COLOR VISION SENSOR SERIES

Patterns Recognition Sensor

CVS2

Instruction Manual

OPTEX

FOREWARD

- Thank you for purchasing our color vision sensor series Patterns Recognition Sensor (CVS2).
- Carefully read this manual before using this device for correct use.
- After reading this manual, keep it handy for ready reference.
- This device cannot be used as a safety-related device to protect human body.

Legend of Safety Symbols

In this manual, various symbols are used for safe use of the device, preventing the harm to you and other persons as well as the damage to the property.
Symbols and their meanings are as follows. Before reading this manual, fully understand the meanings of these symbols.

 WARNING Indicates a possible hazard that may result in death or serious injury if the device is used incorrectly without observing stated instructions.

 CAUTION Indicates a possible hazard that may result in any injury or property damage if the device is used incorrectly without observing the stated instructions.

 Indicates precautions and regulations to be observed or other information useful to know.

PRECAUTIONS FOR SAFE USE

⚠ WARNING

- Do not disassemble nor modify the device. Otherwise, it may cause a fire or an electric shock.
- Continuing to use the device under abnormal conditions, such as those with abnormal smell or smoke, may cause a fire or an electric shock. In such cases, immediately pull out the power plug and confirm that the abnormal condition is removed, and then contact us or our sales representative. Never repair the device by yourself since it is dangerous.
- Do not use the device by a power voltage outside 12-24 V DC. It may cause a fire or an electric shock.
- Avoid wiring a cable and high-voltage or power cable in parallel or wiring them in a same piping. It may cause a malfunction of the device.
- Do not mount the device at any one of the following places to use this product properly and safely. If not observed, it may cause a fire, an electric shock, or a failure.
    - Place at high prospective humidity
    - Place at high prospective temperature (where the device is subject to direct sunshine)
    - Dusty place
    - Place with insufficient ventilation
    - Place where static electricity is likely to be generated
    - Place involving corrosive or flammable gases
    - Place where the device is subject to water, oil, and /or chemical splashes
    - Place with direct vibration and impact
- Do not handle electric cables as follows. Otherwise, cables may be damaged, resulting in a fire or an electric shock.
    - Damage
    - Torture
    - Pull
    - Twist
    - Bundle,
    - Put heavy stuff
- Do not touch the device or its cable with wet hand. Otherwise, it may cause an electric shock.

⚠ WARNING

- Do not insert any improper cable or metal into electrical terminals. It may result in short-circuiting inside the device, causing a fire, an electric shock, and / or a failure.
- Do not drop this device nor give any strong impact on it. It may result in personal injury, if it falls on your foot, or a device failure.

⚠ CAUTION

- Securely mount this device. This device may fall off due to insufficient mounting or unstable mounting position, resulting in personal injury or an accident.
- Wipe off the dirt on this device with a soft, dry cloth or a firmly squeezed cloth wet with diluted neutral detergent.
- Please note that there may be dead pixels or bright pixels with the LCD screen although it has been produced with a super-high precision technology.

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1 BASIC INFORMATION BEFORE USE

Confirm that the device is not damaged before using it.

Names and Functions of Components

Operating Buttons
Use to register patterns or colors, set each item, or switch the display mode of the screen.

☞ See "Names and Functions of Operating Buttons" on Page 15.

LCD Display
Displays the images and the detection result taken by the built-in camera. Also, displays each set item and set value.

☞ See "Display on LCD Screen" on Page 12
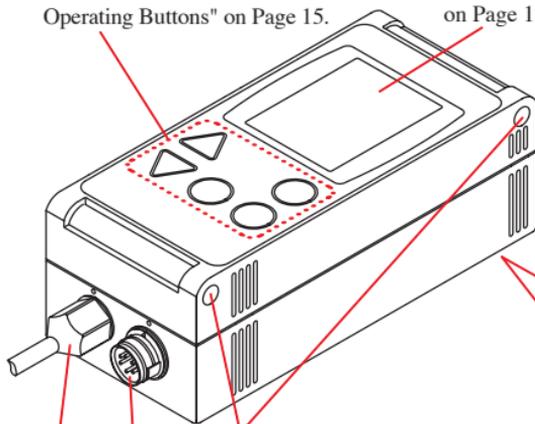
Mounting Hole
Using a screw M4×50 mm or more is recommended.

☞ See "Outside Dimensions Drawing" on Page 66.

Built-in camera and lights are equipped on the back.

Cable Connector
Connects external cable (Option).

☞ See "Options" on Page 11.

Power / Signal Cable Connector
Connects the power / signal cable.

☞ See "Wiring of Power Cable" on Page 10.

Precautions When Mounting This Sensor

• Mount the sensor leaned by 5°-45° so that lighting should not be reflected by a work.

5°-45°
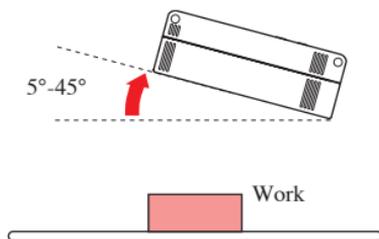
Work

• Detection may become successful by changing the setting even if a detected image is displayed as shown in the right figure.
☞See "Changing Set Value" on Page 48.
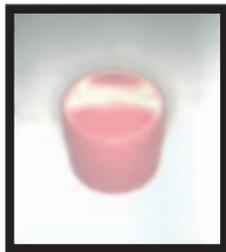
Tilt the sensor by 10°-40° to avoid the mirror reflection when a work is shiny.

• Take caution so that the external lighting (light from fluorescent light, etc.) is not reflected.

• The work imaging condition changes depending on the distance between the sensor and a work and the tilted angle of the sensor. When detecting a slight difference in shape, smear, or flaw of a work, furnish more stable bracket for this sensor and design the machine so that flattering of works is reduced as much as possible.

• Refer to the standard object distance of each model as to the distance between this sensor and a work.
☞See "Specifications" on Page 65.
If the object distance is too near, the sensor becomes out of focus, causing a irregular lighting, while it is too far, the sensor is likely to receive the influence of the turbulence light since the light does not reach the work.
☞See "Correction of Brightness Irregularity" on Page 46.

• When a work moving very fast is going to be detected, the shutter time (brightness) has to be shortened. In such a case, make the distance between the sensor and a work closer or add additional external lighting since quantity of light becomes insufficient with only the light built in this sensor.
☞ See "Options" in Page 11.

• The shutters of the image sensor of this device open in sequence from the right to the left in the screen. Because of this reason, the work traveling from the right to the left is displayed wider and the one traveling opposite is displayed narrower.
In order to detect a slight difference in shape, slow down the travel speed of a work.

• Please note that there may be dead pixels (pixels that cannot receive light correctly) with this image sensor. Although dead pixels may not detect or detect incorrectly, they will not be any problem on the practical use since they are very few.

1

Wiring of Power Cable

The following shows the color and signal allocations of the power / signal cable lines.
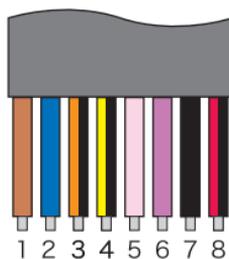
No	Line Color	Content of signal
1	Brown	12-24 V DC
2	Blue	0 V
3	Orange / Black	Bank switch 0 input
4	Yellow / Black	Bank switch 1 input
5	Pink	Bank switch 2 input / External teach input
6	Purple	Bank switch 3 input / Synchronous input
7	Black	Judgment output
8	Red/Black	Aux. output

- The LCD screen and lighting turn ON when the power lines are connected.
- The reference power capacity is 300 mA/unit.

Option

The following options can be connected to this device.

Model	Application
CVS-M1★ Remote Monitor	Monitoring unit furnished with the remote control function for the color vision sensor series. Connected to see the detection result at a place remote from the work. Also, teaching and various settings are possible as done with this device.
CVS-LW1★ External Lighting (white)	One-touch connected external lighting unit for the color vision sensor series; Use this lighting where this sensor is mounted at a dark place and stable result is not obtained due to insufficient lighting.
CVS-C3S Extension Cable (3 m)	Extension cable for the remote monitor. Four cables can be connected at maximum for extension (15 m in total).
CVS-C2C PC Connection Cable	Used to call out or save data, connected with a PC.

★ Patent being applied

· Three external lightings and one remote monitor can be connected per one unit of this device.

· The back light of the LCD display gets dark when the internal temperature increases. The back light will get bright by pressing the operating button of this sensor. The back light will get dark again if any push-button operation is not done within 60 seconds.

1

2   DISPLAY ON LCD SCREEN

Outline of LCD Screen

The display mode of the LCD screen is switched according to the item selected on the main menu.

Standard screen

"Standard screen" is first displayed when the device is powered ON.

Keep the device in this mode during the normal operation.

Main Menu

1 **Press** **or** **to select an intended item on the main menu.**

The selected item is displayed in yellow.

PARAMETER : Displays the Set Value Reference screen

TEACHING :   Displays the Teaching Menu.

SYSTEM :   Displays the System Menu.

2 **Press** **.**

Then, the intended screen will appear.

By pressing for 3 seconds or more after selecting **TEACHING** : **SAVE PATTERN** will be executed.

☞ See "Distinction by Patterns recognition" on Page 16.

Set Value Reference screen

Displays the present set value for each setting item. You can select an intended setting item and change its value in this screen.

☞See "CHANGING SET VALUE" on Page 48.

