

Bantam Tools Studio™ Custom Tools Guide

This guide is intended for advanced users who wish to edit tools and toolsets directly at the JSON level.

Bantam Tools Studio offers deep, flexible control over tool behavior through its graphical interface, and most users will never need to go beyond it. The GUI is designed to safely expose the settings required for drawing, writing, and painting across supported machines, while preventing configurations that could lead to unpredictable results. For the vast majority of workflows, the Tool Library and graphical editor provide everything needed to create expressive, repeatable outcomes.

Directly editing tools as JSON is an advanced workflow, suitable only for users who understand how tools and toolsets function internally and who are comfortable working with structured configuration files. This approach does not provide direct access to the machine itself. Instead, it exposes the complete set of properties that define tools and toolsets: motion parameters, engagement behavior, refill or pause logic, macro sequencing, and how tools are grouped, reused, and applied across different plots.

This advanced workflow also allows you to modify macro patterns and G-code commands directly. These systems were originally built to support painting workflows and palette-based behavior, but they are intentionally exposed so experienced users can experiment beyond their original scope. By editing macros at the tool level, you can redefine how a tool primes itself, how it refills, how it pauses, and how it transitions between actions. This makes it possible to create entirely new behaviors that apply equally to drawing, writing, and painting workflows.

We invite advanced users to explore these capabilities thoughtfully and to share their custom tools and toolsets with the broader community. Separating tool behavior from the plot itself can introduce additional complexity into your workflow, but it also creates a powerful abstraction. Once defined, these behaviors can be recalled for any plot, allowing you to stop re-solving the same technical problems and focus your attention on the art itself. We believe this separation, and the ability to build, reuse, and exchange expressive tool behaviors, is game changing.

Table of Contents

[Introduction](#)

[What is a Custom Tool?](#)

[Supported Machines](#)

[Using the Tool Library](#)

[Opening the Tool Library](#)

[Creating a New Tool](#)

[Editing Tool Properties](#)

[Duplicating Tools](#)

[Deleting Tools](#)

[Import and Export](#)

[Exporting Tools](#)

[Exporting Toolsets](#)

[Importing Tools](#)

[Working with Toolsets](#)

[What are Toolsets?](#)

[Creating Custom Toolsets](#)

[Managing Toolset Contents](#)

[Adding Tools to a Toolset](#)

[Removing Tools from a Toolset](#)

[Preset vs Custom Toolsets](#)

[Bulk Editing Toolsets](#)

[Tool Settings Reference](#)

[Tool Types](#)

[Z-Axis Settings](#)

[Relative Mode \(Default\)](#)

[Absolute Mode](#)

[Motion Settings](#)

[Refill Settings](#)

[Color Settings](#)

[Tool Offsets](#)

[Machine-Specific Guidance](#)

[ArtFrame](#)

[WaterColorBot](#)

[EggBot](#)

[Painting Modes](#)

[G-code Macros \(Advanced\)](#)

[What is G-code?](#)

[Supported G-code Commands](#)

[Motion Commands](#)

[Coordinate System Commands](#)

[Other Commands](#)

[Writing Macros](#)

[Available Macro Types](#)

[Macro Z Sources](#)

[Placeholder Variables](#)

[Common Macro Patterns](#)

[Pattern: Swirl in Place](#)

[Pattern: Multiple Swirls](#)

[Pattern: Dip and Lift](#)

[Pattern: Wipe/Drag](#)

[Pattern: Zigzag Scrub](#)

[Macro Examples](#)

[Example 1: Simple Water Rinse \(Pre-Refill\)](#)

[Example 2: Paint Loading \(Refill\)](#)

[Example 3: Post-Refill Cleanup](#)

[Example 4: Tool Change Pause](#)

[G-code Quick Reference](#)

[Troubleshooting](#)

[Common Issues](#)

[Getting Help](#)

[Appendix A: JSON Reference](#)

[File Locations](#)

[JSON Basics](#)

[Tool JSON Structure](#)

[Field Reference Tables](#)

[Essential Fields](#)

[Z-Axis Fields](#)

[Motion Fields](#)

[Macro Fields](#)

[Complete Examples](#)

[Simple Ballpoint Pen](#)

[Watercolor Brush \(Advanced\)](#)

[Writing Multi-Line Macros in JSON](#)

[Validating JSON](#)

[Appendix B: Fields Not Currently Used](#)

Introduction

What is a Custom Tool?

