MARVEL AI

Operator Manual

Version 5 (January 2026)

Keirton Inc.

Comprehensive Guide to Setup, Operation, and Maintenance

Content

Pre-Start Checklist

Complete the following steps before starting your Marvel machine.

1. **Connect the main power** to a 120 V, 15 A, 60 Hz power source.
2. **Connect the compressed air line** to the machine, 7 CFM @ 120 psi. Ensure that the air is dry and un-lubricated.
3. **Set pressure regulator** to 55 or 25 psi based on the size of your machine, based on the size and moisture state of your batch, this can be adjusted by +-5 psi. Use high settings for wet flowers.
4. **Verify network connectivity.** Ensure the network connection is stable before starting.
5. **Place output conveyors or bins** at all three output positions.
6. **Check for Cleanliness and obstructions.** Make sure nothing is blocking the flower path, and that all Channels and glasses are clean.

Starting Marvel

Follow these steps to power on and start operating Marvel.

1. Connect the main power cable to the power outlet.

2. Turn the main switch on the back of the HMI to the **ON** position.

3. The machine will take approximately **1 minute** to fully come online.

   - If Level One authentication is not disabled (see Chapter 3, **Accessing Marvel**), you will see a password prompt asking for the Level One Access code.
   - If Level One authentication has been disabled, the home page will appear showing Separation Mode once the machine is online and ready (Figure 3.1).

Accessing Marvel

When you turn on Marvel for the first time, a Level One Access Code prompt screen appears. You must enter the correct code to unlock the machine.

1. Enter the Level One Access code in the input box (Figure 2.1).

Level One Access Code

twister

2. Click the green **Login** button to proceed to the home page.

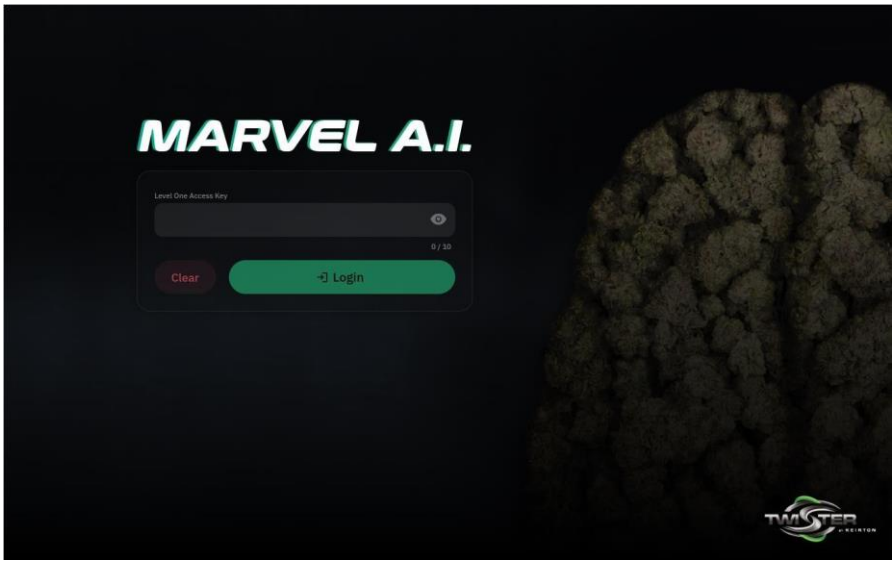


Figure 2.1: Level One Access Code prompt

Shutting Down or Restarting Marvel

1. Go to the home page (Figure 3.1).
2. Click the **power button** in the bottom-left corner.

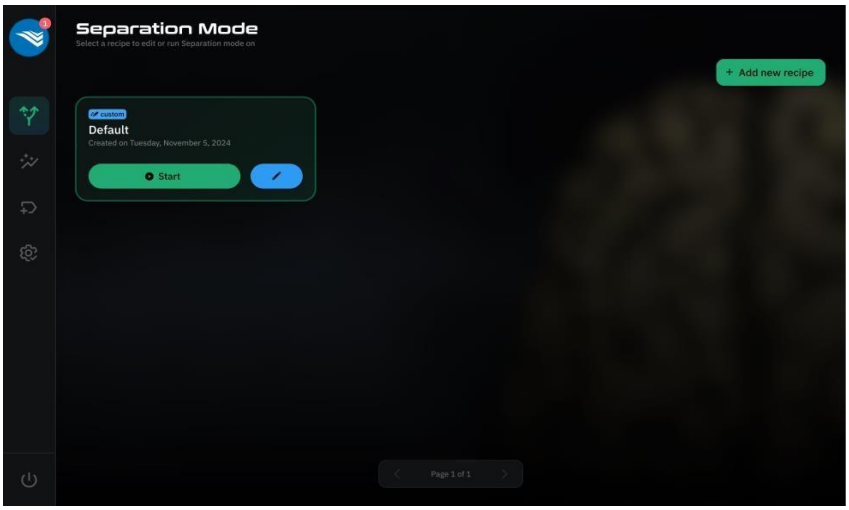


Figure 3.1: Power button location

3. Choose **Restart** or **Shut Down** (Figure 3.2).

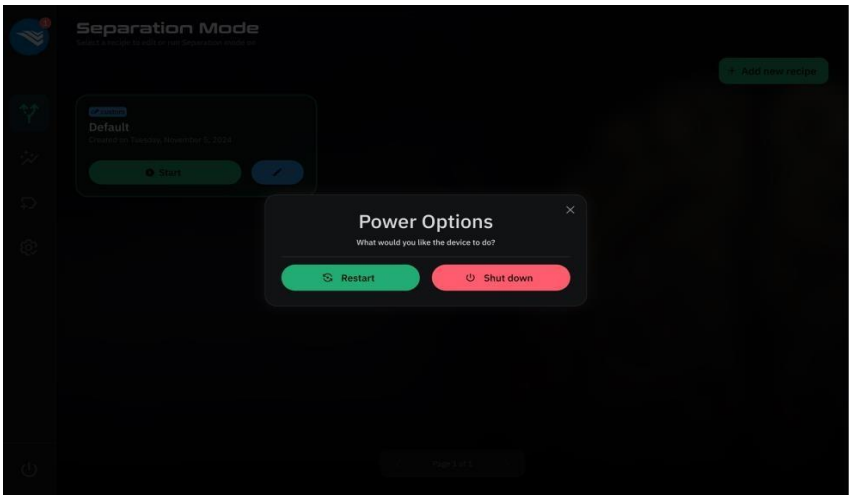


Figure 3.2: Power options

4. After you click the **Shut down** button, be sure to turn off the main switch on the back panel. Please wait for 5 seconds before switching off the main switch on the back panel.
5. After turning off the main power switch, wait at least 2 minutes before starting Marvel again.

Operations

Marvel has three primary operating modes: **Separation Mode**, **Analytics Mode**, and **Labelling Mode**. This chapter covers each mode in detail. Starting with the main mode of operation on the machine, separation mode.

4.1 Separation Mode

Separation mode is the mode that sorts flowers into different streams based on the customized recipe settings.

After entering the Access code, the default home screen will be shown (see Figure 4.1). This is the main screen for separation mode and shows all the recipes existing in Separation Mode.

Each configuration is shown as a recipe. When you click on a recipe, it will be highlighted with a green border. You can add recipes (configurations) by clicking the **Add new recipe** button on the top right of the screen.

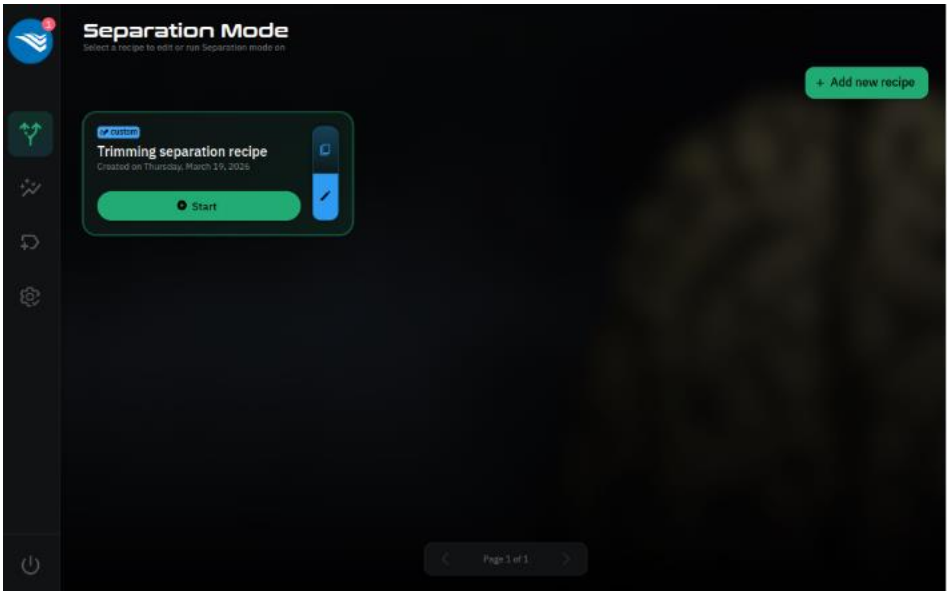


Figure 4.1: Home screen — Separation Mode with recipe cards showing Start, Copy, and Edit buttons

Each recipe card provides three actions:

- **Start** (green start button on the left side): this will start running the selected recipe.
- **Copy** (translucent blue copy button on the top right side). This will create a copy of the selected recipe with its full configurations.

- **Edit** (blue edit button on the bottom right side). This will open up the recipe page to edit its configurations.

4.1.1 Starting a Recipe run

1. Click the **Start** button on the recipe card. Separation Mode prompt with current timestamp is shown, which will ask you to input the batch name/number.
2. A Separation Mode prompt appears showing the current timestamp. Enter a **batch name/Number** in the input field (Figure 4.2). Batch name/number is required since this information will be used to link data of the batch gathered by the machine to your unique batch name/number. You will be able to access and search the data based on these unique name/numbers.
3. After entering the batch name, Click **Start Separation Mode** button to run the Separation Mode in Marvel.

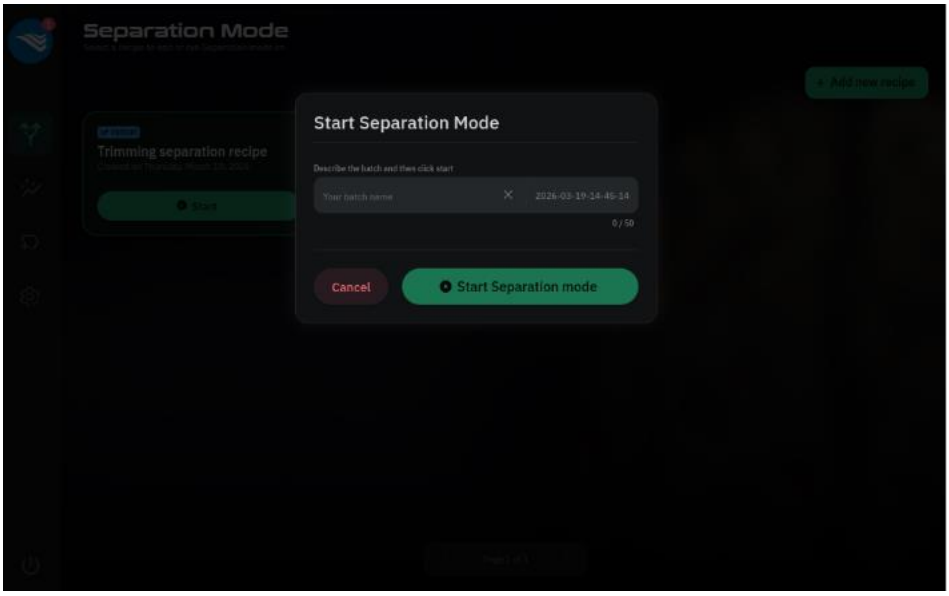
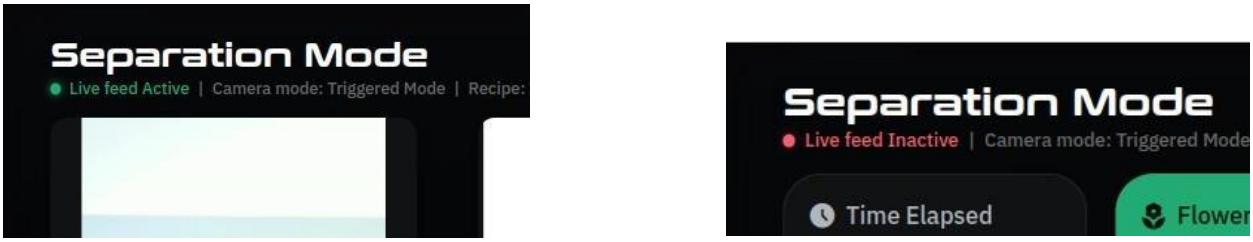


Figure 4.2: Separation Mode — batch name input prompt

Separation Mode will now open. Initialization takes approximately **30 seconds** to finish the initialization. When Marvel is ready, a **green indicator** will appear in the top-left corner of the screen (Figure 4.2-1 a). In rare cases, you may not see the green indicator and keep seeing a **red indicator** (Figure 4.2-1 b). If this occurs, exit the operation and press **Start** again.



(a) *Green indicator — system ready* **(b)** *Red indicator — restart required*

Figure 4.2-1: System status indicators

Once ready, the **Switch View** and **Exit** buttons appear in the top-right corner. You can click **Switch View** to toggle between the Data Dashboard view and the Real-Time flower processing view.

Data Dashboard View

The Data Dashboard view (Figure 4.3) provides:

1. **Separation Mode status (On Top Left):** live feed status (active when the separation mode is running, inactive in all other status), camera mode, recipe name, and batch name.
2. **Processing information:** elapsed time, total flowers and foreign objects processed, size distribution breakdown, grade breakdown, and criteria list breakdown.

Figure 4.3: Data Dashboard view

Real-Time Processing View

The Real-Time Processing view (Figure 4.4) displays a live image feed of the flowers at 3 different angles shown in one column and a flower information card showing state of that flower, flower size (height and width), and criteria level.

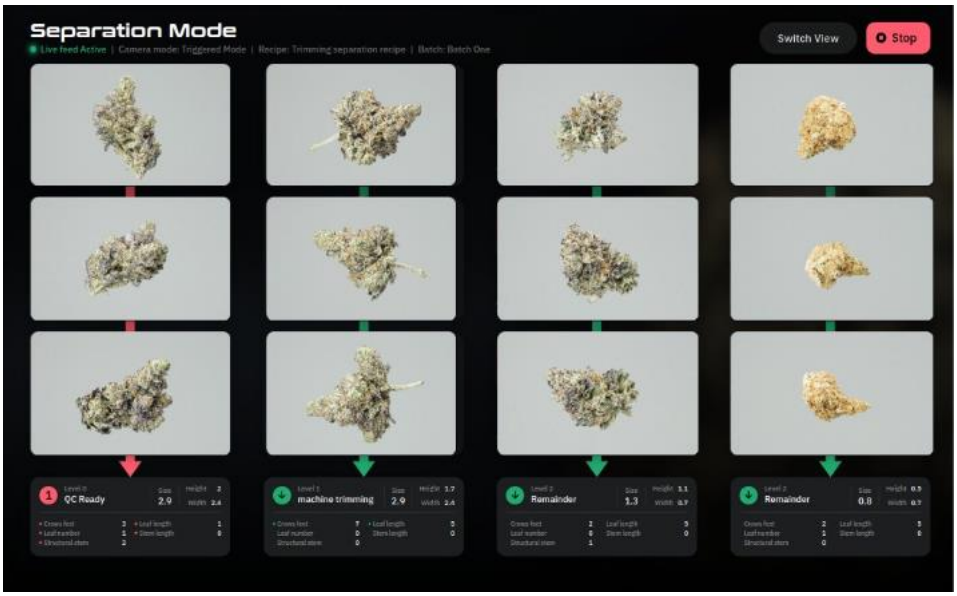


Figure 4.4: Real-Time Processing view

When processing is complete, on the top right click the **Stop** button, then click **Exit** to return to the main menu.

4.1.2 Copying a Recipe

To copy a recipe, click the **Copy** button on the recipe card (see Figure 4.1). The Clone recipe prompt will appear (Figure 4.5). A new recipe name is required to create a copy. The new recipe name must be unique, then click the **Clone Recipe** button.

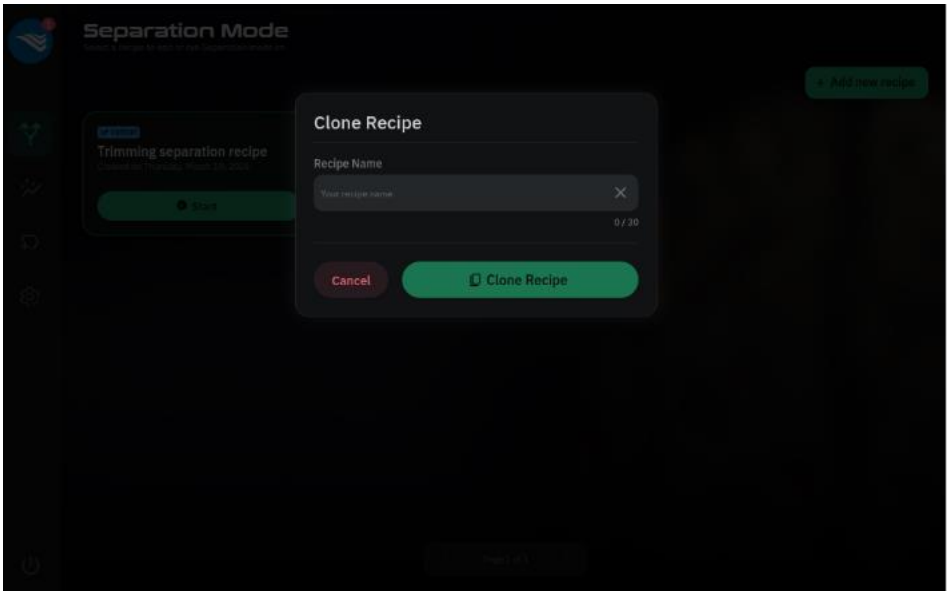


Figure 4.5: Clone Recipe prompt

4.1.3 Editing a Recipe

To change the recipe settings, you can click the **Edit** button on the recipe card (the pen icon button on the right section of each recipe, see Figure 4.1). The recipe customization page will be shown.

Unlocking the Recipe

By default, the recipe customization page is **locked** due to Level Two Access restrictions. All criteria, grades, and stream settings are read-only but cannot be modified (Figure 4.6).

