INNOVATION. PRECISION. EXCELLENCE.

PathMaster X

Software Manual

Revision B

Precision Valve & Automation
6 Corporate Drive
Halfmoon, NY 12065

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Table of Contents

1. Introduction

Before you operate this system, read the operation and setup manual. This will help you to become familiar with the product and ensure successful operation.

If any questions or problems arise, contact PVA's Technical Support department.

1.1 PVA Contact Information

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1.2 Document History

Revision	Revision Date	Reason for Changes
REV B	September 2024	PMX Version 1.1.0.0 Updates
REV A	January 2024	Initial Release

Note: All photographs and CAD model representations in this document are a "general representation" of the system and its components. The actual appearance of the system and its components can differ based upon customer specific configuration.

1.3 Safety

Certain warning symbols are affixed to the machine and correspond to notations in this manual. Before operating the system, identify these warning labels and read the notices described below. Not all labels may be used on any specific system.

Always wear approved safety glasses when you operate or work near the workcell.

Before you operate the system, read and understand the manuals provided with the unit.

Never put hands or tools in areas with this symbol when the machine is in operation. A dangerous condition may exist.

Read and understand the manuals provided with the unit before any repairs or maintenance is done. Only a qualified individual should do service.

Use caution when there are pressurized vessels. Find and repair any leaks immediately. Always wear appropriate safety equipment when you work with pressurized vessels or vessels that contain chemicals

Shear hazard from moving parts. Avoid contact.

Do not remove protective guarding.

In situations where inattention could cause either personal injury or damage to equipment, a warning notice is used.

Do not smoke near the machine. Always have a fire extinguisher available for emergency use.

Before performing any repairs or maintenance to the system, turn off power and lock out the power disconnect switch.

Warning notices are used to emphasize that hazardous voltages, current, temperatures, or other conditions that could cause personal injury exist in this equipment or may be associated with its use. Only qualified personnel should enter areas designated with this symbol.

Laser light source present. Do not stare directly into the beam. Do not use in the presence of highly reflective surfaces

Pinch hazard from moving parts. Avoid contact.

Hot surface. Avoid contact.

Warning, Ultraviolet (UV) light hazard. Do not look directly at the UV light source.

This product meets EU standards for health, safety, and environmental protection.

Warning, no open flames.

Electrostatic sensitive device warning. Observe precautions for handling.

1.4 Theory of Operation

This manual applies to the following PVA workcells:

Delta 6 **Delta 8**

The operator controls the workcell with PathMaster X software. This includes machine setup, manual operation, program selection, and automatic operation. Machine status and error messages are displayed through the application and the light tower. The operator(s) must read this manual or be trained to understand the operation of the machine.

1.5 Hardware and Software Requirements

PathMaster X requires a Windows 10 Operating System or Windows 10 LTSC (Long-Term Servicing Channel).

1.5.1 Offline Requirements

To run the PathMaster X application offline, the computer must also have:

- (1) Monitor of Variable Size and 1920 x 1080 Resolution
- Mouse (USB)
- Keyboard (USB)

1.5.2 Workcell Requirements

To run the PathMaster X application with a workcell or alternate dispense platform, the computer must have:

- (2) Ethernet Adapters
- (1) RS232 Serial Communications Port
- Keyboard Extension Cable, 6 feet
- Mouse Extension Cable, 6 feet.
- HDMI Monitor Cable, 15 feet

PathMaster X may not work correctly with systems that do not meet these minimum requirements.

1.5.3 Supported Controller Drivers

PathMaster X supports DMC 4000 Galil controllers with a firmware revision of D400s08q.

Controllers must be purchased from PVA.

1.5.4 Security Software

Some security software packages and firewalls can interfere with PVA system software.

By default, PVA uses ethernet ports 23, 60007, and 502. Security software and firewalls must be configured to allow traffic on these ports.

2. Setup and Communication

2.1 Startup Procedure

Note: Do not power on the workcell or add material to the pressure vessels until they are correctly grounded.

1. Turn the main power switch **ON**.
2. Confirm the fluid and air pressures are in the correct pressure range.
3. Close all doors.
4. Turn the **Door Bypass Key** switch to the **OFF** position (if applicable).
5. Engage the **Emergency Stop** button.
6. Turn the main power switch to the **ON** position.
7. Ensure the computer associated with the workcell is powered on.
8. Launch the **PathMaster X application** and log in.

2.2 Exhaust Verification

Once the workcell has been initialized, it will perform an exhaust flow rate test. If initialization fails, refer to your workcell manual for fault diagnostics. The exhaust flow rate is monitored with the on-board pressure differential switch.

The workcell exhaust rate must be no less than 300 cubic feet per minute (CFM), otherwise a critical fault will occur and stop the motors. The test will also help to evacuate any vapors that are in the work area. The time this takes is based on the CFM and the area that must be evacuated.

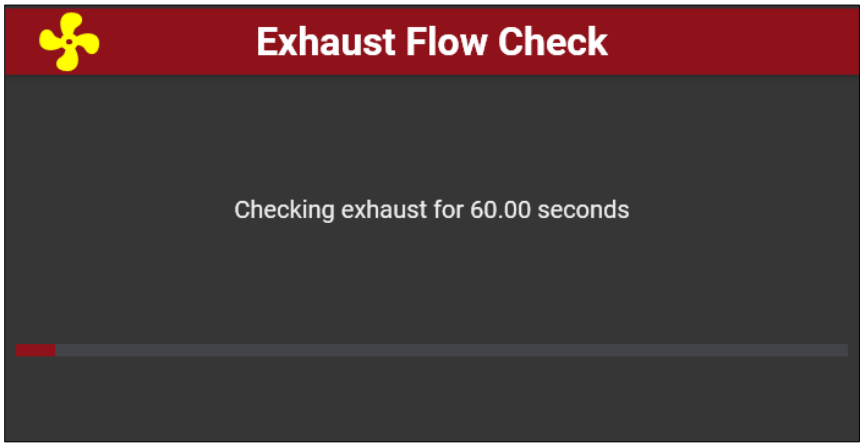


Figure 1: Exhaust Flow Check

2.3 Machine Safety Check

Once initialization and exhaust verification are complete, the machine will require a check of all attached safety devices. The machine safety check ensures the workcell safety devices (Emergency Stop, door interlocks, light curtain, etc.) operate correctly. This safety check must be performed at the beginning of each day. Once the PC clock reaches midnight, the safety check must be executed again. The operator must start the safety check and complete it successfully, or the machine will stop all operations.

1. The machine will automatically begin the safety check.

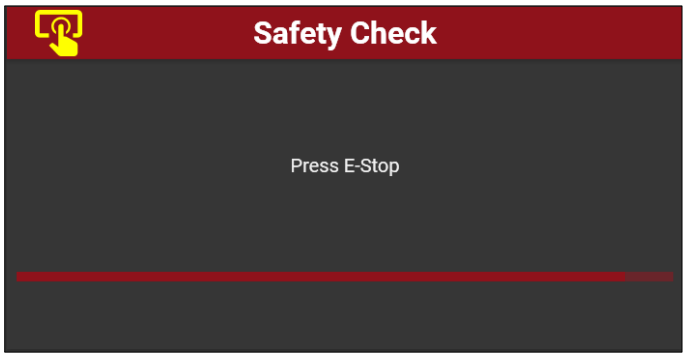


Figure 2: Machine Safety Check

2. You must activate and deactivate the safety devices when shown on the screen. All events in this procedure are timed. If an action is not completed before the displayed timer runs out, an error screen will be shown.

3. Select **OK** to repeat the test.

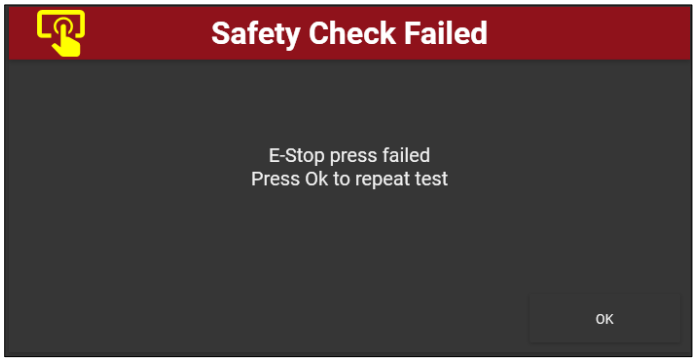


Figure 3: Safety Check Error

Note: If the safety check fails for any reason other than failing to respond to the prompts in time, a qualified person must examine the full system before the machine is operated again. Refer to the Troubleshooting Power Check Failures Document.

2.4 Homing the Axes

After the safety check is complete, the Home Robot screen will display.

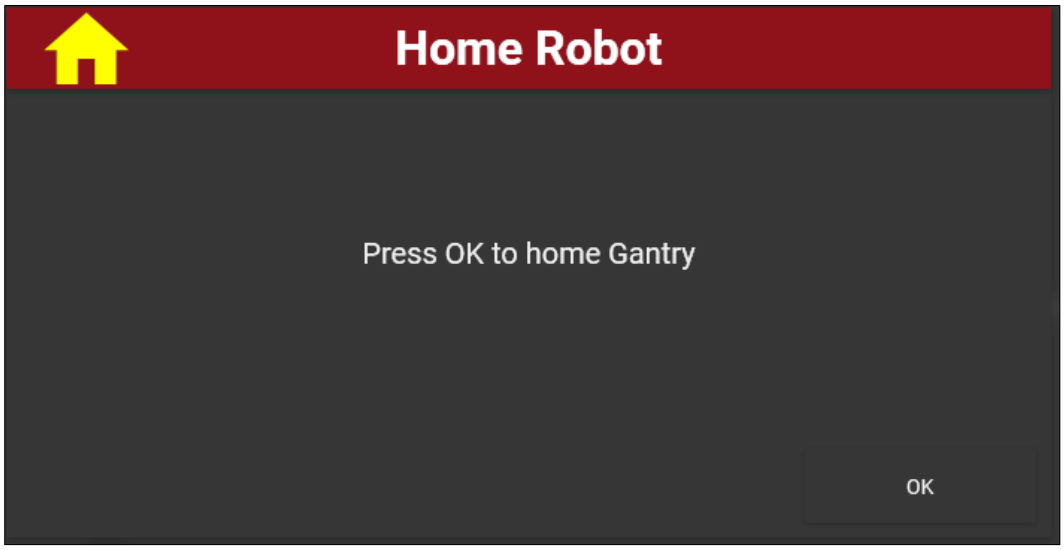


Figure 4: Home Robot

1. Select **OK** to home the system.
2. The axes home in the following order: Z, W (if installed), then X and Y simultaneously.

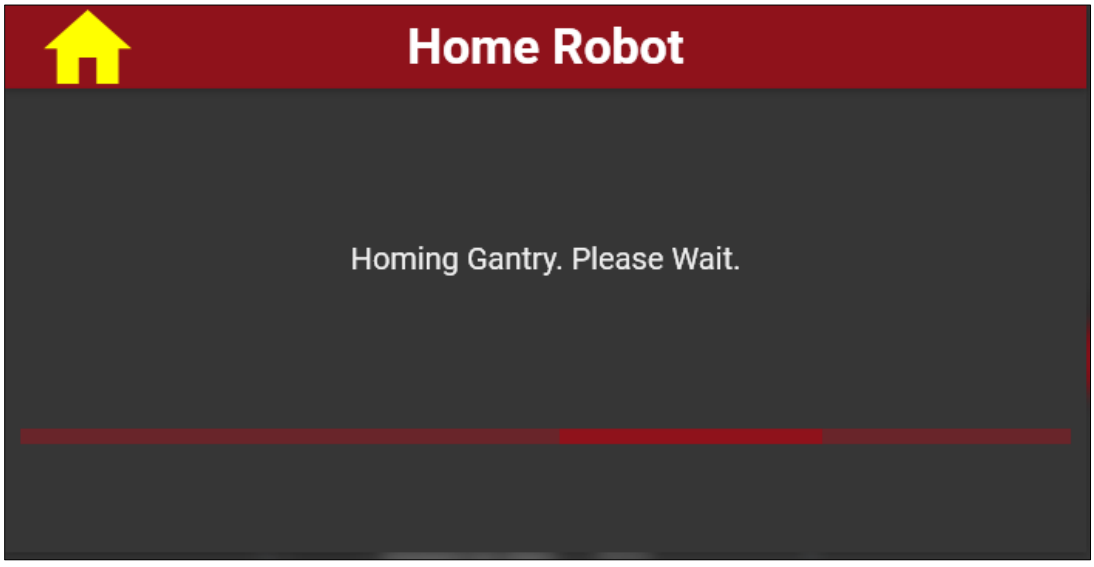


Figure 5: Homing Gantry

2.5 Accessing PathMaster X

1. To open PathMaster X, click the PathMaster X shortcut . *Once all modules successfully load, PathMaster X will require a user login.*
2. Select the appropriate user profile and enter the user pin.
3. The default user pin is “00000”.
4. Select the green checkmark to log in. Press the back arrow to select a different user.

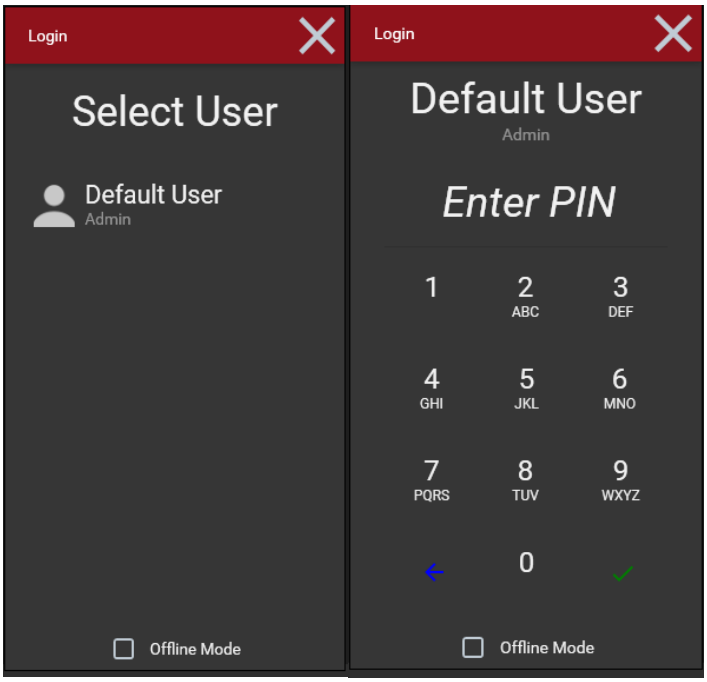


Figure 6: Select User and Enter PIN

Note: If modules do not successfully load, contact PVA Customer Support.

3. PathMaster X Navigation

Navigating the PathMaster X application is performed through a series of tabs and modes. The three modes are: **Production**, **Creation**, and **Configuration**.

Each mode, as well as their subsections, can be accessed immediately by clicking the list button located in the upper left corner of the screen on the top banner.

1	**Dropdown Menu**	*Houses Production, Creation, and Configuration Modes*
2	**Production Mode**	*Houses Process Tab*
3	**Creation Mode**	*Houses Program, Product, and Process Tabs*
4	**Configuration**	*Houses Device, Machine, and Application Tabs*

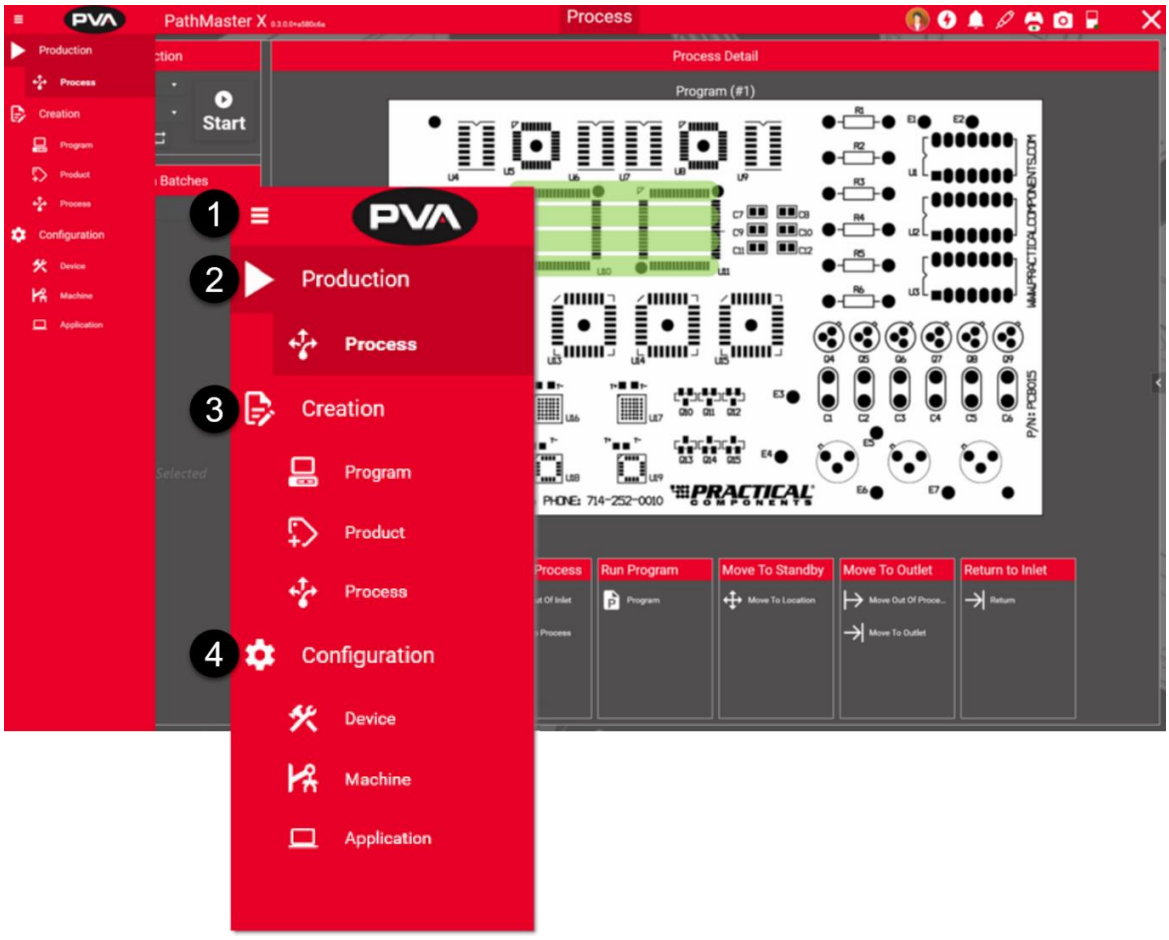
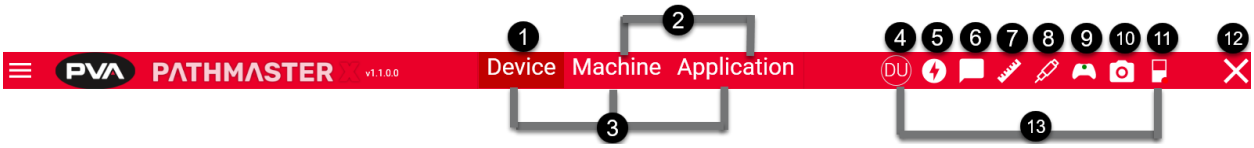


Figure 7: Access Modes Sidebar Menu

3.1 Top Banner Navigation

The top banner contains tools that can be used throughout the application, regardless of mode.



	1	**Navigation Pane**	Allows selection of the current page displayed.
	2	**Available Pages**	Available main pages of the current mode. Selecting a different page will navigate to that page.
	3	**Top Navigation Bar**	Consists of all tabs within a Mode. *Ex. Device, Machine, and Application in Configuration Mode.*
	4	**User Login**	Quick reference of which user is logged in. Select the icon to log out the current user and log in a new user without shutting down the application.
	5	**Quick Actions**	Allows execution of certain functions and motions from any page. See Section 3.2.1 for more details.
	6	**Notifications**	Notifications sent by the application will appear here.
	7	**Calibrated Devices**	Set spray width and current handler position.
	8	**Needle Options**	Allow for a quick run of needle calibration or manual tip change for a selected tool. See Section 3.2.4 for more details.
	9	**Pendant**	Virtual pendant control of the X-PAD. See Section 0 for more details.
	10	**Camera**	Allows you to see a live view of the camera. The camera is able to pop out into its own window.
	11	**Machine Status**	Displays machine connectivity status. If the light is green, your machine is connected and there are no issues.
	12	**Shutdown**	Shuts down the application.
	13	**Header Menu**	Callouts 4-11 make up the header menu.

3.2 Header Menu

3.2.1 Quick Actions

Quick actions allow execution of certain functions and motions from any page.

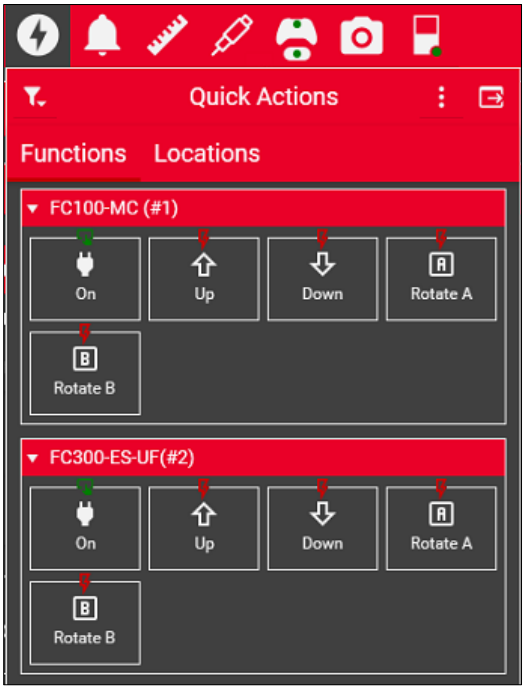


Figure 8: Quick Actions

The top left corner allows for filtering available functions and locations. These can be filtered by name, category, and provider.

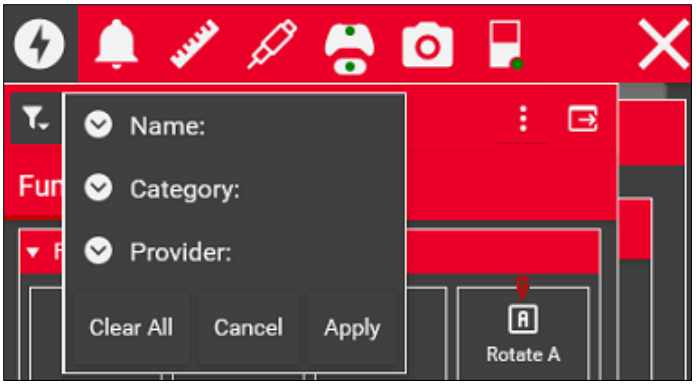


Figure 9: Filter Quick Actions

Quick Actions can pop out to its own window. The popout button is in the upper right corner of the toolbox. This will keep the toolbox on top of the application pages.

The toolbox can be moved anywhere on the screen. Press the button again to return the toolbox to its location on the toolbar.

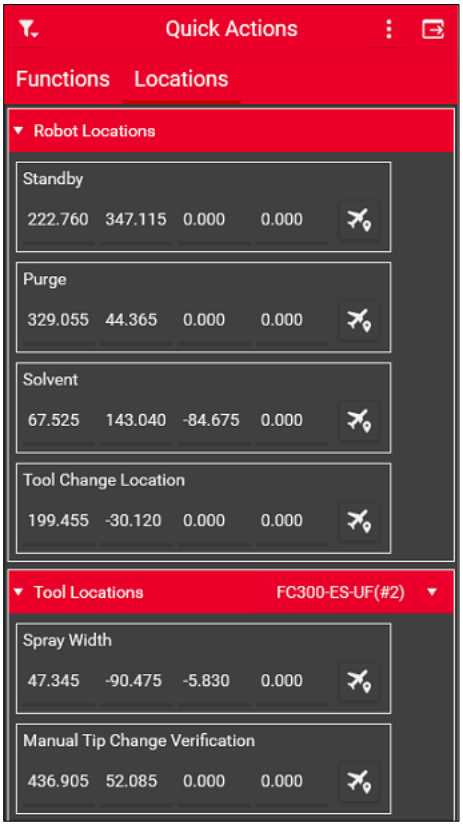


Figure 10: Quick Access Locations

3.2.2 Notifications

Notifications sent by the application will appear here. If there is a dot by the notification bell there are currently unread notifications. Notifications can be dismissed, navigated to the sender, or viewed in the log.

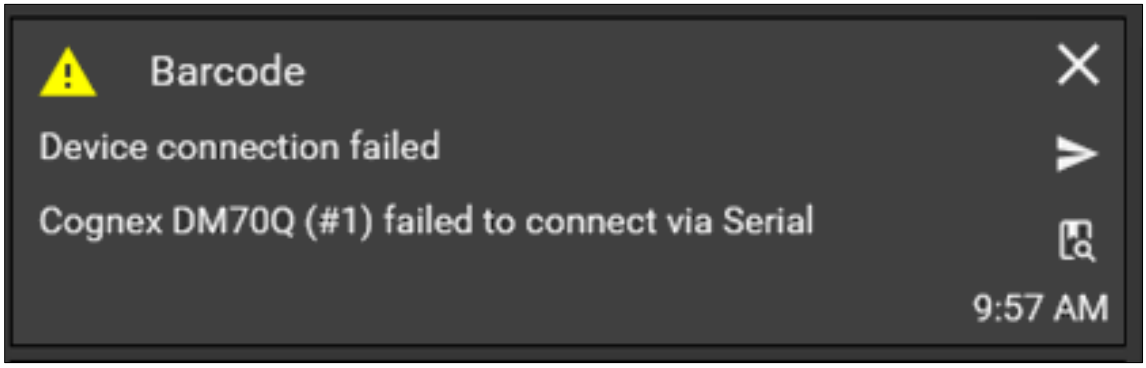


Figure 11: Notifications

3.2.3 Calibrated Devices

3.2.3.1 Handling

To set the current handler position, select the appropriate handler from the dropdown and manually select decrease or increase to modify the handler position. Selecting these options jogs the handler at the set default speed for the duration of the click.

Figure 12: Handling

3.2.3.2 Spray Width

To perform a spray width check, select the spray tool, location, and timeout. Select the Start Demo button. The machine will automatically move to the location and begin the spray test.

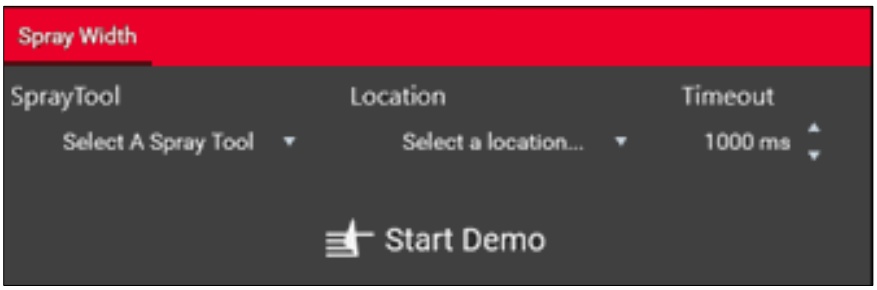


Figure 13: Spray Width

3.2.4 Needle Options

Needle Options allow for a quick run of needle calibration to set a tip offset for a selected tool or allow a manual tip change for a selected tool.

3.2.4.1 Needle Calibration

1. Select the desired tool from the available options.
2. Click the needle button. Select multiple needles to calibrate them consecutively in the displayed order.

Note: Machine functions will be suspended while the needle is calibrating.

Note: A calibration position is required to be setup through configuration to use the calibrate needle function.

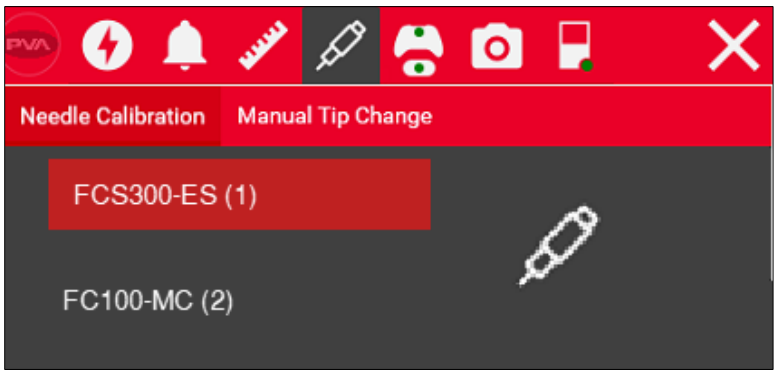


Figure 14: Needle Calibration

3.2.4.2 Manual Tip Change

1. Select the desired location from the available tool locations (see machine options).
2. Choose the appropriate tool from the tool dropdown.
3. Select the **Move** icon .

Note: Use the door bypass when changing any tips to bypass safety measures. Automated motion will not be allowed with the door open.

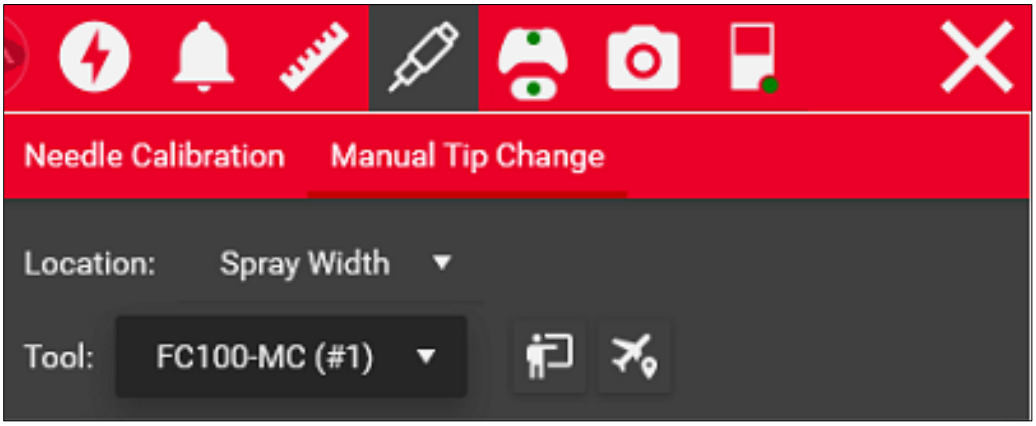


Figure 15: Manual Tip Change

3.2.5 Virtual Pendant

The pendant tab allows virtual pendant control and seeing button assignment of pendant profiles from any tab. If the upper controller is green, this means the virtual pendant is available for use. If the lower controller is green, the machine may use device pendant functions. The **Settings** icon allows further options such as changing the view to a minimized virtual pendant, viewing current button assignment, and navigating to the pendant page. The pendant feature can also pop out into its own window.

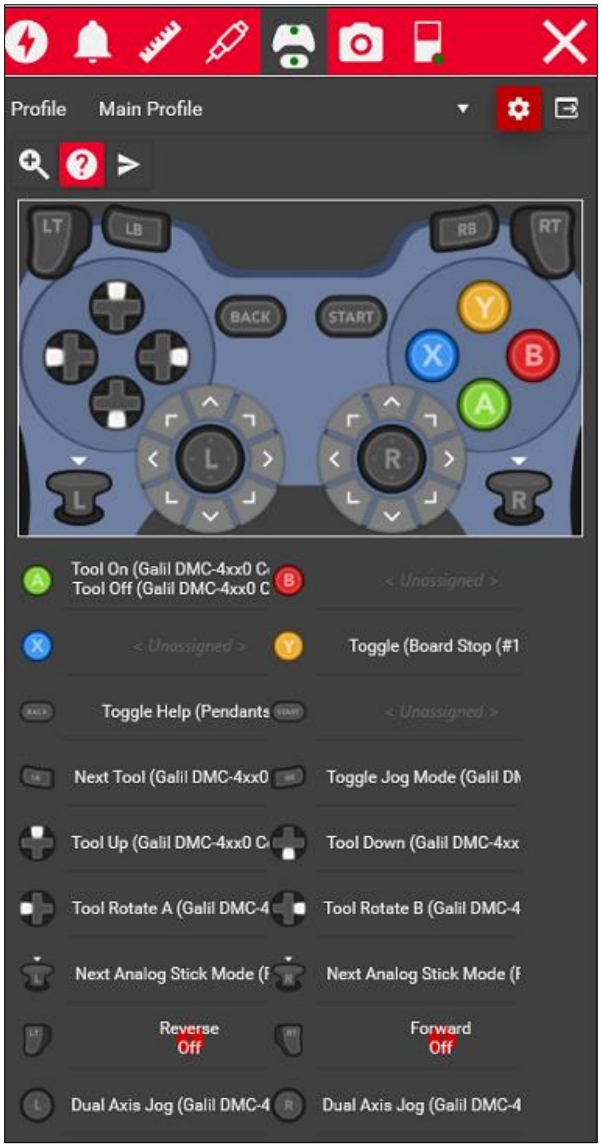


Figure 16: Virtual Pendant

3.2.6 Camera

The camera icon allows the operator to see a live view of the camera. The camera can pop out into its own window. The overlay on the camera may be changed with any available overlays for that camera device. Camera capture settings can be temporarily modified while in this window. This will not change the default capture settings. Multiple overlays can be selected from the overlay dropdown.

Figure 17: Camera

3.2.7 Machine Status

The machine status icon indicates machine connectivity status. If the light is green, the machine is connected and there are no issues. The dropdown allows the user to toggle between online and offline mode. If the application started in offline mode and then switched to online mode, startup triggers such as exhaust flow check, safety check, etc., will be executed.

