture from strokes. The choice changes the look of the result more than any other setting.



The same photograph in Paint Stripes, Paint Shapes, and Paint Shades, left to right

The settings particular to each mode are in the **Mode Options** section.

29.5.1 Paint Stripes

Paint Stripes covers the image with straight, parallel strokes, each one brush width wide, laid side by side with no gap. As a stripe crosses the image, it changes color wherever the image does, becoming a separate stroke of the new color.

The result has a woven, graphic look, and it is the fastest mode to process and to paint. It suits bold images, flat brushes, and markers, and it is a good way to see how a palette handles an image before trying the slower modes.

The number of stripes follows from the brush width: a narrower brush gives more stripes. How far neighboring stripes overlap, or how far apart they sit, is set by **Stroke Overlap/Spacing**; see §29.8 Tool Configuration.

The **Mode Options** for **Paint Stripes** are:

- **Rounded line ends:** Draws stroke ends round, the shape a round brush leaves. Where two colors meet along a stripe, the rounded ends overlap and leave a dot. Leave it off for flat ends that butt together cleanly, or for flat-tipped pens such as the Pilot Parallel Pen. This setting also applies to the other two render modes, even though it is shown only here. (Default: off)
- **Enable dithering:** Scatters palette colors in small blocks to suggest the colors between them. A menu beside it selects the method. (Default: off)
- **Stroke angle:** The direction of the stripes, from 0° to 180°: 0° is horizontal and 90° is vertical. The angle is measured on the paper, so it stays the same when you rotate the image. (Default: 90°)
- **Min stroke:** The shortest stroke kept, from 0.1 to 100 mm. Shorter pieces of color are discarded and leave a gap in the stripe. Raise it to drop specks of color that a brush would render as dabs. (Default: 1 mm)
- **Max stroke:** The longest stroke allowed, from 1 to 1,000 mm. Longer strokes are split into pieces of this length. Shorter strokes give a brush that refills by stroke count more chances to reload. (Default: 200 mm)

Without dithering, each part of the image takes the single nearest palette color, so a smooth gradient, such as a sky, can break into distinct bands. Dithering divides the image into blocks half the brush width across (and at least 3 mm), then assigns palette colors to the blocks so that, seen from a distance, they average out to the colors between. The methods are:

- **Floyd-Steinberg:** Gives the smoothest gradients. (Default)
- **Ordered (Bayer):** Uses a regular, repeating pattern, for a deliberately patterned look.
- **Atkinson:** Leaves less scattered noise, at the cost of some contrast in the darkest and lightest areas.

29.5.2 Paint Shapes

Paint Shapes divides the image into regions of flat color, each matched to a palette color, in the manner of a paint-by-numbers kit. Each region is outlined with a stroke along its edge and filled with concentric strokes that step inward from that edge.

It suits images with large areas of distinct color, such as illustrations, posters, and simple photographs, and it produces the cleanest edges of the three modes. Gradients become visible steps.

The **Mode Options** for **Paint Shapes** are:

- **Min area (mm^2):** The smallest region kept, from 4 to 500 mm^2. Smaller regions are merged into their neighbors. A higher value gives fewer, larger shapes and a simpler painting; a lower value keeps more detail.
- **Generate infill patterns:** Fills each region with concentric strokes. Turn it off to paint outlines only, as a guide for filling by hand. (Default: on)
- **Enable detail lines:** Adds thin black outline strokes. (Default: off)
- **Complexity:** How closely region edges follow the image, from **Max** (detailed, intricate edges) to **Min** (smooth, simple edges). Simpler edges paint more cleanly with a wide brush. (Default: toward **Max**)
- **Enable water wash blending:** Adds strokes of water along the region edges, which soften them into their neighbors on wet paper. (Default: off)
- **Water wash before color:** Places the water strokes before the paint, which wets the paper first. When it is off, the water follows the paint and blends it afterward. Available when **Enable water wash blending** is

on. (Default: on)

29.5.3 Paint Shades

Paint Shades paints with loose strokes that follow the direction of edges and forms in the image, like the strokes of a painter working quickly. Rather than choosing a single palette color for each area, it layers translucent strokes of different paints to build intermediate shades.

It suits photographs, portraits, and landscapes, and gives the most painterly result. It is also the slowest mode to process, and because its strokes overlap freely, the painting depends more on how the paint behaves on the paper than in the other modes.

How translucent each stroke is comes from **Line opacity**, in **Color Processing**; see §29.10 Color Processing.

The **Mode Options** for **Paint Shades** are:

- **Voronoi iterations:** How evenly the starting points of strokes are spread over the image, from 0 to 20. More iterations give a more even distribution and take longer. (Default: 3)
- **Flow coherence:** How smoothly strokes follow the direction of the image, from 0 to 100. Higher values give longer, smoother, more consistent strokes; lower values give a more broken, energetic texture. (Default: 30)
- **Seed density:** How many strokes are started for each paint color, from 100 to 10,000. More seeds give denser coverage and more strokes to paint. (Default: 1,000)
- **Fidelity:** How strongly strokes are chosen to match the image's colors, from 0 to 10. Higher values follow the colors more closely. (Default: 1.0)
- **Fill passes:** How many times the Image Processor returns to fill areas that are not yet covered, from 1 to 5. More passes give fuller coverage and take longer. (Default: 3)
- **Enable water blending:** Adds short strokes of water beside paint strokes where colors meet, for softer transitions. (Default: on)
- **Water opacity:** How strongly the water strokes show in the preview, from 0.10 to 0.50. Available when **Enable water blending** is on. (Default: 0.30)

Paint Shades can also paint with several brushes of different widths, set in **Tool Configuration**; see §29.8 Tool Configuration.

29.6 Image Adjustments

Image Adjustments changes the source image before it is processed. Nothing here alters the image file on disk. Its controls appear once an image is loaded.

- **Rotate 90° ↻:** Rotates the image a quarter turn clockwise. The paper orientation does not follow; change it in **Paper & Layout** if the rotated image would suit the other orientation.
- **Flip Horizontal** and **Flip Vertical:** Mirror the image left to right or top to bottom.
- **Fill Mode:** How the image is fitted to the printable area of the paper:
  - **Shrink to Fit:** Scales the image to fit entirely within the margins, keeping its proportions and centering it. If its proportions differ from the paper's, blank space is left along two sides. (Default)
  - **Zoom to Fill:** Scales the image to cover the whole printable area, keeping its proportions and cropping whatever extends past the margins.

In **Advanced** view, four sliders adjust the image's color:

- **Saturation:** Multiplies the color intensity, from ×0.00 (grayscale) to ×2.00. (Default: ×1.00)
- **Brightness:** Lightens or darkens the image, from −0.50 to +0.50. (Default: 0)
- **Contrast:** Increases or decreases contrast, from −100 to +100. (Default: 0)
- **Hue:** Shifts every color around the color wheel, from −180° to +180°. (Default: 0°)
- **Reset Adjustments:** Returns the four sliders to their defaults.

Adjustments are a good way to steer the palette. Raising **Saturation** helps a muted photograph use more of a bright palette, and raising **Brightness** leaves more of the paper unpainted when white areas are skipped.

29.7 Detail Trace

Detail Trace (Pen Layer) adds a layer of thin black lines that trace edges and details in the image, drawn after all of the paint. It is meant for a pen or fine marker, run once the paint has dried, to restore the definition that broad brush strokes lose. The section appears in **Advanced** view, and it works with all three render modes.

