AMVT Color Sorter

Mini Q Operation Manual

A Quick Start

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1. Turn on and shut down the machine

Before starting the machine, the power and compressed air (5-10 CFM at 60-90 PSI from air compressor) for the machine shall be connected first.　To ensure the extended life of air ejectors of the machine, air dryer and inline filters for moisture, oil and particulate are highly recommended to the air system of the sorter.　To turn on the machine, push up the power switch next to the right side of the touch screen, the machine will automatically do "Self-Testing" and "Initialize the System …" and the interface with AMVT logo and contact information will show up next.　Besides those you see from the touch screen, you will see the front/rear LED light sources, e.g. white LED for material light, and blue LED for background, will turn on also.　Once machine starts up, you will see the screen like this shown in **Error! Reference source not found.**, which is the main menu for operator of the machine.

Figure 1-1

When the machine is on, the default settings, such as feeder speed, sensitivity of sorting function, ejector timing, etc., are for the product you run last time, so if the sorting results meet your sorting requirement and you are going to run the same product, you do not have to change the settings.　You can just press "Feeder On" button to switch the status of the feeder and run your product.　If you

want to change the settings or load the scheme for a different product, please refer to the other sections.

To shut down the machine, press "Halt" button on the touch screen.   The machine will save the parameters for the current run first and then remind you if you want to turn off the screen as shown in Figure 1-2.   When the screen is off, push down the power switch to the right of screen to shut down the machine.

Figure 1-2

2. Select scheme for a specific material

Before you run the machine, please make sure the right scheme which was set up for specific material by plant engineer or technical support of machine is selected.   To select the scheme, start from the main menu as shown in Figure 1-1 and click on the "Scheme" icon, then you will see a list of schemes on the next page shown in Figure 2-1.   There you can select the scheme and click on "Apply" button to activate the scheme and "Back" button to return to main menu.   If there is no scheme for that specific material, please refer to the section on how to create a new scheme or talk to the plant engineer or technical support.
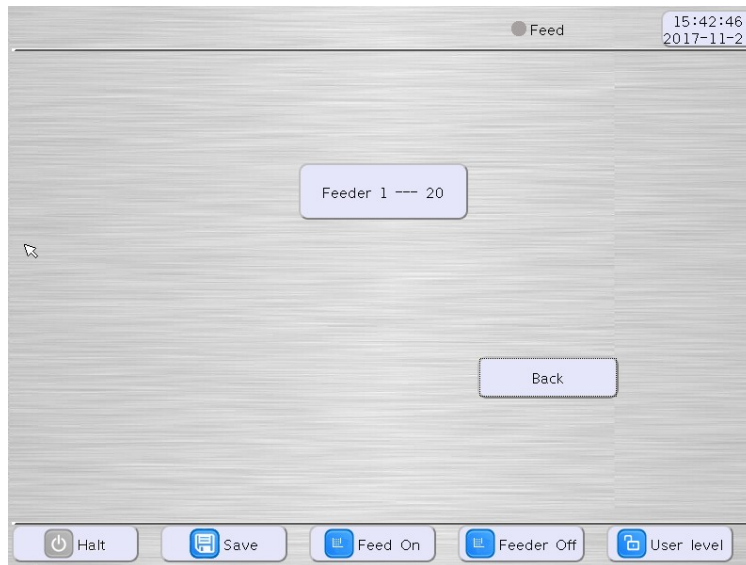

Figure 2-1

3. Turn on the feeder and change the feeder speed

1) On the main menu as shown in **Error! Reference source not found.**, press the "Feed On" button at the bottom of the screen, it will turn on the feeder to the speed the last time it was turned off and the indicator of feeder status at the top of the screen will turn from gray to red, as shown in **Error! Reference source not found.**.　To turn off the feeder, you can simply press the "Feeder Off" button at the bottom of the screen.

2) The vibrating amplitude of the feeder, thus the capacity of machine, can be adjusted by pressing "Feeder" icon shown in Figure 1-1 and the next page like Figure 3-2 will show up. By clicking the "Feeder" button, you will be able to change the feeder speed.　The higher the value, the higher the vibrating amplitude of the feeder, the higher the capacity of the machine.

3) Press "Back" button to return to main menu after the feeder speed adjustment.

Figure 3-1

Figure 3-2

4. Ejector test

1) To test the ejectors, start from the main menu as shown in Figure 4-1.   Press the "Test Ejector" icon, it will then bring you to the next page as shown in **Error! Reference source not found.**.

2) If you want to test all the ejectors of the machine, please uncheck "Keep test single" and then press "Start" button, the machine will automatically test each ejector.   By listening to the beep voice from each ejector, you can judge the failure of ejector.

3) If you want to test a specific ejector, which usually the one fails when you test all the ejectors, check "Keep testing single" and use "+" or "-" icon after the "Test Ejector" text box to define that index of that ejector.   You do not need to change anything after the "Test channel" since the mini sorter has one channel only.   Once the index of that specific ejector is defined, you can press "Start" button, the machine will test that ejector till you hit the "Stop" button.   Most of time, for those ejectors which don't work normally when you test all the ejectors, you can use "Keep testing single" to do individual test based on its index and very possibly it will get back to work after you test it for a couple of minutes.   If those ejectors still don't work as expected, please contact the technical support.

4) Once the ejector test is finished, press "Stop" and "Back" buttons to return to main menu.
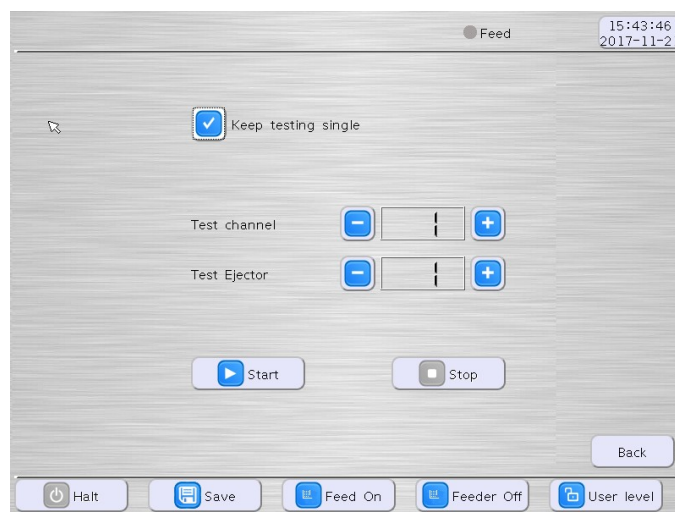

Figure 4-1

5. Change ejector timing and turn on/off ejectors

1) To change the ejector timing, start with the main menu shown in **Error! Reference source not found.**.   Press the "Set time" icon, it will bring you to **Error! Reference source not found.** 5-1.