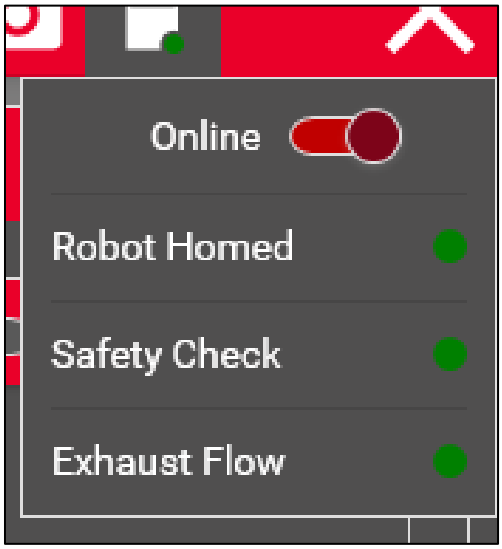


Figure 18: Machine Online

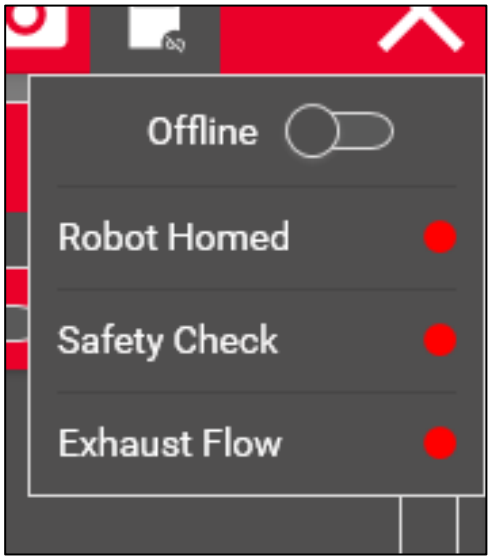


Figure 19: Machine Offline

4. Production Mode

4.1 Process

Process mode allows continuous running of an existing process. Select the desired process and the product to be run, define the number of cycles to be run, and press start to begin the loop.

The currently selected process and program within the process will be displayed in the **Process Detail** section. The process lanes should change to match the currently selected or running process.

When a process has started, **Production Batches** will populate with production data.

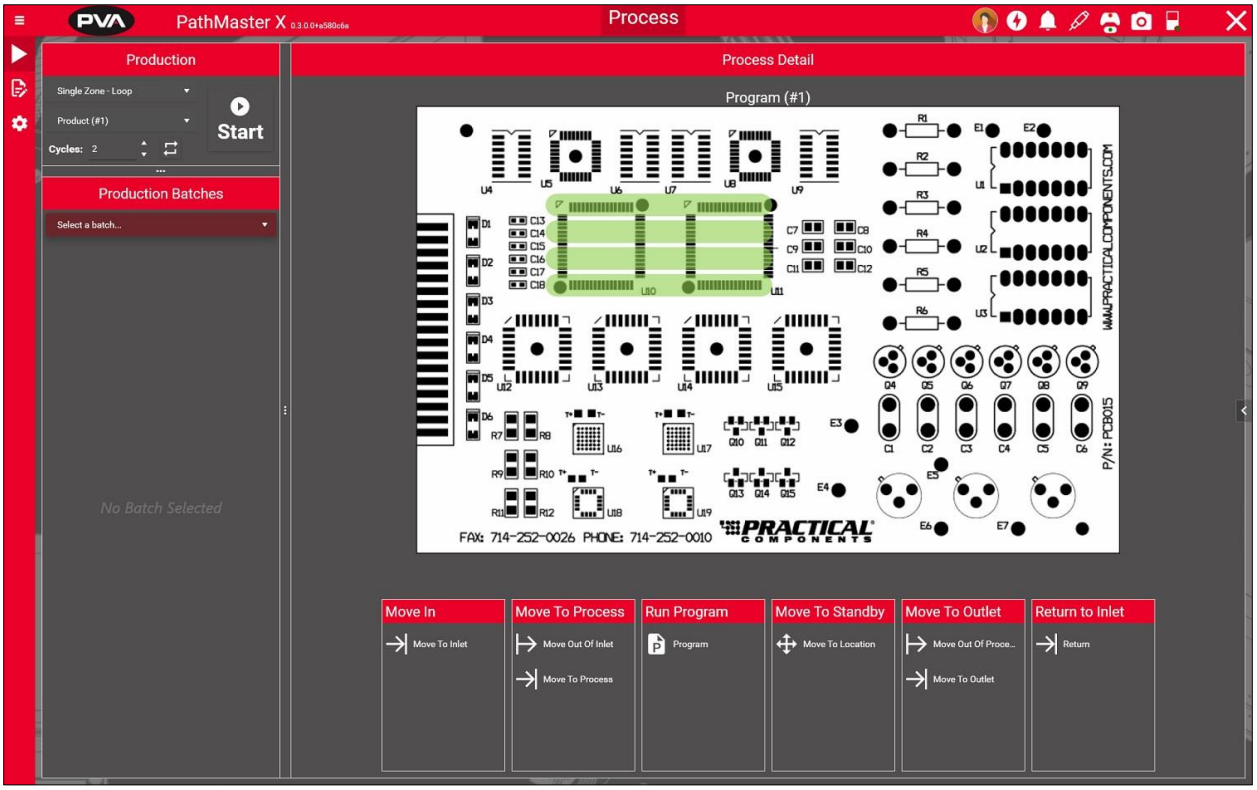


Figure 20: Process Detail

The production batches will indicate what user has started running the process, how long the process loop has been running, and how long individual parts in the batch have taken.

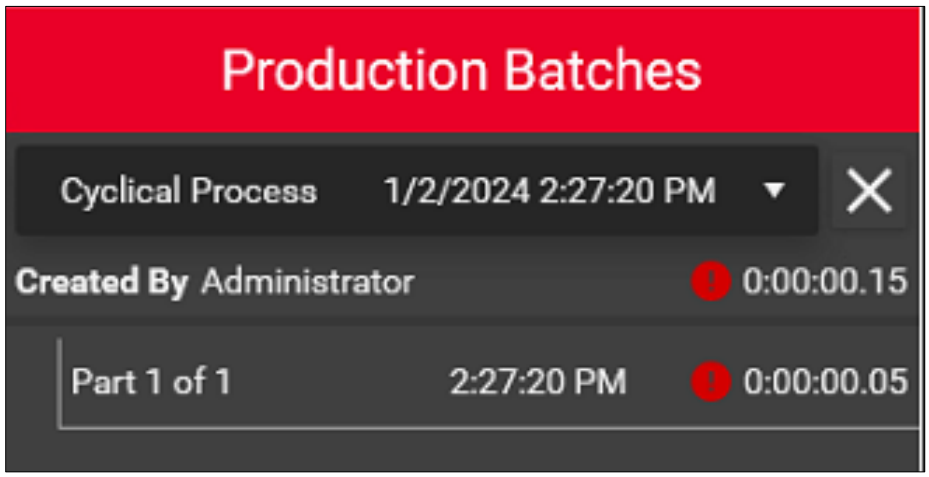


Figure 21: Production Batches

The lane icon  indicates the current lane that the process loop is in. This allows the operator to view what part of the cycle the machine is in at any time.

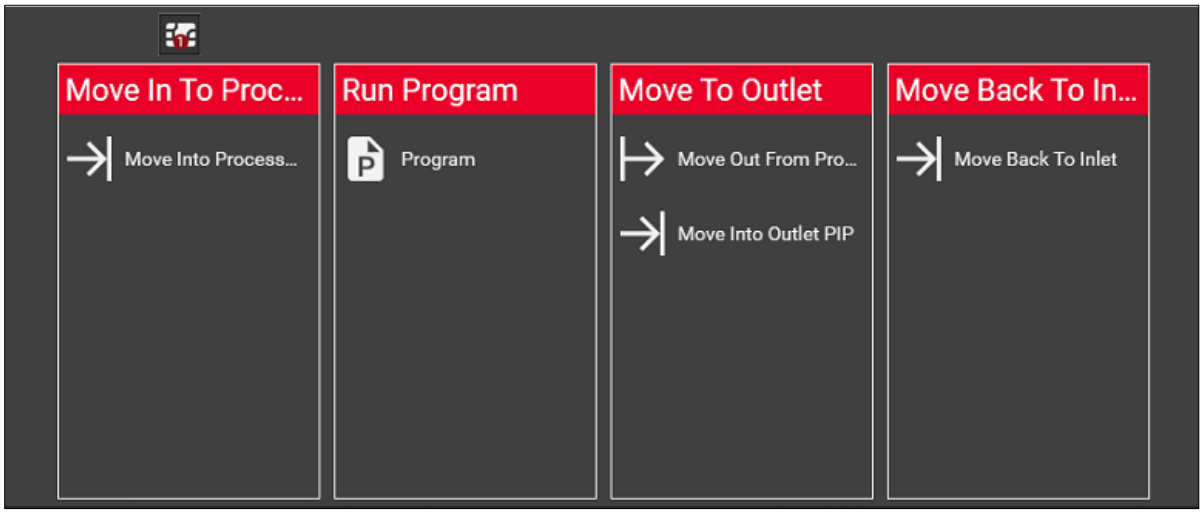


Figure 22: Lane Icon

4.1.1 Dashboard

The dashboard consists of small tiles that display relevant data to the user when open. It can be opened or closed with ease from anywhere in the application through the small arrow on the right-hand side of the application.

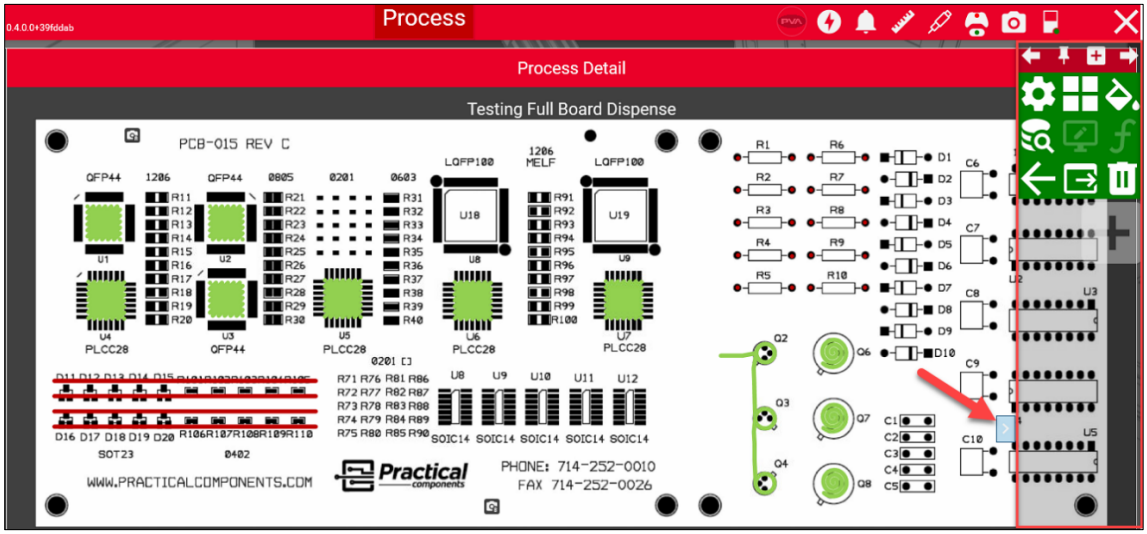


Figure 23: Dashboard Arrow

When selected, the dashboard will expand outward. Select the **Plus** icon at the top to add a page.

Within each page is a collection of tiles. Tiles display a specified set of data. Click the Plus icon on a page to add a new tile. Clicking the Pin icon will permanently keep the dashboard on the right side of the screen. Unpinning will bring the dashboard to its original location.

The **Trash** icon will delete the current page, while the **Lock/Unlock** icon will lock the dashboard to the current page, preventing the top arrows from being used for navigation. The **Pop-Out** icon will pop out the page to a separate window.

When a tile is added, go to the settings to configure the tile. The pin icon will pin the tile in place so it cannot be moved.

4.1.1.1 Settings

The **Settings** icon allows the user to edit the title of the tile as well as the poll rate of the data.

4.1.1.2 Tile Format

The **Tile Format** icon allows the user to change the size and shape of the tile to stack tiles together on a page as desired.

4.1.1.3 Color

The **Color** icon allows the user to change the background color of the tile.

4.1.1.4 Data Source

The **Data Source** icon allows the user to select a data source for the tile. Navigation is sorted by devices, then narrows down to parameters of the device.

4.1.1.5 Data Format

The **Data Format** icon allows the user to change how data is displayed on the tile. For example, an analog signal can be displayed as a radial gauge, linear gauge, two-axis graph, or just as text.

4.1.1.6 Conditionals

The **Conditionals** icon allows the user to add conditionals to modify the tile. For example, if a signal is True, False, or out of a specific range, the tile can change colors to indicate what state it is in.

4.1.1.7 Back

The **Back** icon navigates back to the main tile view.

4.1.1.8 Pop Out

The **Pop Out** icon pops the tile out for free movement.

4.1.1.9 Delete

The **Delete** icon deletes current tile.

5. Creation Mode

5.1 Program

The Program editor allows the user to set up individual program paths for the machine to execute as part of a process.

Programs are created using sequential steps by taking functions from the Toolbox and adding them to the program. Once a step is placed in the program, step details can be edited for accuracy.

Programs can be added by selecting the **Plus** icon  under the Program Edit section. The current program can be selected through the dropdown menu.

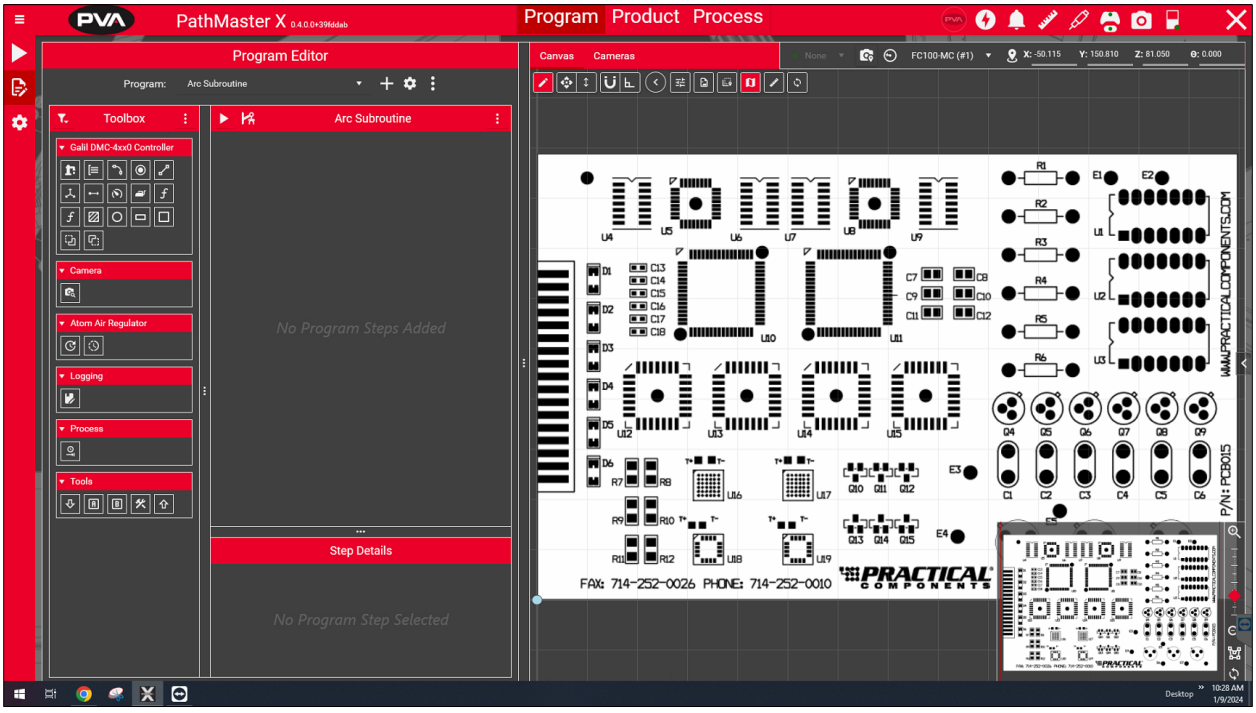


Figure 24: Program

5.1.1 Program Sections

5.1.1.1 Edit Options

Edit options allow the user to undo or redo changes to the program, as well as mirror, clone, import, or export programs.

5.1.1.2 Toolbox

Program steps are found here, separated by their type. The motion controller functions are necessary for gantry movement to points that need dispense, while tool functions have their own category.

5.1.1.3 Program Steps

Program steps are listed out in sequential order of execution. Steps can be reordered by clicking and holding, then dragging them to the proper place in sequence before releasing. A red bar will appear to display what two steps the current step will fit between when released. Program steps can be edited by double clicking on the step, right-clicking and selecting edit, or clicking on the three dots to the right of the step and selecting edit.

5.1.1.4 Program Settings

Program playback can be done with the play button . Playback mode can be determined, as well as whether the full program is performed or only a selected subsection.

Each program must have a program origin, which is set by teaching the desired position.

This position is taught when you press the robot arm icon .

The droplet icon will indicate whether the program is allowed to run wet. If the droplet is crossed out, the program will run dry.

Selecting the kebab menu will bring up more options, such as disabling reorder of program steps and expanding or collapsing sub steps.

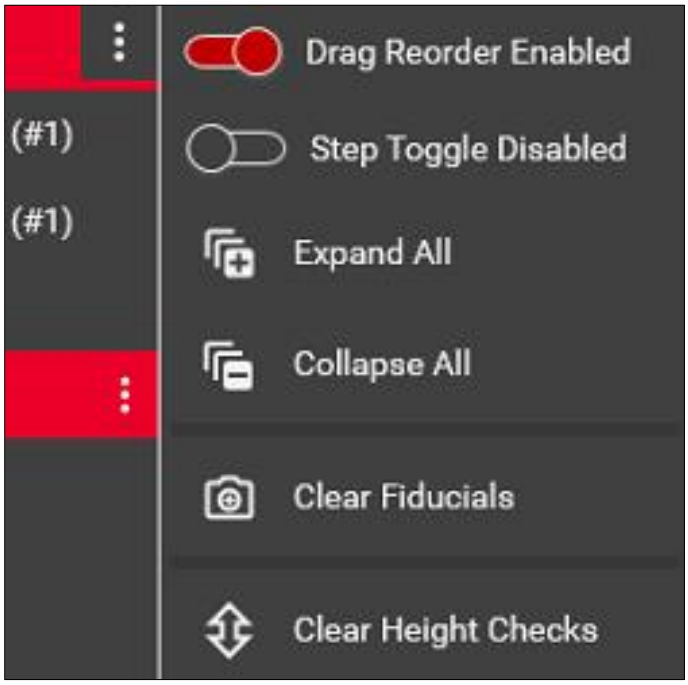


Figure 25: Additional Program Options

6.1.1.5 Virtual Playback

Virtual Playback allows estimation of program time without having to physically move the gantry from its current position. This can be useful in offline programming, as well as ensuring that the gantry will run as intended without risking any unexpected crash. To enable Virtual Playback, select virtual as the playback mode for the program when performing a program playback.

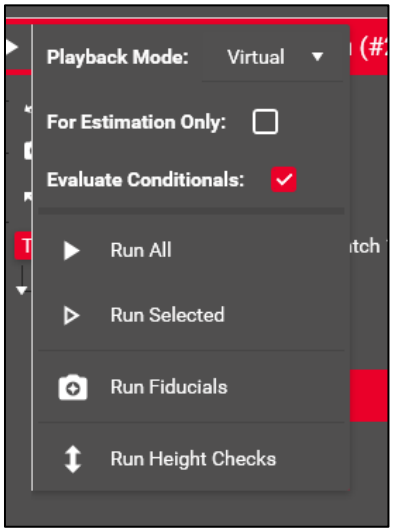


Figure 26: Virtual Playback Selection

For a quick estimate of the program time without viewing any playback on the canvas, select **For Estimation Only**. This will provide an estimated time for program playback that can help determine how close to cycle time specifications the program is. To view playback times, select the stopwatch icon in the right-hand corner of the program editor.

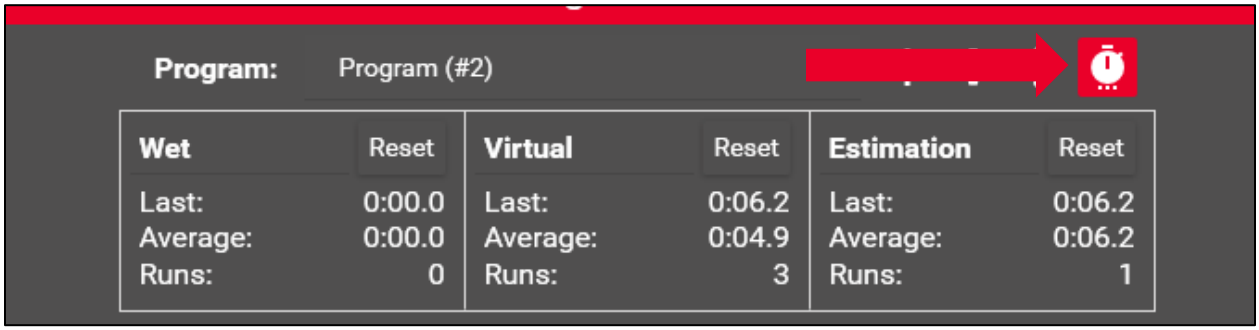


Figure 27: Playback Results

The playback results will show the last run, as well as the average of all runs performed since the results were last reset. Each playback type can be reset individually.

5.1.1.5 Program Details

Details of steps such as move positions, area settings, etc. are accessed through the step details. Details will appear in the Step Details section for any program step that is selected, but greater options and visibility of settings for editing program steps is included through edit. Program steps can be edited by double clicking on the step, right-clicking and selecting edit, or clicking on the three dots and selecting edit.

5.1.1.6 Program Origin

The program origin is the starting point for the program. All path program points are relative to the Program Origin. A variable origin lets the program be executed anywhere in gantry space starting from the defined origin. To properly define a program origin, the Z location must first be taught at substrate height using a physical tool that can reference the substrate such as a valve. The teach tool cannot be used because it cannot reference the substrate. After this, the teach tool can be used to find a more precise X and Y coordinate, as Z coordinate is disabled when teaching program origin with a teach tool.

Warning: It is critical to teach the Z coordinates at the substrate first! If the XY coordinate is taught before the Z, the XY coordinates will be overwritten. Always teach Z before XY.

5.1.2 Canvas

The canvas is part of the Program page that displays the current tool profiles executed in the program. Options for viewing and editing the program are also available through the canvas.

5.1.2.1 Edit Button

Allows access to edit features on the canvas. If selected, function steps can be dragged directly on the canvas rather than needing to be placed in the program steps section.

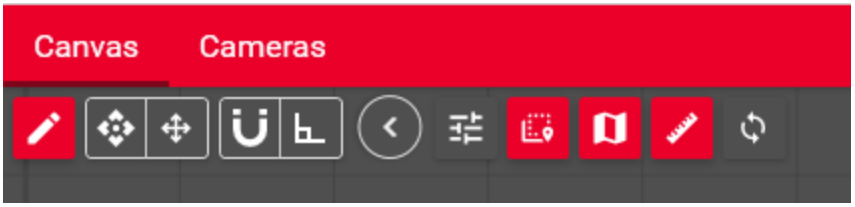


Figure 286: Canvas Edit Options

5.1.2.2 Drag and Snap Options

Drag and snap options allow the user to customize how steps will snap to positions when editing the program positions through the canvas, as well as along which axes program steps can be dragged across the canvas to edit.

5.1.2.3 Canvas Settings

Canvas settings allows the user to modify opacity, padding, and scale of icons.

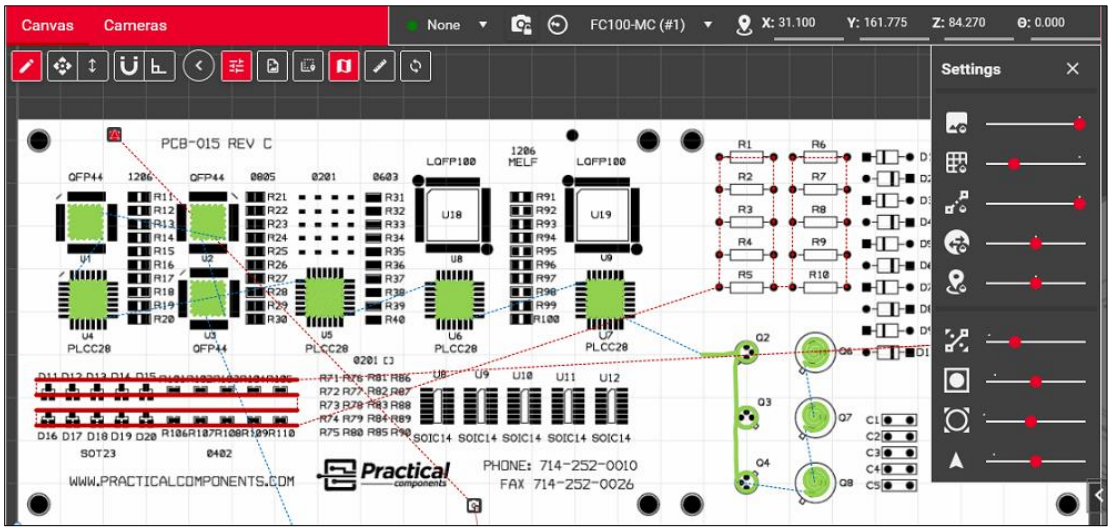


Figure 297: Canvas Settings

5.1.2.4 Image

The image of the canvas can be changed, allowing an exact image of the product to be used instead.

The image file format is .png. For best results, images should be generated from CAD drawings or using the image stitching feature.

Note: Images captured with handheld device such as camera and cell phones are generally not acceptable. It is very difficult to account for perspective and skew with a handheld device.

5.1.2.4.1 Upload an Image

1. Select the **Program Setup** icon in the Editor. Select the **Folder** icon under the image section to navigate to and select the desired image for use.

2. Images that are uploaded can be reoriented and cropped to get the correct representation.

3. The width and height of the image can be modified to match a physical part, with the units being determined by axis units setup in configuration.

4. The modified image can be saved or deleted using the buttons to the right of the folder.

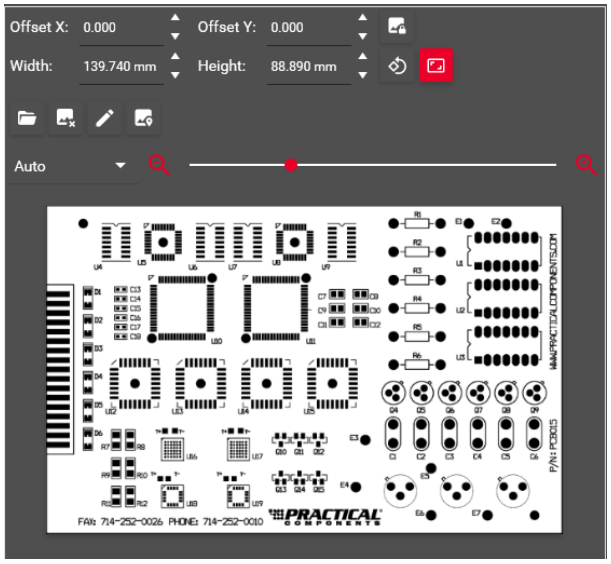


Figure 308: Edit Uploaded Image

5.1.2.5 Coordinate View

The Cursor Coordinate View shows the current cursor position in machine space.

5.1.2.5.1 Move to Cursor

Move the currently selected tool to the cursor position on the canvas. This position in gantry space is calculated using the program origin and defined coordinate position of the cursor in program space.

5.1.2.5.2 Move to Point

Move the currently selected tool to the selected point on the canvas. A point can also be selected on the canvas by selecting it in the editor.

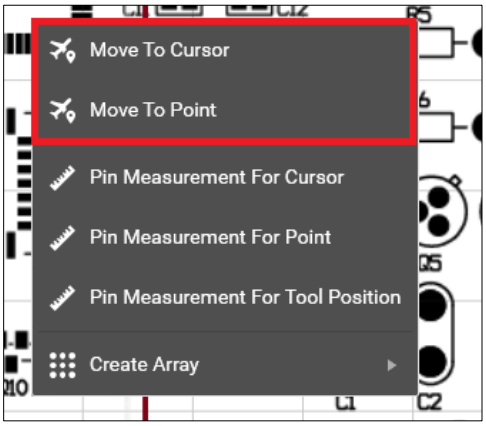


Figure 29: Move to Cursor and Move to Point

5.1.2.5.3 Pin Measurement for Cursor

This option allows the user to make a pin to measure between the pinned location and the cursor location. Pinned locations become selectable from the Measurement Tool.

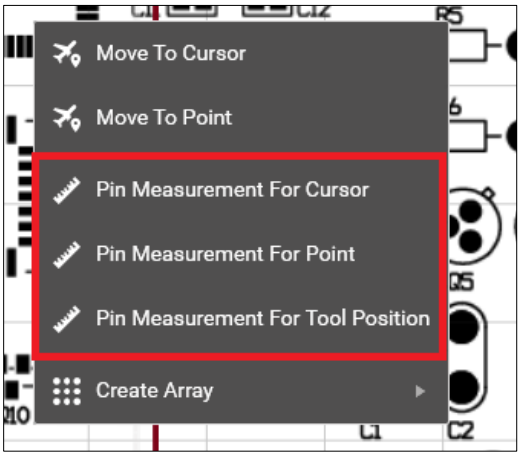


Figure 30: Pin Measurement

5.1.2.6 Canvas Mini Map

The Canvas Mini Map appears in the bottom right corner of the canvas for a preview of the entire board.

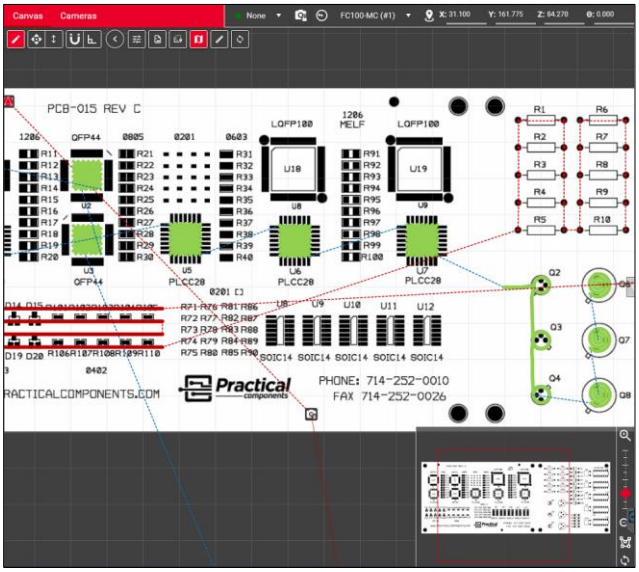


Figure 31: Canvas Mini Map

5.1.2.7 Canvas Menu

Right clicking on the canvas gives multiple options including **Move to Cursor** and **Pin Measurement for Cursor**.

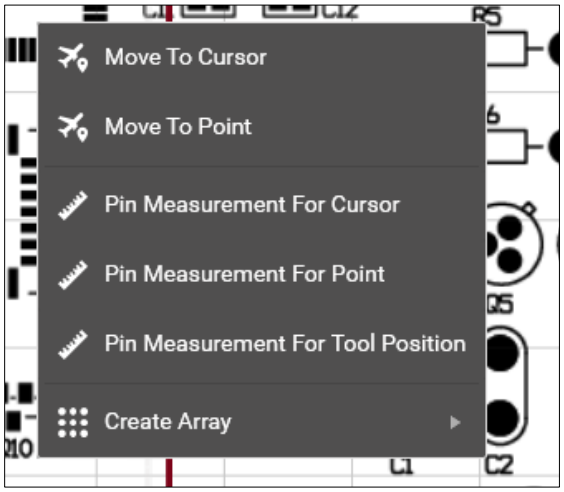


Figure 32: Canvas Right-Click Menu

5.1.2.8 Measurement Tool

The Canvas Measurement Tool allows the user to measure the distance between two selectable locations.

Measurements are broken down between X, Y, and Z axes so legs of triangular coordinates can be determined, while XY and XYZ determine the hypotenuse of triangles formed to the X and Y axes between the two selected locations.

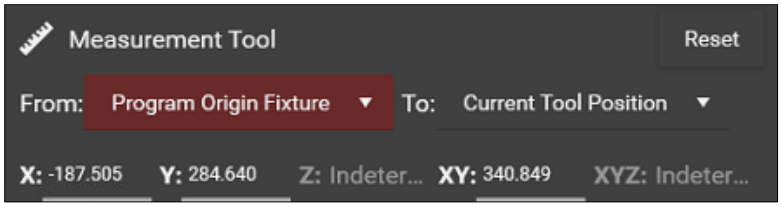


Figure 33: Measurement Tool

Measurements can also be determined between two points on the canvas.

