

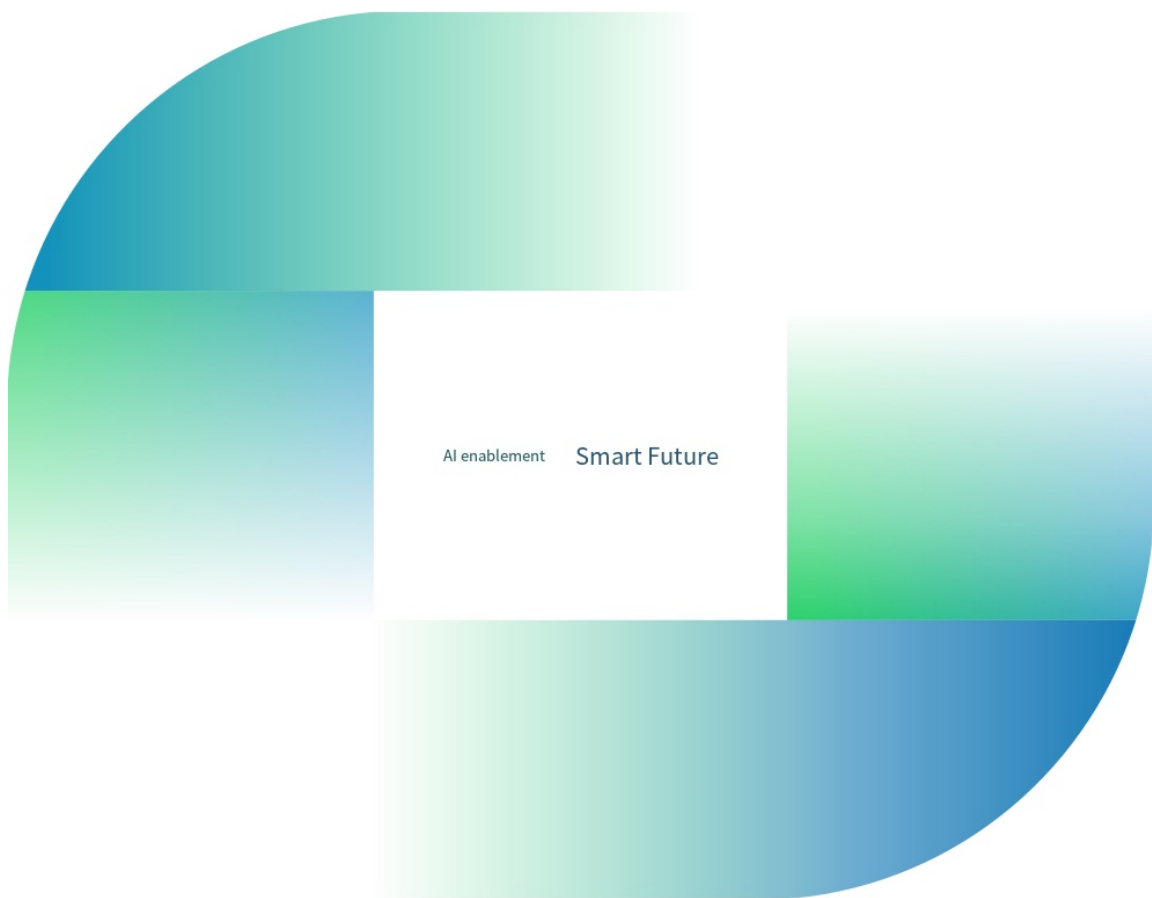
# Shanghai Torzn intelligent equipment Co., LTD

High speed bulk foreign body X-ray and color sorting machine

Intelligent HD X-ray testing machine

Packaging multi-purpose foreign body detection machine

## X-Ray Foreign Body Detection software manual



### Scope and field of application

Food industrial: meat, fruits, vegetables, additives, milk powder, chocolate and other kinds of food.

Electronic components and electronic products, chemical and rubber industry etc.

### Purpose of product use

Can detect foreign bodies including but not limited ( nails, steel wire, iron sheets, glass, ceramic, bones, shells, stone etc.) to ensure the safety and quality. Also identify product defects.

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# 1 PRODUCT OVERVIEW

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Be sure to read and understand the contents of this manual in detail before undertaking the installation, operation, maintenance or maintenance of the equipment. To ensure the correct operation and safety of the equipment, please keep this manual safe so that you can consult it when needed.

Although this manual has been as exhaustive as possible of the hazardous situations that may arise from the equipment, we cannot exhaust all possibilities. Therefore, when performing operations not listed in this manual, be sure to contact the supplier or our after-sales service department for more information. When installing, operating, and maintaining/overhauling equipment, be sure to take adequate safety measures in addition to following the instructions indicated in the user manual and on the equipment.

The copyright of this manual belongs to Shanghai Juzhao Intelligent Equipment Co., LTD., and is protected by copyright law. Without the written permission of Xi 'an Sovision Optoelectronic Technology Co., LTD., it is strictly prohibited to disclose, copy or duplicate the contents of this manual without authorization.

When compiling this manual, you have tried to be considerate, but if you encounter any ambiguity, mistakes or questions during the reading process, please be sure to provide the model (model) of the equipment, and then consult the supplier or after-sales service department.

