

KEYENCE

VISION SYSTEM

GENERAL CATALOG



A Complete Guide to Powerful,
User-Friendly Machine Vision Solutions

CV&CA Series

Illumination / Lens / Monitors & Peripheral Equipment

O v e r v i e w

V i s i o n S y s t e m



Multi-Camera Universal
Machine Vision System

CV-3000 Series NEW

P.7

High-Speed Digital
Machine Vision System

CV-2100 Series

P.21



All-in-one Image Processing

CV-700 Series

P.25



APPLICATION

Part identification

Defect inspection

Presence/absence detection

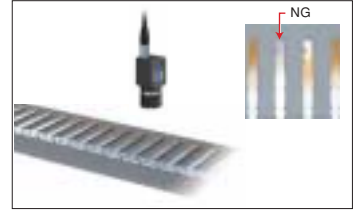
ELECTRICAL/ELECTRONIC



Differentiation of the buttons on a mobile phone



Inspection of burnt marks/short-circuit of connector resin



Detecting defective pin plating



Checking correct cable assembly



Inspection of trimmer switch position



Detecting "reject" marks on electronic components

AUTOMOTIVE/METAL



Differentiation of cylinder blocks



Crankshaft porosity detection



Detecting the presence/absence of bearing grease



Differentiation of tires



Inspection of flaws on a steel plate

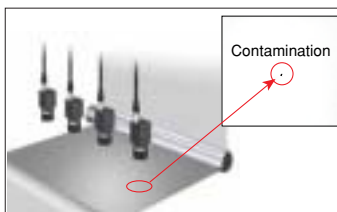


Detecting the groove defect in a piston head

FOOD, PHARMACEUTICAL & OTHERS



Inspection of different types of medicine capsules



Inspection of pinholes and foreign materials on a sheet



Detecting molded products remaining in a mold



Inspection of plastic cups and printing



Inspection of stains on the bottom of beverage cans



Detecting the presence/absence of package inserts and missing items

Dimension measurement

Positioning

Counting



Measuring the coplanarity of connector pins



Positioning of a CCD device



Checking BGA solder balls



Positioning confirmation for silicon wafers



Positioning of LCD glass substrates



Detecting ink marks on a silicon wafer



Measuring the notch position of a gear



Position control of a robot



Check correct seating of parts for die protection



Measuring deformation of metal materials



Checking fit of body panels



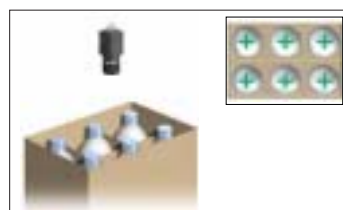
Counting bearing balls



Pitch measurement of construction boards



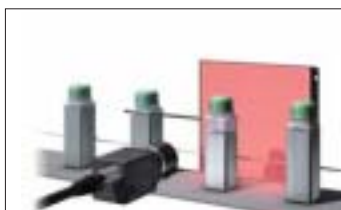
Checking mispositioned labels



Counting items in a carton



Measuring the thickness of building materials



Detecting liquid level in a bottle



Counting beverage cans

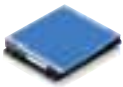
& I n d e x

I l l u m i n a t i o n

Coaxial incident light
CA-DX



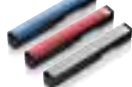
Backlight
CA-DS



Low-angle light
CA-DL



Bar light
CA-DB



Direct-ring light
CA-DR



LED Illumination
Controller CA-DC



Dome light
CA-DD



Fluorescent
Illumination CA-R



LED Illumination
CA-D Series

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Fluorescent Illumination
CV-R/CA-R Series

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L e n s

8X Macro
CA-LM8



2X Macro
CA-LM2

8mm
CA-LH8



50mm
CA-LH25



4mm
CA-LS4



16mm
CA-LS16



8mm
CA-LHS8



3.5mm
CV-L3



16mm
CV-L16



Macro Telecentric Lens
CA-LM Series

P.42

High-resolution & Low distortion
CA-LH Series

P.43

Super Small Lens
CA-LS/CA-LHS Series

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CCTV Lens
CV-L Series

P.46

M o n i t o r s & P e r i p h e r a l E q u i p m e n t

8.4"LCD color monitor
CA-MP81/MN81



Special stand

LCD Color Monitor
CA-M Series

P.50

Color Monitor
CV-M Series

P.51

5.5"LCD color monitor
CV-M30



Camera adjustment
stage CA-S2040



Camera Adjustment Stage
CA-S2040 Series


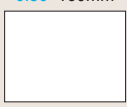






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Camera Cable
CV-C Series

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Vision System

Selection Guide

Model	No. of Pixels / field of View in 1pixels=1mm	Color/Mono	No. of Programs	Small Camera	Application	Page
		No. of Cameras	No. of Inspections			
CV-3502 	2M Pixels 1620(H) x 1220(V) 6.30" 160mm 4.73" 120mm 	Color/ Monochrome Mix & Match (4)	1000 128	<input type="checkbox"/> 0.47" 12mm Color/Mono 245K Pixels <input type="checkbox"/> 0.67" 17mm Color/Mono 2M Pixels	High Performance Inspections - High accuracy dimensional measurements - High resolution part detection - Large target inspections - Color and Grayscale	P.7
CV-3002 	245K Pixels 512(H) x 480(V) 2.01" 51mm 1.89" 48mm 	Color/ Monochrome Mix & Match (2)	1000 128	<input type="checkbox"/> 0.47" 12mm Color/Mono 245K Pixels	General Purpose Inspections - High speed presence/absence detection - Color sorting or part identification - Dimensional measurement or part positioning - Color and Grayscale	P.7
CV-2100 	245K Pixels 512(H) x 480(V) 2.01" 51mm 1.89" 48mm 	Monochrome (2)	32 64	<input type="checkbox"/> 0.47" 12mm Mono 245K Pixels	High Speed Grayscale - High speed presence/absence detection - Limited dimensional measurement and part positioning - Defect inspection	P.21
CV-700 	245K Pixels 512(H) x 480(V) 2.01" 51mm 1.89" 48mm 	Color (2)	8 8	—	All-in-one Compact - Built-in monitor - Simple part inspection - Color and Grayscale - Easy integration	P.25

PC Software

Real time data acquisition with PC simulator ————— **P.29**

Multi-Camera Universal Machine Vision System CV-3000 Series

NEW



Features

- Multi-camera system
- Fastest processing speed in its class
- Superior color processing
- Enhanced inspection tools
- Simple and reliable operations

Description

8 types of camera variations

Choose the camera that meets your specific application needs

MEGA DIGITAL **HI-SPEED DIGITAL** **SUPER-SMALL DIGITAL** **ULTRA-SMALL DIGITAL**

The CV-3000 Series controller allows any of the 8 available cameras to be connected to the same unit. This means that you have the flexibility to choose the best camera arrangement according to your specific application needs. In addition to this, the CV-3502 controller has an expansion unit that allows the simultaneous operation of up to 4 cameras!

Advanced Color extraction Engine (A.C.E.)

using the latest in color processing technology to closely mimic the differentiation capabilities of the human eye



Combining our A.C.E. with cameras that have the best specifications in the industry, like 2,000,000-pixel double-speed color processing, the CV-3000 Series provides extremely stable, fast, high-precision color processing.

KEYENCE's proprietary interfaces also provide simple, reproducible extraction settings.

CV-3000 Series

Triple processors allow use on high-speed lines



In addition to a lightning fast RISC CPU chip, the CV-3000 Series controller uses two DSP chips to achieve image-processing speeds twice that of conventional models. The cameras have also been geared towards high-speed production. Both the 240,000 pixel models and 2,000,000 pixel models use KEYENCE's double buffer technology to cut image transfer times in half!

16 powerful inspection tools

that enable you to solve a variety of application challenges



The CV-3000 Series software contains 16 powerful inspection tools, including the KEYENCE original **Stain** and **Pattern Sort** tools, to tackle today's most difficult machine vision applications. When using the tools individually or in combination with each other, the system can be configured to obtain presence/absence data, position information, and dimensional measurements.

Application Specific Cameras

8 types of cameras that can be chosen according to application needs Highest in its class

You can choose the optimum camera according to your application. For example, you can choose a color megapixel camera for high-resolution appearance inspection, a double-speed camera for inspections where the processing speed has the highest priority, and a small double-speed camera for installation where space is an issue.

2,000,000-pixel series

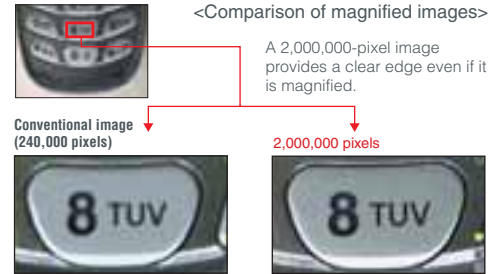


MEGA DIGITAL

color camera
CV-200C

Monochrome camera
CV-200M

The CV-3000 Series employs a highest-in-its-class 2,000,000-pixel color CCD, making it possible to collectively process all 2,000,000 pixels. Suitable for appearance inspection that requires high-resolution and dimension measurement.



240,000-pixel double-speed series



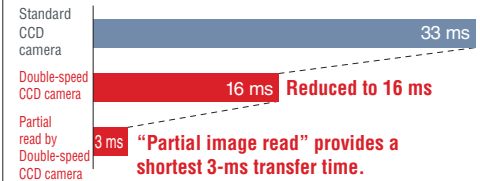
HI-SPEED DIGITAL

color camera
CV-035C

Monochrome camera
CV-035M

For color vision applications, KEYENCE has adopted a CCD with a double-speed progressive drive method drastically reducing the image transfer time from 33 ms (conventional time) to 16 ms. KEYENCE has also adopted a partial read function that uses only a part of the CCD to achieve lightning-fast 3-ms transfer.

<Comparison between image transfer times>



Ultra-small series



SUPER-SMALL DIGITAL

2,000,000-pixel color camera
CV-S200C

2,000,000-pixel monochrome camera
CV-S200M

The size of cameras has been reduced while leaving their performance abilities intact. This makes it possible to build the cameras into impossibly small spaces. The 12 mm-240,000-pixel type and 17 mm-2,000,000-pixel type are available in color and monochrome so that you can choose resolutions tailored to your needs. The side viewer attachment provides sensor-like lateral installation.



Side viewer attachment



ULTRA-SMALL DIGITAL

240,000-pixel color camera
CV-S035C

240,000-pixel monochrome camera
CV-S035M

<Comparison with the size of the conventional model (for CV-S035C)>



Multiple camera system First in its class

KEYENCE has expanded on its multi-camera connection technology to allow simultaneous use of up to 4 cameras on one controller. Any combination of the 8 cameras available for the CV-3000 Series can be used together. The connected cameras provide simultaneous imaging and simultaneous processing(*). In addition, the system can flexibly cope with future additions and modifications to the inspection specifications.

<Multiple camera system>
Maximum of 4 types of cameras can be freely selected.

Camera inputs 2 + 2

<Example of combined use>

<p>Camera 1 2,000,000-pixel camera [Stain detection]</p>	
<p>Camera 2 240,000-pixel camera [Product sorting]</p>	

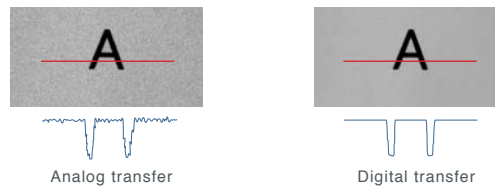
If the two cameras do not require high-resolution, using the 240,000-pixel camera provides a cost reduction.

* The camera expansion unit can only be connected to the CV-3502 controller.

Digital image transfer

The image data captured with the camera is transferred to the controller in digital format. A high-quality image with less degradation than conventional analog transfer significantly improves measurement accuracy.

<Comparison of magnified images>



Highly-sensitive image capturing & span/shift function First in its class

The sensitivity of the camera can be adjusted in 81 levels. Setting a higher sensitivity ensures sufficient brightness even when the high-speed shutter is being used. Expensive strobe lighting is no longer necessary. The span/shift function that can individually adjust R, G, and B increases the difference in the contrast of low-contrast targets, ensuring more stable image processing.

<Effect of increased sensitivity>

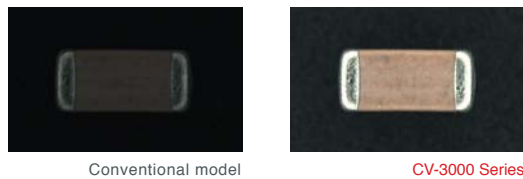


Image comparison at a shutter speed of 1/10000

(* Comparison under the same fluorescent lamp illumination conditions)

<Effect of the span/shift function>



Other functions

Conditional branch function	The conditional branch function enables you to set whether to perform the execution of an inspection window depending on the output result of another inspection window.
Command memory	The CV-3000 Series comes with 128 memory points that can be altered during operation through the external inputs or the remote control console.
Auto-Adjusting inspection area	Enables you to create an area (rectangle, circle) that changes in real-time with an edge position or an operation value.
Scaling function	Enables you to scale the displayed number of pixels to real world values.
File management function	Enables you to copy and format files in the main unit memory or memory card without a PC.

Fastest processing speed in its class

Triple processors push speeds to 10 times that of conventional models Fastest in its class



The CV-3000 Series contains two digital signal processors (DSPs) suitable for image processing (three processors in total). This increases speed by distributing the work normally done by 1 CPU between 3 processors.

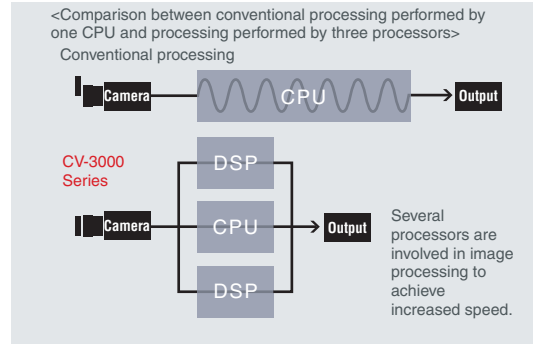
(Comparison of processing speeds between conventional products and CV-3000 Series in 360° rotation search with extra tools)



<Single tool time list> Processing area: 200 x 160

Tool name	Area	Edge position	Stain mode	Shade processing
Processing time	0.77 ms	0.5 ms	0.83 ms	0.5 ms

Achieves 1-ms-or-less processing time



20,000 parts per minute, double-speed color camera



Combining triple processors with a double-speed color camera* has achieved ultra-high-speed processing. This enables the CV-3000 Series to sufficiently cope with high-speed production lines.

(*CV-035C/CV-S035C)

<Appearance inspection of chip components>
The time required for dimension measurement through multiple edge detection, defect detection in stain mode, and position adjustment is only 13 ms. (Use of partial image reading)

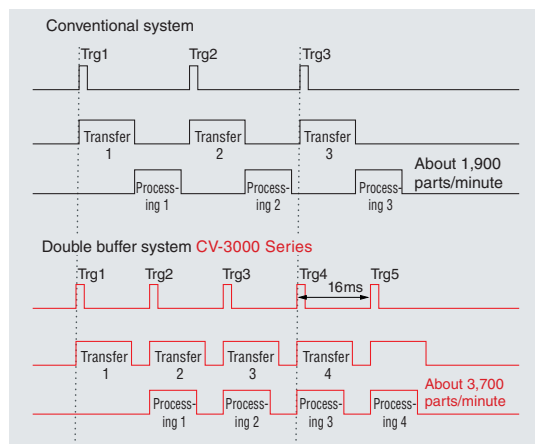


Double buffer Fastest in its class



The double buffer memory allows the CV-3000 Series to accept the next trigger input when an image is being processed. This enables an inspection tact time of about 16 ms (about 3,700 parts/minute)* even in non-interlaced reading mode.

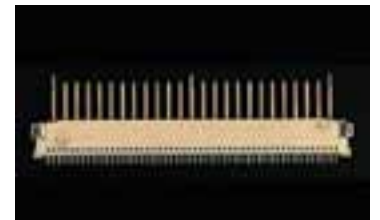
(* When the CV-035C is used and the image processing time is 15 ms)



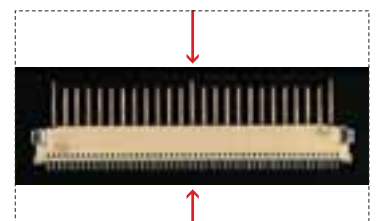
Partial image reading

The partial image reading function enables you to significantly reduce the image transfer time because it transfers only the necessary image data.

(Comparison of image transfer time in CV-035C)



When all lines are read: 16 ms



When 200 lines are read: 7 ms

Superior color processing

Advanced Color extraction Engine (A.C.E.)

NEW

The CV-3000 Series uses an Advanced color extraction Engine (A.C.E.) that employs an HSB extraction system, achieving high color extraction capability for both "color shade processing" and "color binary conversion". This stabilizes conventionally unstable processing.

New color shade processing (patent pending)

New color shade processing can adjust shade inclinations in hue, saturation, and brightness to an optimum level. It can convert low contrast targets to images with clear shade difference, reducing the costs of man-hours and peripheral devices such as illumination.



Shade processing does not become stable because the contrast difference is low.

New color shade processing
This image can be stably processed because the contrast difference is high.

<Conventional system>



Gray scale

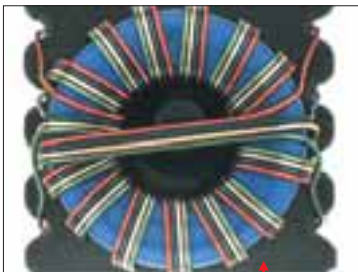


Conventional color

shade processing
This image cannot be stably processed because the contrast difference is low.

New color binary conversion processing

New color binary conversion processing can stably extract low-brightness colors such as dark green and blue, a problem that typically plagues conventional color systems.



Green selection

New color binary conversion processing
Stably extracts only green.

<Conventional system>



Monochrome picture

Monochrome processing cannot distinguish between colors with the same intensity.



Conventional color picture

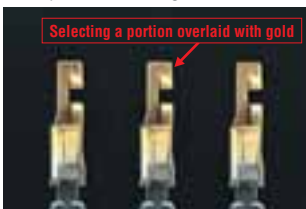
The ability to distinguish colors with low brightness is limited.

Simple, reliable color selection method

NEW

Besides KEYENCE's own "point & click" method of color extraction, user's now have the ability to fine tune the color selection through numerical alterations. This new method provides an objective, highly reproducible setting. You can also adjust colors while viewing the color bar, adding to the intuitive color selection interface.

<Example of color setting from color bar>



Color extraction using the "point & click" method.

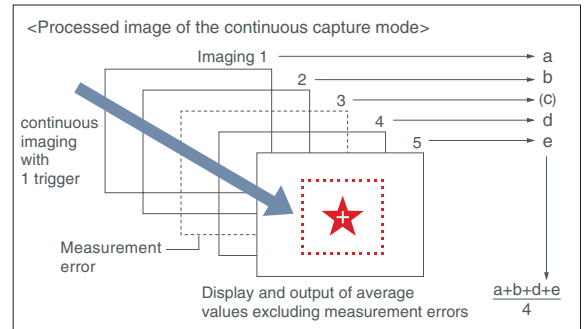


Increasing the upper and lower boundary values of brightness on the color bar further reduces brightness fluctuation.



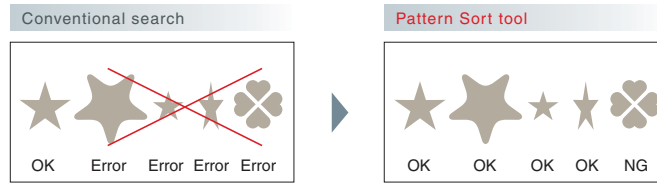
Continuous capture mode Fastest in its class

The continuous capture mode continuously performs image processing several times after a single trigger input. If an inspection is unstable due to poor lighting conditions or line vibration, an average value can be obtained by capturing several images of the same target. In addition, false readings and errors can be eliminated by using the data exclusion function (patent pending)



Pattern Sort tool provides inspection flexibility NEW

To cope with a change in size or shape of an expected search target, the CV-3000 Series can register up to 256 patterns. This allows the CV-3000 Series to find and differentiate targets despite production variations, ensuring stable detection. Furthermore, through group registration by target, the classification function can easily be configured to sort up to 256 target variations.



