



# Precision Plotter

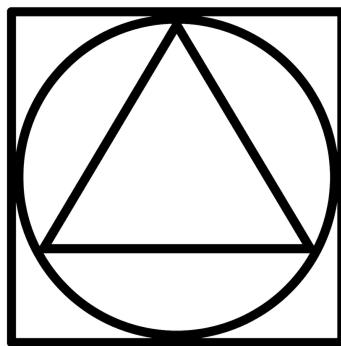
## User Manual

**Group 7 Inc.**

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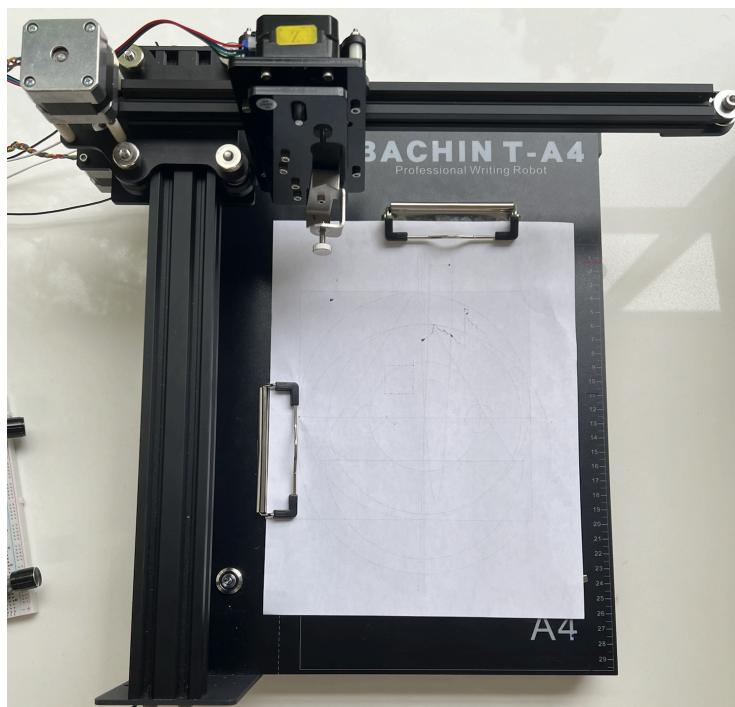


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# 1. Quick Start Guide

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## 1.1 Overview



**Figure 1.1.1: Picture of the Plotter**

- The Precision Plotter is a versatile and user-friendly device designed to cater to a variety of plotting needs. Equipped with three distinct operating modes—Etch-A-Sketch, Math Mode, and G-Code Mode—this plotter offers flexibility for users ranging from hobbyists to professionals. Whether you are looking to engage in freehand drawing, plot complex mathematical functions, or import and execute G-Code files, the Precision Plotter is engineered to handle these tasks with ease.
- Designed for straightforward setup, the Precision Plotter requires minimal assembly and can be powered by simply plugging it into any standard wall outlet. This feature ensures that users can quickly move from unboxing to using the plotter without any technical hassles.
- The accompanying quick start guide provides clear instructions and tips to help users immediately begin exploring the full capabilities of the Precision Plotter. Whether you're a seasoned engineer or a creative enthusiast, this guide will ensure you make the most out of your plotting experience right from the start.

## 1.2 Powering on the Precision Plotter

1. Ensure the plotter is placed on a stable surface near a power outlet.
2. Take the power cable provided with your plotter and plug one end into the plotter's power input, located at the back of the unit.
3. Plug the other end of the power cable into a suitable wall outlet. Make sure the connection is secure



*Figure 1.2.1: Picture of Main Power Supply*



*Figure 1.2.2: Picture of Main Power Supply into Outlet*

4. Locate the power switch on the plotter. This is found on the auxiliary power supply cable.
5. Press or toggle the power switch to the 'On' position.
6. Observe any lights which indicate the plotter is receiving power and starting up. You may hear the device initializing as the motors adjust.
7. Refer to Powering on Video in playlist linked in Section 1.5 for additional guidance