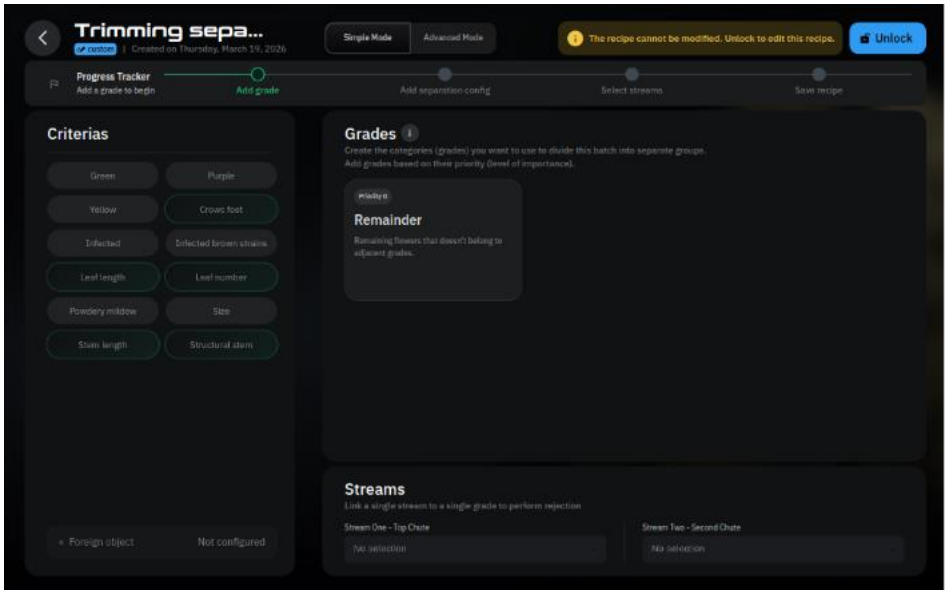


Figure 4.6: Recipe customization page (locked) note the Unlock button in the top-right corner

To unlock the recipe:

1. Click the **Unlock** button in the top-right corner. A Level Two Access prompt will appear (Figure 4.7).
2. Enter the **Level Two Access code** and click **Unlock**.

Level Two Access Code

marvel

3. Once unlocked, you can edit all recipe settings. You can also click the pen shape icon button next to the recipe name to rename it.

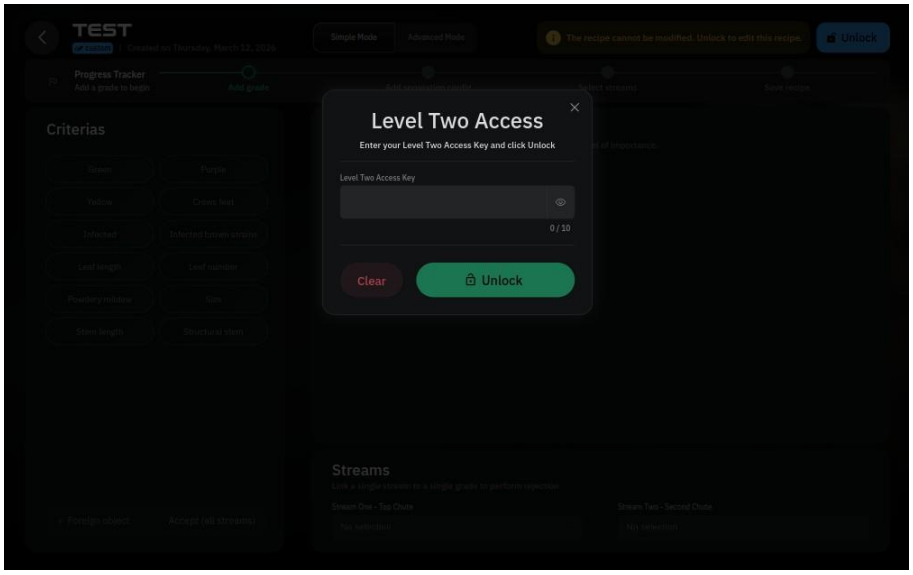


Figure 4.7: Level Two Access Code prompt

Main Recipe Settings

Once the recipe is unlocked, the customization page contains the following sections:

1. **Criteria List:** Located on the left side. Each criterion can be selected or unselected (Figure 4.8).

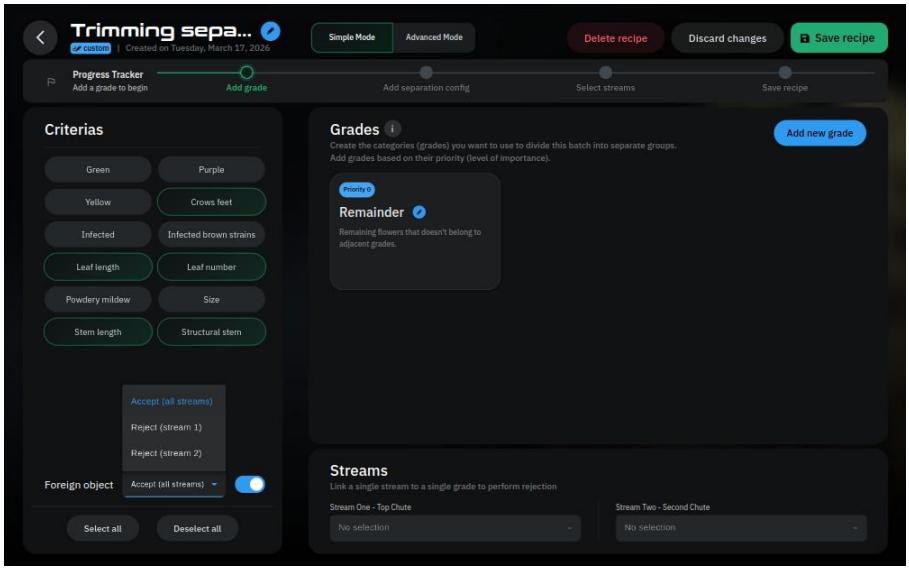


Figure 4.8: Recipe customization (unlocked) foreign object configuration shown at bottom

2. **Grades:** Grades are categories you define to divide the batch into separate groups. These are represented by 'Blue' color cards. Example: leafy flowers, stemmy flowers, good to pack.
3. **Grade List:** A list of all the current grades is located on the right. You can click the **Add new grade** button to add more grades (up to 9 grades per recipe). Click on each grade card to customize its configuration.
4. **Grade Progress Tracker:** Located above the **Criteria List** and **Grade List**. It tracks the highest priority (order of preference) incomplete grade and shows the pending steps for that grade. Steps like **Add grade** and **Add separation config** are tracked individually per grade but **Select streams** and **Save recipe** apply to the full recipe. The tracker does not move to the next step until the required previous steps are completed.
5. **Stream Setup:** You select the stream number from the dropdown list to determine which grade of flower goes to Stream 1 / Stream 2. Stream 1 is the top output chute. The next bottom output chutes will be stream 2 (depending on the Machine model, then stream 3).
6. **Camera Mode Setup** (Advanced Mode only):
    - **Triggered Mode** — cameras will only get triggered to take images when flower is being detected in the run.
    - **Continuous Mode** — cameras keep taking images when Marvel is running the recipe.

Some touchable function buttons on the recipe main page are (see figure 4.8):

1. **Save Recipe:** Click to save. If the user exits a recipe without saving, unsaved changes will be lost.

2. **Discard Changes:** Undo all unsaved changes.
3. **Delete Recipe:** Permanently remove the entire recipe.
4. **Setup Mode:** Toggle between **Simple Mode** and **Advanced Mode** at the top center (refer to next setup modes section for more details).

Recipe Operations

The main steps that user must take to complete setup of a recipe are:

Step1: Creating Grades

Step2: create separation configurations for each grade

Step3: assign grades to streams

Step4: Save the recipe

These steps will be explained in detail in coming sections with various use-case examples given.

4.1.4 Grade Setup

Grade Setup in Simple Mode

Adding a New Grade

Click the **Add New Grade** button. A prompt window opens and requests a grade name (Figure 4.11). Enter a grade name and then click **Add Grade** button. The new grade is then added to the grade list and is available for further setup.

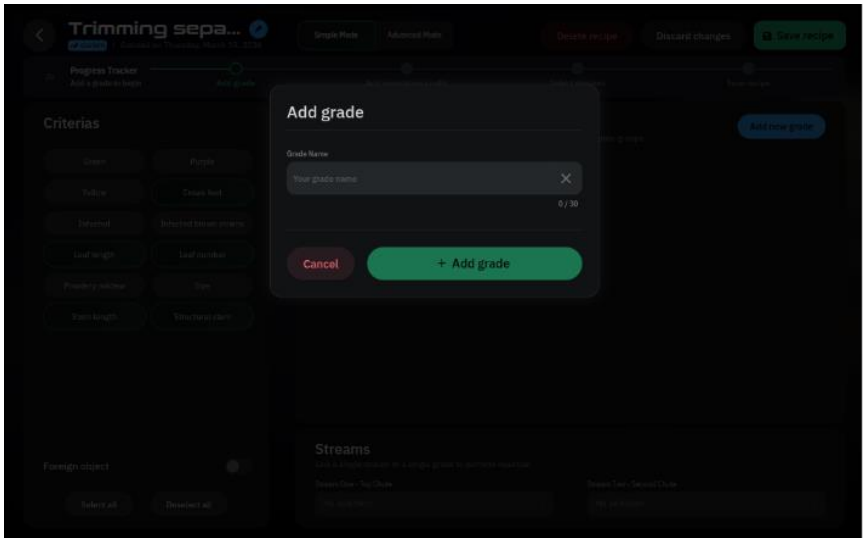


Figure 4.11: Add new grade prompt

Reviewing Grade Progress

Each grade card includes a progress bar on the top section of the screen that shows the setup of progress for that grade (Figure 4.12). It also includes a checklist of completed and pending steps.

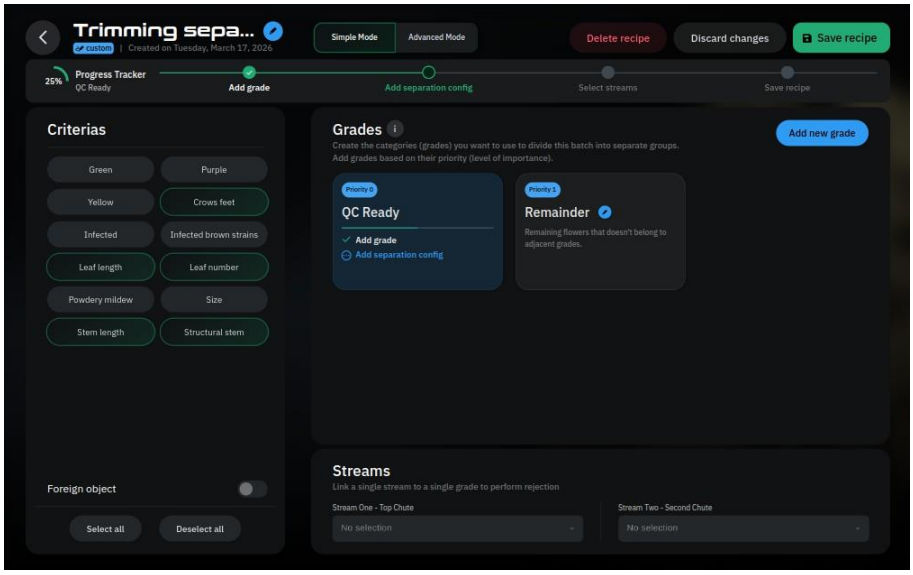


Figure 4.12: Simple Mode — grade list with progress checklists

Next step after adding a grade is adding separation configurations for that grade by opening the garde customization.

Opening Grade Customization

Touch a grade card to open its customization settings (Figure 4.13).

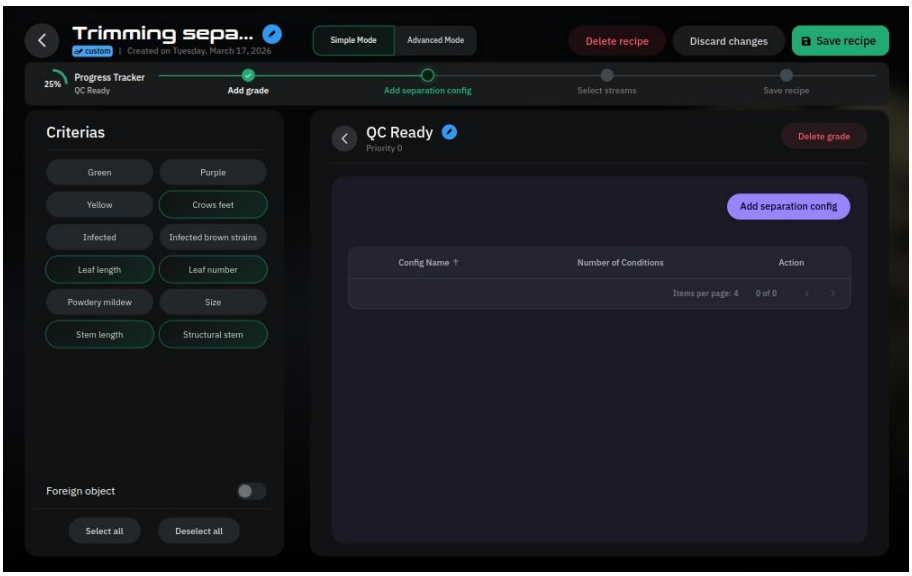


Figure 4.13: Grade customization page — separation configuration list

Opening a Separation Configuration

The grade customization page shows all separation configurations for the selected grade. You can edit an existing separation configuration by clicking its corresponding action icon button → or add a new one by clicking the **Add separation config** button (Figure 4.13).

After clicking the **Add separation config** button or any existing separation configuration action button, the separation configuration window opens.

4.1.5 Separation Configuration Setup

After the Separation Configuration window opens, complete the setup in three steps: **set breakpoints**, **define conditions**, and **save and name the separation configuration**. You can use the progress tracker on top to check the setup progress and see the next pending step (Figure 4.14).

Setting Up Breakpoints

This is the section to set up the boundary value of your separation needs on each criterion. Click on these breakpoint values for each criterion to modify them (Figure 4.14).

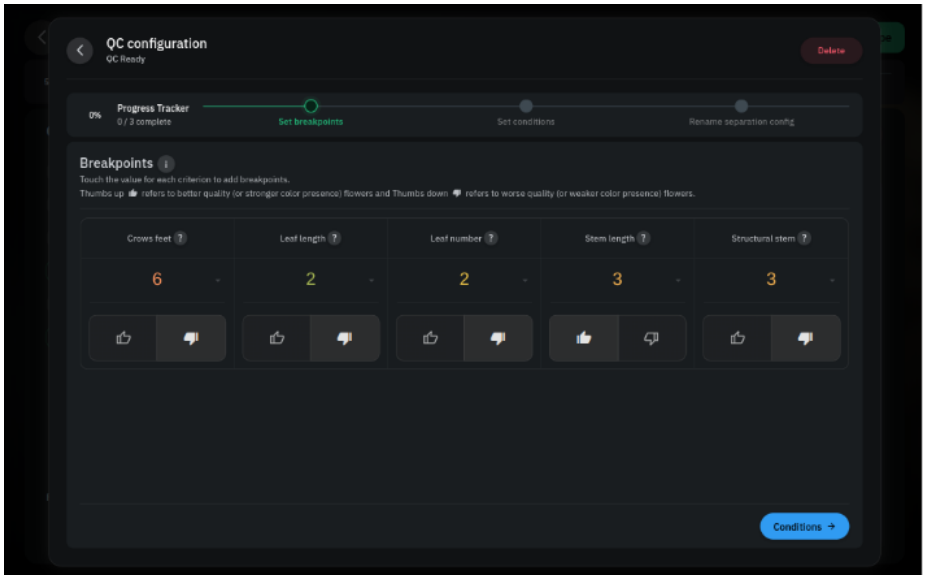


Figure 4.14: Separation Configuration — breakpoints view with thumbs up/down controls

There are two types of criteria:

Threshold criteria: Threshold criteria include size, color, and flat. Set the threshold value by moving the slider. These settings are shared across separation configurations in different sub grades.

- **Size:** The slider sets the breakpoint for flower size, measured by diagonal size. For example, if

the breakpoint is set to 34 mm, flowers are evaluated based on whether their size is below or above 34 mm.

- **Color:** The slider range of 0 to 100 represents how much of the flowers's surface is covered with a specific color. For example, a value of 15 for purple means that 15% of the flower surface is purple.
- **Flat:** The slider range of 0 to 100 represents the percentage of flatness. For example, a value of 25 means that flower thickness is 25% of its length.

Regular Criteria: All the other criteria are in this category. Set the border value using the drop-down list. These selected values are unique to each separation configuration. If there is a need for various breakpoint cases, as is the case for some coming examples in the next sections, you can add several separation configs. Some criteria provide only two options (0, 1), while others may include multiple options (0, 1, 2, 3, ...). In all cases, 0 represents the best state for that criterion, and higher numbers indicate progressively worse object conditions.
The breakpoint values are also color-coded for clarity: 0 (best state) is displayed in Green, while the highest value (worst state) is displayed in Red, with intermediate values shown in corresponding gradient colors.

Adjacent to the criteria names on the screen, there is a question mark ('?') icon button (Figure 4.14). Click the question mark button to open the instruction guide for that specific criterion with example images (**Figure 4.15)**. If you are unsure which breakpoint values to use for a new recipe, see Section 4.4.1, Determining Breakpoint Values Using Analytics Mode.

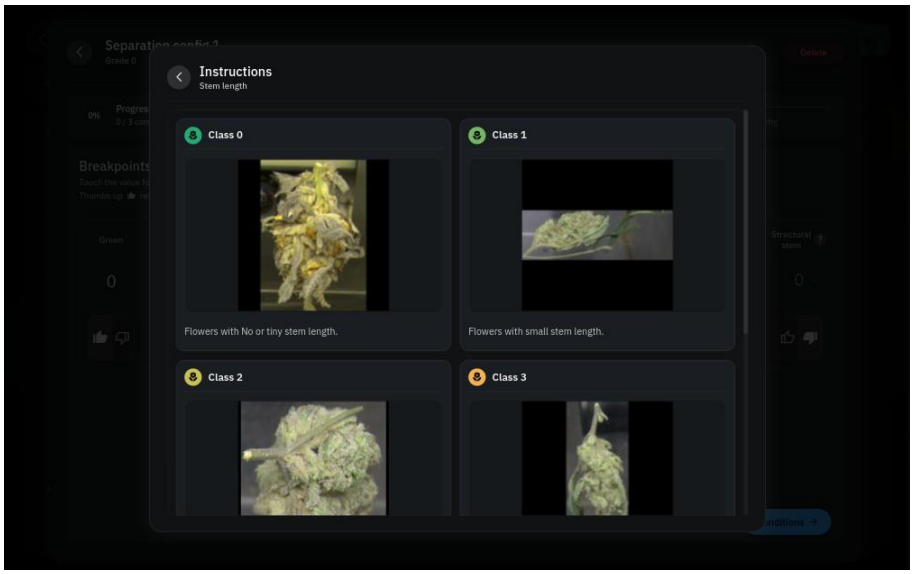


Figure 4.15: Instructions guide window — showing class levels with example images

After breakpoints (boundary values) are selected, you have to select the direction. There is two options:

1. better or bigger: Thumbs up
2. worse or smaller: Thumbs down

If you need to include flowers that are at boundary value or better or bigger state on those criteria, choose thumbs up. If flowers need to be at value or in a worse state or smaller, choose thumbs down.