The conventional pattern search system cannot search for a target if the target shape has changed.

The Pattern Sort tool enables stable detection through preliminary registration of an expected target.

The Pattern Sort tool enables accurate detection of the alignment mark by choosing the optimum pattern among 256 previously registered patterns. This feature is also available with a 360° rotation search.

Pattern list registration screen



Through compression, the number of images that can be registered is remarkably increased. (Approx. 10 times larger capacity than conventional systems)

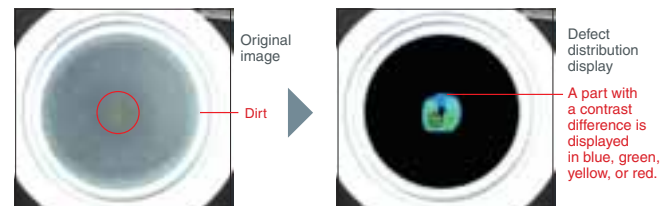
Stain inspection tool NEW

The CV-3000 Series comes equipped with an inspection tool that searches for defects by comparing the average contrast levels on the surface of a target. Compared to color binary processing, the stain tool will actually detect minute differences in a target even with changes in illumination. The defect distribution display function enables you to quickly view what judgment has been made in image processing.

Defect distribution display function

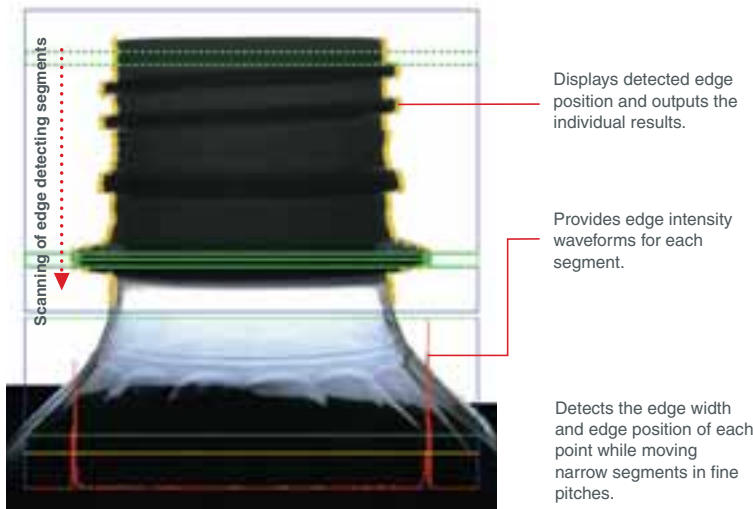
The defect distribution display function colors and displays a defective part in blue, green, yellow, or red according to the contrast difference between the defect and the surrounding background. With this function, you can intuitively understand the degree of the difference between the parts you want to detect as defects and those you don't.

<Dirt inspection of the bottom of an aluminium can>



Upgraded trend edge function NEW

An upgraded version of KEYENCE's trend edge tool, which scans a set inspection area to obtain maximum, minimum and average edge dimensions, has been added to increase the flexibility and stability of edge detection. It is now possible to extract data from each inspection point and take measurements from extrapolated lines and circles.




Scanning of edge detecting segments

Displays detected edge position and outputs the individual results.

Provides edge intensity waveforms for each segment.

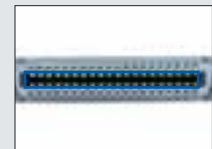
Detects the edge width and edge position of each point while moving narrow segments in fine pitches.

<Measuring the outer diameter of the O ring>



Measures the inner and outer diameters of the O ring with up to 5,000 points and outputs the maximum value, minimum value, and average value. Can also output all measured data.

<Measuring connector terminal gaps>



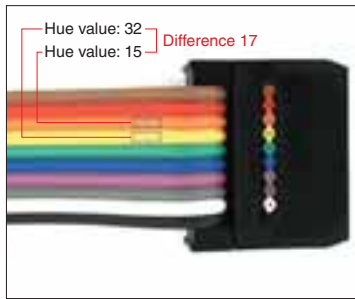
Enclose the entire length of a connector to obtain a pitch value for each pin set.

Color inspection function NEW

The color inspection function quantifies a target using the three values of hue, saturation, and brightness. This function provides more accurate judgment because it discriminates colors by numeric values, not like the conventional method in which colors are discriminated by area values after color extraction*.


(*Color inspection is possible only when a color camera is connected.)

<Normal status>



Hue value: 32
Hue value: 15
Difference 17

<When illumination decreases>



Hue value: 30
Hue value: 14
Difference 16

Even if illumination decreases, stable color discrimination is possible because there is a constant hue difference between orange and yellow.

Differential inspection NEW

The differential inspection function compares captured images with registered images and extracts the difference between the two. Tolerances can be set on these differences depending on the application.

Registered image (non-defective)



Captured image (defective)



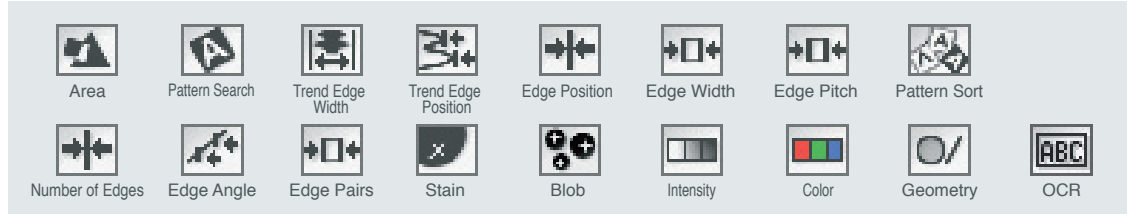
Differential image



The print was cancelled and only a flaw was extracted as defective. The differential inspection function can be used even if the workpiece is rotating.

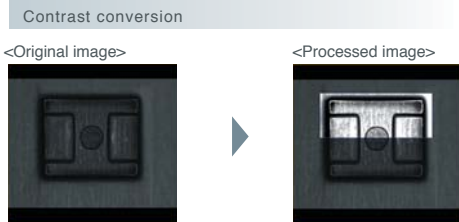
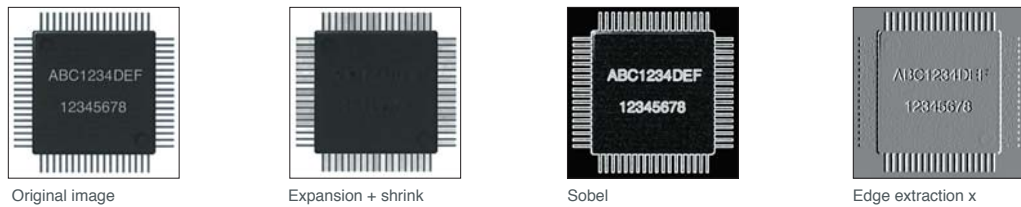
17 types of inspection tools

A large number of inspection tools are available to meet the needs of even the most demanding machine vision applications. The modes can be used individually to solve simple problems or in combination with each other for complex image processing.

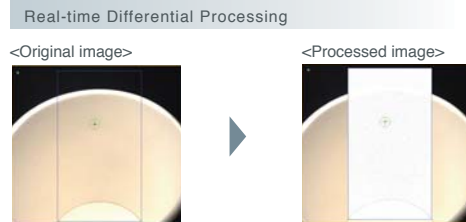


Abundant pre-processing Best in its class

In addition to common filters such as expansion, shrink, and sobel, the CV-3000 Series incorporates color binary conversion processing and color shade processing as pre-processing functions. Up to 16 types of filters can be set per window.



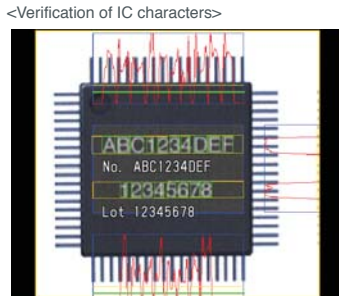
An image can be created by assigning optimum contrast to each area. This function is useful to change the contrast according to inspection items, or to process images with non-uniform light distribution.



A captured image is analyzed in real time, and only subtle differences in the image are extracted. Such feature point extraction, which ignores the background, is effective for the inspection of small defects.

OCR function NEW

The OCR tool on the CV-3000 Series enables easy, reliable detection of alphanumeric characters and symbols. An on-screen projected waveform allows for precise troubleshooting, eliminating the instability that is typically associated with conventional OCR tools. A wide range of limit settings are available to streamline OCV operations.

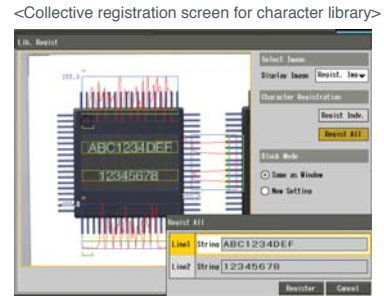


Automatically clips and recognizes each character one by one.

Auto calendar function
The internal calendar of the CV-3000 controller can be referenced for easy date verification.

Multiple extraction
Straight-forward character extraction can be performed automatically. If characters appear in an arc or a random position, fixed character extraction can be employed.

Display of the character correlation
The correlation match value for each character is displayed, allowing for easy determination of character stability.



The collective registration window allows you to register all the characters in the inspection window at the same time. In addition to alphanumeric characters, the collective registration screen allows the registration of up to 20 types of user-defined characters.

New vision flow menu for intuitive operation Best in its class

KEYENCE has further improved its vision flow menu to insure a user-friendly setup. This intuitive menu flows from top to bottom, guiding users through the simple setup procedures.

You only need to make settings from top to bottom.

Preview display enables you to understand window settings at a glance.

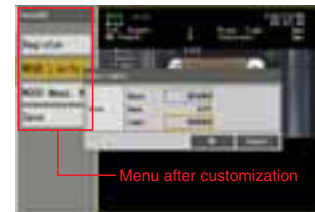
Help display assists in key operations.

Custom menu NEW

The custom menu allows you to display only necessary menu items. For example, the normal menu view can be reduced to only display settings for color extraction and limit setup. This will help to simplify programming and prevent unauthorized system tampering.



In the past, it was possible to alter all the items in setting menus. For this reason, there was a risk that users might alter items mistakenly.



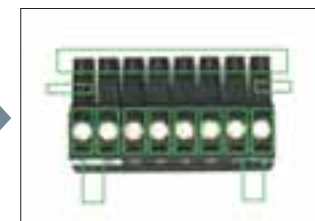
After the display menu is customized, only the items required for daily operation are displayed, so operators can easily understand the settings. This reduces the risk that operators will perform an incorrect operation.

Simultaneous shift function NEW

This enables you to collectively move several inspection windows. Even if you must change the location of a window because the location of the target has changed, you do not have to move each inspection window individually. This greatly reduces adjustment time.



Displaced window location



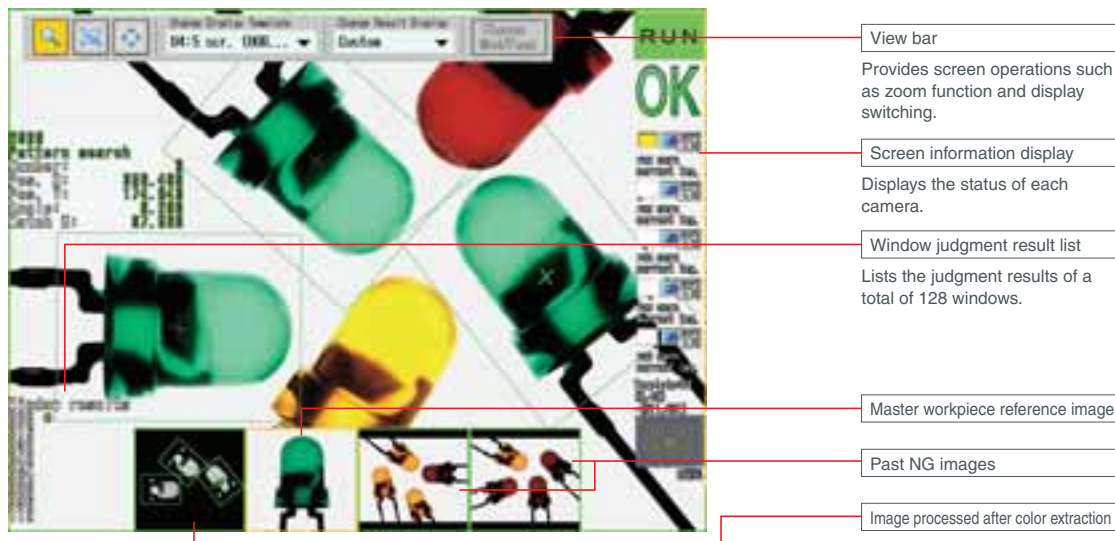
Adjustment result by using the simultaneous shift function

Administrator mode/user mode switch function (with password)

The administrator mode/ user mode enables you to manage the operational changes with the use of passwords while in administrator mode. This prevents unauthorized changes to the system. Combining this function with the custom menu permits only specific functions to be accessed in user mode.

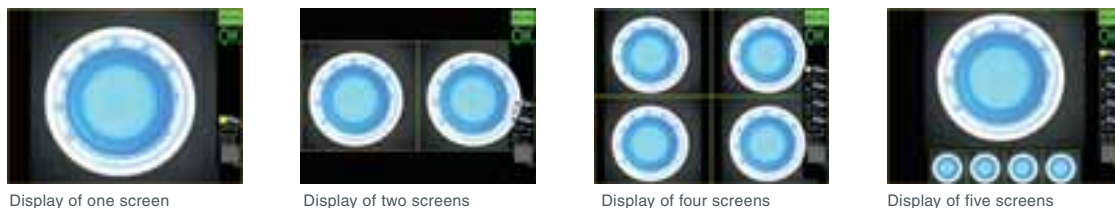
SVGA monitor output

KEYENCE has adopted a high-resolution SVGA (800 x 600 dots) monitor output for superior image quality. This function enables you to quickly monitor the operational status of the inspection at an extensive level. Multiple inspection images can be monitored simultaneously, eliminating the need to switch the screens on the remote console.



Selectable screen display formats NEW

Choose from nine available screen display formats to match your application needs. Display cameras and display contents can be chosen per screen, making it possible to view current images on the main screen while viewing past NG images and registered images on subscreens.



Custom display function NEW

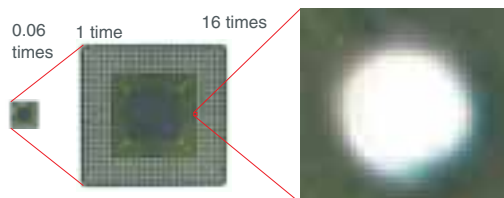
The custom display function enables you to freely create desired displays such as the judgment results of measured values in a specific window. With this function, you can also create and display custom text and graphics.



Example of custom display

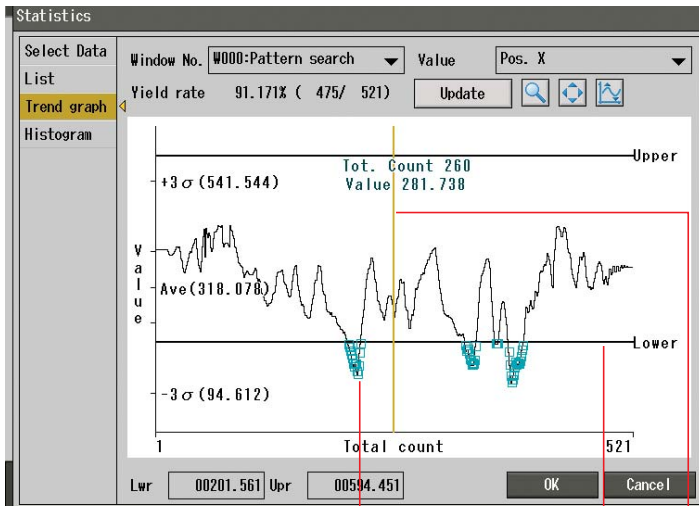
Zoom display function NEW

The zoom display function enables you to continuously zoom the display screen from 0.06 times to 16 times. You can use this function regardless of the operation status or programming menu.

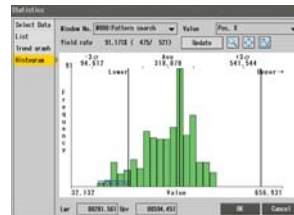


Statistical processing NEW

The statistical function enables you to store up to 20,000 points of measurement data in the internal memory of the unit and easily check the maximum value, minimum value, average value, standard deviation, NG count, and yield, all without having to connect to an external PC. This function also enables you to display trend graphs and histograms and make on-the-fly changes to limits based on the results of the gathered data. Up to 511* previously captured images can also be accessed directly on the graph. (*using the CV-035M or CV-S035M).



Trend graph display



Histogram display

Measured values list screen

Screen storage mark
The data with a square mark contains a saved image. Clicking this icon calls up the image.



Simultaneous display of images and measurement results

Tolerance
Displays the upper or lower limit.

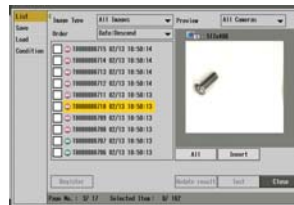
Vertical cursor
Displays the measured values of the selected data and measurement count.

Screen save function Best in its class

The screen save function enables you to save inspected images to the internal memory or a memory card. With this function, you can view the past NG images even during operation.

<Maximum number of images that can be saved by camera>

Save to internal memory		Save to 1GB memory card	
Type of camera	Number of images	Type of camera	Number of images
240,000 monochrome pixels	511	240,000 monochrome pixels	4089
240,000 color pixels	170	240,000 color pixels	1378
2,000,000 monochrome pixels	64	2,000,000 monochrome pixels	530
2,000,000 color pixels	21	2,000,000 color pixels	177



*The number of images that can be saved in the internal memory is a typical value for one camera under the storing condition of "All".
The number of images that can be saved in the 1-GB memory card is a typical value for one camera in the FAT32 format.

Illumination adjustment function

The illumination adjustment function automatically returns the brightness of a captured image to that of the registered image before inspection. This reduces malfunctions due to illumination degradation and variation of external light.

Product lineup and options

Controllers and accessories

High performance model
CV-3502(P)



Standard model
CV-3002(P)



Camera expansion unit
CV-E300



Console (accessory)



Color cameras

2,000,000-pixel color camera
CV-200C



240,000-pixel double-speed
color camera
CV-035C



Ultra-small 2,000,000-pixel
color camera
CV-S200C



Ultra-small 240,000-pixel
double-speed color camera
CV-S035C



Monochrome cameras

2,000,000-pixel monochrome
camera
CV-200M



240,000-pixel double-speed
monochrome camera
CV-035M



Ultra-small 2,000,000-pixel
monochrome camera
CV-S200M



Ultra-small 240,000-pixel
double-speed monochrome
camera
CV-S035M



Specifications

Camera (CV-200C/CV-200M/CV-S200C/CV-S200M)

Model	Camera (CV-200C/CV-200M)	Camera (CV-S200C/CV-S200M)
Image receiving element	1/1.8 -inch color CCD image receiving element, square-pixel/all-pixel reading, 2,010,000 pixels (CV-200C) 1/1.8 -inch monochrome CCD image receiving element, square-pixel/all-pixel reading, 2,010,000 pixels (CV-200M)	1/1.8 -inch color CCD image receiving element, square-pixel/all-pixel reading, 2,010,000 pixels (CV-S200C) 1/1.8 -inch monochrome CCD image receiving element, square-pixel/all-pixel reading, 2,010,000 pixels (CV-S200M)
Number of valid pixels	1,920,000 pixels 1600 (H) x 1200 (V) ¹	
Scanning system	Progressive (59 ms: 2,000,000-pixel mode, 48 ms: 1,000,000-pixel mode) Interlace: CV-200M only (34 ms: 2,000,000-pixel mode, 26 ms: 1,000,000-pixel mode)	Progressive (59 ms: 2,000,000-pixel mode, 48 ms: 1,000,000-pixel mode) Interlace: CV-S200M only (34 ms: 2,000,000-pixel mode, 26 ms: 1,000,000-pixel mode)
Transfer system	Digital serial transfer	
Electronic shutter	1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000, 0.05 msec to 9000 msec can be set with numeric values.	
Lens mount method	C mount	Special mount (M15.5 P0.5 male)
Ambient temperature	0 to +40°C	Head: 0 to 40°C, relay unit: 0 to 40°C (however, 35°C max. in partial capturing 50 lines or lower)
Relative humidity	35 to 85%, No condensation	
Weight	Approx. 110 g (not including lens)	Head: Approx. 210 g (including the cable, not the lens), relay unit: Approx. 70 g

¹ In 1,000,000-pixel mode, 980,000 pixels (1024 x 960) among 1,920,000 pixels serve as the processing area.

