

Edge Identification Sensor

CVS3

Operation Manual

• Thank you for purchasing the color vision sensor series Edge Identification Sensor (CVS3).

• Before operating the product, read this manual thoroughly for optimum use.

• Keep this manual handy for future reference.

• This product cannot be used as safety device for protection of human body.

Before Operation

What is Edge Identification Sensor?

Parts Identification

The image sensor detects the edge (contour) of the color of captured image and stores it as the reference image. The sensor compares the reference image and the object image to find the **missing edge** (the contour may not be perfect), and **stain** (unnecessary pixels may be occupied by edge data). The object is judged OK when its missing/stain pixels are less than the threshold setting. The sensor identifies letters, shapes, directions, stains, and missing edges.

Operation buttons

LCD display

Installation hole
Hole for installing the unit. Screw of M4 x 50mm or more is recommended. (4.3, pitch: 87.0mm, depth: 42.0mm)

Camera and light are mounted on the back side.

Power supply, Input/Output wire

External connector
Connector for optional products. (Remote monitor, external light, cable, etc.)

External Dimensions

Connection of Power Supply and Input/Output Wire

Unit : mm

The line colors and signal allocations of power supply and input/output wire are as follows.

No.	Color	Signal
1	Brown	12 to 24V DC
2	Blue	0V
3	Orange/Black	Bank selection 0 input
4	Yellow/Black	Bank selection 1 input
5	Pink	Bank selection 2 input
6	Purple	Bank selection 3 / Synchronous input
7	Black	OK output
8	Red/Black	NG output / Lighting control output

Specifications

Setup Procedure

Model	CVS3-N20 CVS3-P20	CVS3-N21 CVS3-P21
Detection angle	20°	
Capture range	90 to 150mm	31 to 38mm
Capture area	40 x 40mm to 65 x 65mm (± 10%)	17 x 20mm (± 10%)
Light source	White LED 12 pcs	
Supply Voltage	12 to 24V DC ± 10%	
Power consumption	Max. 140mA/24V DC	
Resolution	16 × 16 to 208 × 236	
Lamp duration	Approx. 5000 hrs (in normal temperature and humidity. Brightness level down by 1/3 of the initial level)	
Response time	48ms (Factory setting), 2.5ms (Min), 518ms (Max)	
Output signal	NPN/PNP open collector output 2 points max. 100mA. Residual voltage 1.0V or less	
Input	Bank selection/Synchronous/External teaching input 4 points	
Operating temperature	0 to 40	
Ambient humidity	35 to 85% RH	
Storage temperature/humidity	-20 to 70 / -35 to 95% RH	
Vibration/shock resistance	10 to 55Hz Amplitude 1.5mm, 500m/s ² (10 times)	
Material	ABS / Acryl / Polycarbonate	
Protection structure	IP67	
Weight	Approx. 180 g	

You can complete the setup of CVS3 series simply by following the menus in order.

SETUP PARAMTR (page 7)
Select the parameters to display the specified contour (edge). If regular reflection of light obscures the normal detection, use the external diffused lighting.

TEACHING menu (page 9)
Store the reference image as well as the capture range and judgment range.

OPTION PARAMTR (page 13)
Adjust the parameters for stable detection of conforming/nonconforming products. Select the action for positional change of object, the settings of response time and input/output signals.

After learning the basic operation in the chapter 2, select the settings in the steps to

2 Descriptions of LCD display

Captured image

Menu

Number of pixels of missing edge/stain

Stability of threshold value

Screen display mode

Judgment result

Bank number / Response time

Main menu
Displays the image captured by the camera.

Menu
Indicates the setting and editing menus.

Number of pixels of missing edge/stain
Indicates the numbers of pixels of missing contour (yellow) and of stain/scratch (red). Upper is threshold level (white).

Stability of threshold value
Displays the threshold margin of the judged edge in arrow UP/DOWN. Reduce the edge threshold value (THRESHLD) if it is displayed in arrow DOWN, or increase the value if in arrow UP.