2) The first eject duration and first eject delay can then be adjusted as shown in Figure 5-1.   Once this is done, press "Back" button.

3) You can also turn on/off of the ejectors from the screen shown in the **Error! Reference source not found.**by ticking the "Eject Mode".   This feature is particularly useful when you play the position of the divider between the accept bin and reject bin.

4) Since there is no wiper installed in the mini sorter and only one chute for the current model of the machine, you can ignore the wipe duration and interval at the moment.
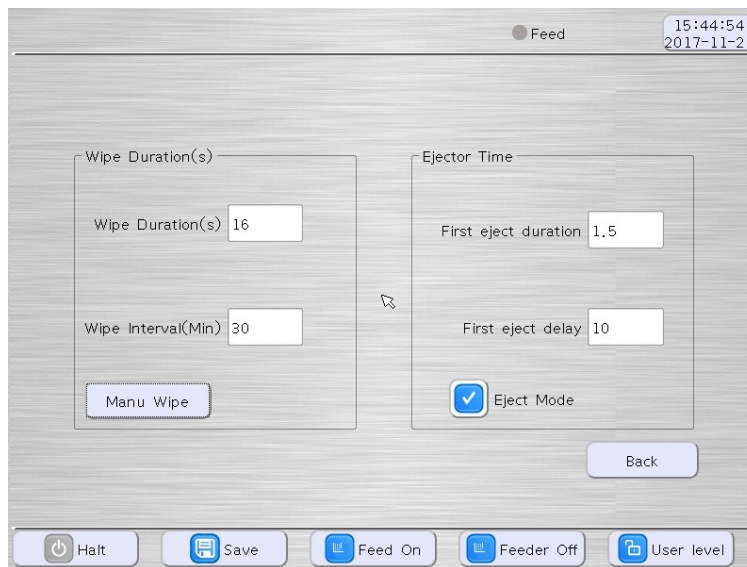

Figure 5-1

6. Adjust the sensitivity based on color

1) As the operator, you are allowed to adjust the detection sensitivity of the bad material from sorting function set up by the plant engineer or technical support.   In general, increasing sensitivity will result in better purity of the accept material, but may carry over some good material in the reject. To adjust the sensitivity, click on the "Set Sens" icon on the main menu, then it will bring you to the next page as shown in Figure 6-1.
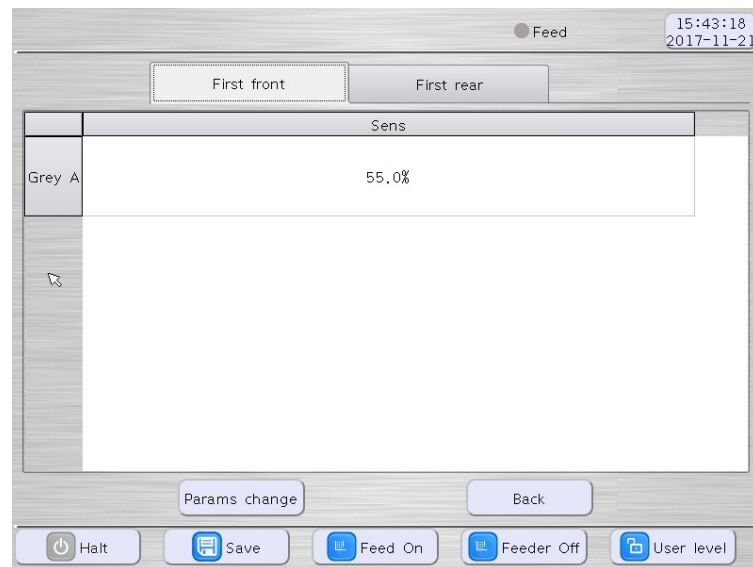

Figure 6-1

2) To adjust the sensitivity, you can change the number in the column "Sens" for "First front" camera and "First rear" camera.   In Figure 6-1, you can only change the sensitivity for "Grey A" but you may have options to adjust the sensitivity for "Grey B", "Discolor A", "Discolor B", "Tricolor A", 'Tricolor B" as well depending on the settings of the original scheme.

3) As operator, you can only adjust the sensitivity, not size and defect of the bad material.   To change the size and defect, please log onto the machine as Engineer first.

7. Adjust the sensitivity based on shape

1) As the operator, you are allowed to adjust the detection sensitivity of the bad material based on shape which was set up by the plant engineer or technical support.

2) Please refer to the advanced shape settings for the meanings of the shape settings such as Small/Big, Circle/Long and distributions as shown in Figure 7-1.

