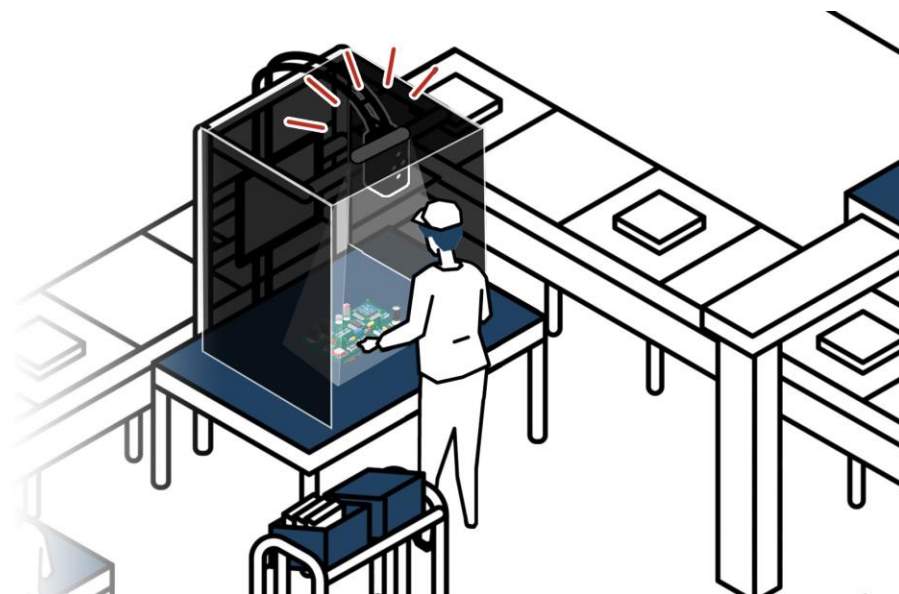


Work Inspection Camera
RICOH SC-20

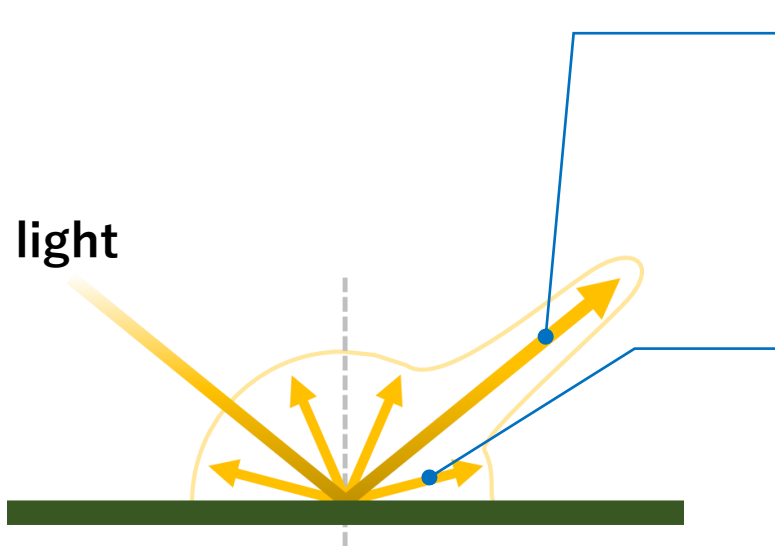
Lighting for
improved
inspection
accuracy

RICOH
imagine. change.



Specular and Diffuse reflection light

There are two types of light reflected from an object.



Specular reflection light

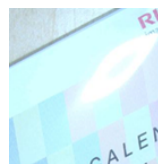
Light that reflects like a mirror. It occurs on objects with shiny surfaces, such as metals. It is suitable for detecting **scratches, foreign objects, and engravings** with uneven surfaces in work inspections. In addition, the light reflected from an object can be used to create a contrast between the object's brightness and darkness, and to outline the object.

Diffuse reflection light

Light reflected in various directions. Occurs on objects with rough surfaces and objects without luster or gloss. Suitable for detecting **shiny objects** that are prone to halation in work inspections, etc., without any effect. Examples: Transparent vinyl, tape, metal parts, etc.



Specular reflection light



Diffuse reflection light



- ✓ Since the judgment value is affected by the way light falls on the image, it is necessary to construct an environment where the light is constant.
- ✓ Since the selection criteria vary depending on the actual installation environment and the object, it is necessary to select the appropriate lighting for the environment. ↓

Need to build an environment that matches the characteristics of the inspection object !

