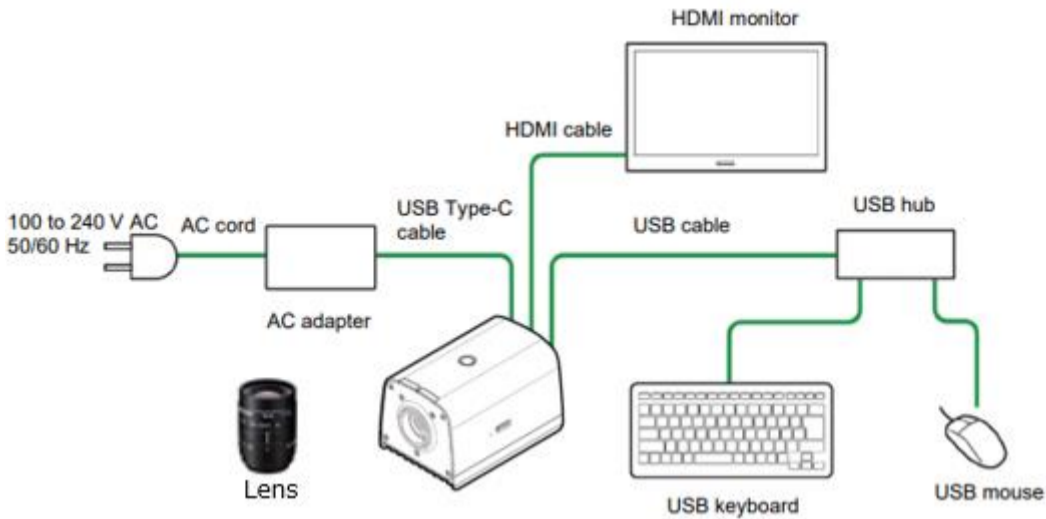
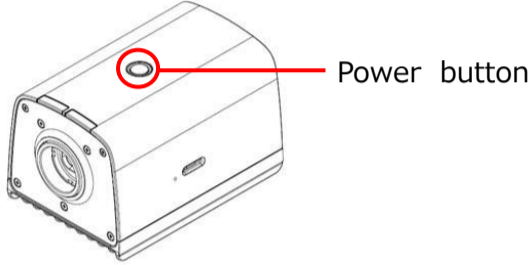
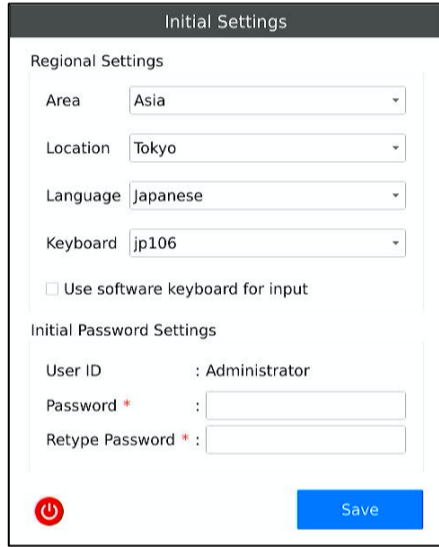