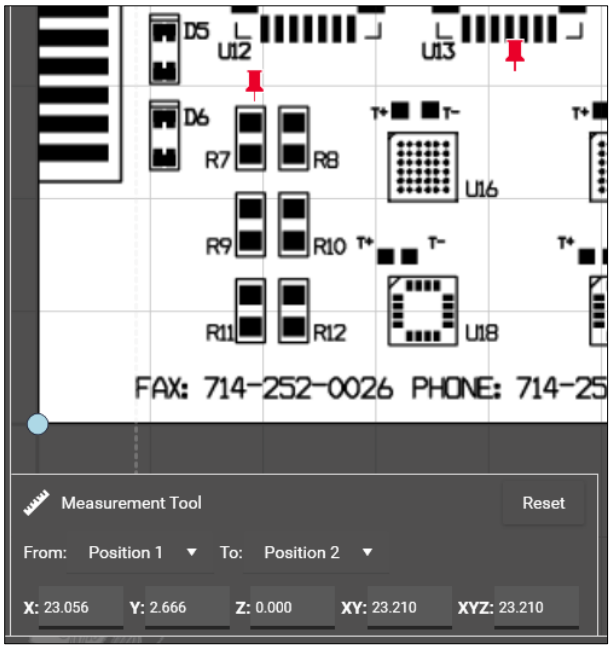


Figure 34: Measurement between two points

5.1.2.9 Cameras (Program View)

The cameras section provides the ability to see a live location feed from the camera to help confirm points in the canvas. A program overlay will not display on the camera page. All overlays available to the camera are available in the upper left corner.

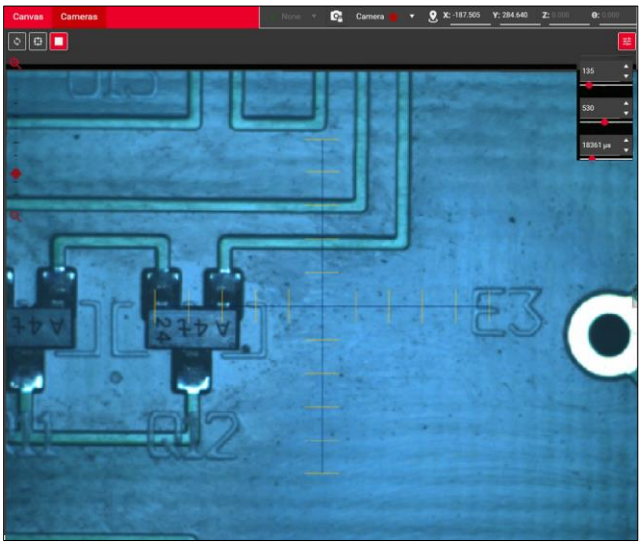


Figure 345: Cameras (Program View)

As with the program canvas, right clicking on the live view of the camera allows the camera to move to the cursor location.

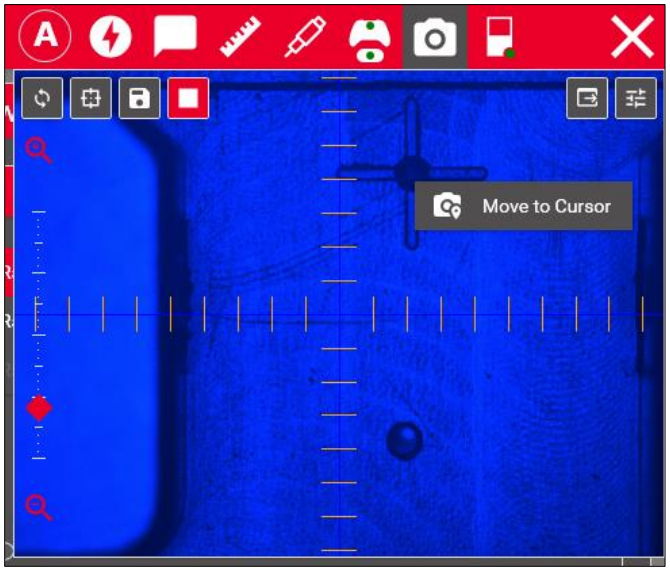


Figure 35: Cameras (Move to Cursor)

5.2 Product

The Product tab allows programs to be assigned to specific products. The **Settings** icon will indicate which processes the product belongs to.

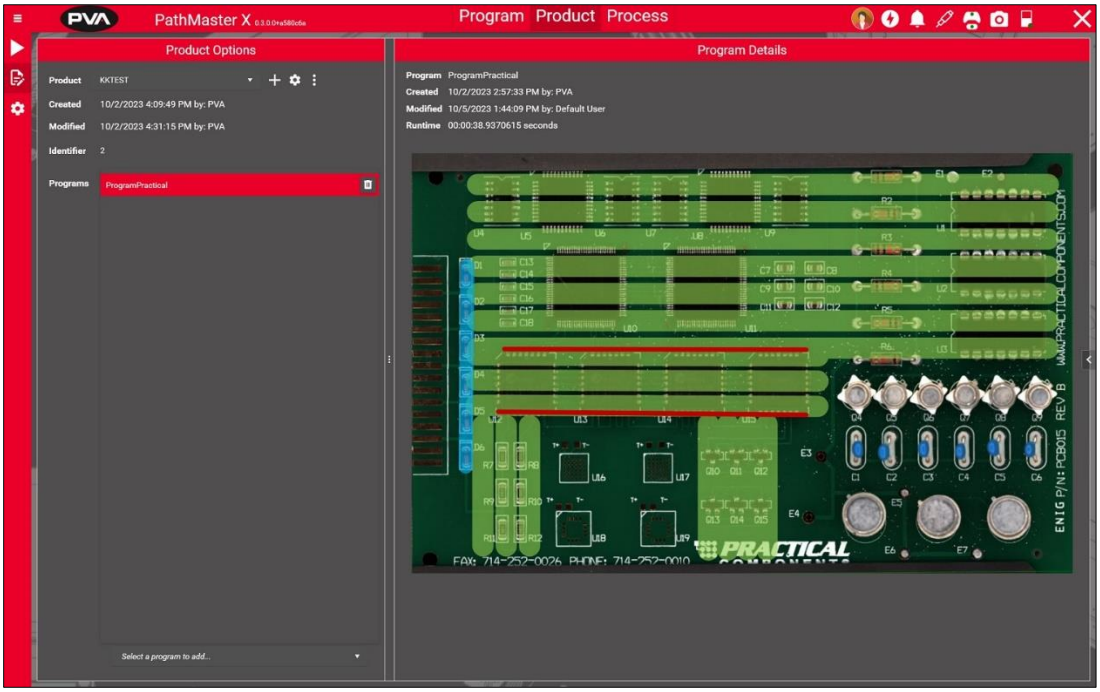


Figure 36: Product

5.2.1 Add Product

To add a Product, select the **Plus** icon . Programs can be added to the product by selecting them from the dropdown menu at the bottom of the page. Conveyor Width is set in the product page, if applicable. Setting a width requires a properly calibrated handler. A User Program must be associated with a product to make it available to the Process. Each Product can have multiple Programs associated with it.

5.2.2 Edit Product

Product names can be edited by selecting the **Settings** icon and clicking the **Pencil** icon . Once the name is edited, select the checkmark to confirm the name change. The product can be favorited by selecting the heart icon. Using the dropdown menu will display all processes associated with the product.

5.2.3 Import, Export, or Delete Products

Products can be exported, imported, or deleted using the kebab menu on the side.

5.2.4 Product Details

Program details will display program information, including when the program was created and last modified, as well as the last runtime of the program.

5.3 Process

The Process tab allows building custom processes using the process toolbox. A process consists of one or more lanes. Lanes execute sequentially in a process. Steps in a lane are carried out concurrently (parallel to each other).

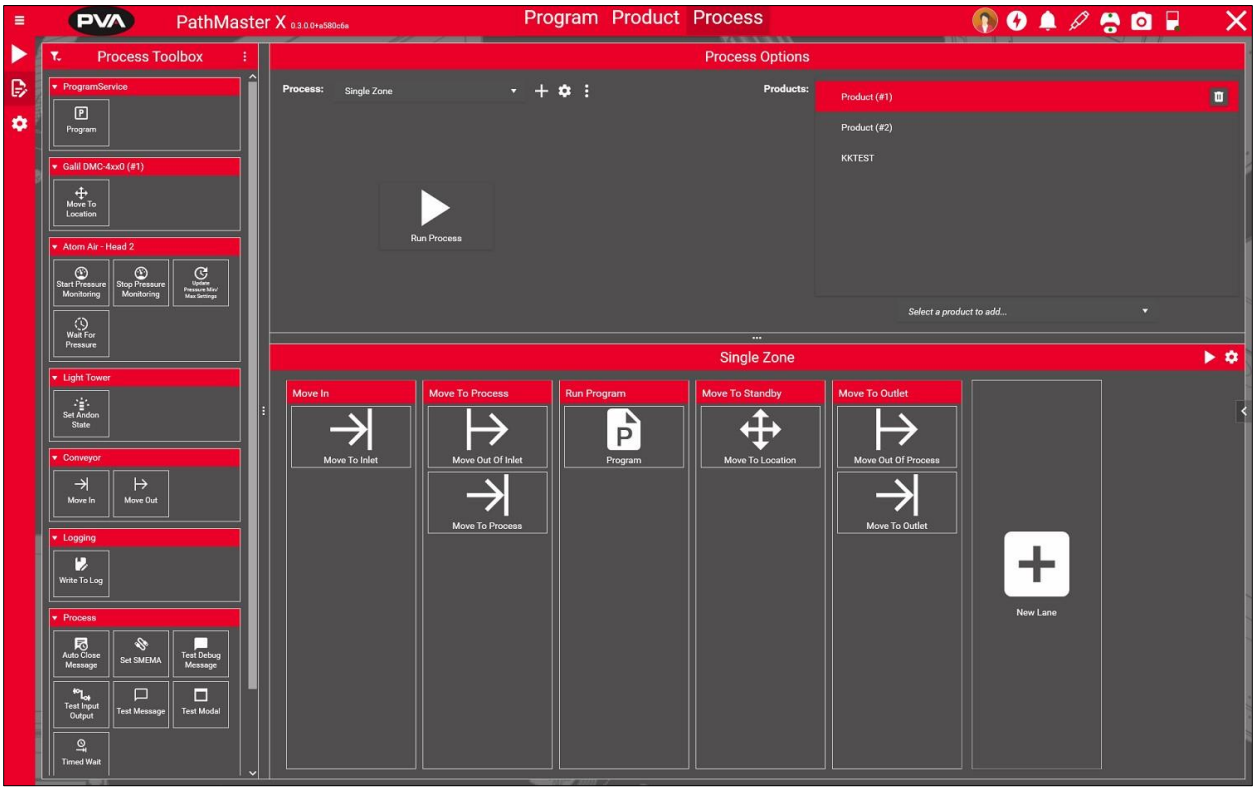


Figure 37: Process

5.3.1.1 Process Creation

All systems come preconfigured with a functional process for the system. Additional processes can be added, or modification can be made to existing processes using the process editor.

Click the **Plus** icon to create a new process. The **Settings** icon will allow renaming the process after creation. Click the three dots to reveal a tool menu for process editing, including undo, import/export, and process deletion.

5.3.1.2 Product Association

Products must be associated with a process to make them available to run in production. The products section of Process Options will indicate which products are used with the currently selected process. The currently selected process is seen from the process dropdown in the Process Creation section.

5.3.1.3 Process Steps

Click and drag steps from the process toolbox into the process. New lanes can be added by pressing the **Plus** button on the top banner of the process layout.

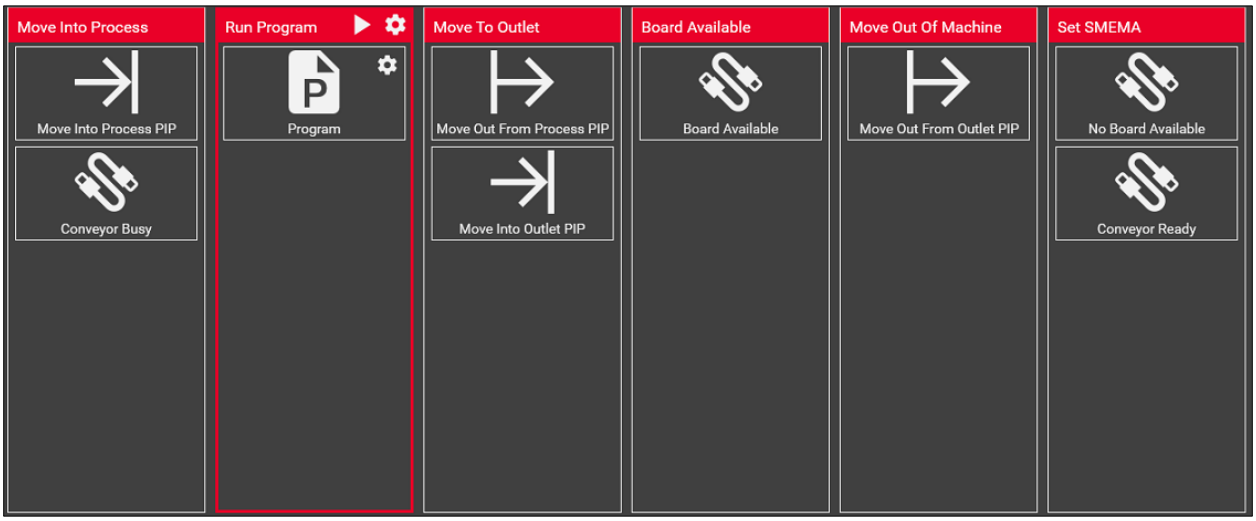
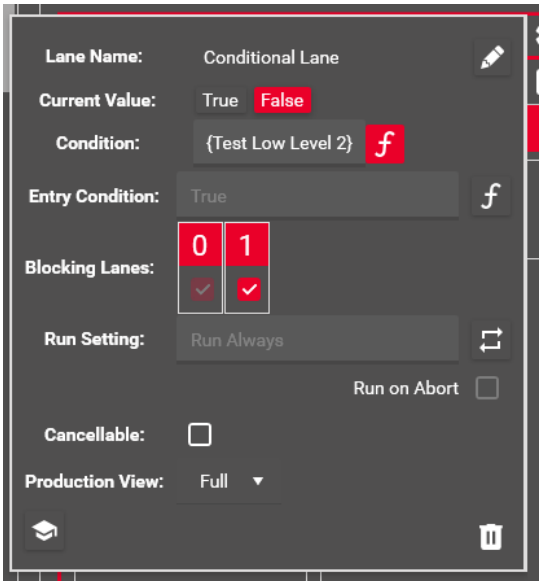


Figure 389: Lanes

Individual lanes can be run with the play button that appears when hovering over the lane and can be edited with the **Settings** icon. The full process can be played with the play icon in the upper right corner of the process steps.

5.3.1.4 Conditional Process Lanes

Conditional Lanes can be added by pressing the **Flag** icon. Conditional lanes can contain other process lanes which will or will not execute depending on if the given condition is true or false. Within the lane settings, an expression evaluator is provided to set up the Boolean condition. Select **True** or **False** to display lanes for that result.



Click the **Plus** button  to add new lanes into the conditional step of the process.

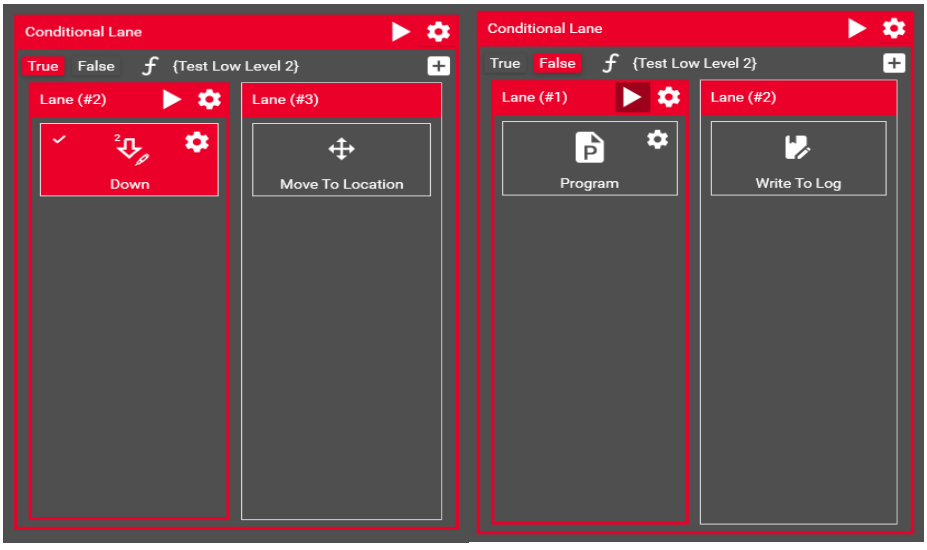


Figure 39: Add Conditional Lanes

5.3.1.5 Process Run Setting

There are five different run settings for a lane in the process to allow greater versatility in uncommon situations.

1. **Run Always** – The lane will run for every cycle of the process.

2. **Run All but First** – The lane will run for every cycle of the process, except for the very first when the process is started.

3. **Run All but Last** – The lane will run for every cycle of the process, except for the last one defined by the batch count (running a single cycle will not run this lane).

4. **Run Once, First** – This lane will only run once on the very first cycle of production.

5. **Run Once, Last** – This lane will only run once on the last expected cycle of production. An early abort of the cycle will not run this lane unless the checkbox is marked to allow the lane to run if production is halted early. Aborting the process must be done manually, and the lane will not necessarily run in the case of an error.

5.3.1.6 Blocking Lanes

Blocking lanes show the required order of completion for a lane to execute. Blocking lanes for each specific lane indicate which lanes can or can't be running when entering that lane.

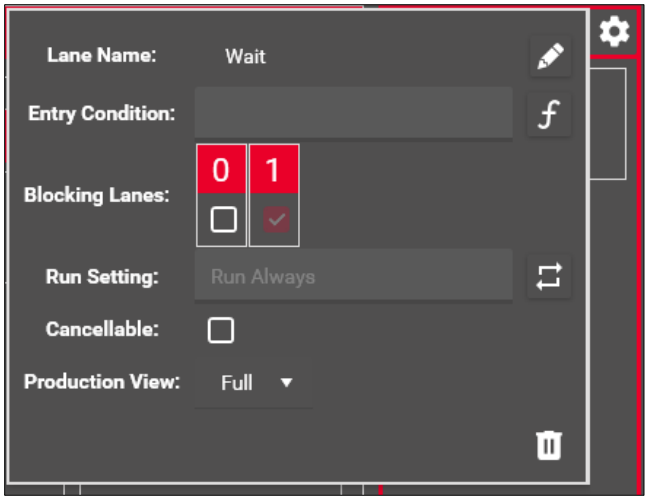


Figure 40: Blocking Lanes

5.3.1.7 Production View

Production view shows how process lanes appear when running the machine in production mode. There are three options.

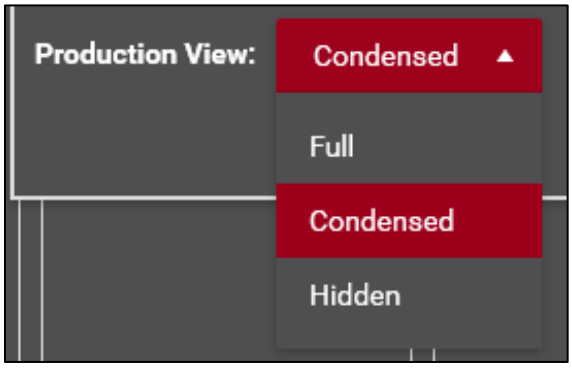


Figure 41: Production View

- **Full** view shows the lane name, as well as all script icons and names within a given lane.
- **Condensed** view only shows lane icons. The lane is condensed to the icon width.
- **Hidden** view hides the lane completely from production view

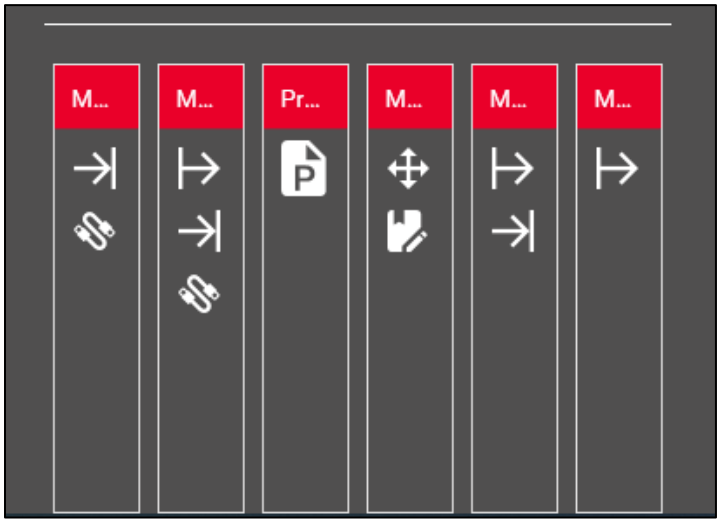


Figure 42: Condensed Production View

6. Configuration Mode

All machines come fully configured from the factory. Changes to the system configuration because of hardware or process changes can be made in **Configuration** mode.

6.1 Device

The devices tab holds information on all the collective devices of the machine. Devices may be added and removed based on their device type. Device types are listed on the left-hand side of the page.

6.1.1 Add a Device

1. Navigate to the tab of the device type you wish to add.
2. Select the dropdown at the top of the page to select the specific device on your machine.
3. Functions and configuration options will populate automatically and may be adjusted for specific machine needs.

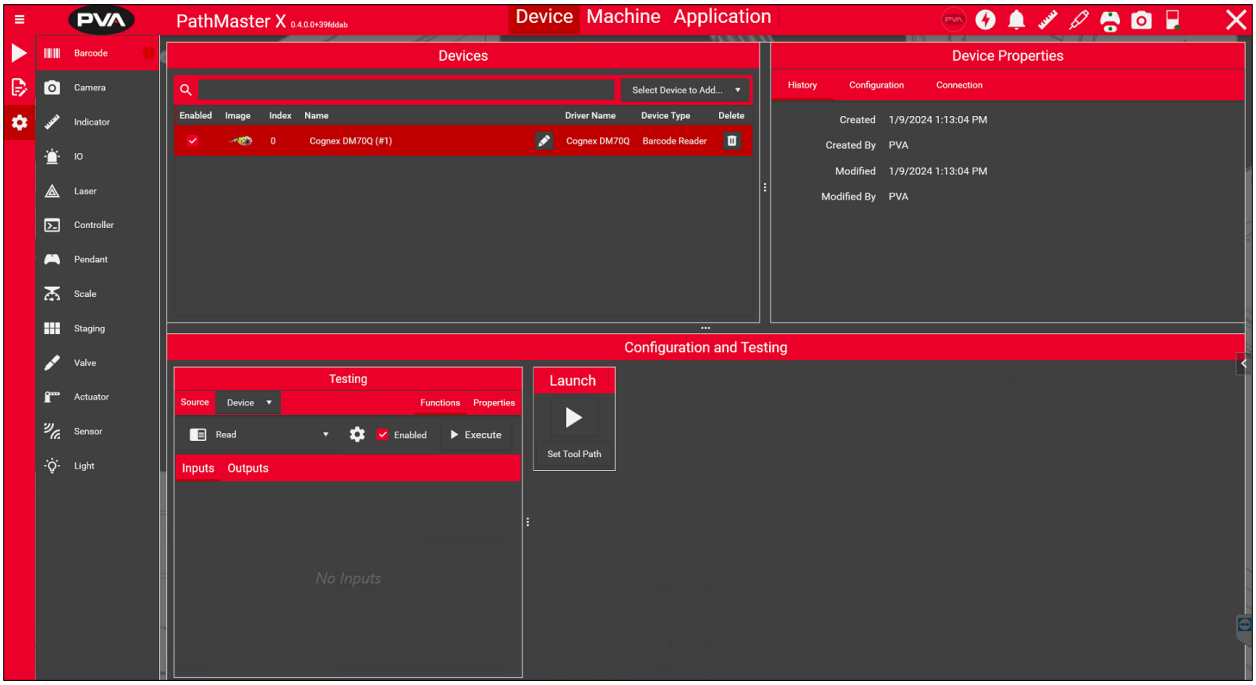


Figure 43: Add a Device

6.1.2 Configuration and Testing

Some tabs have special options under configuration and testing.

For example, the machine IO has tables for setting or viewing individual input and output names and states.

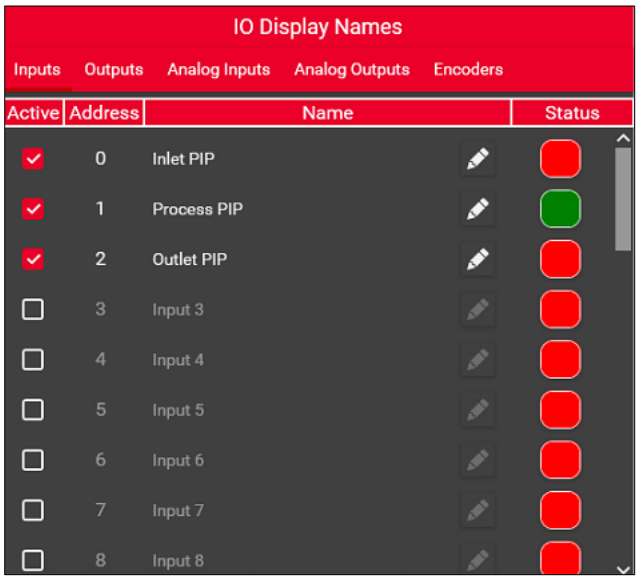


Figure 44: Machine IO Settings

6.1.3 Axes Options

The controller axes selection and configuration allow the operator to set individual axis parameters. Click on the **Pencil** icon to set parameters for a desired axis.

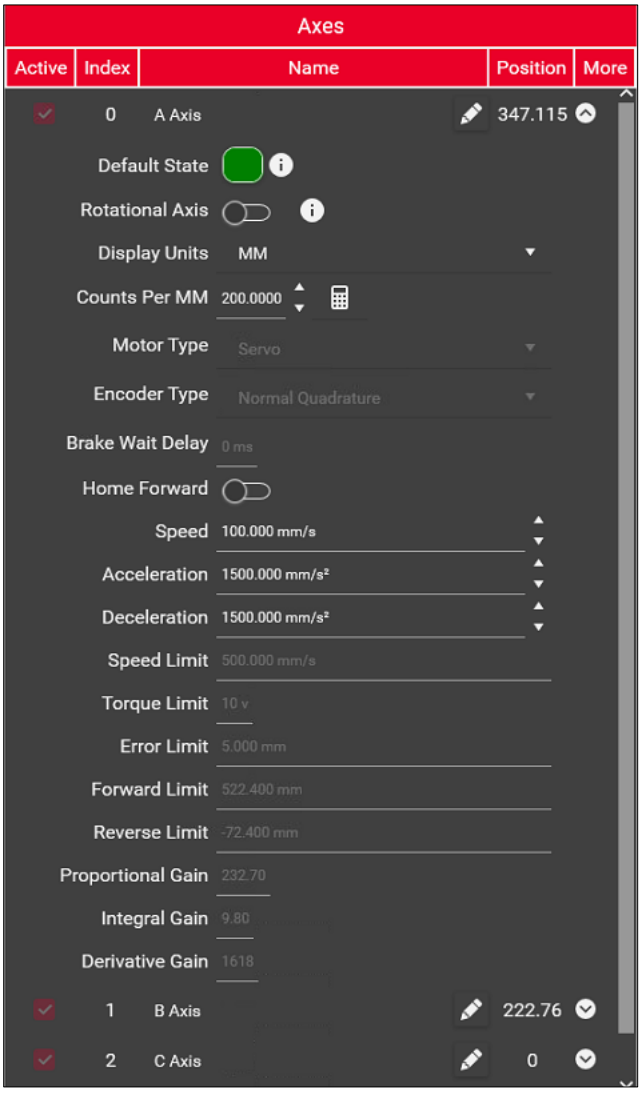


Figure 45: Axes Options

6.1.3.1 Axes Options

Rotational Axis	When toggled on, this axis will be rotational. When toggled off, this axis will be linear.
Display Units	The user can select between counts, mm, or custom units.
Counts Per MM	Sets the encoder resolution per mm (degree for rotational axis).
Motor Type	*Internal Use Only*
Encoder Type	*Internal Use Only*
Brake Wait Delay	Used for machines with a Z-axis. *Internal Use Only*
Home Forward	Determines the direction that the axis homes. This typically homes to reverse limit switch.
Speed Controls	Set speed, acceleration, deceleration, speed limit, and torque limit. **Note: Parameters set will not be flagged as unsafe. It is the operator's responsibility to ensure the speed controls are set to safe and effective parameters.**
Limit Controls	Set how many counts from expected position the axis may move before a limit error is triggered. Set forward and backward software limits.
Axis Tune	Set PID axis tune parameters.

6.1.4 Pendant Options

Separate profiles may be created for the same pendant, allowing for switching between controls. Button assignment allows for switching between profiles with the press of a button, giving greater control flexibility and reducing the limitations of the number of controller buttons available.

6.1.4.1 Button Assignment

All buttons, including joysticks, allow for a pressed/unpressed option. Joysticks are highly recommended for jog axis control. Button assignment allows for setting a pressed action with no unpressed action but does not allow unpressed actions without first assigning a pressed action. Unpressed actions are allowed to be unrelated to the pressed action.

Figure 46: Pendant Control and Button Assignment

6.1.5 IO Configuration for Devices

Certain devices require location configuration on the IO for proper use. The configuration tab prompts for the type of IO allowed for each device. The user can select which IO bus the device is connected to and select individual IO points from that bus. As a part of configuration, users can also set a default ON state to invert the expected polarity of the signal.

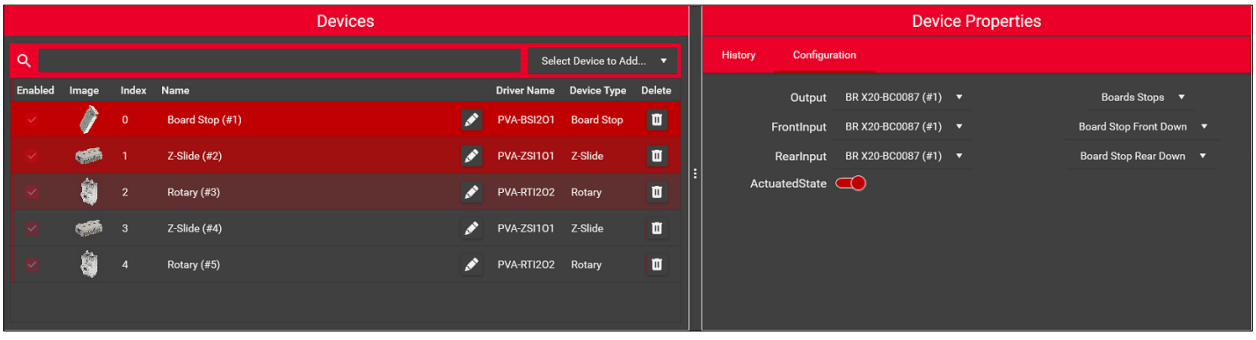


Figure 47: IO Device Configuration

6.2 Machine

6.2.1 Tool Setup

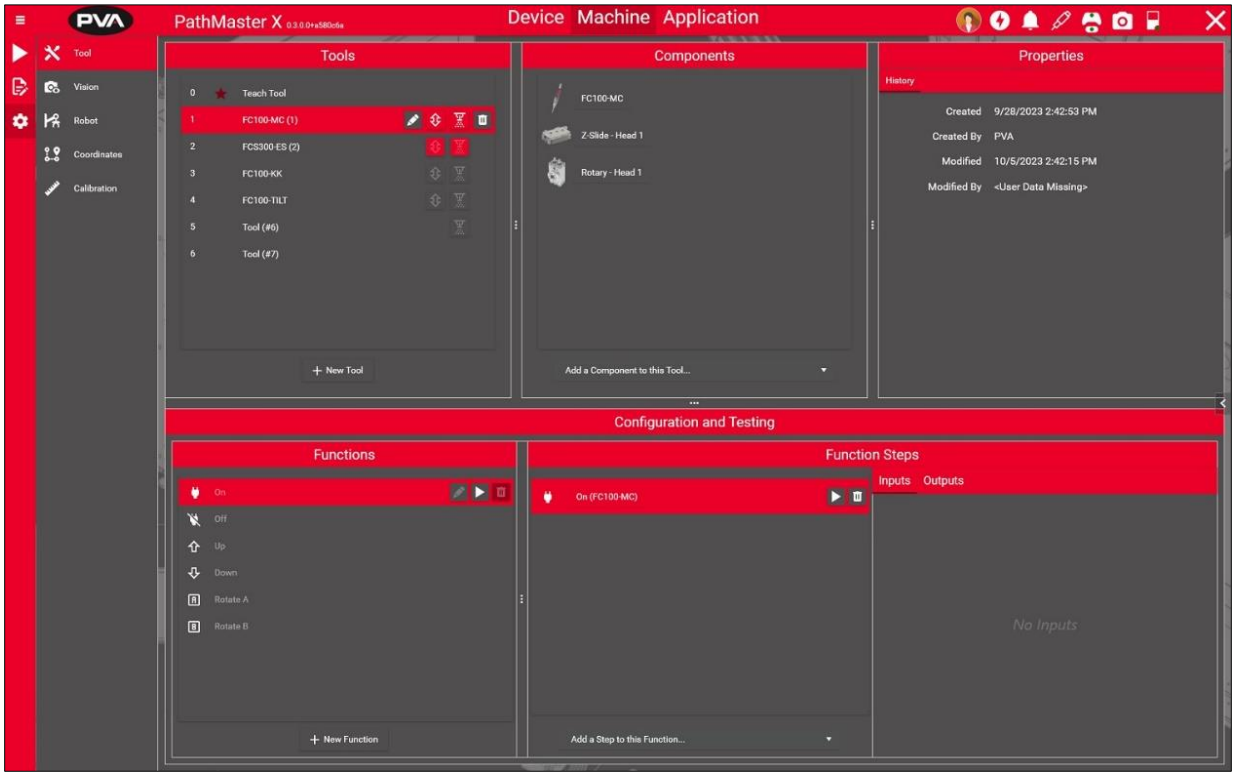


Figure 48: Tools

6.2.1.1 Tools

Add new tools by selecting the **New Tool** button. Created tools will use the next available index for its identifier. Edit the name of the tool by clicking the **Pencil** icon  . Delete a tool by selecting the **Trash** icon  .