Screen display mode
Displays the current screen mode (Page 8)

Judgment result
Displays the result as OK or NG.

Bank number / Response time
Indicates the selected bank number (0 to 14). In the settings screen, indicates the time to output signals after image capture in unit of 0.1 ms.

✗ Detects the background as edge.

The optimum setting

✗ The detected edge is thin and unstable.

Main Menu

Setup parameter reference screen
See page 7.

Teaching menu
See page 9.

Reference screen of other parameters
See page 13.

Output changes

Holding captured image
Holds the image captured at the moment the output changes.
*Cleared when another bank is selected.

Changing the Screen Display Mode

"D" display
Displays the real-time image.

"Z" display
Displays the differentiated contour in the seven(7) levels of shading.

"O" display
Displays the judgment result of missings and stains.

Blue: Masking
Green: Object area of the missing checking (Yellow pixels indicate the missing edges).
Purple: Object area of stain (Red pixels indicate stains).

Parameter Reference/Selection Screen

Parameter reference screen

Parameter selection screen

Red

Previous setting item

Next setting item

Returns to the Main menu

Set value +1

Set value -1

Cancel the selected values and returns to the parameter reference screen.

Saves the selected values and returns to the parameter reference screen.

Locks the selected values. The locked values are displayed in blue and not changed. Press again to cancel the lock.

(See page 14 "INITIALZ.")

3 Settings (SETUP PARAMTR Menu)

After installing the sensor and object, select the following settings to obtain the optimum contour (edge). After completing the settings, proceed with the teaching menu.

Function	Setting range (Initial value)	Description
LCD display		
Edge color filter	0 to 5 (1)	Selects the colors with which the edge is generated. Set to eliminate unnecessary contour. 0: Differentiates all colors evenly. 1: Emphasizes the contour between B/W. 2: Differentiates the green elements. 3: Differentiates the blue and red elements. 4: Differentiates the red elements. 5: Differentiates the blue elements.
Light ON/OFF	0 to 3 (1)	Controls the internal and external lighting. You can set, for instance, the ultraviolet light to ON for the specified bank. 0: Internal light-OFF, External light-ON 1: Internal light-ON, External light-ON 2: Internal light-OFF, External light-OFF 3: Internal light-ON, External light-OFF
External light control signal	0, 1 (0)	0: Red/Black line is used for NG output. 1: Red/Black line turns off in synchronization with image capture.
Shutter time	AUTO, 1 to 250 (100)**	Selects the shutter time (unit: 0.1 ms). Adjust it according to the object speed. SHUTTER value = 10 × Required line width (mm) × Object speed (m/s)
Edge threshold value	AUTO, 1 to 255 (AUTO)**	Selects the threshold value to binarize the detected edge. In the process, search is performed for the values smaller than the set value by 4 to 24, and the optimum threshold value is applied.
Zoom	0, 1 (0)	Selects the zoom setting of the image sensor. 0: Normal mode 1: Magnifies the center part to double size. Reduces the height and width of capture area by half.

* The functions indicated in purple contain the set values for each bank.
** Frequently adjusted parameters.
*** Appears "AUTO" when inputs smaller than "1". Possible to input under the optimum threshold automatically. Manual adjustment is, however, required in case the object was reflecting.

4 Descriptions of Teaching Menu

Teaching Menu Screen

Outside of Judgment area (light blue)
Select in **WINDOW SIZE**. It is not object area, but the position of captured image in this area is corrected.

Masking area (blue)
Select in **MASK EDITOR**. This area is ignored in judgment.

Teaching menu

Teaching Menu Common Procedure

Teaching menu Page 10

Saves the teaching results and returns to the teaching menu.

Cancel the teaching results and returns to the teaching menu.

Window

Performs the displayed option of the selection menu.

Selects the selection menu. (Refer to page 11 and 12 for details).

Teaching Procedure

Main menu
Page 5

Selects the capture area. Page 11
*Cannot save the data when the capture area contains less than 16 x 16 pixels only.