Camera (CV-035C/CV-035M/CV-S035C/CV-S035M)

Model	Camera (CV-035C/CV-035M)	Camera (CV-S035C/CV-S035M)
Image receiving element	1/3 -inch color CCD image receiving element, square-pixel/all-pixel reading, 350,000 pixels 1/3 -inch monochrome CCD image receiving element, square-pixel/all-pixel reading, 350,000 pixels	1/3 -inch color CCD image receiving element, square-pixel/all-pixel reading, 350,000 pixels 1/3 -inch monochrome CCD image receiving element, square-pixel/all-pixel reading, 350,000 pixels
Number of valid pixels	320,000 pixels 657 (H) x 492 (V) ²	
Scanning system	Progressive (16 ms) Interlace: CV-035M only (9 ms)	Progressive (16 ms) Interlace: CV-S035M only (9 ms)
Transfer system	Digital serial transfer	
Electronic shutter	1/15, 1/30, 1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000, 0.05 msec to 9000 msec can be set with numeric values.	
Lens mount method	C mount	Special mount (M10.5 P0.5 male)
Ambient temperature	0 to +50°C	Head: 0 to 50°C, relay unit: 0 to 40°C
Relative humidity	35 to 85%, No condensation	
Weight	Approx. 100 g (not including lens)	Head: Approx. 160 g (including the cable, not the lens), relay unit: Approx. 70 g

² In standard mode, 240,000 pixels (512 x 480) among 320,000 pixels serve as the processing area.

Specifications

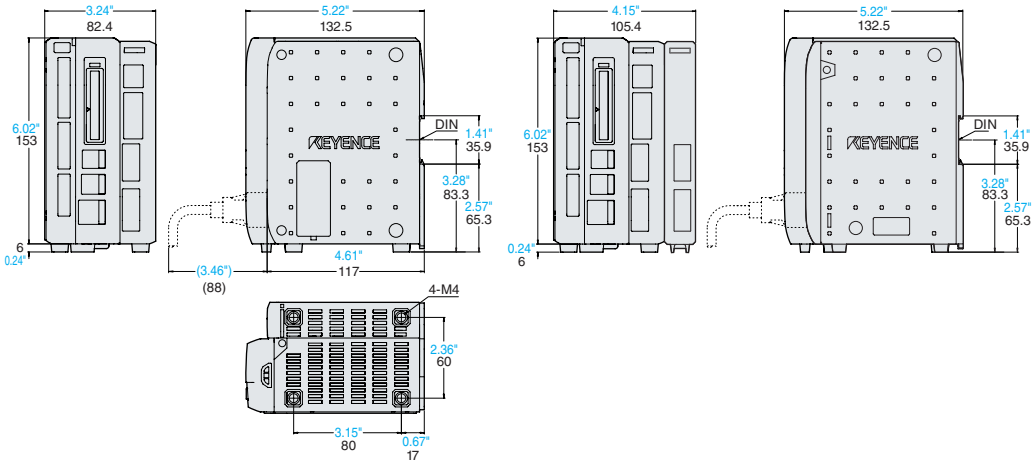
Controller

Model		CV-3502		CV-3002		
		NPN		PNP		
No. of pixels		2,000,000-pixel mode: 1600 (H) x 1200 (V), about 1,920,000 pixels 1,000,000-pixel mode: 1024 (H) x 960 (V), about 980,000 pixels When CV-200C, CV-S200C, CV-200M, and CV-S200M are connected Standard mode: 512 (H) x 480 (V), about 240,000 pixels When CV-035C, CV-S035C, CV-035M, and CV-S035M are connected		512 (H) x 480 (V), about 240,000 pixels		
Camera input		2 color/monochrome cameras (support for CV-200C, CV-S200C, CV-035C, CV-S035C, CV-200M, CV-S200M, CV-035M, and CV-S035M, possible mixed connection) Connecting expansion unit CV-E300 provides 2-point expansion and connection of up to 4 points.		2 color/monochrome cameras (support for CV-035C, CV-S035C, CV-035M, and CV-S035M, possible mixed connection)		
No. of registered programs		Up to 1,000 settings can be registered in each of the main unit memory and memory card (dependent on memory capacity and settings), possible external switching				
Number of screens that can be registered		1000 screens max./setting (Depends on the internal memory and memory card capacity), can be compressed and saved				
Internal memory capacity (Max. number of settings that can be registered, for reference 1)		Approx. 45 MB (1000 settings)		Approx. 15 MB (550 settings)		
Window setting	Measurement area	128 windows/program				
	Mask area	4 areas/window				
Area shape (depending on the inspection mode to be used, some area shapes are restricted)		Rectangle, rotating rectangle, circle, ellipse, circumference, arc, polygon (up to 12 angles), Auto-adjusting rectangle, Auto-adjusting circle				
Color extraction function (valid only when a color camera is connected)		Color binary, color shade, grey (color corresponds to numeric value specification with HSB values)				
Measurement tool	Area measurement	Area (color binary, monochrome binary)				
	Position detection	Pattern search (support of multiple detections), Pattern Sort, edge position, trend edge position, blob (gravity centre position)				
	Inspection mode	Edge tool	Edge width, edge pitch, No. of edges, edge angle, pair edge, trend edge width			
		Feature inspection	Blob (No. of labels, gravity, principal axis angle, area, ferret diameter, circumference length, degree of circularity)			
		Stain/dirt inspection	Stain detection (support of differential stain detection through combined use with the differential filter, detection of multiple positions through grouping, and stability display)			
		Sorting	Pattern Sort (256 types max.)			
		Shade inspection	Shade inspection, color inspection (valid only when a color camera is connected)			
Geometry		Display of points, lines, and circle areas where the operation result can be cited				
Continuous capture function		1-to-32-times continuous capture processing (maximum value, minimum value, average value), possible exclusion of the measurement error value from the measurement result				
Execution condition setting function		Enables you to set execution or non-execution that works with the measurement judgment results (OK/NG) of other optional windows per measurement window.				
Image capturing setting function	Processing area setting function	Enables you to specify a 980,000-pixel area (1024 (H) x 960 (V)) in any position as the processing area within 1,920,000 pixels (1,000,000-pixel mode). Enables you to specify a 240,000-pixel area (512 (H) x 480 (V)) in any position as the processing area within 320,000 pixels (standard mode).		Enables you to specify a 240,000-pixel area (512 (H) x 480 (V)) in any position as the processing area within 320,000 pixels.		
	Scan mode (valid only when a monochrome camera is connected)	Progressive/interlace switching				
Capturing start/end line setting function		Enables you to set any capturing start/end line within the image capturing range (for interlace, this specification is made in units of 2 lines).				
Correction functions	Position adjustment	Batch/individual adjustments (up to 64 settings), X, Y, ±180° rotation				
	Camera gain adjustment	Camera sensitivity adjustment (0.1 unit of 1.0 to 9.0), offset adjustment, span adjustment (supports settings in 16 tone levels; also supports RGB individual settings when a color camera is connected)				
	White balance adjustment (valid only when a color camera is connected)	Manual setting with white paper				
Filter function	Count	9-time repetition for the same type, 13 levels (for binary and difference, 1 level/window)				
	No. of settings	Expansion, shrink, averaging, median, edge enhancement, edge extraction X, edge extraction Y, Sobel, Prewitt, Roberts, Laplacian, binary, difference, illumination adjustment				
Command memory		128 rewritable command memories are installed from the external devices and console during operation.				
Support functions	Statistics analysis	No. of data Statistical item	Up to 20,000 data points (support of batch save to memory card) Maximum value, minimum value, average value, deviation (3s), OK/NG count in total judgment			
	Screen save (valid when monochrome and color cameras are connected)		Standard mode: Up to 511 screens/169 screens, 1,000,000-pixel mode: Up to 127 screens/41 screens, 2,000,000-pixel mode: Up to 63 screens/22 screens (Maximum value when one monochrome camera and one color camera are connected and the accumulation condition is "All")		Up to 511 screens/169 screens (Maximum value when one monochrome camera and one color camera are connected and the accumulation condition is "All")	
	Programming aid functions	Display aid	Enables you to perform screen display zoom, edge differentiation waveform display, profile display, and stain stability display during setup or operation.			
		Batch move	Enables you to collectively move selected windows in X and Y directions during setup.			
	Display template setting function	No. of display templates	10 patterns/setting (of the 10 patterns, 4 patterns are the specified values) Possible external switching			
		No. of screens that can be displayed simultaneously	Enables you to simultaneously display up to 5 screens (when 5-screen horizontal splitting or 5-screen vertical splitting is selected).			
		Hold image	Past images (NG images) can be displayed as hold images (up to 3 times before). The measurement result and measurement time can also be referenced (depending on the camera connection status, the displayable count changes from 0 to 3 times).			
	Screen customization function	No. of customization screens	10 screens/program, character string : Measured value, judgment result, optional character, fixed character, figure			
	Custom menu function		Enables you to create a shortcut menu to an optional setting screen (20 menus/program).			
	Operation rewrite function		Enables you to rewrite upper- and lower-limit tolerances and command memories during operation.			
Memory card save function		Supports measured values, judgment results, NG count, measurement images (can be compressed and saved), saved images (can be compressed and saved), capture images, statistics analysis data, and direct save during inspection operation (excluding settings).				
Others		Image capture function, password function, retest function, file management function, I/O monitor, RS232C monitor (with the log save function)				
Memory card						
Interface	Control input	External trigger input	2 points, simultaneous 2-camera capturing or individual capturing selectable, EV support, input rating: 26.4 V max., 3 mA min.			
		Control input	Simultaneous capturing of up to 4 cameras (excluding the color mega-pixel camera) or individual capturing selectable (if CV-E300 is not connected, up to 2 monochrome or color cameras can be simultaneously captured.) Simultaneous 2-camera capturing or individual capturing selectable			
	Control output	Universal output	18 points, input rating: 26.4 V max., 2 mA min.			
		Total comparator output	27 points (including 2 FLASH output points that work with an external trigger), NPN/PNP open collector, 50 mA max. (30 V min.)			
	Monitor output		1 point, NPN/PNP open collector, 50 mA max. (30 V min.) Analogue RGB output, SVGA 800 x 600 (24-bit color, 60 Hz)			
	Communication port	RS232C (maximum baud rate: 115200 bps)/Ethernet (100BASE-TX/10BASE-T)/USB (USB2.0 HI-SPEED supported) Numerical value output, image data (compressed output available), control I/O available, simultaneous use of 3 ports available				
		PLC link	Numerical value output that uses RS232C port, control I/O, and simultaneous use of Ethernet and USB ports available. A series and Q series of Mitsubishi Electric Corporation, and SYSMACC series and CJ/CJ1 series of Omron Corporation: Support via each link unit			
Display language						
Japanese/English/German selectable						
Power supply voltage						
24 VDC ±10%						
Current consumption						
1.8 A (2-camera connection and maximum load)/2.8 A (4-camera connection and maximum load)		1.4 A (2-camera connection and maximum load)				
Ambient temperature						
2-camera connection: 0 to 50°C megapixel camera connection: 0 to 45°C 4-camera connection: 0 to 45°C megapixel camera connection: 0 to 40°C		0 to +50°C				
Relative humidity						
35 to 85%, No condensation						
Weight						
Approx. 950 g						

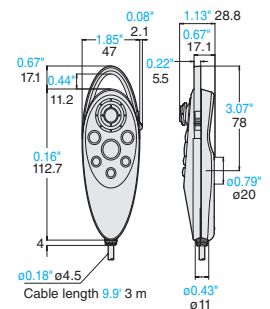
*1 For one standard mode monochrome camera, one registered image (compressed image) and nine measurement windows (Typical)

Dimensions Unit: inch mm

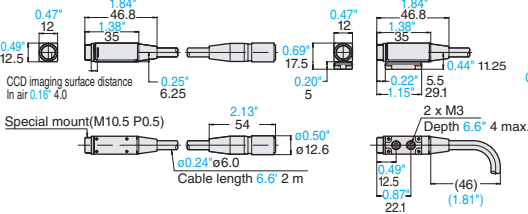
Controller CV-3502(P)/ CV-3002(P)



Console



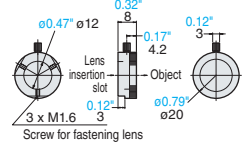
Camera CV-S035CH / CV-S035MH



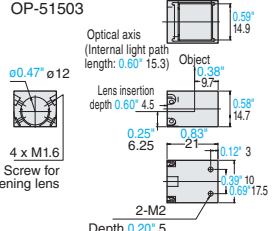
Lens CA-LS□

	CA-LS4	CA-LS6	CA-LS16	CA-LS30
A	0.68" 16.7	0.84" 21.3	0.80" 20.4	1.06" 27
B	0.45" 11.5	0.63" 15.9	0.40" 10.2	0.52" 13.2
C	0.33" 8.5	0.51" 12.9	0.28" 7.2	0.40" 10.2

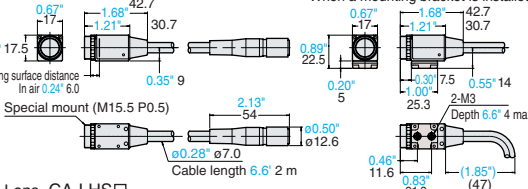
Polarization filter OP-5102



Side viewer attachment OP-51503



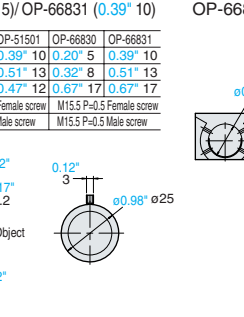
Camera CV-S200CH / CV-S200MH



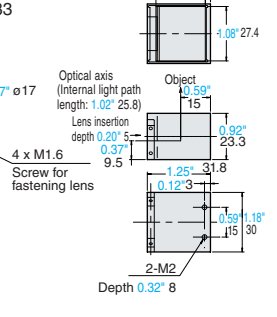
Closeup ring OP-51500 (0.20" 5) / OP-51501 (0.39" 10) / OP-66830 (0.20" 5) / OP-66831 (0.39" 10)

	OP-51500	OP-51501	OP-66830	OP-66831
A	0.20" 5	0.39" 10	0.20" 5	0.39" 10
B	0.32" 8	0.51" 13	0.32" 8	0.51" 13
C	0.47" 12	0.47" 12	0.67" 17	0.67" 17
D	M10.5 P=0.5 Female screw	M10.5 P=0.5 Female screw	M10.5 P=0.5 Female screw	M10.5 P=0.5 Female screw
E	M10.5 P=0.5 Male screw	M10.5 P=0.5 Male screw	M10.5 P=0.5 Male screw	M10.5 P=0.5 Male screw

Polarization filter OP-66832



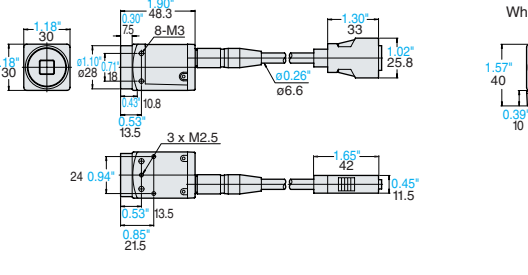
Side viewer attachment OP-66833



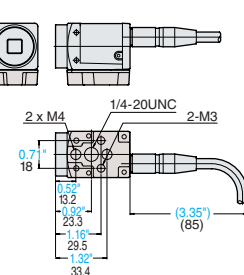
Lens CA-LHS□

	CA-LHS8	CA-LHS16	CA-LHS25	CA-LHS50
A	1.59" 40.4	0.94" 23.9	0.98" 24.9	1.59" 40.4
B	1.13" 28.6	0.70" 17.9	0.73" 18.6	1.07" 27.1
C	0.77" 19.6	0.35" 8.9	0.38" 9.6	0.71" 18.1

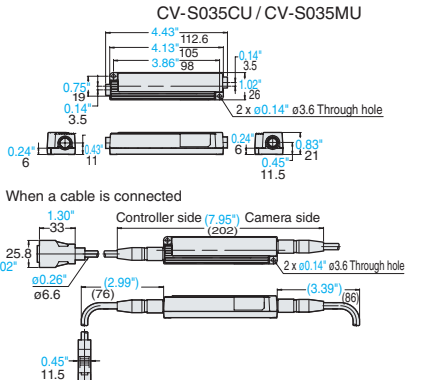
Cameras CV-035C/ CV-035M



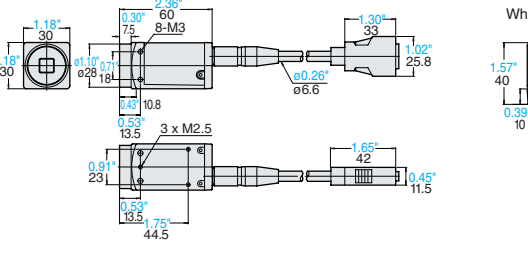
When a mounting bracket is installed



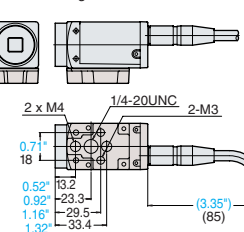
Camera control unit CV-S200CU/ CV-S200MU / CV-S035CU/ CV-S035MU



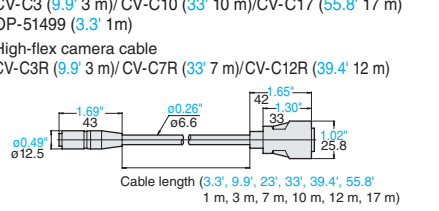
Camera CV-200C/ CV-200M



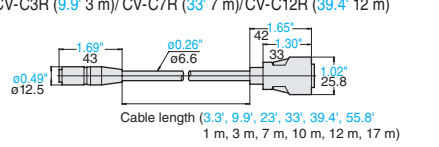
When a mounting bracket is installed



Camera cable CV-C3 (9.9' 3 m) / CV-C10 (33' 10 m) / CV-C17 (55.8' 17 m) OP-51499 (3.3' 1 m)



High-flex camera cable CV-C3R (9.9' 3 m) / CV-C7R (33' 7 m) / CV-C12R (39.4' 12 m)



High-Speed Digital Machine Vision System CV-2100 Series



Features

- Fastest in its class Ultra-high-speed processing of 20,000 parts/min.
- Digital image transfer
- Repeatability of ± 0.05 pixels
- On-screen statistical data processing

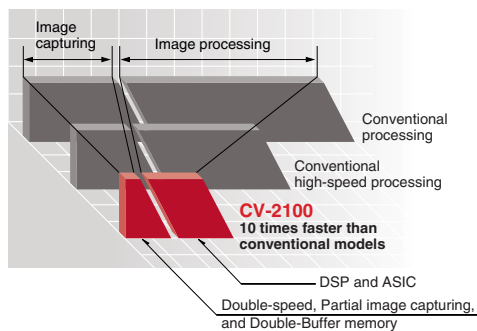
Description

Fastest in its class

Ultra-high-speed processing of 20,000 parts/min.

The combination of a new image-processing engine, doublespeed progressive camera, and partial image capturing function produces a minimum processing time of 3 ms (20,000 times/min.*).

* At a shutter speed of 1/20000 seconds with 12-line reading.
Produces a minimum processing time of 10 ms (6,000 parts/min.) for 1-screen interlaced reading.



On-screen statistical data processing

Simplified tolerance

setting and inspection history analysis **First in its class**

The first-in-class statistical function of the CV-2100 allows the user to check the maximum, minimum, and average values of up to 11264 data points. The data is broken down by inspection number and displayed on a histogram and a trend graph, allowing for easy analysis of failed parts and optimization of tolerance settings.



Digital image transfer **First in its class**

The image data captured onto the CCD is converted to digital data within the camera unit and then transferred to the controller. As a result, the image will not deteriorate and is resistant to noise interference.