6.2.1.1.1 Tool Function Groups

There are two tool groups: **Tool All Up/All Down** and **Tool All On/Off**. To add a tool to a group, select the tool, then press the **Settings** icon. Use the toggles to make the desired group selections for that tool.

Note: Most tools will need to belong to both groups for Auto Purge and Solvent to work correctly.

Figure 49: Tool Function Groups

6.2.1.2 Components

Components may be added to a currently selected tool. To add a component to a tool, select the tool in the Tools section. Add a component to a tool using the dropdown in the Components section. Each component that is selected will be grouped together for that tool. For example, if a valve had an associated z-slide and rotate assembly, all three components would be associated with that tool.

6.2.1.3 Functions

Certain components will automatically add common tool functions. New functions can be added by selecting the **New Function** button. The function may be renamed and edited with different available steps. Function flags allow the function to be used in programs, mapped to pendant buttons, and used through Quick Actions.

6.2.1.4 Function Steps

Select the function in the Functions section. Search for available scripts using the dropdown list in the Function Steps section. The scripts available depend on the components selected for the tool.

Select steps in the order you wish to use them. Steps cannot be reordered without deleting steps.

Note: Certain steps have inputs and outputs attributed to them. Inputs can be configured through this section, while outputs can be viewed as the function or function step executes.

6.2.2 Vision

6.2.2.1 Calibration

1. To create a calibration, select **Add** when viewing available calibration options. A calibration grid is required when setting up a calibration.
2. Move the calibration grid under the camera so full dots are visible and cover as much of the screen as possible.
3. Count the number of rows and columns visible and enter the amounts in their appropriate sections. Modify the grid spacing of rows and columns if needed.
4. **Single Calibrate** will take a single frame when the button is pressed and attempt to find the calibration grid from the single image. **Live Calibrate** will allow the camera to stay live and the grid to be moved so the user can see when a successful grid is found.
5. Press **Save** to save the calibration to the available list.

Figure 50: Calibration

If there is more than one calibration, the default calibration is selected by pressing and holding the **Default Calibration icon** for one to two seconds. Overlays are based on the default calibration. If there is only one calibration, it is set to the default automatically.

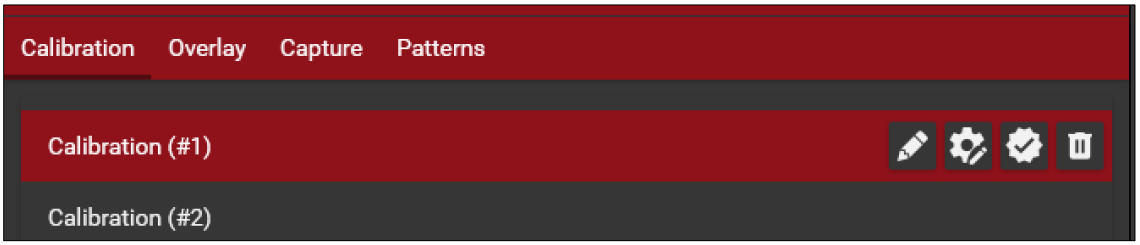


Figure 51: Default Calibration

6.2.2.2 Overlay

The Overlay displays on top of live images of the camera to help the user identify critical points in the field of vision, such as the center point of the camera field of view.

1. To add an overlay, select **Add** in the section displaying available overlays.
2. Select the type of overlay using the dropdown. Available overlays are **Crosshair, Grid, Circle, Rectangle,** and **Region**.
3. Modify the aspects of the selected overlay.
4. Press **Save** to save the overlay to available options.

Figure 52: Overlay

6.2.2.3 Capture

Capture settings determine the camera settings, calibration used, and machine light states when taking a capture.

Camera black level, gain, and exposure time are used to filter the amount of light that the camera receives. Before modifying these values with a live image, turn available lighting options on or off to match how they are desired for an image capture.

1. Select the toggle options to match the lights desired for the current capture.
2. Modify the camera settings as needed to ensure the live image is clear and defined.
3. Select the calibration used for the capture.
4. Click **Save** to save the capture settings.

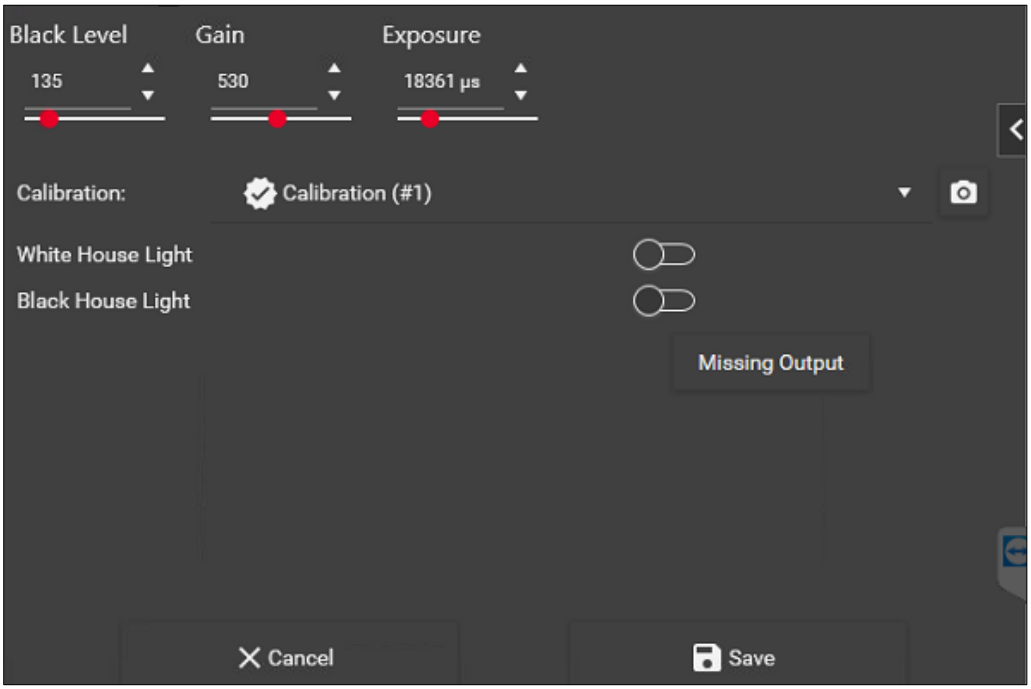


Figure 53: Capture

6.2.2.4 Patterns

1. To add a pattern, select **Add** under the available pattern options.
2. Drag the four corners of the pattern box to crop the pattern that must match.
3. The minimum match score can be modified to allow lesser or greater levels of variation.

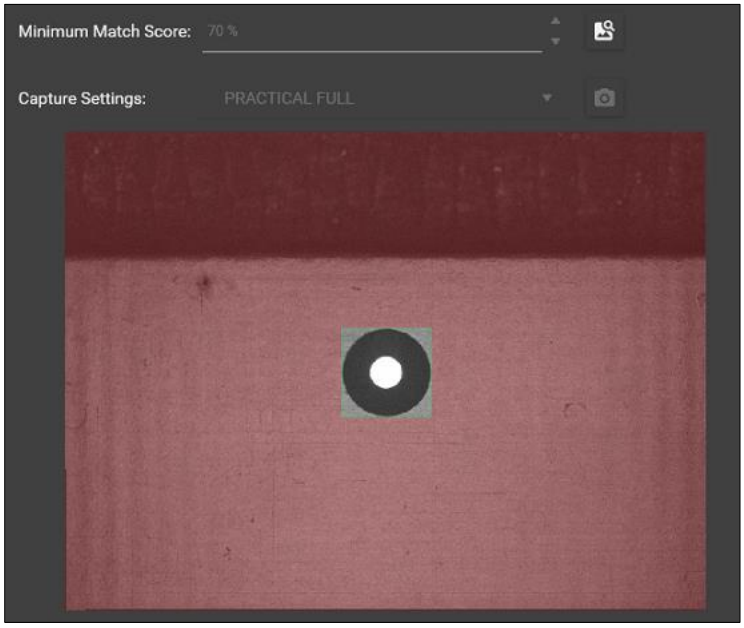


Figure 54: Patterns

6.2.2.5 Stitching

Stitching allows creating an accurate representation of a part or pallet using the camera mounted on the machine. The process involves taking a number of still images and forming them together to create a geometrically accurate image of the part to the given constraints.

To begin stitching, the machine needs two defined corners for the rectangular space that will define the image result. It is recommended that the first coordinate be on the left side, top or bottom, and the second coordinate on the right. Click the graduation cap icon to see advanced features.

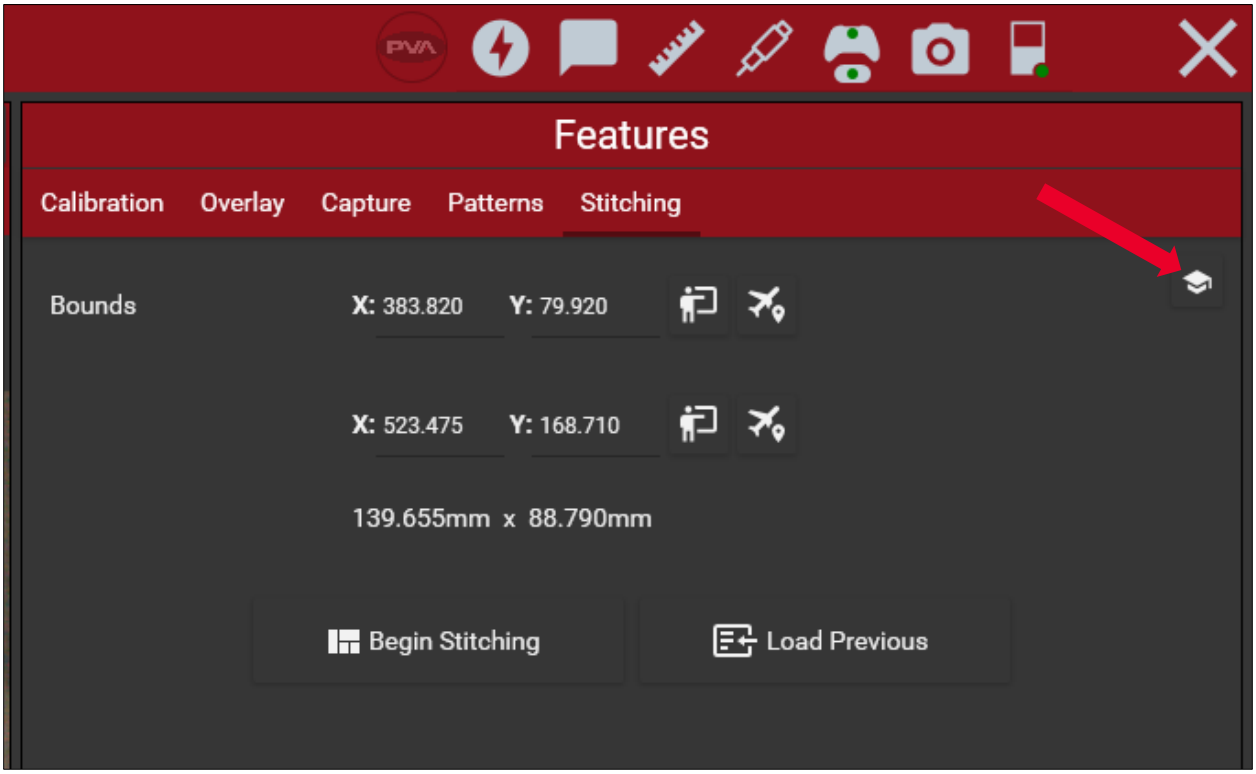


Figure 55: Begin Stitching

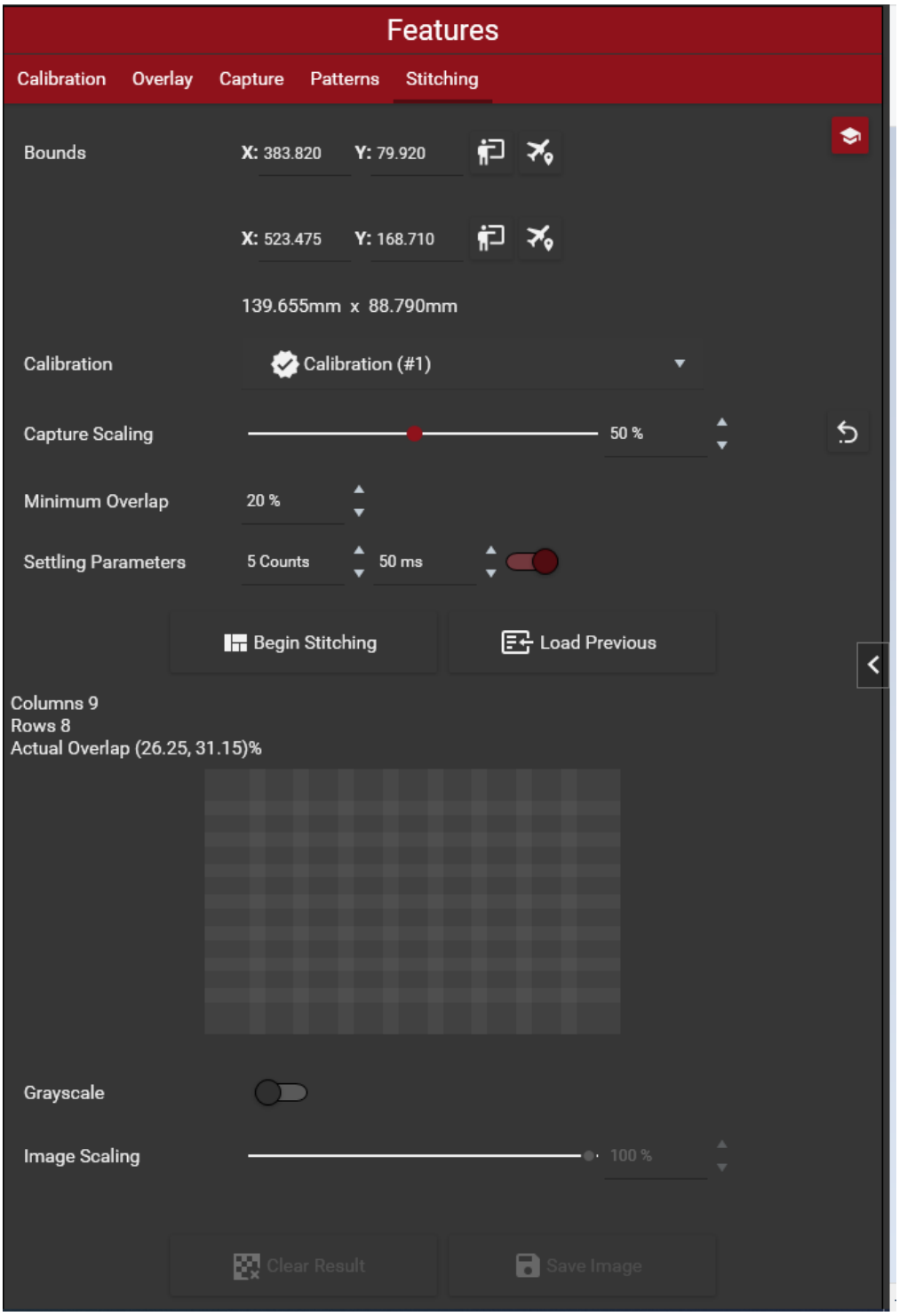


Figure 56: Advanced Stitching Features

A selected calibration is necessary to begin image stitching. The default settings allow for a 20% minimum overlap on images so that images taken can be combined without rough edges appearing between them. Once options are configured as desired, click **Begin Stitching** to start the process.

As stitching begins, a resulting image will appear in the **Result** portion of the camera view. Even if stitching is interrupted, a partial result can be saved and loaded for the future.

Previous stitching results can be loaded by selecting the **Load Previous** button.

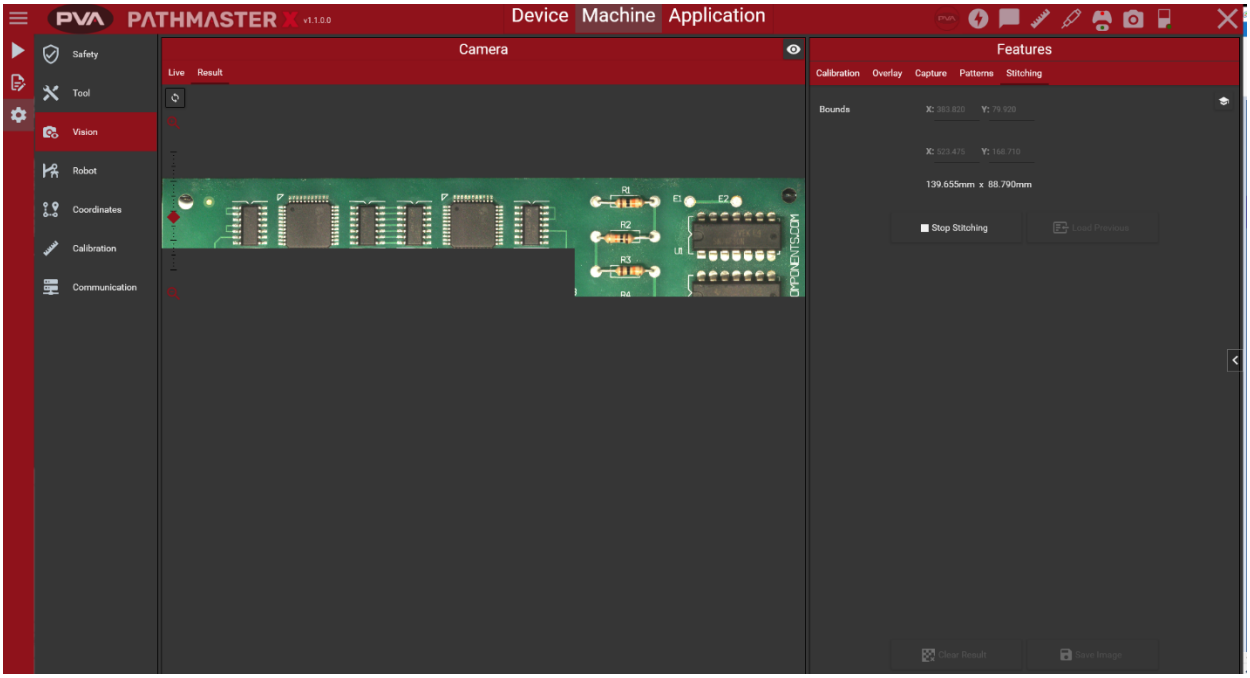


Figure 57: Stitching Result

To load a previous result into the current result, select the desired result from the list.

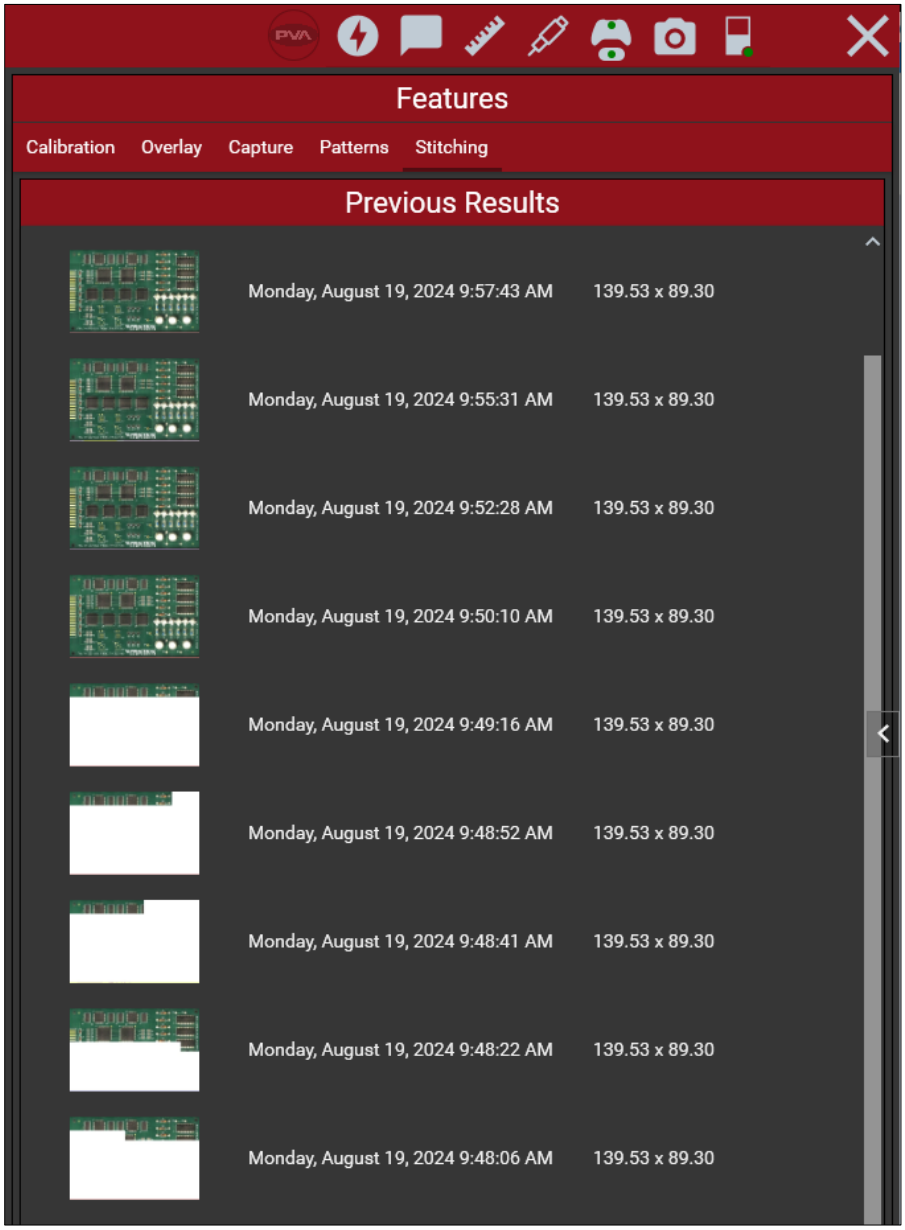


Figure 58: Previous Stitching Results

6.2.3 Robot

Robots may be added and removed from this list. A robot requires an associated controller that is set up in the Devices tab.

The current release allows only one robot and one controller.

6.2.3.1 Robot Properties

Select which axes of the controller are associated with the X, Y, Z, and Theta (if applicable) of the robot, create default robot speeds, and set the defined home origin.

The home origin coordinates override the 0 position for that axis. While the axis will still home to its sensor, it will then move to this position and treat it as coordinate 0. The robot may be manually homed from this section. Typical theta home origin is set such that tools in positions 1 and 2 are facing the operator and parallel with the conveyor.

6.2.3.2 Add Tools to Robot

Once tools are configured in the Tools section, they must be added to the robot to be used. Add available tools using the dropdown menu. Once all tool options are exhausted, the menu will display that no more tools are available to add.

6.2.3.3 Tool Properties

Tool Properties allow settings such as whether the tool travels on the Z (vertical) axis, as well as whether it travels on a rotational theta axis, if one is present.

6.2.3.4 Tool Profiles and Profile Settings

Tool profiles are set up to allow the user to view the tools movements on a program canvas. It is recommended that profiles have a distinct color or shape to differentiate them overlapping on a canvas.

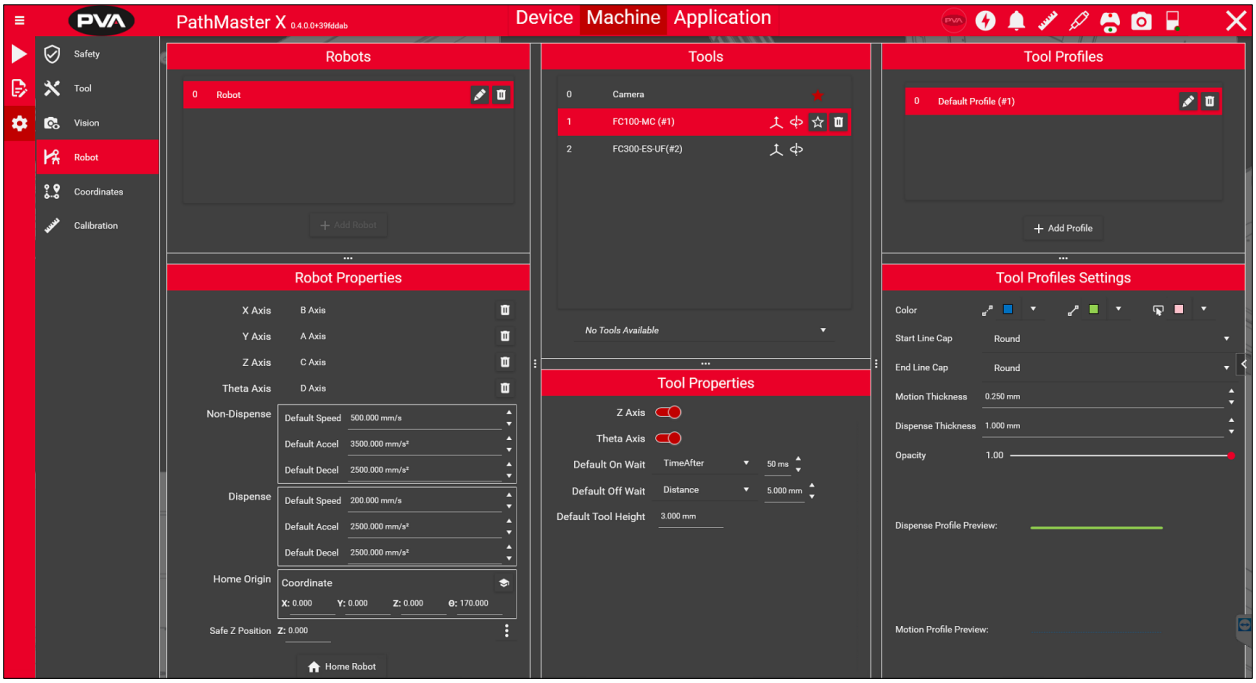


Figure 59: Robots

6.2.4 Coordinates

6.2.4.1 Calibration Plate

The calibration plate is used to establish a fixed reference within the robot workspace. A calibration plate is provided with all systems from the factory. The calibration plate will have a reference point engraved on it. Systems that are equipped with a theta axis will have a proximity sensor mounted on the calibration plate for theta calibration.

- To use the standard calibration plate, put the plate on the conveyor or flex fixture so it is against the fixed rail and the hard stop or board stop.
- The purpose of the calibration plate is to define a consistent workspace reference position. This is very important to the efficacy of machine transportability.

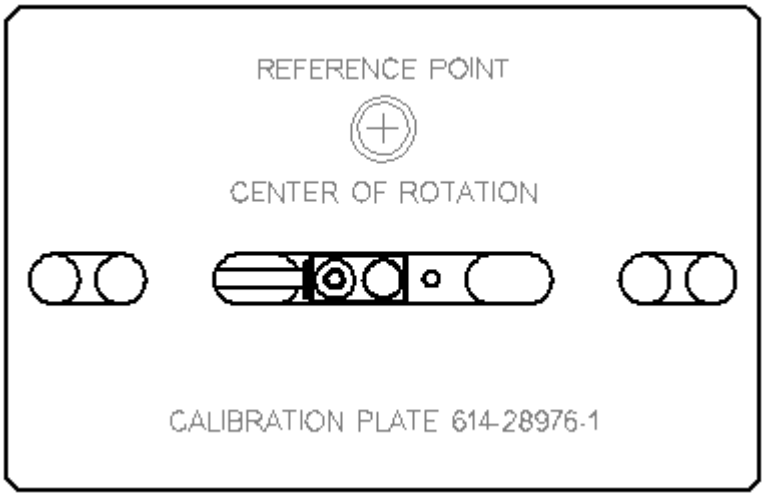


Figure 60: Calibration Plate

6.2.4.2 Robot Locations

Defined robot locations can be added by clicking the **Add Location** button. The name of the position can be edited with the **Pencil** icon and the position may be deleted with the **Trash** icon. To teach a position, enter the coordinates desired, or move the machine axes to the desired position. Select the **Teach** icon. To move to the created position and verify it, click the **Move** icon.

Robot locations are absolute and not tool specific. Tool selection or changes to offsets, workspace reference, or program origin will not transform robot location coordinates.

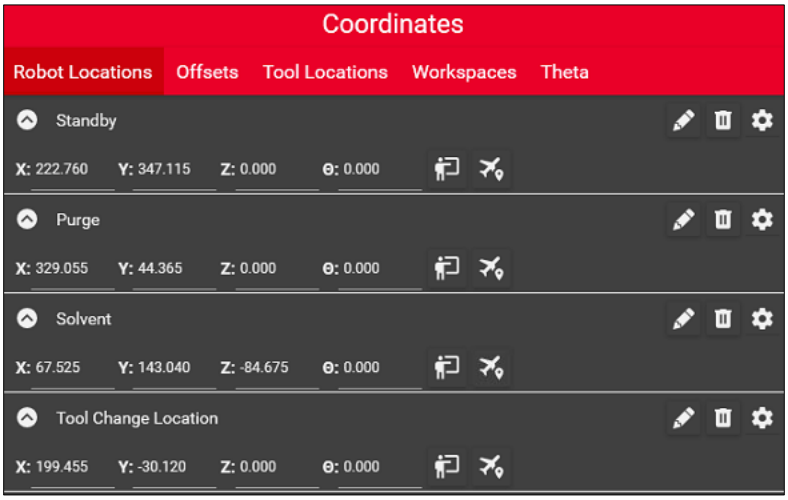


Figure 61: Robot Locations

6.2.4.3 Offsets

Tool offsets define the X, Y, theta relationship (offset) between the teach tool (usually a camera) and every other physical tool installed on the workcell. Tool offsets are used to transform coordinates from one tool to another, so they are critical to positioning.

Proper calibration of offsets is essential to workcell function.

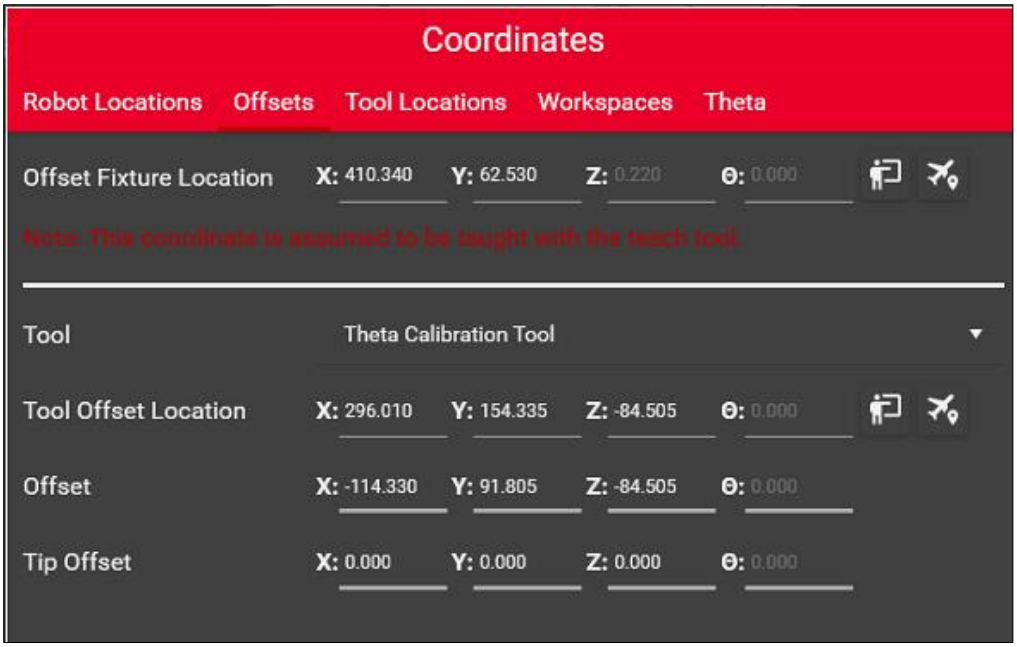


Figure 62: Offsets

6.2.4.3.1 Offset Fixture Location

This is the location of the reference position used to teach all tool offsets. This position is taught with the Teach tool at the reference position on the calibration plate. There will not be a Z or Theta coordinate when taught with the Teach tool. For systems with a theta axis, all tools are taught at a theta position of 0 degrees. When teaching the reference position, theta will move to 0 degrees when entering teach mode if it's not already there.

Tool offsets are relative to the Offset Fixture Location. If the reference position for the Offset Fixture Location is changed, tool offsets are not affected. However, offsets should still be verified after making a change to the Offset Fixture Location.

6.2.4.3.2 Tool

This is the tool selection dropdown. Select the intended tool prior to teaching tool offset.

6.2.4.3.3 Tool Offset Location

This displays the tool offset reference coordinate for the selected tool at the Offset Fixture reference position (calibration plate reference position). This coordinate can be taught or modified with the steps below.