3) As operator, you can only adjust the sensitivity, not options of Small/Big, Circle/Long, etc.   To play other options of shape, please log onto the machine as Engineer first.
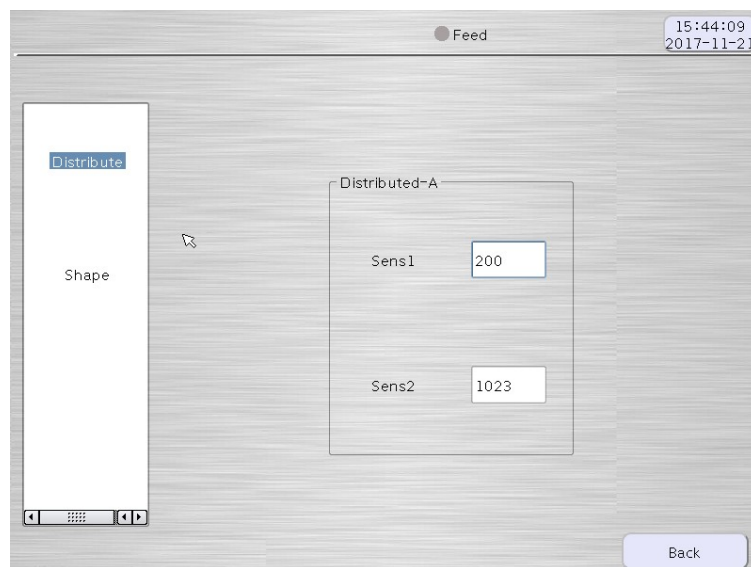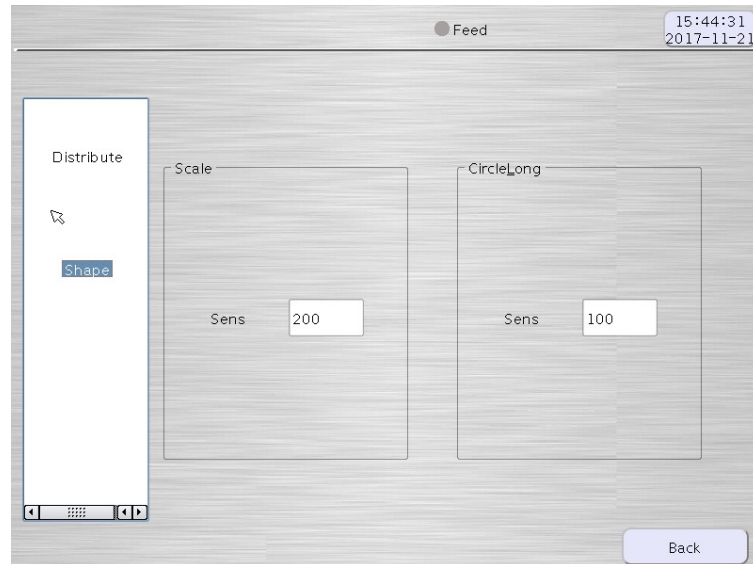

Figure 7-1

Figure 7-2

8. Log on to advanced mode as engineer

Besides the basic settings for operator, advanced mode for plant engineer gives more options, such as changing of size and defect for the detection based on color, selection of desired color sorting functions and shape sorting approaches, artificial intelligence, etc., to set up the sorting parameters for the incoming material.

1) To log on to the advanced mode, click "User Level" button at the bottom of main menu and confirm by clicking on "Ok" button when you are prompted to confirm "Enter advance mode" shown in Figure 8-1, then you will be asked to input the password for the advanced mode, as shown in the Figure 8-2.   Enter the password from the technical support, you will get into the main menu for the advanced mode of the machine, as shown in Figure 8-3.
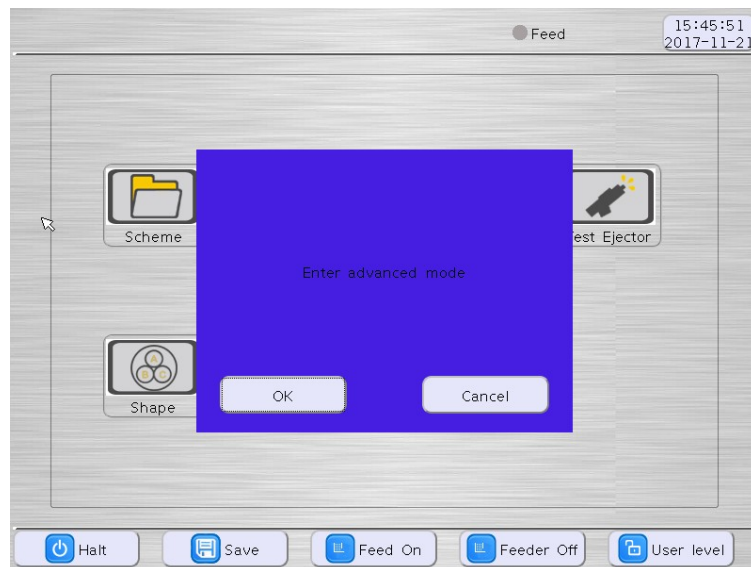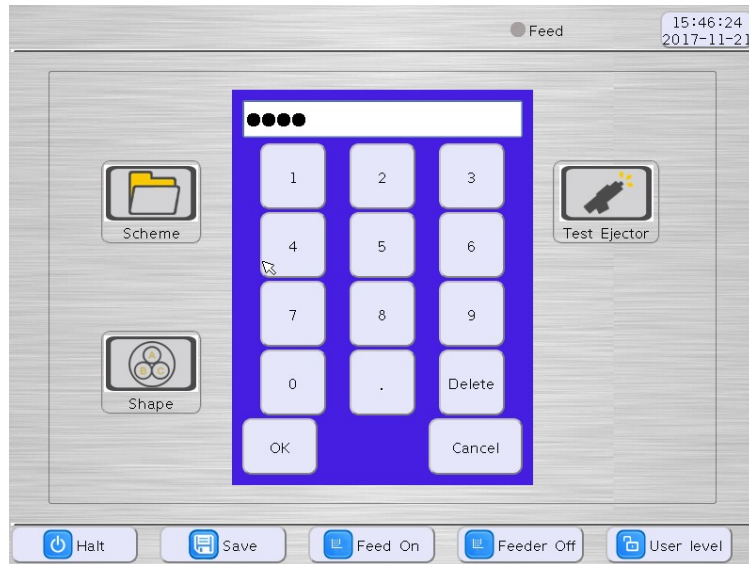
Figure 8-1

Figure 8-2

Figure 8-3

9. Create a new scheme

Under advanced mode, you can crate a new scheme per the following steps:

1) To create a new scheme, press the "Scheme" icon on the main menu, shown in Figure 8-3, the screen changes to Figure 9-1.

2) Choose a "name number" from the list of scheme names shown in Figure 9-1, and click on "Name scheme" button, you will have chance to give a name of the scheme.   Input the scheme name from the keyboard shown on the screen, and click "Ok", you will see the previous scheme name is changed to the name you give.   After clicking "Apply" and then "Back" button, you can then set up the parameters for the new scheme.