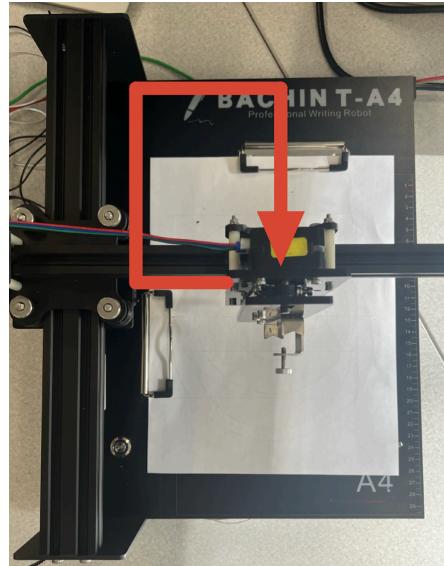
**Figure 1.2.3: Picture of Auxiliary Power Supply Cable with Power Switch circled**

## 1.3 Calibrating the Plotter



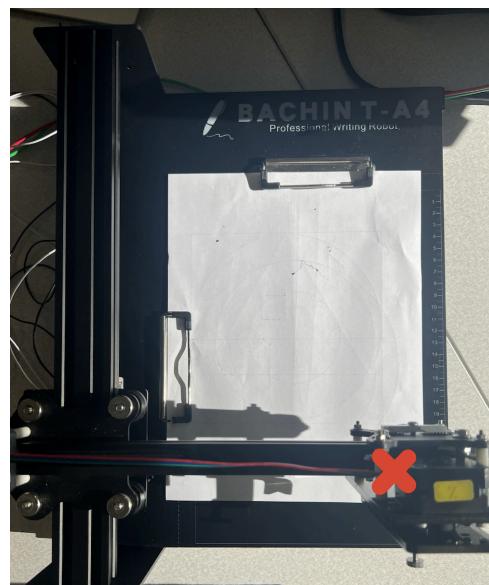
*Figure 1.3.1: Picture of Rotary Encoder*

1. Once the plotter is powered on and awaiting input, the user should be seeing "Plotter Mode" displayed on the LCD screen. This indicates that the plotter is in the main menu. By rotating the right rotary encoder clockwise and counter-clockwise, the user interface will cycle through options forwards and backwards. If this is not the case (the plotter does not show "Plotter Mode" or rotary input does not work), refer to Section 1.2 and restart the plotter.
2. At this point, calibration of the plotter is needed before it can operate. Each mode has its own way to calibrate if it becomes uncalibrated at any point, but the user should follow this guide for initial calibration.
3. In order to calibrate the plotter, the user must navigate to the "Calibrate" Section of the user interface. Use the rotary encoders to cycle to this option, and press down on the right rotary encoder to select it. If you wish to return to the main menu, press down on the left rotary encoder to go back one level of the user interface.



**Figure 1.3.2: Picture of how the Auto Calibrate should move**

4. Once in the calibration mode Section, there are three options: "Auto Calibrate", "Paper Position Calibrate", and "Main Menu". For the simplest calibration, select "Auto Calibrate", and the plotter will move the pen to the upper left corner and then to the center of the page. If the pen does not move after selecting auto calibrate, refer to Section 1.2 and ensure that the main power supply has been connected properly.