To teach tool offsets:

1. Confirm the selected tool.
2. Put the tool pneumatics in their asserted location (z-slide down, rotary vertical, etc.). Quick Actions can be used to put the tool in the correct state.
3. Align the tool with the calibration reference point with the tool tip at the substrate height.
4. Press the **Teach** icon to access the teach menu.
5. Press the **Teach Coordinate** icon to set teach the new reference position.
6. Press the **Move** icon to verify the position after taught.
7. Repeat this process for the remaining tools.

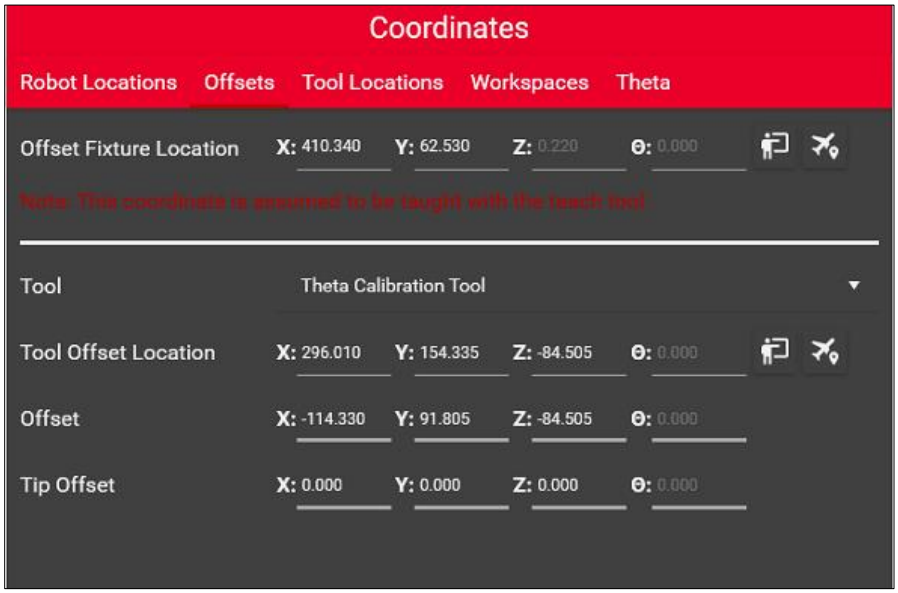


Figure 63: Offsets

Tip offsets are cleared when tool offsets are taught. Tool process offsets are a combination of tool offsets and tip offsets.

When the Teach Tool is used to teach the Offset Fixture Location (calibration plate reference position), the Teach Tool offset is automatically applied and does not typically need to be taught. All other tools need offsets taught including the Theta Teach Tool (if applicable).

If the Teach Tool position physically changes, the Teach Tool offset would need to be taught. An example of this would be if the Teach Tool was removed for maintenance or replaced. Reinstalling would result in some change in position that needs to be corrected.

All tool offsets are relative to the Teach Tool, therefore, when the Teach Tool offset is taught, every other tool is adjusted to account for the change in position to the Teach Tool. Additionally, Offset Fixture Location, Workspace Reference, and Tool Locations are adjusted.

6.2.4.4 Workspaces

Workspaces are a fixed reference point within the robot work area. The workspace reference position is typically the calibration plate reference point. Program origins are relative to the workspace reference.

Only one workspace may be created for a robot. The workspace can be renamed but may not be deleted. Teach the position by pressing the **Teach** icon . The position can be returned to by pressing the **Move** icon .

When teaching a workspace, the Z coordinate must be taught at appropriate height first, followed by the X and Y coordinates. The Z coordinate must be taught with a physical tool such as a valve that can be set at the substrate height (calibration plate). The X and Y coordinates can be taught with any tool. Usually, the teach tool is used to teach the workspace XY component.

Figure 64: Workspaces

6.2.4.5 Theta

Theta calibration is used to calculate the theta center of rotation for each tool in order to transform each tool's X and Y position at any angle of the theta axis. Rather than forcing the tool to a specific taught theta for use, the tool can now be used accurately at any theta angle. Theta calibration uses a wizard to walk the user through a series of steps to complete the calibration successfully.

Two types of theta calibration are available: **Sensor Theta Calibration** and **Manual Theta Calibration**.

- The **Sensor Theta Calibration** uses a proximity sensor mounted on the calibration plate. The Theta Teach Tool finds the proximity sensor at three defined angles on the theta axis to calculate the center of rotation.
- The **Manual Theta Calibration** does not use a proximity sensor. In place of the sensor, the user aligns the Theta Teach Tool with the reference point on the calibration plate at three defined angles.

6.2.4.5.1 Tool Angle Selection

1. Select the theta calibration tool.
2. Select three angles to use for the calibration. One of these angles must be 0°.
3. Typically, these angles will be set to **First**: *0°*, **Second**: *-90°*, **Third**: *90°*.

6.2.4.5.2 Sensor Selection

Use the checkbox to select the **Sensor Theta Calibration** option. To run **Manual Theta Calibration**, leave this box unchecked.

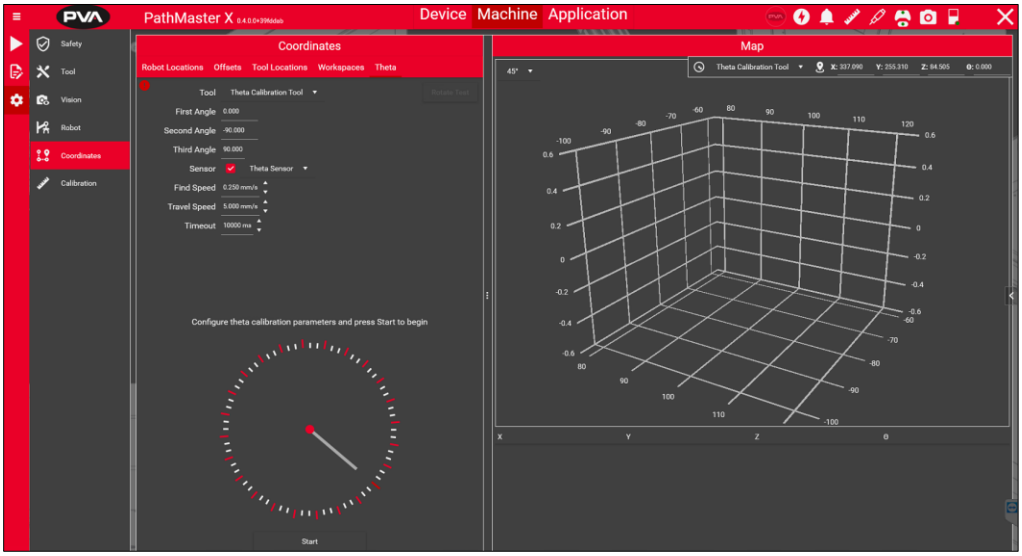


Figure 65: Sensor Selection

6.2.4.5.3 Speed/Timeout

Sensor Theta Calibration requires speed and timeout to be defined. **Find Speed** is the speed used to find the edge of the theta calibration sensor with the theta calibration tool. **Travel Speed** is used to position the tool before the sensor find operation. Timeout is the amount of time the system waits for the sensor to be asserted before throwing an error.

Typical settings are: **Find Speed**: 0.5 mm/sec, **Travel Speed**: 5.0 mm/sec, **Timeout**: 10000 ms.

6.2.4.5.3.1 Calibrating a Theta Axis

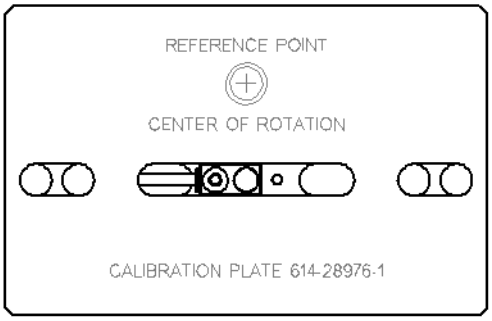


Figure 66: Theta Calibration Plate

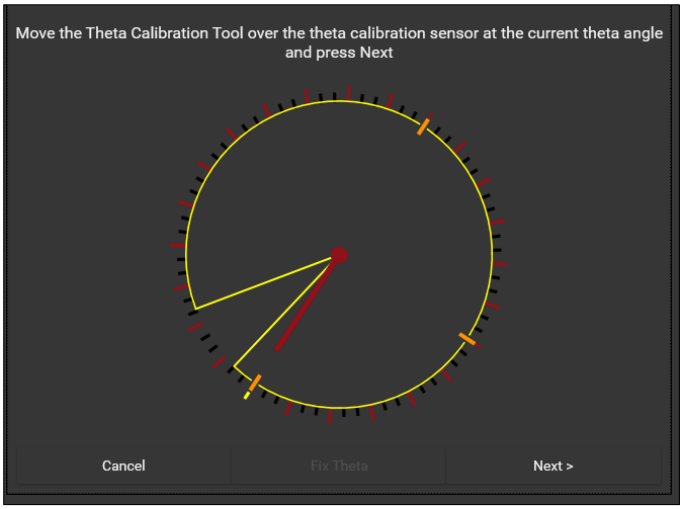


Figure 67: Sensor Theta Calibration

1. Install the Theta Calibration Tool.
2. If applicable, use Quick Actions or devices to actuate the board stops to a down position. Place the theta calibration sensor/plate in place against the board stops or fixed workspace.
3. Press **Start** to begin calibration steps.
4. When prompted, use the pendant to move the calibration tool over the sensor (Sensor Theta Calibration) or calibration reference point (Manual Theta Calibration).
5. If the theta axis is moved to a different angle than the one required, select **Fix Theta** and the machine will move the theta axis back to the correct angle.
6. Once the calibration tool is aligned with the sensor or calibration point, click **Next**.
7. If using a sensor, the machine will determine an exact offset to the sensor before moving to the next angle.
8. Complete all three angles repeating steps 4-6 and review the points displayed.

6.2.4.5.3.2 Calibration Override

Calibration override performs a center of rotation calculation based on a specific tool's location. Global calibration extrapolates the COR calculations for all tools based on the Theta Teach Tool.

1. If applicable, use Quick Actions or devices to actuate the board stops to a down position. Place the theta calibration sensor/plate in place against the board stops or fixed workspace.
2. Select the tool that will have its global offset overridden, as well as the angle between steps of the override. The selected step angle determines how many reference points need to be taught.
3. Press **Start** to begin calibration steps.
4. The machine will automatically move to the theta angle needed. When prompted, move the tool over the fixed calibration point or theta sensor (if selected).

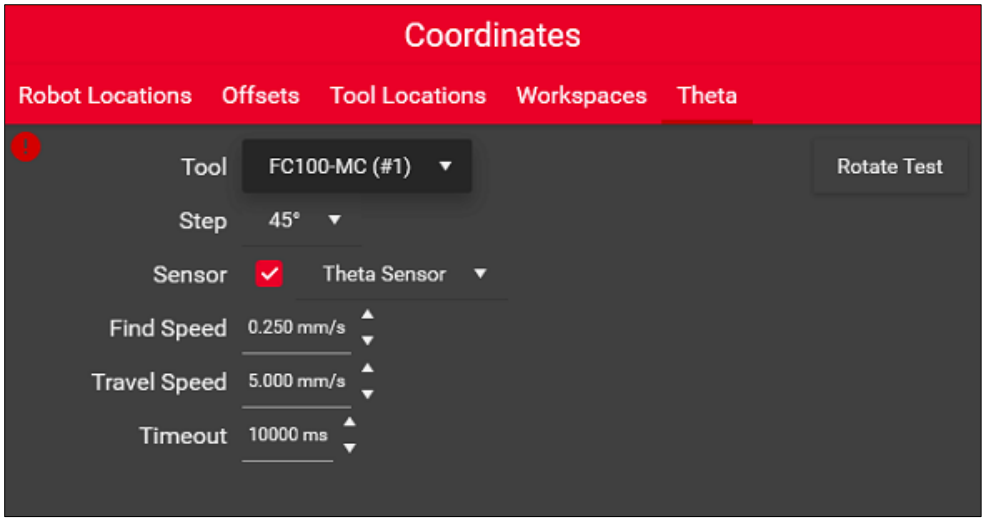


Figure 68: Calibration Override

The graphic in the Maps section of the Theta tab provides a visual representation of the swing arcs for each tool. The user can select the number of points displayed in the graphic with a dropdown near the top of the display.

The total number of points shown is equal to 360 degrees of the circle divided by the number selected. Large sets such as those displayed by 1 or 2 degrees require more resources to calculate and will slow down the page.

6.2.4.6 Calibration

6.2.4.6.1 Needle Calibration

To set up needle calibration, a reference position showing where the needle calibration unit is within the robot needs to be taught. Next, the location of the sensors within the unit needs to be determined. The steps below outline the setup process.

Note: Setting up needle calibration requires valves compatible with the needle calibration sensor and requires a PVA needle calibration sensor purchased with the machine.

1. Select the **Needle Calibration Sensor** from the dropdown. *If one does not appear, the sensor must be configured in the Devices section.*

2. Move the teach tool to the crosshair on the calibration sensor. *A teach tool offset must be defined before the needle calibration reference location can be taught.*

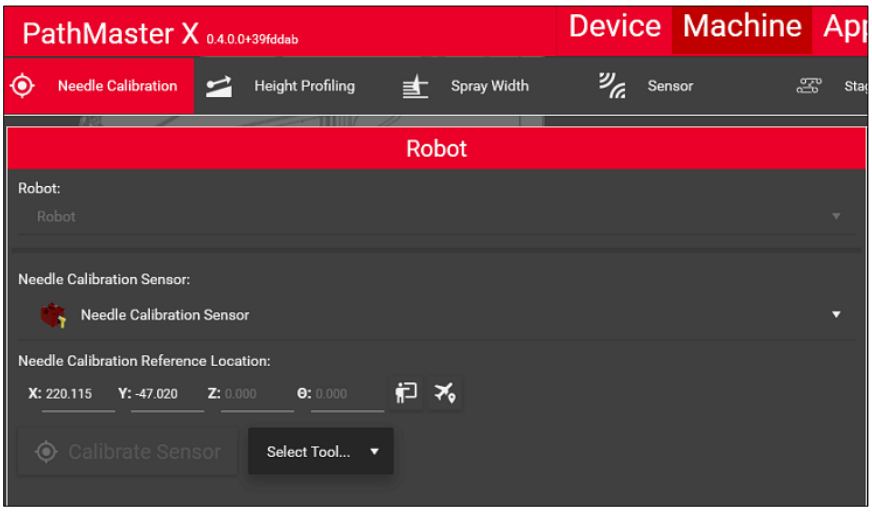


Figure 69: Needle Calibration Sensor

3. Teach the calibration sensor reference position by pressing the **Teach** icon. This position may be returned to with the airplane icon.

4. Select the tool to use for the Calibrate Sensor sequence. The Calibrate Sensor process uses this tool to find the location of all sensors in the calibration unit. Any needle calibration compatible tool can be used. For best results, use a tool and needle that are common to most applications.

5. Start sensor calibration by pressing the **Calibrate Sensor** button. Wait until the calibration routine is complete before continuing.

6. When complete, review the Sensor Visualization graph and tip offsets under the Tools section to verify. The graph represents the location of the calibration reference position and sensors.

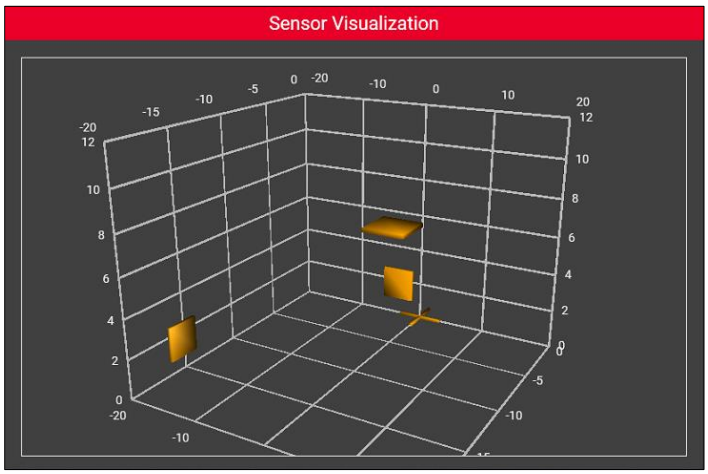


Figure 70: Sensor Visualization

The **Tools** view on the Needle Calibration page is used to define which tools are made available to the needle calibration process. Use the selector switch to the left of each tool that will be used for needle calibration.

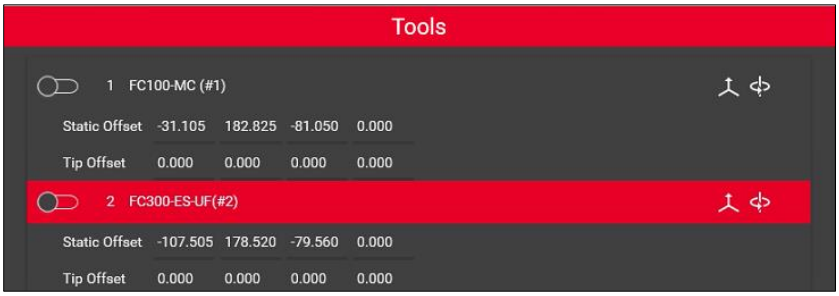


Figure 71: Needle Calibration from Top Toolbar

Once the needle calibration is configured, each needle calibration tool needs to run a needle calibration. In the Tools view, click and select all tools that require calibrating and press the **Calibrate Select Tools**.

Note: The tip offset for a tool is updated after needle calibration is run. Offset positions are displayed for information purposes on this page and can only be updated from the coordinates page.

Needle calibration can be run from the needle calibration configuration page or the header menu. Once configuration is complete, needle calibration is typically run from the header menu. Only tools that have been enabled on the needle calibration tab will be available for use through the header menu.

6.2.4.6.2 Sensor Calibration

In the Sensors section, the user can view the index of the sensor, along with the sensor type and name. They can also see whether the sensor has been successfully calibrated.

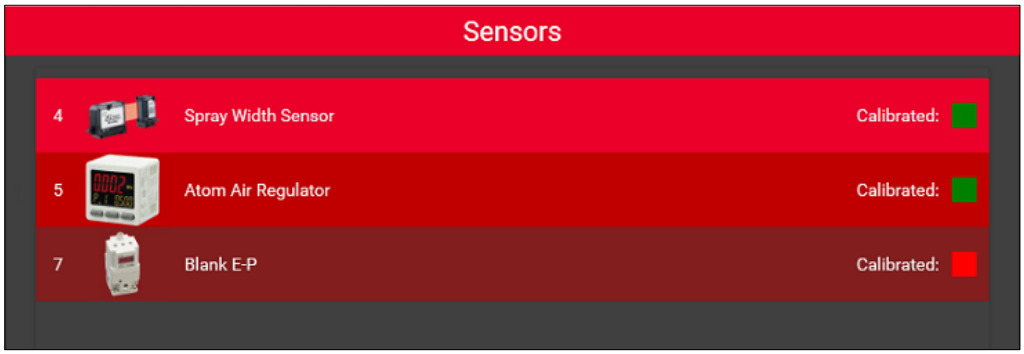


Figure 72: Sensors Section

6.2.4.6.3 Calibrating an Analog Sensor

1. Select the sensor to be calibrated under the Sensors section.
2. Under the Calibration section, select the **Start** button to begin calibration.
3. As prompted, modify the signal to be as low as reasonably possible, and enter the measurement reading into the numeric text editor.
4. If the output needs to be turned on/off for readings, press the **Toggle Output** button. Click **Continue** when the low actual reading matches the low measurement reading in the application.

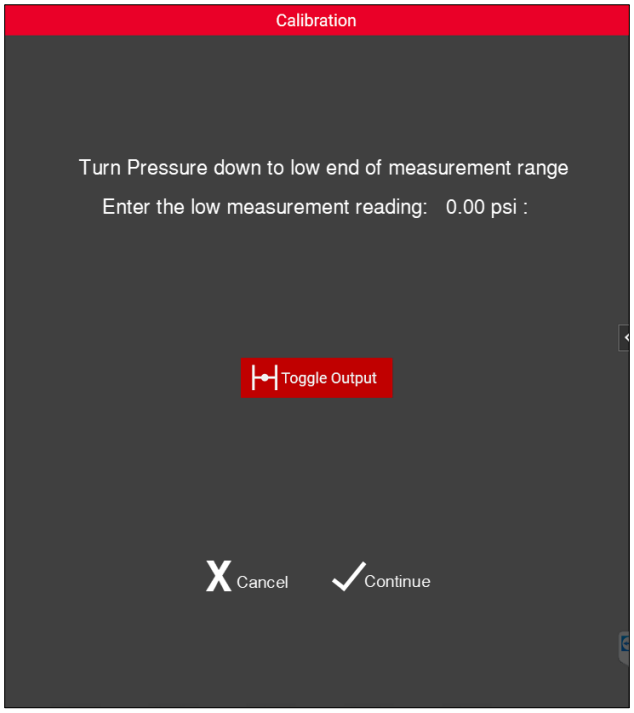


Figure 73: Low Measurement

5. The program will gather signal readings for 10 seconds to filter noise and get an average signal.

6. In the Properties section, review the calibration low signal and low measurement.

7. As prompted, modify the signal to be as high as reasonably possible, and enter the measurement reading into the numeric text editor. If the output needs to be turned on/off for readings, press the **Toggle Output** button.

8. Press **Complete** when the high actual reading matches the high measurement reading in the application.

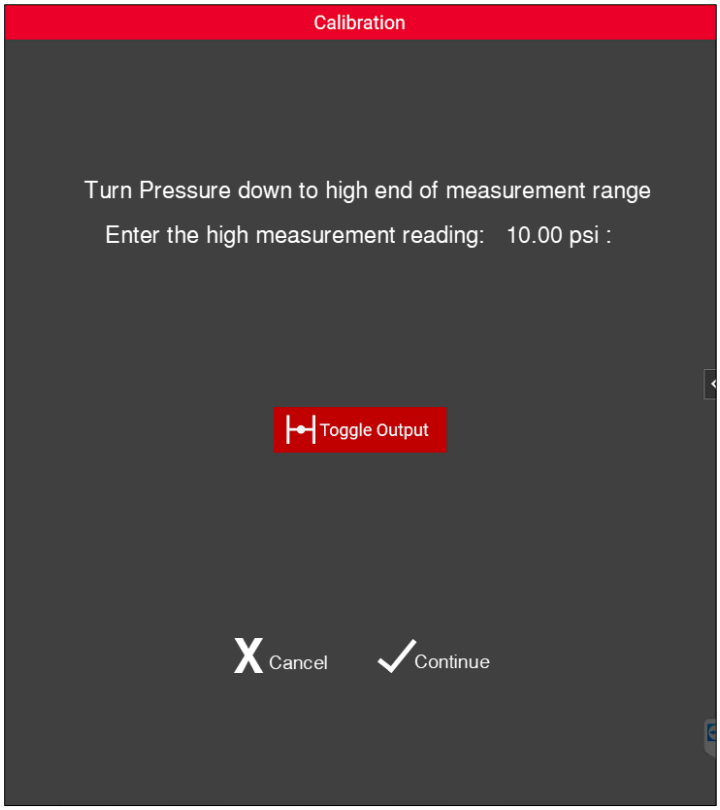


Figure 74: High Measurement

9. The program will gather signal readings for 10 seconds to filter noise and get an average signal.

6.2.4.6.4 Spray Width Calibration

Some valves that have automatic adjustable spray need to be calibrated. The Spray Width section allows setup and refinement of spray width procedures.

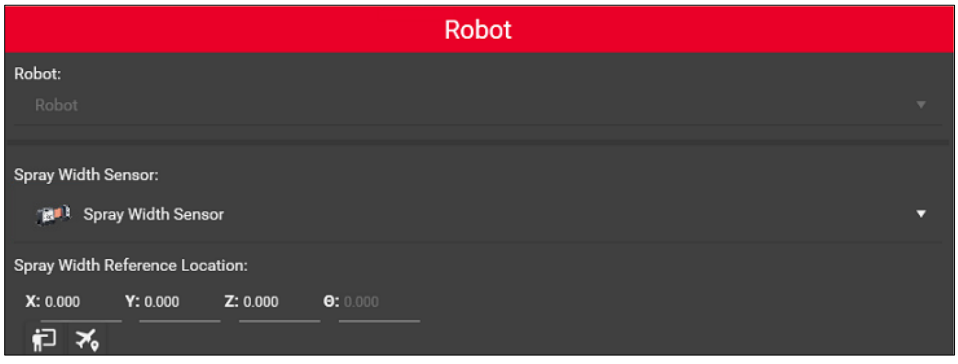


Figure 75: Robot (Spray Width Sensor)

Available tools can be selected from the Tools dropdown. The check width section allows a user to set the valve to a specific height above the taught sensor position and set a target width. If the spray is not within tolerance of the set width target, the test will fail. When equipped with an E/P regulator, the machine will begin at the defined pressure point and increase or decrease pressure to meet the target.

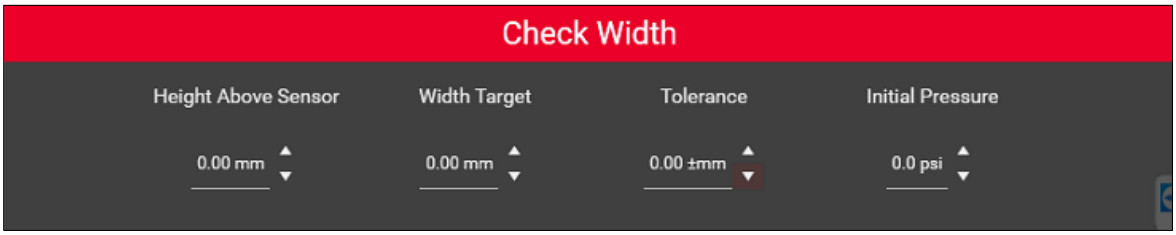


Figure 76: Check Width

6.2.4.6.5 Staging Adjust/Tool Adjust Calibration

In the case of a width adjust, for conveyor or for a tool, the device needs calibration to work appropriately.

In the Staging Adjust or Tool Adjust section, it will display the index of the device, along with the device name and image. It will also indicate whether the handler has been successfully calibrated.

Figure 77: Conveyor Width Adjust

6.2.4.6.5.1 Calibrating Staging Device / Tool Servo Adjust

1. Select the device to be calibrated.
2. Under the Calibration section, select the **Start** button to begin calibrating. The device must be homed to properly calibrate.
3. Use a ruler to measure the real low measurement of the conveyor at its minimum width. Enter this value into the space provided.

4. The application will use encoder counts at the current position when **Continue** is pressed. **End Manual Adjustment** will servo the drive, preventing manual changes to the device position.

Figure 78: Staging Adj/Tool Adj Calibration (Low Measurement)

5. With Manual Adjust active, move the device to its upper limit and use the ruler to take a real measurement. Enter the value into the space provided.

6. The application will use encoder counts at the current position when **Complete** is pressed. **End Manual Adjustment** will servo the drive, preventing manual changes to the device position.

Figure 79: Staging Adj/Tool Adj Calibration (High Measurement)

6.2.4.7 MES Communication

The MES tab allows the machine to integrate MES communication into its manufacturing process. Defined protocols can be selected from the dropdown or imported, though only PVA's protocol is supported at this time.

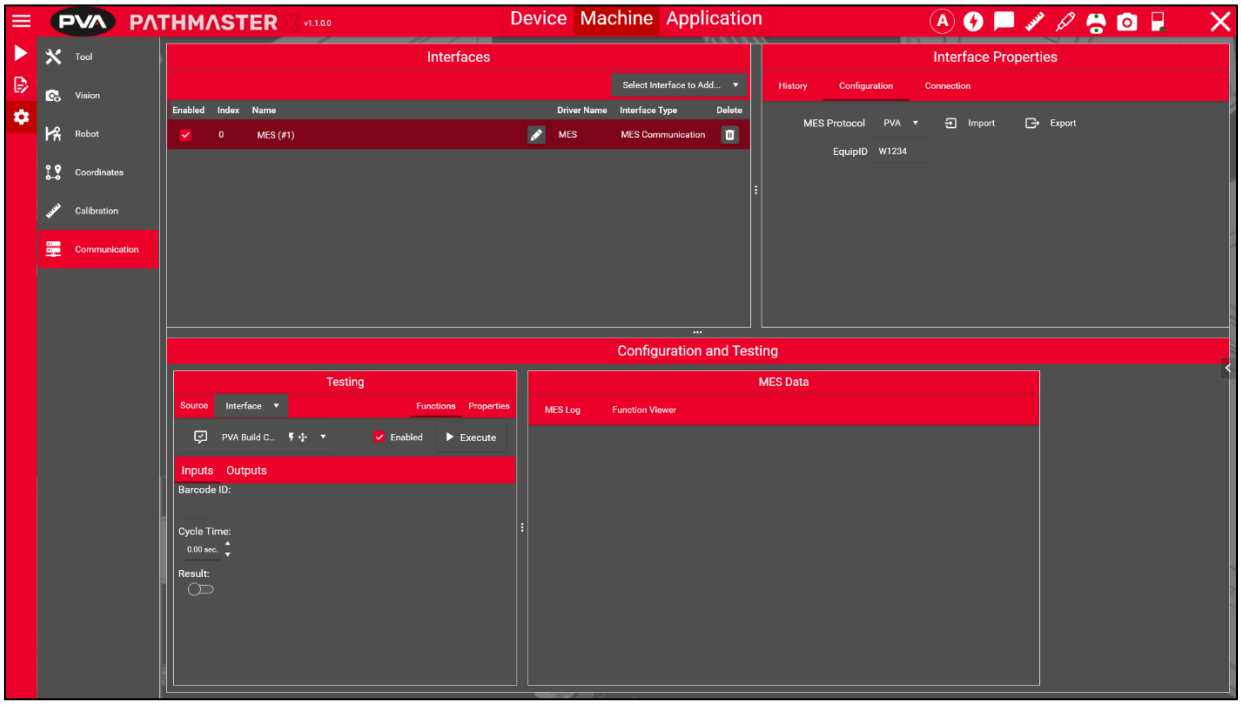


Figure 80: MES Communication

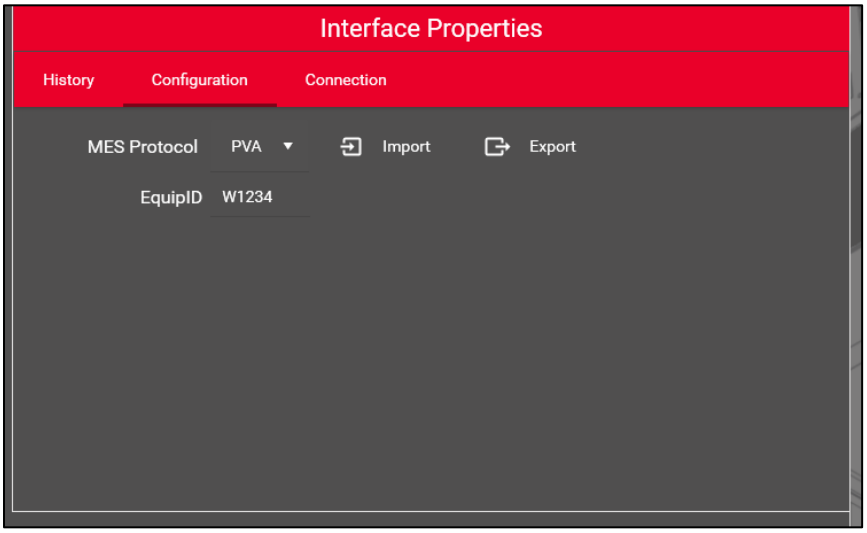


Figure 81: MES Interface Properties

The MES connection works through a static IP and port defined in the connection. Unsolicited messages are also available on a secondary port. The user can configure ACK and NACK characters to match expected server messages.

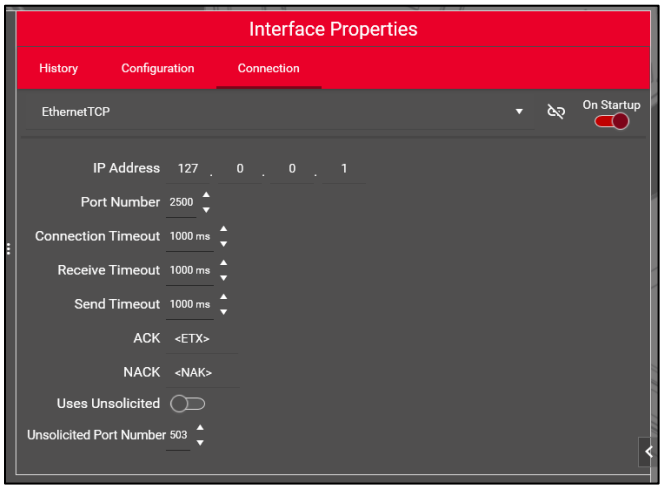


Figure 82: MES Connection

6.2.4.7.1 MES Function Viewer

The MES Function Viewer allows viewing and hot reloading of scripts used in the MES protocol. Functions are written and executed in the Python programming language. Existing PVA functions can be used as a formatting guide for more custom functions. The refresh icon at the bottom allows the application to reload the script without needing to close and reopen the application.

Figure 83: MES Data

Once a function is written and placed properly, it should appear in the function tester dropdown which allows it to be executed from within the application.

Figure 84: MES Testing

6.2.4.7.2 MES Log

An MES log is provided to track messages between client and server. Each instance of MES retains its own log. Log details show the direction of the message relative to the machine's PC, the timestamp of the message, and the message sent. A copy of this log is also available for view on the top banner of the application. The log only displays the most recent 200 messages and clears in a First In, First Out order.