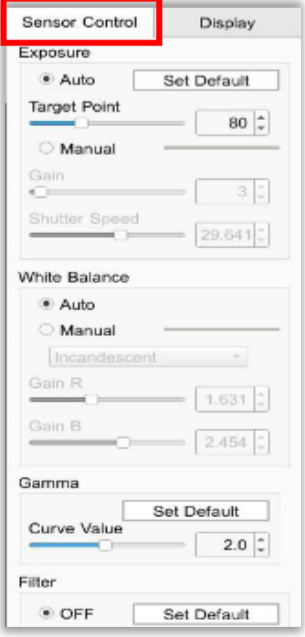



Work Inspection Camera

RICOH SC-20

Easy Setup MANUAL

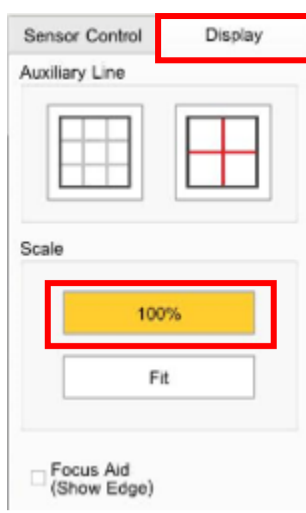
Setup procedure

Explanation	Image
<p>prerequisite</p> <p>Please prepare some tools yourself.</p> <ul style="list-style-type: none"> ■ Required environment for handling the SC-20 <ul style="list-style-type: none"> ● Monitor/HDMI® cable ● USB Mouse/USB Keyboard ■ Option <ul style="list-style-type: none"> ● USB flash drive/SD card ● USB hub (3 or more ports) 	
<p>process 1 : Power on</p> <p>Press the power button.</p>	
<p>process 2 : Initial Setting</p> <p>The initial setup screen will be displayed at first startup.</p> <p>For use in Japan, please configure as follows.</p> <p>Example</p> <p>Regional Settings</p> <p>Area : Asia</p> <p>Location : Tokyo</p> <p>Language : Japanese</p> <p>Keyboard : jp106</p> <p>Click the Save and Reboot the system.</p> <p>The settings can be changed at any time from the "Initial Settings" menu under "System Settings".</p>	
<p>process 3 : Log in</p> <p>Log in as an administrator. Enter user ID "Administrator" and click the Login button.</p>	
<p>process 4 : Setting sensor control</p> <p>Click  button on upper right corner of the screen.</p> <p>From the Sensor Control menu, display the camera image settings screen.</p> <ul style="list-style-type: none"> ● Adjust the exposure compensation (brightness), using the slide bar under [Target Point]. ● Check [Manual] to make detailed settings for gain, shutter speed, and white balance. <p>* Adjust the color and shape to the most visible state while viewing the image of the target object.</p>	<div style="display: flex; justify-content: space-around;"> <div data-bbox="852 2065 1136 2659">  <p>Auto</p> </div> <div data-bbox="1178 2065 1461 2659">  <p>Manual</p> </div> </div>

process 5 : Focus adjustment

Turn the focus ring on the lens and adjust the focus so that the image of the object is clearly displayed.

*The focus can be adjusted even more precisely by using [Scale] in the [Display] menu to display the image in equal size.



process 6 : Capturing the Master Image

This function allows you to capture a master image. Place the object in the completed state (i.e., the work has been done correctly) and click

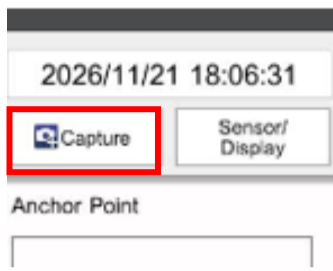


button in the upper right corner of the screen to take a picture.

Set the destination and file name and save the image.

*This is to prepare an image of the completed state (what it should be) of the process to be judged by the camera. The camera compares this image with the state of the work in progress, and judgment is made as to whether or not they match.

*In the case of assembly work, a master image for each work item (Item_1, 2, ...) is required.



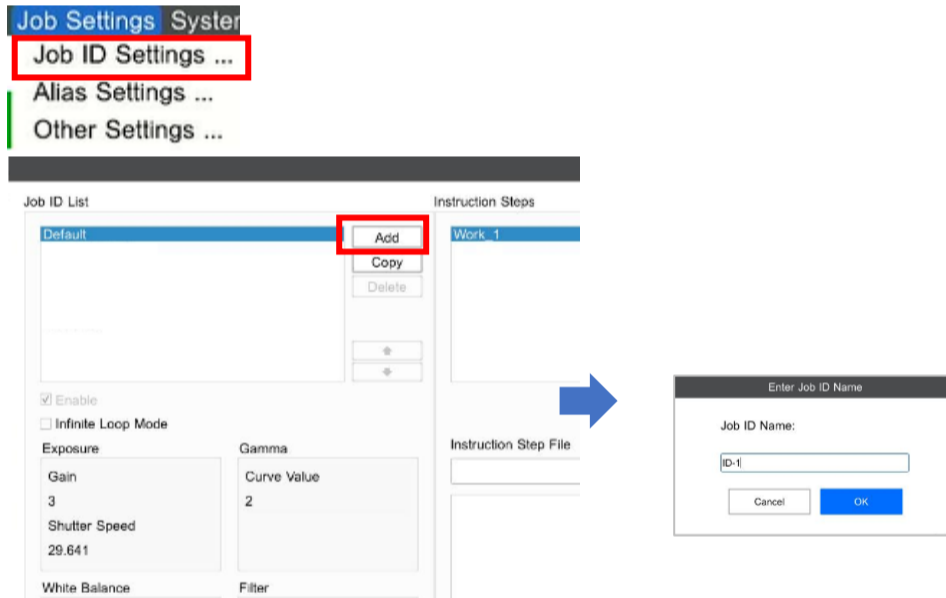
Example: Parts insertion → Cover installation → Screw installation
If the above three processes are involved, three master images are required.

