Color Area Sensor

CVS1

Operation Manual

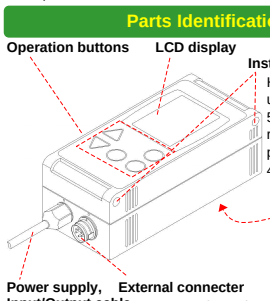
・Thank you for purchasing the color vision sensor series Color Area Sensor (CVS1).
・Before operating the product, read this manual thoroughly.
・Keep this manual handy for the future reference.
・This product cannot be used as safety device for human body protection.

1 Before Operation

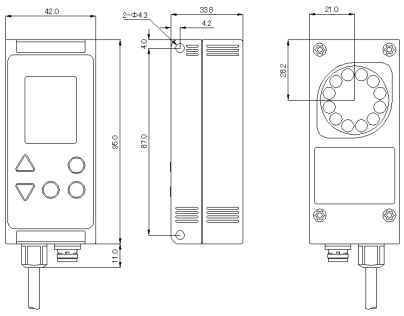
What is Color Area Sensor?

The Color Area Sensor detects the pixels that contain the same color information as the pre-set color, and measures their number (area). It outputs signal when the number of pixel falls within the specified range.
The sensor is suitable for various types of detecting application such as with/without printing detection, mark detection, foreign object detection, and the detection of delicate color difference that is not possible with the color sensor.

Parts Identification



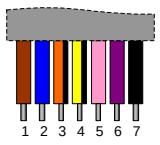
External Dimensions



Unit : mm

Connection of Power Supply and Input/Output Cable

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



No	Color	Signal
1	Brown	12 - 24V DC
2	Blue	0V
3	Orange/Black	Bank selection 0 input
4	Yellow/ Black	Bank selection 1 input/ Lower limit output
5	Pink	Bank selection 2/ Teaching input
6	Purple	Bank selection 3/ Synchronous input
7	Black	Output

Specifications

Model	CVS1-N10 CVS1-P10	CVS1-N20 CVS1-P20	CVS1-N21 CVS1-P21	CVS1-N40 CVS1-P40
Detection angle	10°	20°		40°
Capture range	210 to 270 mm	90 to 150 mm	31 to 39 mm	50 to 100 mm
Capture area (±10%)	40×50 to 55×65 mm	40×50 to 65×75 mm	17×20 mm	50×65 to 100×115 mm
Light source	White LED, 12 pcs			
Supply Voltage	12 - 24 V DC±10%			
Power consumption	Max. 120 mA/24V DC			
Resolution	8×16 to 208×236			
Lamp duration	Approx. 50000 hrs (In normal temperature and humidity. Brightness level down by 1/2 of the initial level)			
Response time	11 ms (Factory setting), 0.6 ms (Min.), 22 ms (Max.)			
Output signal	NPN/PNP open collector output 2 points Max. 100 mA Residual voltage 1.0 V or less			
Input	Bank selection/Synchronous/External teaching input 4 points			
Operating temperature	0 °C to 40 °C			
Ambient humidity	35 % to 85 %/RH			
Storage temperature/ humidity	-20 °C to 70 °C, 35 % to 95%/RH			
Vibration/shock resistance	10 to 55 Hz Amplitude 1.5 mm, 500 m/s² (10 times)			
Material	ABS / Acryl / Polycarbonate			
Protection structure	IP67			
Weight	Approx. 180 g			

Setup Procedure

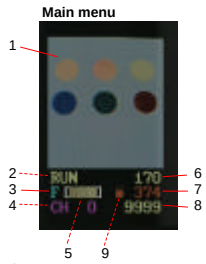
You can proceed with the CVS1 setup in the following order.
1) **Optimum initialization for applications** (Page 8)
Select the optimum INITIAL setting for your application.

2) **Teaching** (Page 9)
Register the detection color. You can reduce the capture area to eliminate undesired objects.

3) **Setting customization** (Page 11)
Select settings such as color margin percentage and input/output signals.

Learn the basic operations in Section 2, and start the setup in the order of 1 to 3 above.

2 Descriptions of LCD display



1) **Captured image**
The image captured by the camera is displayed.

2) **Mode display**
"RUN" mode is selected in the main menu.

3) **Screen display mode**
Indicates the current screen mode. (Page 6)

4) **Bank number**
Indicates the selected bank number (0 to 15).

5) **Detection color**
Displays the colors to be detected.
Left: Darkest color, Middle: Middle tone, Right: Brightest color

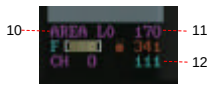
6) **Color area lower limit**
Indicates the lower limit of the detection color area.