When installing, operating, maintaining and inspecting the device, please be sure to follow the instructions and warnings listed in this manual. If you encounter any problems or ambiguities, contact the dealer or the company's after-sales service department immediately. Do not perform any operations until you have obtained the necessary guidance.

Please note that the contents of this manual are subject to change without notice. Therefore, keep an eye out for the latest updates and revisions when using the equipment, and make sure you have the latest version of the manual.

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## 1.1 An overview of X-ray foreign body detection machines

X-ray foreign matter detection machines are widely used in food and industrial production fields, and their functions include detecting foreign objects in metal, glass, stone, bone, high-density rubber and plastic. It provides an important means for high standard enterprises to carry out quality control and quality assurance in the production process.

## 1.2 Applicable objects

This manual is intended for users of X-Ray foreign body detection software, including technical operators and administrators (maintenance engineers).

## 1.3 General Notes

1. For electrical wiring operations, always ensure that you entrust professional personnel with legal



qualifications to perform the operation. Unauthorized personnel engaged in electrical wiring operations will violate relevant laws and regulations. Incorrect electrical wiring can

lead to dangerous situations such as fire, electric shock and ground failure.

2. To ensure safety, be sure to properly ground the device for protection. It is recommended that you entrust a professional with a formal electrical wiring job qualification to perform the protective grounding of the device to minimize the risk of electric shock that may result from a grounding error.
3. To ensure proper operation and safety of the unit, do not pour water on the unit and avoid installing it in areas that are wet or prone to condensation. Unless the device is clearly labeled as waterproof, contact with water can result in hazards such as reduced unit performance, loss of function, failure, and even electric shock. Therefore, take special care to avoid touching the device with water to ensure its proper operation and safe use.
4. To ensure the safe operation of the unit, install it in a sturdy and level place. If the device is mounted in an unstable or tilted position, it may degrade performance, impair function, or even roll over, resulting in injury. Therefore, it is important to ensure that the device is securely installed to prevent potential hazards and accidents.
5. In order to ensure the accuracy of operation and the safety of personnel, please reserve enough space for the operation, operation and maintenance of the device. If the space is insufficient, it may lead

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to operation error or accidental injury. Therefore, when using the device, make sure that there is sufficient space around to perform necessary operation and maintenance, and that the operator is able to work in a safe and comfortable environment.

6. Always wear appropriate work clothing when operating the unit and make sure to tighten buttons or zippers on the clothing. Choose non-slip shoes and lace them up. Avoid wearing any accessories, including ties and belts, and if you must, use clips to hold them in place. Also, keep your hair completely wrapped in a hat or hair cap. Failure to comply with the above regulations may result in hair or fibers getting mixed into the merchandise being handled, triggering a foreign matter contamination incident. At the same time, there may be foreign matter tangled in the device, which may lead to injury. Therefore, please be sure to comply with the above requirements to ensure food hygiene and personnel safety.
7. To ensure safety, do not attempt to disassemble, repair, or modify the unit unless specifically directed in the user's manual. Using tools such as screwdrivers, wrenches to remove, repair, or modify the device can result in electric shock, fire, or injury. For your safety, do not attempt to perform these operations on your own. If repairs need to be made to the device, contact the dealer or our company's customer support department and entrust them with the appropriate repair work.
8. Before starting to operate the device, make sure that no items are placed on the device to avoid mixing items with the goods being handled by the device and causing foreign matter contamination accidents. Placing items in the unit can lead to dangerous situations such as electric shock, fire, or personal injury.
9. Be sure to cut off the power supply and wait at least 5 minutes before performing maintenance or inspection of the device. This is done to ensure that the electrical charge inside the electrical components is eliminated to prevent the danger of electric shock. Keep this safe procedure in mind to protect your personal safety.
10. Strictly follow the maintenance and inspection steps clearly listed in the user manual, and do not perform other unauthorized or unstated maintenance acts. This is to avoid potential electric shock risks, fire hazards, or personal injury. As a professional, follow prescribed procedures and guidelines to ensure safety.

- 
11. Do not turn off the main power switch during operation unless there is an emergency. Turning off the main power switch of the device may result in deletion of configuration data and statistics. Exercise caution and ensure that you perform the necessary actions within a proper maintenance window to avoid data loss and system failure.

#### 1.4 Work environment

Do not use the X-ray foreign body detector in the following environments, so as not to cause instability or even damage to the equipment:

1. Places where there is violent vibration on the ground or near the source of vibration.
2. An environment where the temperature is below  $-10^{\circ}\text{C}$  or above  $40^{\circ}\text{C}$ , or the humidity is greater than 85%.
3. Power supply with voltage fluctuation greater than 10%.
4. In the presence of volatile fuels, corrosive gases, or dust.

#### 1.5 Use safety protection

1. The equipment is non-explosion-proof equipment, and must avoid external impact during installation and use.
2. The equipment adopts thickened steel plate shielding and protective curtain to ensure radiation safety. During the operation of the equipment, it is forbidden to extend the hand or other body parts into the shielding curtain of the X-ray detector, and it is forbidden to open the shell of the equipment.
3. There is an emergency stop button in front of the device, which can be used to stop the operation of the device immediately in case of emergency.