A "tool" in Bantam Tools Studio represents any drawing, writing, or painting instrument—pens, markers, brushes, or custom implements. Each tool has settings that control:

- **How it moves** (speed, acceleration)
- **How deep it engages** (Z-axis positions)
- **When it refills** (for paint brushes)
- **What actions it performs** (custom G-code macros)

Bantam Tools Studio comes with preset tools optimized for common instruments, but you can create custom tools to match your specific pens, markers, or brushes.

Supported Machines

Bantam Tools Studio supports the following machines, each with different capabilities:

Machine	Description	Z Range	Max XY Speed
ArtFrame 24×36	Large format pen plotter	0-60 mm	40,000 mm/min
ArtFrame 18×24	Medium format pen plotter	0-60 mm	40,000 mm/min
ArtFrame 24×72	Panorama format pen plotter	0-60 mm	40,000 mm/min
WaterColorBot	Watercolor painting robot	0-15 mm	20,000 mm/min
EggBot	Spherical/egg plotter	0-20.25 mm	25,000 mm/min

Tools can be configured as compatible with specific machines. The software will warn you if a tool's settings exceed your machine's capabilities.

Using the Tool Library

The Tool Library is the central place to manage all your tools and toolsets. It provides a visual interface for creating, editing, importing, and exporting tools.

Opening the Tool Library

1. Open Bantam Tools Studio
2. Click the **Tool Library** button in the sidebar, or
3. From the Tool Settings panel, click the gear icon next to the toolset selector

The Tool Library opens with a two-panel layout:

- **Left panel:** Lists all toolsets and ungrouped tools
- **Right panel:** Shows configuration options for the selected tool or toolset

Creating a New Tool

1. In the Tool Library, click the **+ New Tool** button
2. Select a **template** to start from:
 - **Empty** - Blank tool with default values
 - **Ballpoint** - Preset for ballpoint pens
 - **Gel Pen** - Preset for gel pens
 - **Marker** - Preset for felt-tip markers
 - **Watercolor Brush** - Preset for watercolor painting
3. Enter a **name** for your tool
4. Click **Create**

The new tool appears in the Ungrouped Tools section and is automatically selected for editing.

Editing Tool Properties

When a tool is selected, the right panel shows all configurable properties organized into sections:

Tool Settings

- Z Heights (pen up, draw depth, setup block height)
- Feedrates (XY and Z movement speeds)
- Acceleration settings

Macro Setup (for brush tools)

- Refill behavior
- Prime, pre-refill, refill, and post-refill actions
- Palette locations

Metadata

- Tool name
- Manufacturer
- Version number
- Description

After making changes:

- Click **Save Changes** to save your modifications
- Hold **Alt/Option** and click to access **Revert** to undo unsaved changes

The software tracks all changes and shows a confirmation dialog listing what will be modified before saving.

Duplicating Tools

To create a copy of an existing tool:

1. Select the tool you want to duplicate
2. Right-click and select **Duplicate**, or
3. Use the **Duplicate** button in the toolbar

A copy is created with "(Copy)" appended to the name. The duplicate is automatically selected for editing.

Tip: Duplicating is the fastest way to create a custom tool—start with a preset that's similar to what you want, then adjust the settings.

Deleting Tools

To delete a custom tool:

1. Select the tool to delete
2. Right-click and select **Delete**, or
3. Use the **Delete** button in the toolbar
4. Confirm the deletion in the dialog

Note: Preset (default) tools cannot be deleted. Only custom tools you've created can be removed.

Import and Export

Exporting Tools

To share a tool or back it up:

1. Select the tool you want to export
2. Click the **Export** button
3. Choose a location and filename
4. Click **Save**

The tool is saved as a `.json` file that can be shared with others or imported later.