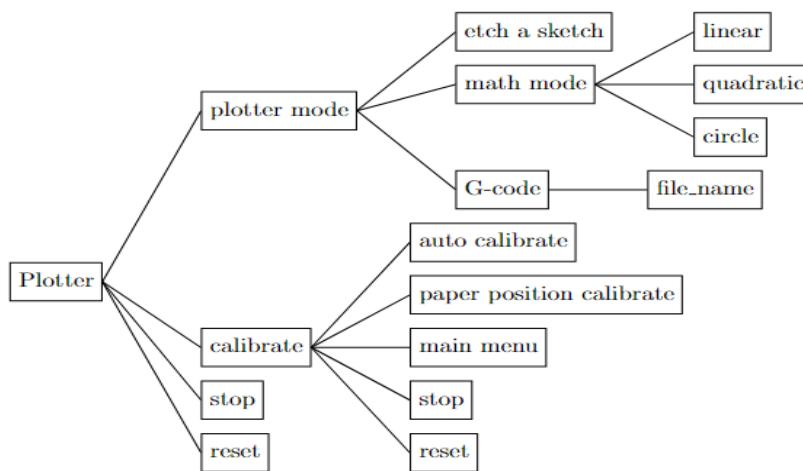


**Figure 1.3.3: Picture of where the Manual Calibrate should land**

5. For a manual calibration, select “Paper Position Calibrate”, and the plotter will move the pen to the upper left corner and then to the current bottom right corner. Use the rotary encoders to precisely place the pen to hover above the bottom right corner of the page, and, once the pen is in the correct position, press down on the right rotary encoder to save. During this mode, pressing down on the left rotary encoder at any time should cancel the calibration process.
6. Once calibration is complete and the user wishes to return to the main menu, either going back (pressing the left rotary encoder) or selecting the “Main Menu” option will both do so.
7. Refer to Initial Calibration Video in playlist linked in Section 1.5 for additional guidance.

## 1.4 Operating Modes

- There are three operating modes that can be used: Etch-A-Sketch mode, Math Mode, and G-Code Mode. Each of these modes is located in the “Plotter Mode” Section.
- The user can operate the interface using the same controls as to navigate to calibration mode (right encoder press to select, left encoder press to go back, rotating right encoder to cycle).
- Refer to the video “Precision Plotter: Scrolling through different modes on the LCD using Right Encoder” in the playlist linked in Section 1.5 for additional guidance.
- Refer to Figure 1.4 for help navigating the user interface.



**Figure 1.4: Diagram of user interface setup**

### 1.4.1 Etch-A-Sketch Mode

Allows the user to draw using the two rotary encoders.

1. For Etch-A-Sketch mode, select “Etch-A-Sketch Mode” in the plotter mode Section of the user interface.
2. The LCD should update to say that the plotter is currently in wait mode, meaning that the motors are disabled. To exit wait mode, press both rotary encoders simultaneously. Another simultaneous press afterwards will enter wait mode again.

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3. Once the plotter is out of wait mode, the motors should be powered on and drawing current. The power output is displayed on the bottom right of the LCD. If the user does not notice a difference in power and the motors can be moved by hand, refer to Section 1.2 and ensure that the main power supply is connected correctly.
  4. The LCD should now display whether the pen is up/down and the current speed of the plotter (1 being slow, 8 being fast).
  5. Now that etch-a-sketch mode is out of wait mode, the user can operate it using these controls.
    - Rotating the right rotary encoder will move the pen along the y-axis
    - Rotating the left rotary encoder will move the pen along the x-axis.
    - Pressing the right rotary encoder will toggle the pen up/down.
    - Pressing the left rotary encoder will toggle slow/fast speed
  6. To exit Etch-A-Sketch mode, go back into wait mode by pressing both rotary encoders at the same time. Once in wait mode, the user can return to the plotter mode sub-menu by pressing the back button (pressing down on the left rotary encoder).
  7. Refer to Etch-a-Sketch Video in playlist linked in Section 1.5 for additional guidance.

## 1.4.2 Math Mode

*Allows the user to plot linear, quadratic, and circular functions.*

1. For Math Mode, select “Math Mode” in the plotter mode section of the user interface.
2. The user can now select between linear, quadratic, and circular functions, and return using the back button (pressing down on the left rotary encoder).
3. Once a function has been selected, the plotter will require the user to input values for the parameters according to these functions:
  - Linear :  $y = mx + b$                       input  $m$  and  $b$
  - Quadratic:  $y = ax^2 + bx + c$               input  $a$ ,  $b$ , and  $c$
  - Circle:       $r^2 = x^2 + y^2$                     input  $r$
4. To input these values, first select a type of function. Then, use these controls to adjust:
  - Rotating the right encoder increments the value by 1.
  - Rotating the left encoder increments the value by 10.
  - Pressing down on the right encoder moves to the next value and saves the current value.
  - Pressing down on the left encoder moves to the previous value or back to the main menu and does not save the current value.
5. When at the last parameter, selecting it will save the current move back to the first parameter. Once all parameters are as desired, holding down the right rotary encoder will confirm and apply these parameters.