#### 1.6 Information about special risks

1. Electrical Systems



- Operate electrical systems, components, or handle materials only by a qualified electrician who must supervise other personnel;
- Must comply with electrical operation regulations and accident prevention regulations!

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If a machine or system component is required to be inspected, maintained or repaired, it must be disconnected from the power supply.

First check that the disconnected parts are still live, then ground them, and ensure that any live parts of the accessories of these parts are insulated.

The electrical parts of the machine/system must be checked thoroughly at regular intervals. Any faults - such as loose connections or burnt cables - must be corrected immediately.

## 2. Pneumatic system

Pneumatic systems or their components should only be operated by persons with relevant knowledge and experience.



Check all lines and wiring, hoses and screw joints regularly to prevent leaks and visible damage! If there is a fault, remove it immediately.

Release pressure from compressed air lines, hoses, or system components to be opened before embarking on repair or maintenance.

Compressed air lines and hoses must be laid and assembled correctly and comply with installation rules. The fixing of pipes and hoses, their length and quality must meet certain specifications.

## 3. Equipment Transportation

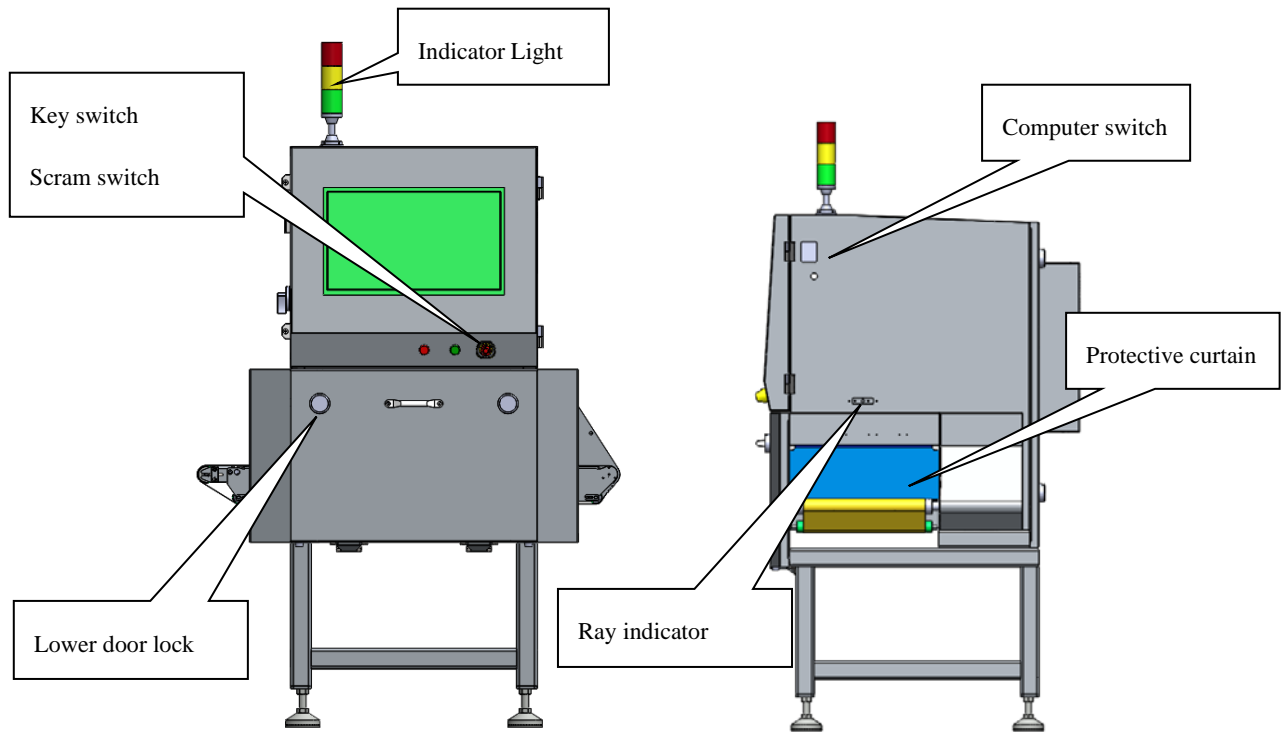
When loading or transporting machinery/systems, only use lifting, hauling equipment and fixtures that have sufficient carrying capacity! An experienced instructor is required to guide the lifting/lifting process!



Follow the operating manual and tie the lifting equipment in place to lift the equipment/system.

All power must be disconnected even if the machine/system is moved a short distance! Reconnect the power supply as well as other lines (such as compressed air units) properly before using the machine/system again.

## 2 INTRODUCTION TO EQUIPMENT COMPONENTS





### 3 INTERACTIVE INTERFACE INTRODUCTION

#### 3.1 Permission description

Compared with administrators (maintenance engineers), technical operations personnel do not have the permission to exit to the desktop/delete products and modify parameters.

#### 3.2 The first interface



The first interface is the software startup screen. It is the screen for preparing the software

before it starts running. Click to jump to the interface



The second interface. For login administrator mode,

Label ① : Software exit area, including one-click shutdown and exit two buttons.



After one-key shutdown, the host and the background will be shut down, about one minute later, you can cut off the host power by rotating the switch. The exit button allows you to log out of the software and return to the system desktop, but it appears only after you log in to the administrator.