- **Enable detail trace:** Adds the Detail Trace layer. (Default: off)
- **Strategy:** How edges are found. (Default: Organic)
- **Stroke width:** The width of the traced lines, from 0.1 to 10 mm. Set it to the width of the pen that will draw them. (Default: 0.7 mm)

The two strategies are:

- **Organic (art/photos):** Follows soft and curving edges, and suits people, animals, landscapes, and artwork.
- **Geometric (architecture):** Finds straight line segments, and suits buildings, machinery, and technical subjects.

Detail Trace changes reprocess only the trace layer, reusing the paint strokes already made, so they update faster than other settings.

29.7.1 Advanced Detail Trace settings

The **Advanced** group, inside the section, holds the settings of the edge-finding methods. The defaults suit most images; reach for these when the trace picks up too much texture or misses edges you want.

For both strategies:

- **Min path length:** Discards traced lines shorter than this, from 0.5 to 20 mm. Raise it to remove specks and short noise. (Default: 2.0 mm)

For **Organic**:

- **DoG Sigma 1** and **DoG Sigma 2:** The Organic strategy finds edges by comparing two blurred copies of the image, a slightly blurred one and a more blurred one (a method called difference of Gaussians, or DoG). **DoG Sigma 1** sets the lighter blur (from 0.5 to 3.0); lower values catch finer edges. **DoG Sigma 2** sets the heavier blur (from 1.0 to 6.0); higher values favor broader edges. (Defaults: 1.0 and 3.0)
- **Block size:** The size of the neighborhood, in pixels, that each point is compared against when deciding whether it lies on an edge, from 3 to 51. Larger blocks respond to broader changes in brightness. (Default: 11)
- **Threshold C:** How strong a change must be to count as an edge, from −10 to 10. Lower values, including negative ones, find more edges. (Default: 2.0)

- **Smoothing:** How much traced lines are simplified, from 0.5 to 3.0. Lower values keep more of each line's small turns. (Default: 1.0)
- **Smooth passes:** How many times traced lines are rounded off, from 0 to 5. Fewer passes keep more detail; more passes give smoother curves. (Default: 2)
- **White thresh:** Areas brighter than this level, from 240 to 255, count as background and are not traced. Lower it if the trace outlines faint marks in a white background. (Default: 254)
- **Expand white filter:** Widens the background areas slightly, to drop edges that sit right against them. Usually left off. (Default: off)
- **Min contrast:** Skips edges in areas of low contrast, from 0 to 100, where 0 skips nothing. Raise it to ignore soft texture such as skin or sky. (Default: 10)

For **Geometric**:

- **Min line length:** The shortest straight segment kept, in pixels, from 5 to 100. Since the image is processed at about one pixel per millimeter, this is close to a length in millimeters. (Default: 10 px)

29.8 Tool Configuration

Tool Configuration sets the size of the brush the strokes are made for.

- **Stroke Width:** The width of every stroke, from 0.1 to 10 mm. Measure the mark your brush or marker actually makes on paper, which is usually wider than its tip, and set this to match. Wider strokes process faster and paint faster, with less detail. (Default: 4 mm)
- **Brush Presets:** Buttons that set **Stroke Width** to a common size: **Fine** (2 mm), **Size 3** (4 mm), **Crayola** (6 mm), and **Flat** (7 mm). Brushes of the same nominal size vary between manufacturers, so treat these as starting points.
- **Stroke Overlap/Spacing (%):** How far neighboring strokes overlap, as a percentage of the brush width, from −100% to 90%. At 0%, strokes just touch. Positive values overlap them, for denser coverage that uses more paint; negative values leave gaps between them, for faster, lighter coverage. The quick presets **Gap (-10%)**, **Touching (0%)**, and **Overlap (+10%)** set common values. (Default: 0%)

A little overlap helps hide the paper between strokes, since a brush rarely lays down an edge as crisp as the preview shows. **Show Grid** draws cells at the resulting stroke spacing, and the processing time estimate grows as the spacing narrows.

29.8.1 Multiple Brush Widths

In **Paint Shades**, the **Multiple Brush Widths** check box lets the image be painted with several brushes, the wider ones covering broad areas and the narrower ones adding detail on top. (Default: off)

When it is selected, the **Stroke Width** slider is unavailable, and a field below the check box takes the brush widths, in millimeters regardless of the display units, separated by commas: `10, 5, 2`. Up to 10 widths from 0.1 to 100 mm are accepted. The widest brush is painted first.

Each brush width becomes its own set of layers in the SVG file, so in Studio you can assign a different brush tool to each. **Save** also writes one additional SVG file per brush; see §29.11 Saving the artwork.

29.9 Paper & Layout

Paper & Layout sets the sheet the artwork is made for. The SVG file is exactly this size, and Studio keeps that size when it loads the file, so choose the paper you will actually use.

- **Paper:** The paper size. The menu offers US sizes from ANSI A (Letter) to ANSI D, architectural sizes from Arch A to Arch E, Full Imperial (22" × 30", a common watercolor sheet), Panorama max (72" × 24", the full ArtFrame Panorama work area), ISO A4 to A0, and **Custom**. (Default: ANSI A (Letter))
- **Width** and **Height:** With **Custom** selected, the paper dimensions, from 10 to 1,000 mm.
- **Paper Margin:** The blank border on every side, from 0 to 25 mm. The artwork is fitted within it. (Default: 10 mm)
- **Orientation: Portrait** or **Landscape**. The dimensions it produces are shown below the buttons.

When an image loads, the Image Processor sets the orientation to match it: landscape for an image wider than it is tall, and portrait otherwise. Change it afterward if you want the other.

Match the margin here to the margin you plan to use in Studio. The Image Processor has no notion of a machine's reach or a palette's position, and a margin that is narrower here than on the **PREPARE** tab will have its outer strokes cropped there.

29.10 Color Processing

Color Processing sets the colors the image is reduced to, and how its white areas are treated.

29.10.1 Palette

- **Palette:** The set of colors the strokes can use. (Default: Crayola 8 Colors)

The built-in palettes model paint sets by their colors:

- **Crayola 8 Colors:** Black, blue, brown, green, orange, red, violet, and yellow, the colors of a Crayola eight-color watercolor set.
- **Winsor & Newton:** Eleven colors, from Lemon Yellow to Lamp Black.
- **Pentel 22 Colors:** The 22 colors of a Pentel watercolor set.
- **Phoenix Watercolors:** The colors of a 36-color Phoenix artist watercolor set.
- **Grayscale:** Evenly spaced grays from black to white, for monochrome work with one paint diluted to several strengths, or with gray markers.
- **Image Colors:** Colors picked from the image itself, for when you mix paints to order.
- **Custom Palette:** Colors you choose; see §29.10.4 Custom Palette dialog.

With **Grayscale** or **Image Colors** selected, a **Colors** field sets how many colors to use. **Image Colors** counts white among its colors, so a setting of 8 gives seven colors from the image, plus white.

A palette color that no part of the image is matched to produces no strokes, so the SVG file can hold fewer colors than the palette.

- **Extend palette by allowing mixing:** Lets **Paint Shapes** and **Paint Shades** layer translucent strokes of two palette colors to make a color the palette lacks, such as red over blue for purple. The mixed colors are predicted from how real pigments combine, not from how colors add on screen. Not shown for **Custom Palette**. (Default: on)
- **Mixing preference:** With mixing on, how strongly to favor a single palette color over a mix, from 0 to 30. At 0, each area takes whichever color or mix matches best; higher values mix only when no palette color comes close, which gives simpler paintings with fewer layered strokes. (Default: 10)

With mixing on, the panel also shows the most strokes that can be layered in one area, which follows from **Line opacity**.