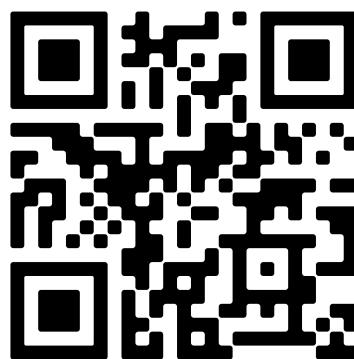
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6. Finally, the program will ask if the system is calibrated. For “no”, pressing the left encoder will calibrate (the same procedure as auto calibrate), and ask again. Pressing the right rotary encoder is “yes” and will initiate plotting. The plotter will draw an axis if there is not one already drawn. Once done, the interface will return to the math mode sub-menu.
  7. Refer to Math Mode Videos in playlist linked in Section 1.5 for additional guidance

### **1.4.3 G-Code Mode**

*Allows the user to plot g-code files that are in the current directory (/team7)*

1. For g-code mode, select “G-Code Mode” in the plotter mode section of the user interface.
2. The user can now choose a file, start, or main menu in this sub-menu. The current file is also shown at the bottom, with “---” indicating no file has been selected.
3. The user should first select a file by choosing “Select a File”. The program will then read and display a list of .gcode files found in the ‘/team7’ directory that can be cycled through in the same way as the user interface. The files must end with “.gcode”.
  - Select a file by pressing down on the right encoder
  - Cancel selection by pressing down on the left encoder
4. When the desired file is selected and displayed on the bottom, press “Start” to have the program read and execute the file. The program will ask the user if the plotter is calibrated, as in Math Mode. Press the right encoder if “yes” and the left encoder if “no”. The plotter will calibrate if “no” is inputted.

## **1.5 How-To Video**



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## 2. General Information

### 2.1 Cautions & Warnings

#### 2.1.1 General Precautions

Read All Instructions: Before using the device, read the user manual thoroughly for a complete understanding of safe operation. This will help you familiarize yourself with the various components of the device and how to handle them safely.

#### 2.1.2 Electrical Safety

Handling of Components: DO NOT touch the MOSFETs, their heat sinks, any resistors, or any open wires while the device is on or has been on within a short period of time. These components can retain heat or carry an electrical charge that can cause burns or electrical shocks. Refer to Figure 2.1.2 for a visualization of what not to touch.