2

Teaching Menu

Performs the patterns recognition, the position & magnification correction, the registration of a pattern (shape) for rotation correction, and the edition of the masking area or the color detection area.

☞See "Distinction by Patterns recognition" on Page 16.

System Menu

Corrects brightness irregularity and captures image.

Details of LCD Screen

This section describes the details of the contents displayed on the LCD screen.
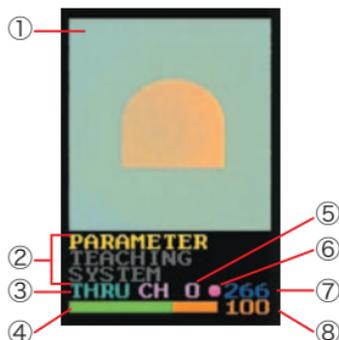
① Image screen

Displays the image taken by the built-in camera.

② Main menu

Displays the menu for setting or edition.

③ Screen display mode

Shows the display status when the display mode is switched with (VIEW) button.

☞ See "Confirming Identity by Switching Screen Display Mode" on Page 19.

④ Identity bar graph

Displays identity in a bar graph. The boundary between green and orange is the threshold value of identity. (The threshold value can be changed by the CMPLEVEL set value).

⑤ Bank number

Displays the present bank number. (0-14)

⑥ Auxiliary output status

Displays ON/OFF condition of an auxiliary output signal. Output is ON when ● is displayed.

⑦ Response time (Unit: 0.1 ms)

Displays the time from the beginning of imaging till the output of the judgment signal by the unit of 0.1 ms.

⑧ Identity and output signal condition

Displays the identity (0 -100) by a numeral.

A numeral displayed in orange shows that output is ON, while a numeral in green shows that output is OFF.

The screen to make setting and edition differs depending on each function. Refer to the explanations of each function for details.

Names and Functions of Operating Buttons
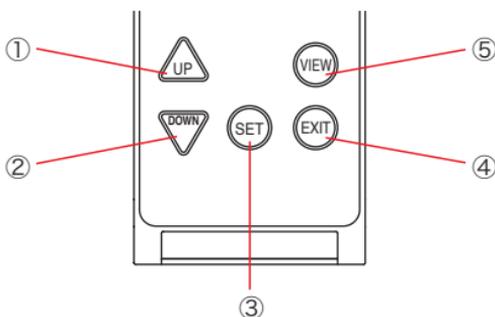
① UP button

Use to increase a set value, etc. or change a set item.

② DOWN button

Use to decrease a set value, etc or change a set item.

③ SET button

Use to change or edit a set value or move to the selected menu.

④ EXIT button

Use to change or edit a set value or return to the previous menu.

⑤ VIEW button

Use to switch the display mode of the screen.

☞ See " Confirming Identity by Switching Screen Display Mode" on Page 19.

3 DISTINCTION BY PATTERNS RECOGNITION

If you want to use this device immediately or try the patterns recognition, try to distinguish works by using the patterns recognition method described here.

The easiest setting method not performing any correction is explained, using the sample work at the end of this manual.

Use the applied functions such as correction, etc. if successful distinction cannot be made by this method.

☞ See "USE OF APPLIED FUNCTIONS" on Page 22.

Outline of Patterns Recognition

To distinguish a work by the patterns recognition, register the pattern of a good work (shape) in the beginning. Identity is distinguished by comparing a work with the registered pattern.

Registered pattern

Compare work with the pattern.

OK   NG
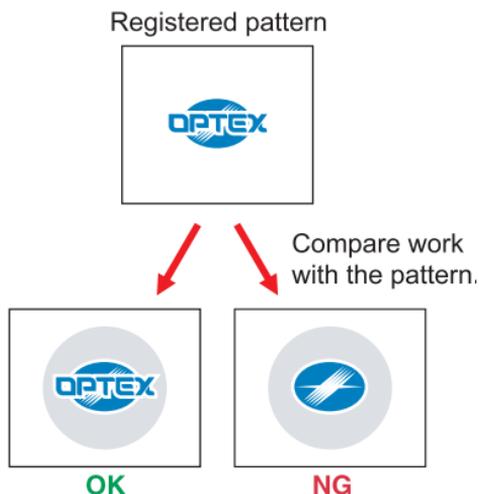
Registration of Work Pattern (Shape)

Register a work pattern (shape) from the teaching menu in the following procedures.

1 **Turn ON the power supply and detect Sample ① .**

☞ See "Operation Check by Using Sample Work" on Page 70.

2 **Press ▼ and select TEACHING .**
   TEACHING is displayed in yellow.

3

3 **Press (SET) .**
   The teaching menu appears.

SAVE PATTERN is directly executed by pressing (SET) for 3 seconds or more. Proceed to Step 7.

17

4 Press ▼ twice to select
SAVE PATTERN .

SAVE PATTERN is displayed in yellow.

5 Press (SET) for 3 seconds or more.
SAVE PATTERN is executed and the
pattern registration menu will appear.

6 SAVE PATTERN is displayed in
red.
Registration of the pattern is
complete when SAVE PATTERN
changes into yellow.

The patterns recognition without any correction
starts operating by the above operations

7 Press (EXIT).

The standard screen is restored.
Proceed to "Confirming Identity by Switching Display Mode" on the
following page.

Confirming Identity by Switching Display Mode

Registered patterns, comparison results, and screens before and after correction is made can by confirmed by switching the screen display.

Every pressing (VIEW) will switch the display mode in the following order.

①　　　　②　　　　③　　　　④　　　　⑤　　　　⑥
THRU → **LIVE** → **COLR** → **TRNS** → **PTRN** → **COMP**

① **THRU**
: Through
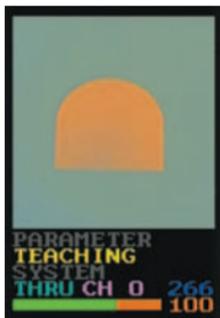
Displays the screen after color correction.
This is the screen on the shipment from our factory.

② **LIVE**
: Live

Displays the image screen before color correction and brightness irregularity correction.
This is the real image screen

③ **COLR**
:Color

Displays only the colors for correcting position, magnification, and rotation.
Displays other areas in purple.

④ **TRNS**
: Transfer
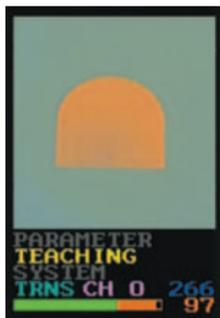
Displays the image screen after correcting position, magnification, and rotation. This is similar to ① **THRU** when there is no correction.

3
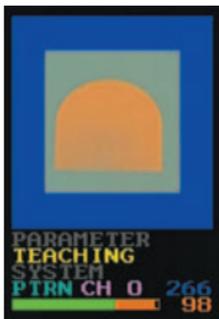
⑤ **PTRN**
:Pattern

Displays the registered screen (used for comparison).

The blue portion is the masked area and treated as the area outside the comparison.

⑥ **COMP**
:Compare
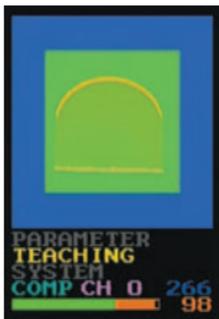
Display the result (identity) of comparing ① **TRNS** with ⑤ **PTRN** .

Green: High identity zone
Yellow: Middle identity zone
Red: Low identity zone

In case of the above screen of ⑥ **COMP** , a work is displayed in green and it shows that identity is very high. This is because the work is at the position same as that in registration.

Proceed to "Operation Check by Shifting Work" on the following page.

Operation Check by Shifting Work

After the registration of a work pattern (shape) is complete, shift the actually detected sample work to confirm whether or not its identity changes.

1 **Shift the sample work to the lower left in the standard screen.**
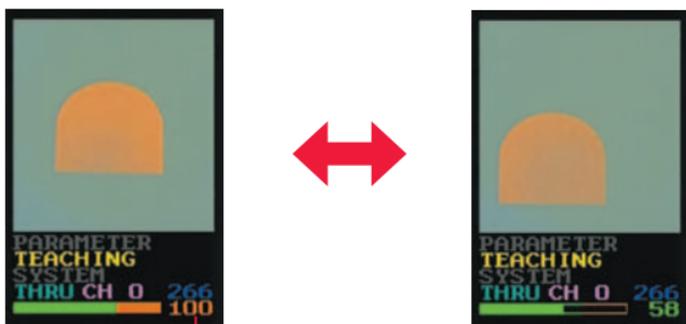
Identity has decreased from 100 to 58.

2 **Press (VIEW) five times.**

COMP will be displayed.

Middle identity zone has increased since the work has shifted.

3
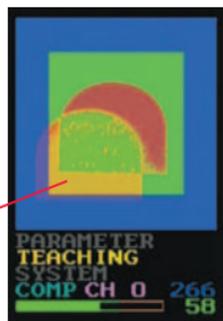
4 USE OF APPLIED FUNCTIONS

Use each applied function such as correction, etc. if works cannot be successfully distinguished by the method without any correction described in "DISTINCTION BY PATTERNS RECOGNITION" (☞ 16).

Position & Magnification Correction

Use the position & magnification correcting function to stably distinguish the works even when the work position has shifted and / or the distance to this sensor has changed.

■Registration of Color and Pattern for Position & Magnification Correction

Register the color and the pattern for the position & magnification correction from the teaching menu in the following procedures.
Here, the method to register a triangle at the upper left in the screen as the color and the pattern for the position & magnification correction is explained as an example.