Exporting Toolsets

To export an entire toolset:

1. Select the toolset (not an individual tool)
2. Click the **Export** button
3. Choose a location and filename
4. Click **Save**

The toolset and all its tools are saved as a single `.json` file.

Importing Tools

To import a tool from a file:

1. Click the **Import** button
2. Select the **.json** file to import
3. Choose the import type:
 - **Tool** - Import as a single tool
 - **Toolset** - Import as a complete toolset
4. If importing a tool, select the destination:
 - **Main Library** - Add to ungrouped tools
 - **[Toolset Name]** - Add to a specific toolset
5. Click **Import**

The imported tool(s) appear in the specified location.

Working with Toolsets

What are Toolsets?

A **toolset** (also called a "grouping") is a collection of tools organized together. Toolsets help you:

- Group related tools (e.g., all pens of the same brand)
- Create project-specific tool collections
- Quickly switch between different tool configurations
- Share complete tool setups with others

Creating Custom Toolsets

1. In the Tool Library, click **+ New Toolset**
2. Enter a name for your toolset
3. Click **Create**

The empty toolset appears in the User Toolsets section.

Managing Toolset Contents

Adding Tools to a Toolset

- **Drag and drop:** Drag a tool from Ungrouped Tools or another toolset onto the target toolset
- **Right-click menu:** Right-click a tool and select **Add to Toolset** → [toolset name]
- **Create in toolset:** When creating a new tool, you can select a toolset as the destination

Removing Tools from a Toolset

- **Drag out:** Drag the tool to Ungrouped Tools
- **Right-click menu:** Right-click and select **Remove from Toolset**
- **Delete:** Deleting a tool removes it from its toolset

Preset vs Custom Toolsets

Preset Toolsets

- Included with Bantam Tools Studio
- Cannot be modified or deleted
- Optimized for specific use cases
- Tools within them are read-only

Custom Toolsets

- Created by you
- Fully editable
- Can contain any combination of tools
- Can be exported and shared

Bulk Editing Toolsets

When you select a toolset (instead of an individual tool), you can edit properties that apply to all tools in the toolset simultaneously:

1. Select the toolset in the left panel
2. The right panel shows shared settings
3. Fields showing "**Various**" indicate tools have different values
4. Change any field to apply that value to all tools
5. Click **Save Changes** to apply

This is useful for quickly adjusting feedrates, Z heights, or other settings across multiple tools at once.

Tool Settings Reference

Tool Types

Each tool has a type that categorizes it and affects default behaviors:

Value	Type	Description	Best For
0	Ballpoint	Standard ballpoint pens	ArtFrame
1	Fountain	Fountain pens	ArtFrame
2	Gel	Gel pens	ArtFrame
3	Felt	Felt-tip markers	All plotters
4	Paintbrush	Brushes for painting	WaterColorBot
5	Calligraphy	Calligraphy pens	ArtFrame

Value	Type	Description	Best For
99	Other	Custom or specialty tools	Any

Z-Axis Settings

The Z-axis controls the vertical position of your tool—how high it lifts for travel moves and how deep it presses when drawing.

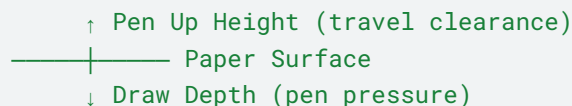
Relative Mode (Default)

Most tools use relative Z positioning, which calculates heights based on a "stackup" of values:

Setting	Description	Typical Range
Pen Up Height	Height above paper for travel moves	5-15 mm
Setup Block Height	Thickness of block used during tool installation	0-10 mm
Draw Depth	How far the pen presses into the surface	0-5 mm
Z Offset	Additional offset added to all Z calculations	-10 to +10 mm

How Relative Z Works:

None



The software calculates actual Z positions:

- **Travel Height** = Z Offset + Pen Up Height
- **Drawing Height** = Z Offset - Draw Depth
- **Install Height** = Z Offset + Setup Block Height

Absolute Mode

For advanced users who need precise Z control, absolute mode specifies exact Z positions:

Setting	Description
Absolute Z Engage	Exact Z position when drawing

Setting	Description
Absolute Z Travel	Exact Z position for travel moves
Absolute Z Install	Exact Z position for tool installation
Absolute Z Refill	Exact Z position for refill operations

When absolute mode is enabled, the relative settings are ignored.