Example 1: if Stem Length is set to level 3 with Thumbs up selected, all flowers with smaller length of stem (levels from 0 to 3) will be included.

Example 2: if purple color is set to 15% with Thumbs up selected, all the flowers with more than 15% purple surface area will be included.

Example 3: if Leaf length is set to 3 with Thumbs down selected, all the flowers with longer leaf than Class 3 will be included.

Example 4: if Brown is set to 20% with Thumbs down selected, all the flowers with less than 20% of brown surface area will be included.

Example 5: if size is set to 18mm with Thumbs down selected, all the flowers smaller than 18mm diagonal size will be included.

After setting up the breakpoints, click **Conditions →** button to go to the next step.

Setting Up Conditions

A condition is a group of criteria rules used together to evaluate placement of a flower based on either flower state is matching the condition or not. Conditions are required for the separation configuration (Figure 4.16).

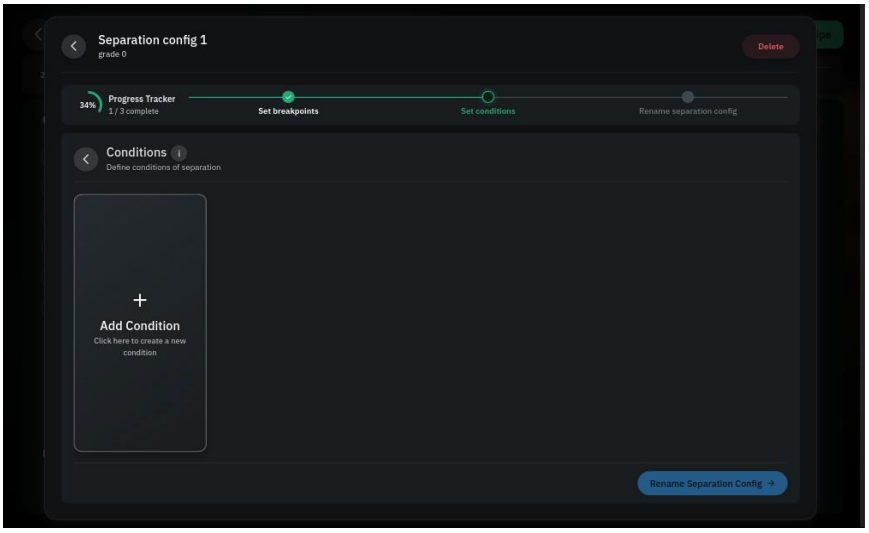


Figure 4.16: Conditions view — Add Condition card and Rename Separation Config button

Creating a Condition

To create a condition, click the **Add Condition +**. This opens the Condition Editing window. You can create one condition at a time in the Condition Editing window (Figure 4.16). If you need to add more conditions, click on **Add Condition +** again after the current one is finished.

Add breakpoints to the condition

Click the **Touch to Add Breakpoints** button to open the list of available criteria rules (breakpoints). Select a breakpoint to move it to the Selected list. To remove a selected breakpoint, click the **X** button on the breakpoint you want to remove.

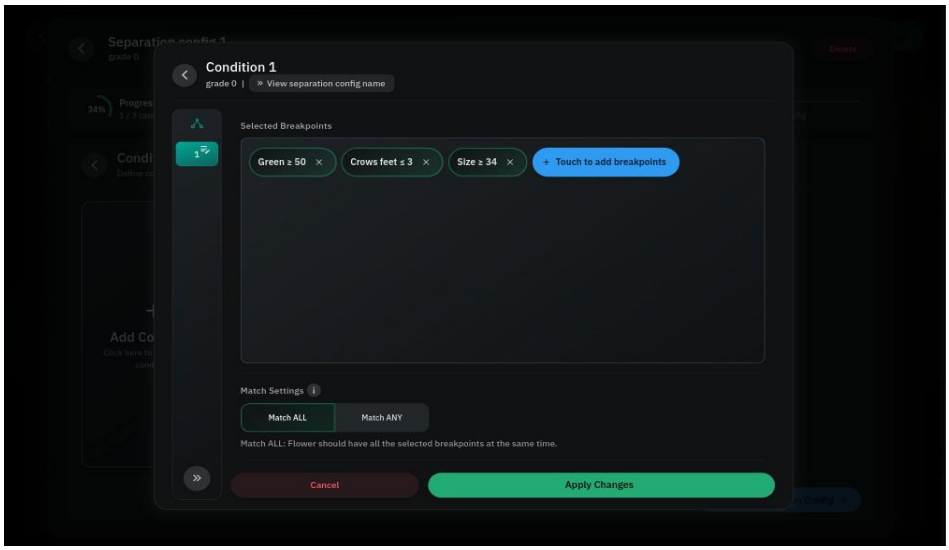


Figure 4.17: Condition Editing window — selected breakpoints and match settings

Select the match setting

After the required breakpoints are selected, choose the match setting. There are two options available, **Match ALL** and **Match ANY**.

- **Match ALL:** Match ALL means the flower must meet all the breakpoint requirements for every selected criterion altogether.
- **Match ANY:** Match ANY means the flower must meet at least one of the breakpoint requirements. If a flower matches any of the criteria rules, then that flower will be selected for this grade (subgrade).

Apply the condition

After the match setting is selected, click the **Apply Changes** button to create the condition. Repeat the same steps to add more conditions.

Other possible action in Condition Editing window

- **View/expand the condition list**

  On the left side of the Condition Editing window, a list of all conditions is displayed. You can expand or collapse this list by clicking the **right arrow (>>)** button.
- **Edit a condition**

  Only one condition can be edited at a time. The edit icon at the top right of the condition number shows which condition is currently editable. To edit another condition, click on that condition card.
- **Review condition cards**

  Once changes are applied in condition editing window, a condition card is created for each condition. Click a card to view or edit it or click on the **bin icon** to delete it. Use the **Overview** and **Details** toggle to review condition contents without opening the Condition Editing window (Figure 4.18).

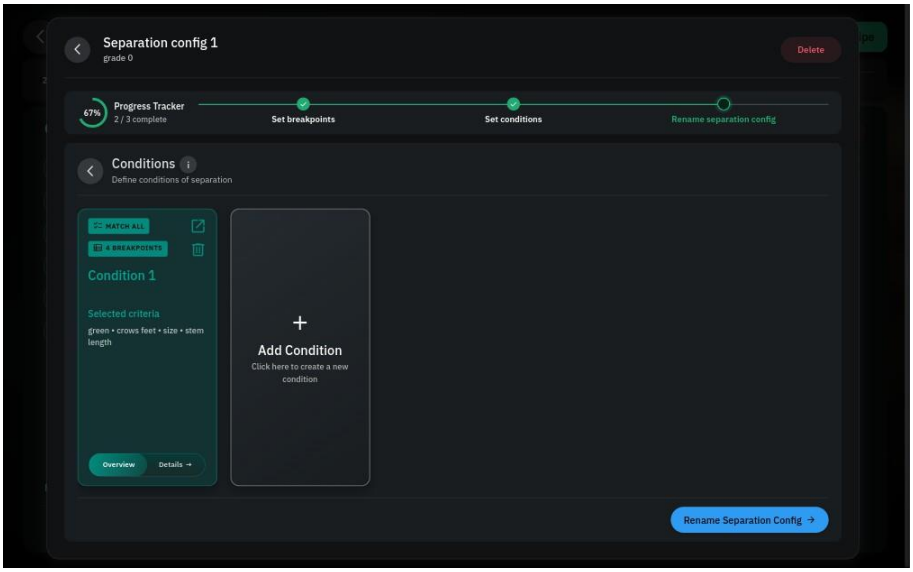


Figure 4.18: Condition cards — Overview/Details toggle and Add Condition option

Renaming and Saving a Configuration

The last step in creating a separation configuration rule is to save it. Click the **Rename Separation Config** button to open **Save Separation Config** prompt. Enter or update the configuration name and click the **Save** button to save all changes (Figure 4.19).

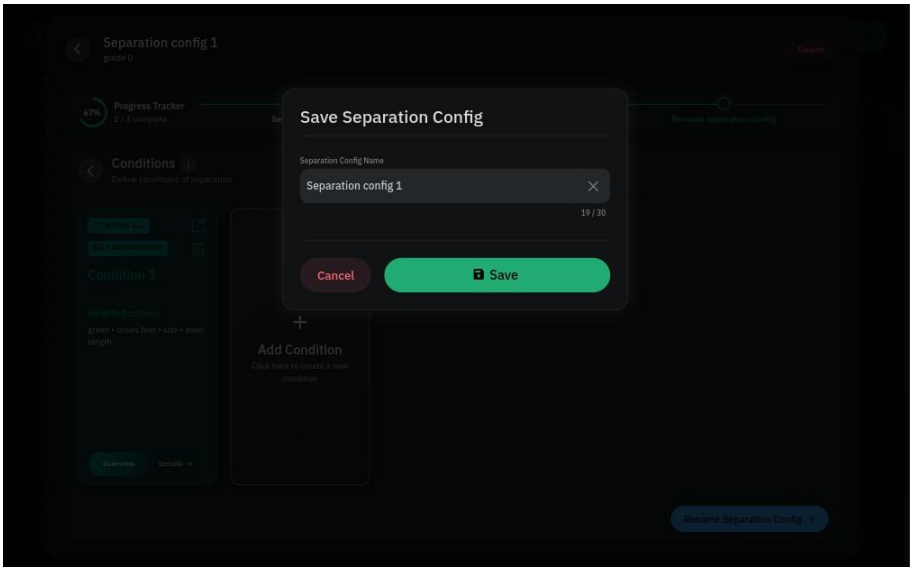


Figure 4.19: Save Separation Config prompt

After a separation configuration is created successfully, it appears in the table below (Figure 4.20).

If you need to add more separation configuration, you can follow the same steps and add a new configuration. Some examples of this will be shown in the use-case sections. After creation of the separation rules are completed for all the grades, the next step will be stream selection.

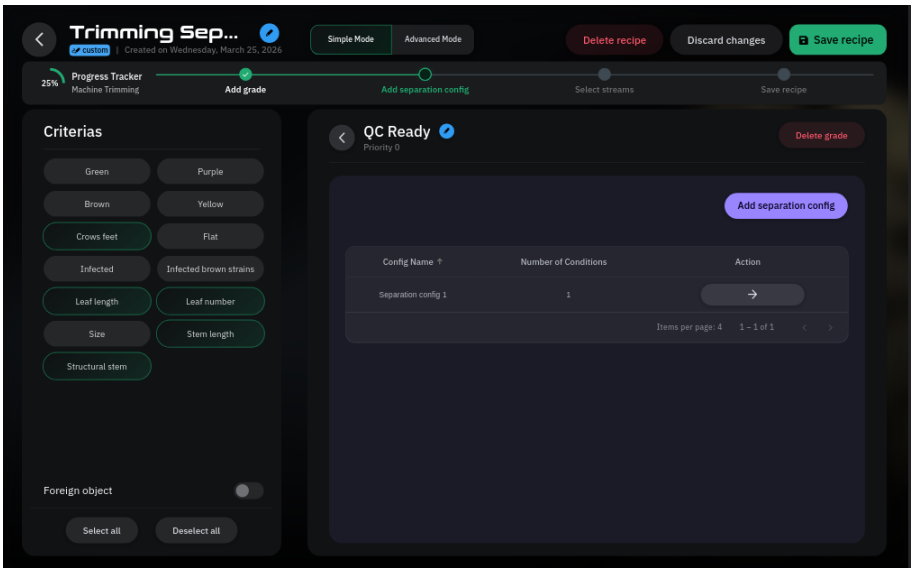


Figure 4.20: Separation Configuration list table

Select Stream

The next step is to assign a stream to the grade. Return to the Grade List view by touching **<** arrow beside the grade name to go back. At the bottom of the screen, there are drop-down menus for each stream/chute. Use the corresponding drop-down menu to assign the grade to a stream. Once a grade is selected from the drop-down menu, a red badge appears on the assigned grade card showing which stream it is assigned to (Figure 4.21).

All the flowers that are matched to the grades that are not assigned to a stream will exit the machine from the drop down output.

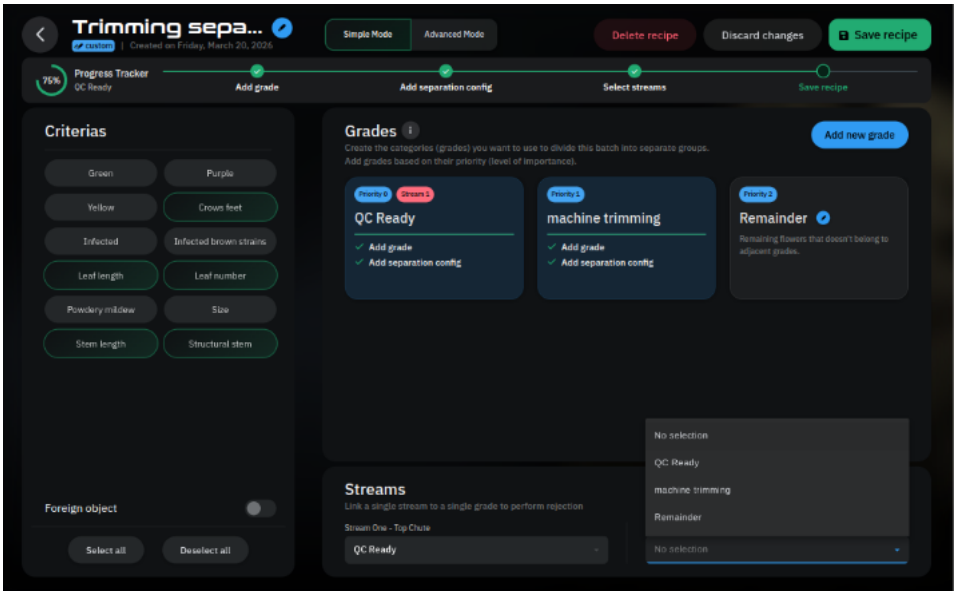


Figure 4.21: Stream Selection

Save Recipe

Finally, after making all required changes, click the **Save Recipe** button in the top right corner of the screen to save the recipe. This is the last step of setting up a new recipe.

4.1.6 Setup Modes

Simple Mode

Simple Mode provides configuration setup for typical grade separation needs. New recipes start in Simple Mode with only the **Remainder** grade (Figure 4.22). Creation and configuration of a new recipe can be done in this mode. In rare cases that more advanced options are needed to setup the recipe, mode can be switched to the advanced mode using the switch on the top of the screen.

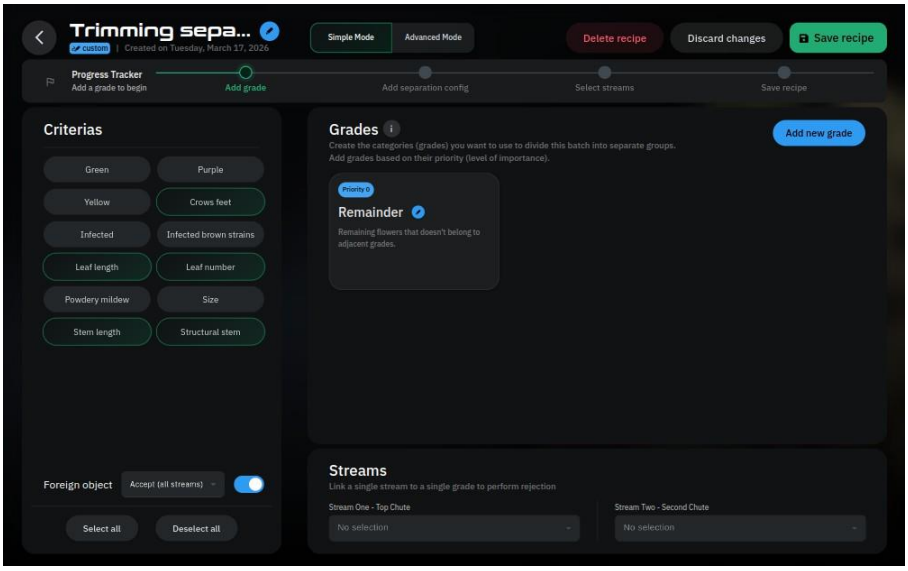


Figure 4.22: Simple Mode — default view with Remainder grade only

Advanced Mode

Advanced Mode provides full control over separation settings. In this mode, grades contain sub grades, grade priority (order of preference) can be changed, and Camera Mode settings are available (Figure 4.23). Subgrades are sub-configurations settings inside a grade that only applies to certain flower size ranges. Grade priority or level of importance can be used to determine which grade is more important compared to other grades. If a flower can belong to multiple grades, it will get a match to only the highest priority grade. An example of this instance is a big and leafy flower that can belong to both “big flower” grade and “un-trimmed” grade.

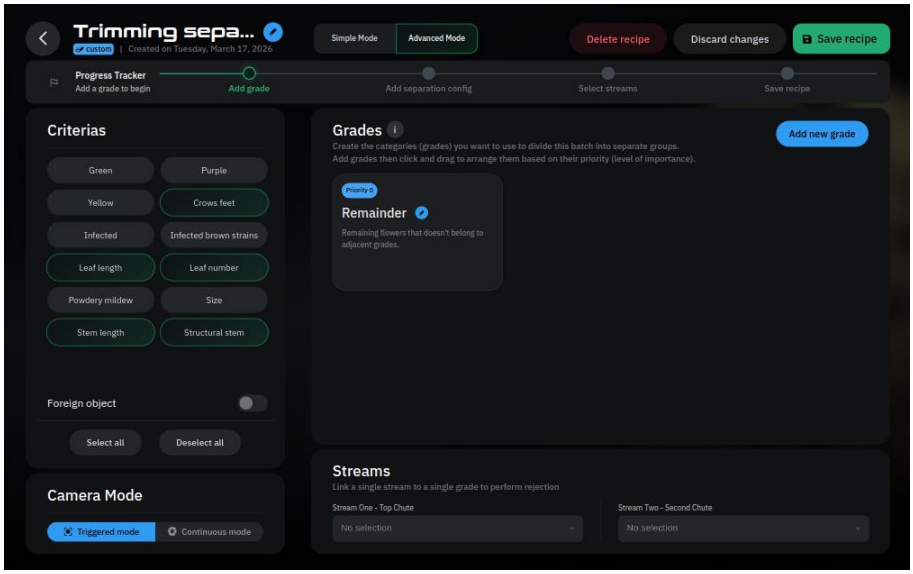


Figure 4.23: Advanced Mode — default view with Camera Mode settings visible

> If you switch from Advanced Mode back to Simple Mode, all Advanced Mode settings and configurations will be lost.