process 7 : Register Job ID

A series of workflows are registered as a [Job ID]. Multiple work processes from the start of inspection to the end of inspection are defined in a single [Job ID] for the object to be assembled by the operator.

Click [Job Settings] - [Job ID Settings...] at the top of the screen to display the settings screen. at the top of the screen to display the settings screen.

Click the [Add] button in the Job ID list to register a new Job ID.



process 8 : Setting the "Instruction Steps"

In the [Job ID List] on the left side of the screen, select the Job ID registered in step 7.

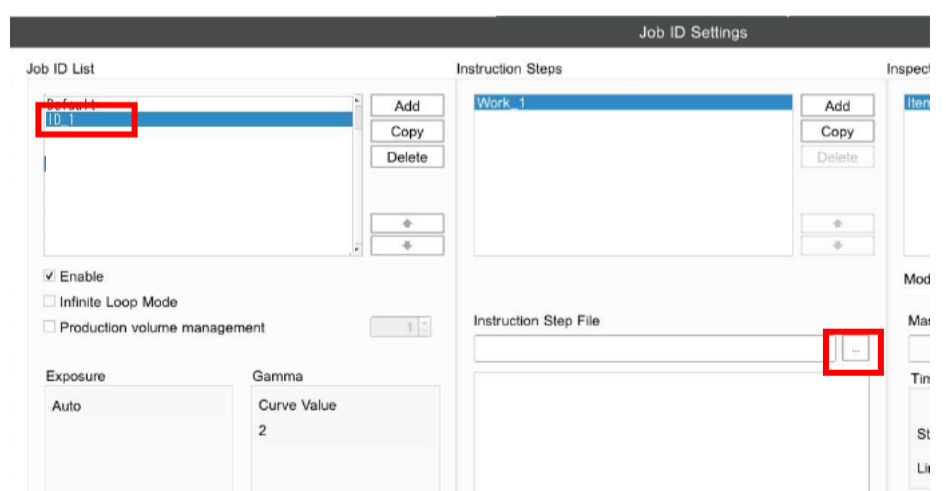
Work_1" is automatically created in [Inspection Steps] in the center of the screen. Example: If there are the three processes: Parts Insertion → Cover Installation → Screw Installation,

Register the work items in Work_1 for parts insertion, Work_2 for cover installation, and Work_3 for screw installation.

Create as many work items in the Inspection Steps as the number of required processes by clicking the "Add" button.

*If there are work instruction images, select the work instruction image from the Instruction Step File [...] under [Instruction Steps] in the center of the screen. The work instruction image will be displayed in the lower area.

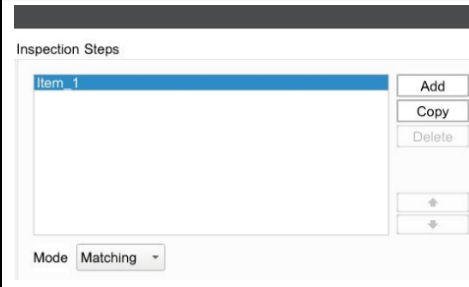
*Only JPEG images can be used for the Instruction Step File. Please convert data created in Word, PowerPoint, Excel, etc. to JPEG using the provided editor software.



process 9 : Setting the "Inspection Steps"

"Item_1" is automatically created in [Inspection Steps] on the right side of the screen. Up to 20 points can be determined for one work item.