7) **Color area**
Indicates the current area of the detection color.
Orange : Within the specified range
Green : Out of the specified range

8) **Color area upper limit**
Indicates the upper limit of the detection color area.

9) **Output status**
● : Output ON × : Output OFF

In the parameter reference screen and the parameter selection screen, items No. 2, 6 and 8 above are respectively replaced with :



10) Parameter 11) Parameter value
12) Response time (unit : 0.1ms)

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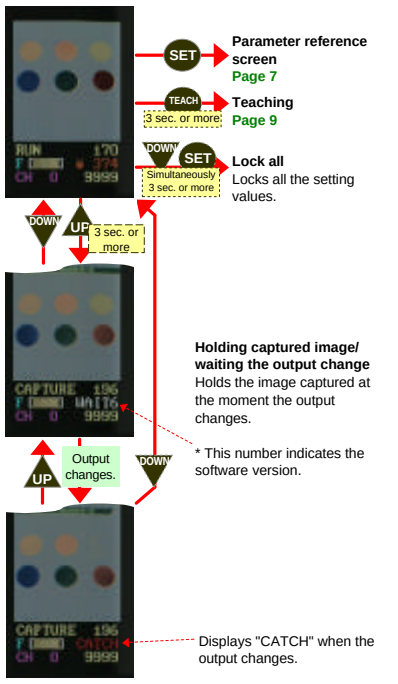
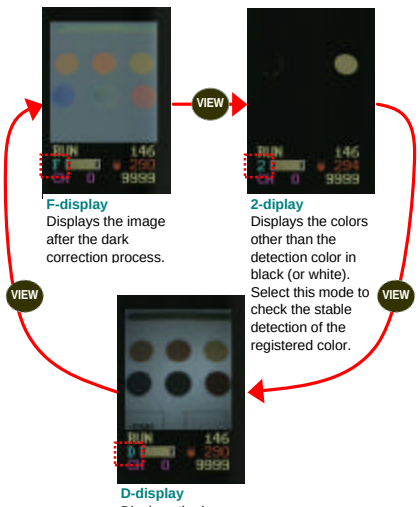
Main menu

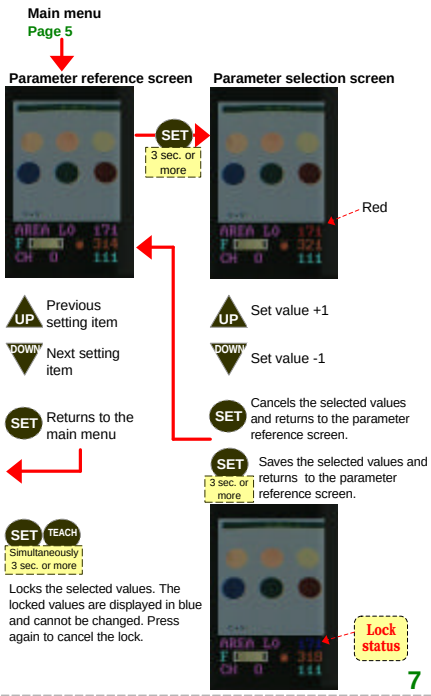


Changing the Screen Display Mode



*Changing the screen display mode does not influence the judgment result. The entire procedure of color detection and registration is completed in **F-display**.

Parameter Reference/Selection Screen



3 Optimum Initialization for the application

Select the INITIAL setting to initialize the parameter settings using the optimum values for your application.

Application		With/without print	Print on lustered/ transparent material	Delicate color difference	With/without luster
		Expiry date 2004.8.25	2004.8.25		
INITIAL setting		1	2	3	4
Values to be changed*	COLRFIL	1	1	0	0
	KIL BLK	27	27	27	20
	LIGHT	3	2↑	3	3
	RESOLUT	0	0	0	1
	TEACHMD	1	1	0	2
Resolution		200×120	200×120	200×240	200×240
Teaching		Normal	Normal	Small	Small

Application		White/Black (on white)	White/Black (on black)	Difference between dark colors	With/without print (on unstable background)
					Expiry date 2004.8.25
INITIAL setting		5	6	7	8
Values to be changed*	COLRFIL	1	0	0	0
	KIL BLK	27	15	30	15
	LIGHT	3	3	3	3
	RESOLUT	1	1	0	0
	TEACHMD	0	0	0	1
Resolution		200×120	200×120	200×240	200×120
Teaching		Normal	Normal	Small	Normal

*All other settings are initialized together.

†Enables stable detection of printing by using diffused lighting or back lighting to eliminate the influence of luster.

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4 Descriptions of Teaching Menu

Teaching Menu Screen

Teaching window
Detects the darkest, middle tone, and brightest colors within the window.
- For delicate color detection : Select smaller area for window view.
- For stable detection in broader color range : Select larger area for window view.
- For character detection (**TEACHMD**=1,3) : Select larger area for window view to include both the characters and background colors.