Repeatability of ± 0.05 pixels **New**

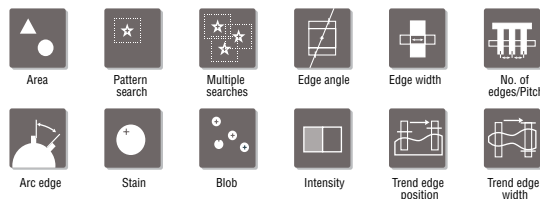
Enabling highly accurate positioning and measurement

The combination of sub-pixel processing and digitalization of image data allows the CV-2100 to achieve high accuracy and repeatability down to ± 0.05 pixels. Sub-pixel processing allows the display resolution to be reduced to 1/1,000 pixel.

Basic Inspection tools

Suitable for every inspection need

Features various inspection tools including Area, Pattern search, Multiple searches, Edge angle, Edge width, No. of edges/Pitch, Stain, Blob, Intensity, Trend edge position, and Trend edge width. Ready to solve all of your application needs.



Specifications

Controller

Model		NPN	CV-2100	
		PNP	CV-2100P	
No. of pixels		512 (H) x 480 (V)		
Camera input		2 cameras		
Processing cycle		100 c/s (Varies depending on the setting.)		
Program registration		32 programs. Programs are externally selectable.		
No. of registered screens		64 screens (Up to 4 screens/1 program)		
Window setting		Measurement area	64 areas/1 program	
		Mask area	4 areas/1 windows	
Functions	Measurement mode	Area sensor	Window shape: square/circle/ellipse/ring/arc/polygon (up to dodecagon)/edge detection area Multiple searches are available. Window shape: square/circle/ellipse/polygon (up to dodecagon)	
		Position detection	Pattern search	Angle measurement available. Window shape: square/rotating square/perimeter/arc
			Edge detection	Window shape: square/circle/ellipse/perimeter/arc/polygon (up to dodecagon)
			Gravity position	Window shape: square/rotating square/ring/arc
			Trend edge position	Window shape: square/rotating square/ring/arc
		Inspection mode	Width measurement	Window shape: square/perimeter/arc
			Pitch measurement	Window shape: square/rotating square/ring/arc
			No. of edges	Window shape: square
			Edge angle	No. of blobs, gravity, principal axis angle, area, ferret diameter, circumference length, and circularity
			Blob (Feature volume)	Window shape: square/circle/ellipse/ring/arc/polygon (up to dodecagon)
	Stain detection		Window shape: square/circle/ellipse/perimeter/arc/polygon (up to dodecagon)/edge detection area	
	Correction functions	Multiple measurement	Split capturing	2 to 4-split capture processing
			Serial capturing	Serial capture processing for up to 32 times (Maximum, minimum and average values)
		CCD partial image capturing	Position adjustment	0 to 479 lines. The starting and end lines can be specified arbitrarily.
			Camera gain adjustment	Total/individual adjustments (Up to 64/programs), X-/Y-axis direction, rotation $\pm 180^\circ$
Illumination adjustment			9 sensitivity levels, shift and span adjustment	
Operation functions	Filter function	1 illumination adjustment window/1 program (2 program when 2 cameras are used.)		
	Calibration function	Up to 4 applications/window. Expand, shrink, average, median, edge enhancement, and edge extraction (In X, Y, and XY directions)		
Support functions	Numerical operation		X and Y scaling factors can be set for each camera.	
			32 operations/program. Operator (four operations, square, maximum, minimum, square root, absolute value, remainder, distance, angle, sine, cosine, and a-tangent)	
	Comparator operation		32 operations/1 program. Operator (AND, OR, NOT, and XOR)	
			The maximum/minimum, average values, deviation, measurement counts, and NG count of up to 11264 measurements.	
			Up to 54 screens can be saved in the main memory.	
Screen save		Text: measurement values, judgment results, free text, and fixed text		
Screen customize function		Graphic: line, cross-point, circle, and square		
Online setting update function		The tolerances and binary level can be rewritten during operations.		
CF memory save function		Measurement values, judgment results, NG count, and screens can be saved directly to a CF memory card.		
Major functions		I/O monitor, screen capture function, password function, and retest function		
Memory card ¹⁾			CompactFlash memory card (GR-M256/NR-M32)	
Interface	Control input	External trigger input	1 input. Input rating: 26.4 V max, 3 mA min.	
		Control input	9 inputs. Selecting programs, switching screens, switching windows, registering screens, and capturing screens	
	Control output	Universal output	Input rating: 26.4 V max, 2 mA min.	
		Total comparator output	16 outputs. NPN/PNP open-collector, 50 mA max (30 V min.)	
	Video output		1 output. NPN/PNP open-collector, 50 mA max (30 V min.)	
	RS-232C		Conforming to the NTSC system	
Ethernet		Numerical value output and image data and control input/output. (Baud rate: 115,200 bit/s max. selectable)		
Display language		100 BASE-TX/10 BASE-T (Numerical value output, image data and control input/output)		
Power supply voltage		English/Japanese/German selectable		
Current consumption		24 VDC $\pm 10\%$		
Ambient temperature		1 A		
Relative humidity		0 to 40°C (32 to 104°F), No condensation		
Weight		35 to 85%, No condensation		
		Approx. 510 g		

Camera

Model	CV-020
Image receiving element	1/3-inch CCD image receiving element, square-pixel, all-pixel double-speed reading, 350,000 pixels
Scanning system	1/60s progressive, 1/120s interlaced
Transfer system	Digital serial transfer
Electronic shutter	1/60, 1/120, 1/240, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/20000 sec.
Lens mount method	C mount
Ambient temperature	0 to 50°C (32 to 122°F), No condensation
Relative humidity	35 to 85%, No condensation
Weight	Approx. 100 g

1. Use of KEYENCE GR-M256 and NR-M32 are recommended.



Stain mode
Inspection of flaws on the bottom of abeverage can
 Detects flaws on the bottom of aluminum beverage cans



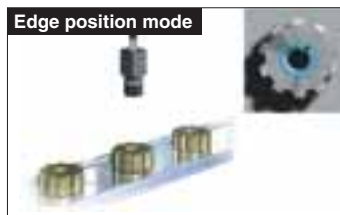
Pattern search mode
Detecting marks on a fiberglass PCB
 Measures the position and angle of marks on a PCB



Edge pitch mode
Inspection of the lead pitch of a connector
 Measures the center pitch of connector pins



Blob mode
Counting the number of tablets
 Counts the number of properly shaped tablets

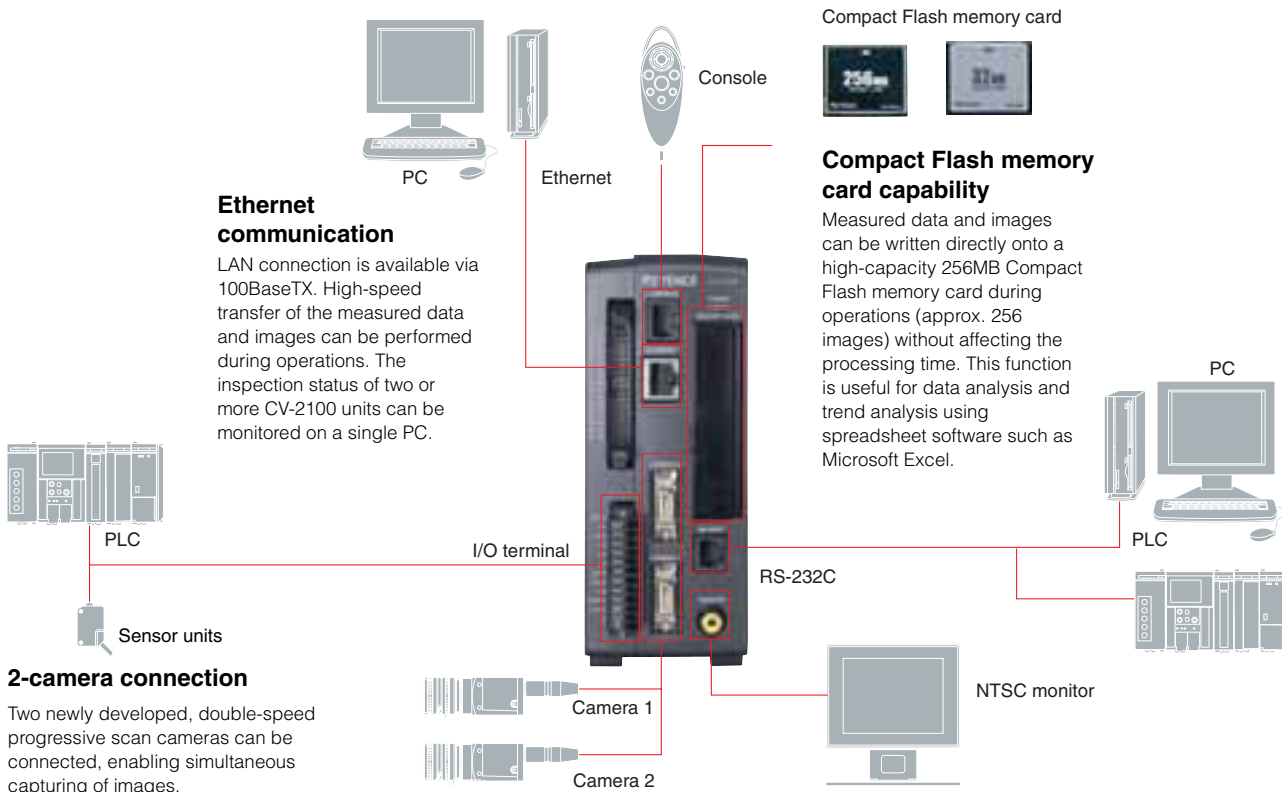


Edge position mode
Measuring the notch position of a gear
 Detects the notch on the inner diameter of a gear and detects/checks the angle

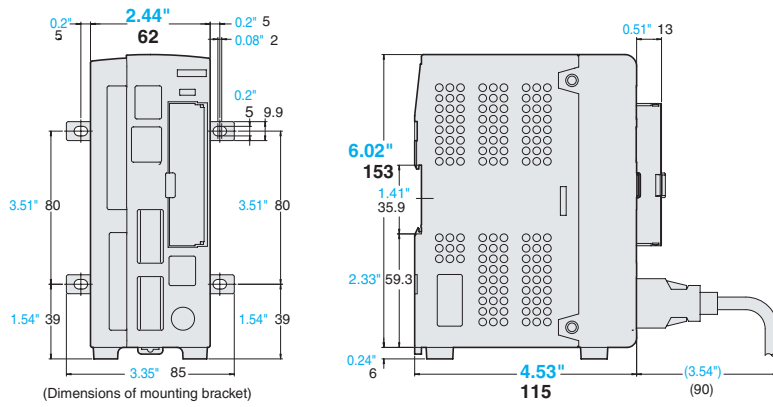


Intensity mode
Differentiation of the correct/incorrect sides of a chip component
 Differentiates correct/incorrect sides of a chip based on the difference in brightness

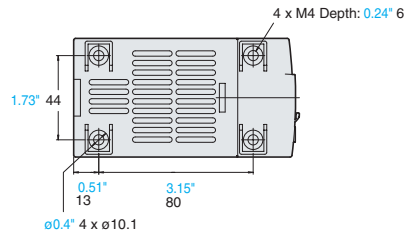
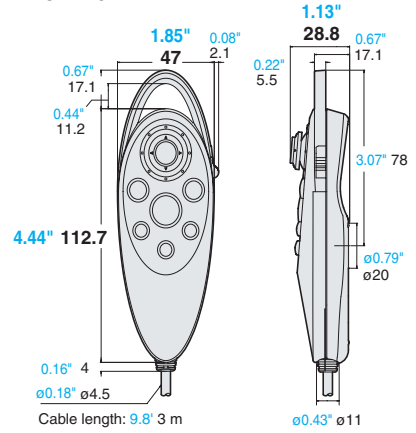
System Configurations



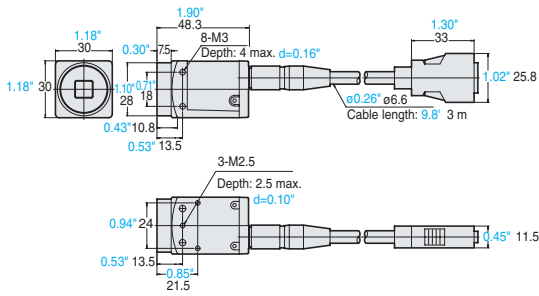
Controller
CV-2100



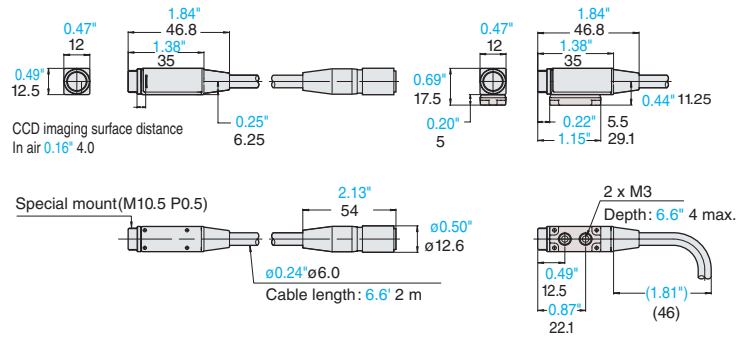
Console
OP-42342



Camera
CV-020

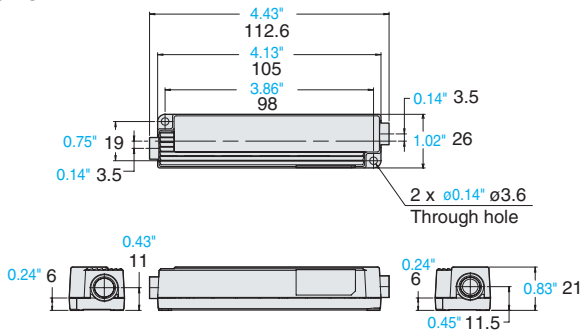


Camera
CV-022

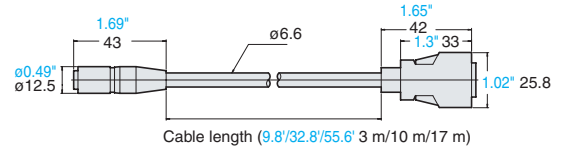


When a mounting bracket is installed

Camera control unit
CV-022U



Camera cables
CV-C3/CV-C10/CV-C17



All-in-one Image Processing CV-700 Series



Features

- Color and Grayscale processing for any application
- Built-in monitor and 2 camera connectivity for easy integration
- Simple touch panel user interface

Description

Simple, Straightforward Programming Designed for Easy Operation

Simple Programming helps for quick and efficient on-site operation, reducing set-up costs.



The All-in-One Unit Provides Space and Wiring Savings

The CV-751 comes standard with a built-in 5.5" TFT color monitor and an array of on-board I/O options, such as discrete, analog, and RS232 communications. You also have the option to configure the system via a remote console or a built-in touch panel.

High-Speed Search & Sub-pixel Measurement

Special ASIC technology ensures accurate measurement by using sub-pixel processing and a fast 360° rotation search.

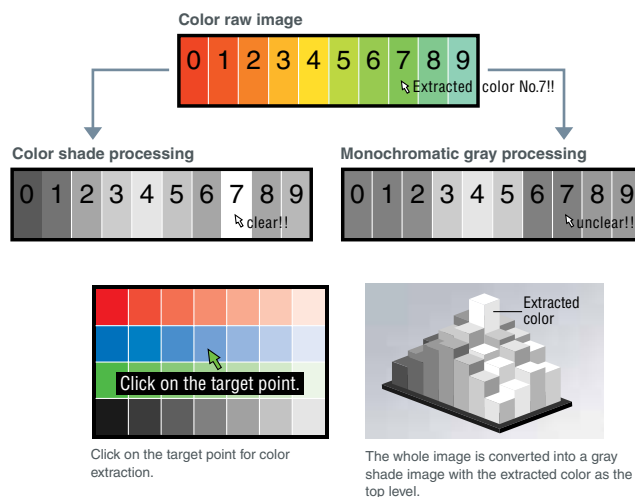
Advanced image processing

Flexible image processing that allows inspection in both Color and Grayscale

Color Shade processing acts as an advanced form of Grayscale

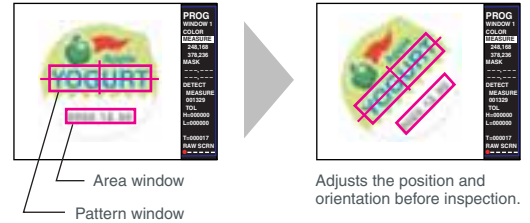
This process enables accurate inspection and measurement of targets whose edges cannot be recognized with monochromatic gray-scale processing.

After you click on a target point to extract its color, the entire image is converted to a shade hierarchy with the extracted color as the top level.



Position/rotation adjustment function

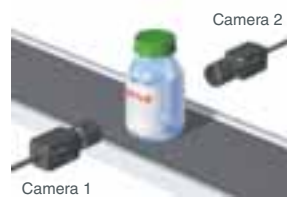
When targets cannot be positioned accurately on the processing line, the vision system adjusts the position of inspection points by recognizing the edges or distinctive shapes of the image on the screen.



Adjusts the position and orientation before inspection.

2-camera connection function

A single controller allows the simultaneous imaging of two sides of a target while displaying both images on the monitor. Connecting 2 cameras to one controller reduces overall integration time and costs.

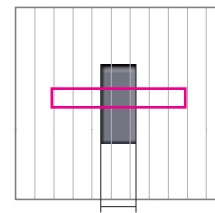


Composite screen of two split images

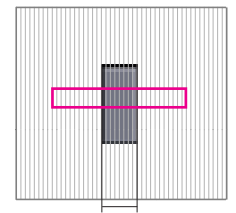


Edge detection down to 0.1 pixel

The embedded software of the CV-700 series uses interpolation to break down pixel values by a factor of 10 in both the X and Y directions, effectively creating a 10 x 10 "sub-pixel" array. These extra sub-pixels can be used to detect edges, patterns, and dimensions with unprecedented accuracy.



68 pixels



67.4 pixels

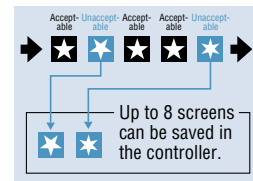
Compact Flash memory port

Save or read 128 inspection settings or 122 images.

The CV-700 Series features a Compact Flash port. Screens can also be saved in bitmap format to generate reports.



Unacceptable images may be saved on the screen



Up to 128 screens can be saved in a memory card.



Screen storage



Up to 8 images can be stored in the internal memory of the CV. In addition, a compact flash memory card can be used to record up to 128 programs.

Controller with built-in TFT color LCD monitor

A TFT color LCD monitor and console are built into a compact, low-cost controller.