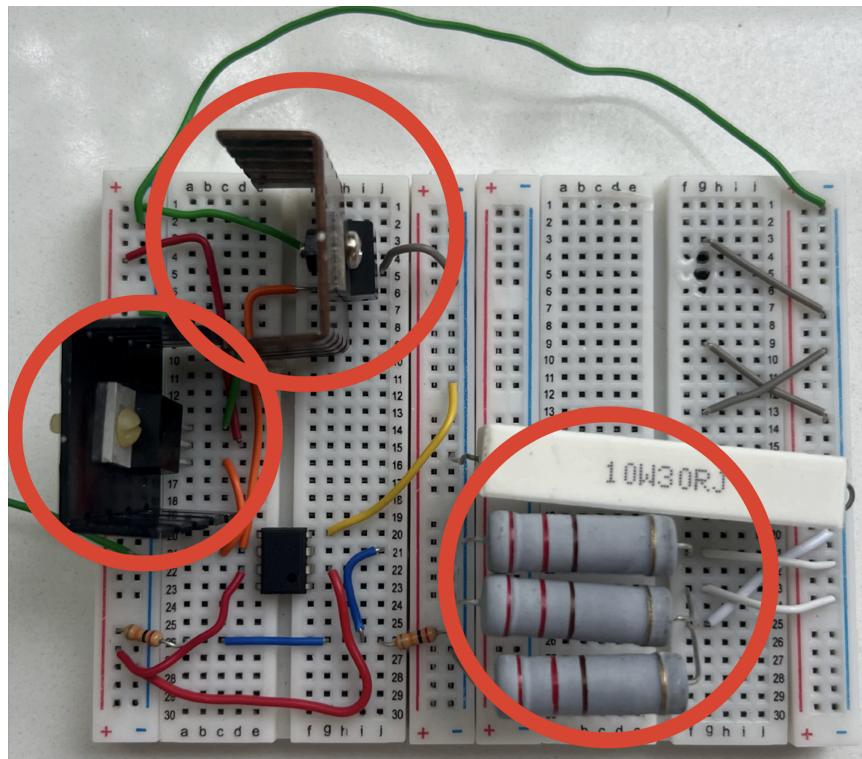


Figure 2.1.2: Picture of Power Supply with MOSFETS and Resistors circled

**Moisture and Water Exposure:** Keep the device away from water or any other type of moisture. Exposure to moisture can cause electrical failures and increase the risk of electric shock. Go to <https://www.esfi.org/water-damaged-electrical-equipment/> to seek more information regarding electrical safety with water.

**Power Issues:** Unplug the device from the wall immediately if you smell any type of burning. This could be an indication of an electrical failure or fire hazard.

### **2.1.3 Device Adjustments and Repairs**

**Adjustments:** Do not attempt to adjust any electrical parts in the system. If the device stops working as intended, seek instructions from a qualified technician or contact our support team at 1-800-266-8226 or email support@precisionplotter.com for guidance.

**Power Supply:** Only use the power block provided to plug into the wall and power the plotter. Do not attempt to use any other power source or battery to power the plotter. If the power block is lost or damaged, contact our support team for a replacement using the contact information provided above.

These precautions are designed to ensure your safety and the long-term functioning of your device. Failure to follow these guidelines may result in injury or damage to the device and may void the warranty.

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## 3. Troubleshooting & FAQ's

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### 3.1 Troubleshooting

#### 1.) Plotter Does Not Power On

**Problem:** The plotter does not respond when the power switch is toggled.

**Solution:** Ensure the power cables are securely connected to the plotter and the wall outlet. Check if the outlet is functioning by plugging in another device.

#### 2.) Unusual Noise During Operation

**Problem:** The plotter makes grinding or clicking noises during use.

**Solution:** Turn off the plotter and check for any obstructions or debris in the path of the moving parts. Ensure all components are clean and properly lubricated.

#### 3.) Inaccurate Plotting or Drawing

**Problem:** The plotter does not follow the intended input accurately.

**Solution:** Recalibrate the plotter according to the calibration instructions provided in the guide. Check that the plotting surface is level and stable.

#### 4.) Pen or Tool Does Not Engage with Paper

**Problem:** The plotting tool fails to make contact with the paper or drawing surface.

**Solution:** Ensure the tool is properly installed and that there is no damage to the tool tip.

#### 5.) Plotter stops Mid-Operation or Responds Slowly

**Problem:** The plotter ceases to function during a task or operates with noticeable lag.

**Solution:** First cancel the current task and turn off the plotter. Wait a few moments, then restart the device to clear its memory.

## 6.) Plotter is Unresponsive When Powering On

**Problem:** Upon attempting to power on, the plotter shows no signs of activity and is completely unresponsive.

**Solution:** If the plotter does not respond when the power switch is toggled, it may require a reset. Disconnect the plotter from the power source by unplugging the power cable. Wait for about one minute to allow the device to reset. Reconnect the power cable and attempt to power the plotter again.

## 7.) G-Code Mode: File Not Visible for Selection

**Problem:** The intended G-Code file does not appear in the file selection interface.

**Solution:** Ensure that the G-Code file is placed within the /team7 directory on the plotters storage. The file must end in ".gcode". Files located outside this specific directory will not be recognized by the file selection interface. Once the file is correctly positioned in the /team7 folder, it should be visible for selection in the G-Code mode UI.