**Label ②** : Visualize the progress of X-ray warm-up and detector calibration. When the device is not turned on for more than three days, the software will automatically preheat the X-ray after it is turned on again, otherwise there is no need to preheat and the progress is 100%. The longer the device is not turned on, the longer the X-ray preheating time, usually controlled within 50 minutes. Under normal circumstances, the detector needs to be calibrated once after each turn on, which can



be calibrated by clicking the button. The calibration progress of the detector can be viewed through the progress bar. When the detector's calibration progress reaches 100%, the software can be started.

**Label ③** : Check that the hardware (X-ray, detector, transmission controller) is all properly connected. Normal connections are gray and abnormal connections are blue.

### 3.3 Product selection

Click the inspection library button in the first interface to open the product selection interface.



The inspection library can save more than 1000 kinds of product information. Select the product to be tested (or produced), click the select and exit button, you can load the selected product.

Select and opt out All parameters of the currently selected product can be adjusted in the third screen.

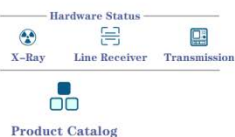


Torzn Intelligence  
X-ray Inspection System

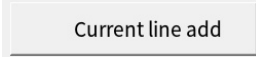
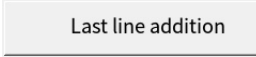
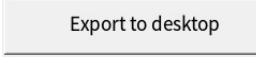

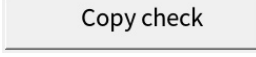
Name	ID	OK	NG	Rate
Example	example	4645	3381	0.42
test	test	416	2581	0.86



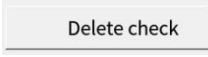

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### Description of other buttons:

-  Add a new product in the location of the currently selected row.
- : Adds a new product at the end position of the table.
- : Converts the report to Excel format and saves it to the desktop.
- : Deletes the currently selected product.
- : Create a new product and copy all the parameters of the currently selected product. All parameters for both will be the same.

### Additional notes:

- 1) After the software is opened, the last produced product will be selected by default.
- 2)  The Delete check button will only appear after you have logged in with admin privileges.
- 3)  Product name and product batch number are required when creating a product for the first time. Only letters and numbers are supported.

### 3.4 Second interface

The second interface is the main operating interface in the production process.



Label ① : real-time display interface. When a product passes through the X-ray machine, the

image will be displayed in the current area.


**Label ②** : Contains thumbnail images of recently abnormal products. Click to enlarge it on ①.

**Label ③** : The hardware status of the equipment in operation, namely, light source, detector, transmission and algorithm. After clicking the button, the red is normal, and the gray is abnormal.



**Label ④** : The real-time status of other parameters when the equipment is in operation, which can be used for equipment maintenance, condition monitoring and Unknown error evaluation.

**Label ⑤** : 3D visualization area of product features. It is mainly used to evaluate the detection accuracy and complexity of the current product. It should be noted that the current module will be enabled only when the cull mode is set to 1, otherwise the resource overhead is large.

Cull mode:  More on cull mode later.

### Other button instructions:

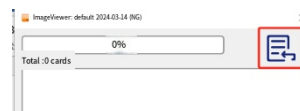
**Production mode:**  : When checked, the transmission will not be stopped even if any unexpected situation occurs (such as partial hardware power failure).

**Background storage:**  : When checked, the original image is saved to the RAW file named after the date of the day. This is only valid when the cull mode is set to 1.

Cull mode: 



**Image View** : Open the abnormal images folder for the day.



Click the

button shown in the red box to select the folder of images you want to browse.



**Setting** : Opens the third screen.



**Return** : Return to the first screen.



**Running** : Controls the start and stop of detection.

Detector calibration progress:  : and the first interface of the ② synchronous display,

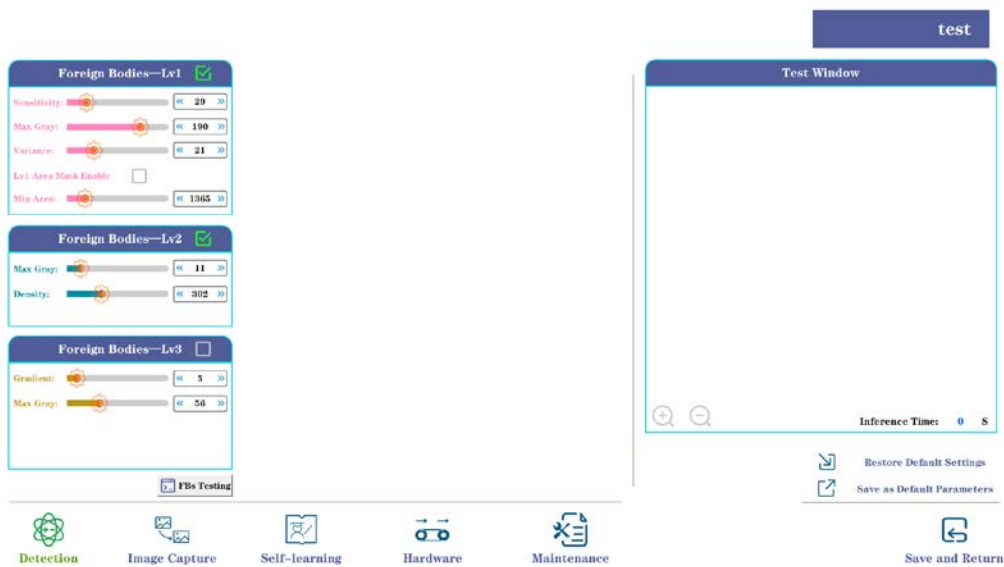
when the progress of 100% automatically disappear.