Specifications

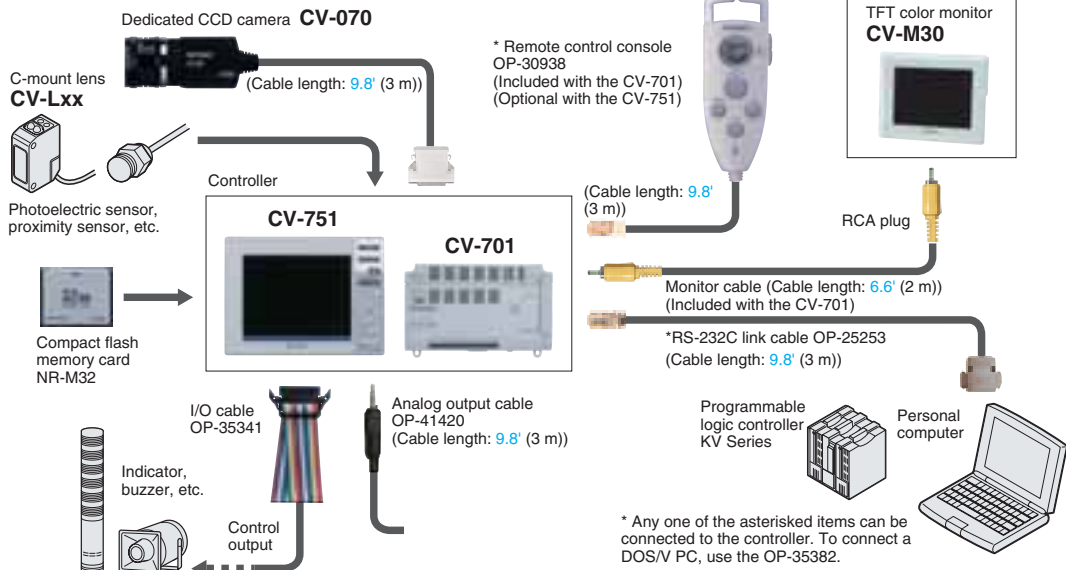
Controller

Type		Built-in monitor type	Separate monitor type	
		CV-751(P)	CV-701(P)	
Model		*Input with a remote control console (optional) is also available. 		
No. of pixels		508 (H) x 480 (V)		
Process cycle		30 c/s (Varies depending on the setting)		
Binary level		Color binary processing by color extraction or color shade processing Color can be specified individually for each window		
Program registration		16 programs (8 programs when two cameras are used) (Programs are externally selectable)		
No. of registered screens		16 screens (1 screen/program or 2 screens/program)		
Functions	Mode	Area sensor	8 max./program, Window shape: Circle/square/free square	
		Absolute position detection	4/program, Window shape: Square	
		Relative position detection	Width measurement	4/program, Window shape: Square
			Pitch measurement	8/program, Window shape: Square
		Edge count	8/program, Window shape: Square	
		Count	8/program, Window shape: Square/circle	
		Flaw detection	8/program, Window shape: Square/circle/ring/arc	
		Point sensor	8/program, 8 points/Window	
		Centre-of-gravity	8/program, Window shape: Square/circle	
	Adjustment	Position adjustment	Color shade search/Line sensor/Color binary processing (Centre of gravity, Major axis inclination, X-/Y-axis direction, ±180° rotation)	
		Illumination adjustment	1 illumination adjustment window/program (two when two cameras are connected)	
		Pre-processing (Filter function)	Expand, Shrink, Median, Average, Edge enhancement, Edge detection, Shading, Lightness-up, Saturation-up, Invert	
	Auto-sequence		Continuous processing of 4 programs max. (Up to 32 inspections [4 programs x 8 windows] can be continuously processed)	
	Data calculation		Unit conversion and offset	
Screen save		8 screens		
Setup menu		Stores parameters of initial setting		
Input	Camera input		2	
	Control input	External trigger	1 (Non-voltage input)	
		Program selection	Data input (x4), 16 programs selectable (Non-voltage input)	
		Continuous detection	Detection continued without an external trigger when the program No. is changed while CONT input is ON. (Non-voltage input)	
		Screen registration	2, Screen is registered by a trigger signal while REC input is ON. (Non-voltage input)	
Display/output window selection		Data input (x3), 8 windows selectable (Non-voltage input)		
LCD monitor	Panel	TFT 5.5 inch, full color	Not provided	
	Backlight	Cold cathode fluorescent tube (Average life: Approx. 40,000 hrs)	Not provided	
Memory card		Compact Flash memory		
Video output		Conforms to NTSC standards		
RS-232C interface		1 ch, Numerical value output and control input/output (Baud rate: 38,400 bps max. selectable)		
Control output	NPN	NPN open-collector: 9, 50 mA max. (30 V max.)		
	PNP	PNP open-collector: 9, 50 mA max. (30 V max.)		
Numerical value output		Binary 13 bits, 10 mA max. (30 V max.)		
Analogue output		0 to 4 V output, Output impedance: 100 Ω		
Display language		English/Japanese selectable		
Power supply voltage		24 VDC±10%		
Current consumption		1.4 A	700 mA	
Ambient temperature		0 to +40°C (32 to 104°F), No freezing		
Relative humidity		35 to 85%, No condensation		
Weight		Controller: Approx. 900 g	Controller: Approx. 400 g, Remote control console: Approx. 160 g	

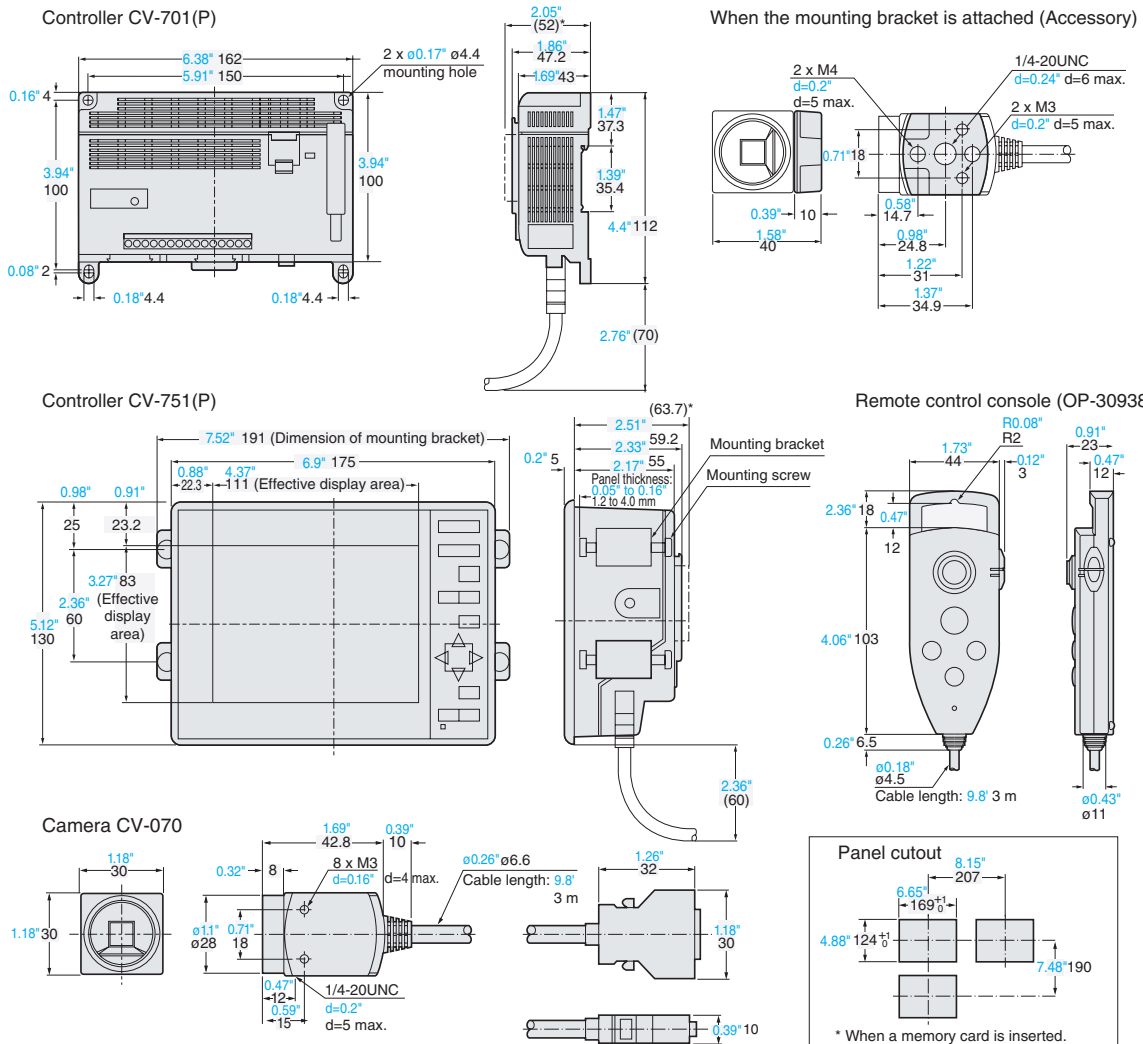
Camera

Model	CV-070
Image pickup element	1/3 inch CCD video element, Square-pixel all reading
Electronic shutter	1/30, 1/50, 1/60, 1/100, 1/125, 1/250, 1/500, 1/1000, 1/2000, 1/4000, 1/10000
Lens mount method	C mount
Ambient temperature	0 to +40°C (32 to 104°F), No freezing
Relative humidity	35 to 85%, No condensation
Weight	Camera: Approx. 310 g (including 9.8' (3-m) cable)

System configurations



Dimensions Unit: inch mm



Real time data acquisition with PC Simulator

MULTI-LINE DATA ACQUISITION

Keyence unique software packages offer simultaneous real-time data acquisition of both measurement results and captured images from up to 8 controllers. The follow versions of CV-H software are available:

1. CV-H1NE – Dedicated data acquisition software for CV-2100/2600
2. CV-H3N – Dedicated data acquisition software for CV-3002/3502 with optional PC Simulator function

Data and image collection

Measurement values collected on the CV controller can be output via RS232, Ethernet, or USB.

The acquired data can be simultaneously displayed and saved onto an external hard drive.

Captured images that are transferred to a PC can be sorted by their OK/NG status based on the measurement results. The images are then displayed in real time and saved to a specified folder.

Transfer and backup programs on a PC

Programs created on the CV controller can be easily transferred and saved on a PC. If the contents of the controller get erased, the saved files can be quickly reloaded to the vision system, reducing downtime.

If record keeping is essential, all program properties and settings can be output to an Excel* spreadsheet and saved for future reference.

Advanced Data logging

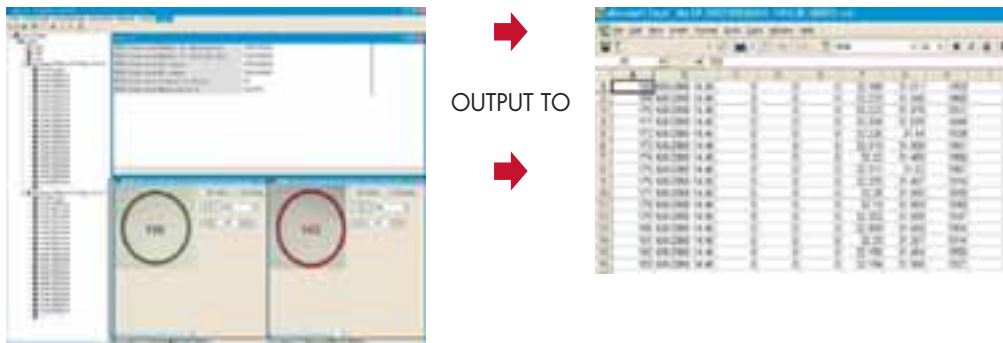
A time-based data log can be set to collect data from various shifts or product runs. Specific pieces of measurement data can also be tied to the corresponding image that was saved on the PC for easy reference.

Data can also be output to a preexisting Excel* spreadsheet, making the CV data simple to integrate into existing reports.

*Excel is a registered trademark of Microsoft Corporation, U.S.A.



8 controllers connect to 1 PC



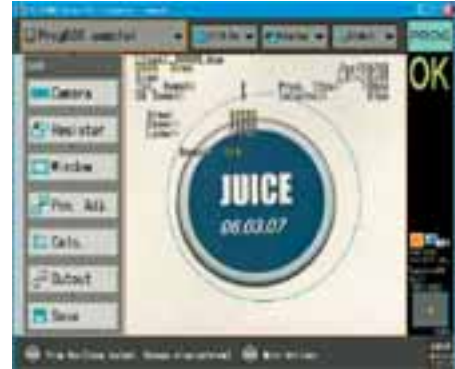
Data is both displayed and saved in real time

CV-H3N PC Simulator Function

CV SIMULATOR

Keyence has added the option of remotely programming the CV from your desktop PC. The CV-H3N PC simulator is designed to precisely mimic the operations of the CV-3002/3502 machine vision controllers. All that you need is a .bmp or .jpeg image and you're ready to program!

- Choose to program/troubleshoot directly online (CV controller) or remotely (PC Simulator), providing optimal flexibility
- Transfer programs & images in real time to make remote, offline modifications to an existing CV-3002 series controller
- Manage CV programs from anywhere in the world!

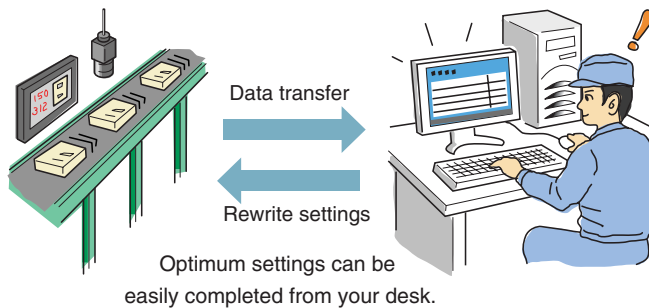
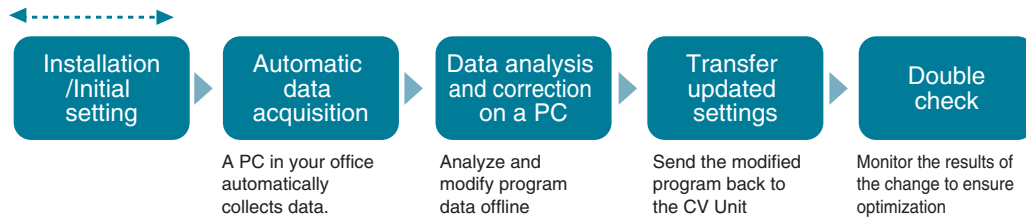


Both Software Tools in One Package

EXAMPLE OF EFFICIENT OPERATION









Operations with data collection and PC Simulator

Only one step
on site



Illumination

Selection Guide

Model	Description	Application	Page
CA-DB 	Bar light	Indirect lighting eliminates glare and applies illumination evenly	P.32
CA-DX 	Coaxial vertical-light	Enhances the edge of the imprinting against the reflective surface	
CA-DL 	Low-angle light	Sharpens the contrast of edges and uneven surfaces	P.33
CA-DD 	Dome light	Indirect light allows clear images without hot spots	
CA-DS 	Backlight	Utilizing the silhouette enables high-accuracy transparent target detection	P.34
CA-DR 	Direct-ring light	General-purpose lighting for various applications.	
CV-R/CA-R 	Inverted high-frequency light	Lights for large-sized targets.	
CA-DC100 	Controller	LED Illumination Controller	P.36

Technical Information

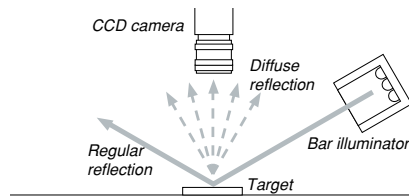
Color lighting	P.37
	P.38
Strobe light & wiring	P.38
Polarization filter	P.39
Direct reflection and diffuse reflection	P.40



Indirect lighting eliminates glare and applies illumination evenly

Detecting defective plating of terminals

Detects imperfect plating on the tips of terminals. Color image processing enables differentiation between the bare silver metal and the gold plating.



Lighting technique using a bar-light

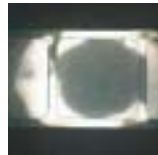
The bar-light illuminator applies uniform light on long targets. Applying the light from an angle creates diffuse reflection, enabling easy differentiation. If the surface is very glossy, a polarizing filter is recommended.



APPLICATION

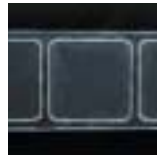
DETECTING THE POSITION OF STICKERS

With direct reflection



Since the sticker reflects the illumination, the edges are not clear.

With bar illumination



Only the edges are extracted. The position detection of stickers can be precisely carried out.

MEASURING THE INTERVALS OF CONNECTOR TERMINALS

With direct reflection



There is no contrast between the edge of terminals and the molded area.

With bar illumination



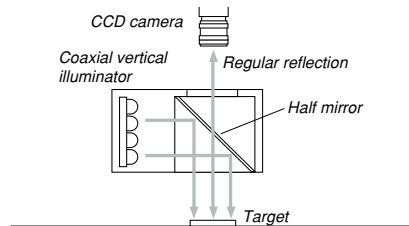
Since only the edges of the terminals appear bright, the edge position can be detected.



Enhances the edge of imprinting against a reflective surface

Detecting imprints on press-molded parts

Product number and specification imprints can be recognized by their patterns. Incorrect stamping and mixing of different products can also be detected.



Lighting technique using a coaxial vertical-light

The coaxial vertical illuminator applies light on the same axis as the lens. The contrast between dark and bright parts is captured and differentiated by allowing the reflected light from the glossy surface into the camera, while blocking the diffuse light at the edge of the imprint.



APPLICATION

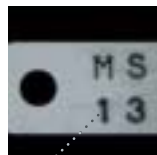
DETECTING AN ENGRAVED MARK ON A METAL SURFACE

With direct reflection



The engraved mark is not stably detected due to irregular reflection.

With coaxial vertical illumination



The engraved mark appears dark so that a stable detection can be conducted.

INSPECTION OF GLASS COMPONENTS

With direct reflection



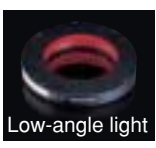
The glass surface reflects the illumination.

With coaxial vertical illumination



Since the entire surface is evenly illuminated, defects such as stains or flaws can be detected.

CA-DL

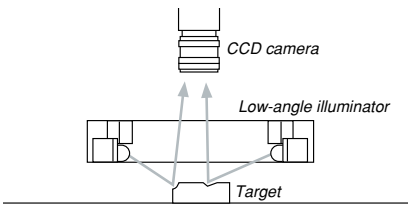


Low-angle light

Sharpens the contrast of edges and uneven surfaces

Detecting chips on rubber packaging

Detects minute defects such as chips on a perimeter edge, surface flaws or deviations in thickness.



Lighting technique using a low-angle-light

The low-angle illuminator allows differentiation by applying light at an angle onto the edge of the surface.

APPLICATION

DETECTING A CHIP ON A RUBBER WASHER

With direct reflection



The chip on the contour is not clear.



With low-angle illumination



The chip on the contour appears bright and is clearly recognized.

DETECTING A CHIP THROUGH FILM

With direct reflection



The film reflects the light.



With low-angle illumination



The characters are clearly highlighted.

CA-DD

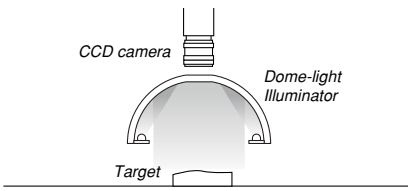


Dome light

Indirect light allows clear images without hot spots

Detecting printing on aluminum packaging material

Detection is normally difficult or impossible due to the hot spots generated from surface irregularities or glare caused by the film sheet.



Lighting technique using a dome-light

The dome-light illuminator casts indirect light from various directions. Since soft diffuse light can be applied uniformly over a target with an irregular shape, the surface condition can be kept uniform, making contrast of inspection points clear.

APPLICATION

DETECTING PRINT ON AN ALUMINUM PACKAGE

With direct reflection



The print is not detected because of glare on the package.



With dome illumination



Glare is effectively eliminated by evenly illuminating the surface, allowing the print to appear with high contrast.

DETECTING MARKS ON A CAN BOTTOM

With direct reflection



The print is not detected because of irregular reflection from the curved can bottom.

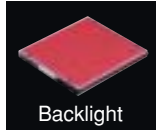


With dome illumination



The curved surface is evenly illuminated and the print can be detected.

CA-DS

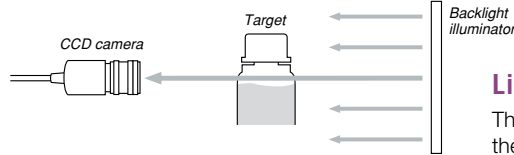
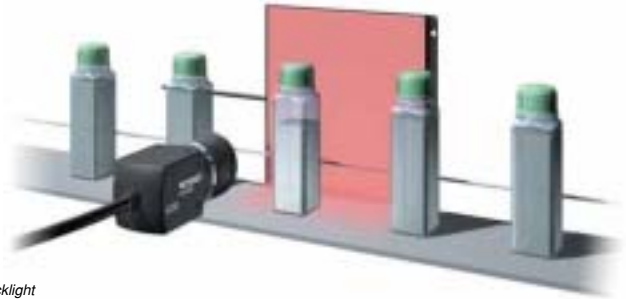


Backlight

Utilizing the silhouette enables high-accuracy transparent target detection

Detecting the level of transparent liquid

Detects the level of a clear liquid substance in a transparent or semi-transparent container.



Lighting technique using a backlight

The backlight illuminator silhouettes the shape of the target using the light passing through the target.