29.10.2 White areas

Paper is usually white, so by default the Image Processor paints nothing where the image is white, and lets the paper show through.

- **Include white as a color:** Paints white areas instead of leaving them blank. (Default: off)
- **Replace with:** With **Include white as a color** selected, the color white areas are painted in. Click the swatch to choose another. Use a pale color that shows against the paper, or the color of white gouache or another opaque paint you plan to use. (Default: a pale blue, #E3F2FD)

Near-white areas of the image, not only pure white, count as white.

29.10.3 Line opacity

- **Line opacity:** How translucent each stroke is, from 10% to 100%. (Default: 80%)

Line opacity models how transparent watercolor is. In the **SVG Preview**, lower values let overlapping strokes show through each other. In **Paint Shades**, it also sets how many strokes can be layered to build a shade: at 80%, two strokes at most, and at 30%, four. Lower it for thin, transparent paints; raise it toward 100% for opaque paints and markers, which hide what lies beneath them.

The opacity is recorded in the SVG file, but it describes the look of the result rather than controlling the machine, which paints every stroke with whatever the brush carries.

29.10.4 Custom Palette dialog

With **Custom Palette** selected, click **Edit Custom Palette** to open the **Custom Palette** dialog. The button shows how many colors the palette holds. A new custom palette starts with eight bright colors, to edit or replace.

The dialog lists the palette's colors, up to 16, each on a row:

- **Color swatch** and **Edit:** Open a color picker for that color.
- **Hex Code:** The color as a six-digit hexadecimal code, such as `#1F75FE`. Type a code and press Enter or Return to change the color.
- **×:** Removes the color from the palette.

Below the list:

- **+ Add Color:** Adds a new, randomly chosen bright color to the end of the list, to edit into the one you want.
- **Quick Presets:** Replace the whole palette with one of six sets of six colors: **Primary**, **Warm**, **Cool**, **Pastels**, **Earth**, and **Monochrome**.

Click **OK** to use the palette.

For paints you own, the most faithful colors come from a painted swatch rather than from the name on the pan: paint a stroke of each color on the paper you will use, photograph or scan the swatches, and enter the hex codes from the image.

29.11 Saving the artwork

The export bar below the preview saves the processed artwork as an SVG file. Its buttons are available once a result is showing.

- **Export:** The **mm** and **in** switch sets the units shown throughout the Image Processor. It is the same setting as Studio's **Display Units**, so changing it in either place changes both. The SVG file is always written in millimeters, whichever is selected. See §23.1 Program options.
- **Lightest to darkest:** Orders the colors in the SVG file from lightest to darkest. (Default: on)
- **Save:** Saves the SVG file and leaves the Image Processor open, for when you want to try other settings or keep several versions.
- **Save & Load in Studio:** Saves the SVG file, closes the Image Processor, and opens the file on the **PREPARE** tab.

Studio rotates the loaded artwork, if needed, to fit the paper, and centers it.

29.11.1 What the SVG file contains

The SVG file is a sheet the size of the paper, in millimeters, with the artwork inside the margins. Its strokes are grouped into layers, one for each combination of color and stroke width, named for their order, color, and width, such as `3 – #1F75FE 4.0mm`.

With **Lightest to darkest** selected, the layers are ordered from the lightest color to the darkest. This is usually the right order to paint in, since pigment carried over on the brush then darkens later colors rather than tinting light ones. The layer numbers in the names do not follow this order. With it cleared, the layers are ordered darkest to lightest.

Water strokes, from water wash or water blending, are on layers of their own, in pale blue colors that differ slightly from one layer to the next. Each sits beside the color it blends: before the paint, or after it, as the mode's settings direct.

A Detail Trace layer, named `Detail Trace`, is always last, after every paint layer, whichever order is selected.

With **Multiple Brush Widths**, **Save** writes the combined file under the name you chose, plus one file per brush with its width added to the name, such as `parrot_5.0mm.svg`. The per-brush files hold that brush's strokes alone, without the Detail Trace layer. **Save & Load in Studio** writes the combined file only.

The Image Processor does not save its settings with the SVG file or anywhere else. To return to a result later, keep the SVG file, and note the settings that produced it.

29.12 Painting Image Processor artwork

Artwork from the Image Processor is an ordinary SVG file once it is saved, and it is prepared on the **PREPARE** tab like any other; see §22. Studio: the PREPARE tab and §28. Painting with brushes. A few points are particular to it.

- **Tool assignments:** Sort strokes by **Colors** or by **Layers**. Each paint color arrives as its own entry, ready to assign to a brush tool at the matching palette location.
- **Water layers:** Assign the pale blue water layers to a tool that paints with water only, such as **WaterColor Brush (Water)**, or to **None; skip this task** to leave them out.
- **Detail Trace:** Assign the black **Detail Trace** layer to a pen, and run it after the paint has dried.
- **Painting order:** Keep the layer order the Image Processor wrote, lightest to darkest, by leaving the list in the order it loads. Paint Shades strokes are laid down in a deliberate order as well, and should reach the paper as written. **Path Reordering** starts at **Optimize speed & quality**, which reorders strokes to save travel; set it to **Off** for Paint Shades artwork. See §22. Studio: the PREPARE tab.

- **Paper:** Set the same paper size and margins you used in the Image Processor, so that the artwork keeps its size.

The stroke count can be large. A Paint Shades painting on a large sheet may take many hours of brush travel and refills, so check the estimated time on the Setup Sheet before you commit to it; see §26.5 Setup Sheet. For a first attempt, a small paper size and a wide brush give a quick, inexpensive test of the palette and the settings.

30. Using your own G-Code

The Bantam Tools ArtFrame™ runs G-Code, and it does not care which program wrote it. Bantam Tools Studio™ is one source of G-Code; a text editor, a script, or a third-party tool is another. This chapter is the reference for that second case: what the firmware accepts, what it ignores, what it rejects, and what a file has to contain to run.

Keeping every move inside the machine's working area is your file's responsibility. Studio does that for its own output; the travel figures for each axis are under Limits and common errors, below.

> ***Tip:*** Generate a file for a job in Studio, then open it in a text editor. It is the fastest way to see which commands the machine is given in practice, in what order, and with what values.

30.1 What the machine reads

A G-Code file is a plain text file, one command per line. The machine runs files whose names end in `.gcode` or `.nc`, and it lists no other file in its browser.

How the file reaches the machine — a microSD card, a USB cable, or WiFi — makes no difference to how it runs; see §18. Sending files to your machine. Browsing the card and starting a file at the display are covered in §11. The ArtFrame interface.

30.2 Units

The firmware works internally in millimeters and in millimeters per minute, whatever a file says. `G21` selects millimeters for the numbers in the file and `G20` selects inches. Millimeters are the default at power-up, and a `G20` stays in force after its file ends, so a file should state its units with `G21` or `G20` rather than rely on the default.

An `F` word sets the feed rate in current units per minute. `G94`, the default, reads `F` that way; `G93` reads it as inverse time. A `G1`, `G2`, or `G3` move made before any feed rate has been set fails with an undefined-feed-rate error and stops the file, so set `F` before the first move at feed rate. Once set, the rate carries forward, and a later move needs an `F` word only to change it.

An `F` larger than the machine's configured maximum rate is quietly clamped to that maximum rather than refused, and `F0` is not applied: the log records it, and the previous rate stays in force.