Since SC-20 uses the image recognition function to inspect the work, it is very important to stabilize the "light".

- ✓ **Maintaining constant lighting (brightness)*1**
- ✓ **Prevention of ambient light**

In the absence of stable light, the following adverse effects may occur during SC-20 work inspections.

- **OK/NG judgment at the time of work execution does not work well or is not constant**
- **The condition at the time of inspection is not the same as when the master image was taken**

*1 [Reference] ILLUMINANCE

JIS Illuminance Standard_Factory

※ Excerpt from JIS Z 9110 : 2010

※ The illuminance of the work surface on the workbench should be set to 1000lux or less.

◆ Activity Name and Maintained Illuminance

- Extremely fine vision work 1500lux
- Slightly fine vision work **750lux ← Recommended**
- Normal vision work 500lux

Illumination levels high enough to eliminate ambient light are not acceptable in an environment where workers are present.

(It is too dazzling for some people to work in)

[Reference]JIS Z 9110:2010 General rules of recommended lighting levels

Source: Japan Industrial Standards Committee Table 10 - Factories (Some of the data are shown in the table)

Type of area, work, or activity		Em (lx)
Work	Extremely detailed visual work in precision machinery and electronic component manufacturing and printing plants, e.g., assembly a, inspection a, testing a, sorting a	1500
	Fine visual work such as sorting and inspection in textile factories, typesetting and proofreading in printing factories, and analysis in chemical factories, e.g., assembly b, inspection b, testing b, and sorting b.	750
	Ordinary visual work in general manufacturing plants, e.g., assembly c, inspection c, testing c, sorting c, packaging a	500
	Limited by rough vision work, e.g., packaging b, packing a	200
	Very rough and limited visual work, e.g., packing c, packing b and c	100
	Design, Drawing	750
	Monitoring of instrument panels and control panels in control rooms, etc.	500
	Clerical work in warehouse	300
	Loading, unloading, moving of cargo, etc.	150
	Office space	Design Office, Drawing Room
Public space	Control room	200
	Electrical room, HVAC machine room, warehouse with work, lavatory, washroom	200
	Stairs	150
	Warehouse (200lx for permanent use), corridors, passageways, entrances and exits	100

Note: The names of similar tasks are divided into the following three categories according to the nature of the object and the task to be performed.

a) "a" in the table denotes fine, dark, weakly contrasting, particularly expensive, hygiene-related, requiring high precision, or requiring long working hours, etc.

b) "b" in the table represents the intermediate between a) and b).

b) "b" in the table represents the intermediate between a) and b).

c) c in the table represents coarse, light-colored, rugged and less expensive ones.

Explanation of Terms Maintained Illuminance (Em): the value at which the average illuminance of a given surface should be maintained not to fall below during the period of use.

Basically, the environment is set up with existing lighting on the workbench.

First, the environment is established with lighting on a general workbench to see if the inspection judgment is stable.

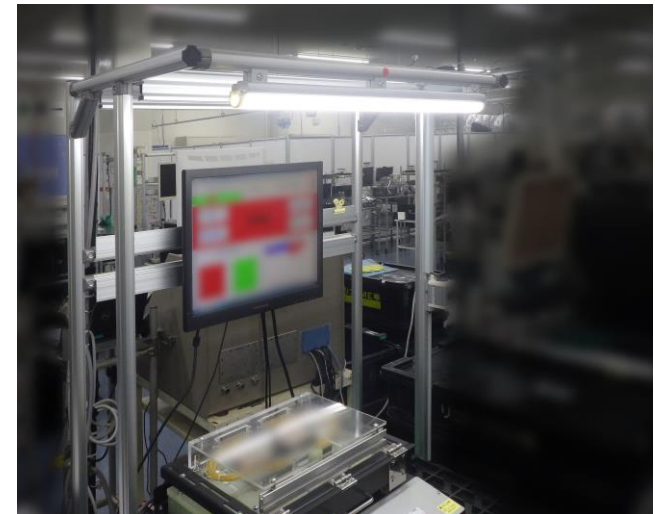
- Is it possible to create an environment unaffected by ambient light by using translucent boards, etc.?
- Is the inspection affected by nearby workbench lighting or nearby lights going out?
- Is the lighting level too low and dark?
- Is there a shadow on the inspection object due to the position of the worker?

Installation of lighting equipment to stabilize light.