Figure 9-1

Figure 9-2

10.   To use "Grey A" and "Grey B"

Grey A and Grey B are very basic approaches for optical sorting of materials, especially when both good and bad materials have relatively simple colors, for example, to sort out light yellow rice from white rice, to clean coffee beans with black spot from green coffee beans, remove ergot from wheat, etc.

1) To use the grey level sensitivity Grey A and Grey B, start with the main menu shown in Figure 8-3 after logon to advanced mode.   Press the "Set Sens" icon, it will bring you to next page shown in Figure 10-2 10-1.   Please note you do not have to use both Grey A and Grey B simultaneously.   For example, if you want to remove black material from white, one of the two shall be good enough. For some material which may have a few different colors of defects, you actually can combine "Grey A", with "Grey B", sometimes even with "Discolor A", "Discolor B", "Tri color 1" and "Tri color 2" to sort out different kind of defects.

2) There are 10 sorting functions under the icon of "Set Sens".   In Figure 10-1, you see the sorting approaches of "Grey A", "Grey B", "Discolor A", "Discolor B".   If you click "Params change" button on the page, you will see options of "expand 1", "expand 2", "expand 3" and "expand 4" and if click "Params change" one more time, you will see "Tri color 1" and "Tri color 2".   While "Grey A" and "Grey B" are sorting methods based on the intensity of one primary color in visible color space of R(red) G(green) B(blue), "Discolor A" and "Discolor B" are based on the ratio of two primary colors. We do not recommend operator or engineer to use "expand 1" to "expand 4".   The details of using "Tri color 1" and "Tri color 2" will be given in another section.   In Figure 10- 10-2, only "Grey A" is "enabled" after you click on "disable".

3) To use "Grey A", in the row for "Grey A", press text "Disable" in the "Enable" column and the text "Disable" will toggle to "Enable", which means "Grey A" detection for both front and rear camera is enabled.   Then you can click the "Color" in the "Grey A" row, to select the primary color for sorting, such as "Red low", "Red high" etc. as shown in Figure 10-1.   After that, you can define the "Size" and "Defect" and "Sens" for "Grey A".   Sensitivity, size and defect settings together determine if an individual piece of material is good or bad.   Once all the settings for "Grey A" is defined, you can press "Back" button and do the test of the settings.   Please contact the technical support if you have any questions.

If you want to remove dark color material, in principle, you can use the "Color" as "Red Low", "Blue Low" or "Green Low".   For the case in Figure 10-3, if you increase the "Grey A" sensitivity level, the sorting will be more sensitive, i.e. more material will be removed.   Besides playing the sensitivity, keeping "Size" with no change but reducing "Defect", or keeping "Defect" the same but increasing "Size", the sorting will be more sensitive.

If you want to remove light color material, in principle, you can use the "Color" as "Red upper", "Blue upper" or "Green upper".   For this case, if you increase the "Grey A" sensitivity level, the sorting will be more sensitive, i.e. more material will be reject as bad.   Again, besides playing the sensitivity, keeping "Size" with no change but reducing "Defect", or keeping "Defect" the same and increasing "Size", the sorting will be more sensitive.
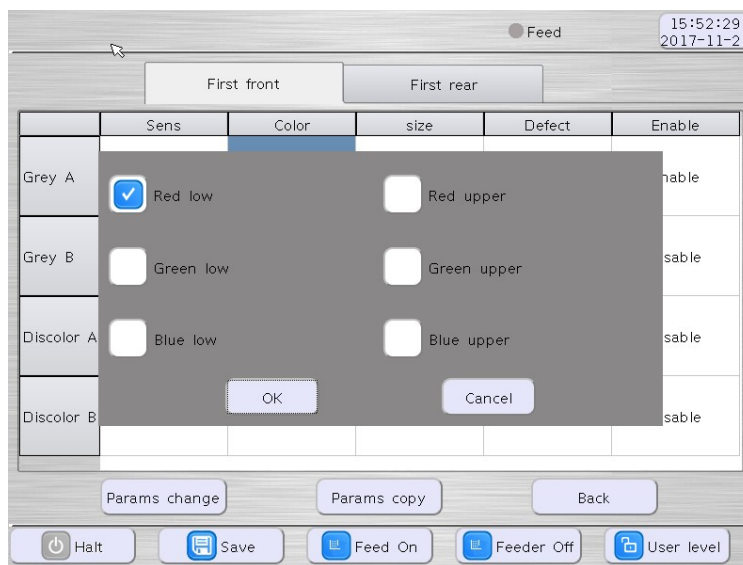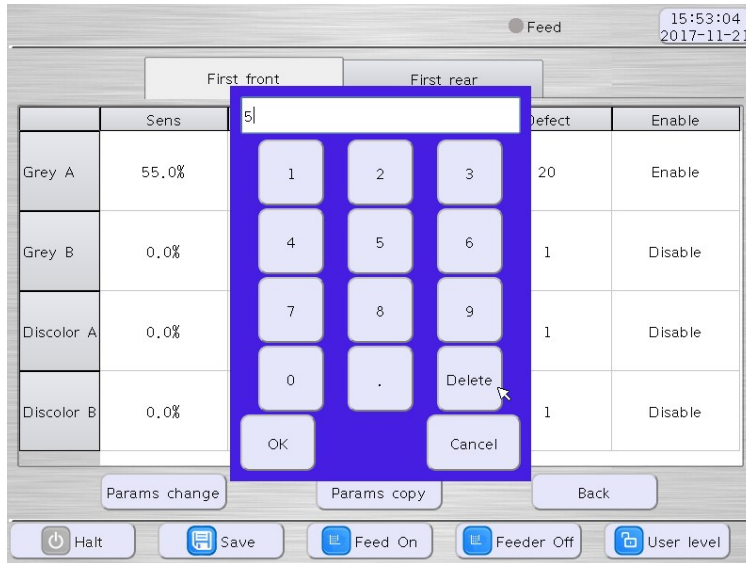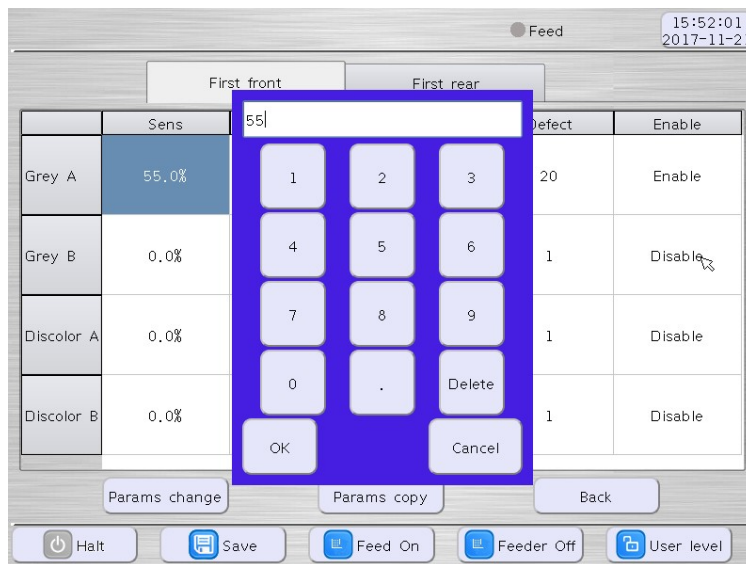