> Always register a color of the same size not included on the background as the color for the position & magnification correction. Registering a color other than white, gray, and black will make the distinction stable even when the brightness changes.

1 **Turn ON the power supply and detect Sample ② .**

☞ See "Operation Check by Using Sample Work" on Page 70.

2 **Select** `TEACHING` **by pressing** ▽.

`TEACHING` is displayed in yellow.

3 **Press** (SET) **.**
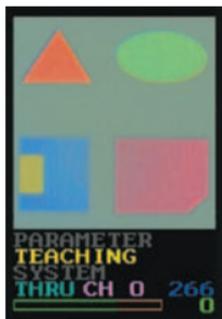
The display changes to the teaching menu.

4 **Select** `STD TEACH` **by pressing**
△ **or** ▽ **several times.**

`STD TEACH` is displayed in yellow.

5 **Press** (SET) **for 3 seconds or more.**

`STD TEACH` is executed, and the display
changes to the color selection menu.

4

The following screens will be displayed alternately.

■ (or Color detection window) blinks at the center in the screen. Colors between the brightest and the darkest inside the color detection window are set as the detection colors.

The color in the color detection window is displayed. The "darkest color" is shown on the left and the "brightest color" is shown on the right.
[XX], if displayed, shows that no detection color is registered.
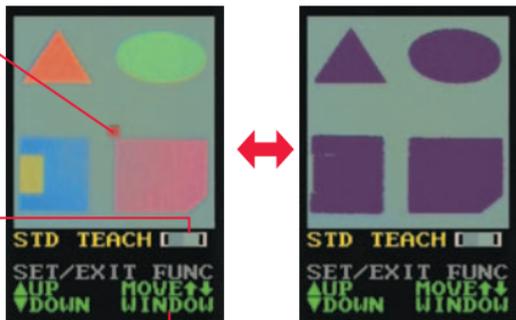
A function item of the color selection menu is displayed.
Pressing [SET] will display the next function while pressing [EXIT] will display the previous function.
Other than the functions to move the position of the color detection window and change the window size, a function to change a set value is also available.
See "Function of Color Selection & Mask Edition Menu" (☞ Page 58) for details of the function.

6 Confirm that ▲UP MOVE▲↓ is displayed. (Press [SET] or [EXIT] several times if other function is being displayed.)

7 **Move the color detection window up to the center of the triangle, holding ▲UP pressed.**

If the color detection window rises too much, lower it by pressing ▼DOWN.
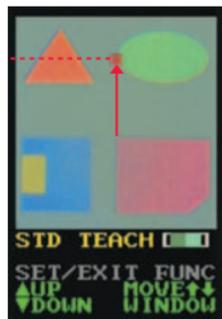
8 **Display ▲RIGHT MOVE◄► by pressing SET.**

9 **Move the color detection window to the left as far as the center of the triangle by holding ▼DOWN pressed.**

If the color detection window moves to the left too much, move it to the right by pressing ▲UP.

By pressing VIEW, imaging stops and the image on the display becomes a still picture and it will be easier to operate this device. Pressing VIEW again will restart imaging.
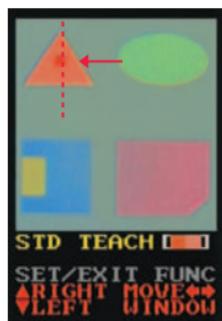
10 **When the color detection window moves to the center of the triangle, the following screens will be displayed alternately. Check the following points in these screens.**

Are the colors other than the selected color displayed in purple?

Is this the target color?

11 **If the check result is correct, press (SET) for 3 seconds or more.**
The teaching menu will be restored.

· Pressing (EXIT) for 3 seconds or more will return to the teaching menu without completing the registration.

· If not performing the position & magnification correction, cancel the registration for the correction. For this operation, set the color display on the right of **STD TEACH** in the teaching menu to **[XX]**. Then, select **STD TEACH** to display in yellow and press (EXIT) for 3 seconds or more.

The registration of the color and pattern for the position & magnification correction is complete by the above operations.
Proceed to "Operation Check at Position & Magnification Correction" on the following page.

■ Operation Check at Position & Magnification Correction

After the registration of the color and pattern for the position & magnification correction is complete, confirm that the identity remains high level even when the work actually being imaged is shifted.

1 **Display the teaching menu and confirm that the output is ON with the identity is 100"Confirm identity frequency becomes "100".**

2 **Press (EXIT).**

The standard screen is restored.

3 **In the standard screen, shift the sample work to the lower right.**

Identity remains high level.

4 **Press** (VIEW) **3 times.**

TRNS is displayed.

The position & magnification correction is executed and the image is moved to the original position.
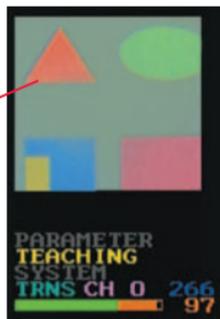
5 **Press** (VIEW) **twice.**

COMP is displayed.

By the initial setting, the portions other than the central part are masked (shown in blue). In this case, only the central part in the screen can be compared.
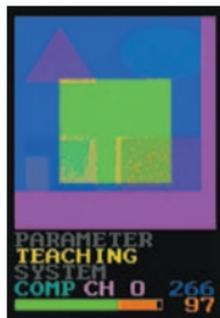
In such a case, widen the comparison target zone or move its position by editing the masking zone.
See "Masking" on the following page for details.

Masking

The comparison target may not be included by the masking zone by the initial setting. In such a case, widen the comparison target zone or move its position by editing the masking zone.

■ Edition of Masking

Edit masking from the teaching menu according to the following procedures.

Here, the method to make the triangle and its surrounding at the upper left in the screen the target zone by editing the masking zone is explained below as an example.

> The following two methods are available to select the masking zone.
>
> ① Method to select the zone occupied by the color in the masking window or other zone
>
> ② Method to select the masking window itself or other zone ②
>
> The following explains the edition of masking by the method.

4

1 Select TEACHING by pressing ⬇ in the target screen.

TEACHING is displayed in yellow.

2 Press (SET).

The teaching menu is displayed.
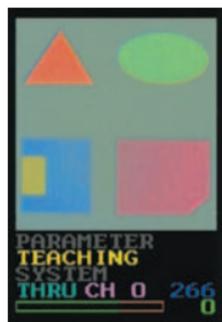
3 Select MASK EDITOR by pressing ▲UP or ▼DOWN.

MASK EDITOR is displayed in yellow.

4 Press SET for 3 seconds or more.

MASK EDITOR is executed and the mask edition menu is displayed.
The following screens are displayed alternately.

The masking window blinks. The status of the color detection window of the applied function used last time is reflected.
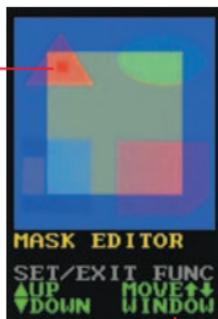
The function item of the mask edition menu is displayed.
Pressing SET will display the next function while pressing EXIT will display the previous function.
Other than the functions to move the position of the masking window and change the window size, a function to change the color range is also available.
See "Function of Color Selection & Mask Edition Menu" (☞ Page 58) for details of the function.

5 **Display** ▲LARGE SIZE↑↓ **by pressing** (SET) **twice.**

6 **Enlarge the masking window to the height a bit higher than that of the triangle by pressing** (UP).

If the height of the masking window gets too high, reduce it by pressing ▽.

4

7 **Display** ▲LARGE SIZE←→ **by pressing** (SET).

8 **Enlarge the masking window to the width a bit wider than that of the triangle by holding** **pressed.**

If the width of the masking window gets too wide, reduce it by pressing .

9 **Display** **▲MASK WINDOW** **by pressing** **4 times.**

▲MASK WINDOW is a function to add or delete this masking window zone (shown by red translucent portion) to or from the mask zone.

10 **When** **is pressed, the masking window zone is deleted from the mask zone.**

Mask zone (blue portion)

When is pressed, the masking window zone is added to the mask zone.

11 **Display** ▲MASK OUTSIDE **by pressing** (SET)**.**

▲MASK OUTSIDE is a function to add or delete the zone outside the masking window (shown by red translucent portion) to or from the mask zone.
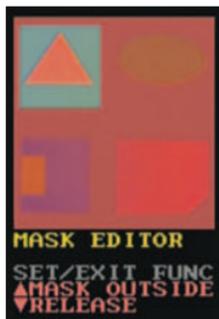
12 **Add the zone outside the masking window to the mask by pressing** (UP)**.**

Mask zone (blue portion)

When (DOWN) is pressed, the zone outside the masking window is deleted from the mask zone.

13 **Press** (SET) **for 3 seconds or more if the mask zone is appropriate.**

The teaching menu is restored.

If you want to restore the former mask zone when the mask area is deleted by mistake, press (EXIT) for 3 seconds or more. Then, the former mask zone is restored, canceling the revision to it.

The edition of the mask zone is complete by the above operations. Proceed to "Operation Check after Edition of Masking" on the following page.

4

Confirm that the device operates properly after the edition of masking is complete.

1 **Display the teaching menu and confirm that the identity is remains high.**

2 **Press (EXIT).**

The standard screen is restored.