Grade Setup in Advanced Mode

Switch to Advanced Mode using the setup mode button at the top. Camera mode settings appear below the criteria list, and you can reorder grades by dragging and dropping the grade to a new position within the list. The **Remainder** grade always stays at the lowest priority (in order of preference).

Adding a New Grade

In Advanced Mode, grade creation follows the same steps as in Simple Mode. Click the **Add New Grade** button. Enter the grade name in the prompt, then click the **Add Grade** button. The new grade is added to the grade list for further setup.

Reviewing Grade Progress

Each grade card includes a progress bar that shows the setup progress for that grade. It also includes a checklist of completed and pending steps (Figure 4.24)**.**

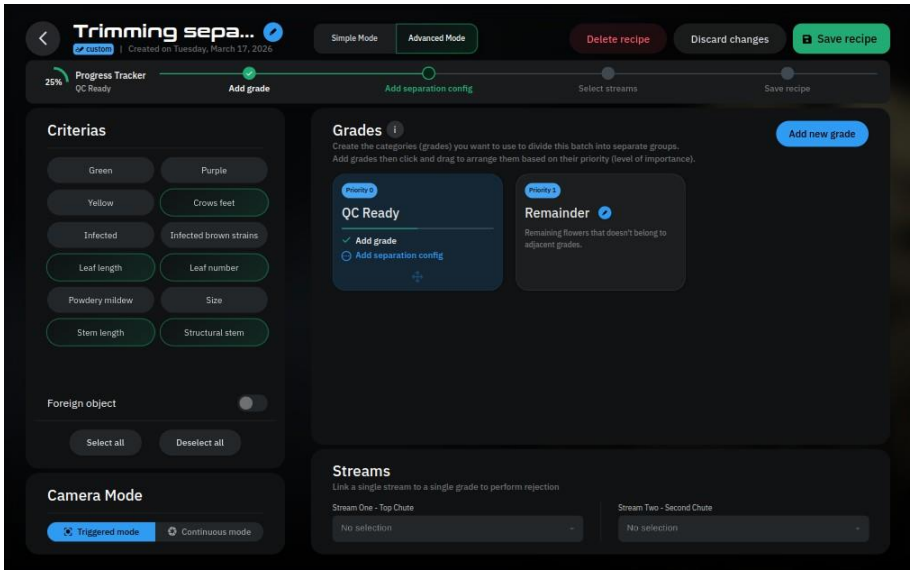


Figure 4.24: Advanced Mode — grade list with progress indicators

Setting Up Sub-Grades

Click on the grade card to open the Sub Grade Configuration settings. In sub grade configuration, you can divide the selected grade into smaller groups called sub grades. Each subgrade is only applicable to a defined size range of flowers. For example, you can create a subgrade with its own configurations for small flowers, and a different set of configurations for big flowers to define a complete grade. Instance for this will be the case that you need to separate flowers that need to be diverted to the hand trimming table, the trim state configurations for small flower and big flower may be different for defining all the flowers that need to be graded as hand trimming table. Use the size slider on the top to define the size range for each sub grade (Figure 4.25).

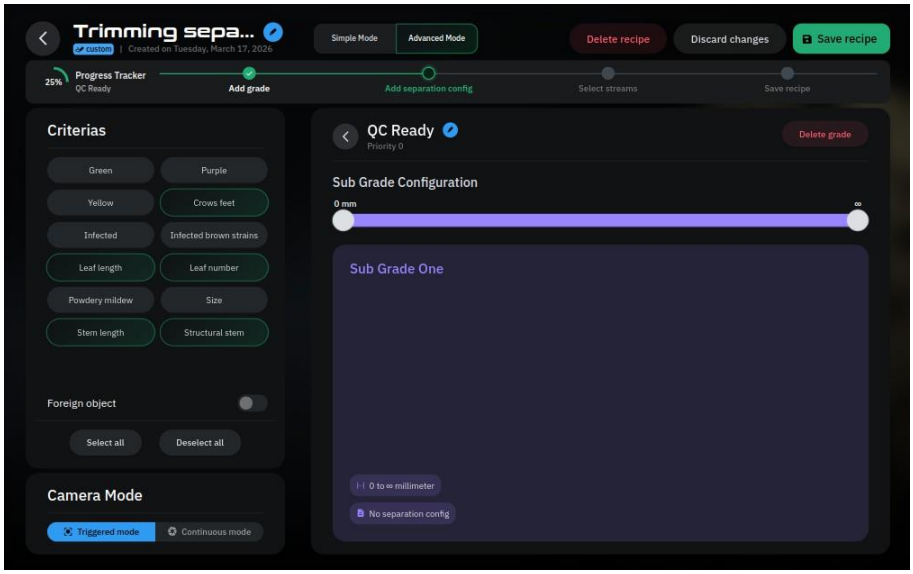


Figure 4.25: Sub-Grade Configuration — single sub-grade with size slider

Flower size is measured by the diagonal size of the flower. By moving the slider handles, you can set the size limits that apply to each sub grade (e.g. Flower with size from 0mm-27mm will be categorized to Sub Grade One). Marvel supports up to three sub grades for each grade (Figure 4.26).

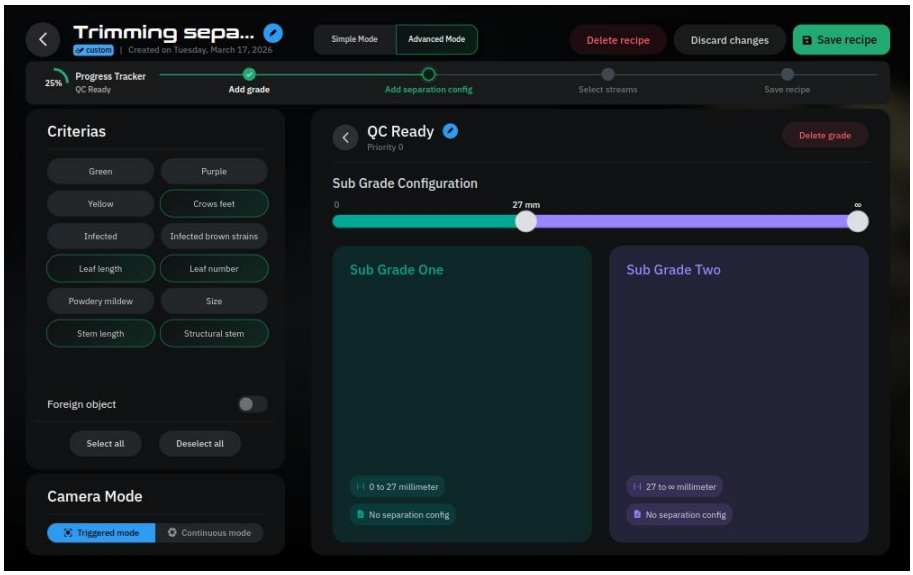


Figure 4.26: Multiple sub-grades configured with size ranges

Opening a Sub-Grade

Click on the sub grade card to open its configuration. You can edit an existing separation configuration by clicking the → action button on the list or add a new separation configuration by clicking the **Add separation config** button (Figure 4.27).

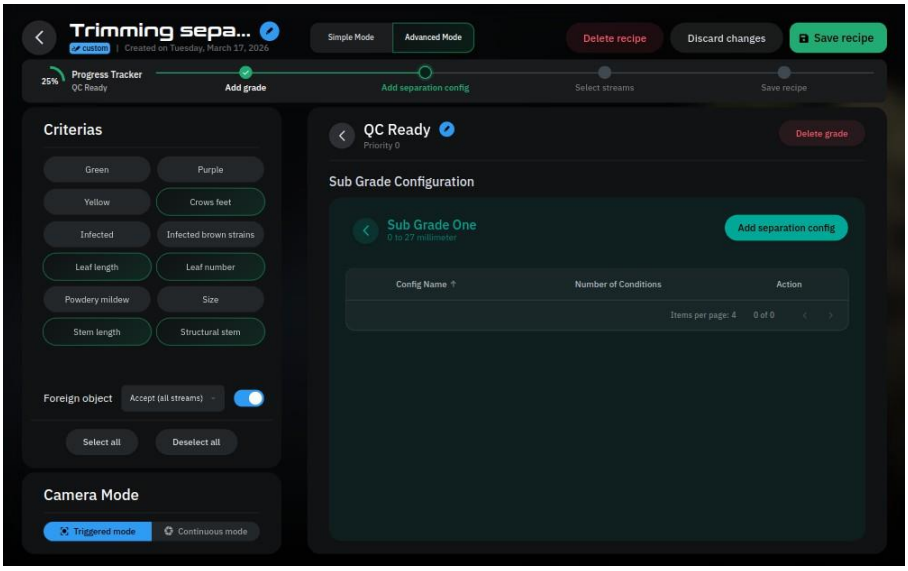


Figure 4.27: Sub-grade opened — separation configuration list

4.2 Separation Case Examples

4.2.1 Case 1: Flowers with Stem

To separate flowers with visible stems from the rest of the batch, use the settings below. This setup diverts stemmy flowers out of the main product stream.

Separation criteria: Stem Length and Structural Stem

1. Create a recipe called **Flowers with Stem**, Select Stem Length and Structural Stem as the criteria, then open the recipe settings using the edit pen. Add a new grade and name it **Stemmy Flower**.

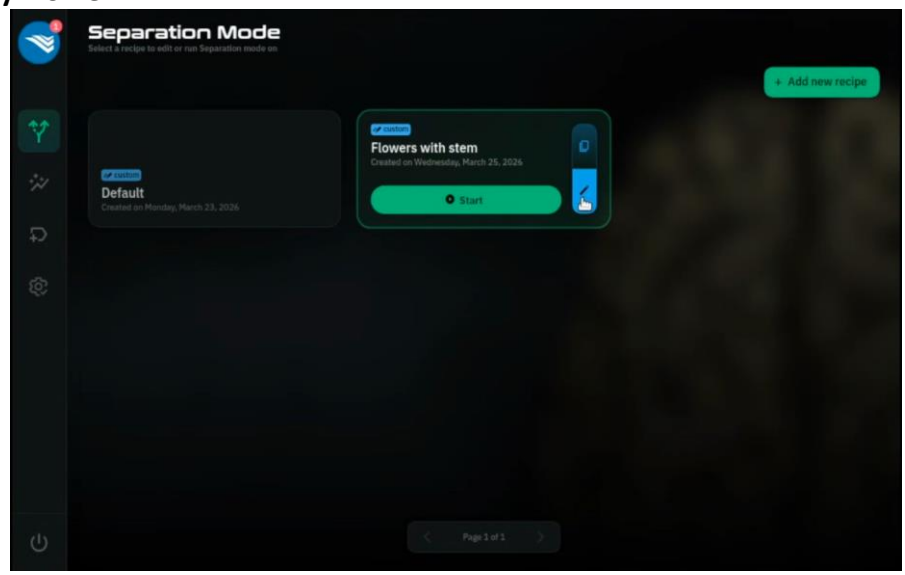


Figure 4.2.1-1: Recipe "Flowers with stem" created

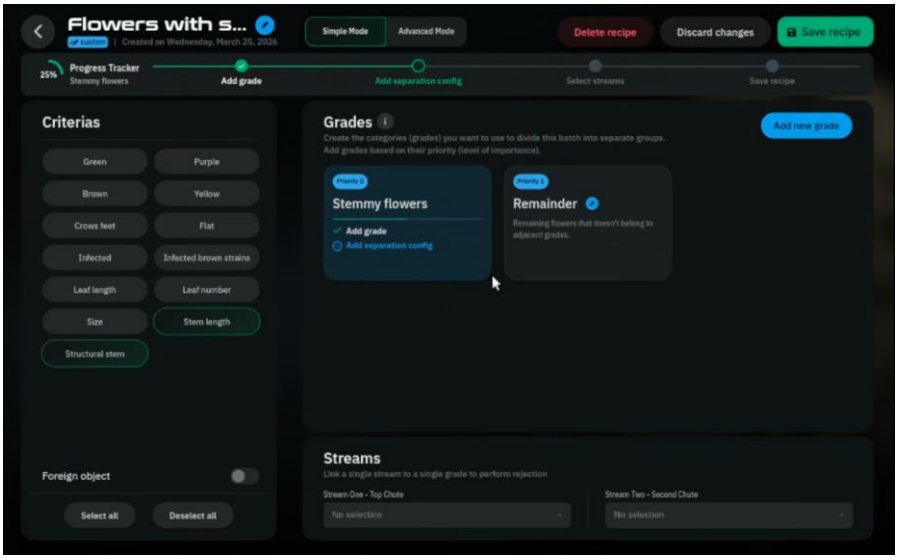


Figure 4.2.1-2: Grade "Stemmy Flowers" created

2. Open that grade and add a new separation configuration. Set Stem Length to class 2 and Structural Stem to class 3. Because we want to remove flowers with more stems, select the thumbs down direction for both settings.

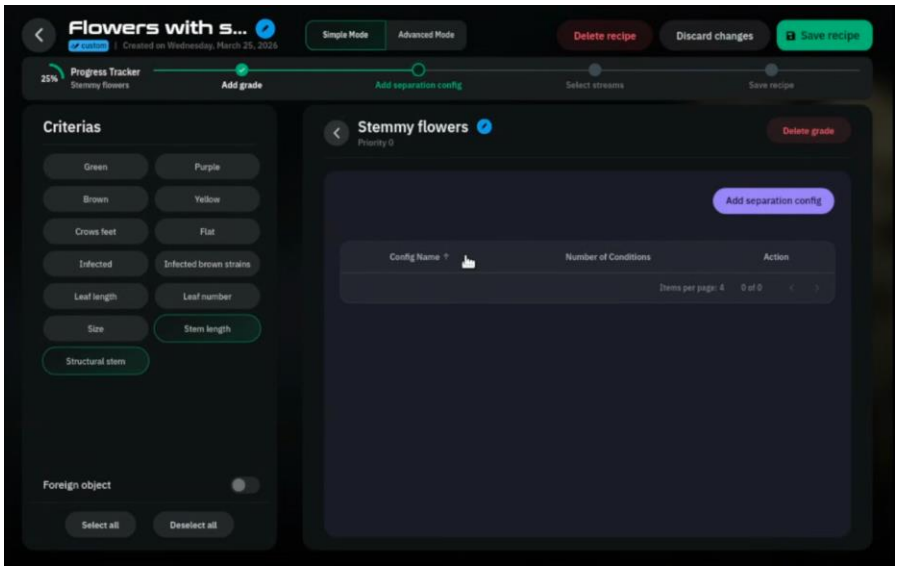


Figure 4.2.1-3: Grade customization page

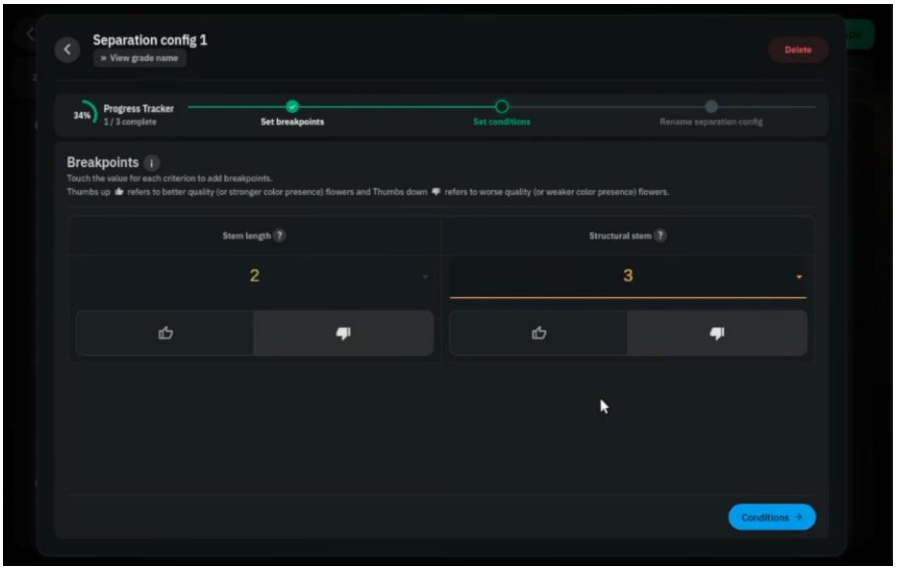


Figure 4.2.1-4: Select breakpoints values for separation configuration

3. In Conditions, include both Stem Length and Structural Stem, then choose Match Any, so a flower is separated if either condition is detected.