Figure 10-1

Figure 10-2

Figure 10-3

Figure 10-4

11. To use "Discolor A" and "Discolor B"

The use of "Discolor A" and "Discolor B" is very similar to that of "Grey A" and "Grey B", except it is based on two primary colors. For example, "Red less green", which as a combination of Red and Green using formula of "Red/(Red+Green)", defines the pixel where the value of Red/(Red+Green) less than the sensitivity setting as bad. Conversely, "Red more green", defines the pixel whose value of Red/(Red+Green) larger than the sensitivity setting as bad. You will need to select the right combination of colors to achieve the best contrast of good and bad materials.

Again, sensitivity, size and purity settings together determine if an individual piece of material is good or bad.

Settings of Discolor A and B are not straightforward as Grey A and Grey B. Please contact your technical support if any questions.

12. To use "Ai image", "Tri color 1" and "Tri color 2"

Using of "Tri color 1" or "Tri color 2" approach must be combined with "Ai image" or artificial intelligence image processing, which is specially designed to separate materials with much more complicated colors, for instance, cleaning plastic flakes with all kinds of different colors, removing different color of defect in grain/seeds/nuts, etc., which may be hard to sort using "Grey A", "Grey B", "Discolor A" and/or "Discolor B".

1) To use "Tri color 1" or "Tri color 2", first click on "Ai image" icon on the main menu for advanced mode, the image capturing page Figure 12-1 will show up.   On this page, you have options to capture images (18 in total), delete images as shown in Figure 12-2, view the images on the last or next page, define the good material or bad material as shown in Figure 12-3 by clicking the text at the bottom of each image, use high speed or low speed for image capture, do "Auto" calculation as shown in Figure 12-4 to find the settings in order to separate the good and bad materials, or simulate how the auto calculation results and "Tri color" settings work on the captured images as shown in Figure 12-5.   You can also click the wrench icon shown in Figure 12-1 if you want to import or export the images, define to use both front and rear cameras or just single camera to capture image as shown in Figure 12-6.   This page also gives you options to calculate the settings for front and rear cameras the same or differently by choosing different images.   More details of these features are given below.

2) By click on "Capture" button at the bottom of the page, you are given 10 seconds to drop representative sample of good or bad materials from chute to the field of view of cameras.   Figure 12-1 shows two images are captured.

3) Sometimes, you may want to delete one or more images on the screen, you can click on the "Del image" button, as showing in Figure 12-2, and then click the image you want to delete to achieve that.

4) Once all the images are captured, you need to define if a specific image represents good material or bad material.   By clicking on the "Material 1" for instance, you can toggle to "Material 1/Good/0" or "Material 1/Bad/0".   The number "0" or the number after "Good" and "Bad" means how many pixels on that image are selected as samples to represent the typical color of good or bad material for artificial intelligence image processing.   There may be one or multiple images for good or bad material depending on the details of sample.

5) By clicking on a specific image of good or bad material, as shown in Figure 12-5, you will see the enlarged image on the screen, there moving your finger nail from top to bottom and left to right, you can do the sampling of image, i.e. select the typical area in the image to cover the representative color of the material.   If the sampling is successful, you will see the selected area turns to pink color on the screen.   Click on the "Back" bottom to return to the image capturing page.   Now you can do the sampling for another image.   Repeat the same process till all the reparative colors of good and bad materials are covered.

6) After the sampling of images is done, click "Auto" button, as shown in Figure 12-4, the artificial intelligence will calculate the settings to separate the good and bad materials based on the samples you selected on the images.

7) As mentioned before, artificial intelligence image process needs to combine with "Tri color 1" or "Tri color 2" to achieve the sorting of good and bad material.   Click on "Back" on the image capturing page and return to the main menu for advanced mode, then press "Set sens" icon and "Params change" to find the page for "Tri color 1" and "Tri color 2".   You can click "Disable" which will toggle to "Enable" in order to activate "Tri color 1" and play the settings for "Tri color 1".   The meanings of "Sens", "Size", "Defect" and "Disable" are the same as those for "Grey A", "Grey B", "Discolor A" and 'Discolor B".

8) By clicking "Params Copy" button as shown in Figure 12-7 when you set the parameters for 'Tri color 1" and "Tri color 2", you can elect to have the sorting parameters for front and real cameras the same or different.   Note this setting will be imposed to all the sorting functions such as "Grey A", 'Grey B", "Discolor A", "Discolor B", "expand 1" to "expand 4", "Tri color 1" and "Tri color 2".