Saves the captured image. Page 11

Select the judgment area. Page 11
*Cannot save the data when the judgment area contains less than 36 pixels only.

Masking Page 12

PC communication
Data saving and loading with PC.
(PC software information : <http://www.optex-fa.com>)

Returns to the Main menu

Locks the selected menu. The locked menu are displayed in blue and not changed. Press again to cancel the lock.

Capture Area (VIEW AREA)

Saving the Reference Image (SAVE PATTERN)

Judgment Area (WINDOW SIZE)

Narrows the capture area when the object position is not properly corrected due to unnecessary background contour, or when the object response time is required.

Capture area vertical magnification/reduction
UP/DOWN: Magnifies the window vertically. Reduces the window vertically.

Capture area horizontal magnification/reduction
UP/DOWN: Magnifies the window horizontally. Reduces the window horizontally.

Result saving
Saves the result and exits. Cancels the result and exits.

Saving the Reference Image (SAVE PATTERN)
Set the reference image to be compared with the object image. It takes 6 to 7 seconds to save the image due to processing the contour information. (During processing, "SAVE PATTERN" turns red.) When selecting of the judgment area and the mask setting is completed, adjust the object position so that its contour fits in their settings.

Judgment Area (WINDOW SIZE)
Selects the size and position of the judgment area. Set the required minimum setting since a larger judgment area results in a longer response time.

Judgment area Up/Down
UP/DOWN: Moves up the window. Moves down the window.

Judgment area Right/Left
UP/DOWN: Moves the window to right. Moves the window to left.

Judgment area vertical magnification/reduction
UP/DOWN: Magnifies the window vertically. Reduces the window vertically.

Judgment area horizontal magnification/reduction
UP/DOWN: Magnifies the window horizontally. Reduces the window horizontally.

Result saving
Saves the result and exits. Cancels the result and exits.

Masking

Specifies the area to be ignored in the judgment area. You can create the shape by lapping over or cutting out the quadrangular windows.

Window
The mask is added/deleted in this red part.
*The yellow bar is for guide.

The masked area is displayed in blue.

Masking window Up/Down
UP/DOWN: Moves up the window. Moves down the window.

Masking window Right/Left
UP/DOWN: Moves the window to right. Moves the window to left.

Masking window vertical magnification/reduction
UP/DOWN: Magnifies the window vertically. Reduces the window vertically.

Masking window horizontal magnification/reduction
UP/DOWN: Magnifies the window horizontally. Reduces the window horizontally.

Mask add/delete with masking window
UP/DOWN: Adds the inside of window. Deletes the inside of window.

Mask add/delete outside masking window
UP/DOWN: Adds the outside of window. Deletes the outside of window.

Masking result saving
Saves the result and exits. Cancels the result and exits.

5 Settings (OTHER PARAMTR Menu)

Parameters to adjust the missing edge/stain detection.
Adjust to shorten the response time or to select the action for the object change.
Adjust the parameters indicated in blue to stabilize the detection.

Function	Setting range (Initial value)	Description
LCD display		
Bank selection	0 to 16 (16)	Selects the bank selection option. 0: 14: Selects the set bank. (Bank selection 2 input is the external teaching input) 15: Selects a bank by external input. (Bank selection 2 input is the external teaching input) 16: Selects a bank by external input. (Bank selection 2 input is available)
Copy of bank setting	0 to 14 (0)	Copies the set values and masking display of the current bank to the destination bank. During copying, capture is interrupted. When the power is turned off, the setting returns to "0".
Background edge pixel threshold level	AUTO, 1 to 9999 (AUTO)	Selects the threshold level of the occupied pixels out of the saved reference edge (displayed in red). The value lower the setting is judged NG. Select "AUTO" to adjust optimum pixel automatically.
Background edge detection margin	AUTO, 1 to 14 (AUTO)	Select the area margin to be ignored near the saved reference contour. Select "AUTO" to adjust optimum with automatically. Select larger value to ignore the edge near the contour.
Background edge detection sensitivity	0 to 7 (6)	Set the edge threshold level of the stain detection area larger than that of the missing edge detection area, and select here smaller value so that unnecessary stain is not detected. Larger value will bring the display of threshold margin (page 4) closer to arrow DOWN.