30.3 The coordinate system

The machine uses a right-handed coordinate system, with Z pointing up away from the work surface. Z 0 is the bottom of the pen lift's travel and larger Z values raise the tool. Where the tool actually touches the media depends on how far down you install it, not on a fixed Z value.

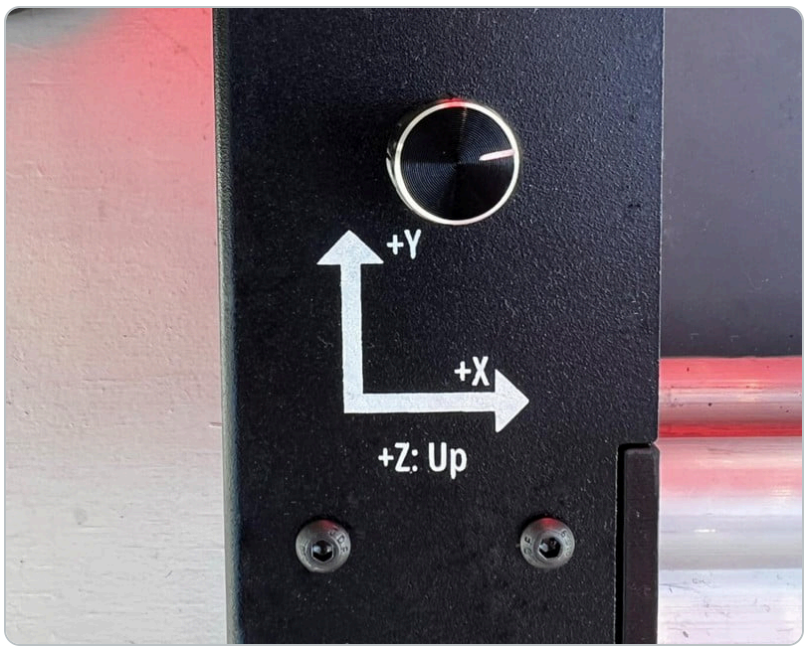
The axes are:

- **X** — the tool's position across the work area, in millimeters.
- **Y** — its position along the work area, in millimeters.
- **Z** — the pen lift, in millimeters.

The ranges of travel are:

- **X** — 0 – 458 mm on ArtFrame 1824, 0 – 915 mm on ArtFrame 2436, and 0 – 1,829 mm on ArtFrame Panorama.
- **Y** — 0 – 610 mm on every model.
- **Z** — 0 – 60 mm on every model, with 60 mm at the top of the lift's travel.

X 0, Y 0 is the Home corner, marked by the printed axis arrows on the frame, and every position the machine will accept has X, Y, and Z greater than or equal to zero.



The printed axis arrows mark the Home corner.

These figures come from the machine's configuration file; the **Version** screen shows which configuration is installed (see §11.11 The Settings menu).

Coordinates are machine coordinates unless you change them. The machine starts in `G54`, whose offsets are zero by default, so a plain `G0 X0 Y0` goes to the machine's own zero. `G53` uses machine coordinates for the one line it appears on. `G92` sets a temporary offset, which lasts until `G92.1` clears it or the machine restarts. `G10 L2` stores an offset in flash memory, where it survives a restart; see §30.5 Setting the origin.

`G90` selects absolute positions and `G91` selects positions relative to the last one. `G90` is the default, and it is the safer of the two in a file written by hand, since one bad relative move shifts everything after it.

30.4 Homing and where a file starts

The machine homes when it needs to, either because you selected **Home** at the display or because you started a file on an unhomed machine. A file therefore does not need to home itself, and a file that begins with `$H` will home a second time.

Homing runs Z first, raising the pen away from the work surface, then Y, then X, both toward the Home corner. Z homes away from the paper so that the pen cannot draw a line across your work while the machine finds its position.

Homing leaves the machine knowing where it is, and nothing else: it does not move to the start of your artwork. The first move in your file decides that.

30.5 Setting the origin

Two commands set where a file's coordinates start, and both work on your machine.

`G28.3` tells the machine where it is without moving it: given an axis and a value, the machine takes its present position on that axis to be that value. It is how a file declares an origin that no limit switch can find.

`G10 L2` stores a work coordinate offset, and `P1` chooses the first one, which is `G54`. `G10 L2 P1 X0 Y-193.4 Z0` puts the G54 origin at that point in machine coordinates, and every move after a bare `G54` is measured from there. This is how the work area is placed without moving the machine, and it is used widely: it is what puts a file's origin at the corner of the media.

Use `G53` on any single line that should ignore the offset and move in machine coordinates instead. A stored offset outlives the file that set it, so a later file that assumes `G54` is zero will be wrong unless it sets the offset itself.

Each `G10 L2` that changes an offset writes the new value to the machine's flash memory, and flash wears with repeated writes. Set the origin with `G10 L2` once, at the top of the file, with the same value on every run, as Studio's files do; a repeated `G10 L2` with an unchanged value writes nothing. For an offset that changes while a file runs, use `G92`, which is held in working memory and never written to flash.

30.6 Commands the firmware accepts

The firmware is a Bantam Tools fork of FluidNC, the open-source controller firmware, and it inherits FluidNC's parser. Unmodified FluidNC is not supported on ArtFrame plotters.

Commands fall into two groups. The recommended commands are the ones Studio itself writes, so every job generated in Studio runs them. Machine-years of use, in many different circumstances, are what build our confidence in this group. The second group is the rest of what the firmware accepts. We expect these to work well, but they are not part of Studio's output, so they do not have the same machine-years of testing behind them.

30.6.1 Recommended commands

- `G0` — move at the rapid rate, for pen-up travel.
- `G1` — move at the feed rate set by `F`.
- `G2` and `G3` — clockwise and counterclockwise arcs, with `R` giving the radius.
- `G4` — dwell, for the time in seconds given as `P`.
- `G20` and `G21` — units, inches and millimeters.
- `G10 L2` — store a work coordinate offset, with `P` choosing which one. See "Setting the origin", below.
- `G28.3` — set the machine's idea of where it is, without moving. See "Setting the origin", below.
- `G53` — machine coordinates, for the one line it sits on.
- `G54` through `G59` — select a stored work offset. Studio uses `G54` for the work area and `G59` for a palette.
- `G90` and `G91` — absolute and relative positions.
- `G92` — set a coordinate offset.
- `M0` — pause (see Pausing a file, below).

- `M2` and `M30` — end of program.
- `F` — feed rate.
- `N` — a line number, which the firmware accepts and ignores.

Arcs are cut into short straight segments before they reach the motors. Studio writes them with `R`, the radius form. Arc centers, where you give them, are always relative to the arc's start point, which is the `G91.1` convention; `G90.1`, absolute arc centers, is rejected, and G-Code written with absolute arc centers will not run.

Studio's output is always in millimeters, whichever units the interface is displaying, and the file says so: the preamble writes `G21` alongside `G90`. State your own file's units the same way, with `G21` for millimeters or `G20` for inches.

30.6.2 Other commands the firmware accepts

Several of these refer to hardware your machine does not have, such as spindles, coolant, probes, and tool length offsets, and have nothing to act on here.