: Zoom in/out the image in label ①.


### 3.5 Third interface

The third interface is the operation interface to adjust the current product parameters.



Label ① : used to adjust the Detection parameters. There are three detection algorithms for foreign body detection (Lv1 is the morphological detection algorithm, Lv2 is the light and dark detection algorithm, and Lv3 is the gradient detection algorithm), which are used to meet different detection requirements. **The sealing detection and bulk material detection are optional, and the packaging type foreign body machine does not have this function.**

Label ② : Function option bar, click to switch different pages.

Label ③ : Test window. The image of the current window will be synchronized with the image in label ① of the second interface. At the same time, it can also be manually selected 

(pressing this button). Sliding the progress bar in the identification parameter can automatically display the detection effect of the current parameter in the test window.

Label ④ : Restore default Settings: restore all parameters of the current product to default parameters. Save as default parameters: Reset the default parameters using the current parameters.



**Detection:** used to control the detection accuracy of foreign bodies.

#### **Foreign Bodies - Lv1:**

**Sensitivity:** the larger, the more strict the foreign body detection; The smaller, the more relaxed the foreign body judgment.

**Max Gray:** The grayscale of the target must be less than this value for it to be detected.

**Variance:** The deviation of the center and sides of the target must be greater than this value to be detected.

**Lv1 Area Mask Enable:** When checked, it will mask targets with less than the minimum area.

**Min Area:** The limit of the Lv1 area shield.

#### **Foreign Bodies - Lv2:**

**Max Gray:** Only foreign objects whose grayscale is less than this value will be detected.

**Density:** Only foreign objects larger than this value will be detected.

### Foreign Bodies - Lv3:

Gradient: Only foreign bodies whose grayscale is less than this value will be detected.

Max Gray: Only foreign bodies with gradients greater than this value will be detected.

**Note: All parameters of foreign body detection can be automatically set by the self-learning function.**



: Import the test image manually.

**Image parameters: used to control the acquisition process of product images.**



**Image emphasis: used to achieve image light and dark adjustment, non-administrators please debug carefully.**



: Click to enable image emphasis function.

**Benchmark:** The emphasis benchmark used to control the image.

**Intensity:** used to control the degree of emphasis of the image, the greater, the greater the image contrast.

**Image Capture Parameters: used to control the original acquisition process of the image.**

**ROI Enable:** The image will be enlarged, unselected by default.

**Capture test:** Click and wait for a while, the image of the current parameter will appear

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in the test window. Generally used for development and maintenance.

**ROI Thre:** The threshold of local magnification, the larger the image magnification higher.

**ROI Margin:** The margin of white edge of local magnification, the larger, the more remaining white edge.

**Head/Tail Frames Num:** used to control the left and right white margin of the current image during the acquisition process. The default is 1, except for sealing inspection machine.

**Background determination:** the grayscale threshold of the image when there is a product, and the grayscale is less than this value, it is considered that there is a product through.

**Frame Width:** The number of columns to collect a frame of data.

**Initial Stretch:** Used to control the contrast of the sensor's raw data.

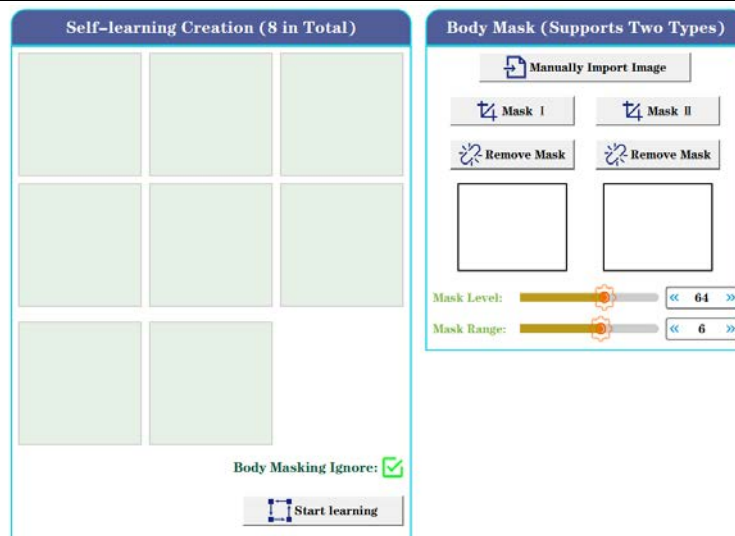
**Min Width:** Do not image when the image width is less than this value to eliminate possible anomalies in the channel or conveyor belt.

**Integration Time:** The exposure time of the detector, which needs to be correctly matched to the transfer speed.


**Image Cut:** The upper and lower clipping of the captured image, used to solve the problem that the ends of the detector are not illuminated by X-ray.