Motion Settings

Control how fast your tool moves:

Setting	Unit	Typical Range	Description
XY Feedrate	mm/min	1000-15000	Horizontal drawing speed
Z Feedrate	mm/min	1000-10000	Pen lift/lower speed
X Acceleration	mm/s ²	500-5000	X-axis acceleration
Y Acceleration	mm/s ²	500-5000	Y-axis acceleration
Z Acceleration	mm/s ²	500-5000	Z-axis acceleration

Speed Guidelines:

Use Case	XY Feedrate	Notes
Detailed work	2000-4000	Slower for precision
General drawing	5000-8000	Good balance
Fast drafts	10000-15000	Speed over precision
Watercolor	3000-5000	Slower for paint flow

Warning: Very high speeds may exceed your machine's capabilities. The software will warn you if settings exceed machine limits.

Refill Settings

For brushes and other tools that need periodic refilling:

Setting	Description
Refill Distance	Distance (mm) to draw before refilling. Set to 0 to disable.

Setting	Description
Refill Mode	When to refill: By distance or by stroke count
Enable Macros	Master switch to enable/disable all macros
Refill After Install	Run refill sequence after installing the tool

Advanced Refill Intervals:

Setting	Description
Refill Interval	Run refill every N refill cycles
Pre-Refill Interval	Run pre-refill every N cycles
Post-Refill Interval	Run post-refill every N cycles
Action Counts	How many times to repeat each action

Color Settings

Each tool has a color setting used for preview rendering and automatic color matching:

Setting	Range	Description
Red (a)	0-255	Red channel
Green (b)	0-255	Green channel
Blue (c)	0-255	Blue channel
Alpha	0-255	Opacity (255 = fully opaque)

Tool Offsets

Adjust the tool's position for specialized setups:

Setting	Description
Tool X Offset	X offset applied to all drawing
Tool Y Offset	Y offset applied to all drawing
Macro X Offset	X offset for macro operations only
Macro Y Offset	Y offset for macro operations only
Macro Z Offset	Z offset for macro operations only

Machine-Specific Guidance

ArtFrame

The ArtFrame series are large-format pen plotters ideal for posters, artwork, and signage.

Models:

- ArtFrame 24×36 (24" × 36" work area)
- ArtFrame 18×24 (18" × 24" work area)
- ArtFrame 24×72 Panorama (24" × 72" work area)

Recommended Settings:

- **Z Range:** 0-60 mm (generous clearance for thick media)
- **XY Feedrate:** 5000-15000 mm/min for most pens
- **Pen Up Height:** 10-15 mm for safe clearance

Best Tool Types:

- Ballpoint pens, gel pens, felt markers, paint markers
- Fine liners, brush pens, calligraphy pens

Tips:

- Use higher pen up heights when working with thick media
- Reduce acceleration for large markers to prevent skipping
- Test draw depth with scrap material before long jobs

WaterColorBot

The WaterColorBot is designed for watercolor painting with automatic brush dipping and paint loading.

Recommended Settings:

- **Z Range:** 0-15 mm
- **XY Feedrate:** 3000-5000 mm/min (slower for paint flow)
- **Refill Distance:** 100-500 mm depending on brush and paint

Best Tool Types:

- Paintbrush (type 4) with appropriate macros
- Round brushes for detail work
- Flat brushes for washes

WaterColorBot-Specific Settings:

- **Water Dish Z Offset:** Adjust for water dish depth
- **Paint Pan Z Offset:** Adjust for paint pan depth
- **Palette Macro Locations:** Configure which palette positions to use for each macro

Tips:

- Configure separate pre-refill (water rinse) and refill (paint load) actions
- Use prime actions to wet brush before starting
- Adjust refill distance based on paint consistency

EggBot

The EggBot plots on spherical and egg-shaped objects using rotational axes.