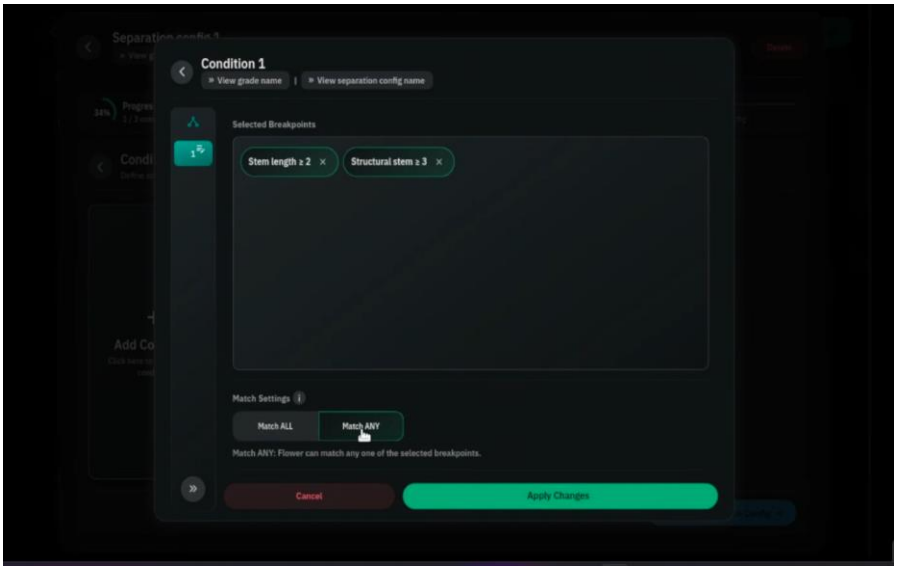


Figure 4.2.1-5: Create a condition

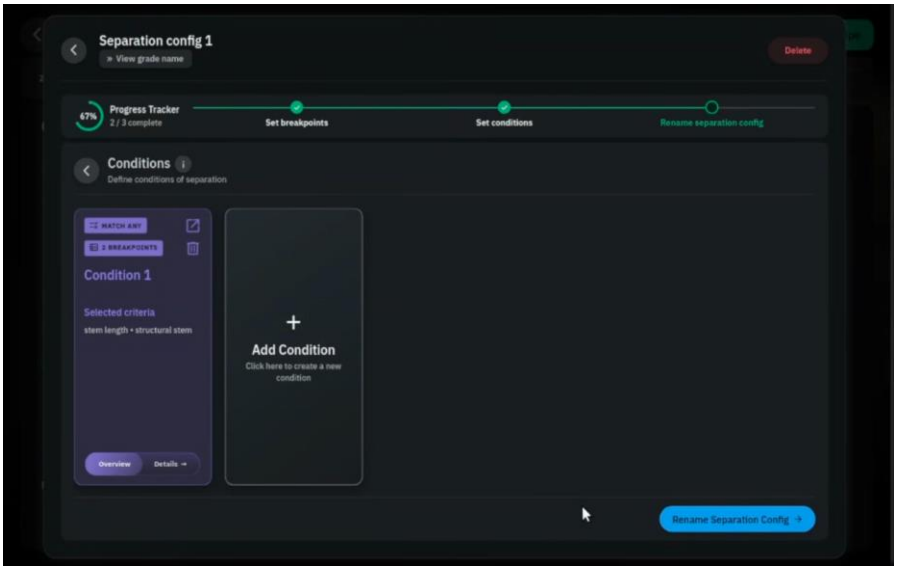


Figure 4.2.1-6: Condition created

4. Save the configuration, return to the main recipe page, and assign the Stemmy Flower grade to Stream 1. Save the recipe. The machine is now ready to separate stemmy flowers from the batch.

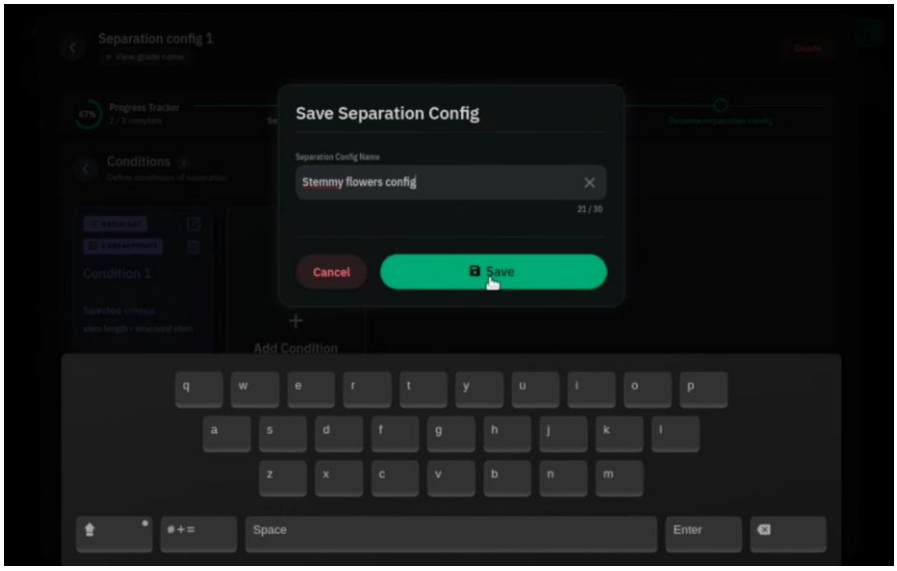


Figure 4.2.1-7: Condition created

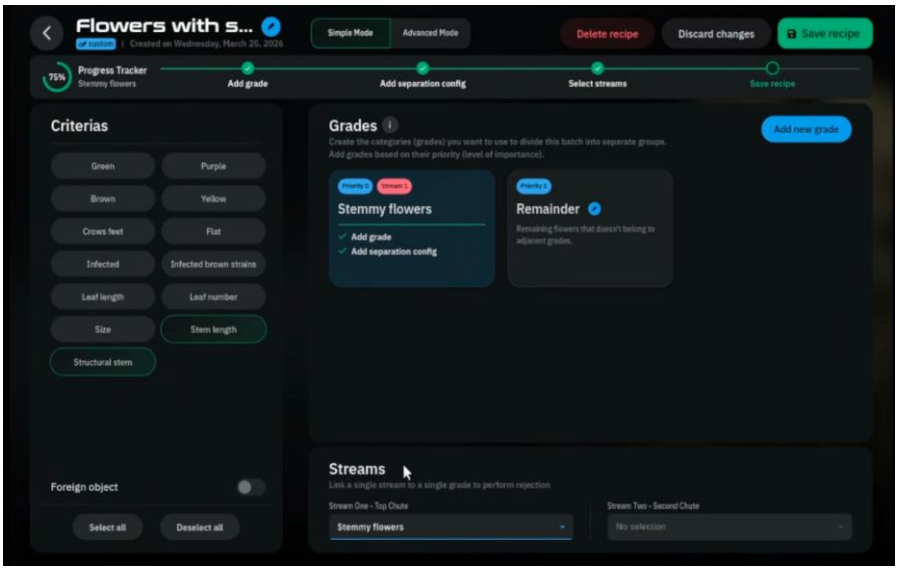


Figure 4.2.1-8: Stream selected

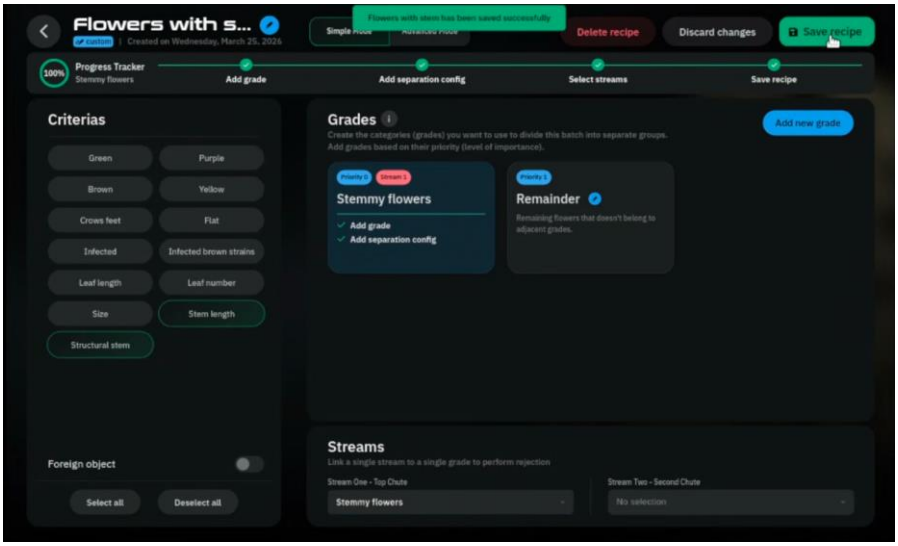


Figure 4.2.1-9: Recipe Saved

4.2.2 Case 2: Leafy flower

To separate flowers with noticeable leaf material from the rest of the batch, use the settings below. This setup removes leafy flowers from the main product stream

Separation criteria: Leaf Length and Leaf Number

1. Add a new recipe and name it **Leafy Flowers**. Select Leaf Length and Leaf Number as the criteria, then open the recipe settings with the edit pen. Added a new grade called **Leafy Flower**.

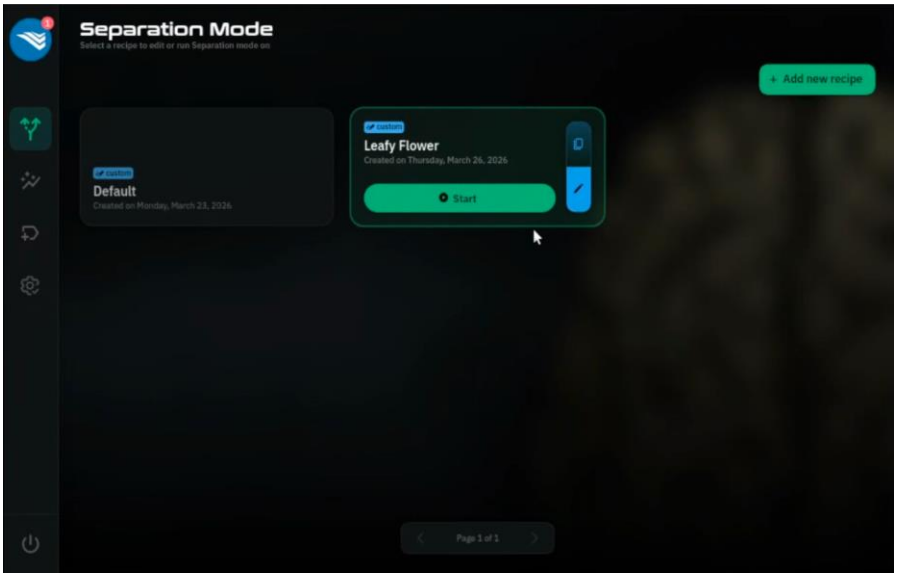


Figure 4.2.2-1: Leafy Flower recipe created

2. Create the first separation configuration for flowers with several short leaves. Set Leaf Length to class 3 and Leaf Number to class 2, select thumbs down, and set the condition to Match ALL so both thresholds must be present. Save that separation configuration.

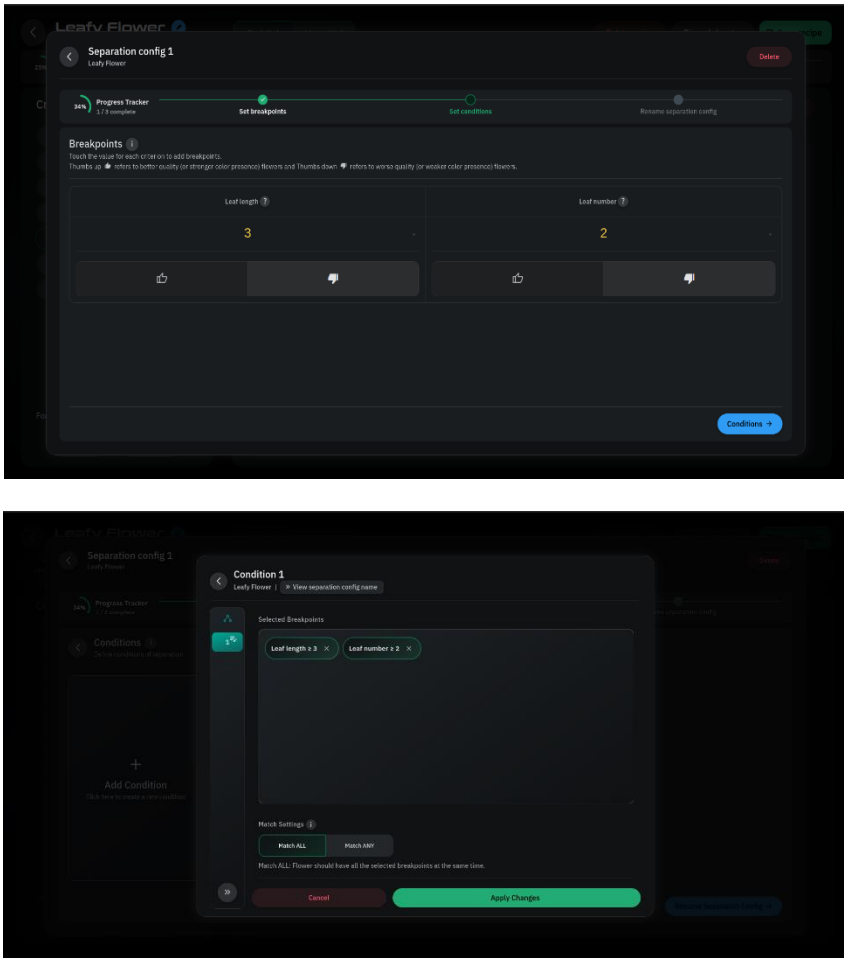


Figure 4.2.2-2: Leafy Flower Separation Config 1

3. Next, add a second separation configuration for flowers with medium leaf length and moderate leaf count. Set Leaf Length to class 4 and Leaf Number to class 1, then keep Match ALL condition.

4. Add a third separation configuration for flowers with long leaves by setting Leaf Length to class 5 and Leaf Number to class 0, again using Match ALL. Save each separation configuration.

5. Assign the grade to Stream 1 and save the recipe. The machine will now separate leafy flowers from the batch.

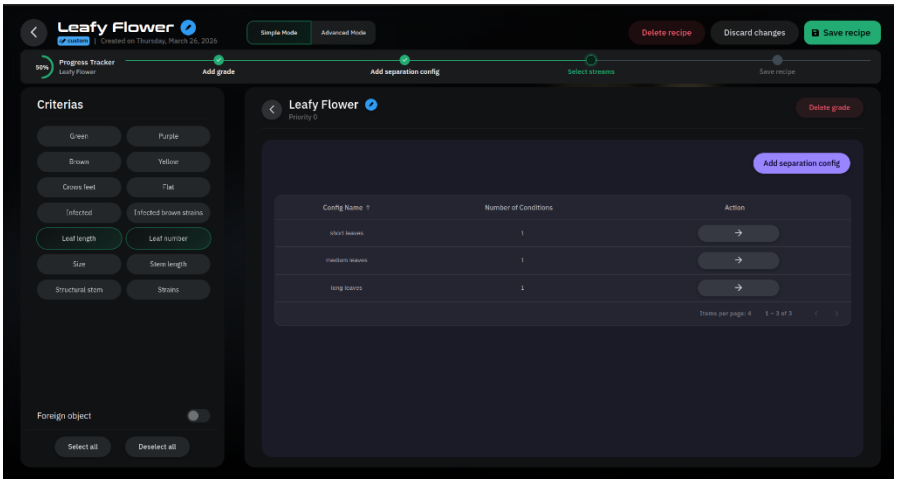


Figure 4.2.2-3: Leafy Flower separation Configs

4.2.3 Case 3: Crow's Feet

We will create a recipe to separate flowers with visible detached crow's feet. To separate flowers with visible detached crow's feet from the rest of the batch, use the settings below. This setup diverts those flowers away from the main product stream.

Separation criteria: Crow's Feet

1. Add a new recipe and name it **Crow's Feet**. Select Crow's Feet as the criterion, then open the recipe settings using the edit pen. Add a new grade called **Crow's Feet Flower**.

2. Open the grade and add a new separation configuration. Set Crow's Feet to class 4. Because we want to remove flowers with more visible crow's feet, choose the thumbs down direction. In Conditions, include Crow's Feet, then save the configuration.

3. Return to the main recipe page, assign the Crow's Feet Flower grade to Stream 1, and save the recipe. The machine is now ready to separate flowers with visible detached crow's feet from the batch.

4.2.4 Case 4: Brown Discoloration Separation

We will create a recipe to separate flowers with brown discoloration. To separate flowers with brown discoloration from the batch, use the settings below. This setup removes discolored flowers from the main product stream.

Separation criteria: Brown

1. Add a new recipe and name **Brown Discolored Flower**. Select Brown as the criterion, then open the recipe settings with the edit pen. Added a new grade called **Brown Flower**.

2. Open the grade and add a new separation configuration. Set the Brown surface coverage threshold to 15 percent. Because we want to separate flowers with browner present, select the thumbs up direction. This targets flowers showing approximately 15 percent or more brown surface coverage.

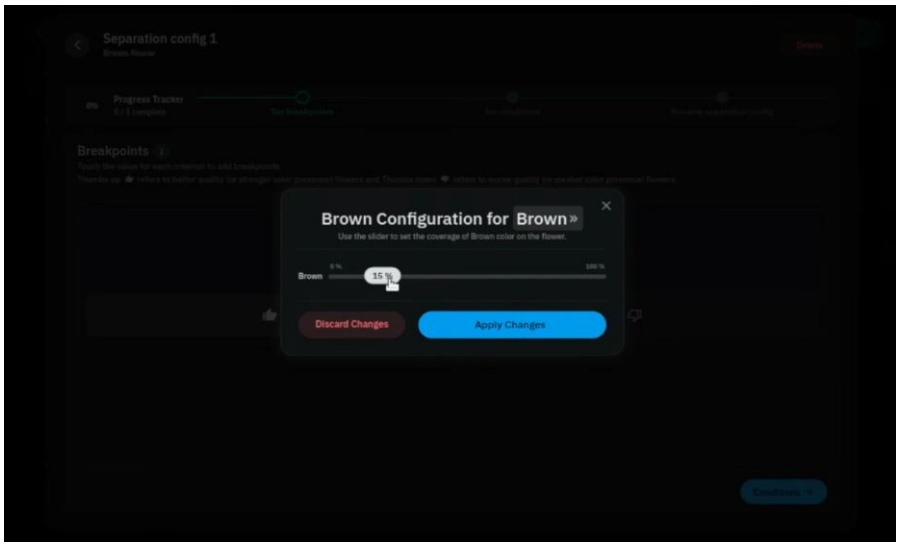


Figure 4.2.4-1: Set Brown threshold

3. In Conditions, include Brown, then save the separation configuration.

4. Return to the main recipe page, assign Brown Flower to Stream 1, and save the recipe.

4.2.5 Case 5: Purple Flowers Separation

We will create a recipe to separate purple flowers. To isolate purple flowers from the batch, use the settings below. This setup identifies flowers with purple surface coverage and diverts them to a dedicated stream.

Separation criteria: Purple

1. Add a new recipe and name it **Purple Flower**. Select Purple as the criterion, then open the recipe settings using the edit pen. Add a new grade called **Purple Flower**.
2. Open the grade and add a new separation configuration. Set the Purple surface coverage threshold to 10 percent. Because we want to separate flowers with stronger purple expression, choose the thumbs up direction. This targets flowers showing approximately 10 percent or more purple coverage. In Conditions, include Purple, then save the separation configuration.
3. Return to the main recipe page, assign the Purple Flower grade to Stream 1, and save the recipe. The machine will now separate purple flowers from the rest of the batch.