- `G2` and `G3` with `I`, `J`, or `K` — arcs given by their center rather than a radius.
- `G17`, `G18`, `G19` — plane selection, for arcs.
- `G28`, `G28.1`, `G30`, `G30.1` — go to and record a predefined position.
- `G38.2` through `G38.5` — probing, and only where a probe pin is configured.
- `G40`, `G43.1`, `G49` — cutter compensation and tool length offset.
- `G61` — exact path mode, which is the only mode, so it does nothing.
- `G80` — cancel motion mode.
- `G91.1` — relative arc centers.
- `G92.1` — clear a coordinate offset.
- `G93` and `G94` — inverse-time and units-per-minute feed modes.
- `M1` — optional stop. The firmware parses it and does not stop.
- `M3`, `M4`, `M5` — spindle control, with `S` for speed.
- `M6` — tool change, with `T` for the tool number. Nothing moves and nothing pauses: the tool-change prompts you see on the display come from comments instead, not from `M6`.
- `M7`, `M8`, `M9` — coolant control.
- `M56` — restore parking motion.
- `M62` through `M65` — digital output control, with `E` for the pin number.
- `M67` and `M68` — analog output, with `E` and `Q`.

Canned cycles, cutter radius compensation, subroutines, variables, and expressions are not implemented, nor is the `%` program delimiter. A file that relies on any of them will not run.

> ***Aside:*** Studio writes `M5` (spindle stop) before `M2` at the end of every file. It has no practical effect on your machine, but it is a normal part of the end-of-job boilerplate on CNC machines.

30.6.3 Anything else

A G or M word the parser does not recognize is an unsupported-command error. The firmware logs it, naming the file and the line, and then carries on with the next line, because a file that stops dead on one stray command is worse than one that skips it. Every other kind of error stops the file where it stands; see Limits and common errors, below.

30.6.4 Dollar commands

The firmware's own commands begin with `$` and are normally typed into a terminal over USB rather than put in a file. A line beginning with `$` inside a G-Code file is run as a `$` command all the same. The useful ones:

- `$H` — home every axis that has a homing cycle. `$HX`, `$HY`, and `$HZ` home one axis, where that axis homes at all.
- `$X` — clear an alarm.
- `$$` and `$S` — list the machine's settings.
- `$#` — report the stored coordinate offsets.
- `$G` — report the parser's current modes.
- `$I` — report the firmware version and the machine's name. It answers even while a file runs.
- `$Limits` — report each axis's limits.
- `$J=` — jog, as a one-off move that does not disturb the parser's modes.
- `$C` — toggle check mode, which parses a file without moving.
- `$E` and `$A` — list the error and alarm codes the firmware can report.
- `$SD/List` and `$SD/Run=` — list the microSD card and start a file on it.
- `$Help` — list every command.

`$RST=` restores settings and `$NVX` erases them. Both are recovery tools, and the display's **Reset Factory Settings** is the route we document for owners; see §11.11.8 Factory reset.

30.7 Comment-syntax commands

A comment is text in parentheses: `( like this )`. Comments are stripped before the line is parsed, so a comment may sit on a line of its own or follow a command on the same line. A semicolon also begins a comment, which runs to the end of the line.

A handful of comments are commands. The firmware reads the start of each parenthesized comment and acts on the ones it recognizes; every other comment is ignored, with no error. These commands exist only in the Bantam Tools fork of FluidNC.

Three rules govern all of them:

- They are case-sensitive. `( CLEAR )` works and `( clear )` does not.
- They must be in parentheses. The semicolon form is a comment to the parser but is never read as a command, so `; Install Tool: 1` does nothing at all.
- Where the form includes a colon, the colon is required. `( Park Height 5 )` is an ordinary comment.

Leading and trailing spaces inside the parentheses are fine, and are how our own output is written.

30.7.1 Display and pause instructions

These set the text the display shows. Tool-change prompts and what you do with them are described in §11.7 Tool-change prompts; the syntax is here.

- `( ## text )` — holds `text` and shows it at the next `M0`.
- `( Install Tool: text )` — shows the whole comment, beginning with `Install Tool`, at the next `M0`. The colon is optional in this one form, and any text may follow.
- `( Toolchange text )` — shows the whole comment, beginning with `Toolchange`, at the next `M0`.

- `( CLEAR )` — clears the display's instruction. This one must be exact: nothing may follow `CLEAR` inside the parentheses.
- `( !! text )` — shows `text` at once rather than waiting for a pause, for about ten seconds.
- `( MSG text )` — writes `text` to the machine's log and shows nothing. A colon may replace the space.

An instruction longer than 64 characters is cut off and ends with an ellipsis, and only about 40 characters fit on the display at once. The instruction Studio puts in front of each tool change is also sent to Studio's **MACHINE** tab, which shows it while the machine waits.

The usual order is the instruction, then `M0`, then `( CLEAR )` once the pause is over.

30.7.2 Park height

`( Park Height: 5.25 )` sets how far the pen lift retracts when a job is paused, in millimeters above the bottom of Z travel. This is the same setting as **Pen Parking Height** in Studio's G-Code generation options; see §22.11 G-Code generation options.

The value must be at least zero and no more than the Z axis's travel, which is 60 mm. A value outside that range is not applied, and neither is a value the firmware cannot read as a number; the log records a warning, and the previous value stays in force.

`( Install Height: )` is accepted as a synonym.

30.7.3 Acceleration

`( Accel: 2000 )` sets the acceleration of the X and Y axes, in mm/sec^2. A single axis takes a letter: `( AccelX: 2000 )`, `( AccelY: 2000 )`, or `( AccelZ: 2000 )`.

A file may only lower acceleration. The value must be at least 10, and it may not exceed the ceiling the machine's configuration sets for that axis; a request above the ceiling is refused rather than trimmed to fit, and the refusal is logged with the value, the axis, and the ceiling. The two-axis form is all or nothing, so `( Accel: )` either applies to both axes or to neither, and never leaves the two mismatched.

An acceleration a file sets lasts until the end of that job. `M2` or `M30` restores the configured values, so the next file starts from the machine's own settings whatever the last one did.

30.7.4 Firmware version notice

`( FW: 2.10.13 available )` names the newest firmware Studio knew of when it wrote the file. If the machine's firmware is older than that version, the display briefly shows that a newer version is available (at bantam.tools/fw) at most once per power cycle; the file then runs as usual, delayed only by a couple of seconds.

> ***Tip:*** This guide describes the firmware as it was when the guide was written. If your firmware is older, particularly if it is older than 2.10, you may find quite a few features missing, including the firmware version check, and we highly encourage you to update (bantam.tools/fw).

30.8 Pausing a file

`M0` pauses the file. Buffered moves finish first, so the machine comes to rest where the file last told it to go, and the pen lift is left where it is rather than retracting. That is what makes `M0` usable for a tool change: put the pen lift at the height you want to work at, then pause.

The display shows **Click to RESUME** and **HOLD to CANCEL**, or the instruction a comment supplied in place of them. A press of the knob resumes; a press and hold cancels. This is the same pause the knob produces, and

§11.6 Pausing, resuming, and canceling covers both.

A pause you request at the display, by contrast, does retract the pen lift to its park height, so that the pen is clear of the work while you attend to it.

`M1`, the optional stop, is parsed and ignored. It does not pause anything.

30.9 A typical startup routine

A file's first few lines put the machine in a known state and give you a chance to install the pen. A minimal version reads:

```
G21
G90
G0 Z3
( Install Tool: 1. Layer: Neutral Gray )
G0 X0 Y0
M0
( CLEAR )
```

Line by line:

- `G21` sets millimeters, so the file does not depend on what ran before it.
- `G90` sets absolute positions, so every coordinate that follows is measured from the machine's zero. Studio's files set both `G21` and `G90` in their first few lines.
- `G0 Z3` raises the pen lift to 3 mm, clear enough of the work surface to install a pen without dragging it.
- The `Install Tool` comment supplies the text the display will show at the pause. Edit it to say whatever is useful.
- `G0 X0 Y0` moves to the machine's zero. Z stays at 3 mm, since the line does not mention it.
- `M0` pauses. Install the pen and press the knob to go on.
- `( CLEAR )` clears the instruction from the display now that the pause is over.