Recommended Settings:

- **Z Range:** 0-20.25 mm
- **Feedrate:** Moderate speeds work best on curved surfaces

Best Tool Types:

- Fine-tip markers
- Paint markers
- Sharpies

Tips:

- Test on practice eggs first
- Secure objects firmly in the holder
- Use slower speeds for detailed work

Painting Modes

Painting modes are presets that control automatic wash and refill behaviors. They're primarily used with WaterColorBot but apply to any brush-based tool.

Mode	Description	Auto Wash	Auto Refill
Manual	Full manual control over all painting actions	No	No
WaterColor	Automatic wash and dip sequence for watercolor painting	Yes	Yes
WaterColor + Post-Dip	Watercolor mode with additional dip after each	Yes	Yes

Mode	Description	Auto Wash	Auto Refill
	stroke for consistent color saturation		
Tempera	Thick paint mode with minimal washing—suitable for tempera and acrylic paints	No	Yes
Dip Pen	Traditional dip pen mode with ink reservoir management	No	Yes
Pen/Pencil	Dry media mode with no liquid handling—suitable for pens, pencils, markers	No	No

Choosing a Mode:

- **WaterColor:** Standard watercolor painting with regular brush cleaning
- **Tempera:** Thick paints where water would dilute the color
- **Dip Pen:** Ink drawing where you want automatic re-inking
- **Pen/Pencil:** Dry media that doesn't need refilling
- **Manual:** Full control for custom workflows

G-code Macros (Advanced)

Macros are custom G-code sequences that run at specific times. This is the most powerful feature for creating sophisticated tool behaviors like watercolor brush washing and paint loading.

What is G-code?

G-code is the standard language used to control CNC machines, 3D printers, and plotters. It consists of simple text commands that tell the machine where to move, how fast to move, and what actions to perform.

Each line typically contains:

- A **command** (like **G0** or **G1**)
- **Parameters** (like **X10 Y20 Z5**)
- Optional **comments** in parentheses

Example:

None

```
G0 X100 Y50      ( Rapid move to X=100, Y=50 )  
G1 Z-2 F1000     ( Linear move to Z=-2 at 1000 mm/min )
```

Supported G-code Commands

Motion Commands

Command	Name	Description
G0	Rapid Move	Move as fast as possible (no cutting/drawing)
G1	Linear Move	Move in a straight line at specified feedrate
G2	Clockwise Arc	Move in a clockwise circular arc
G3	Counter-clockwise Arc	Move in a counter-clockwise circular arc

Coordinate System Commands

Command	Name	Description
G90	Absolute Mode	Coordinates are absolute positions
G91	Relative/Incremental Mode	Coordinates are relative to current position
G92	Set Position	Set the current position to specified coordinates

Other Commands

Command	Name	Description
G4	Dwell	Pause for a specified time
M0	Program Pause	Pause and wait for user to resume
M2	Program End	End the program
M5	Stop	Stop spindle/tool (used at end of jobs)
F	Feedrate	Set the movement speed (mm/min)

Writing Macros

Available Macro Types

Macro	When It Runs
<code>primeAction</code>	At the start, to prepare the tool
<code>preRefillAction</code>	Before getting paint (e.g., rinse in water)
<code>refillAction</code>	To get paint/ink
<code>postRefillAction</code>	After getting paint (e.g., wipe excess)
<code>startAction</code>	Once at the beginning of the job
<code>changeAction</code>	When switching to this tool

Macro Z Sources

Control where each macro gets its Z height from:

Source	Value	Use Case
Custom	0	Use a specific Z value for this action
Water Dish	1	Use water dish depth (default for wash/prime)
Paint Pan	2	Use paint pan depth (default for refill)

Placeholder Variables

Use these placeholders in your G-code—they're replaced with actual values at runtime:

Placeholder	Description	Example
<code>{xPos}</code>	Refill location X coordinate	25.5
<code>{yPos}</code>	Refill location Y coordinate	180.0
<code>{zEngage}</code>	Z position for drawing	0
<code>{zTravel}</code>	Z position for travel	15
<code>{zRefill}</code>	Z position for refill	5
<code>{zInstall}</code>	Z position for tool install	7