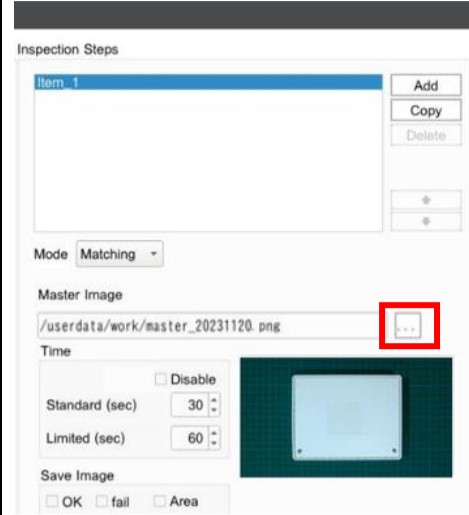
If you need to judge more than 21 points, please add the item.



process 1 0 : Select Master Image

Press the [...] button to select the master image captured in process 6.

The master image is displayed in the master image display area.



process 1 1 : Set checkpoint

Click on the master image in Process 10 to set the checkpoints.

Checkpoints → Specify the actual work area.

Up to 20 checkpoints can be set.

*To set more than 21 checkpoints, add items from the "Add" button in Process 10 [Inspection Steps] and set the 21st and subsequent checkpoints.

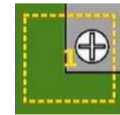
*Anchor point is set to specify the location of the object. The position of each checkpoint is specified by the relative distance from the Anchor point, and judgment is made.

*The maximum and minimum ranges of checkpoints are determined.



When a checkpoint is specified, a yellow dotted frame is displayed. The number of the search order is displayed in the frame.

- The maximum specified size of checkpoint is 500 (pixel) x 500 (pixel).
- The minimum specified size of checkpoint is 50 (pixel) x 50 (pixel).



process 1 2 : Checkpoint Parameter Settings

Right-click on the checkpoint (yellow frame) set in Process 11 and select

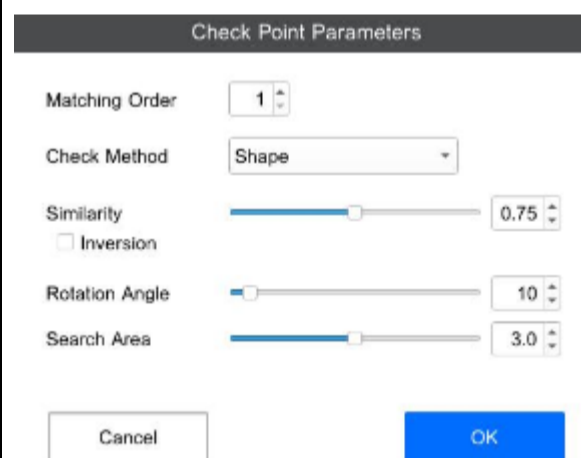
"Parameter Settings" to configure detailed settings.

[Similarity Inversion] → Threshold can be set. The score is 1.00 for a 100% match. Ideally, the similarity should be adjusted by checking each score before and after the work to be inspected.

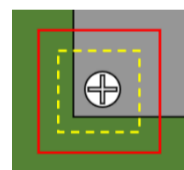
[Rotation Angle] → Sets a tolerance range from 1 to 180 for any variation in the rotation of the checkpoints.

[Search Area] → Sets the size of the checkpoint search area.

Example: If the checkpoint is 100 x 100 pixels and this setting is 1.5, the image on the right is shown.



*The rotation angle values are ±° (±10° in the example at left).

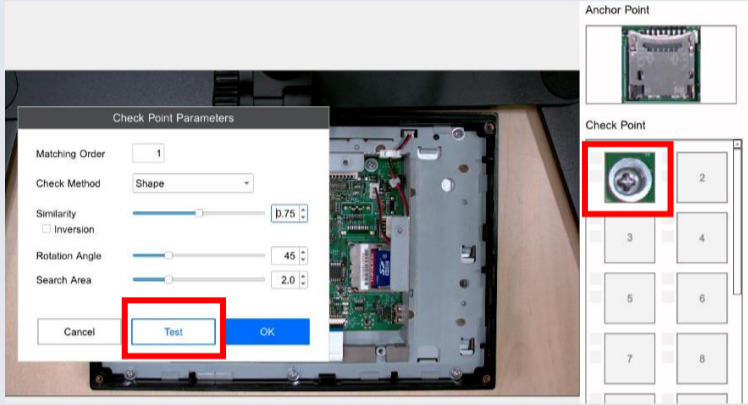


Tips **Work Inspection Flow**

Q : What is the work inspection process for SC-20?