From there, set a feed rate and start drawing. Lower the pen with a `G1` Z move, run the strokes, raise it again, and close the file with `M2` or `M30`.

30.10 File requirements

A file the machine will run through to the end has four properties.

It ends with `M2` or `M30`. The end-of-program marker is how the firmware knows the file is complete rather than truncated, and it is also what restores the machine's configured acceleration and park height after a job that changed them. A file that ends cleanly without a marker still runs to the end and is still marked complete, but the display holds **File ended without end marker** until you press the knob.

Its last line ends with a line break. A file whose final line is cut off mid-command is treated as truncated: that partial line is not run, the display shows **File ended unexpectedly**, and the file is not marked complete. This is usually the sign of an interrupted copy rather than a mistake in the file. See §11.8 The post-run screen.

Its lines are under 255 characters. The firmware reads each line into a fixed buffer, and a longer line stops the file with a line-length error. Ordinary G-Code lines are nowhere near this, but a long comment, or a single line

holding a whole path, can reach it.

Its line endings are `LF` or `CRLF`. These are the line endings every modern operating system writes, so a file saved on Windows, macOS, or Linux runs as it is.

Its text is ASCII or UTF-8. Plain ASCII is recommended. UTF-8 characters in comments are passed to the display as written, and a file saved as UTF-8 runs the same as an ASCII one.

File names and where files live on the card are covered in §18. Sending files to your machine, and browsing them at the machine in §11. The ArtFrame interface.

30.11 What Studio writes

Reading a generated file beside your own is the quickest way to see what a working file looks like on your machine.

Every generated file opens the same way, whatever the job. A block of `;` comment lines records the Studio version, the file name, the date, the target machine, the media size, and the work offset in use, and the setup lines follow:

```
G10 L2 P1 X0 Y0 Z0
G90
G21
G54
```

`G10 L2 P1` places the G54 work origin and `G54` selects it, both covered in §30.5 Setting the origin. `G90` selects absolute positions and `G21` selects millimeters. The first tool's instruction comment and its park-height raise come next, and the strokes after that.

The rest of the output reflects the settings in the **PREPARE** tab's G-Code generation options, so the same job can produce quite different G-Code:

- **Use Curves** decides whether curves become `G2` and `G3` arcs or many short `G1` segments.
- **Disable Rapids** and **Disable Rapids in Z** replace `G0` moves with `G1` moves at a controlled feed rate.
- **Split Long Moves** breaks a long move into shorter ones.
- **Pen Parking Height** sets the `( Park Height: )` value.
- Each tool change becomes an instruction comment, an `M0`, and a `( CLEAR )`.

Those options are described in §22.11 G-Code generation options, and what each export format holds in §26. Studio: exporting output. The Setup Sheet that follows a G-Code export lists the feed rates, accelerations, and heights the file was built with, which makes it a useful crib when writing your own; see §26.5 Setup Sheet.

30.12 Limits and common errors

The firmware keeps a soft-limit envelope for every axis, derived from each axis's travel and its homing position, with a half-millimeter tolerance. A `G0` or `G1` move whose target falls outside the envelope is not trimmed to fit: the machine brings itself to a controlled stop, resets, and raises a soft-limit alarm. It also forgets that it is homed, since the job was abandoned partway, so the next file homes first.

Press the knob to clear the alarm and return to the menus. The file does not resume, and it is not marked complete.

Jogging at the display is treated differently from a file: a jog that would leave the travel range is clamped, so the axis simply stops at the end and raises no alarm. See §11.11.2 Jog mode.

Three other outcomes are worth knowing:

- **An unsupported G or M word** is logged and skipped, and the file keeps running. It is the one error that does not stop a job.
- **Any other error** — an undefined feed rate, a line too long, two commands from one modal group on a line, an arc whose geometry does not close — stops the file at that line. The display offers **Run Again**, which starts the file from the beginning rather than from where it stopped.
- **A value a comment command cannot use** is not applied. The machine's log records a warning, and the file keeps running with the previous value.

The machine's log is where every one of these is recorded, with the file name and the line number. Studio's **MACHINE** tab shows the log for a connected machine; see §25. Studio: the MACHINE tab.

If a file of your own does something you cannot account for, please contact technical support. Send us the file along with what the machine did, and we can read it with you.

Part IV: Appendices

31. Studio: keyboard shortcuts and dimension entry

This chapter collects Studio's keyboard shortcuts and the rules for entering dimensions.

31.1 Keyboard shortcuts

These are Studio's keyboard shortcuts and mouse gestures. The **Keyboard Shortcuts** window lists most of them:

SETTINGS → HELP & REFERENCE → Keyboard Shortcuts



*The **Keyboard Shortcuts** window*

On macOS, ⇧ is Shift, ⌥ is Option, and ↩ is Return.

31.1.1 File

Action	macOS	Windows
Open File	⌘O	Ctrl+O
Open from Clipboard	⇧⌘V	Ctrl+Shift+V
Open Project	⇧⌘O	Ctrl+Shift+O
Save Project	⌘S	Ctrl+S
Save Project As	⇧⌘S	Ctrl+Shift+S

See §22.1 Opening files and file actions and §26.4 Project files.

31.1.2 Navigation

Action	macOS	Windows
Switch to the PREPARE tab	⌘1	Ctrl+1
Switch to the TEXT tab	⌘2	Ctrl+2
Switch to the TOOLS tab (Tool Library)	⌘3	Ctrl+3
Switch to the MACHINE tab	⌘4	Ctrl+4
Switch to the SETTINGS tab	⌘5	Ctrl+5

The MACHINE tab shortcut works only when the tab is shown.

31.1.3 Actions

Action	macOS	Windows
Save G-Code File	⌘↩	Ctrl+Enter
Open License Manager	⇧⌘L	Ctrl+Shift+L
Undo a layout change	⌘Z	Ctrl+Z
Redo a layout change	⇧⌘Z	Ctrl+Shift+Z or Ctrl+Y

See §22.13 The PROCESS AND SAVE button.

31.1.4 View

Action	macOS	Windows
Toggle full-screen mode	⌘F	Ctrl+F
Toggle units (millimeters/inches)	⌘U	Ctrl+U
Dock the Preview window	⌘W	Ctrl+W

Docking applies when the Preview is open in a separate window, and that window is the one in front. See §23.1 Program options.

31.1.5 Preview shortcuts

Action	macOS	Windows
Fit to view	⌘0	Ctrl+0
Actual size (1:1)	⌥⌘1	Ctrl+Alt+1
Zoom in	⌘+ or ⌘=	Ctrl+Plus (+) or Ctrl+=
Zoom out	⌘-	Ctrl+Minus (-)
Pan view	Arrow keys	Arrow keys
Pan view five times faster	⇧ with arrow keys	Shift with arrow keys

These shortcuts act on the Preview only after you click in it. See §22.12 Preview.

31.1.6 Mouse and trackpad

Action	macOS	Windows
Pan view	Scroll, two-finger swipe, or middle-button drag	Scroll, two-finger swipe, or middle-button drag
Zoom at the cursor	Hold ⌘ and scroll	Hold Ctrl and scroll
Zoom in or out	Trackpad pinch	Trackpad pinch
Move the artwork	Drag the artwork	Drag the artwork
Adjust a margin	Drag the margin edge	Drag the margin edge

31.2 Dimension entry reference

The dimension fields on the **PREPARE** tab and the palette offsets in Tool Settings evaluate arithmetic with unit suffixes. §22.5 Artwork settings explains the rules. The tables below list the units each kind of field accepts, worked examples, and the syntax errors Studio reports.