Placeholder	Description	Example
{xyFeedrate}	Tool's XY feedrate	5000
{zFeedrate}	Tool's Z feedrate	3000
{zPrimeEngage}	Z for prime action	3
{zPreRefillEngage}	Z for pre-refill	-3
{zRefillEngage}	Z for refill action	3
{zPostRefillEngage}	Z for post-refill	-3

Common Macro Patterns

Pattern: Swirl in Place

A circular swirl motion, useful for mixing or loading paint:

```
None
G91                ( Relative mode )
G2 X0 Y0 I5 J0    ( Full clockwise circle with radius 5mm )
G90                ( Absolute mode )
```

Pattern: Multiple Swirls

Repeat a swirl pattern multiple times:

```
None
G91
G2 X0 Y0 I3 J0
G2 X0 Y0 I3 J0
G2 X0 Y0 I3 J0
G90
```

Pattern: Dip and Lift

Simple dip motion:

```
None
G0 X{xPos} Y{yPos} ( Move to position )
G1 Z{zEngage} F{zFeedrate} ( Lower slowly )
G4 P0.5            ( Pause briefly )
G0 Z{zTravel}      ( Lift quickly )
```

Pattern: Wipe/Drag

Drag brush across a surface:

```
None  
G91  
G1 X20 F500      ( Drag 20mm in X at slow speed )  
G90
```

Pattern: Zigzag Scrub

Scrub back and forth:

```
None  
G91  
G1 X5 F1000  
G1 X-10  
G1 X10  
G1 X-5  
G90
```

Macro Examples

Example 1: Simple Water Rinse (Pre-Refill)

Rinses the brush in water before getting new paint:

```
None  
G0 X{xPos} Y{yPos}  
G0 Z{zPreRefillEngage}  
F{xyFeedrate}  
G91  
G2 X0 Y0 I2.5 J0  
G90
```

What it does:

1. Rapid move to water dish position
2. Lower brush to water level
3. Swirl with 2.5mm radius
4. Return to absolute coordinates

Example 2: Paint Loading (Refill)

A paint loading sequence with swirls:

```
None
G0 X{xPos} Y{yPos}
G0 Z{zRefillEngage}
F{xyFeedrate}
G91
G2 X0 Y0 I5 J0
G2 X0 Y0 I5 J0
G90
```

What it does:

1. Move to paint pan location
2. Lower to paint level
3. Swirl twice to load paint
4. Return to absolute mode

Example 3: Post-Refill Cleanup

Wipes excess paint:

```
None
G0 X{xPos} Y{yPos}
G0 Z{zPostRefillEngage}
F{xyFeedrate}
G91
G2 X0 Y0 I2.5 J0
G0 Z5
G1 Y30 Z5 F500
G90
```

What it does:

1. Move to wipe position
2. Lower brush
3. Swirl once to distribute paint
4. Lift 5mm
5. Drag brush 30mm slowly (wipe motion)

Example 4: Tool Change Pause

Pauses for manual tool change:

```
None
G0 X0 Y0
M0
```

What it does:

1. Move to home position
2. Pause and wait for user to resume

G-code Quick Reference

None

MOTION:

```
G0 X__ Y__ Z__      Rapid move (fast, non-drawing)
G1 X__ Y__ Z__ F__  Linear move at feedrate F
G2 X__ Y__ I__ J__  Clockwise arc (I,J = center offset)
G3 X__ Y__ I__ J__  Counter-clockwise arc
```

MODES:

```
G90                Absolute coordinates
G91                Relative/incremental coordinates
```

CONTROL:

```
F____             Set feedrate (mm/min)
G4 P__            Dwell/pause (seconds)
M0                Pause for user input
```

COMMENTS:

```
( text )          Comment (ignored by machine)
```

Tips for Writing Macros:

1. **Always end with G90** - Return to absolute mode
2. **Test with slow feedrates first** - Use lower F values while testing
3. **Use comments** - Add (`description`) to explain sections
4. **Start simple** - Begin with basic moves, then add complexity
5. **Check Z heights** - Ensure values won't crash into your palette or media
6. **Remember the sequence** - Prime → Pre-Refill → Refill → Post-Refill