A : For each checkpoint, the degree of conformity of the shape (or color in the case of color recognition) with the master image is measured by image recognition, and if they match, it is judged as OK. The setup work can be repeated to find the optimal settings while repeatedly testing the judgment, thereby preventing misjudgment.

■ ■ ■ Glossary ■ ■ ■

Checkpoint	Actual inspection points. For example, in the case of screw tightening work, the screw point is the checkpoint.
Test	Function to test the judgment. Click the thumbnail image of the checkpoint on the right side of the standby screen and click the "Test" button in the dialog to test. 
Score	This is a numerical value of the shape matching (or color matching in the case of color recognition) with the master image. A score of 1.00 is assigned when there is a 100% match with the master image.




Tips **Logic for Judgment**

Q : What logic is used to calculate scores for "shape" and "color" recognition, respectively?

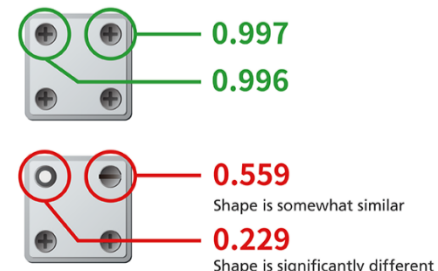
A : In the "Shape" check method, the image to be inspected is binarized, and the degree of agreement is calculated by comparing only the shape of the outline (color differences have no effect). The "Color" check method compares the area of the color specified in the "Specified Area" to calculate the degree of matching (shape differences have no effect).

Shape

Similarity: Outline similarity (Any color)
Application: For shape differences




Subject of inspection	Score
Master image / Sample 0 	0.997
Sample 1 	0.422 Shape is different
Sample 2 	0.992 Shape is the same (Any color)

Usage example: Check for screws

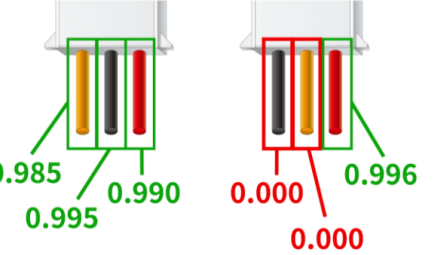


Color

Similarity: Designated color area similarity (Any shape)
Application: For color differences For designated color area differences

Subject of inspection	Score
Master image / Sample 0 	0.993
Sample 1 	0.905 Same red color with minor area differences
Sample 2 	0.000 No red color area

Usage example: Check cord color differences

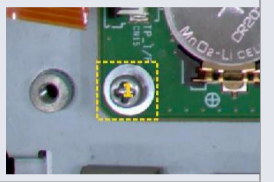
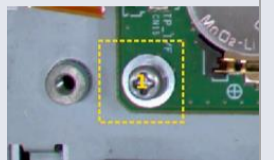


Tips Checkpoint size

Q : How large should the checkpoint be?

A : When specifying checkpoint, the size of the area to be surrounded is important. Perform a "test" of the judgment before and after the work to be inspected, respectively, and set the size to which the score difference is the largest.

■■■ This is the trick ! ■■■

Trick①	Basically, set the minimum size according to the size (shape) of the object to be inspected. If other items are included, the score will also reflect the size of the items, and therefore, the difference in score tends to be less pronounced.	
Trick②	If the score varies with the minimum size and the judgment is not stable, please try a slightly larger enclosure. Since SC-20 is a high-definition product, the scores may be skewed depending on the way the light hits the object or the condition of the object. In such cases, including the area around the object to be inspected in the checkpoints will stabilize the score difference and make it effective.	
Trick③	If the inspected object is too large to fit in the specified size of checkpoint , please specify a characteristic point of the inspected object (a point where there is a clear difference between before and after work). <ul style="list-style-type: none">● The maximum specified size of checkpoints is 500 (pixel) x 500 (pixel).● The minimum checkpoint size is 50 (pixel) x 50 (pixel).	