Field type	Accepted units	Bare number means
Length (margins, offsets, width, height)	`mm`, `cm`, `in`, `ft`, `pt`	The unit shown in the box
Percent (Scale)	`%`	Percent

Results below are for a length field displaying millimeters unless noted.

Typed	Result
`8 1/2`	8.5 mm
`1 in`	25.4 mm
`2.54 cm`	25.4 mm
`1 ft`	304.8 mm
`72 pt`	25.4 mm
`4/3 in`	33.867 mm
`6 in + 3 mm`	155.4 mm
`10 / 2 mm`	5 mm
`10 mm / 2`	5 mm
`(2 + 3) * 10`	50 mm
`8 1/2 in`	215.9 mm
`1/16`, field displaying inches	0.0625 in
`25.4 mm`, field displaying inches	1 in
`4/3`, percent field	1.333%
`(4/3) * 100%`, percent field	133.33%

You can use either a period or a comma as your decimal point, as is common in many regions: `1.5` and `1,5` both enter 1.5. Because a comma is always read as a decimal point, it never separates thousands, so `1,000` means 1. To enter one thousand, type `1000`.

Studio checks each entry as you type and reports what it could not read. The entries below are the ones that come up most often, with the message shown and what to type instead.

Typed	Message	Type this instead
`1/8in`	Syntax: Don't divide by a unit	`1/8 in` — put a space before the unit, so the unit applies to the whole fraction
`2 in * 3 in`	That value already has a unit.	`2 * 3 in` — give the unit once; this evaluates to 6 in (152.4 mm)
`10 km`	This field does not accept the unit "km".	Use `mm`, `cm`, `in`, `ft`, or `pt`
`10 mm` in a percent field	This field does not accept the unit "mm".	Percent fields take `%` or a bare number
`5 ft 6 in`	Unexpected input after the expression.	`5 ft + 6 in` — join the two with `+`
`abc`	A unit needs a number before it.	Enter a number, optionally followed by a unit
`1/0`	Division by zero.	Use a nonzero divisor — the expression has no value as written

A value outside the field's allowed range is rejected with "Value is out of range."

32. Glossary

Terms used throughout this guide.

Acceleration: How quickly the machine builds up to its target feedrate, and how quickly it slows again at the end of a move.

Alarm: A machine fault state that stops all motion until it is cleared. While the machine is in an alarm state, the **MACHINE** tab offers **Clear Alarm**: resolve whatever triggered the alarm, then clear it to return the machine to Idle.

ArtFrame™: A family of Bantam Tools machines for flat drawing and painting workflows, made in three sizes.

Bantam Tools Studio™ Text Add-On: The part of Bantam Tools Studio™ that adds the full font library, custom SVG fonts, signatures, letter and word spacing, overflow controls, and clipboard and text-file import. It is a separate purchase for Studio; bantamtools.com/text has details.

Batch: A set of documents open together. A file batch comes from opening several files at once.

Centerline: The line running down the middle of a drawn stroke. Single-stroke fonts are built from centerlines, so the pen follows the middle of each letter rather than tracing its outline.

Chevron: The small arrow beside a button that opens a menu of related actions.

Dip: Lowering the brush into one location on the palette. It is the basic action each stage of **Tool Macro Setup** performs, with a repeat count setting how many dips happen at each location.

Document: One unit of input content. Opening several files at once gives as many documents as files.

Draw Depth: The distance the tool travels past the point of surface contact. It applies to tools using relative heights, and turning on **Enable Absolute Z Positions** replaces it with **Pen Down Height**.

Feedrate: The speed at which the tool moves along a programmed path, set per tool in the Tool Library.

Fill: The SVG property that colors the inside of a shape. Studio processes artwork as though paths have a stroke and no fill, so a filled shape does not come out solid; the pen draws the outline it finds.

G-Code: A machine instruction language that tells a computerized tool how to move.

Hershey Sans 1-stroke: A single-stroke sans-serif font included with Bantam Tools Studio™.

Hershey Script 1-stroke: A single-stroke script font included with Bantam Tools Studio™.

Hidden Line Removal: A processing option that draws only the paths that have a stroke and are not hidden behind filled objects, so overlapping artwork does not show lines that should be covered.

Home: The machine's starting place: a known reference position that every later move is measured from. As a verb, to move the machine there; see **Homing**.

Homing: The procedure by which a machine finds home. It moves the toolhead until it reaches a position the machine can sense, so that afterward it knows where the toolhead is.

Image Processor: A window in Studio that converts a photograph or other raster image into an SVG file of brush strokes in a chosen set of paint colors.

Job: The set of things open at a given time, which Studio turns into one or more output files. A job may hold one document or many.

Jog: Moving the machine's axes by hand, one step at a time. You jog the machine from its display with **Jog mode**; see §11.11.2 Jog mode.

JSON: A plain-text file format. Tools, toolsets, and palettes are exported and imported as JSON files, so you can back them up, move them to another computer, or share them; see §24.3 Importing and exporting toolsets.

Media: Whatever the machine draws on.

On-Machine Files: Files stored on the machine's microSD card, listed in Studio's **Files** section while the machine is connected.

Outline font: A regular computer font, such as a TrueType (`.ttf`) or OpenType (`.otf`) font. Each letter is stored as closed outlines that are filled in on screen, so a pen can trace only its edges; compare **Single-stroke font**.

Page: One sheet of a document.

Palette: In painting contexts, the tray of paint and water a brush visits between strokes, together with the layout Studio uses to find each location on it. In the Image Processor, a palette is instead the set of colors an image is reduced to.

Pan: One well of a palette, holding a single color.

Path: A shape in an SVG file, described as a line or curve rather than as pixels. Paths are what Studio turns into machine motion.

Plob: Short for "Plot Object": a highly specialized kind of SVG file, already processed for one machine model, that the machine draws without reprocessing it. **Save as Plob** appears only after **Enable Plob output** is turned on in Settings.

Plot: To draw with a machine, and the run that does so. A plotted page is drawn with a pen rather than printed.

Precision: A setting controlling how closely generated paths follow the source geometry. It is a tolerance, so a smaller value preserves more detail and a larger one simplifies.

Preset: A tool or toolset supplied with Studio and marked read-only. Duplicate a preset to get a version you can edit.

Rapids: Fast positioning moves that run at the machine's own rate rather than at a set feedrate. **Disable Rapids** replaces them with controlled feedrate moves.

Raster image: An image stored as a grid of colored pixels, such as a PNG or JPEG photograph. A machine cannot follow pixels, so Studio converts a raster image to strokes in the Image Processor.

Render mode: The method the Image Processor uses to build a picture out of strokes: **Paint Stripes**, **Paint Shapes**, or **Paint Shades**.

Section: A titled, collapsible group of controls in the Studio window, such as the **FONT** section or the **PAPER SETTINGS** section. Click its header, or the chevron in it, to expand or collapse it.

Setup Sheet: An on-screen summary of a processed job, which can be saved as a PDF. When a job produced more than one output file, the summary is titled **Batch Setup Sheet**.

Signature (Text Add-On): A feature that signs documents by placing a loaded signature file into the text workflow.