**Paint Mode:** that is, the display mode of the image, which changes automatically according to the culling mode.






### Self-learning:

**Self-learning task creation:** When the device calibration is ready,  will turn bright, click the button, the device will start. You can arbitrarily place all kinds of situations (different shapes, folding, folds, etc.) of the current product, learn 8 times and automatically stop.

**Body Masking Ignore:**  The ontology mask learning enable is turned on by default to prevent the machine from mistakenly learning the area that needs to be shielded.

**Body masking:** The CSS family of software supports two different types. You can either import the image manually and using the capture button, or use the self-learning function.

: Used to remove the masked ontology.

**Mask Level:** It is used to judge the morphological similarity between the ontology and the exception. The smaller it is, the stricter the judgment of the two.

**Mask Range:** used to judge the area similarity of the ontology and the exception, the smaller, the more stringent the judgment of the two.



**Hardware:** Set all kinds of hardware related parameters.

**Cull parameters:**

**Duration:** Reset after how long the culling action lasts. In milliseconds.

**Delay:** The delay between the time the anomaly is detected and the time the culling begins. In milliseconds.

**Cull Calibration:** Used to solve the problem of inaccurate culling caused by time deviation of the algorithm or sampling. The default value is 20. If there is no special need, non-professionals should not adjust it.

**Cull mode:** See software for instructions. The mode with the word "bulk material" is used for small products to pass in piles, and the mode without the word "bulk material" is used for single pieces to pass. Most of the modes used in the standard machine are 1, 2 and 8, and the others require special scenes and hardware configuration.



: Click the button to test the elimination effect of the hardware.

**X-ray Voltage (kV) :**

**Tube Voltage:** Adjust the energy value of the X-ray, when the product is thicker, the recommended voltage is 55 to 65kV. When the product is thinner, the recommended voltage is 40kV.

It should be noted that the tube current does not have an open interface in the CSS series software and can be dynamically adjusted during operation. The specific adjustment strategy can be referred to the following table:



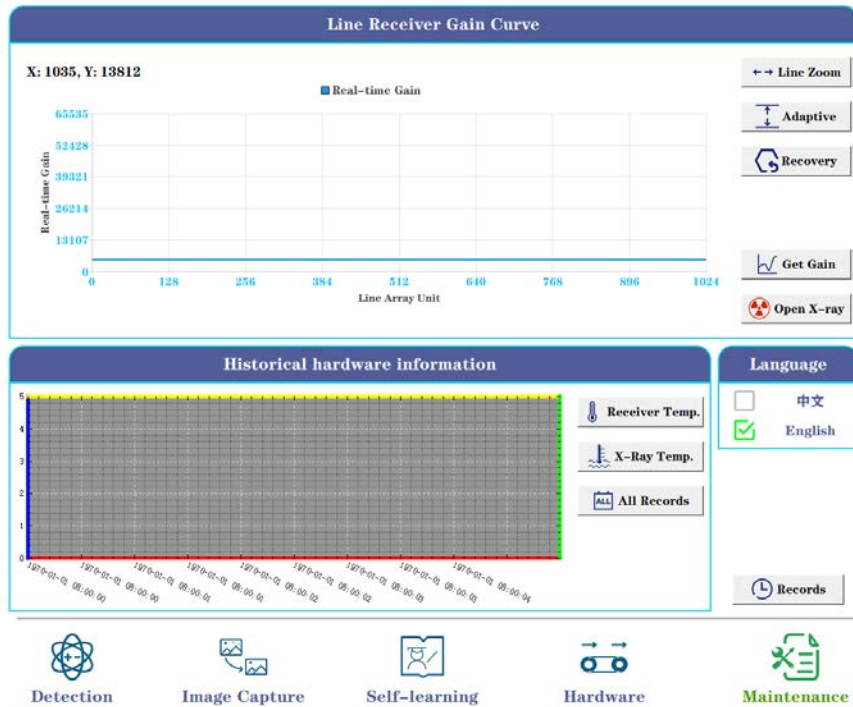
**Transmission:**

**Speed:** Control the transfer speed. Standard machine default 4000mm/min, if you want to change the need to keep pace with the integration time.

**Ratio:** Control the motor drive of the conveyor belt.

**Direction:** Controls the running direction of the conveyor belt.

**Bulk material hardware parameters:** bulk machine proprietary, packaging machine is not open.



## Maintenance:

### Line Receiver Gain Curve:

**Get Gain:** Read the response data of the detector and display it to the window.

**Open X-ray:** Used to turn on and off X-rays to see the detector's bias and gain values, respectively.

**Line Zoom:** Make the spacing of the X-coordinates larger.

**Adaptive:** Adaptively adjusts the response of the ordinate.

**Recovery:** Restore the original coordinate position of the window.

### Historical hardware information:

**Receiver Temp:** Click to view the detector temperature curve for the last three days.


**X-Ray Temp:** Click to view the last three days of the ray temperature curve.

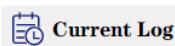
**All Records:** Click to select a file in history and visualize it (create a data file in three days).