3 **Display COMP by pressing (VIEW) several times.**

4 **Shift the sample work in the standard screen.**
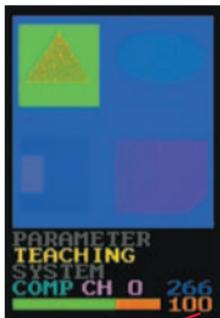
Identity remains high even when the work position is shifted.

5 **Rotate the sample work.**

Zone outside imaging zone (in purple)

Identity decreases.
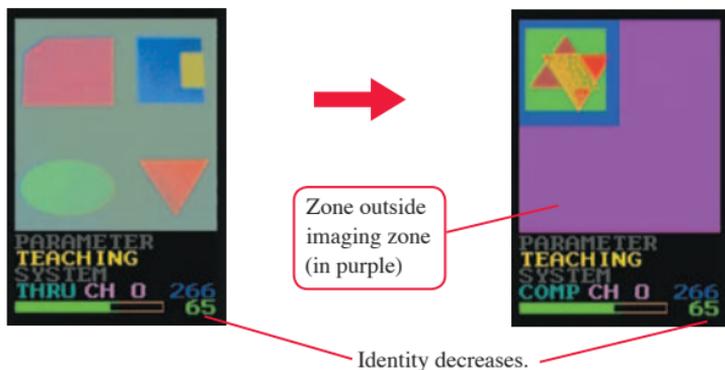
In such a case, register another color for the rotation correction. Then, the patterns can be compared by correcting the rotating angle even when a work rotates.

See "Rotation Correction" (☞ Page 39) for details.

4

Edition of Color Detection Area

The following explains the method to edit the area to detect the colors for the position & magnification correction and the rotation correction.
Edit the color detection area from the teaching menu in the following procedures.

1 Select `TEACHING` by pressing ▽(DOWN) in the standard screen.

`TEACHING` is displayed in yellow.

2 Press (SET).
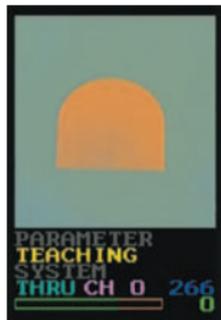
The teaching menu is displayed.

3 Select `COLOR WINDOW` by pressing △(UP) or ▽(DOWN).

`COLOR WINDOW` is displayed in yellow.

4 Press (SET) for 3 seconds or more.

`COLOR WINDOW` is executed and the color detection area edition menu is displayed.

> Area outside color detection area (Red translucent portion)

> Color detection area (Area outside red translucent portion)

> A function in the color detection area edition menu is displayed.
> Pressing (SET) will display the next function while pressing (EXIT) will display the previous function.

5 **Confirm that** ▲UP MOVE↑↓ **is displayed. (Press** (SET) **or** (EXIT) **several times if other function is displayed.)**

6 **Every pressing** ▲UP **will move the color detection area upward while every pressing** ▼DOWN **will move it downward.**

7 **Display** ▲RIGHT MOVE←→ **by pressing** (SET).

8 **Every pressing** ▲UP **will move the color detection area to the right while every pressing** ▼DOWN **will move it to the left.**

4

9 **Display** ▲LARGE SIZE↑↓ **by pressing** (SET).

10 **Every pressing** ▲UP **will increase the vertical size while every pressing** ▼DOWN **will decrease it.**

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11 Display **▲LARGE SIZE ◄►** by pressing (SET).

12 Every pressing (UP) will widen the horizontal size while every pressing (DOWN) will narrow it.

Imaging stops or restarts by pressing (VIEW). When imaging is stopped with SYNCHORN is "1" to "3", a still picture is displayed inside the window by pressing (VIEW).

13 Press (SET) for 3 seconds or more if the color detection area is appropriate.

The teaching menu is restored.

When (SET) is pressed for 3 seconds or more, the former color detection area is restored, canceling the revision to it.

The edition of the color detection area is complete by the above operations.

14 Press (EXIT).

The standard screen is restored.

Rotation Correction

Use the rotation correction to distinguish the shape of a work by correcting its rotating angle even if a work rotates during detection.

■Registration of the Color and Pattern for the Rotation Correction

In order to execute the rotation correction, you must register a color different from the color for the position & magnification correction. Register the color and pattern for the rotation correction from the teaching menu in the following procedures.

Here explained is the method to register the quadrangle at the lower right in the screen as the color and pattern for the rotation correction.

Always register a color of the same size out of the colors not included in the background for the rotation correction just as done with the color for the position & magnification correction. Registering a color other than white, gray, and black, will make the recognition more stable even when the brightness changes. Stabilize even when brightness changes.

However, select a color at a position apart as much as possible since the error at the rotation correction is greater when the color for the position & magnification correction is close to the center position.

1 **Before registering the color for the rotation correction, register the color and pattern for the position & magnification correction, referring to "Position & Magnification Correction". (☞See Page 22.)**

2 **Select** TEACHING **by pressing** ▼(DOWN)
in the standard screen.

TEACHING is displayed in yellow.

3 **Press** (SET)**.**
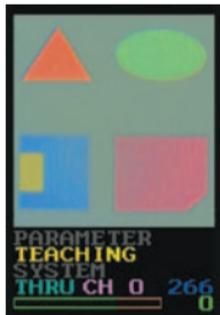
The teaching menu is displayed.

4 **Select** ROTATION **by pressing** ▲(UP)
or ▼(DOWN)**.**

ROTATION is displayed in yellow.

5 **Press** (SET) **for 3 seconds or more.**

ROTATION is executed and the color selection menu is displayed.

The operating method on the color selection menu is the same
as that on the position & magnification menu.

The following screens will be displayed alternately.

The color detection window blinks.
The status of the color detection window or the masking window of the applied function used last time is reflected.
The colors from the brightest color to the darkest color are set as the detection colors.
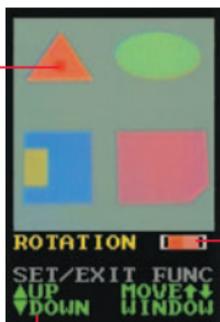
The function item of the color selection menu is displayed.

Pressing (SET) will display the next function while pressing (EXIT) will display the previous function.
Other than the functions to move the position of the color detection window and change the window size, a function to change the color range is also available.
See "Function of Color Selection & Mask Edition Menu" (☞ Page 58) for details of the function.

The color in the color detection window is displayed. The "darkest color" is shown on the left and the "brightest color" is shown on the right. [XX], if displayed, shows that no detection color is registered.

4

6 **Confirm that ▲UP MOVE▲▼ is displayed. (Press (SET) or (EXIT) several times if other function is displayed.)**

7 **Move the color detection window down as far as the center of the quadrangle at the lower right in the screen by holding ▼ pressed.**

If the color detection window has moved down too much, move it upward by pressing ▲.
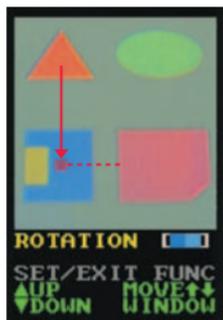
8 **Display** ▲RIGHT MOVE◀▶ **by pressing** (SET).

9 **Move the color detection window to the right as far as the quadrangle center by holding** (UP) **pressed.**

When the color detection window has moved to the right too much, move it to the left by pressing (DOWN).

Pressing (VIEW) will stop imaging and a still picture will be displayed in the screen, allowing easier operation. Pressing (VIEW) again will restart imaging.
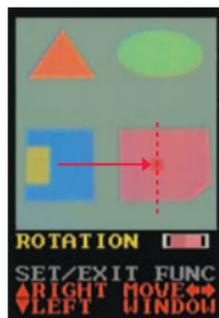
10 **The following screens are displayed alternately when the color detection window has moved to the quadrangle center. Check the following points at that position.**
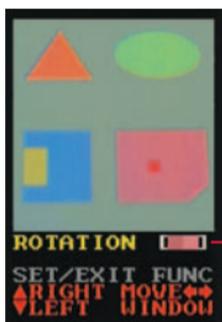
Are the colors other than the selected color displayed in purple?

Is this the target color?

11 **If the check result is correct, press (SET) for 3 seconds or more.**

The teaching menu will be restored.

・ Pressing (EXIT) for 3 seconds or more will return to the teaching menu without completing the registration.

・ If not performing the rotation correction, cancel the registration for the correction. For this operation, set the color display on the right of **ROTATION** in the teaching menu to **[XX]**. Then, select **ROTATION** to display in yellow and press (EXIT) for 3 seconds or more.

Color for rotation correction

Color for position & magnification correction

・ If some masking zone is registered referring to "Masking" (☞ See Page 29.), the setting can be used as is if the position of a work is not changed.

The registration of the color and pattern for the rotation correction is complete by the above operation.
Proceed to the following "Operation Check after Rotation Correction".

■Operation Check after Rotation Correction

After the registration of the color and pattern for the rotation correction is complete, confirm that the identity remains high even when the sample work actually imaged is rotated.

4

1 **Display the teaching menu and confirm that the identity is remains high.**

2 **Press (EXIT).**

The standard screen is restored.
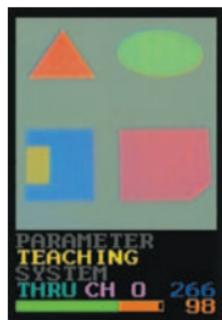
3 Display `COLR` by pressing (VIEW)
several times.

Color for position &
magnification correction

Color for rotation correction

Confirm that both the colors are displayed.