4.2.6 Case 6: **Separate Small Flowers and Stemmy Flowers**

We will build a recipe that separates both stemmy flowers and small flowers. To remove both stemmy flowers and undersized flowers from the main batch, use the settings below. This setup sends stemmy flowers to one stream and small flowers to another.

Separation criteria: Size, Stem Length, Structural Stem

1. Add a new recipe and name it **Small and Stem Separator**. Select Size, Stem Length, and Structural Stem as the criteria, then open the recipe settings with the edit pen. Add one grade called **Small** and another called **Stemmy Flower**.

2. Open the Stemmy Flower grade and add a separation configuration. Set Stem Length to class 2 and Structural Stem to class 3. Choose thumbs down for both settings, then include both criteria in Conditions and select Match Any so either stem condition can trigger separation. Save the configuration.

3. Next, open the Small grade and add a separation configuration using a size breakpoint of 18 millimeters. Because we want to separate smaller flowers, select thumbs down, include Size in Conditions, and save.

4. Return to the main recipe page, assign Stemmy Flower to Stream 1 and Small to Stream 2, then save the recipe. The machine will now separate both categories from the batch.

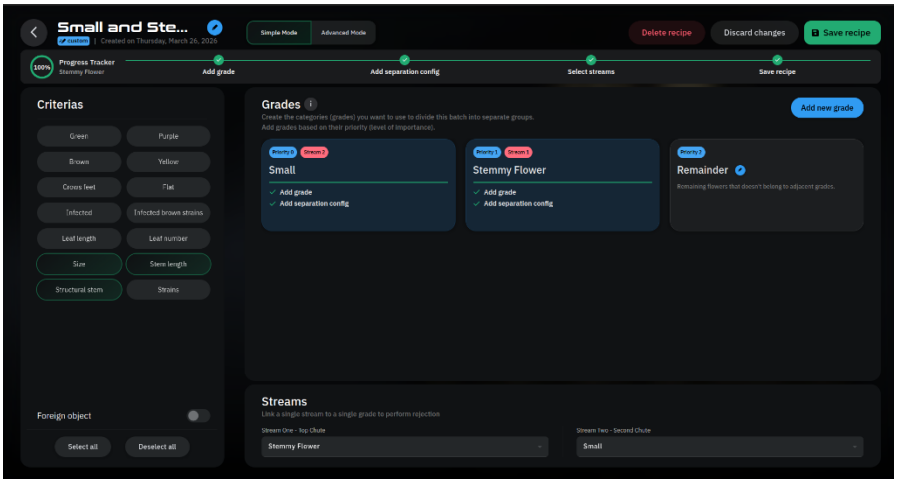


Figure 4.2.6: Small and Stemmy Flower

4.2.7 Case 7: Separate Moldy Flowers

To remove moldy flowers from the batch, use the settings below. This setup diverts suspect flowers away from the main product stream.

Separation criteria: Infected

1. Add a new recipe and name it **Moldy Flower**. Select Infected as the criterion, then open the recipe settings using the edit pen.

2. Add a new grade called **Moldy Flower**. Open the grade and add a new separation configuration. Set Infected to class 2 and choose thumbs down. This targets flowers showing visible surface infection as well as flowers that may indicate internal mold. In Conditions, include Infected, then save the separation configuration.

3. Return to the main recipe page, assign the Moldy Flower grade to Stream 1, and save the recipe. The machine is now ready to separate moldy flowers from the batch.

4.2.8 Case 8: **Separate Small Flowers and Moldy Flowers**

We will build a recipe that separates both moldy flowers and small flowers. To clean the batch by removing both moldy flowers and undersized flowers, use the settings below. This setup sends each category to its own stream.

Separation criteria: Size and Infected

1. Add a new recipe and name it **Small and Mold Separator**. Select Size and Infected as the criteria, then open the recipe settings using the edit pen. Add one grade called **Small** and another called **Moldy**.
2. Open the **Moldy** grade and add a separation configuration. Set Infected to class 2, choose thumbs down, include Infected in Conditions, and save.
3. Next, open the Small grade and add a second separation configuration. Set Size to 18 millimeters, choose thumbs down, include Size in Conditions, and save.
4. Return to the main recipe page, assign Moldy to Stream 1 and Small to Stream 2, then save the recipe. The machine is now ready to remove both moldy flowers and small flowers from the batch in a single pass.

4.2.9 Case 9: Shaggy Flowers

To separate shaggy flowers from the batch, including flowers with visible stem, leaf, or crow's feet, use the settings below. This setup diverts those flowers out of the main product stream.

Separation criteria: Leaf Length, Leaf Number, Stem Length, Structural Stem, and Crow's Feet

1. We will create a recipe to separate shaggy flowers. Add a new recipe and name it **Shaggy Flower**.

2. Add a new grade called **Shaggy Flower**. Create the first separation configuration for stemmy flowers or flowers with visible Crow's feet. Set Stem Length to class 2, Structural Stem to class 3, and Crow's Feet to class 4. Choose thumbs down and set the condition to Match Any so any one of these defects can trigger separation. Save the separation configuration.

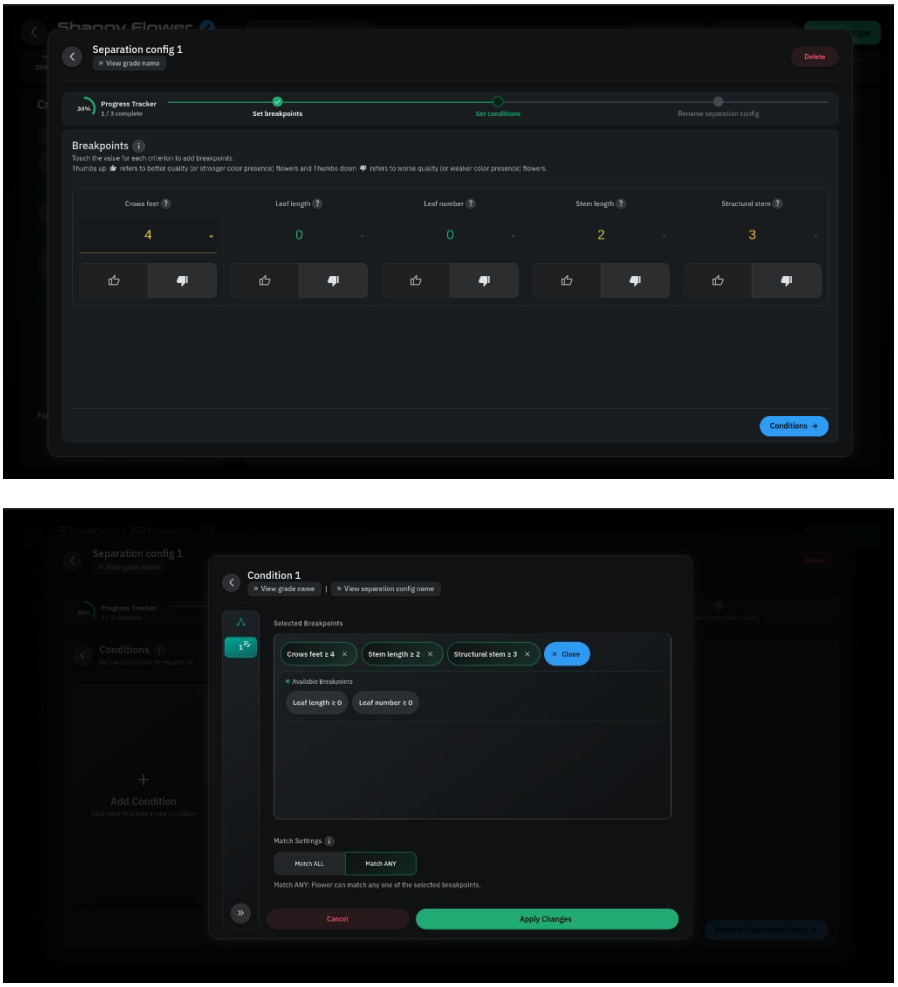


Figure 4.2.9-1: Stem and Crow's Feet separation Configuration

3. Next, add three leaf-based configurations: Leaf Length class 3 with Leaf Number class 2, then Leaf Length class 4 with Leaf Number class 1, and finally Leaf Length class 5 with Leaf Number class 0. Use thumbs down and Match All for each of those separation configurations. Save each one.

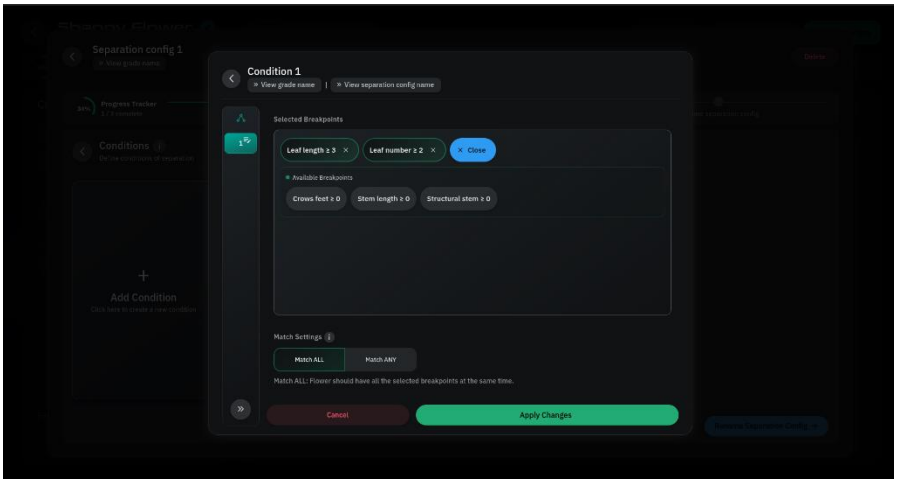


Figure 4.2.9-2: Leaf separation Configuration 1

4. Return to the main recipe page, assign Shaggy Flower to Stream 1, and save the recipe. The machine will now separate shaggy flowers from the batch.

4.2.10 Case 10: **Big and Well-Trimmed Flowers**

We will create a recipe for big, well-trimmed flowers. To separate larger flowers that are well trimmed and not moldy, use the settings below. This setup identifies premium flowers and sends them to a dedicated stream.

Separation criteria: Leaf Length, Leaf Number, Stem Length, Structural Stem, Crow's Feet, Infected, Size.

1. Add a new recipe and name it **Good and Big Flowers**. Then open the recipe settings using the edit pen. Add a new grade called **Big and Good**.

2. Open the grade and create the first separation configuration. Set Size to 26 millimeters, Stem Length to class 1, Structural Stem to class 2, Crow's Feet to class 3, Infected to class 1, Leaf Length to class 2, and Leaf Number to class 3. Because we are selecting the better state, choose thumbs up and use Match All so every condition must be met. Save that separation configuration.

3. Then add a second configuration with Size still at 26 millimeters, Leaf Length at class 3, Leaf Number at class 1, Stem Length at class 1, Structural Stem at class 2, Crow's Feet at class 3, and Infected at class 1. Keep thumbs up and Match All. Save the separation configuration.

4. Assign **Big and Good** to Stream 1 and save the recipe. The machine will now separate larger, well-trimmed flowers from the batch.

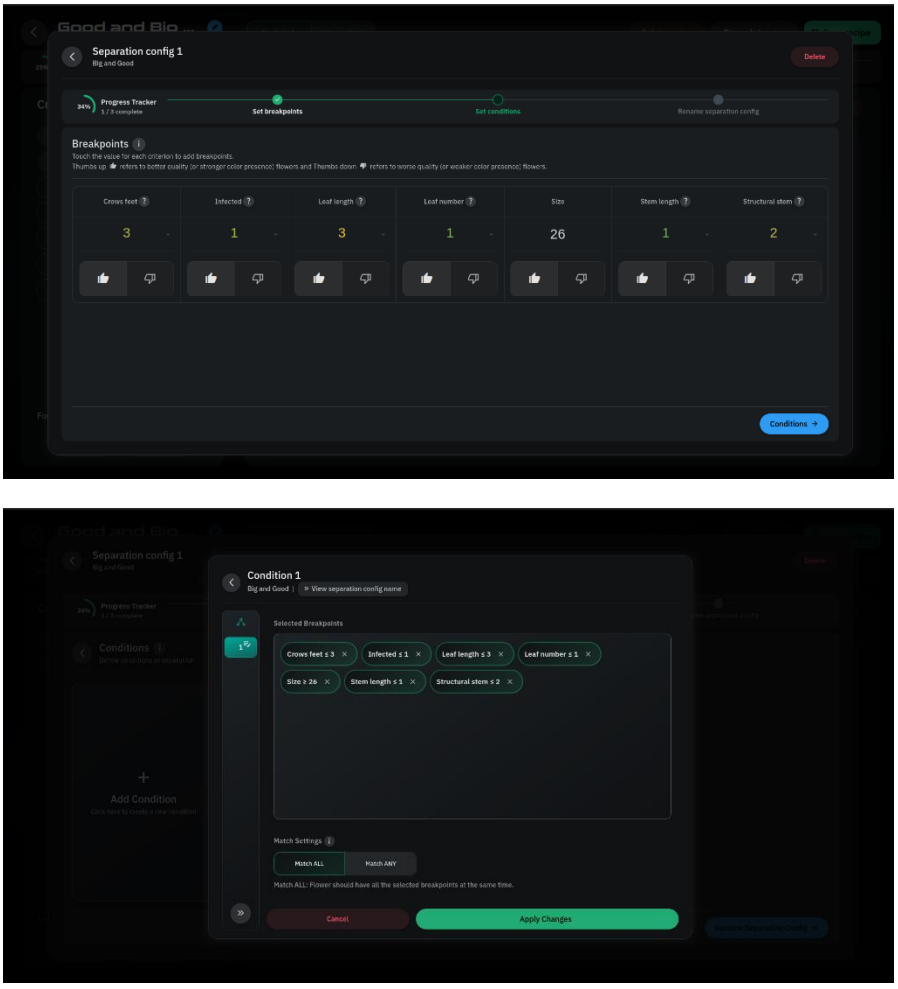


Figure 4.2.10-1: Second separation Configuration

4.2.11 Case 11: **Separate Very Shaggy Flowers from Flowers Requiring Only 0 to 3 Manual Snips**

The goal is to isolate very shaggy flowers so the remainder consists of flowers that need little or no manual touch-up. To separate flowers that need minimal hand touch-up from flowers that require much more trimming, use the settings below. Flowers needing only 0 to 3 manual snips can move forward quickly, while very shaggy flowers can be routed for additional processing.

Separation criteria: Leaf Length, Leaf Number, Crow's Feet

1. Add a new recipe and name it **Very Shaggy Flower**. Select Leaf Length, Leaf Number, and Crow's Feet as the criteria, then open the recipe settings with the edit pen.
2. Add a new grade called **Very Shaggy Flower**. Create the first separation configuration for flowers with many medium leaves and visible crow's feet by setting Leaf Length to class 3, Leaf Number to class 3, and Crow's Feet to class 3. Choose thumbs down and use Match All. Save that separation configuration.
3. Next, add a second separation configuration with Leaf Length class 4, Leaf Number class 2, and Crow's Feet class 3, again using thumbs down and Match All. Then add a third separation configuration with Leaf Length class 3, Leaf Number class 2, and Crow's Feet class 5. Save each separation configuration.
4. Assign Very Shaggy Flower to Stream 1 and save the recipe. The machine will now separate the flowers that need more trimming work.

4.2.12 Case 12: **Separate Flowers That Are Ready to Be Packaged**

We will create a recipe to identify flowers that are ready to be packaged. To identify flowers that are ready to pack, use the settings below. This setup selects flowers with clean trim, low stem exposure, limited crow's feet, and no infection.

Separation criteria: Leaf Length, Leaf Number, Stem Length, Structural Stem, Crow's Feet, Infected

1. Add a new recipe and name it **Good to Pack**. Then open the recipe settings using the edit pen.
2. Add a new grade called **Good to Pack**. Create the first separation configuration with Leaf Length at class 1, Leaf Number at class 3, Stem Length at class 1, Structural Stem at class 1, Crow's Feet at class 2, and Infected at class 0. Because we are selecting the better condition, choose thumbs up and use Match All. Save that separation configuration.
3. Then add a second separation configuration with Leaf Length at class 2 and Leaf Number at class 2, while keeping Stem Length at class 1, Structural Stem at class 1, Crow's Feet at class 2, and Infected at class 0. Keep thumbs up and Match All. Save the separation configuration
4. Assign **Good to Pack** to Stream 1, and save the recipe. The machine will now separate flowers that are ready for packaging.

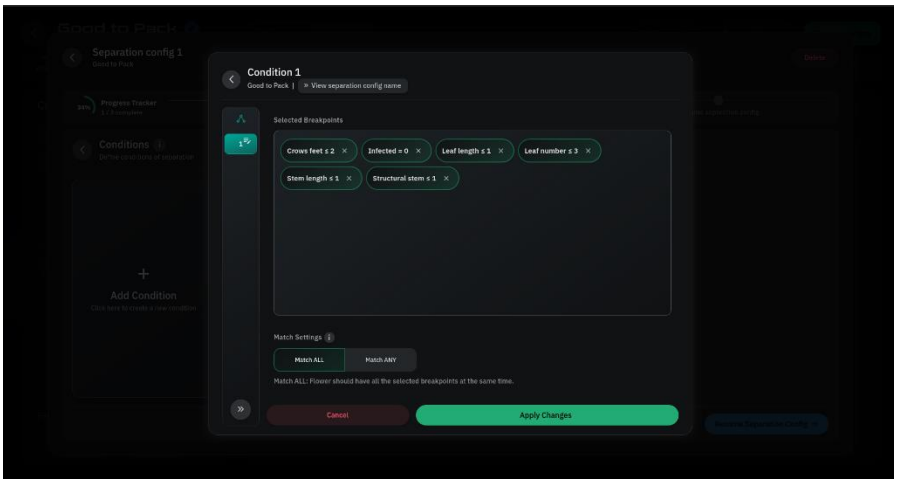


Figure 4.2.12-1: First separation Configuration

4.2.13 Case 13: **Separate Flowers by Strain**

We will create a recipe to separate Jellyfish flowers from Runts flowers. To separate flowers by strain, such as Jellyfish from Runts, use the settings below. This setup identifies one strain and diverts it to a dedicated stream.

Separation criteria: Strains.

1. Add a new recipe and name it **Jellyfish Flower**. Select Strains as the criterion, then open the recipe settings using the edit pen.
2. Add a new grade called **Jellyfish**. Open the grade and add a new separation configuration. Set Strain to class 11. In Conditions, include Strains, then save the configuration.
3. Return to the main recipe page, assign Jellyfish to Stream 1, and save the recipe. The machine is now ready to separate Jellyfish flowers while the remaining flowers continue in the remainder stream.