APPLICATION

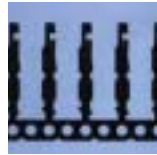
MEASURING THE SIZE OF A LEAD TERMINAL

With direct reflection



Some edges are not clear.

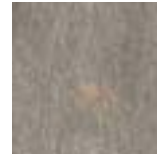
With backlight illumination



The complicated contour becomes a sharp silhouette so that shape and size measurements can be conducted.

DETECTING FOREIGN OBJECTS IN UNWOVEN FABRIC

With direct reflection



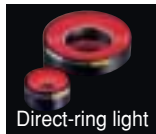
There is no clear contrast between the flaw and the background

With backlight illumination



The silhouette of the foreign object enables a stable measurement.

CA-DR



Direct-ring light

General-purpose lighting for various applications.

The circularly arranged LEDs provide equal lighting suitable for many applications.



CV-R/CA-R Lights for large-sized targets.

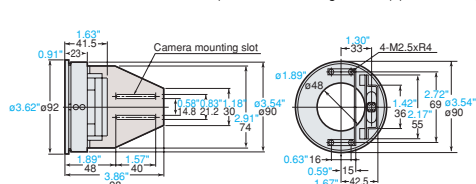
These fluorescent illuminators use an inverter method and are excellent for image processing. The large ring light provides optimal lighting for large-sized targets.



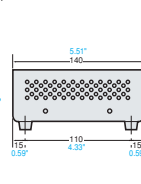
		CE ^{*3}	
MODEL	CV-R11	CA-R20	
Lighting method	Inverted high-frequency lighting (25 to 35 KHz)		
Luminescent color of lamp	N-EX (daylight white color)		
Dimension of lamp	Outside diameter: $\phi 3.15$ $\phi 80$ mm, Inside diameter: $\phi 2.21$ $\phi 56$ mm	Outside diameter: $\phi 7.88$ $\phi 200$ mm, Inside diameter: $\phi 6.93$ $\phi 176$ mm	
Lamp life *1	Approx. 2000 hours average	Approx. 1500 hours average	
Power supply voltage	24 VDC \pm 10%		
Current consumption	0.7A	1.5A	
Ambient temperature	+5 to +50°C	+5 to +40°C	
Relative humidity	35 to 90% (No condensation)		
Weight	Illumination unit	Approx. 150 g	Approx. 300 g
	Controller	Approx. 650 g (including cable)	Approx. 900 g (including cable)
Model of replacement lamp	OP-25526	OP-51495	

*1: The lamp life refers to the average time it takes for the illumination intensity to drop to 70% of the initial illumination intensity*2 when the lamp is illuminated continuously in an vibration-free environment with an ambient temperature of 25°C. Note that the life may be shorter according to the conditions of the use environment.
 *2: The initial illumination intensity refers to the illumination intensity measured at the moment when the lamp, being in mint condition, is turned on for the first time.
 *3: Consult your sales representatives for conformity of the model to CE Marking.

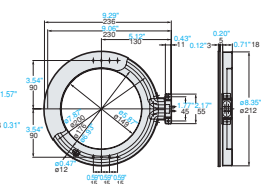
CV-R11 Illumination unit (When the mounting bracket (L) is attached.)



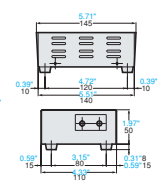
Controller



CA-R20 Illumination unit



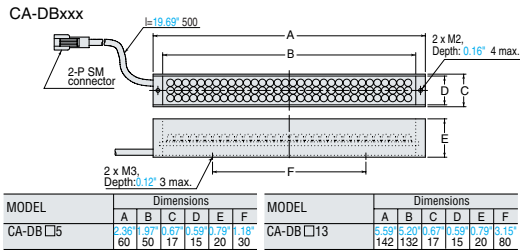
Controller



LED illumination units Unit: inch mm

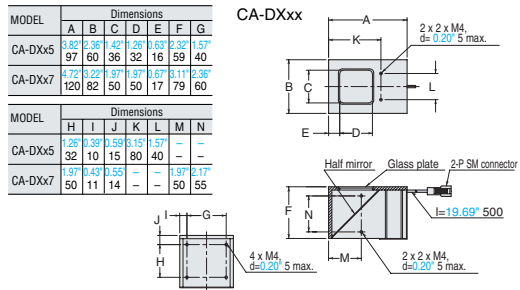
Bar light CA-DB

MODEL	LED color	Weight (g)	Power consumption (w)
CA-DBR5	Red	Approx. 35	1.7
CA-DBW5	White	Approx. 40	2.9
CA-DBB5	Blue	Approx. 40	2.9
CA-DBR13	Red	Approx. 80	4.2
CA-DBW13	White	Approx. 90	7.3
CA-DBB13	Blue	Approx. 90	7.3



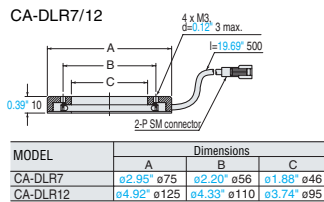
Coaxial vertical light CA-DX

MODEL	LED color	Weight (g)	Power consumption (w)
CA-DXR5A	Red	Approx. 230	5
CA-DXW5A	White	Approx. 230	4.9
CA-DXB5A	Blue	Approx. 230	4.9
CA-DXR7	Red	Approx. 380	6.7
CA-DXW7	White	Approx. 380	10.1
CA-DXB7	Blue	Approx. 380	10.1



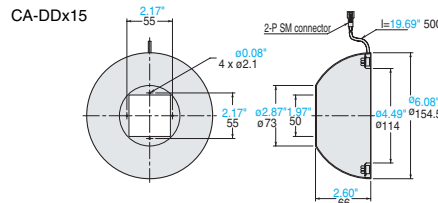
Low-angle light CA-DL

MODEL	LED color	Weight (g)	Power consumption (w)
CA-DLR7	Red	Approx. 40	2
CA-DLR12	Red	Approx. 85	3.3



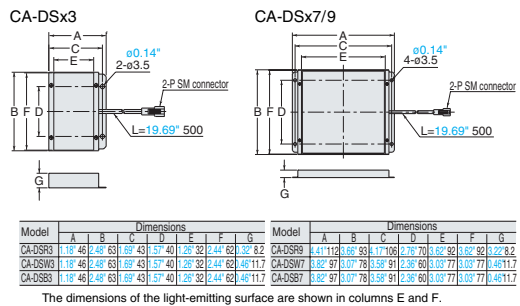
Dome light CA-DD

MODEL	LED color	Weight (g)	Power consumption (w)
CA-DDR15	Red	Approx. 130	11
CA-DDW15	White	Approx. 170	18.8
CA-DOB15	Blue	Approx. 170	18.8



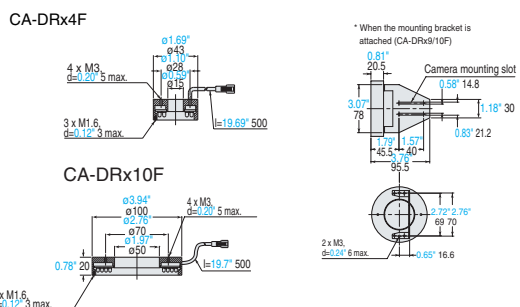
Backlight CA-DS

MODEL	LED color	Weight (g)	Power consumption (w)
CA-DSR3	Red	Approx. 40	3.6
CA-DSW3	White	Approx. 40	5.8
CA-DSB3	Blue	Approx. 40	5.8
CA-DSR9	Red	Approx. 110	14
CA-DSW7	White	Approx. 90	18
CA-DSB7	Blue	Approx. 90	18



Direct-ring light CA-DR

MODEL	LED color	Weight (g)	Power consumption (w)
CA-DRR4F	Red	Approx. 20	1.5
CA-DRW4F	White	Approx. 20	2.9
CA-DRB4F	Blue	Approx. 20	2.9
CA-DRR10F	Red	Approx. 90	8.3
CA-DRW10F	White	Approx. 80	7.9
CA-DRB10F	Blue	Approx. 80	7.9



LED Illumination CA-D Series



LED Illumination Controller



CA-DC100

High frequency lights

The high light-emitting frequency of 100 kHz ensures consistent image capture even under high-speed shutter mode on high-speed lines.

Limit function to ensure safety INDUSTRY FIRST

The limit function prevents light emission from exceeding approx. 60% of the maximum light intensity. This function prevents the LED life from being shortened from setting the light intensity to excessive levels.

Light adjustment trimmer for fine-tuning

The CA-DC100 features a light adjustment trimmer that allows fine adjustment of the light intensity to achieve optimal irradiation volume. The CA-DC100 also allows you to switch light emission on and off by external inputs.

Specifications

MODEL		CA-DC100
Output	Light control method	Light-emitting frequency: 100 kHz, pulse width modulation method
	Number of outputs	2 channels
	Voltage	12 V
		30 W max. (20 W per channel)
Input		External control input (EXT), 2 contacts (non-voltage contact input)
Power supply voltage		DC24V±10%
Current consumption		1.8A(under maximum load)
Ambient temperature		0 to +45°C
Relative humidity		35-85% No condensation
Weight		Approx. 220 g

*Environment for illumination unit: Ambient temperature of 0 to +40°C and relative humidity of 35 to 65% (no condensation).

2-channel connection for a wide range of applications INDUSTRY FIRST

Two illumination units can be connected to a single controller. Switching between the two illuminators makes compound inspections and 2-line inspections easy and low cost.

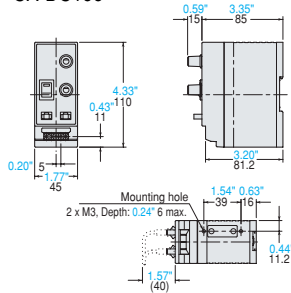
DIN-rail mountable design

The CA-DC100 can be mounted on a DIN rail for easy on site installation. In addition, various mounting brackets (sold separately) enable installation in various environments.

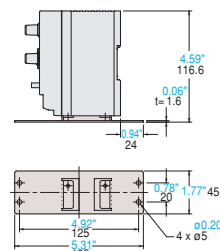
Dimensions

Unit: inch mm

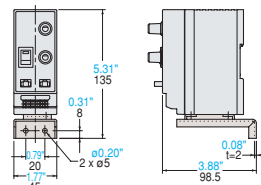
CA-DC100



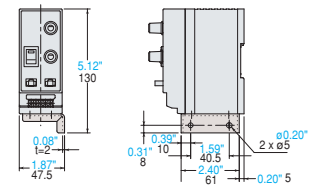
Bottom mounting (with OP-42169)



Front mounting (with OP-42168)



Side mounting (with OP-42170)



* The mounting brackets OP-421xx are sold separately.

Options

Diffuser



For LED reflection prevention

Eliminates the reflection of LEDs and inconsistencies generated in capturing the image of glossy targets. (Compatible with direct- and bar lights)

MODEL	Compatible illuminator
OP-42282	CA-DBx13
OP-42283	CA-DBx5
OP-42337	CA-DRx4F
OP-42339	CA-DRx10F

Extension cable

Cable length (m)	MODEL
0.08* 2	CA-D2
0.20* 5	CA-D5

Precautions for use of LED illumination

- Continuous operation under high temperature and high humidity accelerates the reduction and deterioration of light intensity.
- Reduce heat generation of the product.

Use the limit function and light-control volume.

When used at the maximum light intensity, the product will produce a greater amount of heat, which will have a negative effect on the operating life. It is recommended that the limit function be turned on or the light-control volume be set to 40 to 60%. (Standard features of the CA-DC100.)

Turn on the LED only when capturing images.

It is recommended to use the on/off external switching function (Standard feature of the CA-DC100) to turn on illumination in sync with image-capturing.

*LED is resistant to switching operation and will not deteriorate when turned on and off repeatedly.

Use the product in an optimum environment for heat radiation and cooling.

Take measures such as installing cooling air and fans or using mounting brackets with good heat-transfer properties.

Common specifications of LED illumination unit

Ambient temperature	0 to +40°C
Relative humidity	35 - 65%(No condensation)

Color lighting

Complementary color

Detection using complementary colors

The contrast between the red candy wrapper and the carton is compared with white, red, or blue LED light.

Target



With white LED

Contrast is not clear as objects have homogeneous brightness.



With red LED

The red object is slightly brighter than the carton.



With blue LED

The red object appears darker than the carton and detection can be stably carried out.



Hue circle

Position of opposing colors in the complementary color hue circle

The contrast of the image is produced by **the complementary colors** of the illumination to the candy wrapper.

Contrast between gold and silver colors

To obtain a clear contrast between gold and silver colors, blue illumination is more efficient than red illumination as blue is a complementary color to gold.



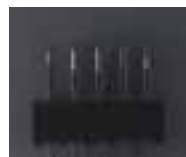
With color camera



With color camera and red light



With color camera and blue light



With monochrome camera and red light



With monochrome camera and blue light
clear contrast is created between gold and silver.

Characters on a chip carrier tape

Inspecting characters printed on a chip through a film. Since red has higher transmission (low scattering rate) than blue, red illumination produces clear contrast.



With color camera



With color camera and red light



With color camera and blue light



With monochrome camera and red light
clear contrast is created through the film.



With monochrome camera and blue light
less contrast is created.

Scattering rate

Blue light from an angle



Blue

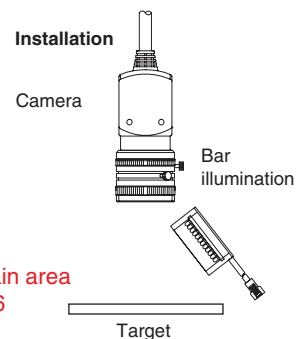
Stain area
2749

Red light from an angle



Red

Stain area
786



To obtain a clear contrast with LED illumination, the scattering rate can be used along with color relation (complementary/similar colors). Blue light has a short wavelength and a high scattering rate. In contrast, red light has a long wavelength, low scattering rate and a high transmission. Light with a high scattering rate is effective to detect surface conditions as shown in the pictures.

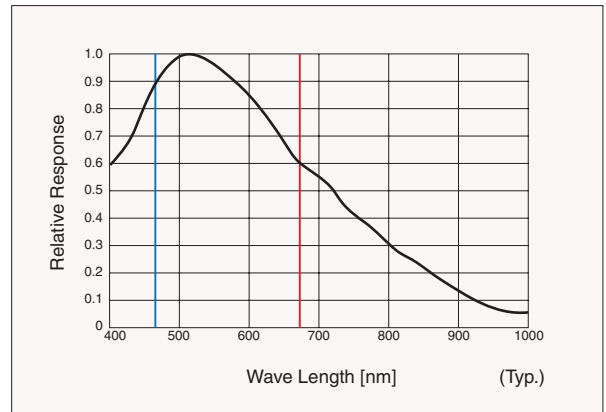
When using a blue light with its high scattering rate, there is a larger amount of diffuse reflection on the stain, which allows the stains to be detected more easily.

Color lighting

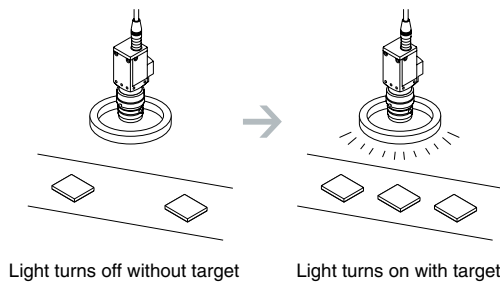
CCD camera sensitivity

CCD sensitivity is close to that of the human eye and detects in the vicinity of 500nm with highest sensitivity. So, the sensitivity is better with blue light than with red light. Also, a brighter image can be captured with blue light than with red light. This is why blue light is suitable to capture a bright image with a high-speed shutter and large depth of field.

Blue 460nm/spectral sensitivity approx 90%
 Red 660nm/spectral sensitivity approx 60%
 Blue light is 1.5 times brighter than red light.

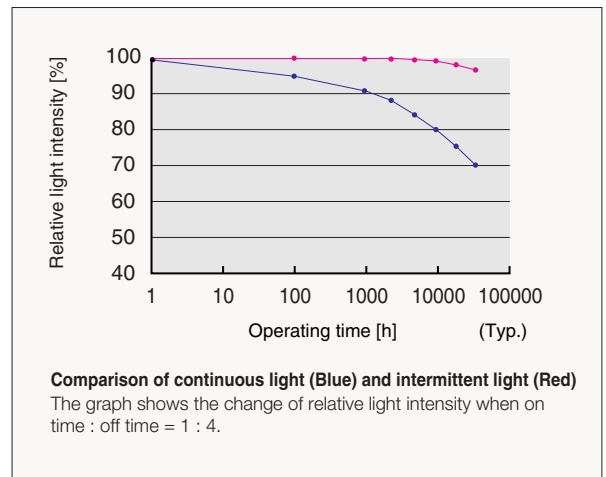


Strobe lighting & wiring



Effects of intermittent lighting & wiring

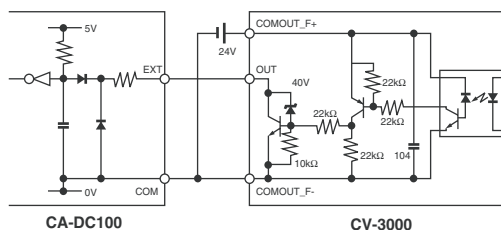
The service life becomes longer when the ratio of off time to on time increases. High-speed blinking does not burden LED elements. When on time is 4 times longer than on time, the service life lasts 5 times longer than that of continuous light.



Example of wiring for intermittent lighting

Connection of the CA-DX100 controller to the sensor of the CV-3000 imaging sensor

LED illumination lights intermittently when input is received from the CV-3000 sensor.

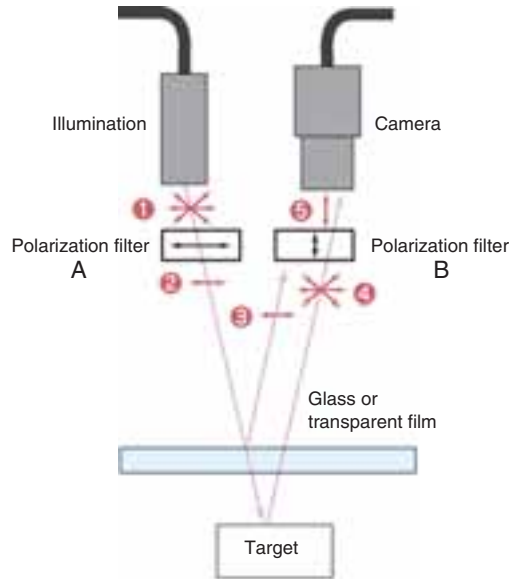


The effect of a polarization filter

A polarization filter transmits only a light wave in a specified direction. Regular reflections from a glossy surface can be eliminated when polarization filters are mounted on the lens and the illuminator as shown in the illustration.

Principle

The light 1 is polarized with the polarization filter A and becomes light 2. The glass surface specularly reflects light 2. The specular reflection 3 is intercepted by the polarization filter B while the target surface diffusely reflects light 4. The diffuse reflection 4 is polarized by the polarization filter B and only the polarized light 5 enters into the camera.



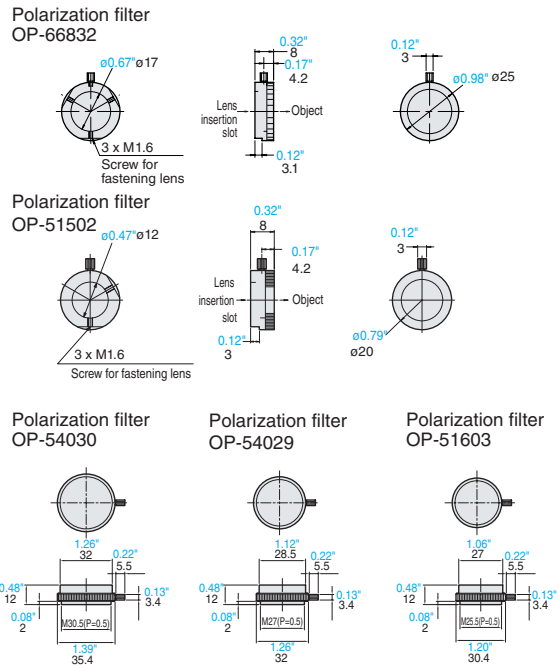
Without polarization filter
The CD case reflects the illumination.