4 Rotate the sample work in the standard screen.

5 Display `THRU` by pressing (VIEW)
4 times.
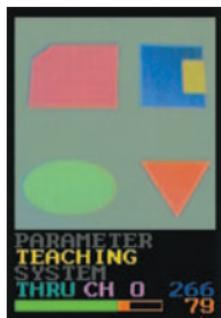
Identity remains high.

6 Display `COLR` by pressing (VIEW)
twice.

Color for rotation correction

Color for position &
magnification correction

7 Display `TRNS` by pressing (VIEW).

The screen is displayed rotated.
This screen is compared with the registered
screen.
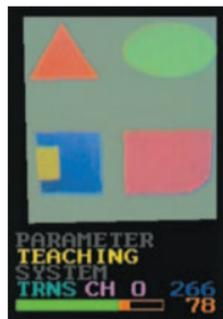
8 Display `COMP` by pressing (VIEW) twice.

The triangle at the upper left is
being accurately compared.

The reason when the low identity
portion (in red) has increased is
because imaging error occurs
with the near side shifted from the
far side when a work is imaged
obliquely.

4
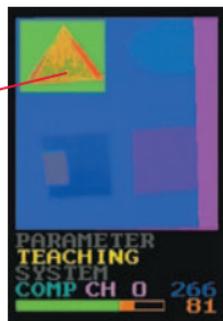
Brightness Irregularity Correction

When color cannot be detected well depending on the place to take image due to the irregularity of lighting, it is effective to use the brightness irregularity correction.

1 Select SYSTEM by pressing 🔽 in the standard screen.

 SYSTEM is displayed in yellow.

2 Press (SET).

The system menu is displayed.

3 Confirm that BRIGHT CMPENST is displayed in yellow.

(If not, press 🔼 or 🔽 several times.)

4 Press (SET) for 3 seconds or more.

 BRIGHT CMPENST is executed and the brightness irregularity correction is displayed.

5 Take image of white paper (paper not lustrous).

The brightness of the screen is read, the value is registered, and the image screen is corrected.

The following screens are displayed alternately.

Screen after brightness
irregularity correction (There
is no irregularly in brightness)

Screen without brightness
irregularity correction (There
is in brightness)

6 Confirm the optimally adjusted shutter time (by unit of 100μs).
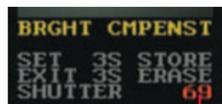
Green: Stable condition
Red: During adjustment

When the display of the shutter time does not change remaining in red, it is at the upper limit of the shutter time. In such a case, get this device closer to the work or increase the image sensor gain (IMG GAIN).

7 If no irregularity is found in the screen after the color correction, press (SET) for 3 seconds or more.

Then, the system menu is restored.

・Pressing (EXIT) will return to the system menu canceling the revision to the setting.

・Pressing (EXIT) for 3 seconds or more will initialize the brightness correction value.

8 Press (EXIT).

The standard screen is restored.

4

5 CHANGING SET VALUE

The set value for the distinction can be changed in detail according to the condition of the work to be distinguished and the circumstance of the line where this sensor is attached.
See "Set Items List" (☞ See Page 52.) for the details of the changeable set items.

Changing Set Value

1 **Cofirm that** **PARAMETER** **is displayed in yellow in the standard screen.**
(If not, press 🔼(UP) **or** 🔽(DOWN) **several times.)**

2 **Press** (SET)**.**

Then, the set value reference screen is displayed.

3 **Display an intended set item whose data to be changed by pressing** 🔼(UP) **or** 🔽(DOWN)**.**
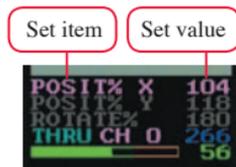
Set item   Set value

PURPLE : Independent set item for each bank

YELLOW : Set item common to all banks

BLUE : Set item being locked

Pressing (SET) and (EXIT) for 3 seconds or more simultaneously with the set item displayed will change over Lock / Release condition of the set value alternately.
Also, Lock / Release condition of all set items can be switched all at once.
☞ See "Permission to Set Value Initialization (INITIALIZ)" on Page 56.

Set value changes to red.

4 **Press (SET) for 3 seconds or more.**

The set value change screen is displayed.

5 **Change the set value by pressing (UP) and (DOWN).**

(UP): Value increments by "1".

(DOWN): Value decrements by "1".
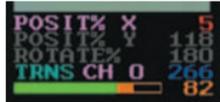
6 **Press (SET) for 3 seconds or more.**

The set value is entered and the set value reference screen is restored. Pressing (EXIT) will restore the set value reference screen, canceling the revision to the set value.

7 **Press (EXIT).**

The standard screen is restored.
Initializing Set Value

Initializing Set Value

1 **Change the value of the set item INITIALIZ to "15".**

2 **Turn OFF the power supply temporarily and turn it ON again with (UP) and (DOWN) pressed simultaneously.**

The right screen is displayed.
Do not turn OFF the power supply until the device restarts.

5
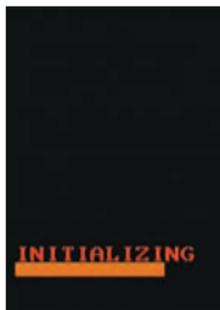
Example of Changing Set Value

The following shows an example of changing the margin of horizontal position correction.

When positioning a work traveling in the horizontal direction in the screen, this device can be used to correctly position a work horizontally, allowing its vertical dislocation by prohibiting the position correction in the vertical direction.

1 **Register a pattern involving the position & magnification correction using the sample work ① attached at the end of this manual (☞ See Page 70.) in advance.**

☞ See "Position & Magnification Correction" on Page 22.

2 **Confirm that** PARAMETER **is displayed in yellow in the standard screen.**

(If not, press ▲UP or ▼DOWN several times.)

3 **Press** SET.

The set value reference screen is displayed.

4 **Select** POSIT% X **by pressing** ▲UP **or** ▼DOWN.

POSIT% X is displayed in purple.

5 **In order to confirm the movement of the position correction, display** **TRNS** **by pressing** (VIEW) **several times.**

A work in orange is displayed with its position corrected to the center (registered position).

6 **Press** (SET) **for 3 seconds or more.**

The set value change screen is displayed and the set value is displayed in red.

7 **Decrease the set value by pressing** (DOWN)**. (POSIT%X=5)**

The work in orange returns to the right since the maximum value for the horizontal position correction is limited to 5 (pixels).

8 **Press** (SET) **for 3 seconds or more.**

The set value is entered and the set value reference screen is restored.

Pressing (EXIT) will restore the set value reference screen, canceling the revision to the set value.

9 **Press** (EXIT)**.**

The standard screen is restored.

5

Set Items List

The following table shows the functions, the setting range, and the initial values of the set items whose settings are changeable.

Function name / LCD display	Setting range (Initial value)	Explanation
Sensitivity of lack for identit*[1] — CMP LACK	0 – 15 (0)	**0** : Average identity of the pixels not being masked will be the identity. **1 – 15**: Set to one of these values for the inspection of smear or lack. As the value increases, the sensitivity to the number of pixels of different color will be higher.
Threshold value of identity*[1] — CMPLEVEL	0 – 100 (70)	Sets the level of the identity to turn ON the output. As the set value increases, higher identity is required. Since negative value is also processed internally, output may not turn ON even when "0" is displayed for the identity if "0" is set as the set value.
Color sensitivity for identity*[1] — CMPSENSE	0 – 15 (10)	Sets the level to permit the difference in color against the registered pattern. "0" brings the highest sensitivity and slight difference in color can be distinguished.
Range of detection color for position correction*[1] — COLOR% P	0 – 25 (1)	Sets the range of the color for the position correction (margin against the color selected by teaching). As the set value increases, wider range of colors is covered.
Range of detection color for rotation correction*[1] — COLOR% R	0 – 25 (1)	Sets the range of the color for the rotation correction (margin against the color selected by teaching). As the set value increases, a wider range of colors is covered.
Darkness correction factor*[1]★ — DARK CMP	0 – 31 (27)	Sets the ratio to correct the darkness of colors. No correction is made with "0", and maximum correction is made with "31" (amplifying black and converting it to other color). As the set value increases, dark color tends to be a noise element; while as the set value decreases, sensor is affected by disturbance light more.

*[1]: Set value changes when the bank is switched.

★: Patent is pending.

Function name **LCD display**	Setting range (Initial value)	Explanation
Image sensor gain[1] **IMG GAIN**	0 – 63 (0)	Sets the gain of the image sensor. Though the screen gets brighter as the value increases, the screen noise also increases. Increase the value when trying to shorten the shutter time.
Magnification correction tolerance[1] **MAGNIFY%**	0 – 127 (0)	Sets the tolerance of the magnification and reduction. Correction can be done up to the ratio of 128 / (128±Set value). When set to "0", magnification & reduction correction is not executed.For example, when set to "40", correction is made within the range of 0.76 - 1.45 times since the ratio is 128 / (128±40)When colors for both the position correction and the rotation correction are registered, correction is made based on the distance of each color. And when a color for the position correction only is registered, correction is made based on the color area of that color.No correction is made when neither one of colors is registered.
Horizontal position correction tolerance[1] **POSIT% X**	0 – 208 (104)	Sets the tolerance of the horizontal position correction. Corrects up to the set value ± pixels.When set to "0", no horizontal position correction is made. Correction is made when a color for the position correction is registered, and no correction is made when no color is registered.
Vertical position correction tolerance[1] **POSIT% Y**	0 – 236 (118)	Sets the tolerance of the vertical position correction. Corrects up to the set value ± pixels.When set to "0", no vertical position correction is made. Correction is made when a color for the position correction is registered, and no correction is made when no color is registered.
Rotation correction tolerance[1] **ROTATE%**	0 – 180 (180)	Sets the tolerance of the rotation correction. Corrects up to the set value ±angle.When set to "0", no rotation correction is made. With the initial value "180", correction is made up to ± 180° (360°).Rotation correction is made only when colors for both the position and rotation corrections are registered.