4.3 Fine-Tuning Recipes to Adjust Output Streams

If you already have a base recipe and need to make small changes to the differentiation of the output streams, you can fine-tune the recipe by making incremental adjustments to the relevant breakpoints.

Fine adjustments may be useful in cases such as:

1. Making the separation of leafy flowers stricter or reduce the pass threshold for the acceptable leaf length.
2. Allowing flowers with small stems to pass when stem-length separation is too strict.
3. Loosening the purple color surface-area requirement so that flowers with slightly smaller purple coverage are also captured.
4. Adjusting the threshold by 1 mm when separating medium flowers from small flowers to capture more medium flowers that were mixed with the smalls.

In general, fine-tuning Marvel to create small or incremental changes between separated streams is done by adjusting the breakpoints. This is done by increasing or decreasing the breakpoint value by 1.

We recommend making one incremental change at a time, evaluating the result, and then making another incremental change only if necessary.

The following examples show how to apply this process.

4.3.1 Example 1: Tightening the Acceptance Threshold for Crow's Feet

During examination of the separated flowers, some flowers in the good stream may have small crow's feet.

Tighten the acceptance threshold for crow's feet to eliminate even small crow's feet from the good stream.

To make this adjustment:

1. Go to the **Edit Recipe** section.
2. Select the corresponding grade.
3. Reduce the breakpoint value for **crow's feet** by 1.
4. Save the configuration.
5. Save the recipe.

The change is now applied and the recipe is ready to run.

4.3.2 Example 2: Loosening the Stem Allowance

During examination of the separated flowers, some flowers in the stem-separated stream may have very small stems. The amount of stem on some of these flowers may be small enough to be acceptable.

Loosen the acceptance threshold for stem length to avoid unnecessary extra work on those flowers.

To make this adjustment:

1. Go to the **Edit Recipe** section.
2. Select the corresponding grade.
3. Increase the breakpoint value for **stem length** by 1.
4. Save the configuration.
5. Save the recipe.

The change is now applied and the recipe is ready to run.

4.3.3 Example 3: Purple Flower Separation

During examination of the separated flowers, some flowers in the non-purple stream may have a small purple surface area. The purple amount on some of these flowers may be small, but still acceptable as purple.

Loosen the threshold for the required purple surface area on the flower to capture more flowers that can be accepted as purple.

To make this adjustment:

1. Go to the **Edit Recipe** section.
2. Select the corresponding grade.
3. Reduce the breakpoint value for **purple surface area** by 1% to 3%.
4. Evaluate the result.
5. Make another incremental change only if necessary.
6. Save the configuration.
7. Save the recipe.

The change is now applied and the recipe is ready to run.

4.3.4 Example 4: Separating Medium Flowers That Were Mixed with Smalls

During examination of the separated flowers, some flowers in the small-flower stream may be large enough to be acceptable as medium flowers. The combination of length and width makes these flowers appear larger than the rest, and they can be placed in the medium-size flower stream.

Loosen the size threshold for the medium-flower stream to avoid downgrading these flowers to the small stream.

To make this adjustment:

1. Go to the **Edit Recipe** section.
2. Select the corresponding grade.
3. Reduce the size breakpoint value in the **medium flower** configuration by 1 step.
4. Evaluate the result.
5. Make another incremental change only if necessary.
6. Save the configuration.
7. Save the recipe.

The change is now applied and the recipe is ready to run.

4.4 Analytics Mode

In Analytics Mode, you can get the statistics of a batch that you put into Marvel by running the recipes. In this mode, Marvel will not separate the batches, but it will give you the analytic data of the running batches based on the criteria set up in the recipes (Figure 4.28).

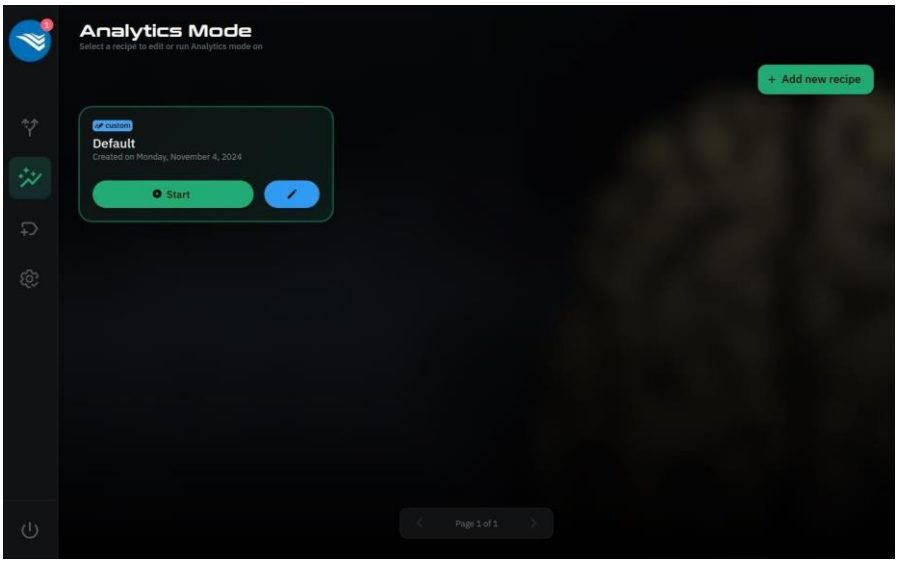


Figure 4.28: Analytics Mode home screen

4.4.1 Determining Breakpoint Values for New Recipe using Analytics Mode

One of the steps in creating a new recipe is determining the breakpoint values for the criteria you want to use in Separation Mode. These breakpoints define the separation boundaries between different flower outputs. For example, you may want to set breakpoints for criteria such as leaf length, leaf number, stem length, or structural stem length.

Analytics Mode is a helpful tool for determining these values. In Analytics Mode, Marvel analyzes sample flowers and displays the measured values for the active criteria. You can then use this information to decide which values should be used as the separating boundaries, or breakpoints, between different groups of flowers.

To begin, manually separate a small sample of flowers into the output groups you want Marvel to separate them into. A handful of flowers for each output group is sufficient.

Next, go to **Analytics Mode** on Marvel. Create a new recipe, or use an existing recipe, that has the relevant criteria activated for the type of separation you want to perform. For example, if you are separating flowers based on leafiness and stemminess, the recipe should have criteria such as **leaf length**, **leaf number**, **stem length**, and **structural stem length** activated.

Run the recipe and send flowers from one specific output group through the machine. As Marvel analyzes the flowers, take note of the values shown on the screen for each active criterion. You should also review the full batch data analytics charts for the active criteria list.

This process provides information about the typical values associated with each specific output group. By comparing the data from the different groups, you can determine which values should act as the boundary points between them. These boundary points become the breakpoint values used to separate the groups of flowers from each other in Separation Mode.

4.5 Labelling Mode

In addition to making Marvel more intelligent, you can train the machine in Labelling mode. Marvel offers a platform that allows you to define the flower levels while running the batches (Figure 4.29).

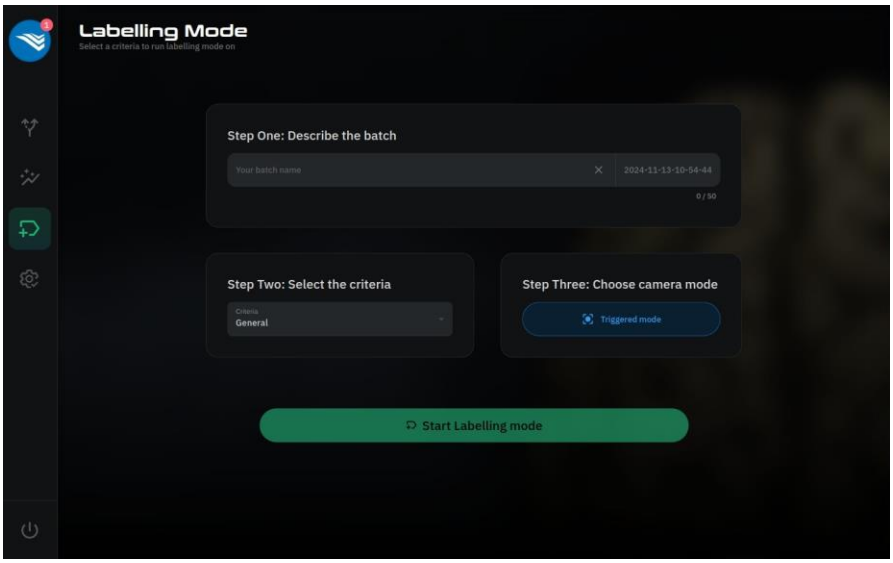


Figure 4.29: Labelling Mode home screen

Setup Steps

Step 1. Batch name input field. It is required to name the batch for result storage and analysis.

Step 2. Labelling criteria selection. Criteria that determine the flower quality are listed in the drop-down list; you can choose one specific criterion for the training in each run.

Step 3. Camera mode selection. Set up the cameras whether they will keep taking images or only take images when the flower is detected.

Some of the defects on the flower are only visible from one side, so multiple cameras are mounted on different sides inside the machine to take image of the dropping flower, each flower will be captured from different angles, to make sure that the defects won't be missed.

Labelling Scenarios

- **When training Marvel with good examples without defects:** Choose 'General' from criteria drop-down list and run the flower batch.

- **When the criterion already exists:** You may examine multiple images of a single flower and tag each image of each side of the flower on the screen by clicking on the corresponding level number in the bucket list. Click on the class level that the flower belongs to and click 'Next' (Figure 4.30). A lower number indicates better quality in the selected criteria, while a higher number signifies worse quality.
- **Criterion does not exist:** Inform Keirton support team of the case and definition of the criteria. Choose 'General' from the criteria drop-down list, run the flower batches and act as Keirton support team instructed you to do.

Beside the labelling option in the portal, you can click the **Skip all** button to skip the remaining images) or click the **exit** button (located on the top right of the screen) to terminate the labelling process.

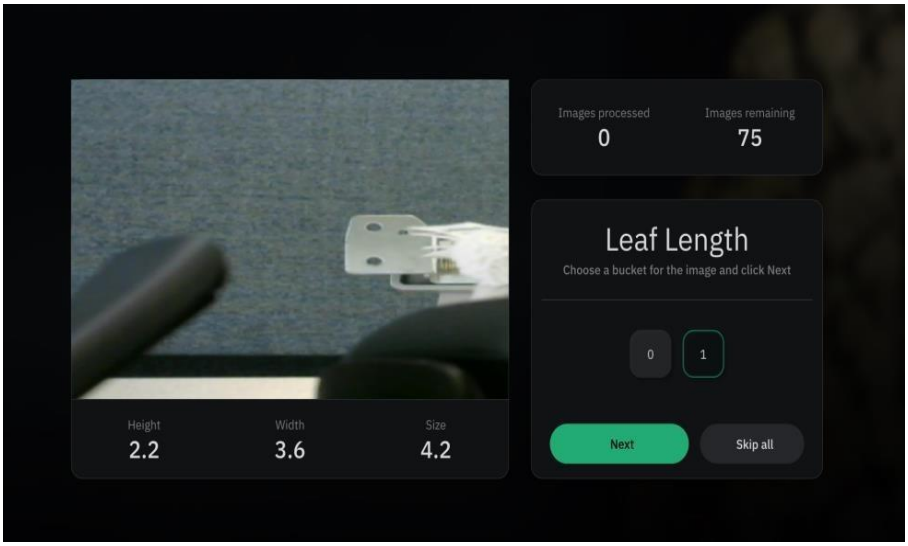


Figure 4.30: Choosing a class level for each flower

Hardware Testing

Hardware testing offers the option to troubleshoot if the air valves or cameras are working as expected (Figure 5.1).

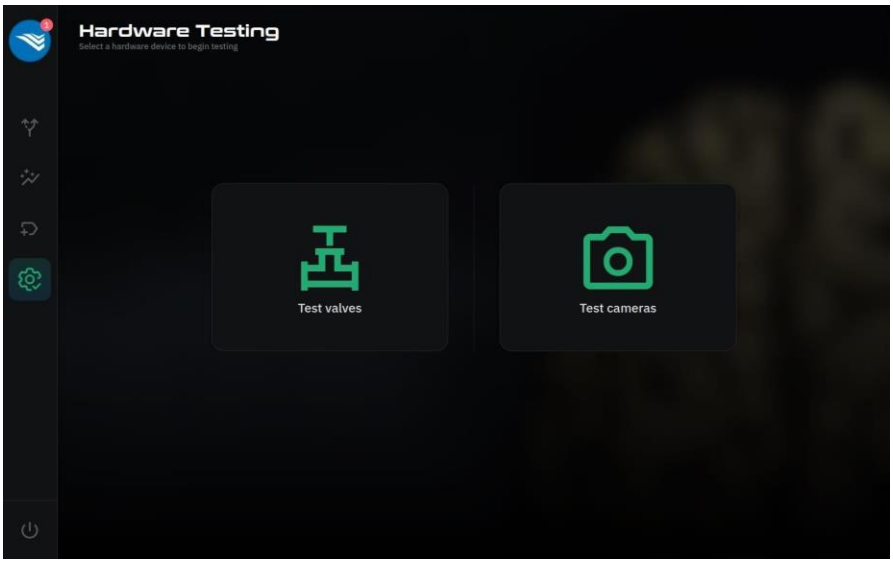


Figure 5.1: Hardware Testing home screen

5.1 Air Stream Testing

To test the air streams and verify the air is pushed out from the selected valves, you can select one or multiple valve items from the screen and click the **Test valves** button.

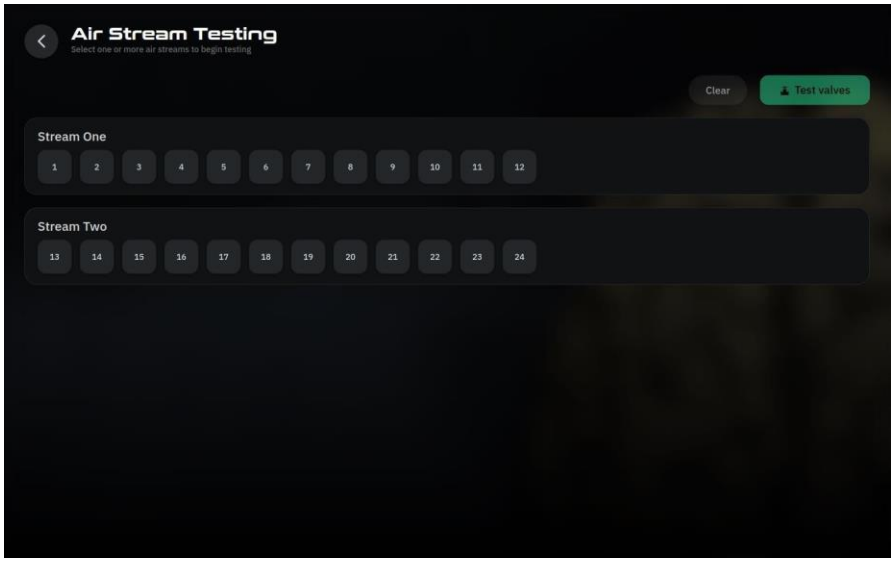


Figure 5.2: Air stream testing

5.2 Camera Testing

Two modes: **Instant Shot** and **Flower Triggered Shot**.

5.1.1 Troubleshooting

When clicking on the mode, it will take a while for the camera to set up, then the test mode will be ready when the initialization process is finished.

The initialization process should not exceed 2 seconds, if it takes more than 2 seconds, the screen will show the error information (see Figure 5.3), in this case, please go back to the home page to restart Marvel.

When exiting the camera test mode, a process is running in the background to disconnect the cameras. This process should not exceed 2 seconds, otherwise the screen will show an error banner indicating that the process fails to disconnect the cameras (see Figure 18-2). In this case, please click the **back** button again to the home screen and restart Marvel or contact Keirton support team.

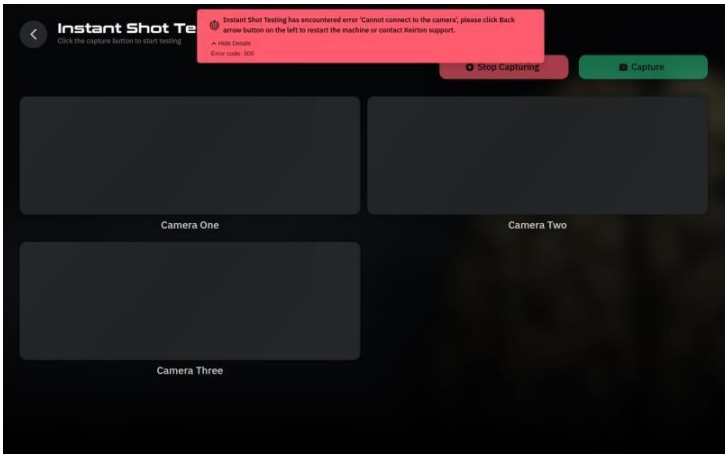


Figure 5.3: Camera initialization failure

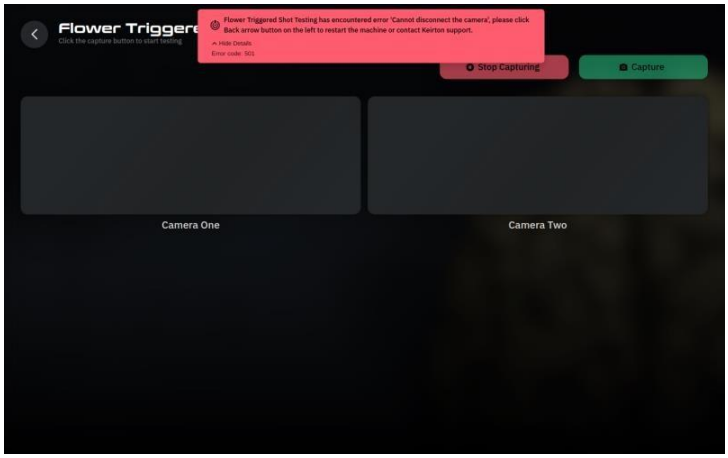


Figure 5.4: Camera disconnection failure

5.1.2 Instant Shot

Cameras capture immediately when **Capture** button is clicked.

1. **Initiating:** A banner on the top of the screen shows the mode is initiating, testing buttons are disabled (Figure 5.5).
2. **Ready for test:** When the testing mode is ready, a green banner will appear, and it informs that Marvel is ready for camera testing, 'Capture' button will become available (Figure 5.6).
3. **Start test:** Click to take an image.
4. **Stop and exit test:** Click the back arrow (top-left).