Tips Parameter Setting for Checkpoint

Q : Do I need to set parameters for checkpoint?

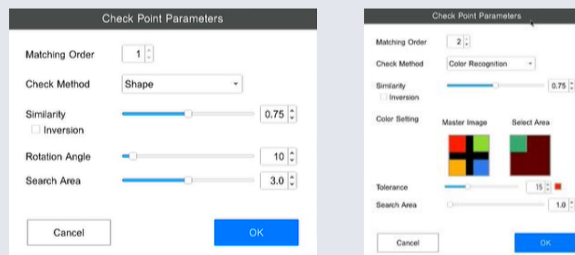
A : The accuracy and speed of judgment can be improved by adjusting the parameters of each checkpoint.
There are three parameters to adjust: "Similarity," "Rotation Angle," and "Search Range".

■ ■ ■ Glossary ■ ■ ■

Similarity	Set how much the score (shape matching with master image (color matching in case of color recognition)) is acceptable for judgment, and the lower limit for OK.
Rotation Angle	Set the acceptable range for judgment when the inspection target is rotating, from $\pm 1^\circ$ to $\pm 180^\circ$. This parameter is especially important for screw tightening work.
Search Range	Set the width of the search range when locating the inspection target. The equivalent checkpoint width is set to 1.0, and the larger the number, the wider the search range.

■ ■ ■ This is the trick ! ■ ■ ■

Trick①	The best value for " Similarity " is based on the results of the test. For example, if the test results are [Before: 0.37] and [After: 0.98], set any value in between. The closer the set value is to the pre-work value, the more lenient the judgment will be, and the closer it is to the post-work value, the more severe the judgment will be.
Trick②	The " Rotation angle " value should be set to [45] ($\pm 45^\circ$) for screw tightening operations, since there are variations in the rotation state of screws after the operation.
Trick③	If the value of " Search Range " is set too small, it may not be possible to locate the inspection target, so first test with the default value [3.0]. If there are objects of similar shape near the object to be inspected, adjust the value smaller if necessary. For three-dimensional objects such as screws, set the value to [1.2] or higher.
Trick④	If there are different-colored items , two checkpoints can be set for the same inspection target, and the check method can be set to "shape" and "color" matching to prevent misjudgment.



Process 1 3 : Anchor Point/Anchor Point ROI settings

After the checkpoints have been set, set the Anchor Point.

*If you are using a positioning mechanism (e.g., a jig to place an object (product) in a fixed location) for assembly, you do not need to set reference points.

- Anchor Point → Set a point that serves as a positioning reference for the object. Specify the area where there is a feature and no similar shape exists.
- Anchor Point ROI → Set the area where the Anchor Point is searched.

*The Anchor Point is set to specify the location of the object. The position of each checkpoint is specified by the relative distance from the Anchor Point, and judgment is made.

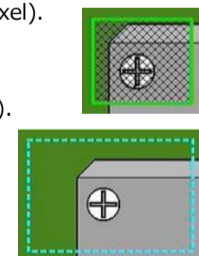
*The maximum and minimum range of the Anchor Point is determined.



When [Anchor Point] is specified, a green frame is displayed.

- The maximum specified size of the Anchor Point is 700 (pixel)x700 (pixel).
- The minimum specified size of the Anchor Point is 50 (pixel)x50 (pixel).

A light blue dotted frame is displayed when specifying the area for [Anchor Point ROI].



Tips **Anchor Point**

Q : Why is it necessary to set an **Anchor Point**

A : To specify the location of the object (product) to be assembled and one anchor point from which to search for checkpoints.

Since the setting of the anchor point affects the speed at which the inspection starts and the accuracy of the judgment, we recommend making optimal adjustments [here](#) as well.

*When using a positioning mechanism for the object (product) to be assembled (e.g., a jig to place the product in a fixed location), setting of an anchor point is not required.

■■■ This is the trick ! ■■■

Trick①	Specifying a position as close as possible to each checkpoint reduces errors in relative position to the checkpoint and improves search accuracy.
Trick②	As with checkpoint, the Anchor Point is searched for by comparison with the master image through image recognition. Therefore, specify areas where the shape is unique and no similar shape exists. <ul style="list-style-type: none">● The maximum specified size of an Anchor Point is 700 (pixel)x700 (pixel).● The minimum specified size for an Anchor Point is 50 (pixel)x50 (pixel).
Trick③	Please specify a part of a shape that includes straight lines, not a circular object. If you specify a circular object, the orientation of the object's installation will be incorrectly recognized, resulting in a large error in the relative position to the checkpoint.