[1]:When bank is switched, the set value also changes.

5

Function name / LCD display	Setting range (Initial value)	Explanation
Shutter time*1 / SHUTTER	0 – 263 (100)	Sets the shutter time.Set value×100μs will be the actual shutter time.The shutter time exceeding the image transfer time cannot be set.
Temperature compensation level*1 / TEMPCOMP	0 – 50 (15)	Sets the temperature compensation level of the image sensor. For instance, adjust by this value if the color taught at low temperature shifts at high temperature. No compensation is made when set to "0".
Teaching enable*2 / TEACHENA	0 – 2 (0)	Permits / prohibits the execution of registration of detection color and screen (STD TEACH / ROTATION), screen registration (SAVE PATTERN), mask edition (MASK EDITOR), color detection range (COLOR WINDOW), brightness irregularity correction (BRIGHT COMPENST), and PC communication (PC LOAD / SAVE). 0 : Permits teaching on all items. 1 : Prohibits the screen registration (SAVE PATTERN) only. 2 : Prohibits teaching on all items.
Synchronization input / SYNCHRON	0 – 4 (4)	Sets a synchronization input signal. When set to "0" to "3", the bank switch 3 input becomes synchronization input. Also, the response time becomes twice of the standard transfer time. 0 : Takes image continually while synchronization input is OFF. 1 : Takes image when synchronization input is switched from ON to OFF. 2 : Takes image continually while synchronization input is ON. 3 : Takes image when synchronization input is switched from OFF to ON. 4 : Invalidates synchronization input. (Image is always taken.)

*1:When bank is switched, the set value also changes.

*2:External teaching can be executed if bank is set to "15" or less even when TEACHENA is set at "2".

Function name **LCD display**	Setting range (Initial value)	Explanation
Screen size **SCREEN**	0 – 3 (0)	Sets the size of the pixels to take out from the image sensor. 0 : 208×236 1 : 160×236 2 : 112×236 3 : 64×236 View will be narrower as the number of pixels is smaller.
Resolution*3 **RESOLUTN**	0, 1 (0)	Sets the fineness of the pixels in the horizontal direction to take out from the image sensor. 0 : Standard mode 1 : Horizontal double speed modeMakes the number of pixels to take out from the sensor to the half and interpolates it to the same number of pixels. Response speed increases.
Identity reverse **OUTSIDE**	0, 1 (0)	0 : Turns ON output when identity is above the threshold value and turns OFF output when identity is below the threshold value. 1 : Turns OFF output when identity is above the threshold value and turns ON output when the identity is below the threshold value.
One-shot output **ONESHOT**	0, 1 (0)	When set to "1", output turns ON by one-shot by the OFF delay time after the output signal turns ON.
ON delay time **ON DELAY**	0 – 5000 (0)	Turns ON output when condition is met for over this set time (ms)
OFF delay time **OFFDELAY**	0 – 5000 (0)	Turns OFF output when condition is not met for over this set time (ms).

*3:Brightness and color change when RESOLUTN is changed. In such a case, perform teaching again.

5

Function name **LCD display**	Setting range (Initial value)	Explanation
Lighting ON/OFF **LIGHT ON**	0, 1 (1)	0 : Turns OFF internal lighting. (External lighting remains ON.) 1 : Turns ON internal lighting.
LCD Up/Down reverse★ **LCDVIEW**	0, 1 (0)	0 : Normal LCD display 1 : Displays the display of LCD display upside down (Image screen is not reversed.)Set to "1" when mounting this device upside down. The display of the remote monitor reverses only the image screen.
Set value initialization enable **INITIALIZ**	0 – 15 (0)	When the device is powered ON with "15" set as this set value and ⚠ and ▽ pressed at the same time, all the set values, registered screens, brightness irregularity data are initialized. 10 : All set values will be locked. 11 : Locked condition of all set values is released.

Communication setting
COMMUNIC
	0 – 5
	(0)
		Sets communication function.
		0 : Communication function is not used.
		1-5 : Communication function is used.
		    1 : 4800 bps 2 : 9600 bps
		    3 : 19200 bps 4 : 38400 bps
		    5 : 57600 bps
		Data length is 8 bit without parity bit, and stop bit is 1bit.When using this communication function, the external lighting remote monitor function cannot be used.

Set value copy **BANKCOPY**	0 – 14 (0)	Set values and registered screens of present bank are copied to the bank of the target bank No. set by this setting. During execution, imaging and judgment are stopped. This set value will be "0" when powered OFF.

★:Patent pending

Function name **LCD display**	Setting range (Initial value)	Explanation
Bank selection **BANK**	0 – 16 (16)	Sets the method to switch the bank No. 0-14 : Selects the set bank. (Bank 2 switch input is an external teaching input.) 15 : Switches the bank by an external input. (Bank 2 switch input is an external teaching input.) 16 : Switches the bank by an external input. (Bank switch 2 also can be used.)

Auxiliary output
AUX OUT
	0 – 4
	(4)
		Sets the method to output the auxiliary output.
		0 : Effective output
		  Turns OFF by the bank switch and turns ON by the first judgment output after bank switch. Turns OFF after the first imaging is complete after powered ON.
		1 : Judgment timing output
		  Every time judgment is done, output repeats ON / OFF alternately.
		2 : Lighting output
		  Used to turn ON lighting other than CVS-LW1. Turns ON output for the time lighting is necessary.
		3 : Inside correction tolerance output
		  Turns ON only when all the tolerances of the position & magnification correction and rotation correction are within their set values.
		4 : Always ON
		  Always turns ON the auxiliary output.

5

Function of Color Selection & Mask Edition Menu

On the color selection menu for the colors for the position & magnification correction and the rotation correction and on the mask edition menu for the mask edition, some set values are changeable.

Switch to an intended function by pressing (SET) and (EXIT) and change a set value by pressing (UP) or (DOWN).

The changeable set values are as follows.

Function name / LCD display	Setting range (Initial value)	Explanation
Range of color **COLOR**	0 – 25 (0)	Sets the range of the color (margin against the color selected by teaching). As the set value increases, wider range of colors is covered.
Darkness correction ratio[1] **DARK CMP**	0 – 25 (27)	Sets the ratio to correct the darkness of colors.No correction is made with "0", and maximum correction is made with "31" (amplifying black and converting it to other color).As the set value increases, dark color tends to be a noise element; while as the set value decreases, sensor is affected by disturbance light more.
Shutter time[1] **SHUTTER**	0 – 263 (100)	Sets the shutter time.Set value×100 μs will be the actual shutter time.The shutter time exceeding the image transfer time cannot be set.
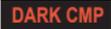
[1]:Not included in the set items on the mask edition menu.

6 TROUBLESHOOTING

When in trouble:

This section describes the measures to be taken when this sensor does not operate properly or cannot detect a work due to some reasons.

Q **Color cannot be selected well.**

A The color selection window may be too large.

- Reduce the size of the window and mach it to the intended color.

A The color range may be too wide.

- Reduce the set value of COLOR% P(Width of the detection color for the position correction) for the position & magnification corrections and the set value of COLOR% R (Width of the detection color for the rotation correction) for the rotation correction.

A The screen may be dark.

- If the screen is dark, it is more difficult to detect the target color since noise element increases. Reduce the set value of IMG GAIN (Image sensor gain) and add the external lighting or make the distance to the work closer.
- If the set value of DARK CMP (Darkness correction ratio) is too large, a dark color cannot be detected. When a dark color is selected, set this value to "20" to "24".

Q **Color is not detected at a part in the screen.**

A The color detection area may be limited with COLOR WINDOW on the teaching menu.

- Set the color detection area again since it is switched over for each bank.

A The brightness may be irregular at the edge in the screen by the lighting.

- There is a case where the intended color is not detected due to the brightness irregularity. Execute the brightness irregularity correction on the system menu.

Q **Position, magnification, and rotation corrections shift gradually.**

A Confirm that the detection color when the teaching is done is correctly detected.

- Display COLR by pressing (VIEW) several times, and confirm that the

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target color is displayed. If not, increase the set value of COLOR% P or COLOR% R (Color margin) or adjust TEMPCOMP (Temperature compensation level).

A The center of the color for the position correction may be close to the center of the color for the rotation correction.

- The error will be greater when their positions are close. Select a color at the farthest position.

A A part of the color for the position correction may be outside the imaging area.

- If it is, the number of the pixels for the color varies. In such a case, specify other color and do not make the position correction.

Q **Rotation correction shifts.**

A The color also existing at the side may be selected.

- The center coordinates of the color change by the rotation angle. Select a color in the rotation surface.

Q **Position correction, Magnification correction, or Rotation correction is not done.**

A The set value of MAGNIFY% (Magnification correction allowable ratio), POSIT%X (Horizontal position correction allowable ratio), POSIT%Y (Vertical position correction tolerance), and ROTATE% (Rotation correction tolerance) may be small.