Automatically switches between F display and 2-display.

In 2-display, ensure that only the color you register is displayed.

Teaching Point 1.

Teaching Point 2.

For details of 1-point teaching, 2-point teaching, and Upper/Lower limit teaching, refer to **Page 11**, **AREA LO**, **AREA HI**.

SET Switches the teaching point between Point 1 and Point 2.

TEACH Selects the window operating function (**Page 10**).

SET Saves the teaching results and exits the menu.
3 sec. or more

TEACH Cancels teaching.
3 sec. or more

UP DOWN Performs the displayed option of the parameter (changing window position, window size and captured area).

Teaching Procedure

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

Window Up/Down
UP Moves up the window.
DOWN Moves down the window.

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

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

Capture area size
UP Sets the window view area as the capture area (Zoom-in).
DOWN Resets the capture area to the full size (Zoom-out).

Full size / Magnified

5 Settings

Select the settings before teaching.
Adjust the settings after teaching to optimize the detection performance.
*The functions in purple display contain the setting values for each bank.

Function (LCD display)	Setting range (Initial value)	Description
Color area lower limit AREA LO	0 to 9999 (5000)	Selects the lower limit of color detection area. It is automatically selected according to the teaching mode. (1-point teach: Half area, 2-point teach: the average value of Point 1 and 2, Upper/Lower limit teach: Point 2 area)*1
Color area upper limit AREA HI	0 to 9999 (0)	Selects the upper limit of color detection area.*1 **0**: Sets the upper limit to 9999. In teaching, only the color area lower limit is registered. **1 or over**: Selects Upper/Lower limit teaching. The color detection area of Point 1 teaching is registered as the upper limit.
Bank selection BANK	0 to 17 (17)	Selects the bank selecting option.*2 **0** to **15** : Selects the set bank. ("Bank selection 2 input" is the external teaching input.) **16** :Selects a bank by external input. ("Bank selection 2 input" is the external teaching input.) **17** : Selects a bank by external input. ("Bank selection 2 input" is available.)
Screen brightness BRIGHT	0 to 255 (100)	Selects the screen brightness (=shutter time). The optimum value is normally selected during teaching. 1 step value corresponds to 54.5µs of shutter time.*3 To capture a fast-moving object, select the value according to the moving speed and switch to the fixed brightness teaching (**TEACHMD**=2 or 3). Setting value = 18 × Detection width (mm) ÷ Object moving speed (m/s)

*1 The maximum value is adjustable using the **MAXAREA** setting.
*2 The bank selection input specifies the bank number using binary digit. (Ex. For Bank 10, set the bank selection 1 and 3 to ON.)
*3 Time setting longer than the response time is ignored.

Function (LCD display)	Setting range (Initial value)	Description
Color margin percentage COLOR%	0 to 127 (20)	Selects the margin for the color registered in teaching. The value obtained by the following formula is stored: Color width in teaching window x **TEACH%** setting value ÷ 10. After teaching, select a smaller value (**5** to **20**) for delicate color detection, or a larger value (over **20**) for stable detection in the broader color range.
Color filter COLRFIL	0 to 3 (0)	Selects the filtering setting of the captured image. **0** : Calculates the RGB rate by pixel. Secures stable color detection against variable luminance influenced by shadow formation and lighting variation. Not suitable for black and gray. **1** : Corrects the brightness based on the brightness of the right end of screen. Suitable for black and gray detection such as black characters on white background. **2**, **3** : Functions as **0** and **1**, and doubles the screen brightness.
Area hysteresis HYSTRSY	0 to 200 (10)	Selects the hysteresis of color area upper/lower limits. 1 step value corresponds to 0.1% of the full screen (9999).
Input time constant IN FILT	0 to 4 (4)	Selects the bank selection and the time constant for external teaching signal (filter-out time). **0** : 160µs, **1** : 2.5ms, **2** : 5ms **3** : 7.5ms, **4** : 10ms (Each value±20%) *Synchronous input is constantly 40µs.
Set value initialization INITIAL	0 to 15 (0)	**1** to **8**: Initializes to the optimum setting values for each application. (**Page 8**) **15**: Initializes to the standard default values.
Darkness correction rate KIL BLK	0 to 31 (27)	Selects the correction rate against the variable luminance due to shadow formation of object or lighting variation. **0** to **10** : Very low rate to view the luminance such as LED lighting. **10** to **20** : Slightly low rate to separate black and gray. **24** to **28** : Standard rate for normal condition. (Corresponds to **COLRFIL**=1) **29** to **31** : Rate for differentiating specially dark colors.