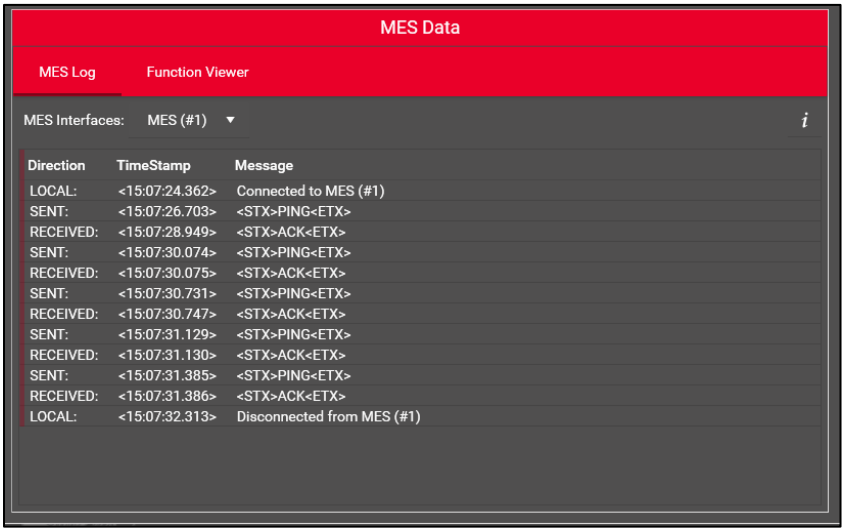


Figure 85: MES Log

The Log displayed in the application clears every time the software shuts down and restarted. Old logs are saved in the application's file structure as .txt documents and are not viewable in the application.

6.2.5 Calibration

6.2.5.1 Sensor Calibration

Analog sensors are calibrated to ensure that readings are accurate to measured values within their range.

Sensors that are not calibrated appear with a red square. The square turns green when that device is calibrated.

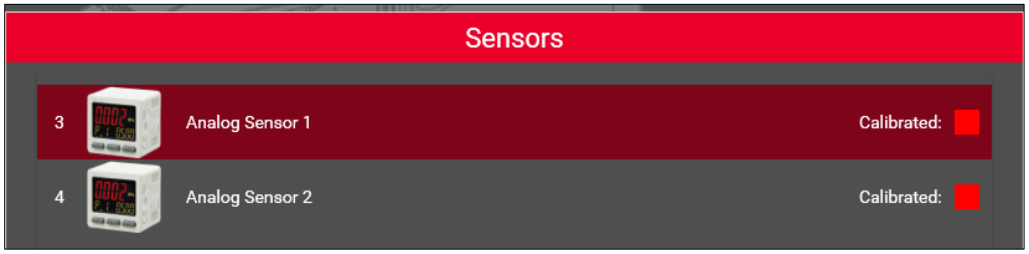


Figure 86: Sensor Calibration

The properties section displays the current analog signal, as well as the calibrated low and high levels of signal and measurement.

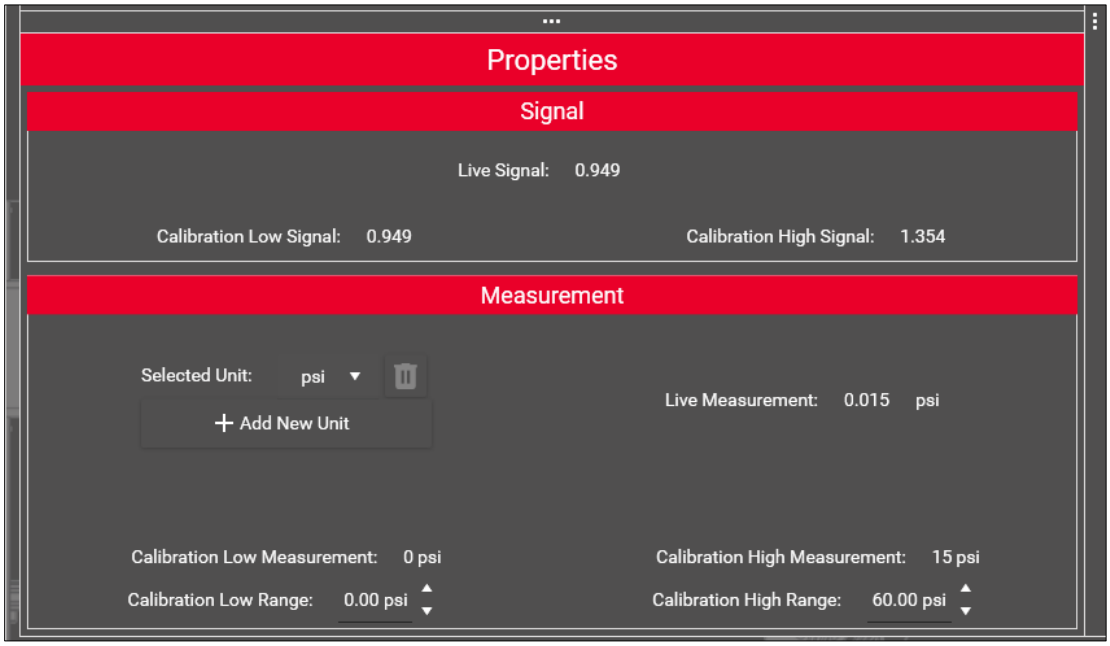


Figure 87: Sensor Calibration Properties

A calibration is configured and performed under the calibration section on the right-hand side of the page. If a calibration is already completed, a new calibration can be performed by hitting the **Recalibrate** button. The **Total Reading Time** and **Time Between Readings** determine how many samples are used for the calibration. The default settings take ten samples per second for 10 seconds.

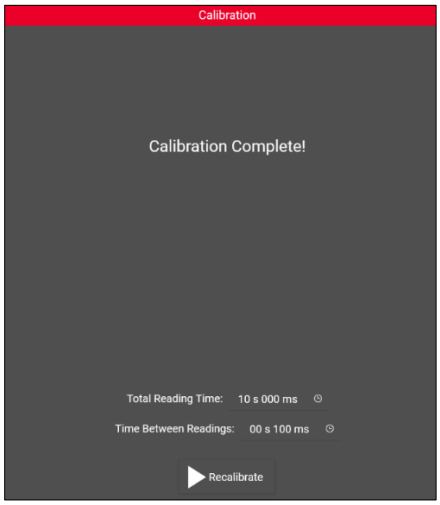


Figure 88: Sensor Calibration Complete

Follow the instructions to complete the calibration. Entering the low and high **value** of the calibration is always required. If a manual calibration is desired due to high noise levels, etc. mark the **Manually Enter Signal** checkbox at the bottom which will allow entry of a low and high **signal** value. Continue with the given instructions to complete a calibration.

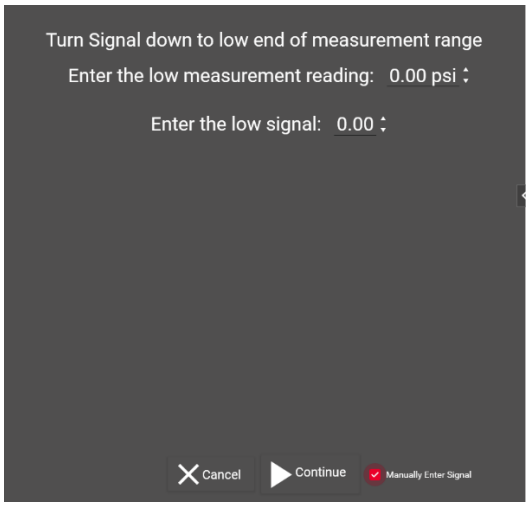


Figure 89: Manually Enter Signal

6.3 Application

6.3.1 Triggers

Triggers are used to run specific features and scripts at certain events. To add a new trigger, select the **Create New Trigger** button. Pressing the **Pencil** icon allows the trigger to be renamed.

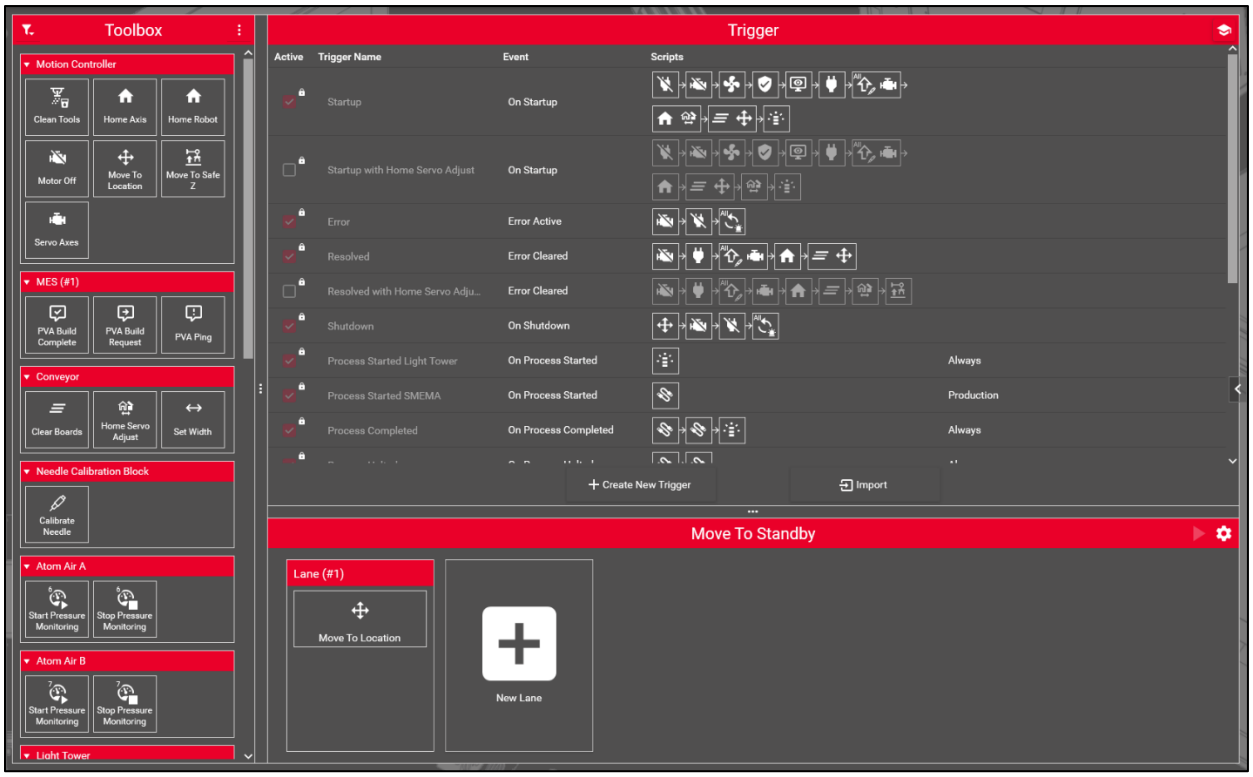


Figure 90: Create New Trigger

6.3.1.1 Creating and Configuring a Trigger

1. Select **Create New Trigger**.

2. To configure a trigger, select an **Event Source** and **Event** from the Configuration section. Available general events are selectable from the source list, and events specific to that source can be selected from the event list.

3. When **Wait for Completion** is checked, the trigger will hold up the application until execution is finished instead of running parallel to other application processes. This way the trigger gains priority.

Note: Locked triggers are for PVA use only.

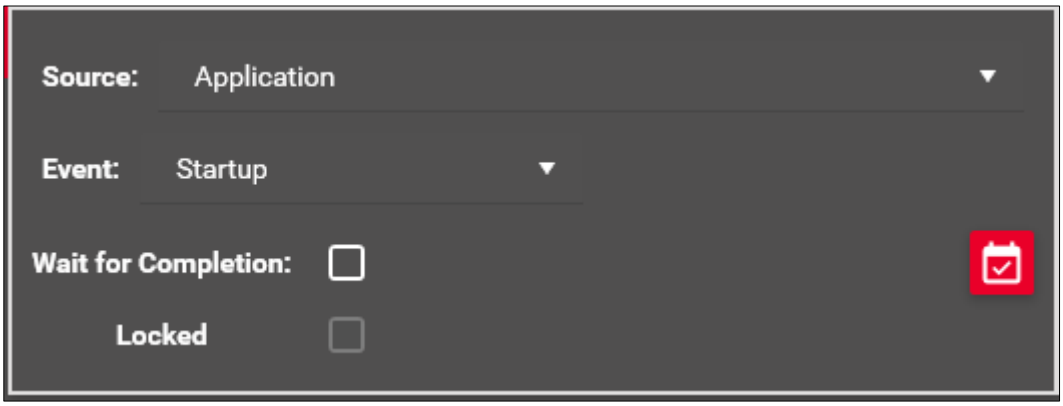


Figure 91: Configure Trigger

4. When the event scheduler is selected, a trigger will only run once within the given time period. Below is an example of a trigger that will run at most once per day.

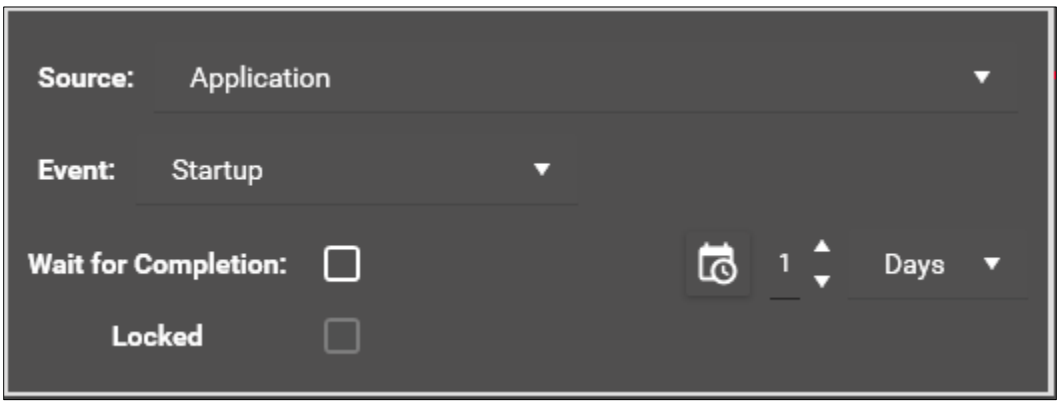


Figure 92: Event Scheduler

5. Select a trigger step from the toolbox and drag it into the first available lane. Some steps have inputs that will need to be configured correctly to work as intended. Both lanes and trigger steps can be reordered in any desired order. Multiple triggers within the same lane run parallel to each other, and lanes run sequentially. Event schedulers are available for lanes and individual scripts as well.

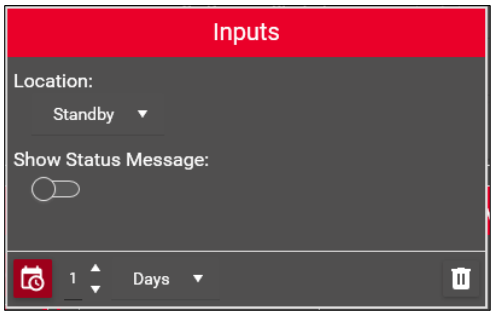


Figure 93: Trigger Inputs

Triggers can be enabled and disabled with the checkboxes on the left side.

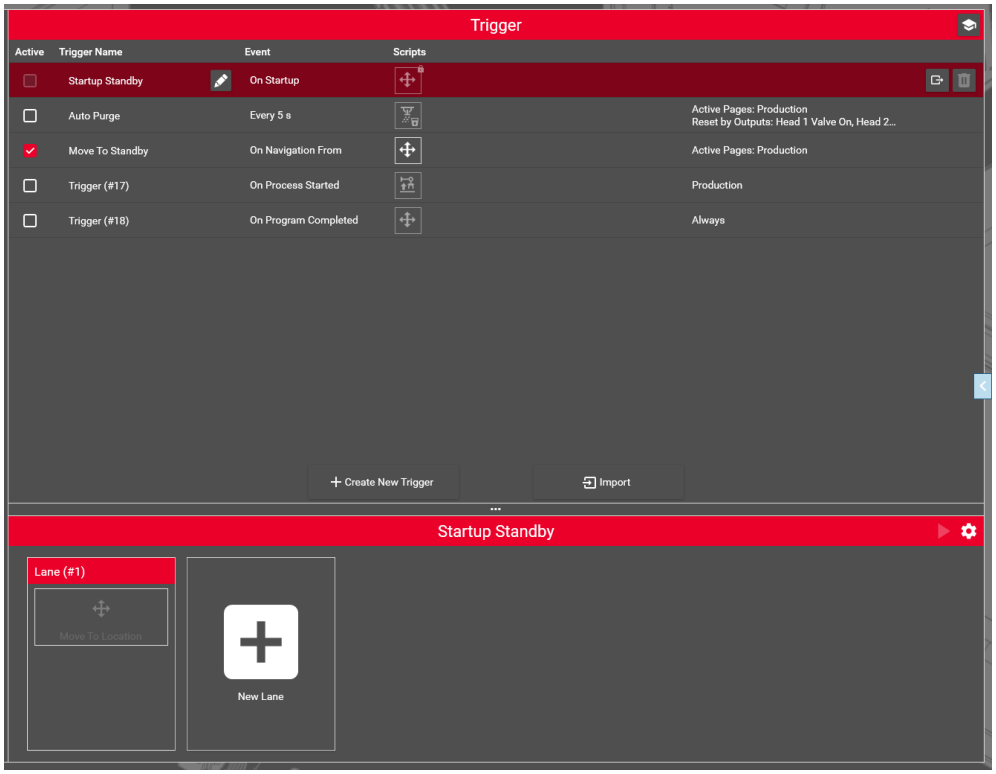


Figure 94: Triggers

6.3.2 Themes

In the Themes section, themes may be added using the **Add Themes** button. Theme names can be edited using the **Pencil** icon  . Themes may be deleted using the **Trash** icon  .

6.3.2.1 Theme Settings

In settings, the user can modify color settings of the currently selected theme. Using the dropdown provides standard colors as well as a custom color selector. To apply a custom color, match the desired shade then deselect the dropdown menu or click elsewhere on the page.

6.3.2.2 Content Preview

The Theme Content Preview section displays all major controls present in the application and allows testing with the current theme. Some controls are modifiable, such as the timed button.

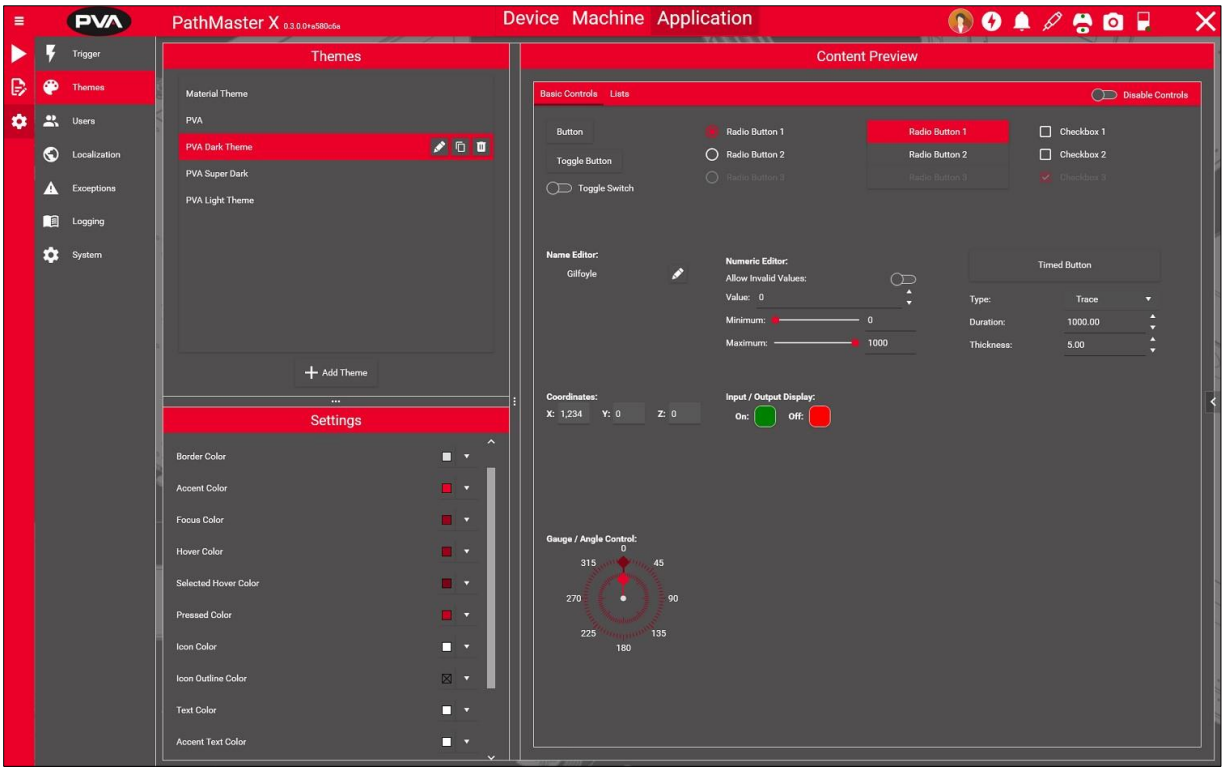


Figure 95: Themes

6.3.3 Users

Users and roles can be added to allow different access to application features for different parties. Each user that is created is a part of a role. Users of the same role share permissions with each other but can have their own login pin and log signature. Role permissions for specific users can be overridden by an admin when creating the user. How permissions are modified depends on whether a role or a user is selected.

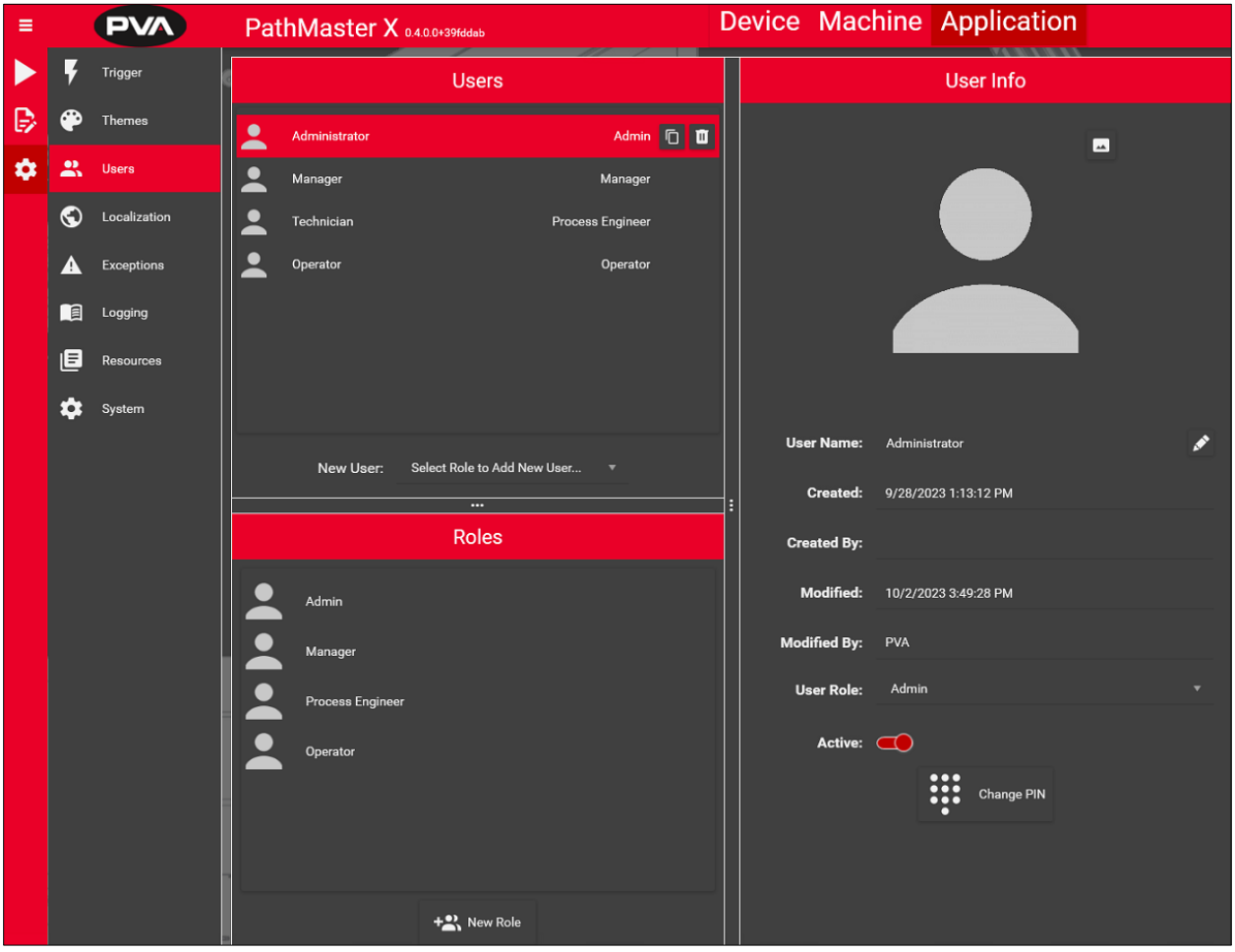


Figure 96: Users

6.3.3.1 Add a Role

To add a role, select the new role button. To change the name or icon of the role, click the **Pencil** icon  next to the Role Name in the Role section. Role permissions can be edited when a role is selected through the Permissions section. The three levels of access are full, read only, and none.

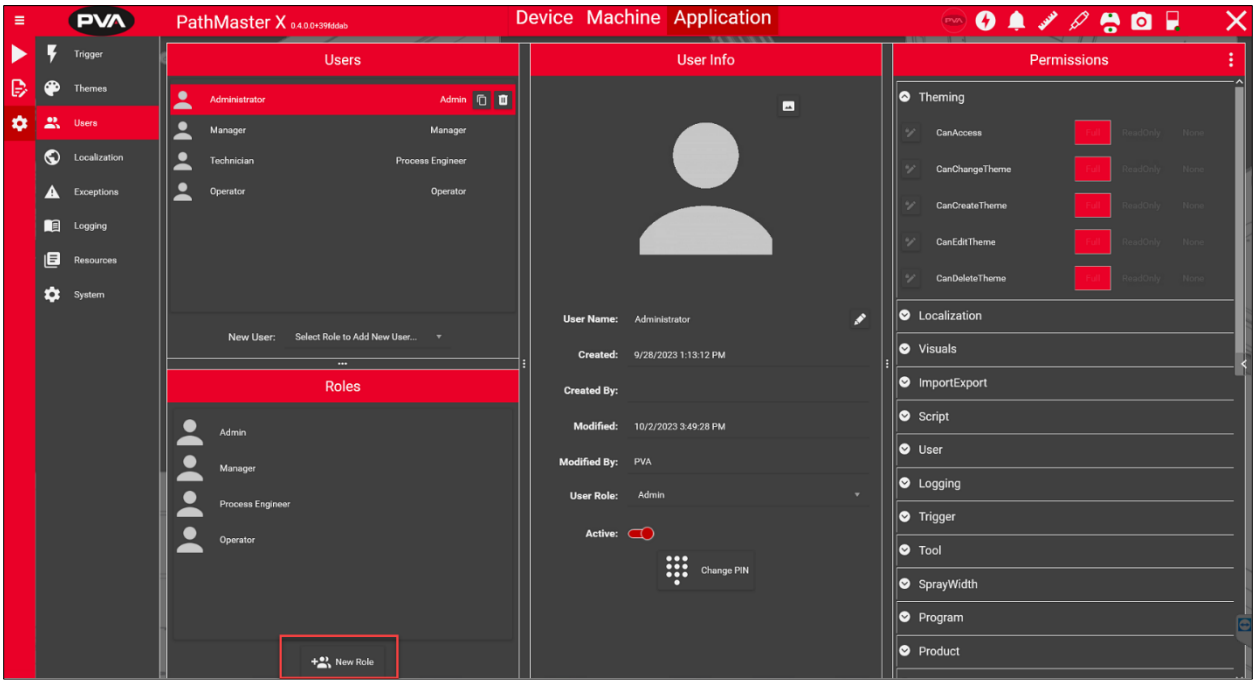


Figure 97: Add a Role

6.3.3.2 Change PIN

A user can change their PIN with the Change PIN option. When selected, the keypad will prompt the PIN of the user currently logged on. This is not the existing PIN of the user selected, but the PIN of the current user.

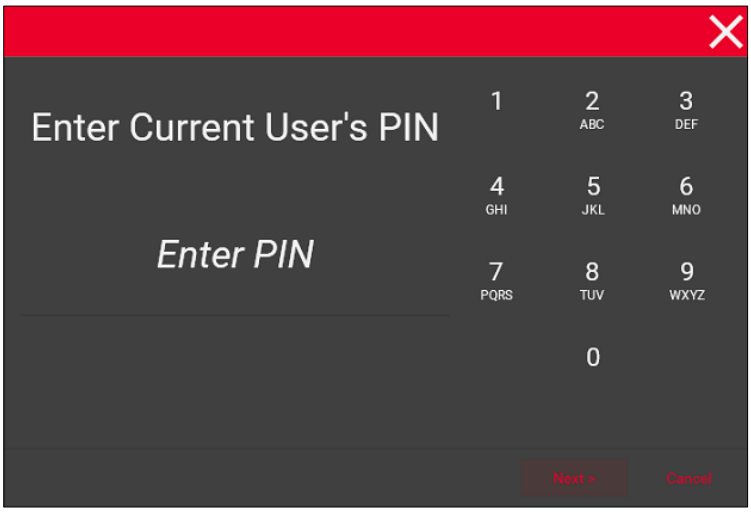


Figure 98: Enter Current User's PIN

Once entered, the keypad will prompt a new PIN input. The new PIN must be reentered to confirm. Once confirmed, the user's PIN will be successfully changed.

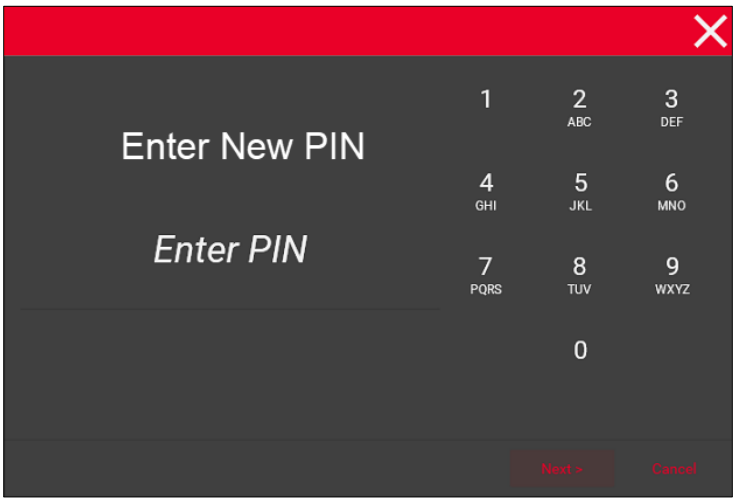


Figure 99: Enter New PIN

6.3.3.3 User Permissions Override

User permissions can be overridden for a specific user if an admin is logged in. Select the desired user and go to the permissions section dropdowns. The **Pencil** icon on the left allows for an override of the user permission. Select the button to allow modification of the specific user's permissions. Reselecting the button now with the lock icon will reset the permission to the base role's permission level.

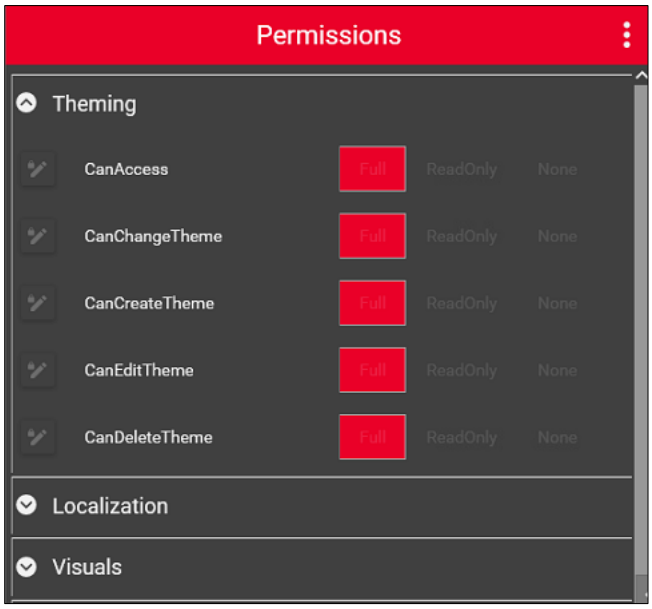


Figure 100: Override User Permissions

An asterisk next to the user role for a user indicates that the role has been overridden for that user.

Figure 101: User Override Indicator

6.3.4 Localization

Localization allows changing the language of the application. New languages, or localizations, can be added through the **Import/Export** feature at the bottom of the page. Localization files are typically expected to be CSV files, but any file format can be used if the delimiter between texts is consistent.

The Module Localizations section allows the user to see what texts are available in the translation.