Single-stroke font: A font whose letters are drawn as single paths along the centerline of each stroke, rather than as outlines to be filled in. Letters come out as drawn lines, at pen width.

Soft Lift: A slower lift as the pen leaves the paper and at the top of its travel, set in the tool editor's **Pen Landing & Lift** section.

Soft Touchdown: A gentler final approach before the tool contacts the surface. The pen drops quickly to the **Approach Above Paper** height, then passes through contact at the slower **Touchdown Speed**.

Split button: A button whose face performs its usual action and whose chevron opens the other choices.

Stroke: The SVG property that draws a shape's outline, and the mark the pen makes. Studio plots the paths that have a stroke.

SVG: Scalable Vector Graphics, a vector image format based on XML.

Toast: A brief on-screen notification that clears on its own.

Tool: A single physical pen, marker, or brush. Each tool has a name and attributes such as its color, its speed settings, and any refill behavior defined for it.

Tool Macro Setup: The section of a brush tool's settings that sets what the brush does at the palette: Prime/Wash after a tool change, and Pre-Refill, Refill, and Post-Refill at each refill, with the palette locations each one visits.

Toolset: A saved, named collection of tools and their settings. A setting such as feedrate can be edited across every tool in the set at once.

Tooltip: A short description of a control that appears when you hover over it.

Transport: The connection method used to send a job to the machine, either USB or WiFi.

Travel move: A move made with the pen up, repositioning between drawn strokes rather than drawing.

US Letter: The 8.5" × 11" paper size.

Z Offset: A per-tool adjustment to a tool's relative heights. It does not apply in absolute mode, where the field is hidden.

33. Troubleshooting

Most problems on the Bantam Tools ArtFrame™ are covered where the subject is: drawing quality and speed in §20. Drawing quality and speed, cleaning and wear in §19. Maintenance, tool mounting in §12. Tool mounting and holders, and media and fixturing in §15. Paper and workholding. This chapter collects the problems that belong to none of them.

33.1 Connection problems

Issue: Studio does not connect to the ArtFrame over USB.
Solution: Remove as many adapters, hubs, and docks as you can from between the computer and the machine; a direct cable is best. If Studio shows **BT-205**, unplug the USB cable, switch the ArtFrame off and back on, then reconnect.

Issue: A small **x** appears at the top right of the display.
Solution: The machine is set up to join a WiFi network but has not joined it, or has lost its connection. Work through the entries below. See §11.11.3 WiFi on and off.

Issue: Scan for Plotters in Studio does not find the machine.
Solution: Connect with **Enter IP**, using the IP address shown on the display's **WiFi Status** screen. See §11.11.3 WiFi on and off.

Issue: The machine never joins the WiFi network.
Solution: The machine joins 2.4 GHz networks only. If your router gives its 2.4 GHz and 5 GHz bands separate names, set up the machine with the 2.4 GHz name. See §18.5 Sending files over WiFi.

Issue: WiFi stopped working after the network's name or password changed.
Solution: Run setup again from Studio's **Set Up Your Plotter** dialog; the machine keeps its old network settings until you do. See §18.6 Putting your machine on a network.

Issue: The display shows **WiFi off**.
Solution: WiFi has been turned off at the machine. Select **Turn WiFi ON** under **Settings**. See §11.11.3 WiFi on and off.

Issue: The machine cannot join a network at work or school, one that asks you to sign in, or one without a password.
Solution: Networks like these often cannot carry the machine at all. Send files over a USB cable or on the microSD card instead. See §18.5 Sending files over WiFi.

Issue: Studio has trouble connecting to the machine over WiFi.
Solution: Check that the machine's firmware is up to date. Studio's **Check for Updates** window shows the latest firmware and the version on a connected machine, and the display's **Version** screen shows the version installed. If a newer release is available, update the firmware. See §23.8.3 Check for Updates, §11.11.1 Version, and §11.11.6 Updating the firmware.

33.2 Alarms

Issue: The top line of the display reads **Alarm**, and the menus are gone.
Solution: The machine has stopped all motion because of a fault, and no longer knows its position. If a message is showing over the screen, press the knob once to dismiss it, then press it again to clear the alarm and return to

the menus. You can also click **CLEAR ALARM** on Studio's **MACHINE** tab; Studio's error message names the alarm. The machine homes on its own before the next file runs. See §25. Studio: the MACHINE tab.

Issue: The machine stops with the message **Soft limit hit.**
Solution: The file asked for a move outside the machine's travel, so the machine stopped instead of making it. The file does not resume. Check that the artwork fits the ArtFrame's drawing area, then clear the alarm and run the file again. See §30.12 Limits and common errors.

Issue: The message **Homing before file run unsuccessful** appears, and the file does not start.
Solution: The carriage did not reach its home position. Check that every orange shipping cable tie has been cut, both orange shipping brackets are removed, and nothing is in the rails; see §3. Unboxing the ArtFrame. Then press the knob and start the file again.

Issue: After you click **Cancel** in Studio during a plot, the display shows **Alarm**.
Solution: This is expected. Canceling a plot while the machine is moving stops it with an alarm. Clear the alarm as above; the machine homes before the next file.

33.3 Motion and position

Issue: The machine loses its position partway through a drawing, and the rest of the artwork is offset.

Solution: A large electrostatic discharge on the ribbon cables during operation can cause a loss of position. Power the machine off and back on to restore normal operation, then home it before running the file again. See §2. Safety and safe operation.

Issue: The carriage does not move freely, or binds during homing.

Solution: Check that every orange shipping cable tie has been cut and both orange shipping brackets removed. See §3. Unboxing the ArtFrame. If the machine has been moved recently, check that nothing has fallen into the rails.

33.4 Pausing and resuming

Issue: A paused plot will not resume.
Solution: A pause lasts as long as the machine stays on, even if Studio disconnects. Press the knob briefly at **Click to RESUME**, or click **Continue** in Studio; see §11.6 Pausing, resuming, and canceling. An alarm or a cancel ends the file instead of pausing it. A file that ended that way cannot pick up where it stopped: run it again from the beginning.

Issue: After a pause, the rest of the drawing is offset.
Solution: The carriage was moved by hand while the machine was paused. The machine carries on from the position it held when it paused, wherever the carriage now is. Leave the carriage where it stopped while paused. To recover, cancel the file and run it again on a new sheet.

33.5 Power interruption

Issue: The machine lost power partway through a plot.
Solution: A plot cannot be resumed after a power loss. The machine starts up again without its position or its place in the file. Turn the machine back on, put in a new sheet, and run the file again from the beginning; the machine homes on its own first. In Studio's queue the job reads **Plot did not finish**, with **Retry** to run it again. See §25.8 The queue.

Issue: Some files in a batch were interrupted, and you need to know which.
Solution: The machine adds a check mark beside a file's name when it finishes plotting it, so an interrupted file has none. Over USB, **Queue Unplotted** in Studio adds every file on the card without a check mark to the queue. See §25.6 Files stored on the machine.

33.6 Files and the microSD card

Issue: The machine shows no files, or does not see the card.
Solution: Check that the card is fully seated in its slot, that your files finished copying to it, and that a card of your own is formatted as FAT32. See §18.3 About microSD cards.

Issue: Files on the microSD card go missing or will not open, especially as the card fills.
Solution: The card may be a counterfeit that holds less than its label says. Copy off what you can and use a different card, bought from a seller you trust. See §18.3 About microSD cards.

33.7 Getting help

If none of this matches what you are seeing, reach out. A photo or a short video of the machine is usually the fastest way for us to understand the problem. See §0.2 Support and online resources for other details that help.