Troubleshooting

Common Issues

Tool doesn't appear in the list

- Ensure you've saved the tool after creating it
- Check the Tool Library for the Ungrouped Tools section
- If imported, verify the JSON file is valid

Tool moves too high/low

- Check Pen Up Height and Draw Depth values
- If using absolute mode, verify Absolute Z Engage and Absolute Z Travel
- Ensure Z Offset isn't causing unexpected shifts

Macros don't run

- Enable Macros must be turned on
- Check that macro strings aren't empty
- Verify placeholder syntax uses curly braces: `{zEngage}`

Tool draws too fast/slow

- Adjust XY Feedrate (higher = faster)
- Check machine limits—very high values may be capped

Refill not triggering

- Ensure Refill Distance is greater than 0
- Check Refill Mode is set correctly
- Verify Enable Macros is on

Machine compatibility warning

- Tool settings exceed machine capabilities
- Reduce feedrates, adjust Z heights, or modify acceleration
- Orange warning = caution, Red warning = incompatible

Getting Help

If you encounter issues:

1. Check the compatibility warnings in the Tool Library
2. Compare your settings to a working preset tool
3. Start with a default tool and modify incrementally

Appendix A: JSON Reference

For advanced users who want to edit tool files directly or understand the underlying data format.

File Locations

Tool configurations are stored as JSON files:

Custom tools:

- macOS: ~/Library/Application Support/BantamTools/BantamToolsStudio/ToolLibrary/
- Windows: %LOCALAPPDATA%\BantamTools\BantamToolsStudio\ToolLibrary\

Toolsets (groupings):

- macOS: ~/Library/Application Support/BantamTools/BantamToolsStudio/ToolGroupings/
- Windows: %LOCALAPPDATA%\BantamTools\BantamToolsStudio\ToolGroupings\

JSON Basics

If you're new to JSON:

Objects use curly braces `{ }` and contain named values:

```
JSON
{
  "name": "My Pen",
  "penUpHeight": 10
}
```

Arrays use square brackets `[]` and contain lists:

```
JSON
{
  "colors": [255, 128, 0]
}
```

Data Types:

- **Strings:** Text in quotes → "Hello"
- **Numbers:** No quotes → 42 or 3.14
- **Booleans:** true or false (no quotes)
- **Null:** Empty value → null

Tool JSON Structure

Minimal tool configuration:

```
JSON
{
  "name": "My Custom Pen",
```

```

"uniqueID": "{12345678-1234-1234-1234-123456789abc}",
"isCustom": true,
"type": 0,

"color": {
  "a": 0,
  "b": 0,
  "c": 0,
  "alpha": 255,
  "space": 0
},

"penUpHeight": 10,
"setupBlockHeight": 3.5,
"drawDepth": 2,
"zOffset": 0,

"xyFeedrate": 5000,
"zFeedrate": 3000,

"refillDist": 500
}

```

Field Reference Tables

Essential Fields

Field	Type	Default	Required
name	string	"New Tool"	Yes
uniqueID	string (UUID)	Generated	Yes
isCustom	boolean	true	Yes
type	integer	0	No
color	object	Black	Yes
toolWidth	float	1.0	Yes
refillDist	float	1000	Yes

Z-Axis Fields

Field	Type	Default	Mode
penUpHeight	float	5.0	Relative
setupBlockHeight	float	3.0	Relative
drawDepth	float	1.0	Relative
zOffset	float	0.0	Both
useAbsoluteZPositions	boolean	false	-
absoluteZEngage	float	0.0	Absolute
absoluteZTravel	float	5.0	Absolute
absoluteZInstall	float	3.5	Absolute
absoluteZRefill	float	3.5	Absolute

Motion Fields

Field	Type	Default	Unit
xyFeedrate	double	3000	mm/min
zFeedrate	double	1000	mm/min
xAccel	integer	1000	mm/s ²
yAccel	integer	1000	mm/s ²
zAccel	integer	1000	mm/s ²

Macro Fields

Field	Type	Default
enableMacros	boolean	false
primeAction	string	""
preRefillAction	string	""
refillAction	string	""
postRefillAction	string	""