With polarization filter
The polarization filter reduces the reflection.

Specifications

LENS	TYPE	MODEL	NOTE
CV-L	1.06" 27mm 1.20" 30.5mm	OP-54029 OP-54030	Screw diameter OP-54029 1.06" 27mm OP-54030 1.20" 30.5mm
CV-LH	1.00" 25.5mm 1.06" 27mm	OP-51603 OP-54029	Screw diameter OP-51603 1.00" 25.5mm OP-54029 1.06" 27mm
CA-LHS	0.63" 16mm	OP-66832	
CA-LS	0.47" 12mm	OP-51502	

Dimensions Unit: inch mm



Options

For glare prevention

Eliminates glare of glossy targets together with the lens polarizing filter. (Compatible with direct-ring light and bar lights)

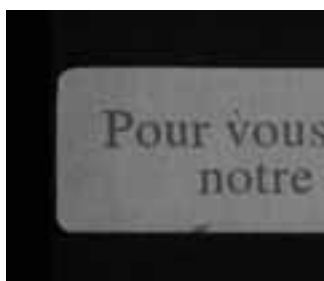
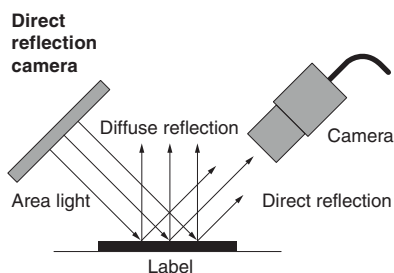
MODEL	Compatible illuminator
OP-42280	CA-DBx13
OP-42281	CA-DBx5
OP-42336	CA-DRx4F
OP-42338	CA-DRx10F



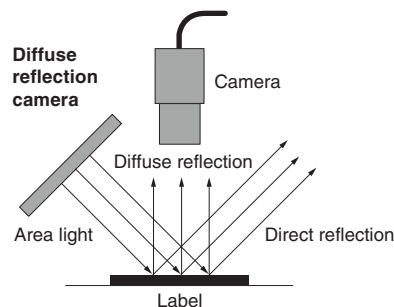
* Protection filter ▶ p.48

Direct reflection and diffuse reflection

Object surfaces have a variety of colors and reflections, and surface gloss is especially important to determine lighting angle. A glossy surface specularly reflects the light and a matte surface diffuses the light. A glossy surface can appear bright or dark by changing position of the illuminator and the camera.



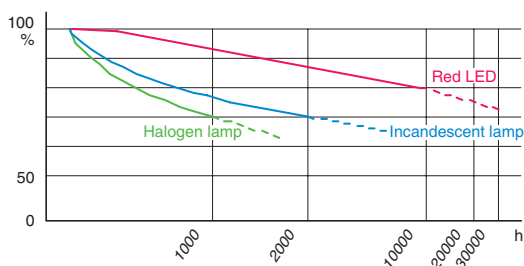
The glossy background of the label appears bright and the print appears dark as it diffusely reflects the light.



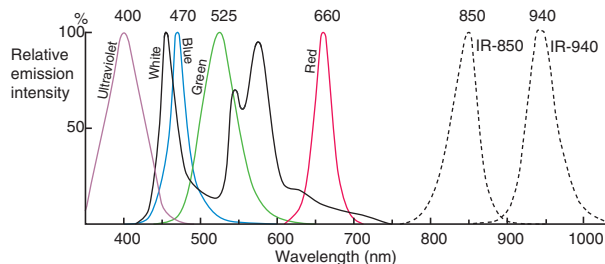
The glossy background of the label appears dark and the print appears bright.

Features & data of various LEDs

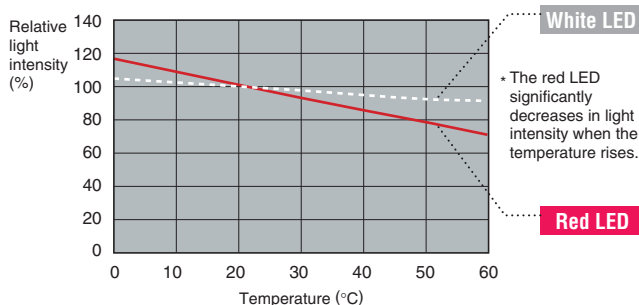
Service life Service lives of different lamps (Typ.)



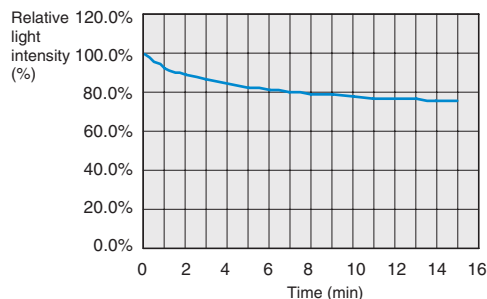
Wavelength Emission wavelength/spectral distribution (Typ.)








Heat and deterioration of light intensity (Typ.)



Initial drift LED initial drift (Typ.)



Selection Guide

Model	Description	2M Pixels	240K Pixels	2M Pixels Ultra Small	240K Pixels Ultra Small	Application	Page
		CV-200C CV-200M	CV-035C CV-035M	CV-S200C CV-S200M	CV-S035C CV-S035M		
CA-LM 	Macro Lens	○	○	—	—	High-accuracy measurement of minute targets	P.42
CA-LH 	High-resolution & Low distortion Lens	○	○	—	—	High-accuracy size measurement	P.43
CA-LS 	Super Small Lens	—	—	—	○	Space saving	P.44
CA-LHS 	High-resolution Small Lens	—	—	○	—	High-accuracy and space saving	P.44
CV-L 	Standard Lens	○	○	—	—	General purpose	P.46

Technical Information

Focal distance and lens	P.47
Distortion	P.47
Aperture diaphragm and depth of field	P.48
Protection filter	P.48

Macro Lens CA-LM Series

0.5x-1.0x
CA-LM0510



CA-LM2



CA-LM4



CA-LM6



CA-LM8



Telecentric lenses yield small measurement errors

A telecentric lens has an optical system designed to allow principal rays to pass the focal point. Principal rays pass through the lens in parallel with the optical axis as shown in Figure 2. Consequently, the angle of view is 0°. One of the advantages of telecentric lenses is that the change in the target position causes less change in the size of the captured image, resulting in accurate dimension measurement. A telecentric lens is suitable for dimension measurement or positioning of targets with some height variation.

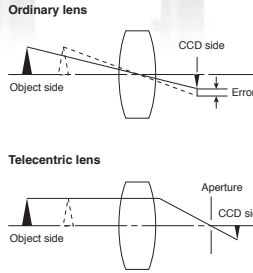


Figure 2

Fine magnification adjustment feature

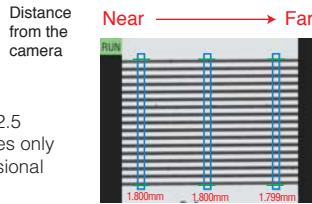
Even though the magnification is fixed, the lens features a fine adjustment that enables delicate adjustment of back-focus error.

0% TV distortion

In spite of its compact design, TV distortion is eliminated, enabling highly accurate measurement across the entire FOV.

Telecentric effect

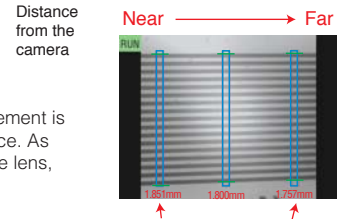
Telecentric lens
CA-LM2
(2.0x optical magnification)



With a telecentric lens, the 2.5 mm height differential causes only a minimal amount of dimensional variation.

Standard CCTV
low distortion lens
50 mm lens
(with 95-mm close-up ring)

With a CCTV lens, the measurement is affected by the height difference. As the target moves away from the lens, the dimensional measurement becomes smaller.

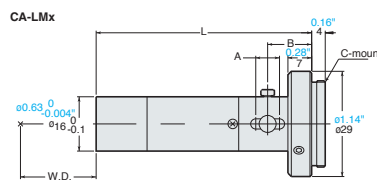
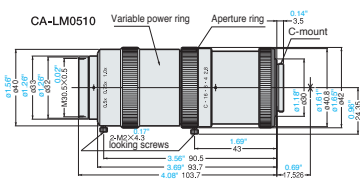


Specifications

MODEL	CA-LM0510		CA-LM2	CA-LM4	CA-LM6	CA-LM8
Shape	Straight					
Optical magnification (Reference magnification)	x0.5-x1		x2	x4	x6	x8
Allowable variation in magnification	Approx. ±5% of the reference magnification					
WD (With the reference magnification)	x0.5 x1.0	4.37" 111mm 3.07" 78mm	2.63" 66.9 mm	2.77" 70.3 mm	2.54" 64.4 mm	2.54" 64.5 mm
Maximum size of applicable image	2/3-inch CCD		1/2-inch CCD			
Imaging field of view (With the reference magnification)	1/3-inch CCD	3.6x4.8mm to 7.2x9.6mm	0.07" x 0.09" 1.8 x 2.4 mm	0.04" x 0.05" 0.9 x 1.2 mm	0.02" x 0.03" 0.6 x 0.8 mm	0.018" x 0.024" 0.45 x 0.6 mm
	1/2-inch CCD	4.8x6.4mm to 9.6x12.8mm	0.09" x 0.13" 2.4 x 3.2 mm	0.05" x 0.06" 1.2 x 1.6 mm	0.03" x 0.04" 0.8 x 1.07 mm	0.024" x 0.032" 0.6 x 0.8 mm
Effective F No.	2.8 to CLOSE		15.4	26.5	39.3	52.4
Depth of field	x0.5	99.8 Mil 2560µm	15.6 Mil 400 µm	6.7 Mil 172 µm	4.33 Mil 111 µm	3.08 Mil 79 µm
	x1.0	49.9 Mil 1280µm				
TV distortion (Max.)	x0.5	-0.4%	-0.04%	-0.22%	-0.10%	-0.04%
	x1.0	-0.1%				
Resolution	x0.5	0.15 Mil 3.8µm	0.20 Mil 5.1 µm	0.18 Mil 4.5 µm	0.17 Mil 4.4 µm	0.17 Mil 4.4 µm
	x1.0	0.13 Mil 3.4µm				
Mount	C-mount					
Ambient temperature and relative humidity	0 to +50°C, 80% (No condensation)					
Weight	Approx. 220g		Approx. 57g	Approx. 58g	Approx. 64g	Approx. 67g

* The value of the depth of field is obtained with theoretical calculation on the assumption of a 1/2" image size and a horizontal resolution of 320 TV lines. (The minimum circle of confusion on the image side: 40 µm)
 * The resolution is a theoretical value at a distance of 550 mm.
 * The ranges of the imaging field of view indicate the reference field of view of each image size. The value can be modified by approx. ±5% by adjusting the magnification.
 * The values of WD indicate the working distance when each lens is used with reference magnification, and they will change by adjusting the magnification.
 * The values in the specifications above are obtained based on the optical design value, and individual differences are generated depending on the assembly accuracies.

Dimensions Unit: inch mm



	CA-LM2	CA-LM4	CA-LM6	CA-LM8
L (Length)	2.50" 63.5	2.73" 69.3	3.17" 80.6	3.56" 95.0
A (Adjustable range)	0.28" 7.0	0.37" 9.3	0.30" 7.7	0.30" 7.6
B (Adjustable position)	0.51" 13.0	0.59" 15.1	0.81" 20.5	1.37" 34.9
C (Coaxial position)	1.21" 30.7	1.25" 31.8	—	—

High-resolution & Low distortion Lens CA-LH Series

CA-LH8



CA-LH16



CA-LH25



CA-LH50

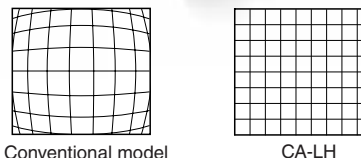


Low optical distortion Best in its class

An original optical design has been adopted to eliminate distortion, which is often the largest obstacle for dimensional measurements and other applications requiring high accuracy. The CA-LH Series has a low distortion level of 0.01% or lower.*

* When using the CA-LH50

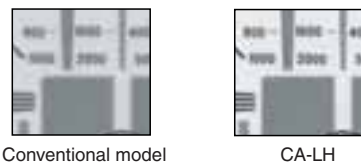
Comparison of distortion



High resolution and high contrast

The floating mechanism moves the front and rear spherical elements separately, obtaining high resolution from close range to infinity. In addition, the contrast is improved dramatically from conventional products. Even targets with small intensity contrasts can be reproduced reliably without being washed out in the background.

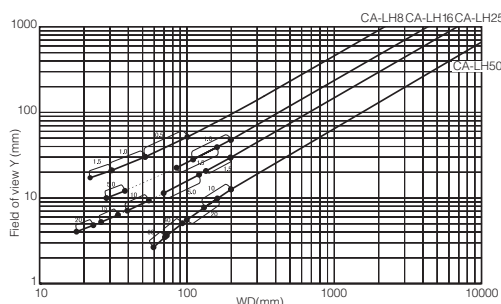
Comparison of magnified images



Large focus range

Using lens extenders/spacers to bring smaller targets in focus can be a hassle when setting up a machine vision application. The CA-LH Series provides an extremely long focus range, which allows for easy camera adjustment during product changeovers.

Chart of field of view



When the CV-035/-020/-070 is attached, the values on the chart are reference values. Adjustments may be required for installation.

List of models: specifications of the CA-LH series

MODEL	CA-LH8	CA-LH16	CA-LH25	CA-LH50
Focal distance	0.31* 8mm	0.63* 16mm	0.98* 25mm	1.97* 50mm
Aperture	F1.4 to F16	F1.4 to F16	F1.4 to F16	F2.8 to F22
Minimum close-up distance	0.33* 0.1m	0.66* 0.2m	0.66* 0.2m	0.66* 0.2m
Mount	C-mount			
Screw diameter of filter	1.06* 27.0mm P0.5	1.01* 25.5mm P0.5	1.06* 27.0mm P0.5	1.06* 27.0mm P0.5
Maximum size of applicable image	2/3-inch CCD			
TV distortion*	-0.6% (-0.28%) max.	-0.05% (-0.1%) max.	-0.04% (-0.02%) max.	-0.03% (-0.01%) max.
Ambient temperature and relative humidity	0 to +50°C, 80% (No condensation)			
Weights	Approx. 83g	Approx. 81g	Approx. 89g	Approx. 92g

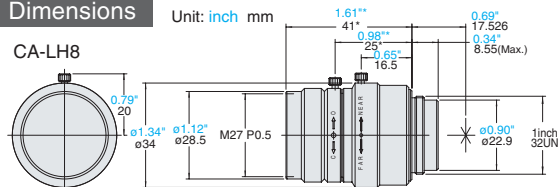
* Indicates the values of 2/3-inch CCD. The values in parenthesis are for 1/3-inch CCD. Notes: When connecting the CA-LH8 with a camera other than the CV-035/200/020, a close-up ring of 1.5 mm or more is required.

List of options

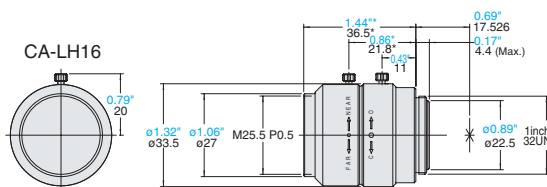
Type	Model	Remarks
Close-up ring set for the CA-LH	OP-51612	Thickness: 0.02", 0.04", 0.20", 0.39", 0.87"
Polarizing filter 25.5	OP-51603	For a 1.00" 25.5-mm screw diameter
Polarizing filter 27	OP-54029	For a 1.06" 27-mm screw diameter

Dimensions

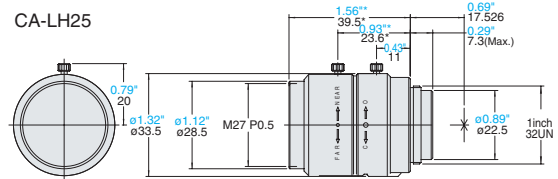
Unit: inch mm



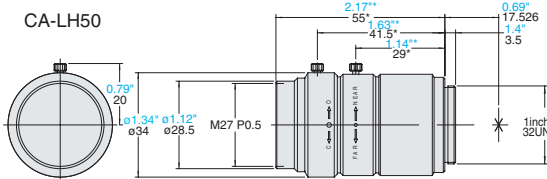
* Variable depending on the focal distance. Extension amount: 0 to 1.2 mm



* Variable depending on the focal distance. Extension amount: 0 to 4.5 mm



* Variable depending on the focal distance. Extension amount: 0 to 0.16"



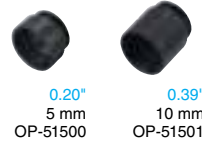
* Variable depending on the focal distance. Extension amount: 0 to 0.73"

CA-LS Series CV-S035C/CV-S035M dedicated lens

High-resolution lens



Closeup ring



Polarization filter



Side viewer attachment



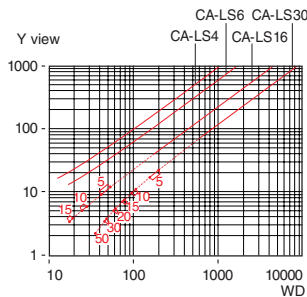
Ultra-small 240,000-pixel double-speed color camera CV-S035C



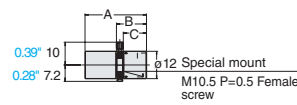
Ultra-small 240,000-pixel double-speed monochrome camera CV-S035M



CV-S035C/CV-S035M
(When CA-LS Series is installed)



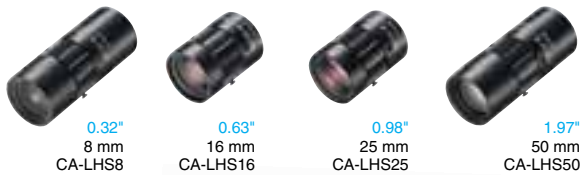
Lens CA-LS□



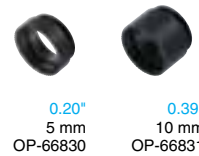
	CA-LS4	CA-LS6	CA-LS16	CA-LS30
A	0.66" 16.7	0.84" 21.3	0.80" 20.4	1.06" 27
B	0.45" 11.5	0.63" 15.9	0.40" 10.2	0.52" 13.2
C	0.33" 8.5	0.51" 12.9	0.28" 7.2	0.40" 10.2

CA-LHS Series CV-S200C/CV-S200M dedicated lens

High-resolution lens



Closeup ring



Polarization filter



Side viewer attachment



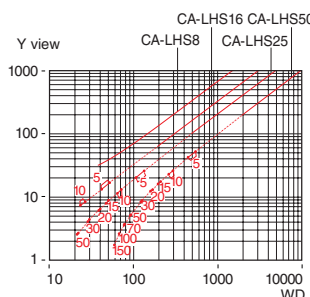
Ultra-small 2,000,000-pixel color camera CV-S200C



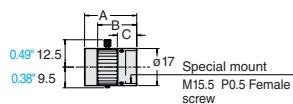
Ultra-small 2,000,000-pixel monochrome camera CV-S200M



CV-S200C/CV-S200M
(When CA-LHS Series is installed)



Lens CA-LHS□



	CA-LHS8	CA-LHS16	CA-LHS25	CA-LHS50
A	1.59" 40.4	0.94" 23.9	0.98" 24.9	1.59" 40.4
B	1.13" 28.6	0.71" 17.9	0.73" 18.6	1.07" 27.1
C	0.77" 19.6	0.35" 8.9	0.38" 9.6	0.71" 18.1

Mounting space can be cut even more using the side-view attachment

The side-view attachment with a built-in precision mirror enables sensor-like lateral mounting, significantly improving the mounting flexibility.

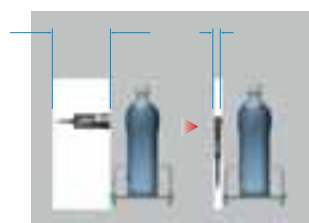


Mounting the camera inside a packaging machine



Detecting missing print

Significant decrease in mounting space



Required mounting space is decreased to one-tenth.