9) You can run the material or do a drop test or use the acquired images for a simulation based on the parameters from previous steps.   To test the settings with material, you need to turn on the feeder first.   By playing the sorting parameters, which include sensitivity, size and defect of the enabled sorting functions and air eject timing, etc., you may achieve the desired separation of good and bad materials.   Please contact your technical support if any questions when you use "Ai image", "Tri color 1" and "Tri color 2".
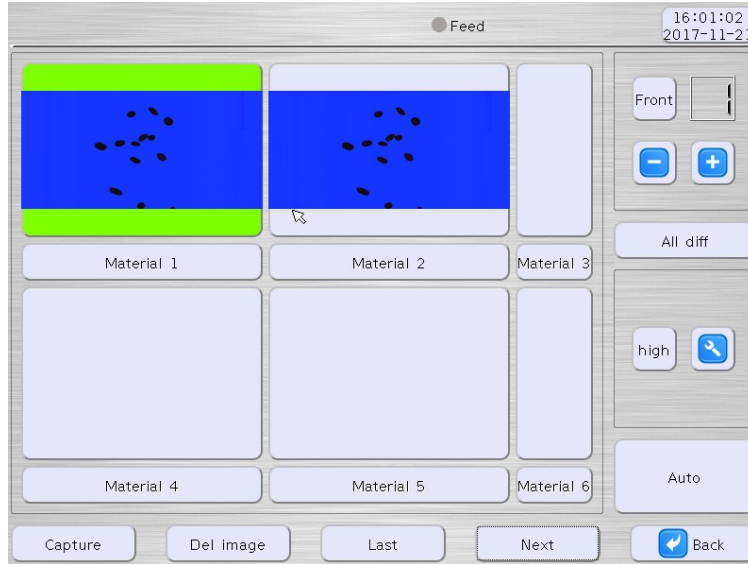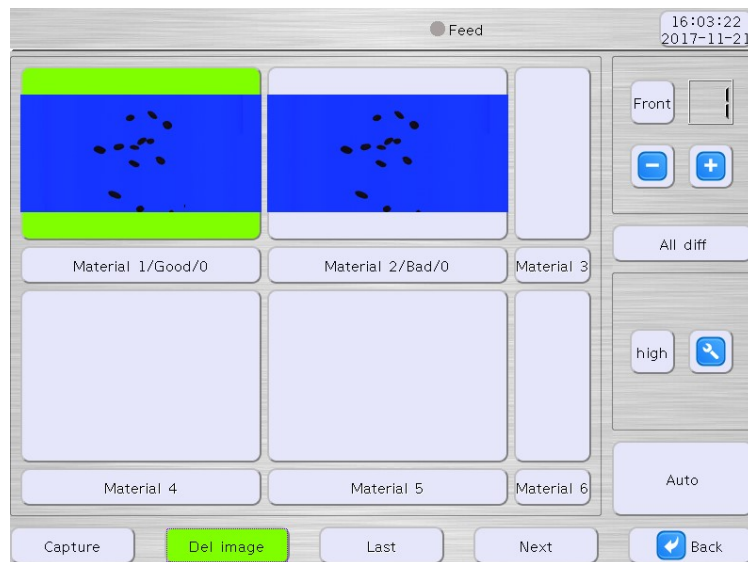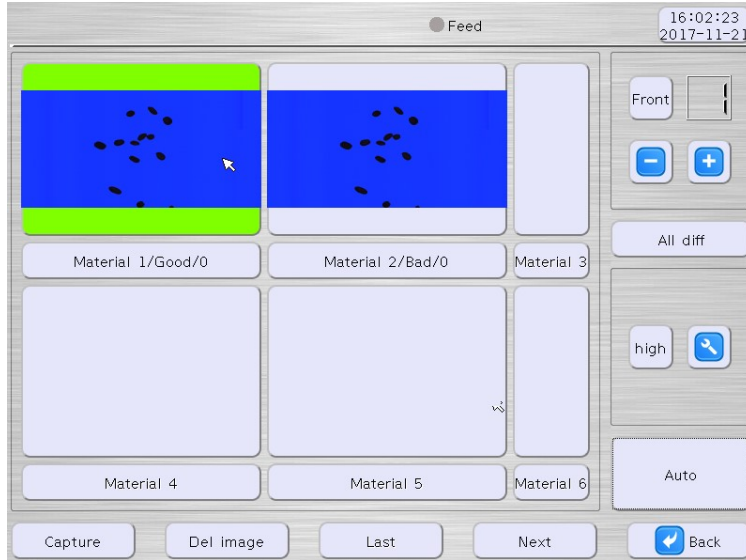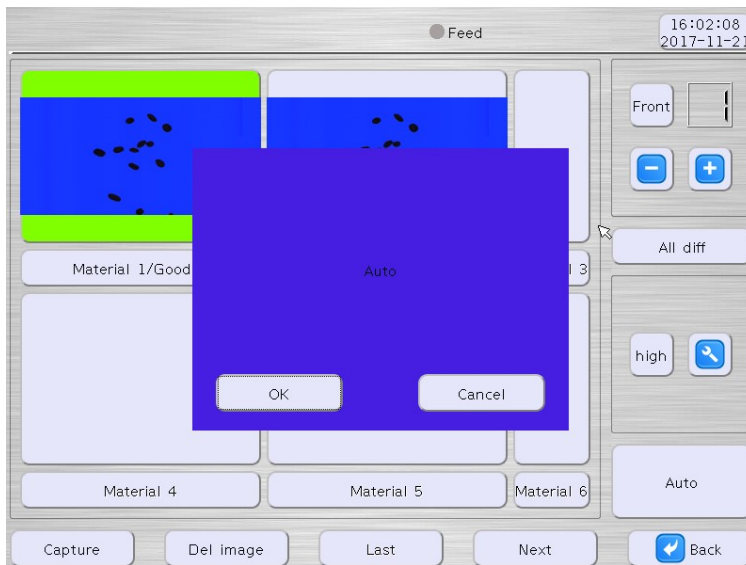
Figure 12-1