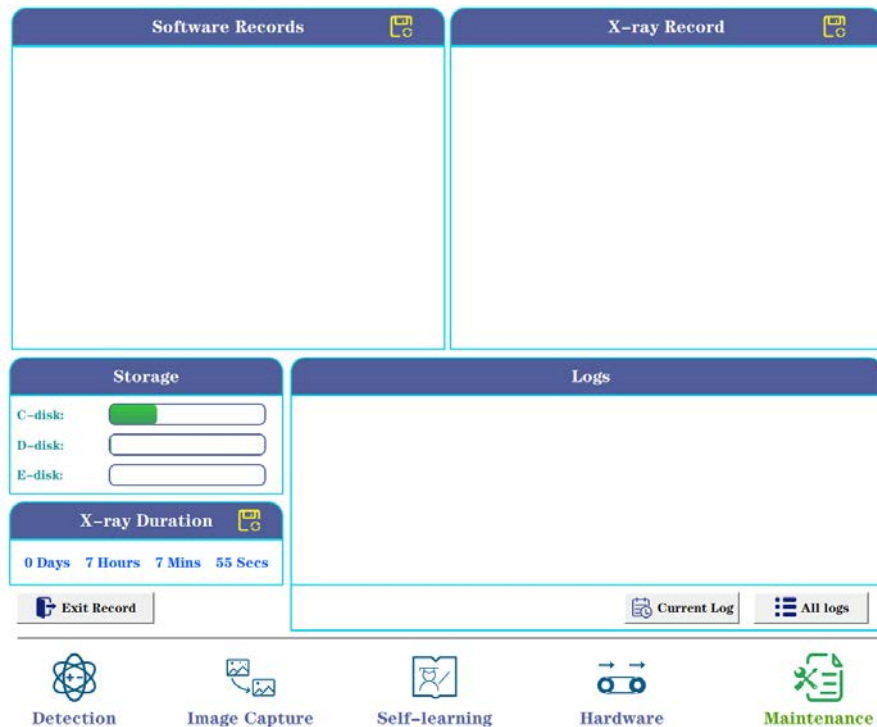
**Language selection:** Switch between Chinese and English, additional dependent components, need to be customized and optional.

**Records view:** Click to switch to the second record maintenance interface, as shown in the

picture below. Click the icon shown in the red box in the picture, you can update the software use

history, X-Ray use history and the total duration of X-ray exposure. Press  to

exit the resume maintenance page.  Used to refresh the log screen.



## 4 MAIN OPERATION PROCESS

### 4.1 When the product has been entered earlier

The software opens automatically after the machine is turned on



## X ray-HD Pro Foreign bodies Visualizer

Method 1: After software startup, **automatically** switch to the selected test item -> **Click Start** ->

**Click Running** -> Then Calibrate and running



Method 2: **Click on** Product Catalog -> **Click on** the product you want to test -> **Click** Select and Exit -> **Click on** Start -> **Click on** Running

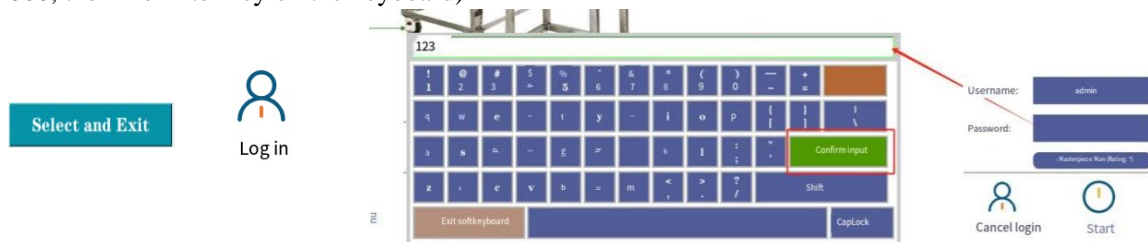


#### 4.2 When the product is a new category

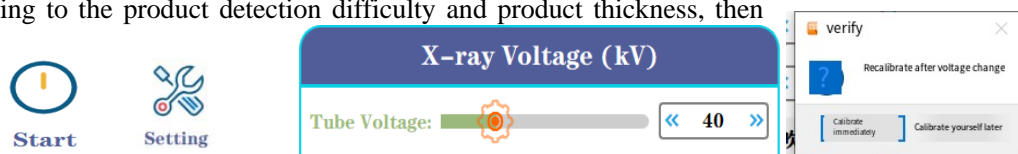
-> **Click on** Product Catalog -> **Click on** the Add at End Line -> **Double-click on** the column where the product name is and enter the product name -> **Double-click on** the column where the product lot number is and enter the product lot number



-> **Click** Select and Exit -> **Log in** to the secondary administrator (user name: worker password: 000, then **hit** Enter key on the keyboard)



-> **Click** Start -> **Click** Setting, **click** Hardware, **adjust** the tube voltage to the appropriate value according to the product detection difficulty and product thickness, then



**click** Calibrate.

-> **Click Save** and after returning, **click Running**



### 4.3 Self-learning feature

This function needs to be enabled when the default parameter error rate is high or there are desiccant, aluminum buckle and other objects that need to be shielded.