*External teaching starts at rising of the bank selection 2 input signal.
*Select the bank number by binary digit for bank selection input.
(Example : Bank 10 = Bank 1 and 3 ON)

Function

Setting range (Initial value)

Description

LCD display

Communication setting

Communication setting

Parameter initialization

Missing pixel threshold level

Missing edge detection margin

LCD up/down freeze

OFF delay time

ON delay time

ON/OFF delay

Selects Communication setting.
0: OFF
1 to 6: On. Baud rates are 4800, 9600, 19200, 38400, 57600bps in order. Data length=8bit, no parity, stop bit=1bit.
When the communication function is activated, external lighting and remote monitoring are disabled.

Select "16". Press and hold **UP** and **DOWN** and turn the power on. Selected values and mask settings are all initialized.
10: Locks all the settings.
11: Cancels the lock status.

Selects the threshold level of the missing pixels (displayed in yellow) from the saved reference contour. The value over the setting is judged as NG. Select "AUTO" to adjust optimum pixel automatically.

Selects the contour width by the set captured contour in bincode. Increasing by "1" widens the contour to downward or right by "1" pixel so that slight position shift does not result in error detection. Select "AUTO" to adjust optimum width automatically. Selecting larger value is effective when search is not stable.

0: Normal display
1: Reverses the LCD display vertically. Select "1" when installing the unit upside-down.

Delays turning OFF of the OK/NG output. Allows it to turn off when the judgment result remains in OFF condition continuously for over the selected delay time (unit: ms).

Delays turning ON of the OK/NG output. Allows it to turn on when the judgment result remains in ON condition continuously for over the selected delay time (unit: ms).

Function

Setting range (Initial value)

Description

LCD display

One shot/Output holding

Rolling correction margin

Magnification

Rotating angle fine adjustment

Position search range

Position search mode

Select "1" to keep the output ON for the off-delay time after the output turns on.
When the off-delay time is set to "0", the output remains on. Change the bank to turn off the output.

Corrects the horizontal width variation of moving object caused by influence of the rolling shutter. Increase/reduce the value by "1" to change the width by approx. 0.8%, and search the maximum value. The expansion rate is ±15.6% at the maximum value "20".
*The acceptable object transfer direction is only right/left against the sensor front.

To magnify the correction value set at ROLLING of above. When the distance to workpiece would fluctuate, select "1".

Adjusts delicately the angle of captured image to search the optimum angle. Increase/decrease the value by "1" to rotate the image right/left by approx. 0.6 degrees. The angle is ±6.2 at the maximum value "14".

Selects the number of pixels to search the captured edge position so that the edge is aligned with the reference edge by median point. Search is performed up to four(4) times as large as the setting to right/left, and up to the same number as the setting to up/down. Select larger value when position shifting of the object results in unstable position correction.

0: Starts searching from the point that position shifting is given at median point of the edge that appears in the view area.
1: Use this when to detect only dirt. In this case edge is not given. Position shifting is not given.

Function

Setting range (Initial value)

Description

LCD display

Synchron-ization

Selects the synchronization input setting. When set to 0 to 3, the bank selection 3 input is assigned to the synchronization input. The capturing conditions are as follows.
0: While the synchronization input is Off
1: When the synchronization input is switched from On to Off
2: While the synchronization input is On
3: When the synchronization input is switched from Off to On
4: Captures images continuously

* Calculate the object transformation ratio caused by rolling shutter using the following formula.
Transformation ratio (%) = Object speed (m/s) × Horizontal resolution × 5.65 / Horizontal capture area (mm)

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Sample object

CVS3 TEST

JVS3 TEST

Conforming product

Non-conforming product