Field	Type	Default
startAction	string	""
changeAction	string	""

Complete Examples

Simple Ballpoint Pen

JSON

```
{
  "name": "Pilot G2 - Blue",
  "uniqueID": "{11111111-2222-3333-4444-555555555555}",
  "isCustom": true,
  "type": 2,
  "manufacturer": "Pilot",
  "toolWidth": 0.7,

  "color": {
    "a": 0,
    "b": 0,
    "c": 255,
    "alpha": 255,
    "space": 0
  },

  "penUpHeight": 10,
  "setupBlockHeight": 3.5,
  "drawDepth": 2,
  "zOffset": 0,

  "xyFeedrate": 8000,
  "zFeedrate": 5000,

  "refillDist": 0
}
```

Watercolor Brush (Advanced)

JSON

```
{
  "name": "Round Brush #4 - Crimson",
  "uniqueID": "{33333333-4444-5555-6666-777777777777}",
  "isCustom": true,
  "type": 4,
  "manufacturer": "Bantam Tools",
  "toolWidth": 4.0,
}
```

```

"color": {
  "a": 220,
  "b": 20,
  "c": 60,
  "alpha": 255,
  "space": 0
},

"penUpHeight": 12,
"setupBlockHeight": 0,
"drawDepth": 0,
"zOffset": 3.0,

"xyFeedrate": 5000,
"zFeedrate": 3000,

"refillDist": 200,
"refillMode": 1,
"enableMacros": true,
"refillAfterInstall": true,

"waterDishZOffset": -3.0,
"paintPanZOffset": 3.0,

"primeAction": "G0 X{xPos} Y{yPos}\nG0 Z{zPrimeEngage}\nF{xyFeedrate}\nG91\nG2 X0 Y0 I5
J0\nG90\n",
"preRefillAction": "G0 X{xPos} Y{yPos}\nG0 Z{zPreRefillEngage}\nF{xyFeedrate}\nG91\nG2 X0
Y0 I2.5 J0\nG90\n",
"refillAction": "G0 X{xPos} Y{yPos}\nG0 Z{zRefillEngage}\nF{xyFeedrate}\nG91\nG2 X0 Y0 I5
J0\nG2 X0 Y0 I5 J0\nG90\n",
"postRefillAction": "G0 Z{zTravel}\n",

"primeActionCount": 3,
"preRefillActionCount": 2,
"refillActionCount": 1,
"postRefillActionCount": 1,

"holdOnToolchange": true,

"paletteMacroLocations": {
  "{00000804-0000-0000-0000-000000000001}": {
    "primeLocations": [9, 10, 11, 12],
    "preRefillLocations": [10],
    "refillLocations": [1],
    "postRefillLocations": [9]
  }
}
}

```

Writing Multi-Line Macros in JSON

Use `\n` for newlines in JSON strings:

```
JSON
{
  "refillAction": "G0 X{xPos} Y{yPos}\nG0 Z{zRefillEngage}\nF{xyFeedrate}\nG91\nG2 X0 Y0 I5
J0\nG90\n"
}
```

Validating JSON

Before saving manually edited files:

- Use online validators like jsonlint.com
- Use a text editor with JSON support (VS Code, Sublime Text)
- The software will report errors when loading invalid files

Appendix B: Fields Not Currently Used

The following fields appear in some JSON files but are not currently used by the software. They are preserved for potential future features:

Field	Status
<code>paletteXLocation</code>	Reserved for future use
<code>paletteYLocation</code>	Reserved for future use
<code>toolChangeMacro</code>	Reserved for future use
<code>flowRate</code>	UI display only
<code>washDepth</code>	UI display only
<code>paintingMode</code>	UI display only
<code>xClearance</code>	Reserved
<code>yClearance</code>	Reserved
<code>autoChangeColors</code>	Reserved
<code>reInkAfterDistance</code>	Reserved
<code>reInkPerStroke</code>	Reserved

Field	Status
preDipInWater	Reserved
postDipInWater	Reserved
reInkWithWaterOnly	Reserved

These fields can be safely omitted from custom tools.