-> **Click on** the Inspection Library -> **Click on** the product you want to test -> **Click on** Select and Exit -> **Click on** Calibration

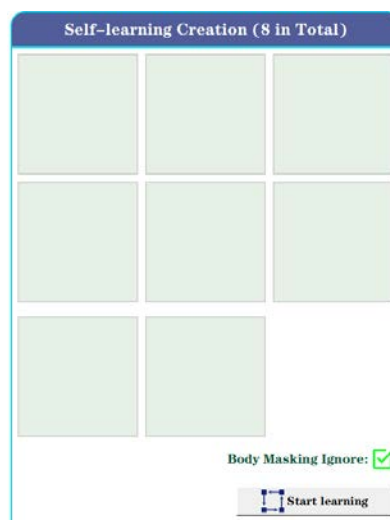


-> **Login** Administrator rights (User name: admin Password: 123, then **hit** Enter on the keyboard)

-> **Click Start** -> **Click Parameters**



-> **Click Self-Learning** -> **Check** Body Masking Ignore -> **Click** Start Self-learning (learning will stop automatically after 8 times, and the software will calculate algorithm parameters automatically).



-> **Click** Save and return and then **click** Running



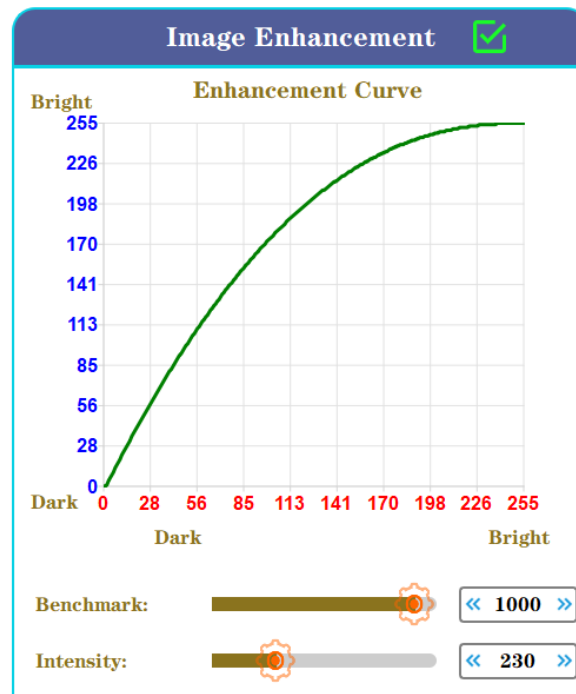
#### 4.4 Image Emphasis

-> **Log** in with secondary administrator permissions (username: admin Password: 123, then **hit** Enter on your keyboard)

-> **Click** Start -> **Click** Setting



-> **Click** Image Capture -> **Check** Image Enhancement -> **Adjust** the emphasis base and emphasis intensity slider, **observe** foreign objects and image contrast maximum.



#### 4.5 Maintenance Guide

1. Click calibration invalid or click start invalid solution: Check the main interface X-Ray,

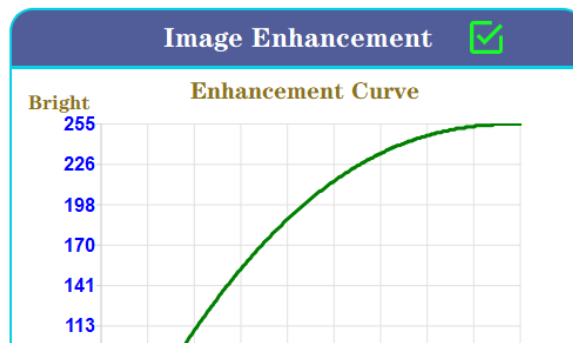


Line Receiver, Transmission are all properly connected (normal connection is gray, abnormal connection is blue).



2. Solution when the image is oversaturated or too dark after successful calibration and startup:

-> First check if the enhancement enable is turned on, if it is turned off.



-> If the first step does not work, then click on the image parameter and adjust the Initial Stretch to about 42500.



3. In the process of use, the solution when the image suddenly does not appear:

-> First check whether the X-Ray, Line Receiver, Transmission and algorithm are normal (red is normal after starting, gray is abnormal).

Real-time status		
CPU Usage:	3.2	%
Memory Usage:	21.6	%
Tube Voltage:	0	kV
Tube Current:	0.00	mA
Line Receiver Temp.:	0	°C
X-Ray Temp.:	26	°C
Capture Time:	0	S
Inference Time:	0	S

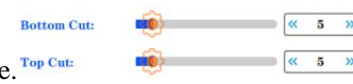
-> If the first step is normal, check whether the Tube Current and Tube Voltage are greater than 0%.


-> If the second step is normal, check whether the X-Ray Temp and the Line Receiver Temp are over temperature (more than 52°C will alarm shutdown).

4. The solution when the picture is not shown once the machine is started:

-> Possible case 1: both sides of the detector are not irradiated by radiation, you can slightly

adjust the cutting parameters of the large image.



-> Possible case 2: **Initial Stretch:**  The Initial Stretch parameter is too large, please reduce it to about 42500.

-> Possible situation 3: There is interference in the transfer channel, need to stop to clean the belt and channel and recalibrate.

#### 4.6 Turn off the X-ray foreign object detector

1. The technical operator clicks the "one-click Power Off" button to shut down the computer directly or the administrator (maintenance engineer) exits the software and shuts down the computer from the windows Power Management in the lower left corner of the computer.
2. Turn off the right side safety lock (turn it 90 degrees counterclockwise);

3. Do a safety check (power supply, etc.).