- If the set value is small, the correction area is limited. Increase the set value and confirm the correction result again.

Q **Position & magnification correction or rotation correction is done.**

A Cancel the registered color for the correction.

- So as not to make any correction, set the color display at the right of STD TEACH and ROTATION on the teaching menu to [XX].Select an intended item to display it in yellow, and then press (EXIT) for 3 seconds or more.

Q **How can stable distinction be secured even when the work dislocations or the distance to this sensor changes during measurement?**

A Perform the position & magnification correction.

- ☞ See "Position & Magnification Correction" on Page 22.

How can stable distinction be secured even when a work rotated during measurement?

Perform the rotation correction.

- ☞ See "Rotation Correction" on Page 39.

Identity lowers when image is taken with the shutter actuated.

SHUTTER (Shutter time) may be long.

- When the set value of SHUTTER (Shutter time) is long, the image will be blurred if the work moves. Since the images cannot be correctly compared if blur occurs, shorten the set value of SHUTTER (Shutter time) and make the screen brighter by getting the sensor close to the work, adding an external lighting, or increasing the set value of IMG GAIN (image sensor gain).

- The blur amount is obtained by the following equation.

  When RESOLUTION =0:

  Blur amount =Shutter time set value (0.1 ms) ×Work travel speed (m/s) / Horizontal width of imaging area×20.8

  When RESOLUTION =1:

  Blur amount =Shutter time set value (0.1 ms) ×Work travel speed (m/s) / Horizontal width of imaging area×10.4

  (e.g.) When shutter time set value = 135, Work travel speed = 0.7, Horizontal width of imaging area = 30,

  Number of pixels causing blur = 32.76

Shape deforms when moving work is imaged.

CMOS image sensor used for CVS2 opens the shutter from right to left in the screen in sequence. Therefore, the imaged shape deforms if the travel speed of a work is fast.

The width will be wider when a work travels from right to left, while it will be narrower when a work travels from left to right. Also, the image will be slant toward lower left when a work travels from top to bottom.

- In order to obtain better image, set RESOLUTN (Resolution) to "1" or lower the resolution in the horizontal direction of the image sensor by increasing SCREEN (Screen size) the value of SCREEN (screen size).

- If the travel speed of a work does not change greatly, take image of a traveling work and teach it to the sensor. Then, deformed shape is registered and can be used for comparison.

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Identity is high even with a defective work.

When the difference between non-defective work and defective work is a little, the difference in the identity does not appear apparently.

- Mask the portions other than there is a difference with the mask editor.
  ☞ See "Masking" on Page 29.

- Increase the set value of CMP LACK (Sensitivity of lack for identity).

The brightness irregularity correction for the screen does not operate properly.

This trouble occurs when BRIGHT COMPENST (Brightness irregularity correction) was executed when the set value of SCREEN (Screen size) is different from the present value.

- Execute the brightness irregularity correction again at the set value of the present SCREEN (Screen size).

There is a brightness irregularity in the image screen.

When the installation condition of the sensor has changed after the brightness irregularity correction was executed under the other installation condition, the brightness irregularity correction for the previous condition may remain in the sensor.

- Execute the brightness irregularity correction again.

Was white paper (not lustrous) used for the brightness irregularity correction?

- When other paper is used as the reference instead of white paper without any pattern (not lustrous), correction may not be executed correctly.   Execute the brightness irregularity correction again using white paper without any pattern (not lustrous).

Edition for masking or the brightness irregularity correction cannot be executed.

TEACHENA (Teaching permission) may be set to "1" or "2".

- Normally, set to "0".

Any screen cannot be registered.

TEACHENA (Teaching permission) may be set to "2".

- Normally, set to "0".

External teaching cannot be performed.

BANK (Bank specification) may be set to "16".

- To permit the external teaching, set to "0" to "15".

The external bank switch input does not function.

BANK (Bank specification) may be set to "0" to "14".

- In order to use the external bank switch input, set to "15" or "16".

Output turns OFF even when the identity of the identity bar graph is high.

ONESHOT (Oneshot output) may be set to "1".

- If set to "1", the output is already OFF.

The set value of ON DELAY (On delay time) may be long.

- When the On delay time is long, it takes time to turn ON.

OUTSIDE (Identity reversing) may be set to "1".

- If set to "1", the output turns OFF when the identity becomes over the threshold value.

The external lighting does not turn ON correctly.

COMMUNIC (Communication setting) may be set to "1" to "5".

- Set to "0". When COMMUNIC (Communication setting) is set at "1" to "5", the external lighting control signal is used as the communication signal and the external lighting or remote monitor cannot be used.

There I no difference in the operation of the sensor with the set values "0" and "1" of ROTATE% (Rotation correction tolerance).

Internally, the rotation correction tolerance is calculated by the equation (Set value of ROTATE% × 256 / 360). Therefore "1", if set, will be rounded down.

- There is no trouble with this sensor.

Set value cannot be changed.

The set value may be locked.

- If the set value is displayed in blue, it is at the LOCK (Change prohibition) condition. To release the LOCK condition, display the

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setting item in the set value reference screen and then press (SET) and (EXIT) simultaneously for 3 seconds or more.

C? **The registration screen has changed before anyone is aware.**

A! BANK (Bank specification) may be set to "0" to "15".

- If not set to "16", Bank switch 2 input becomes the teaching input and the image is registered at the rise of the signal. Use this sensor without connecting this signal or by setting the set value of BANK to "16".

C? **Bank repeats switching fast automatically.**

A! The wiring for the judgment output and the auxiliary output may be short-circuited with the signal line of the bank change input.

- This trouble occurs if the wires are short-circuited. Check the wiring and take appropriate measures.

C? **The color detection window is not displayed.**

A! The set value of SYNCHRON (Synchronization input) may be set at "0" to "3".

- When the set value of SYNCHRON is "0" to "3", the window is not displayed when image is not being taken. This is because the display is updated every time image is taken. In such cases, enter the still picture mode by pressing (VIEW) to display the window.

C? **PC LOAD/SAVE menu, if displayed, is immediately cancelled.**

A! CVS-M1 may be connected.

- This trouble occurs when CVS-M1 is connected.

C? **How can the image at the moment when the output changed be checked?**

A! Use the image capture function of this sensor.

①Select CAPTURE on the system menu.

②Display the image at the moment when the output changed in the image screen and stop updating the image.
Taking image and judgment of identity are done continually.

③Select a function other than CAPTURE by pressing (SET) , (UP) , or (DOWN) . Then, the hold condition of the screen is released.

7 APPENDIX

Specifications

| Model	CVS2-N10 CVS2-P10	CVS2-N20 CVS2-P20	CVS2-N40 CVS2-P40
View angle	10°	20°	40°
Object distance	210 – 270mm	90 – 150mm	50 – 100mm
Image-taking range*1	40×40mm – 55×55mm	40×40mm – 65×65mm	50×50mm – 100×100mm
Light source	White LED: 12 pcs		
Power voltage	12 – 24 V DC±10%		
Current consumtion	Max. 140 mA / 24 V DC		
Resolution	0 : 208×236, 1 : 160×236 2 : 112×236, 3 : 64×236		
Temperature drift (for color detection)	±2% (after set value is adjusted)*2		
Lighting durability	Approx. 50000 hours*3		
Response speed	26.6/20.7/14.7/8.6ms (at Standard resolution) 15.2/11.9/8.4/5.0ms (at Double speed resolution)		
Output*4	NPN/PNP O.C. Max. 100 mA, Residual voltage: 10V or less		
Input	Bank switch input / External teaching: 4 points		
Ambient working temperature	0 – 40°C		
Ambient humidity range	35 – 85%/RH		
Storage temperature	– 20 – 70°C		
Storage humidity	35 – 95%/RH		
Vibration resistance, Impact resistance	Vibration: 10 - 55 Hz (Amplitude: 1.5 mm), Impact: 500 m/s^2		
Material	ABS / acrylic fiber / polycarbonate		
Protection degree	IP67		
Weight	Appprox. 180g		

*1 Tolerance: ±10%
*2 When the set value of DARK CMP is "10" or more
*3 When luminance has dropped to one third under the normal temperature and normal humidity circumstance
*4 CVS2-N☐☐: NPN I/O, CVS2-P ☐☐: PNP I/O; ☐☐ shows the view angle (10°, 20°, 40°).