## 8.) Plotter Does Not Recognize Command Inputs

**Problem:** The plotter fails to respond to commands from the user interface.

**Solution:** Begin by resetting the plotter to clear any temporary software issues. Turn off the power, wait for at least one minute, and then power the device back on. If the plotter remains unresponsive after the reset, check the internal connections. Specifically, ensure that the ribbon cable connecting the main circuit board to the LCD display is securely fastened. A loose connection here can prevent the plotter from recognizing inputs from the rotary encoders. Tighten this connection if necessary to restore functionality.

## 9.) Plotter Attempts to Exceed Physical Boundaries

**Problem:** The plotter is trying to move beyond its physical gantry limits.

**Solution:** This issue typically occurs when the plotter's calibration is off, which can happen if the initial calibration settings were altered accidentally or if the initial calibration process was not successful. To resolve this, recalibrate the plotter to re-establish the correct boundaries. The recalibration process will allow the plotter to relearn its limits and prevent it from attempting to move beyond the gantry's physical constraints. Follow the recalibration instructions detailed in Section 1.3 to ensure the plotter operates within its designated area.

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## 3.2 First Asked Questions

### 1.) Can the Precision Plotter operate with different types of drawing tools?

- Yes, the plotter is compatible with various tools, including pens, pencils, and markers. Different tools provide different levels of thickness and precision, any tool that fits in the enclosure is compatible! Ensure that any tool used will not damage the paper.

### 2.) What types of materials can I use with the plotter?

- The plotter can be used on a variety of materials, including paper, cardstock, and other specialty plotting papers. Avoid materials that are too thick or that could cause issues with plotting. Unique calibrations for different materials may be necessary.

### 3.) What should I do if the plotted lines are not straight or the drawing is skewed?

- Ensure the plotter is on a level surface and that the paper or material is properly secured. Check for any mechanical issues with the plotter's arms or belts, and recalibrate if necessary.

### 4.) Is there a limit to the size of the design I can plot?

- The maximum size for designs that can be plotted is initially set by the plotter's specifications. However, this limit can be adjusted to accommodate different sizes of paper or materials. To modify the plotting boundaries, you can use the "Paper Position Calibrate" feature found in the calibration mode. Detailed instructions for adjusting this setting are provided in Section 1.3 of the user manual. This flexibility allows you to tailor the plotting area to meet the specific requirements of your project.

### 5.) How can I plot complex mathematical functions in Math Mode?

- To plot complex mathematical functions using the Precision Plotter's Math Mode, please consult Section 1.4.2 of the user manual. This Section provides a comprehensive list of mathematical functions that the plotter is capable of handling, along with detailed instructions on how to input and plot them.

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## 6.) Can I pause a plotting job midway and resume later?

- The Precision Plotter does not support pausing and resuming plotting jobs midway through. Once a plotting job has started, it must be completed in its entirety before the device can accept further commands. This design ensures that each plotting job maintains a high level of quality. If you need to stop the plotter for any reason during operation, you will need to use the emergency stop process by toggling the power. Please be aware that stopping the plotter in this manner will require the job to be restarted from the beginning once the plotter is powered back on.

## 7.) What file formats are supported for G-Code Mode?

- The Precision Plotter is specifically designed to accept files in the .gcode format for G-Code Mode. To access and select these files, navigate to the G-Code menu on the plotter's user interface. Here you can easily browse and choose the appropriate .gcode files for your plotting projects. For further details on managing and loading these files, please refer to the Section 1.4.3.

## 8.) What should I do if the plotter's performance decreases over time?

- Regular maintenance is crucial. Clean the plotter regularly and calibrate the device as specified in Section 1.3.

## 9.) How do I switch between different modes like Etch-A-Sketch, Math Mode, and G-Code Mode?

- To switch between Etch-A-Sketch, Math Mode, and G-Code Mode on the Precision Plotter, use the rotary encoders to select your desired mode from the main menu. Confirm your choice to activate the mode. For detailed guidance on each mode's use, see Section 1.4 of the user manual.