Figure 12-2
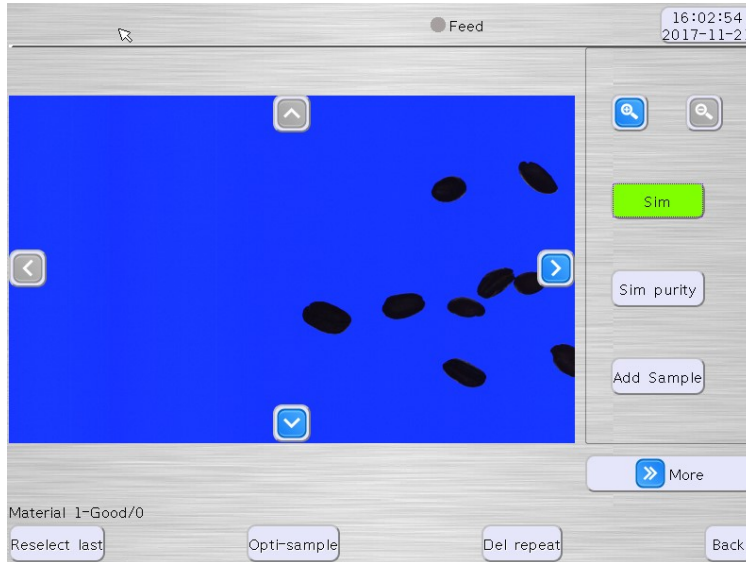
Figure 12-3

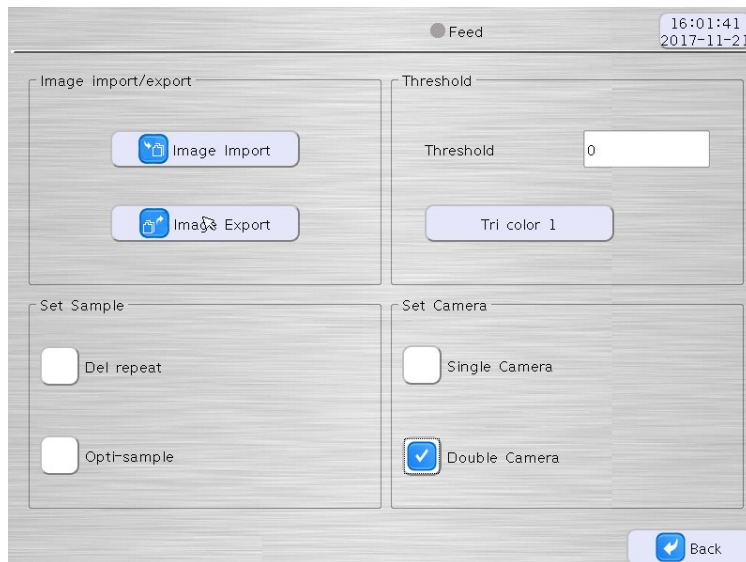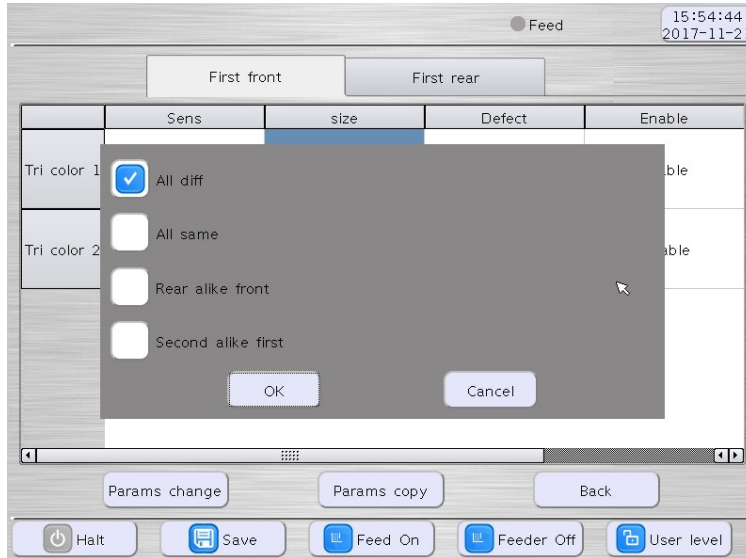**Figure 12-4**

Figure 12-5

Figure 12-6

Figure 12-7

13. Shape sorting---distribution

As discussed in last section, "Tri color 1" and "Tri color 2" use artificial intelligence image processing and color sensitivity, size and defect settings to identify the bad material from good one. Taking advantage of the un-even distribution of bad pixels on the whole material, which can be a grain, seed or nut, by defining the lower and upper limits of bad area which is determined by sensitivity in "Tri color 1" or "Tri color 2", "Distributed A" or "Distributed B" can be used to remove material with size of bad area size falling within these limits.

To use "Distributed A", disable "Tri color 1" first, and click the "Shape" icon on the main menu, then click "Distribute" in the left box of the page, enable "Distributed A" as shown in Figure 13-1. "Distributed A" will detect the material with size of bad area between the lower limit "Sens 1" and upper limit (max value 1023) "Sens 2" based the color sensitivity settings from "Tri color 1".

Application of "Distributed B" is the same as that for "Distributed A" except that the bad pixels are defined from "Tri color 2".

When the relation "Or" is checked as shown in Figure 13-1, material will be rejected if either the condition of "Distributed A" or "Distributed B" is satisfied.   If the logical relation "Or" is not checked, material will be rejected only if both the condition of "Distributed A" and "Distributed B" are satisfied.
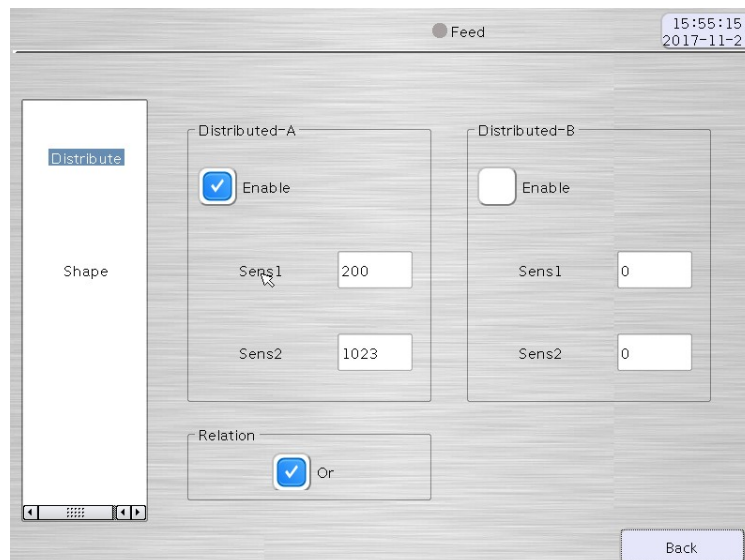

Figure 13-1

14.   Shape sorting---shape

Besides shape sorting "Distributed A" and "Distributed B' based on color space, the machine provides real shape sorting, such as scale (small/big), circle and long, based on the geometry of material as detailed below.