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Function (LCD display)	Setting range (Initial value)	Description
LCD up/down reverse LCD VIEW	0 to 3 (0)	**0** : Normal display **1** : Reverses the LCD display vertically. Select **1** when installing the unit upside-down. **2**, **3** : Functions as **0** and **1** on the condition that the remote monitor (CVS-M1) is connected. LCD display turns off if no button operation is detected for a minute. NTSC composite video signal is output from the external connection port.
Light ON/OFF LIGHT	0 to 3 (1)	Controls the internal and external lighting. **0** : Internal light=OFF, External light=ON **1** : Internal light=ON, External light=ON **2**, **3** : Functions as **0** and **1**. When "**SYNCHRO**=1,3" is selected, the light turns ON only during image capture*4.
Maximum display area MAXAREA	0 to 9999 (9999)	Selects the maximum area. Use the function to directly read the displayed value in **AREA LO** or **AREA HI** as the area.
OFF delay time OFFDELA	0 to 5000 (0)	Delays turning OFF of the output. Allows it to turn off when the judgment result remains in OFF condition continuously for over the selected delay time (unit: ms).
ON delay time ON DELAY	0 to 5000 (0)	Delays turning ON of the output. Allows it to turn on when the judgment result remains in ON condition continuously for over the selected delay time (unit: ms).
One-shot ONESHOT	0, 1 (0)	Select "**1**" to keep the output ON for the off-delay time after the output turns on.

Select the settings before teaching.

*4 Immediately after a button operation, the light does not turns off even during the image capture.

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Function (LCD display)	Setting range (Initial value)	Description
Outside area range OUTSIDE	0 to 3 (0)	**0** : Output ON within the specified area range. **1** : Output ON outside the specified area range.*5 **2**, **3** : Functions as **0** and **1**. "Bank selection 1 input" performs detection when the area exceeds the lower limit.
Resolution RESOLUT	0, 1 (1)	Select the number of pixels taken out from the image sensor. **0** : High resolution (240 x 200) Suitable to detect delicate color difference and thin characters. **1** : High speed (240 x 100) Suitable to shorten the response time retaining the current capture area.
Synchronization input delay time SYNCDLY	0 to 255 (0)	Selects the delay time of synchronization input. The synchronization signal input (bank selection 3 input) delays for the period of the setting value x 64µs. Suitable for fine adjustment of image capture timing.
Synchronization input SYNCHRO	0 to 4 (4)	Selects the synchronization input setting. When set to **0** to **3**, "bank selection 3 input" is assigned to the synchronization input. The capturing conditions are as follows.*6 **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 independently.

*5 When ON delay time, OFF delay time, and One-shot are activated together, Area hysteresis is deactivated (**HYSTRSY**=0).
*6 When "**SYNCHRO**=1,3" is selected, the color area judgment is properly proceeded while the LCD does not display the image captured immediately after any button operation. An array of the right end of the image may appear at left end of the display, but does not interfere with the performance.

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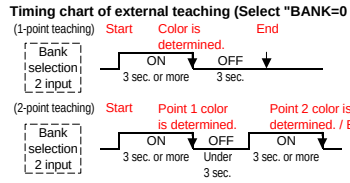
Function (LCD display)	Setting range (Initial value)	Description
Teaching enable TEACHEN	0 to 3 (0)	**0** : Enables changing the teaching window and its position, and the capture area. **1** : Prohibits changing the capture area. **2** : Prohibits changing the teaching window and the capture area. **3** : Prohibits entering the teaching mode.
Teaching mode TEACHMD	0 to 3 (0)	**0** : Normal teaching. Determines the darkest and brightest colors in the teaching window, and selects the detection color within the range between them. **1** : Stain and character detection teaching. Selects a dark color in the teaching window as the detection color. **2**, **3** : Functions as **0** and **1**. Performs teaching without changing the brightness (**BRIGHT**).
Teaching color margin percentage TEACH%	0 to 30 (15)	Selects the color detection margin in teaching. (Refer for the details to **page 12**, **COLOR%**).
Temperature compensation level TEMPCMP	0 to 255 (30)	Adjusts the setting against the deviation in color detection due to variable temperature. (Available only when both **COLRFIL**=0,2 and **RESOLUT**=1 are selected.) Perform teaching at low temperature and adjust the setting at high temperature to obtain the optimum value.

Timing chart of external teaching (Select "BANK=0 to 16.")



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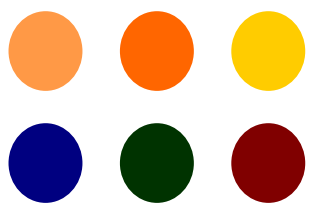
Sample object



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