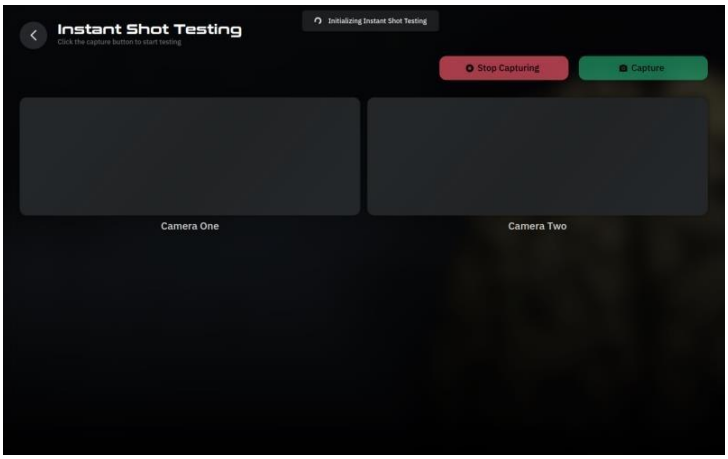


Figure 5.5: Camera test — initializing

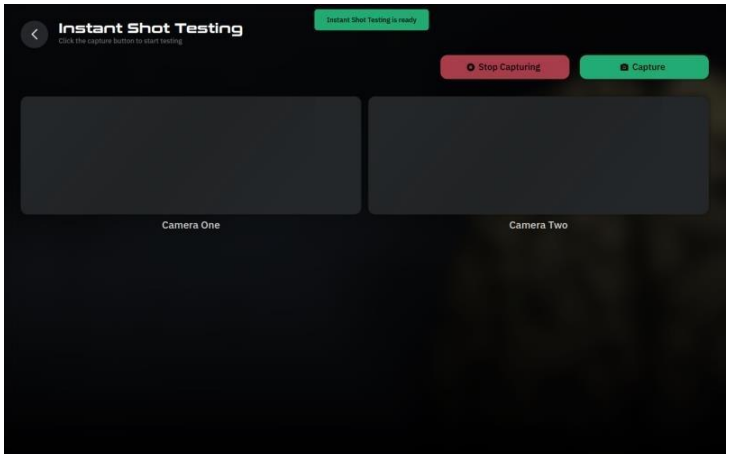


Figure 5.6: Camera test — ready

5.1.3 Flower Triggered Shot

In this mode, cameras will capture images only when the sensor detects dropping flowers. Same as the instant shot mode, it will take some time to initiate the testing mode.

1. **Start test:** After clicking on the 'Capture' button, the mode will provide a 5-minute window for users to place flowers on the conveyor. If the sensor doesn't detect any flowers within 5 minutes, testing mode will automatically stop.

2. **Stop shot:** During the waiting period, you can still click on the red 'Stop Capturing' button on the screen to stop the testing.

Settings

Click on the Keirton icon on the top left of the screen, the settings panel will show up.

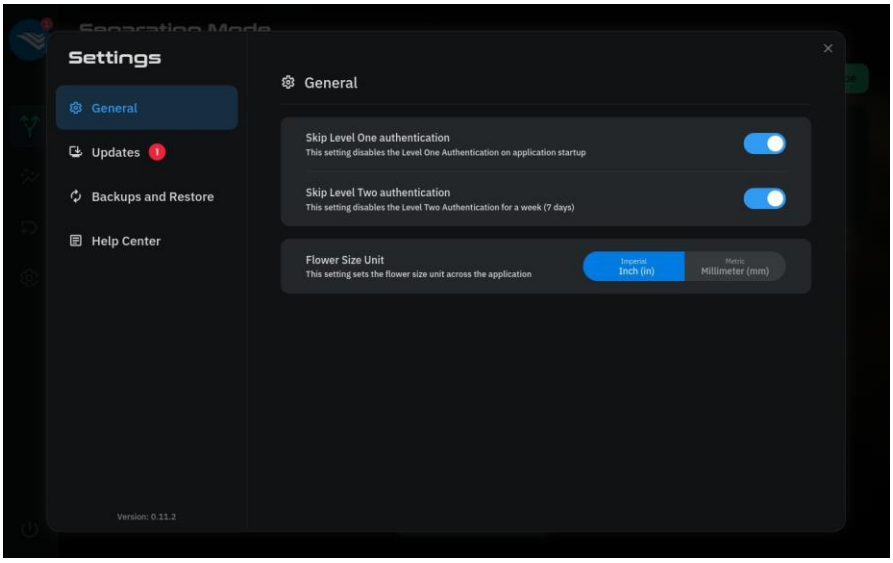


Figure 6.1: Settings menu

6.1 General Settings

There are two setting sections – Skip level authentication and Change flower size unit (see Figure 6.1).

- **Level Authentication:** Level One authentication controls entering the application and making changes in labelling mode; Level Two authentication controls editing the recipe and changing settings. When the toggle is on, that means the authentication input is not needed.
- **Flower size unit:** Measurement units vary in different regions; you can set up your measurement unit by clicking the unit buttons based on your preferences.

6.2 Updates

Marvel checks for the latest updates automatically. Click **Check for Updates** to refresh manually. If the latest cumulative update is available (see figure 6.2), click **Download and Install**. Otherwise, the panel will show system-up-to-date information. A **Pre-update Backup** is created automatically, which will be stored in the Backup and Restore section.

During updates, Marvel should not be disconnected from power or network. Machine restart is required after updates (see Figure 6.3).

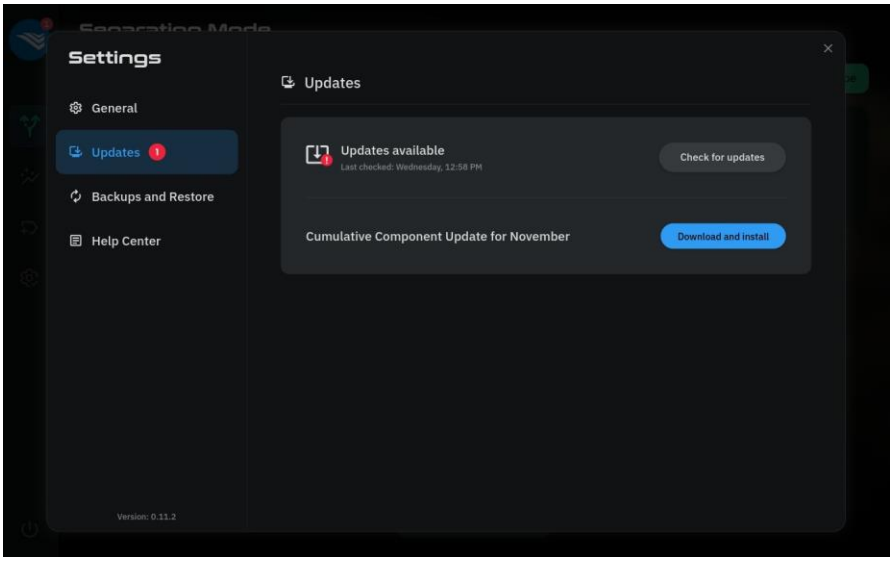


Figure 6.2: Updates available

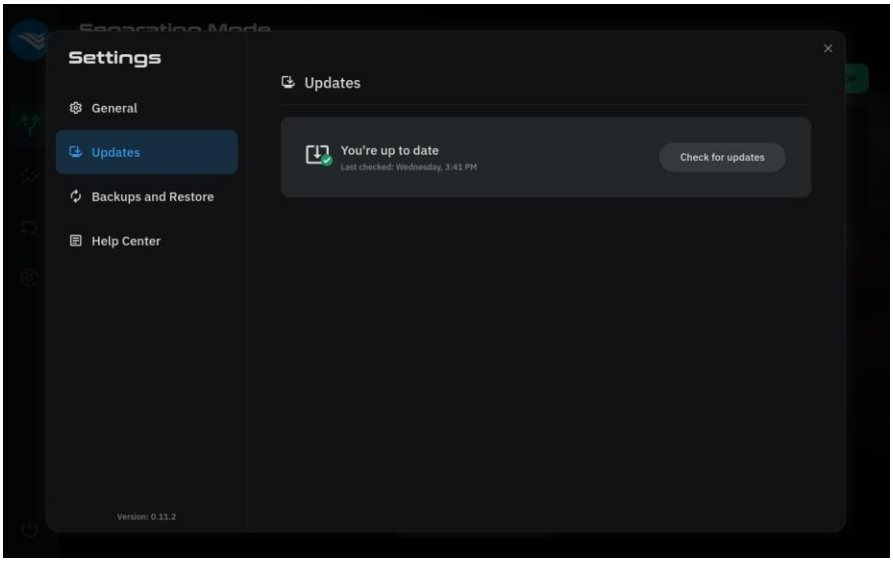


Figure 6.3: System is up to date

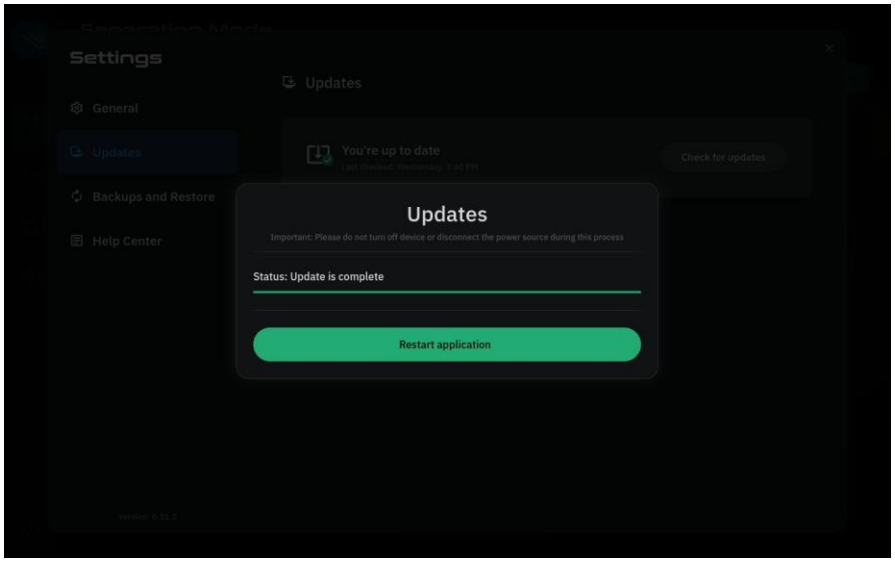


Figure 6.4: Updates Panel - Restart required

6.3 Sync Data

The latest Marvel supports system allows you to share your recipes with your other Marvel machines (see Figure 6.5). This will sync all of your Marvel machines at your various facility locations.

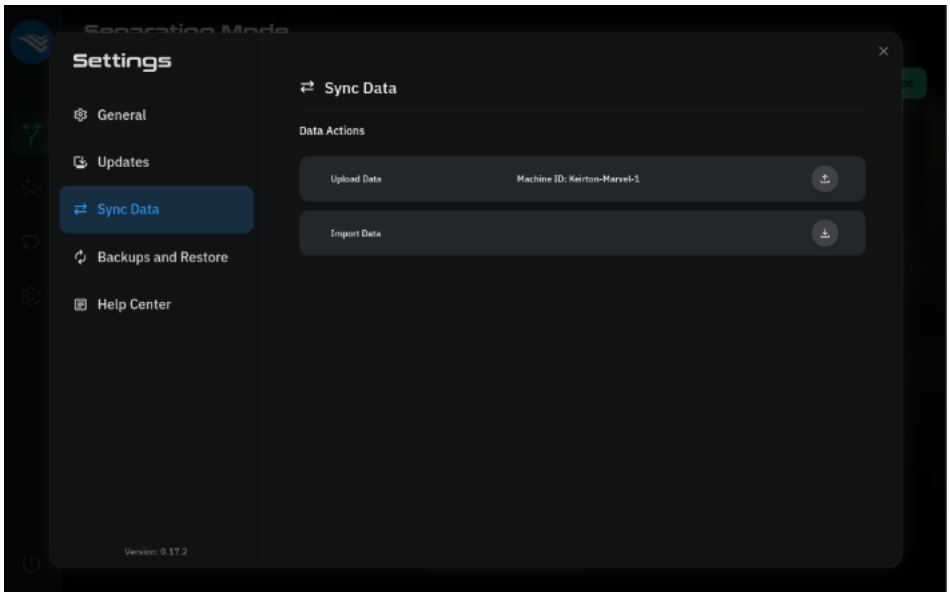


Figure 6.5: Sync Data

6.1.1 Upload Data

Click the Upload Data button on the source Marvel system.

6.1.2 Import Data

Click the **Import Data** button on the destination Marvel system. When the prompt opens, click the drop-down menu to select the Marvel system ID you want to import data from, then click the Import button.

6.4 Backup and Restore

Latest Marvel supports system reserved backups and user customed backups (see Figure 6.6).

6.1.3 Reserved Backups

Pre-update backup is the snapshot of Marvel creates before each update (mentioned in section 2. Updates). It can be used for system recovery.
A factory backup preserves the original version of your machine. It can be used to restore the machine to its default factory settings.
Only restore option is available for reserved backups. The restore button is located on the far-right side of each backup item.

6.1.4 Custom Backups

When clicking the 'Create backup' button, Marvel will create a backup for your current system. Marvel can store up to 3 custom backups. Backups are listed in order of creation, with the most recent first. Three options are provided for each backup:

- **Delete**: You can delete the backup by clicking on the left-most red button. This operation is permanent.
- **Rename**: The Rename button is positioned in the middle of the three buttons.
- **Restore**: You can restore specific backup by clicking on the right-most button, Marvel will show the settings, recipes, etc. stored in that backup.

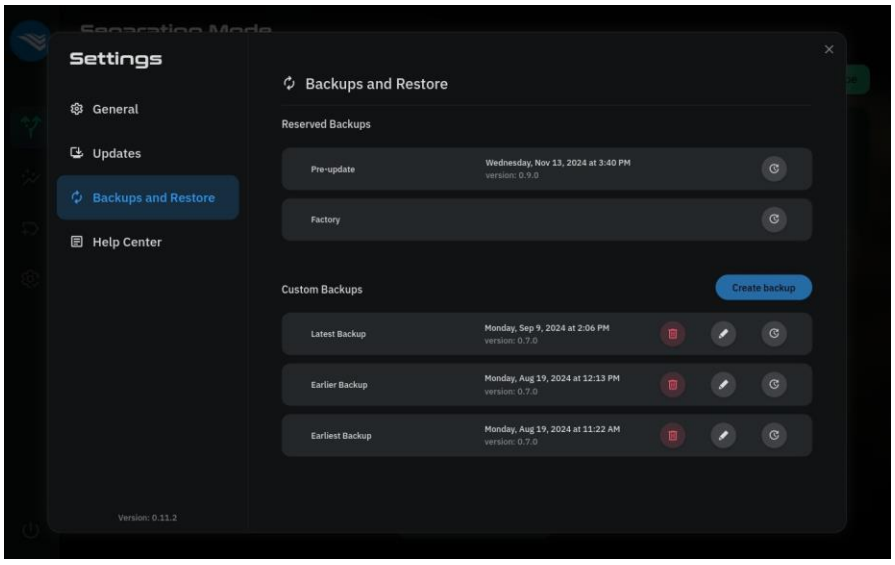


Figure 6.6: Backup and Restore screen

6.5 Help Center

This section will provide you with the operating and maintenance instructions for Marvel (Figure 6.7).

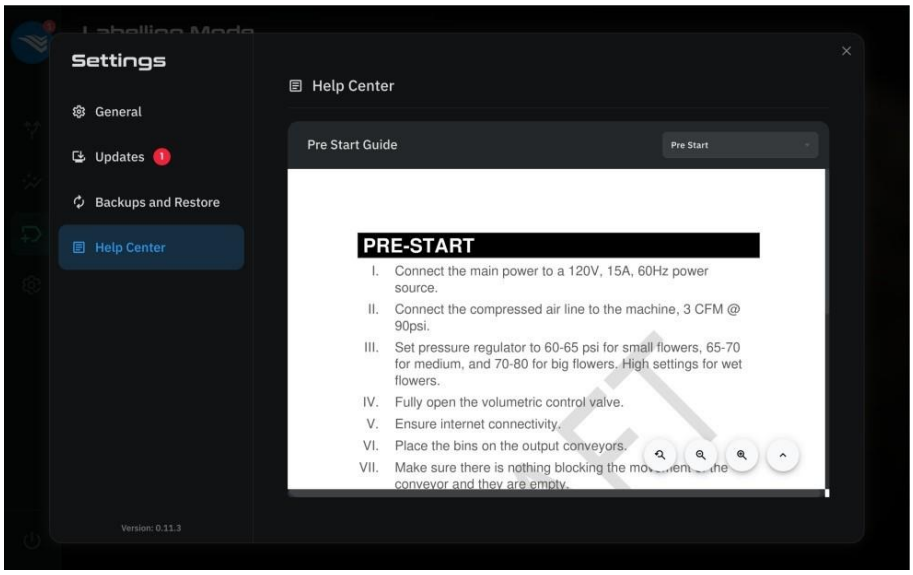


Figure 6.7: Help Center

Maintenance and Cleaning

7.1 Removing the Top Cover and Chutes

Unscrew the top cover and lift it out. Secure screws back into holes. Please remove the chutes by loosening the screws on them, then lift them up and out.

Figure 8.1: Top cover removal

7.2 Cleaning the Chutes and Curtains

Clean the chutes and curtains on them using ISO and cloth. Afterwards pop back on the curtain (make sure the convex direction of the curtain is pointing inwards into the chute).

Figure 8.2: Chute and curtain cleaning

Figure 8.3: Curtain orientation — convex side inward

7.3 Cleaning the Shake Drawer

Remove the shake drawer, empty and clean it, and then put it back in.

Figure 8.4: Shake drawer removal

7.4 Cleaning the Tray and Channels

Frequency: Every 4 hours of operation, or once daily.

1. Make sure the machine is shutdown on the screen, and the power switch on back is turned off.
2. Blow off the dirt on the inside and outside of the cannels and conveyor with compressed air. If needed, low pressure water and mild soap can be used.

7.5 Cleaning the Lens Glass

Frequency: Every 4 hours of operation, or once daily.

1. Make sure the machine is shutdown on the screen, and the power switch on back is turned off.
2. Clean the glasses using soft, clean cloth, if necessary, use water and mild soap.
3. Three square glasses on front and back, also small rectangular glasses on sides should be cleaned.

Figure 8.5: Lens glass locations

7.6 Reassembly

After cleaning, place the cover and chutes back on the machine and fasten all screws securely.

Material Specifications

All components on the flower path — including the conveyor tray, chutes, and metal covers — are made of **SS304 stainless steel**.