To use "Scale" sorting, click the "Shape" icon on the main menu for advanced mode, then click "Shape" in the left box of the page, activate the "Scale" by ticking the "Enable" and "Sort Sma" or "Sort Big".   If "Sort Sma" is checked, by playing the number after the "Sens", machine will remove small material. Increasing the "Sens" will result in more small material will be rejected.   The same idea applies to "Sort Big" too.

To sort circle or long material, on the same page, activate the "CircleLong" by ticking the "Enable" and "Sort Circl" or "Sort Long".   If "Sort Circl" is checked, by playing the number after the "Sens", machine will remove material with circle shape.   Increasing the "Sens" will result in more circular material will be rejected.   The same idea applies to "Sort Long" too.

For some material, you may want to avoid wrong detection of good and bad material due to the edge effect of material.   To achieve that, you can use "Edge Cut" function as shown in Figure 14-1 to cut 1 to 3 pixels deep along the edge of the image for individual piece of material.

Sometimes, you may also to avoid the ejecting of very small material, for instance, dust in the material. To achieved that, you can give a "Shape Low Limit" as shown in Figure 14-1, then machine will ignore the individual piece of material whose image size is lower than that limit.

Figure 14-1

15.   Set material lamp

For some material, it is very efficient to use its translucent feature to sort out opaque material.   For this application, press "Advanced" on the main menu for advance mode, and then click "Set Lamp" and you will see the page shown in Figure 15-1.   There you can simply keep the blue background light on and uncheck the "Mat Lamp", then the camera with its "Mat Lamp" off will see transmitted light only from the material.   Since the transmitted light from translucent material is much stronger than that of opaque material, you can use "Grey A" to separate them.

Figure 15-1

16. Background

It's very important to have correct setting of background signal for image processing so the machine won't get confused with background signal and real signal of material. In Figure 16-1, it shows "Background" light "Blue BG" is blue, and if any blue light component of signal is above 70 and the percentage of that blue light component, "Blue/(Red+Green+Blue)", is equal or larger than 40%, then that signal is from background, otherwise it is from a material in the camera field of view.
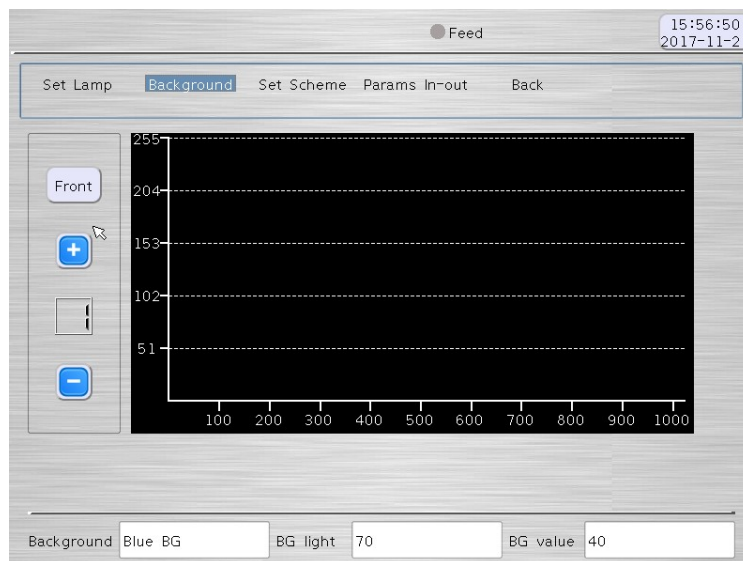

Figure 16-1

17. Ejector mode and sort mode

Depending on the sorting criteria, you may want to lower the carryover of good material in the reject as much as possible, but sometimes, you may want to keep the accept as clean as possible but do not care the carryover of good material in the reject.   Besides other settings, such as sorting parameter, ejector delay and duration, choosing of ejector mode is also important for these two cases.

For the first case, you can use the following ejector mode setting:

1) Click on the "Advanced" icon on the main menu for advance mode, then click on the "Set Scheme" at the top of next page.

2) From the three options of "Eject Arith", tick the "1 st Eject Center", then the machine will strictly use the ejector settings (delay and duration) to reject bad materials.

For the second case, you can uncheck "1 st Eject Center" and "1 st Hori Center" and tick "1 st Extended Eject" to achieve that.

Most of time, as a "normal sort", we reject bad from good material, but sometimes you may want to do a reverse sort after you set up the "normal sort" as shown in Figure 17-1.   You can simply uncheck "1 st Normal Sort" to realize the reverse sort, though you may need to play the other settings, for example, sensitivity to achieve meaningful result.

Sometimes, you may prefer to reject the material which has defects on both sides of each individual piece and keep the material with defect on one side.   To achieve this, you can tick "1 st F-R And" from the options under "Sort Mode", as shown in Figure 17-1.
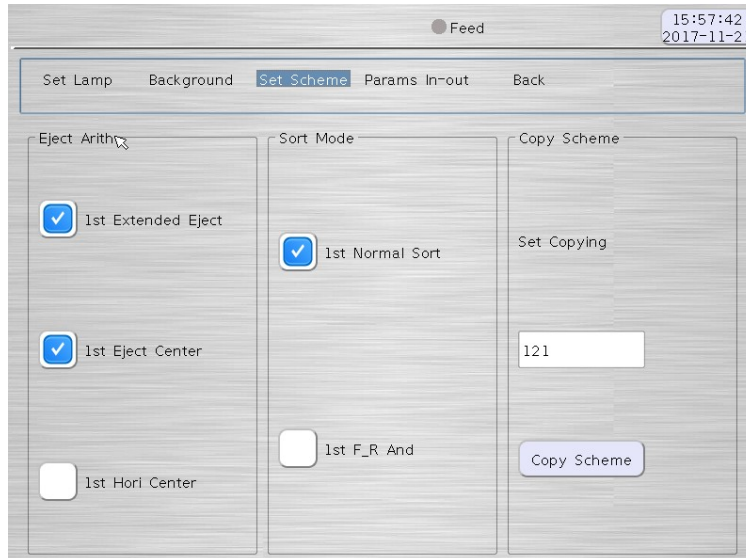
Figure 17-1