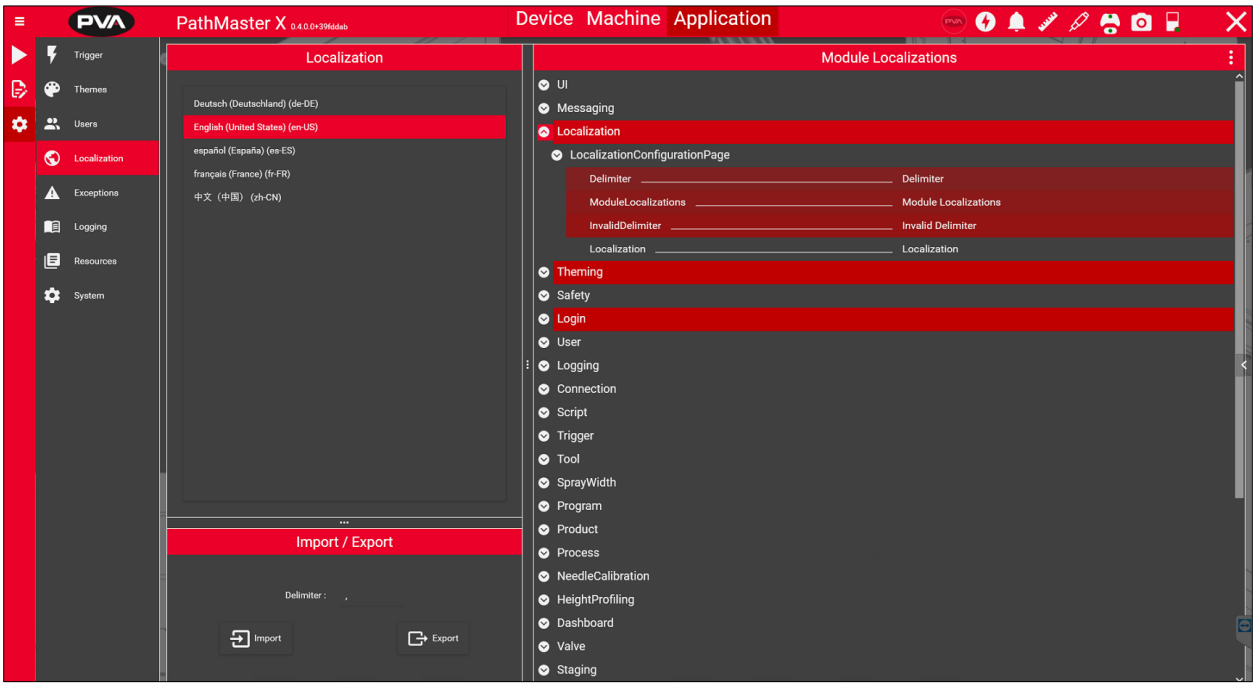


Figure 102: Localization

6.3.5 Logging

Logging allows the user to see important events that occur for the machine and allows tracing of machine errors to give a better understanding of their cause.

The latest log entries are available in the live view list, while the full log can be accessed through the **View Log** button in the upper right. The log name can be edited using the **Pencil** icon  in the upper left.

Set Directory allows the user to set a new destination directory for log files other than the default. A new log file is created for each day for improved resolution of logged events.

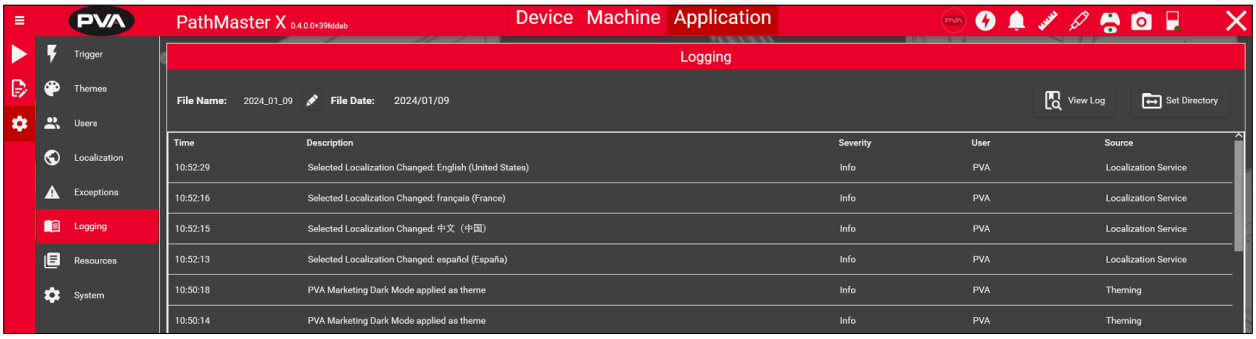


Figure 103: Logging

6.3.6 System

Machine configurations can be freely imported and exported through the System tab, which allows individual settings to be saved or loaded. The topmost checkmark allows selection or deselection of all options, but options can be imported or exported individually

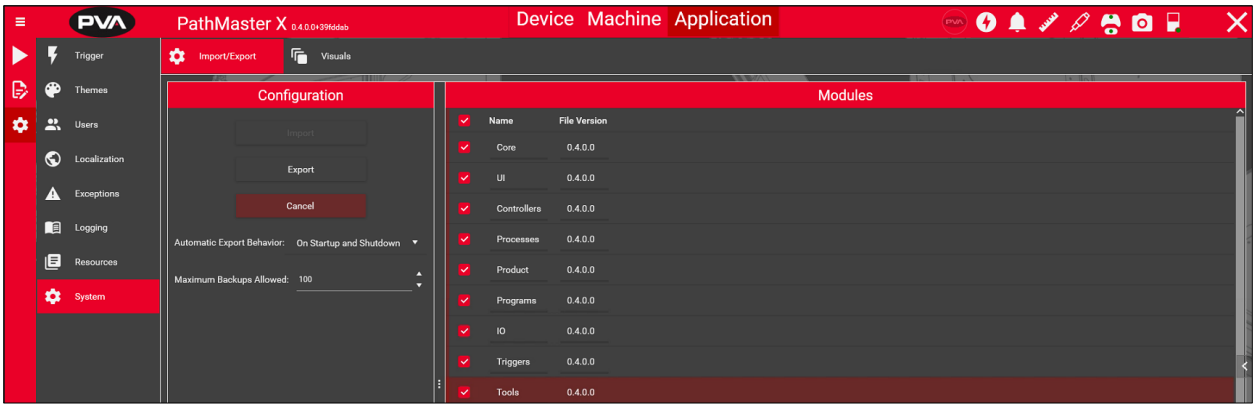


Figure 104: System

6.3.6.1 Importing and Exporting Configurations

To import, select the **Import** button, navigate through the file explorer to the intended file, and select the file containing a valid machine export. The list of modules will populate and allow selection of those to import. Once satisfied with the selections, select the Import button again. The application will need to be restarted for imported changes to take effect.

To export, select the **Export** button and select the modules needed to be exported. Select the export button again to allow saving of the file. Navigate to the desired file location, enter the desired file name, and click the **Save** button.

6.3.6.2 Visuals

The Visuals tab under System allows the user to change certain options related to the visual function of the application.

Select an **Animation** speed for changing between tabs and modes. Available options are **Slow**, **Fast**, and **None**.

Button Duration options allow the user to change the duration a button must be pressed to complete an action for delete and shutdown.

Horizontal/Vertical Drag Start sets the number of pixels the mouse cursor must move on the program editor canvas before the canvas considers the motion a drag operation.

The **Color Selector Preset** allows the user to choose which preset options are available when selecting color options such as in themes or editing tool profiles.

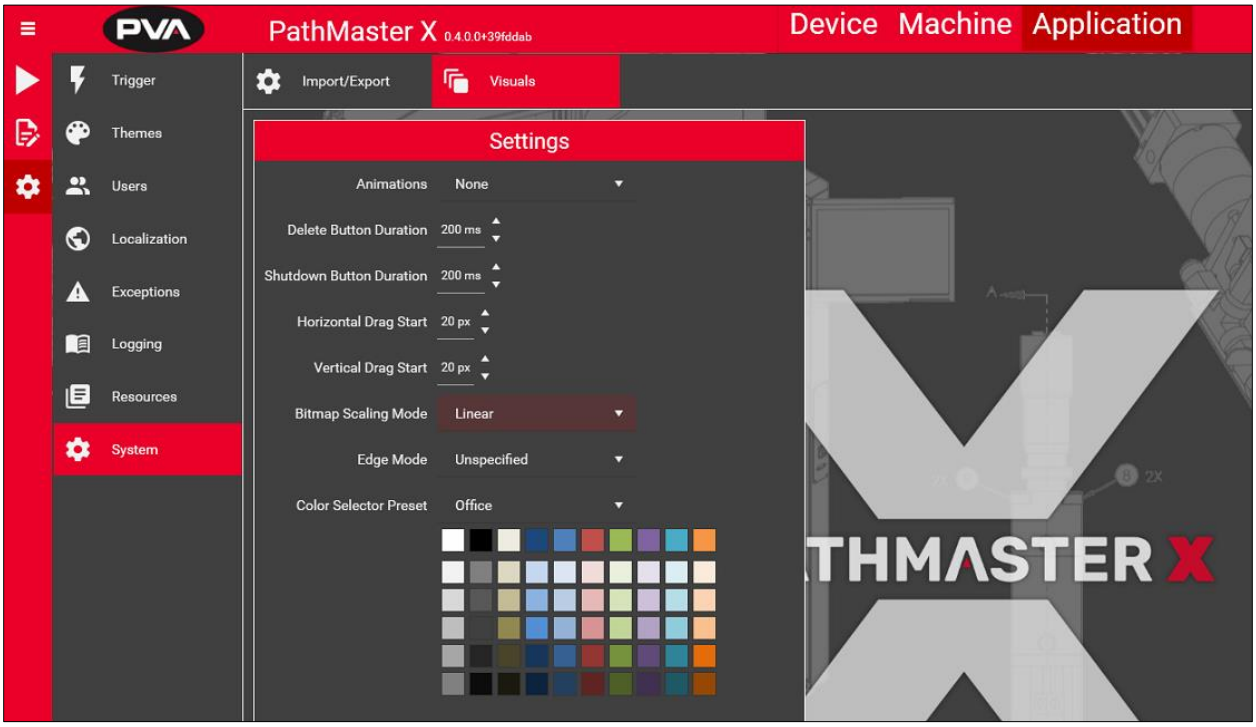


Figure 105: Visuals

7. Operation

7.1 Programming Functions

7.1.1 General Editor Parameters and Buttons

7.1.1.1 Tool / Cursor Position

The current tool position is shown in the coordinates view box in the upper right corner.

Press the **Coordinate View icon** on the canvas to see the coordinate view box. Tool Coordinates update as the robot moves or if another tool is selected.

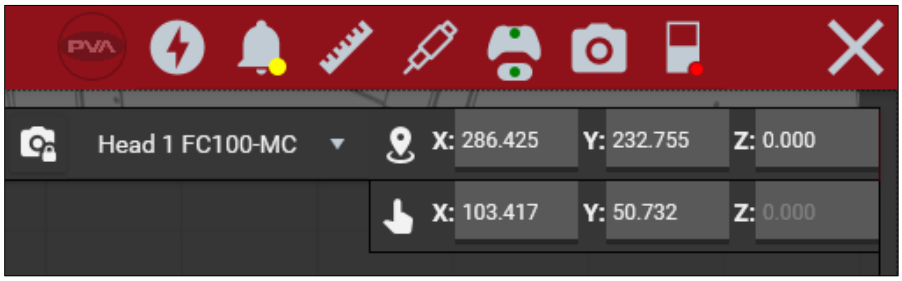


Figure 106: Coordinates View

Tool Position shows the position of the current tool (in user units) within the program coordinate system.

Figure 107: Tool Position

Cursor Position shows the position of the cursor (in user units) within the program coordinate system.

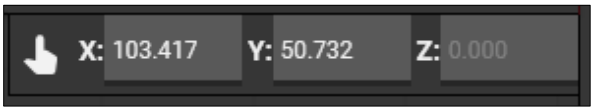


Figure 108: Cursor Position

7.1.1.2 Teach

The Teach function records the current point.

7.1.1.3 Edit Mode

Edit mode allows the user to drag function steps on the canvas.

7.1.1.4 Step Edit Menu

The Step Edit menu allows the user to edit any step function parameters. Editable parameters in the Step Edit menu look different for each distinct function. To menu can be accessed in three ways:

1. Double click on the desired step function.
2. Right click on the desired step function and click **Edit**.
3. Select the kebab menu  on the right-hand side of the desired step function. Select **Edit**.

When using the Step Edit menu, use the left and right arrow keys to move between step functions without having to back out of the edit menu. Use the up and down arrow keys to move between parent and child steps, with program editing at the top and individual functions at the bottom.

7.1.2 Dispense Path

The Dispense Path is used to associate all dispense moves with a desired profile and easily groups multiple dispense moves from the same tool. All dispense moves must be a part of a dispense path.

1. Select the **Dispense Path** from the toolbox and drag it to the program editor list.
2. Open the **Step Edit** menu.

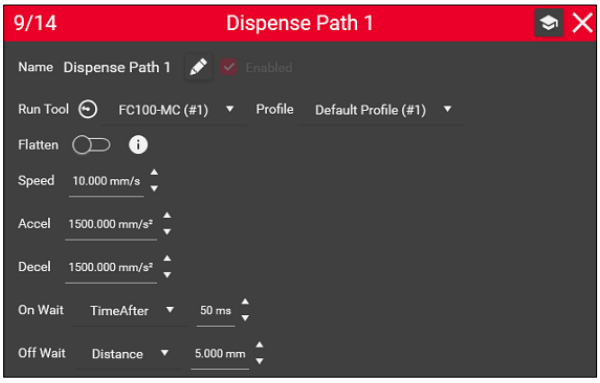


Figure 109: Dispense Path

3. Select a desired tool and profile. Modify other parameters if desired.

4. All dispense paths have an initial move by default. Set the location of this move to the position where a dispense will begin.

7.1.3 Move

The Move command is a non-dispense move. The speed and approach of individual moves are definable by editing the move.

1. Select the **Move** function and drag it to the desired place in the program step list or drag it onto the canvas.

2. Open the **Step Edit** menu for the move.

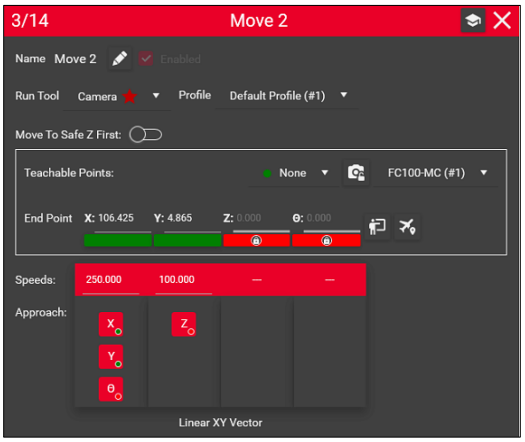


Figure 110: Move

3. Select the tool that is moving to position. If a move is part of a dispense path, the tool cannot be changed.

4. Select the tool that will be used to teach the position.

5. Use the teach pendant to move to the desired location or input the coordinates for the move.

6. If using live location, select **Teach**.

7. Select the desired approach. Axes can be toggled from the approach by selecting the green or red rectangle under the coordinates. Green enables the axis, red disables it.

8. Select the X to close the Step Edit menu.

7.1.4 Arc

This function teaches an arc. An arc must have three points. The Z-axis may change position in the path.

1. Select the **Arc** function. An existing dispense path is required to use an arc function.
2. Open the **Step Edit** menu for the Arc.

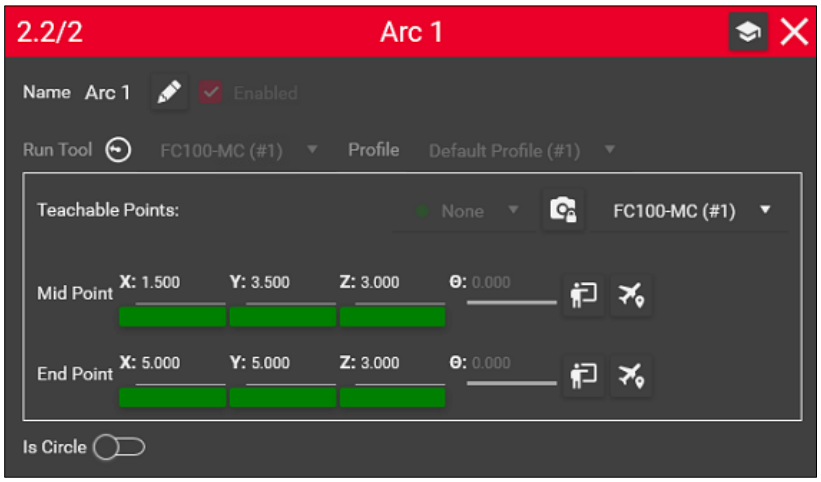


Figure 111: Arc

3. Select the tool and profile performing the arc.
4. The start point will be established from the last move end position or dispense step move. Mid and end points can be taught by dragging their locations on the canvas, moving to the desired location, and clicking **Teach** or entering the desired coordinates.
5. The **Is Circle** toggle, when turned on, will turn the arc into a full circle.
6. Select the X to close the Step Edit menu.

7.1.5 Circle

This function teaches a circle. No points are taught, the circle is only draggable on the canvas. The Z-axis does not change position in this path.

The circle start point and direction can be edited through the reverse, offset, or rotation options by right-clicking on the step or clicking the kebab menu.

7.1.6 Line

This function teaches a straight line between two points. The start point is determined from the last moved position of the previous step.

1. Select the **Line** function and drag it to the program steps or canvas. An existing dispense path is required to use lines.

2. Open the **Step Edit** menu for the Line.

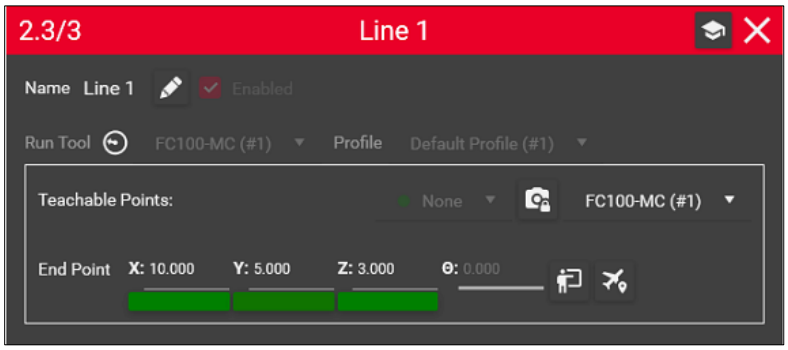


Figure 112: Line

3. Teach the endpoint by dragging its location on canvas, moving to the desired location, and pressing **Teach,** or entering the desired coordinates.

7.1.7 Dot

This function teaches a timed dispense over a coordinate point.

1. Select the Dot function and drag it to the program steps or canvas. An existing dispense path is required to use an arc function.

2. Open the Step Edit menu for the Dot.

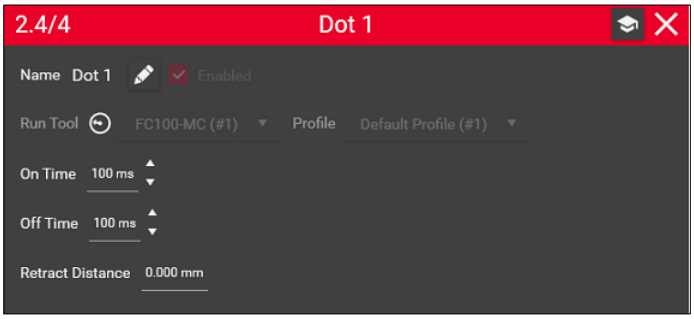


Figure 113: Dot

3. Select the desired tool, profile, dwell time, and retract distance.

4. Teach the point by dragging its location on canvas. A dot may need an associated **Move** step to move to the desired coordinates before dispensing.

7.1.8 Dot Array

A dot array can be created from a single dot. The array can be defined by several dots with specified spacing or filling a certain area with the defined number of dots.

1. Create a dot move. It is best to set up a common retract and dwell time before creating the array.

2. Access the create array option by either right clicking on the dot move or selecting the kebab menu. Select **Create Array**.

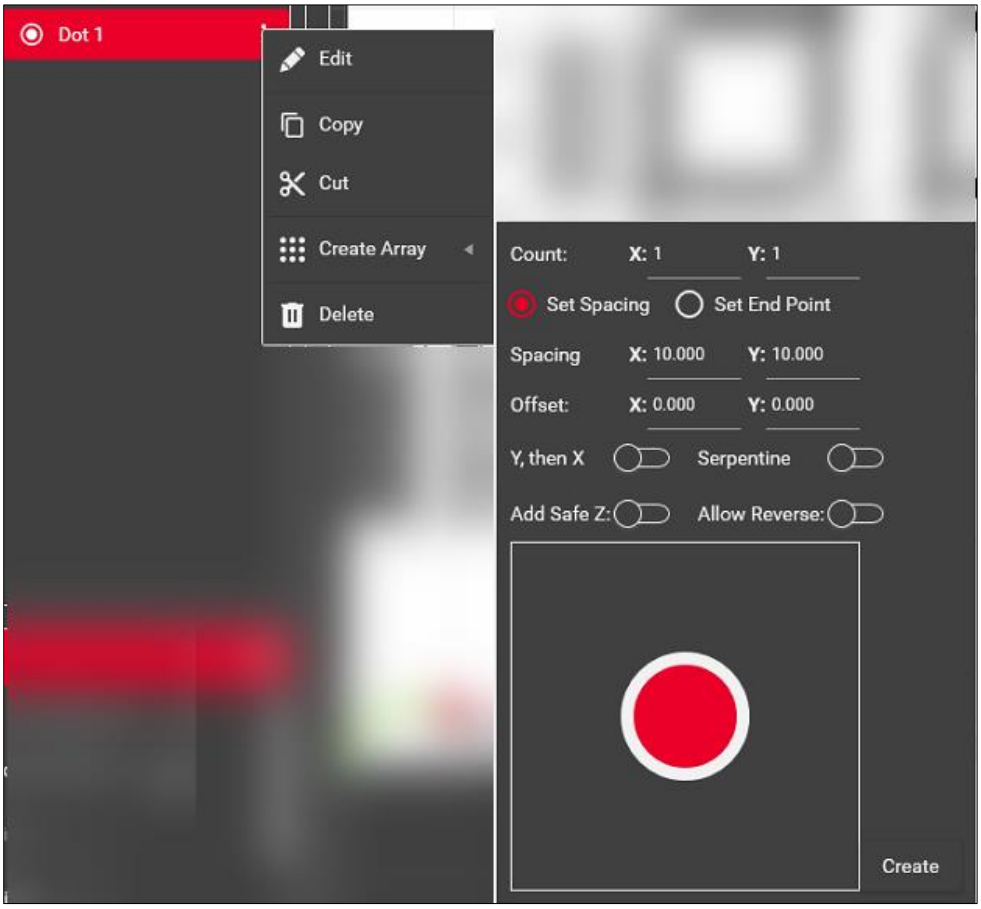


Figure 114: Create Dot Array

3. Determine the X and Y count of the array.

4. Select either a spacing interval or an end point of the array (the first dot acts as the opposite corner to the endpoint)
5. Use the toggles to define pathing through the array.
6. Press **Create** to create the array. An array is defined by individual Dot and Move steps and cannot be moved or edited as a whole step.

7.1.9 Area

This function teaches a rectangular or circular area dispense. The Z-axis does not alter its position during the path. The area has multiple fill options to allow increased flexibility.

1. Select the **Area** function from the toolbox.
2. Open the **Step Edit** menu for the Area dispense.

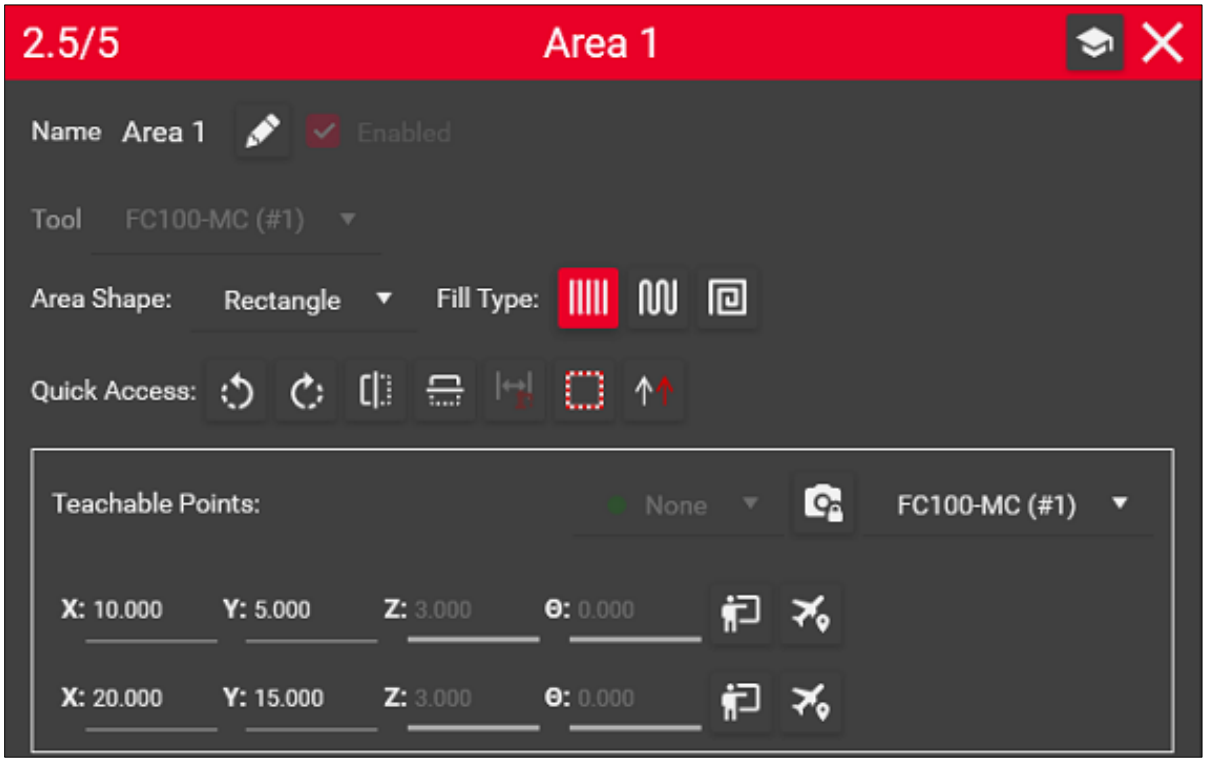


Figure 115: Area

3. Select the area shape and fill. If using a Serpentine pattern, select the icon to change between rounded edges or square edges.
4. Either drag beginning and end points on the canvas to their desired locations or teach their positions under **Teachable Points**.
5. Set the spacing interval of the area. Modify the space or fill angle if desired by using the radial diagram or entering the values into the text boxes.

Figure 116: Set Spacing Interval

7.1.10 Square

This function teaches a square outline. No points are taught. The square is only draggable on the canvas. The Z-axis does not change position in this path.

The square start point and direction can be edited through the reverse, offset, or rotation options by right-clicking on the step or clicking the kebab menu .

7.1.11 Rectangle

This function teaches a rectangle outline. No points are taught, the rectangle is only draggable on the canvas. The Z-axis does not change position in this path.

The rectangle start point and direction can be edited through the reverse, offset, or rotation options by right-clicking on the step or clicking the kebab menu  .

7.1.12 Tool Function

All tool functions can be done through a **Tool Function** program step. Several tool functions are included as their own steps for convenience. These include Down, Up, Rotate A, and Rotate B. To use a tool function in a program:

1. Select the **Tool Function** from the toolbox and drag it to the program steps in the desired position.
2. Open the **Step Edit** menu for the Tool Function.
3. Select the device and the function (if applicable).

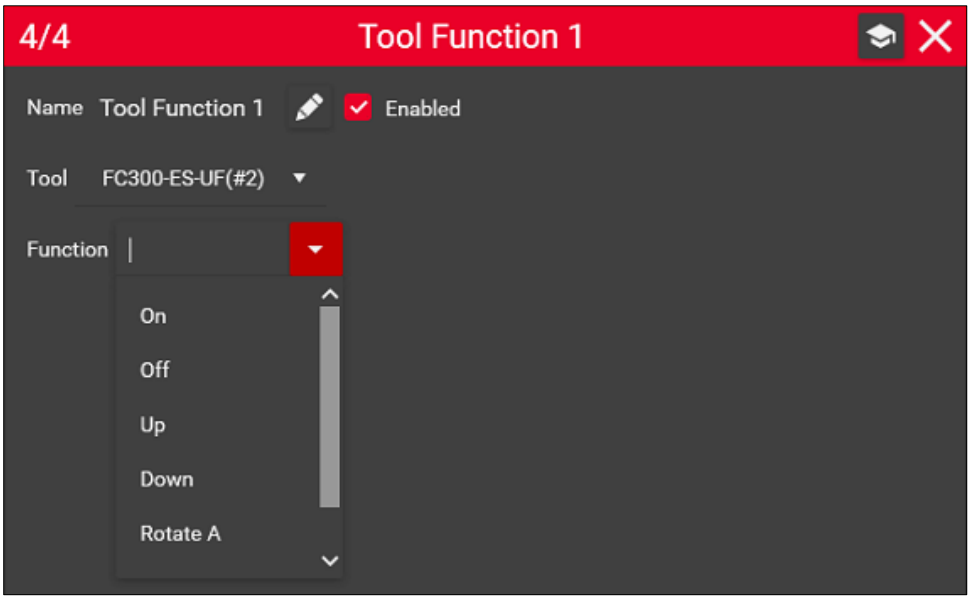


Figure 117: Tool Function

7.2 Additional Functions

7.2.1 SubProgram

With this function, the operator can execute another existing program within the current program.

1. Select **SubProgram** from the toolbox and drag it to the program steps in the desired position.

2. Open the Step Edit menu for the **SubProgram**.

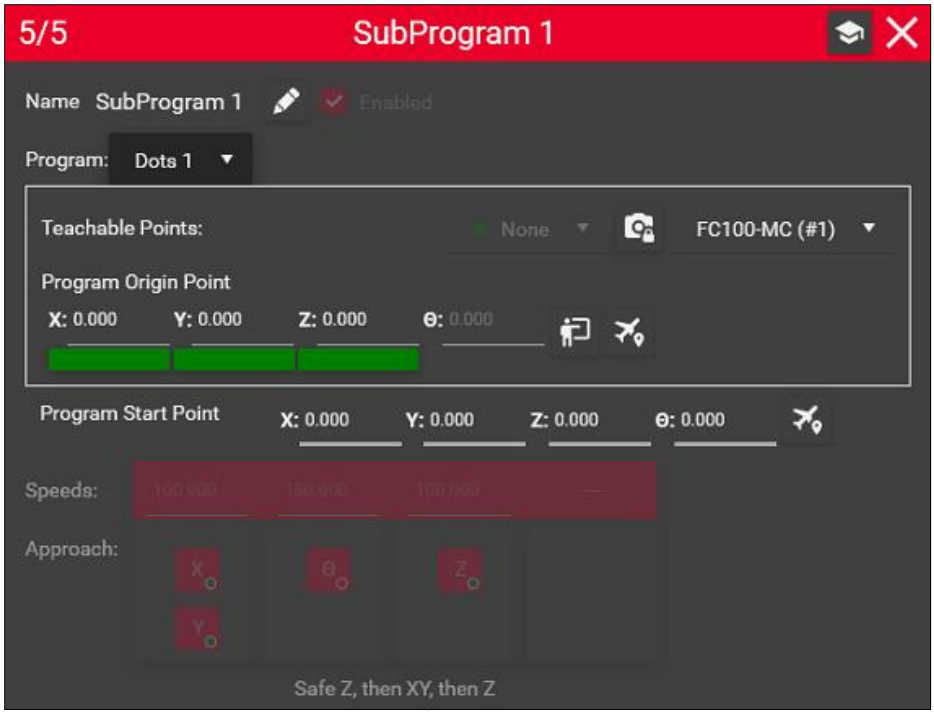


Figure 118: SubProgram

3. Select the program to be used as a **SubProgram**. The SubProgram may be renamed to define specific routines defined by the program selected. The tool selected is dependent on the program chosen. This cannot be changed.

4. The beginning point of the SubProgram can be taught using a tool or manual entry of coordinate points. This aligns the origin of the program selected as a subroutine to the defined point. This does not guarantee a dispense will begin at the point selected. Refer to the selected program to anticipate behavior. Subprogram paths will also be displayed on canvas to view.

7.2.2 Set Speed

Set speed will change the gantry speed to match a certain number of counts/second.

Note: If the speed is changed, existing default speeds will be overridden. Commands running in the program after set speed will run using the new speed unless a new set speed command is used. Speeds reset to default values at the beginning of a program playback.

7.2.3 Motion Smoothing

The motion smoothing command is a jerk limiting function applied to independent and vector motion profiles. Motion smoothing applies to all axes.

Note: If motion smoothing is set, the default smoothing curve is overridden. Commands running in the program after motion smoothing will run with the set motion smoothing unless a new motion smoothing is defined. Motion smoothing resets at the beginning of a program playback.

7.2.4 Pattern Match

The Pattern Match is used to find and confirm identifiable locations such as fiducials on products. The use of two pattern matches configured as fiducials creates a corrected space based on the pattern location.