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# Outside Dimensions Drawing
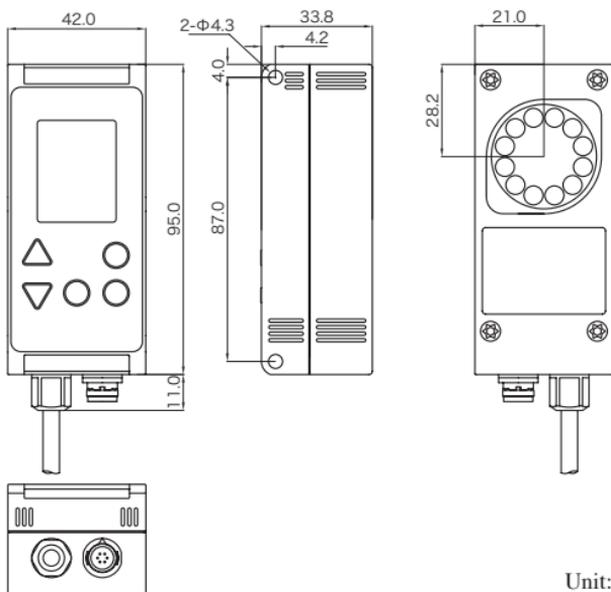
Unit:mm

I/O Circuit Diagrams

■CVS2-N10, N20, N40: NPN I/O

Input circuit (Bank switch 0 - Bank switch 3)

Photocoupler

Internal Circuit

7.5kΩ

15kΩ

12-24 VDC (Brown)

Bank switch 0 input (Orange / Black)
Bank switch 1 input (Yellow / Black)
Bank switch 2 input (Pink)
Bank switch 3 input (Purple)

Output circuit (Judgment output, Aux. output)

Protection diode

Internal Circuit

12-24 VDC (Brown)

Judgment output (Black)
Aux. output (Red / Black)

0 V (Blue)
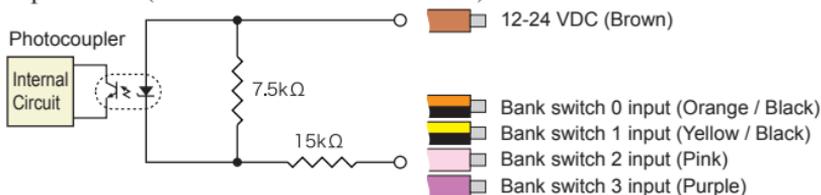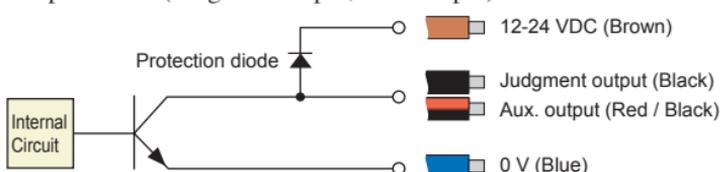
■CVS2-P10, P20, P40: PNP I/O

Input circuit (Bank switch 0 - Bank switch 3)

Photocoupler

Internal Circuit

7.5kΩ

15kΩ

0 V (Blue)

Bank switch 0 input (Orange / Black)
Bank switch I input (Yellow / Black)
Bank switch 2 input (Pink)
Bank switch 3 input (Purple)

Output circuit (Judgment output, Aux. output)

Protection diode

Internal Circuit

0 V (Blue)

Judgment output (Black)
Aux. output (Red / Black)

12-24 VDC (Brown)

7
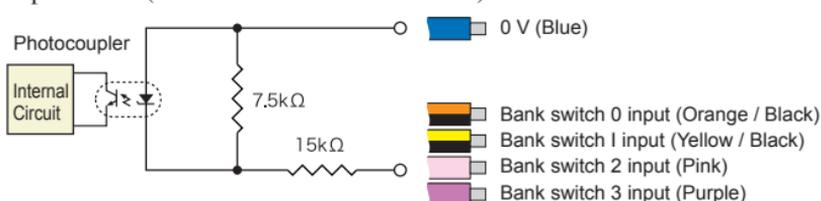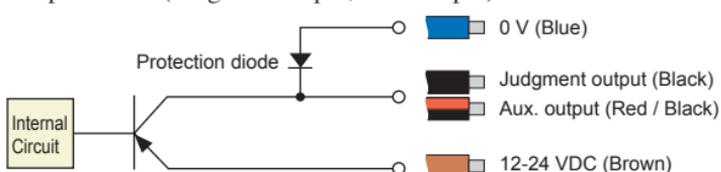
Relation between External Input and Bank No.

Set value	BANK	0-14		15		16	
	SYNCHRON	4	0-3	4	0-3	4	0-3
External input	Bank switch 0 input	Invalid		Bank switch 0			
	Bank switch 1 input	Invalid		Bank switch 1			
	Bank switch 2 input	External teaching input				Bank switch 2	
	Bank switch 3 input	Invalid	Signal input	Bank switch 3	Signal input	Bank switch 3	Signal input

Bank number	Bank switch 0	Bank switch 1	Bank switch 2	Bank switch 3
0	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF
7	ON	ON	ON	OFF
8	OFF	OFF	OFF	ON
9	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON
11	ON	ON	OFF	ON
12	OFF	OFF	ON	ON
13	ON	OFF	ON	ON
14	OFF	ON	ON	ON

*Bank No. is "0" when all the bank switches "0" - "3" are ON.

External Teaching Timing
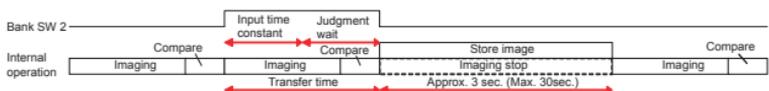
*Max. storage time is warranted value when writing frequency has become its limit value (100, 000 times).

Function of Auxiliary Output

AUXOUT=0: Ready output

Application: Used to confirm when the judgment result of imaging is output by a new bank after bank is switched.

| Bank switch	0			
Internal operation	Imaging		Bank switching	Imaging	Imaging
Aux. output		↑ Turns OFF when bank switch input changes.		↑ Turns ON when the first judgment result bank switch is output.
Judge output	Previous condition	Image condition	Image condition

Compare ... Compare ... Compare

AUXOUT=1: Judgment timing output

Application: Used to output judgment result at specified timing by imaging a work by synchronization input signal for the image-taking with synchronization input signal.

Synch. input			
Internal operation	Pixel reset	Imaging	Pixel reset	Imaging
Aux. output		↑ Reversed every time judgment output is renewed.	

Compare ... Compare
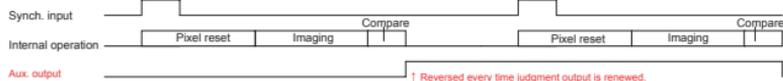
AUXOUT=2: Lighting output

Application: Used when turning ON a light other than exclusive external light (CVS-LW1) only when taking image for the imaging using a synchronization input signal.

Synch. input			
Internal operation	Pixel reset	Imaging	Pixel reset	Imaging
Aux. output			

Compare ... Compare
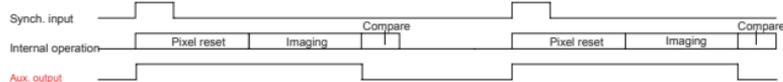
AUXOUT=3: Position / Magnification / Rotation correction allowable range output

Application: Used to measure the distance between the work and sensor, angle, and position.

| Internal operation	Imaging	Imaging	Imaging	Imaging
Aux. output				

Compare ... Compare ... Compare ... Compare
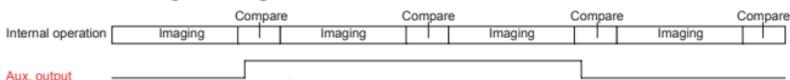
↑ Turns ON when the values for which the position, magnification, and rotation corrections are performed are within the set values of "MAGNIFY%", "POSIT X%", "POSIT Y%", and "ROTATE%".

※When the set value of "MAGNIFY" is "0", turns ON only when the values for which the position and rotation corrections are made are within corresponding set values.

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Operation Check by Using Sample Work

Two kinds of sample works are prepared. Teach this illustration and use it for the registration of colors and patterns or the confirmation of set values, etc.

Sample ①
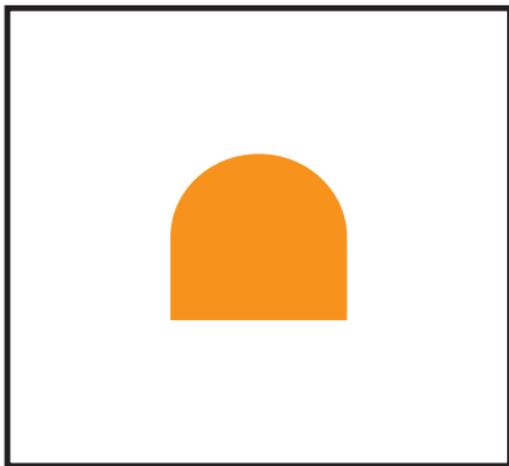
Sample ②
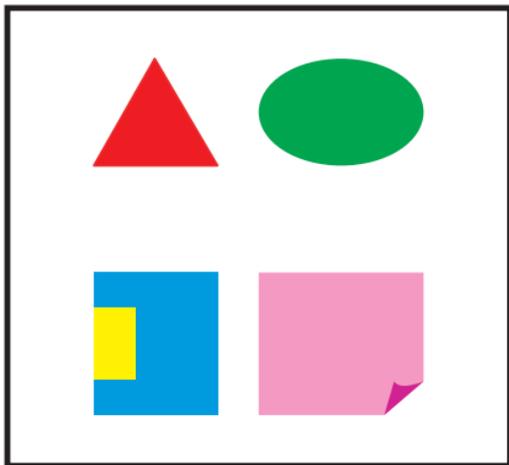
Warranty

Period of Warranty

The period of warranty of this device shall be one year
after its delivery to the customer.

Range of Warranty

The manufacturer will exchange this device (by sending a substitute),
free of charge, on the responsibility of the manufacturer
if the failure arises due to the manufacturer's liability during this period of warranty.
However, the failure occurred by the following causes shall be excluded
from the manufacturer's warranty.

1. Failure caused by any abuse, misuse, and misapplication
2. Failure due to a cause other than the delivered manufacturer's product
3. Failure caused by an approved modification or repair
4. Failure due to acts of God

The warranty stated herein shall cover only the delivered manufacturer's sole product.
The damages that have caused by the failure of the delivered manufacturer's product
shall not be covered by this warranty.

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