If existing lighting is difficult to stabilize, lighting equipment can be installed to reduce variation in inspection judgments.


- ✓ Install ring or bar lighting above the object to be inspected.
- ✓ Ensure that checkpoints (areas to be judged) are clearly visible (clear outlines) rather than the entire object.
- ✓ Minimize the effects of changes in time of day and ambient lighting.
- ✓ Adjustable illumination intensity that is not too glaring and stable for inspection
- ✓ No need to worry about the shadow of the worker

Example of bar lighting installation



Adjustment by "Sensor Control" function of SC-20

SC-20 is equipped with a "Sensor Control" function that adjusts the exposure and color of the camera function. When used in conjunction with lighting equipment, SC-20 can further stabilize inspection accuracy.

Press  in the upper right corner of the screen to display the [Sensor Control] menu.

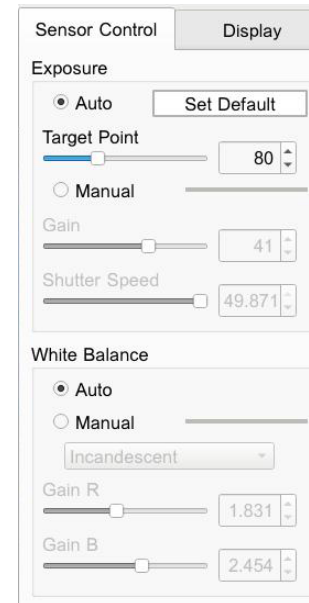
■ Exposure

- Exposure compensation (brightness) can be adjusted using the slide bar under **Target Point**.
- By checking **Manual**, you can make detailed settings for gain, shutter speed, and white balance.

■ White Balance

- By checking **Manual**, you can select from presets and adjust the gain.

Auto state (default)



Sensor Control Display

Exposure

Auto Manual

Target Point

Gain

Shutter Speed

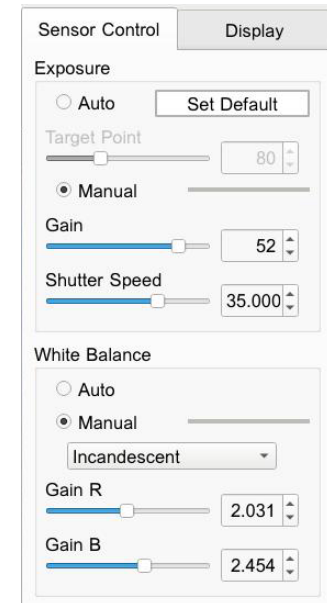
White Balance

Auto Manual

Gain R

Gain B

Manual State



Sensor Control Display

Exposure

Auto Manual

Target Point

Gain

Shutter Speed

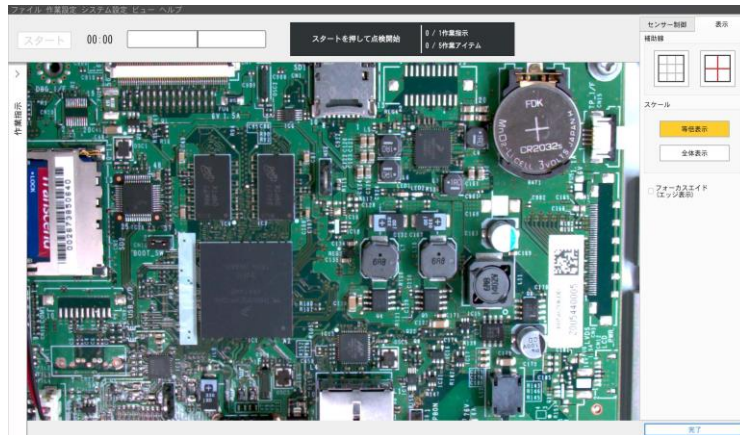
White Balance

Auto Manual

Gain R

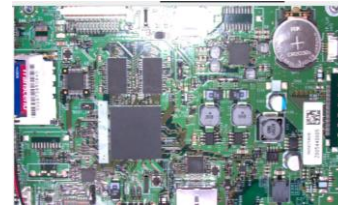
Gain B

Example of ideal view



The outline of the object can be clearly confirmed.

Bad examples




There is a blown out highlight and checkpoints are not visible.



The fluorescent light is reflected and the threads appear.



Shadows appear on the object.

※ In the reference material  [Collection of tips by application \[Lighting\]](#), we introduce various tips for building environments for different types of objects and lighting equipment.