1. Select **Pattern Match** from the toolbox and drag to the desired position in the program.
2. Open the Step Edit menu for the **Pattern Match**.
3. Select the operation:
    - **Inspection**: At the current location, run an inspection comparing the live image to the selected pattern using the image match score of the calibrated pattern. Pass/fail behavior is used to configure following program steps.
    - **Fid A**: At the current location, run an inspection comparing the live image to the selected pattern with match score. Fid A calculates the distance of the found pattern to the expected location and applies an XY translation for all subsequent steps.
    - **Fid B:** At the current location, run an inspection comparing the live image to the selected pattern with match score. If Fid A offset is currently applied, it will calculate the skew using expected positions and found pattern positions. At this point the Fid A translation is removed and skew is applied to all subsequent steps as new corrected space or will error if no transformation is found.
4. The operation must use an existing pattern. To configure a pattern, refer to Section 6.2.2.4.

7.2.5 Conditional

The Conditional Program step is used to branch the program on two paths depending on a given condition. For example, if a pallet with multiple parts using a fiducial identifier for each part. A conditional step would allow the program to skip over empty places on the pallet if a fiducial point is not identified or run the subprogram for the part if a fiducial point is identified.

1. Select **Conditional** from the toolbox and drag it to the program steps in the desired position.

Like a dispense path, conditionals contain children steps which can include dispense paths. To add a child to the conditional, drag the desired step or steps to the bottom edge of the function name, rather than to the bottom edge of the step where the conditional expression is given. Make sure the current value of true or false is selected as intended before adding children for each branch.

2. Open the Step Edit menu for the **Conditional**.

3. Select an option for the condition and set the condition. If there are any existing conditions in the program that can be used, they are suggested, such as the result of a pattern match or evaluation of a preceding conditional step. The expression evaluator can also be used to create custom conditions.

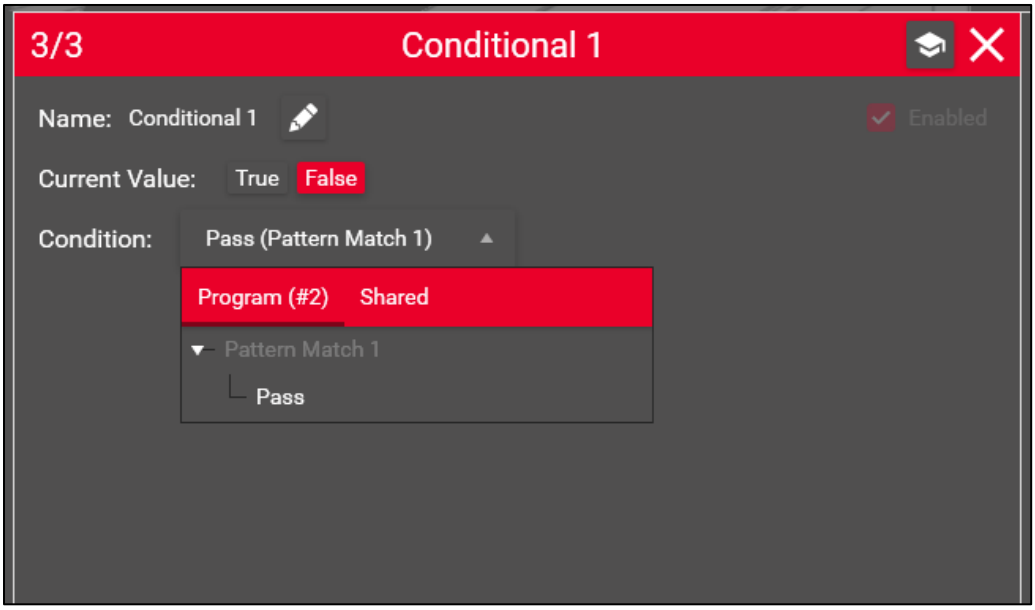


Figure 119: Conditionals

Below is an example of a conditional that uses the result of a pattern match inspection to either run a dispense path (on pass) or write the failure to log (on fail).

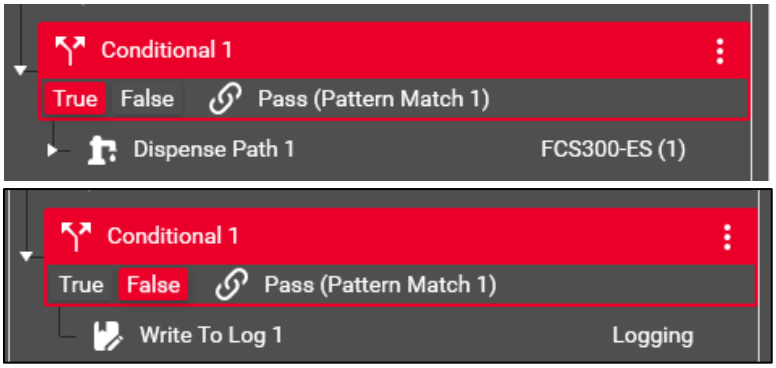


Figure 120: Conditional Example

7.2.6 Custom Shape Options

Custom shapes are available outside of the default shapes using custom shape options. To create a custom shape, a dispense path must be made in the desired image of the shape. The dispense path an consist of lines, arcs, and other shapes. The dispense path created for a custom shape does **not** need to be an enclosed area.

1. Right click on the dispense path or all steps included in the desired shape. Select **Create Shape**. This will group the steps into a single shape step.

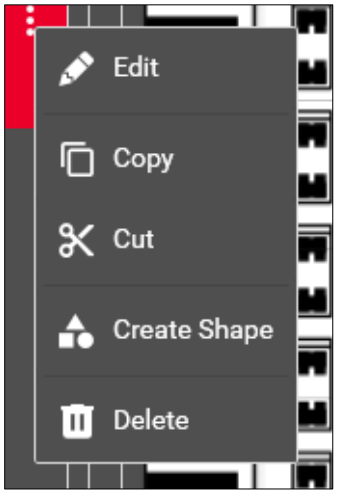


Figure 121: Create Shape

2. To save the shape so that it can be copied or used, right click on the shape and select the **Save Shape** option.
3. Use the pencil icon to edit the template name and click **Save**. A new toolbox step will now appear with the shape name.
4. In the event a custom shape is no longer needed or must be deleted, the step can be dragged from the toolbox to the trash can at the bottom of the toolbox.

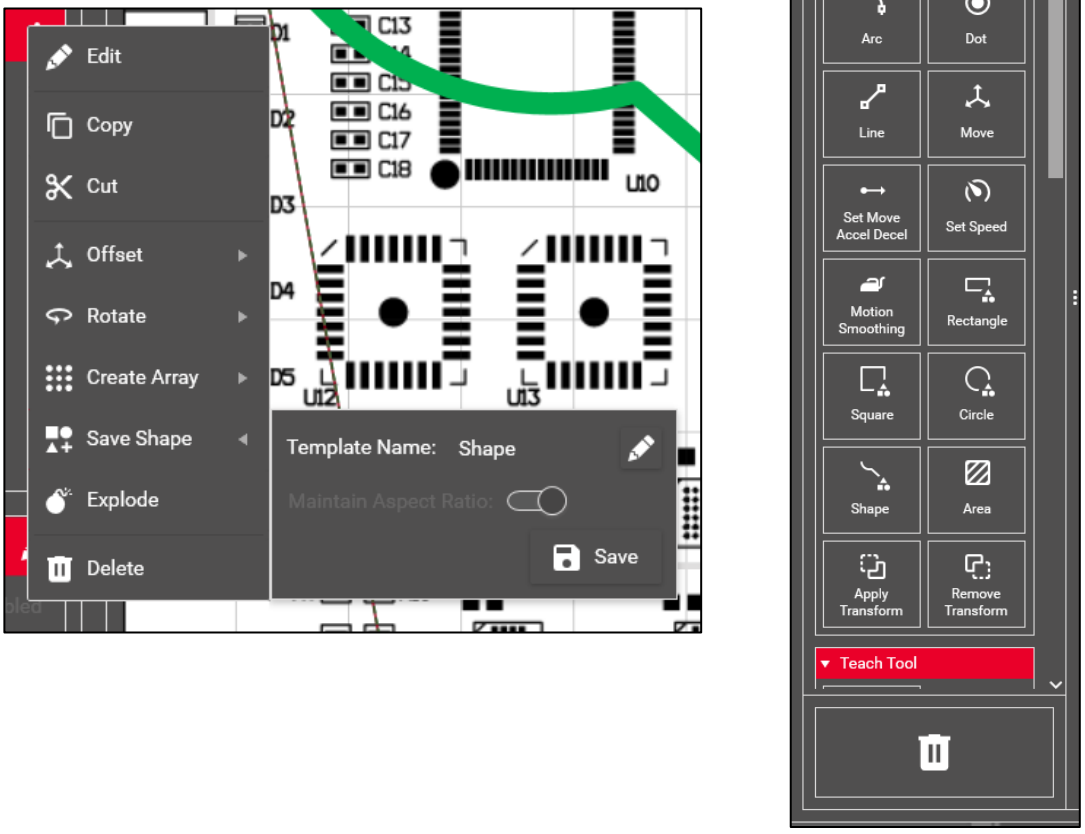


Figure 122: Save Shape / Delete Shape

7.3 Process Functions

7.3.1 Move In

This function uses the conveyor handler to move a board to a specific PIP sensor. If board stops are selected, the board stops will go down at the beginning of the script.

1. Select the **Move In** function from the Process Toolbox and drag it into the desired process lane.

2. Open the **Step Settings** menu by pressing the **Settings** icon in the top right corner of the step.

3. Select the sensor, timeout, and filter delay. If applicable, check the box for board stops and select the set of board stops. Select the conveyor direction with the **Reverse** toggle.

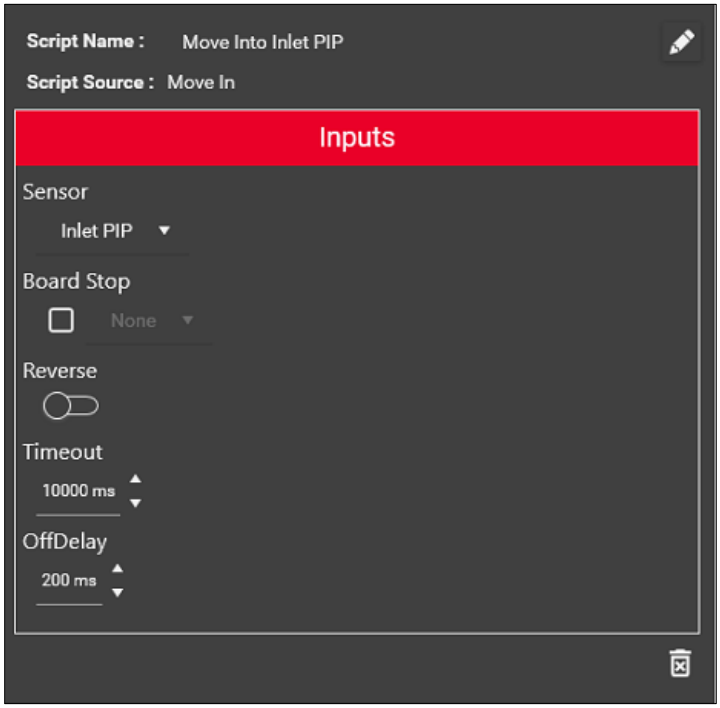


Figure 123: Move In

7.3.2 Move Out

This function uses the conveyor handler to move a board away from a specific PIP sensor. If board stops are selected, the board stops will go up at the beginning of the script.

1. Select the **Move Out** function from the Process Toolbox and drag it into the desired process lane.

2. Open the **Step Settings** menu by pressing the **Settings** icon in the top right corner of the step.

3. Select the sensor, timeout, and filter delay. If applicable, check the box for board stops and select the set of board stops. Select the conveyor direction with the **Reverse** toggle.

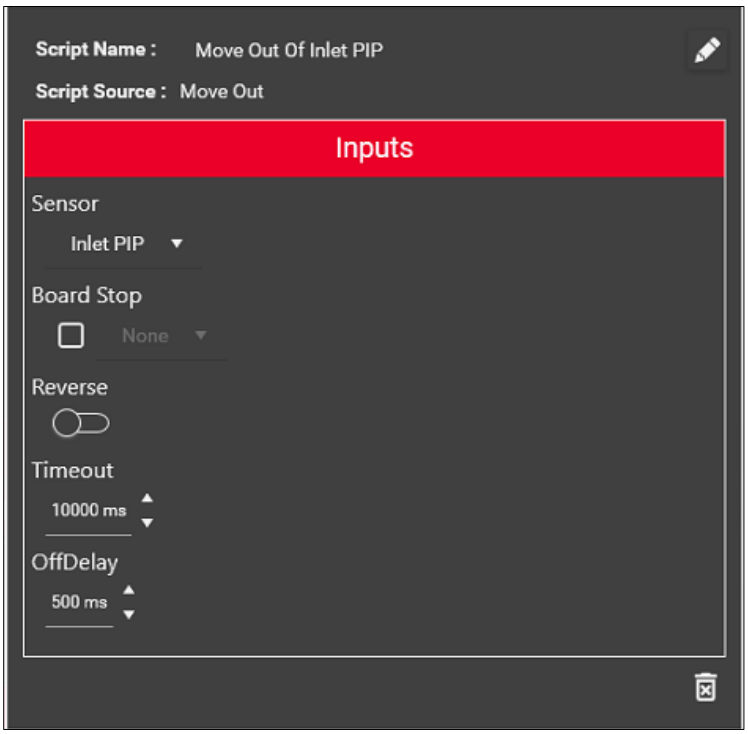


Figure 124: Move Out

7.3.3 Place Part

Specific to Flex Fixture handlers, this function allows the user to temporarily bypass safeties to place a part. Placing the part uses a part in place check for an existing sensor, but this feature can be bypassed.

1. Select the **Place Part** function from the Process Toolbox and drag it into the desired process lane.

2. Open the **Step Settings** menu by pressing the **Settings** icon in the top right corner of the step.

3. Select the part sensor or select the **ByPassPartCheck** toggle.

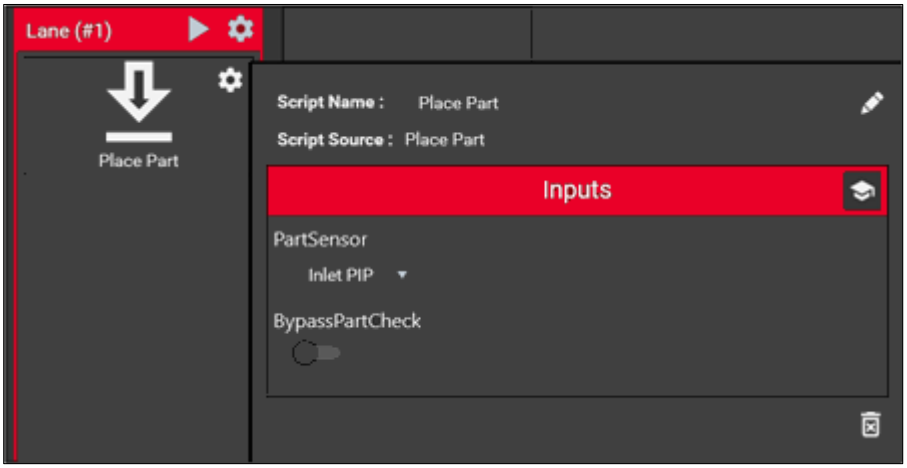


Figure 125: Place Part

7.3.4 Remove Part

Specific to Flex Fixture handlers, this function allows the user to temporarily bypass safeties to remove a part. Removing the part uses a part in place check for an existing sensor, but this feature can be bypassed.

1. Select the **Remove Part** function from the Process Toolbox and drag it into the desired process lane.

2. Open the **Step Settings** menu by pressing the **Settings** icon  in the top right corner of the step.

3. Select the part sensor or select the **ByPassPartCheck** toggle.

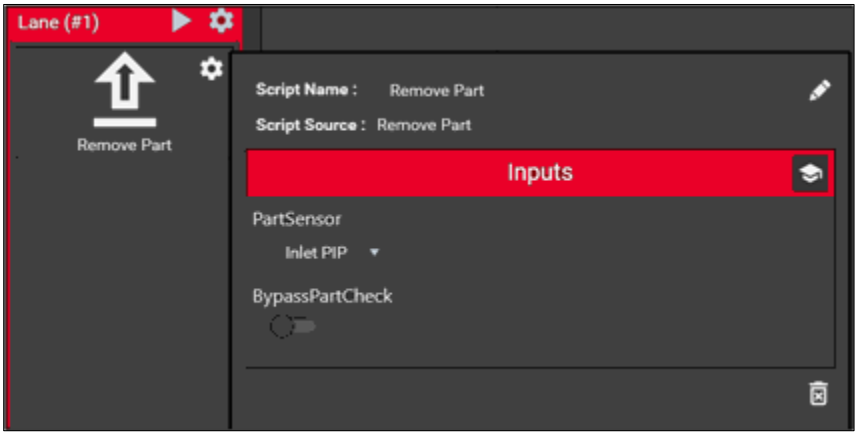


Figure 126: Remove Part

7.3.5 Set SMEMA

This function is used to set the states of SMEMA outputs for upstream and downstream communication. This does not read states from other machines, only sets states on the current machine.

1. Select the **Set SMEMA** function from the Process Toolbox and drag it into the desired process lane.

2. Open the **Step Settings** menu by pressing the **Settings** icon in the top right corner of the step.

3. Select the correct output pertaining to the SMEMA output and select the desired state using the toggle.

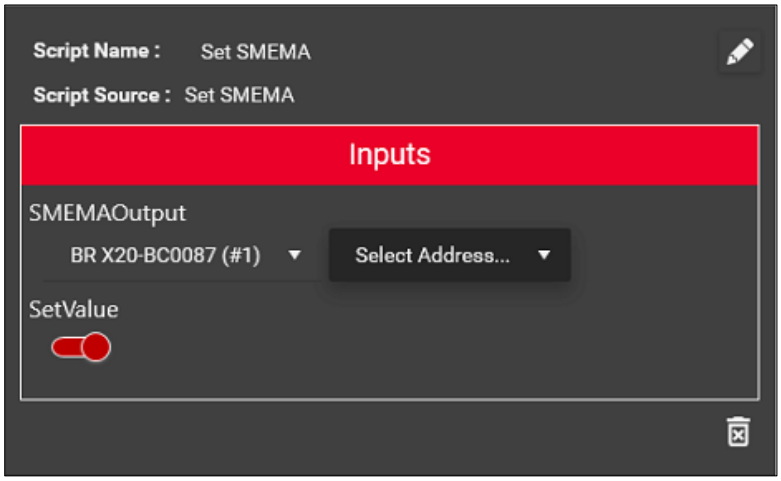


Figure 127: Set SMEMA

7.3.6 Clear Boards

This function is used to remove all boards currently in the workcell. For those who used the legacy PVA Portal application, this operates in the same manner. This function requires a conveyor handler.

1. Select the **Clear Board** function from the Process Toolbox and drag it into the desired process lane.

2. Open the **Step Settings** menu by pressing the **Settings** icon in the top right corner of the step.

3. Select the desired conveyor to clear, the direction to clear, and timeouts. Overall timeout determines the total time the routine will run before error if the conveyor is still not cleared. PIP Travel timeout determines how long the routine will run without any PIP sensors being active before completing successfully.

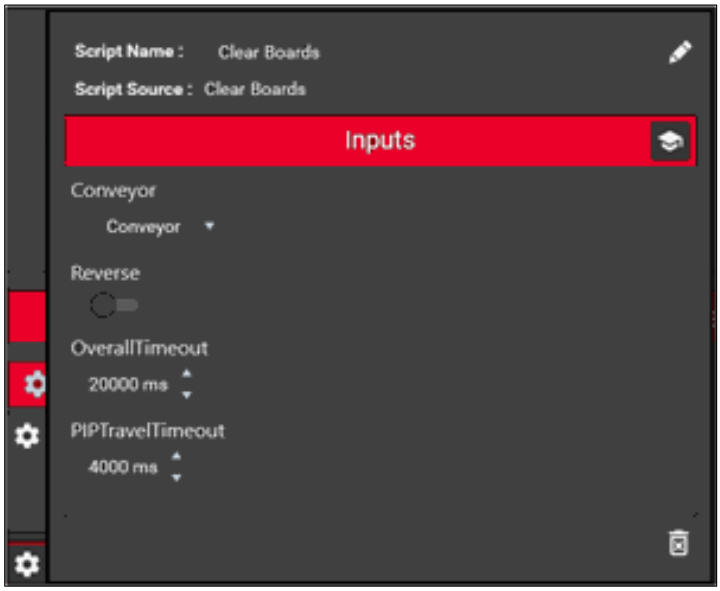


Figure 128: Clear Boards

7.3.7 Timed Wait

Timed Wait is used to suspend the process for a specified amount of time.

1. Select the **Timed Wait** function from the Process Toolbox and drag it into the desired process lane.

2. Open the **Step Settings** menu by pressing the **Settings** icon in the top right corner of the step.

3. Define the amount of time to wait (in milliseconds).

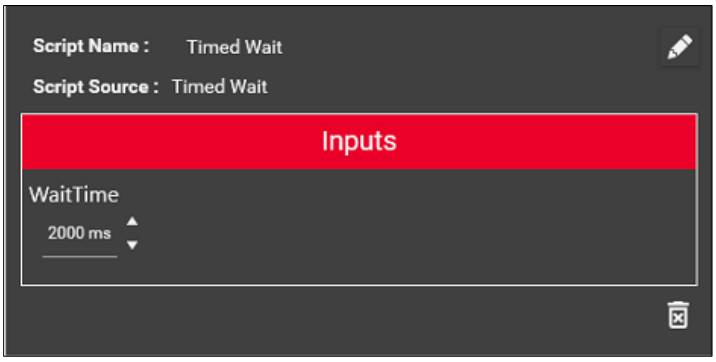


Figure 129: Timed Wait

7.3.8 Data Logging

To enable data logging, a data logging script must be added to program or process.

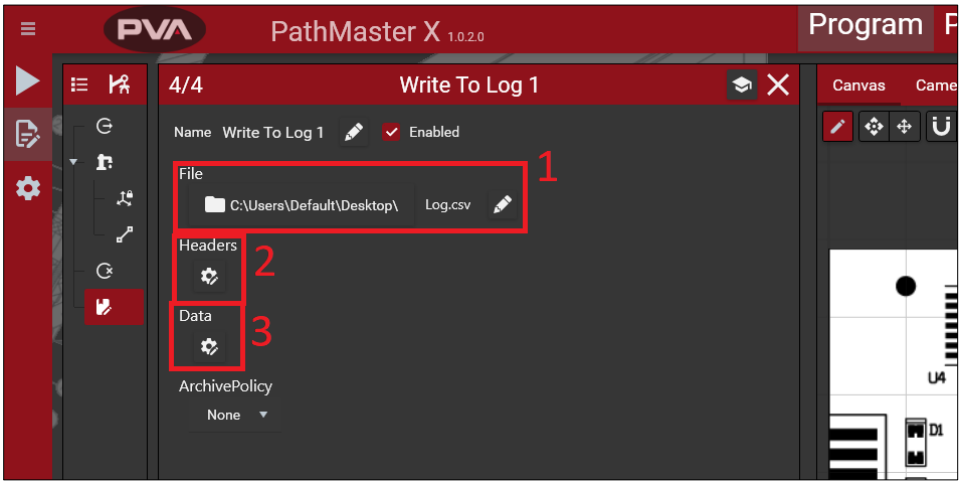


Figure 130: Data Logging

1. **File**: Click on the folder icon to change where the log file will appear when written to. This will open the File Explorer which will prompt selecting a folder. The name of the log itself is editable using the pencil icon.

2. **Headers**: Headers are constants which are written once at the top of the log file to help categorize the information presented in the log. Headers may be selected using the expression evaluator or manually typed.

Manual entries to the expression evaluator should be between single quotation marks and separated by commas. Hit verify to ensure the expression is suitable. If verified, the box will turn green. Hit save to apply the changes.

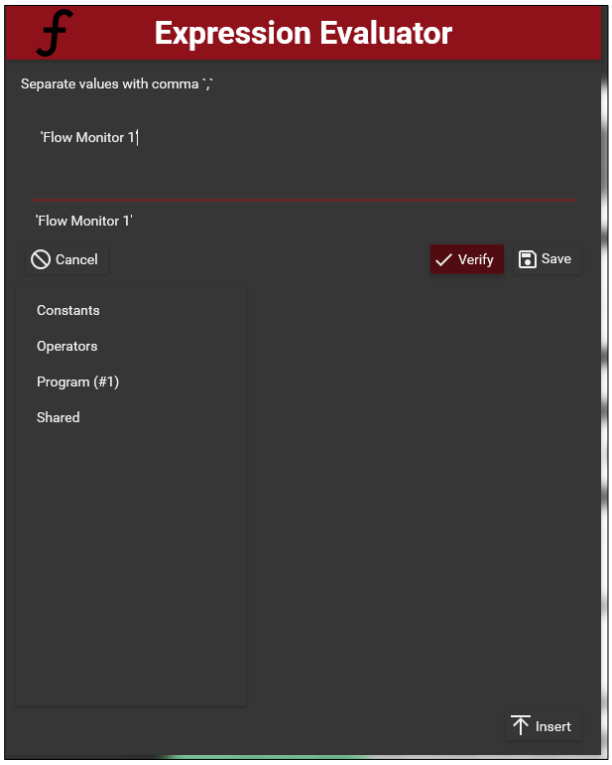


Figure 131: Headers

3. **Data**: This will write the selected data to the log file in comma separated order presented in the expression evaluator. The data is accessed by first selecting a source then navigating to the desired data from that source.

When complete and saved, both headers and data should display in their respective locations in the edit menu.

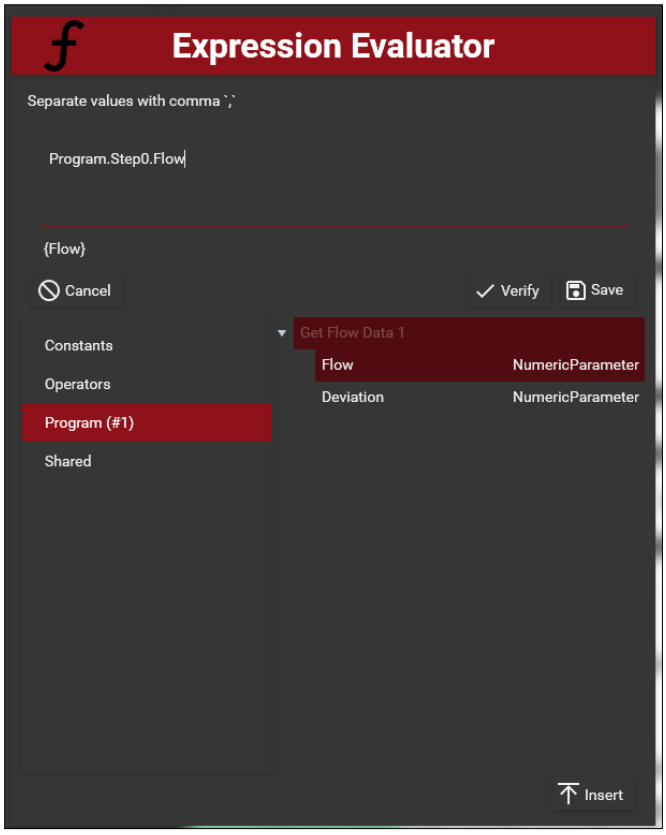


Figure 132: Data

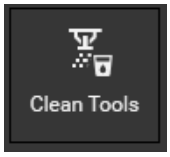
The log file generated is in .csv format, allowing it to be opened in several applications such as Notepad or Excel. The time header and time of the log entry are automatically generated for every log file.

	A	B	C	D
1	Time	Flow Monitor 1		
2	14:52:27	0		
3	15:00:28	0		
4	15:00:29	0		
5	15:00:30	0		
6	15:00:31	0		
7	15:00:31	0		
8	15:00:32	0		
9	15:00:33	0		

Figure 133: Data Log File .csv

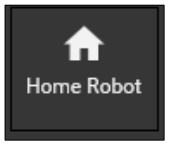
7.4 Trigger Functions

7.4.1 Clean Tools



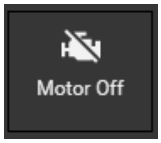
Clean Tools allows movement of all dispense tools to an existing solvent location and/or complete a purge. Solvent and purge locations are configurable to the trigger.

7.4.2 Home Robot



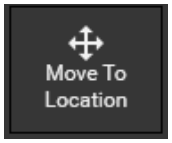
Home Robot causes robot to home all defined axes on the controller. The application will prompt the operator before movement begins. Once in motion, the home must complete before any other gantry motion can occur.

7.4.3 Motor Off



Motor Off turns off the motor for all axes, preventing automated movement. With the motors off, the gantry can be pushed or pulled, but doing so gives the machine a position error.

7.4.4 Move to Location

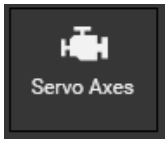


Move to Location moves to a location defined in the Robot Locations section of Coordinates. On trigger, if axes are servoed and the machine has control power, the gantry will move to the defined position. The position can be changed by selecting the **Settings** icon  and choosing the position from the dropdown.

7.4.5 Move to Safe Z

Move to Safe Z moves the gantry to a safe Z location that should not crash anywhere within X and Y machine limits. The safe Z position is typically the Z home sensor but can be altered in the Robot Tab of Machine configuration.

7.4.6 Servo Axes



Servo Axes define the servo position for all axes encoders, allowing automated movement. This requires control power.

7.4.7 Clear Boards

Clear Boards runs a conveyor to remove all parts from within the machine. If a part is found and is not trafficked to a downstream machine, it must be manually removed.

7.4.8 Set Andon State

Set Andon State turns the light tower outputs on or off to defined behavior. Useful for changing the light tower when in different process modes, when automated movement is allowed, or indicating a machine error.

7.4.9 Reset IO Devices

Reset IO Devices resets all IO to their assigned default states under the Devices section.

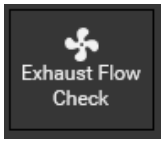
7.4.10 Control Power On

Control Power On prompts the operator to enable control power. Control power will only successfully turn on if the safety circuit is satisfied.

7.4.11 Control Power Off

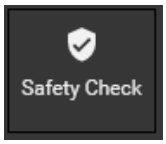
Control Power Off immediately cuts control power to the machine.

7.4.12 Exhaust Flow Check



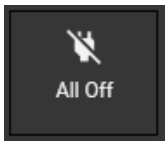
Exhaust Flow Check runs a subroutine ensuring the machine is properly ventilated. The startup and check time can be modified through the **Settings** icon .

7.4.13 Safety Check



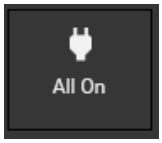
Safety Check runs a safety check routine. Safety checks are predefined by safety devices on the machine. Once a safety check begins, all safety devices must be satisfied before automated motion can resume.

7.4.14 All Off



All tools that are selected as part of the All Off script will turn to an Off state.

7.4.15 All On



All tools that are selected as part of the All On script will turn to an On state.

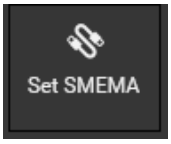
7.4.16 All Down

All tools that are selected as part of the All Down script will actuate their motion to a Down state.

7.4.17 All Up

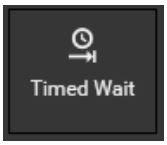
All tools that are selected as part of the All Up script will actuate their motion to an Up state.

7.4.18 Set SMEMA



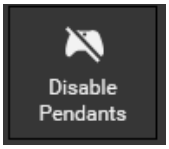
Set SMEMA allows the user to set digital outputs associated with SMEMA control. The SMEMA outputs can be set to on or off with this trigger.

7.4.19 Timed Wait



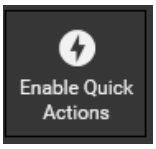
Timed Wait waits a specified time before continuing. This is useful with other trigger scripts to stagger their effects or useful on its own to create a delay.

7.4.20 Enable/Disable Pendants



Disable Pendants prevents the usage of any actions within a pendant profile until Pendants are re-enabled from an application or trigger level event. Enable Pendants is used to allow Pendant profiles in certain scenarios, as well as undo a Disable Pendants step.

7.4.21 Enable/Disable Quick Actions



Disable Quick Actions prevents the usage of any actions within the Quick Actions menu until Quick Actions are re-enabled from an application or trigger level event. Enable Quick Actions is used to allow Quick Actions in certain scenarios, as well as undo a Disable Quick Actions step.

7.5 Keyboard Shortcuts

Shortcut	Description
Ctrl + Alt + B	Disable PMX topmost (Top Menu bar should have focus before shortcut is keyed)
Ctrl + Alt + K	Kill Popup Dialog Box
Ctrl + Alt + X	Request Application Shutdown
Ctrl + Alt + C	Remove Application background blurring
Ctrl + Alt + S	Silence Alarm

8. Table of Figures

9. Notes

10. Warranty

PVA Warranty Policy

PVA warrants the enclosed product against defects in material or workmanship on all components for one year from the date of shipment.

The warranty does not extend to components damaged due to misuse, negligence, or installation and operation that are not in accordance with the recommended factory instructions. Unauthorized repair or modification of the enclosed product, and/or the use of spare parts not directly obtained from PVA (or from factory authorized dealers) will void all warranties.

All PVA warranties extend only to the original purchaser. Third party warranty claims will not be honored at any time.

Prior to returning a product for a warranty claim, a return authorization must be obtained from PVA's Technical Support department. Authorization will be issued either via the telephone, facsimile, or in writing upon your request.

To qualify as a valid warranty claim, the defective product must be returned to the factory during the warranty period. Upon return, PVA will repair (or replace) all components found to be defective in material or workmanship.

(Retain this for your records)

Product Information:

PRODUCT: _____

SERIAL NUMBER: _____

DATE OF PURCHASE: _____