Tips **Anchor Point ROI**

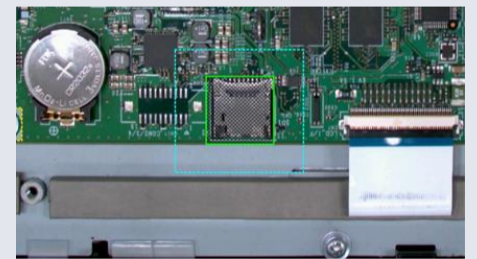
Q : What is the **Anchor Point ROI** ?

A : In order to search for the **Anchor Point** quickly and improve processing speed, the search can be focused on the area specified in the "**Anchor Point ROI**" instead of the entire screen.

*If you do not set an **Anchor Point**, you do not need to set a search area.

■■■ This is the trick ! ■■■

Trick①	Specify a range so that the Anchor Point is in the center of the search area.
Trick②	Specify a range wider than the Anchor Point (About 3 times larger). If the range is too large, the search area will expand and processing speed will decrease.



process 1 4 : Time and image storage settings

[Standard (sec)] → Allows you to set the standard time for that operation.
 *When the standard time elapses, the elapsed time bar on the main screen changes to yellow.

[Limited (sec)] → If the set time is exceeded, a NG judgment will be made.

[Save image] → The image of the OK/NG judgment can be saved.
 *The frames of checkpoints, etc. can also be saved as JPEG images.



process 1 5 : Flow methods setting

Please set up the inspection flow at your choice.

Sequentiality	Check registered checkpoints in order.
Batch	Check all registered checkpoints at once.
One Shot	Check all registered checkpoints only once.

* [Sequentiality] and [Batch], the mode is to search for OKs up to the maximum time limit set in process 14.




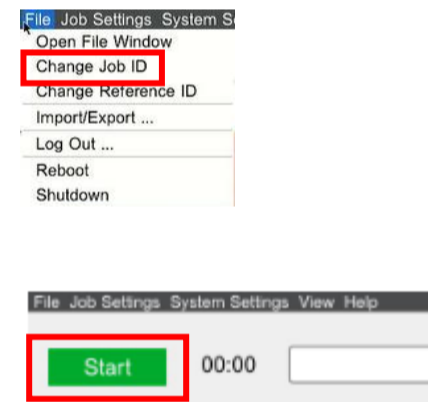
process 1 6 : Save Settings

Click the "Apply" button in the lower right corner to save the settings.

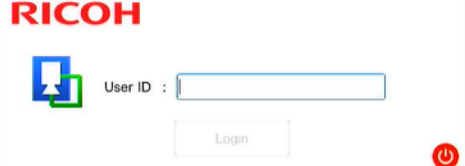

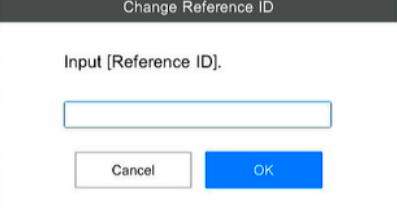


process 1 7 : Confirmation of Settings

Return to the main screen, select the Job ID created in Process 7 from "Change Job ID" in the "File" menu, and confirm the judgment status with the  button.



Operation procedure (worker mode)

Explanation	Image
<p>process 1 8 : Login</p> <p>Log in with the worker's user ID.</p> <p>*User ID is recorded as data in the operation log.</p>	
<p>process 1 9 : Job ID</p> <p>Enter the Job ID from the pulldown.</p>	
<p>process 2 0 : Reference ID</p> <p>Enter the Reference ID.</p> <p>*The entered data will be recorded in the operation log.</p> <p>(The data entered will be recorded in the operation log.)</p> <p>*The camera flow starts automatically when the Reference ID is entered.</p>	
<p>※ supporting information ※</p> <p>The Job ID and Reference ID can be omitted in the preset settings.</p>	