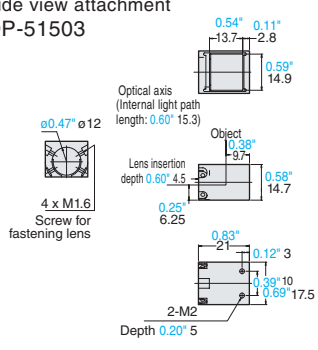
Detecting a wafer notch



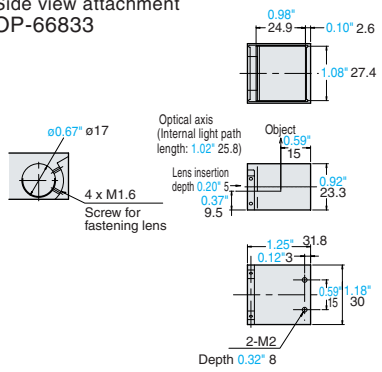
Collisions with moving mechanical components caused by the large size of conventional cameras can be eliminated.

Dimensions Unit: inch mm

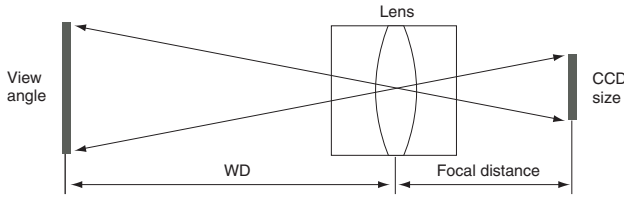
Side view attachment OP-51503



Side view attachment OP-66833

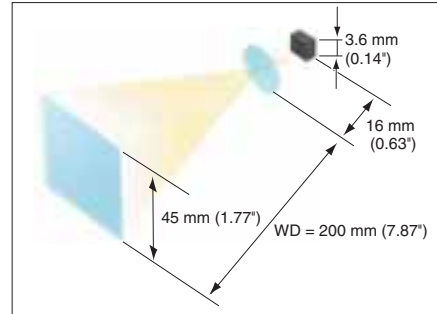


Focal distance and lens



The size of the WD and the view angle are determined by the focal distance and the CCD size. When NOT using a closeup ring, the following proportional expression can be applied.

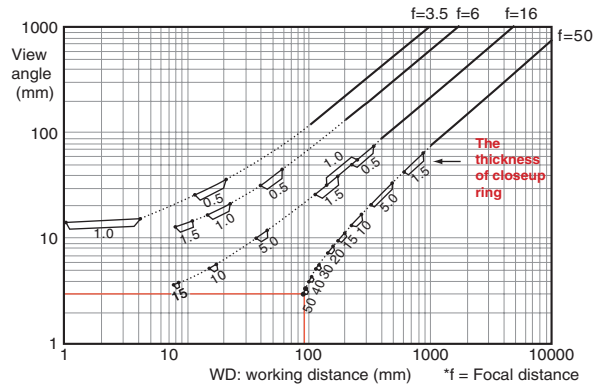
$$\frac{\text{Working Distance}}{\text{View angle}} = \frac{\text{Focal distance}}{\text{CCD}}$$



When the focal length is 16 mm (0.63") and the CCD size is 3.6 mm (0.14"), WD should be 200 mm (7.87") to make the view angle at 45 mm (1.77").

$$WD = 16 \times 45 / 3.6 = 200 \text{ mm (7.87")}$$

The graph on the left (visual field graph) shows the relationship between the focal distance, the working distance (WD), and the visual field. A suitable lens can be determined based on the intersection of WD and visual field. If an object is placed at a distance shorter than the minimum focal distance of the lens, attach a close up ring or spacer for a close shot. The solid lines between the dots in the visual field graph indicate the size of the close up ring.



When mounting a closeup ring of 50 mm (1.97") on a 50 mm (1.97") lens, you can capture an image with a view of 3 mm (0.12") at WD = 90 mm (3.54"). (Intersection of red lines)



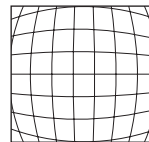
Distortion

What is distortion?

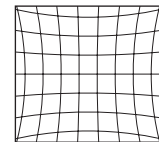
Distortion is the ratio of the change between the center and edge areas of a captured image. Due to the aberration of the lens, the distortion is more noticeable at the edges of a captured image. There are two types of distortion: barrel distortion and pincushion distortion. The general rule is that when the absolute value of the distortion value is smaller, the lens offers higher accuracy.

Reference: Distortion values

Barrel distortion

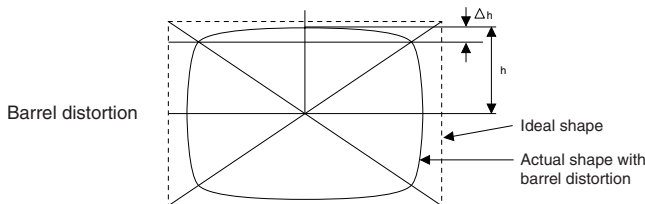


Pincushion distortion



Focal distance	CA-LH Series			Comparison with conventional models	Conventional lens		
8 mm/6 mm	CA-LH8	-0.28%	○	2.1 times higher accuracy	CV-L6	-0.60%	△
16 mm	CA-LH16	-0.10%	○	6 times higher accuracy	CV-L16(CV-LC16)	-0.60%	△
25 mm	CA-LH25	-0.02%	◎	—	—	—	—
50 mm	CA-LH50	-0.01%	◎	16 times higher accuracy	CV-L50	0.16%	△

* Typical values obtained with 1/3-inch CCD



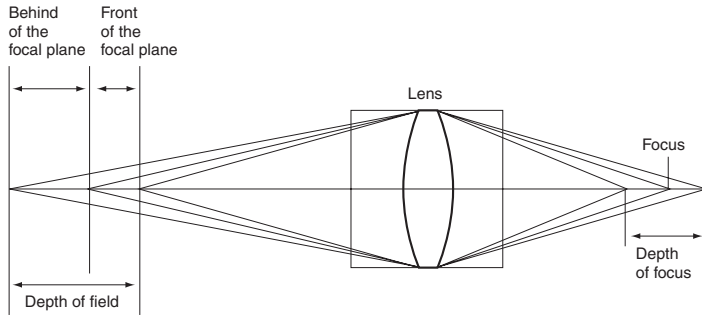
Calculating formula

$$TV \text{ distortion (Dtv)} = \Delta h / 2h \times 100 (\%)$$

A positive value of TV distortion indicates pincushion distortion and a negative value indicates barrel distortion.

Aperture diaphragm and depth of field

A depth of field is a range in which a lens can focus on objects. So, a lens with a large depth field can focus on a target which moves in the direction of the lens.



< Depth of field >

- (1) The shorter the focal distance, the larger the depth of field.
- (2) The longer the distance from the lens to the object, the larger the depth of field. Closeup rings and macro lenses make the depth of field smaller.
- (3) The smaller the aperture, the larger the depth of field. Small aperture and bright illumination make focusing easy.

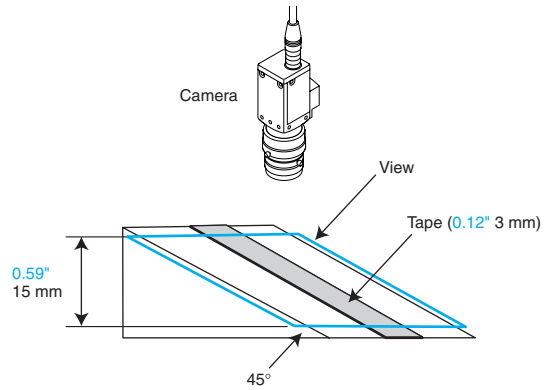
A camera is installed as shown in the illustration. A graduated tape that indicates the height is attached on a slope. In this condition, the pictures are taken for comparison of aperture.



When the aperture is closed (CA-LH25)



When the aperture is open (CA-LH25)



Protection filter



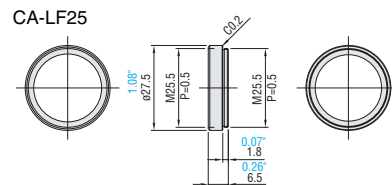
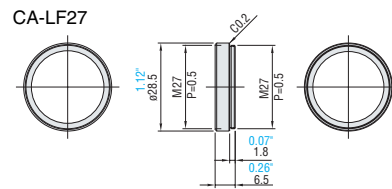
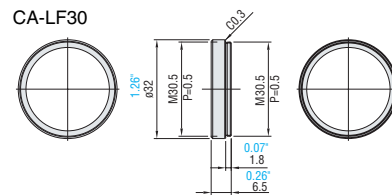
Name	Model	Compatible lens
Protection filter 25.5 mm 1.00"	CA-LF25	CA-LH16
Protection filter 25.5 mm 1.00"	CA-LF27	CA-LH8/CA-LH25/CA-LH50/ CV-L16/CA-LC16
Protection filter 30.5 mm 1.20"	CA-LF30	CV-L6/CV-L50/CA-LM0510

Features of lens protection filter

- ¥Prevents damage to the lens while maintenance is performed on the machine.
- ¥Since the cover is easily removed and cleaned, lens maintenance time is reduced.
- ¥Prevents machining swarf from damaging the lens.
- ¥Protects the lens from abrasive metal particles and oil/dirt.




* Polarization filter ▶ p.39

Dimensions Unit: inch mm







Monitors

Selection Guide

Model	Description	Resolution	CV-3000	CV-2100	Color	Page
CA-MP81 	8.4" LCD color Monitor	SVGA(800X600)	○	—	○	P.50
CA-MN81 	8.4" LCD color Monitor	NTSC(640X480)	—	○	○	P.50
CV-M30 	5.5" LCD color Monitor	NTSC(640X480)	—	○	○	P.51

Peripheral Equipment

Model	Description	Page	Model	Description	Page
CA-U2 	24VDC Power Supply Unit	P.52	CV-C 	Camera Cable	P.53
CA-S2040 	Camera Adjustment Stage	P.52	OTHER 	Other Peripherals	P.53

8.4" LCD Monitor CA-MP81/MN81



When mounted on the special stand

Ultra slim, space-saving design

Ultra slim design with a thickness of 40 mm facilitates installation on a control panel.

IP-65 rated environmental resistant specifications

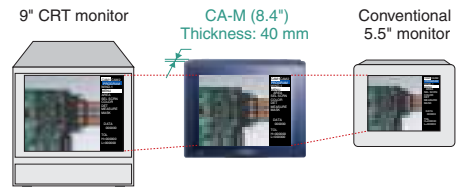
Environmental resistant specifications are provided for protecting the monitor from splashes of water or powder dust.

High-intensity and high-definition color TFT-LCD

The TFT active-matrix system is employed to realize a bright screen and high-definition display with 262,144 colors.

Wide range of mounting options

In addition to the options for panel-mounting, a special stand and pole-mounting bracket are also available for a wide variety of mounting styles.



Special stand with holes for locking screws



Pole-mounting bracket Enables installations on any round bars

Specifications

NTSC composite signal (1.0Vp-p,75Ω)

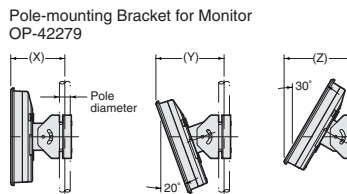
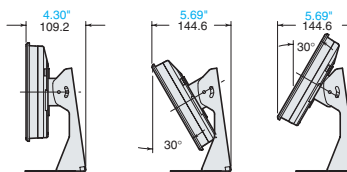
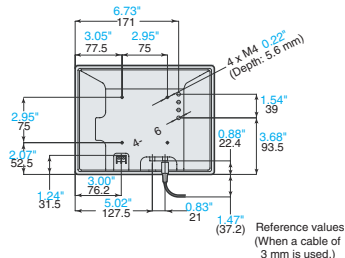
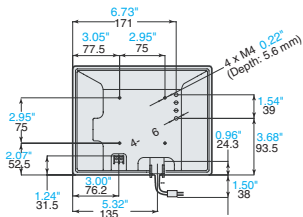
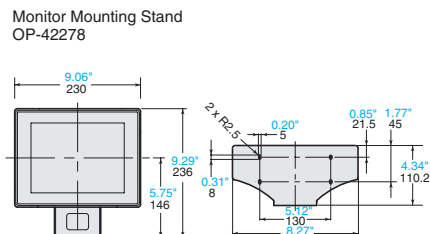
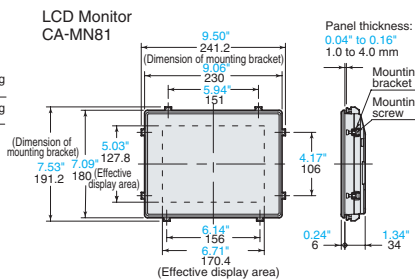
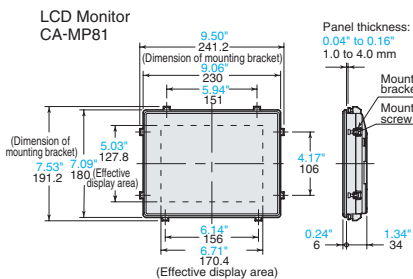


Model	CA-MP81	
Display panel	Display element	a-Si, TFT active matrix method
	Display color	262,144
	No. of dots	31.50" 800 (W) x 23.63" 600 (H) dots
	Active display area	6.71" 170.4 (W) x 5.03" 127.8 (H) mm
Backlight	Drive system	One-way cold cathode fluorescent tube
	Operating life	Approx. 50,000 hours (average) (When installed in an upright position under 25°C (77°F))
Input/Output	Input signal	Analog RGB signal (0.7 Vp-p, 75 Ω), Horizontal/vertical synchronization signal
	Input signal mode	31.50" 800 (W) x 23.63" 600 (H), Vertical frequency: 60 Hz
	Connector	High-density D-sub 15-pin female (3-way, inch screw)
Power supply voltage	24 VDC ±10%	
Current consumption	1 A max.	
Ambient temperature	0 to +40°C	
Relative humidity	35 to 85%	
Construction	Panel-mount type Only the front face is dust-proof and splashproof equivalent to IP65	
Weight	Approx. 1200 g	

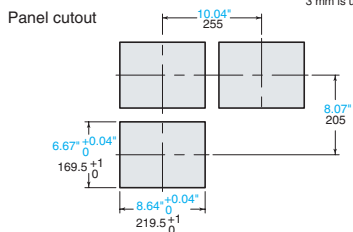
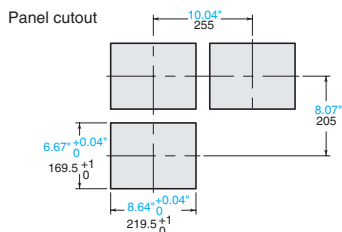
* Optional: Monitor cable (3M) OP-66842

Model	CA-MN81	
Display panel	Display element	a-Si, TFT active matrix method
	Display color	262,144
	No. of dots	31.50" 800 (W) x 23.63" 600 (H) dots NTSC signals are displayed on full screen by scaling.
	Active display area	6.71" 170.4 (W) x 5.03" 127.8 (H) mm
Backlight	Drive system	One-way cold cathode fluorescent tube
	Operating life	Approx. 50,000 hours (average) (When installed in an upright position under 25°C (77°F))
Input/Output	Input signal	NTSC composite signal (1.0Vp-p,75Ω)
	Connector	RCA pin-jack (1 each for In and Out)
Power supply voltage	24 VDC ±10%	
Current consumption	1 A max.	
Ambient temperature	0 to +40°C (32 to 104°F), No freezing	
Relative humidity	35 to 85%, No condensation	
Construction	Panel-mount type Only the front face is IP65-rated dustproof and splash-proof construction.	
Weight	Approx. 1200 g	

Dimensions Unit: inch mm



Pole diameter	X	Y	Z
ø20	3.90" / 99	4.72" / 120	5.28" / 134
ø30	4.09" / 104	4.96" / 126	5.47" / 139
ø40	4.29" / 109	5.16" / 131	5.67" / 144
ø50	4.45" / 113	5.31" / 135	5.87" / 149
20 ^D	3.94" / 100	5.00" / 127	5.35" / 136
30 ^D	4.13" / 105	4.80" / 122	5.67" / 140



5.5" LCD Color Monitor CV-M30

Specifications

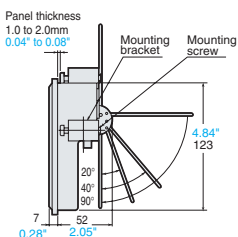
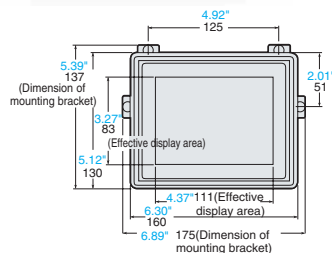


MODEL		CV-M30
LCD panel	Display screen size	5.5", 4.38" 111.36 (W) x 3.37" 85.52 (H)mm
	No. of dots	12.60" 320 (W) x 9.45" 240 (H)dots
	Display color	Full color
	Drive system	TFT active-matrix system
Video input	NTSC composite signal 1.0Vp-p 75Ω	
Power supply voltage	24 VDC ±10%	
Current consumption	700mA max.	
Ambient temperature	0 to +40°C (32 to +104°F), No condensation	
Relative humidity	35 to 85%, No condensation	
Weight	Approx. 570g	

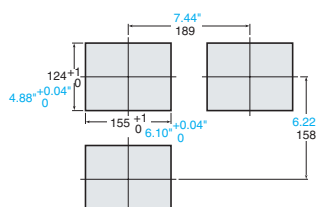


Dimensions Unit: inch mm

CV-M30



PANEL CUTOUT



24 VDC Power Supply Unit CA-U3



- *1: Specified with the rated input voltage (100 or 200 VAC) and 100% load applied.
- *2: Automatic recovery occurs after dropping. When output is interrupted, wait for 1 minute or longer after the input is turned off, and then turn on the input for recovery.
- *3: Output is cut off by an amplitude interrupting system. When output is interrupted, wait for 1 minute or longer after the input is turned off, and then turn on the input for recovery.

Specifications

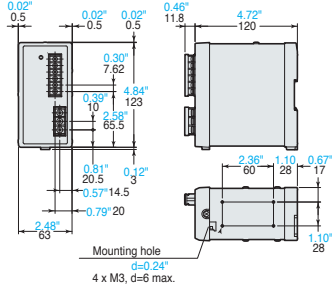


MODEL		CA-U3
Input conditions	Rated input voltage	100 to 240 VAC (±10%), 50/60 Hz
	Efficiency	78 to 80% (typical)
	Rated input current	2.1 A max.
	Power factor (100/200 VAC)	0.99/0.95 (typical) with maximum load applied
	Leakage current (100/200 VAC)	0.4/0.75 mA max.
	Rush current (100/200 VAC)	18/36 A max. (at 25°C cold start)
Output conditions	Overvoltage category	II
	Rated output voltage	24 VDC
	Rated output current	6.0 A (Total of 3 output terminals)
	Ripple/noise voltage	1% (p-p) max.
	Input fluctuation	0.4% max.
	Load fluctuation	0.7% max.
	Starting time (100/200 VAC)*1	1300/700 ms max.
Protection	Output holding time	20 ms min. (100 to 240 VAC)
	Overvoltage*2	Constant current drops or output is cut off at 7.9 A or higher.
	Overvoltage*3	Provided
Ambient temperature	-10 to +55°C (No freezing) (Refer to derating characteristics)	
Relative humidity	-20 to +70°C (No freezing)	
Pollution level	2	
Withstand voltage	3.0KVAC 50/60Hz/1min (Input-output) 2.0KVAC 50/60Hz/1min (Input-GND) 500VDC/1 min (Output-GND)	
Impact resistance	300 m/s ² , 2 times for each direction of 3 axes	
Vibration resistance	10 to 55 Hz, Double amplitude of 0.06~1.5 mm max.2 hours each in X, Y, and Z directions (9.8 m/s ² max. when mounted on a DIN-rail)	
Insulating resistance	100 MΩ min. at 500 VDC (Input-output) (Input-GND) (Output-GND)	
Safety standards	UL60950-1, UL508, CAN/CSA C-22.2 60950-1-3, EN60950, EN60950-1	
Noise terminal voltage	FCC part 15B class A, EN55011 class A	
Radiated interference field strength	FCC part 15B class A, EN55011 class A	
Limits for harmonic current emissions	Conforms to EN61000-3-2.	
Weight	Approx. 700 g	

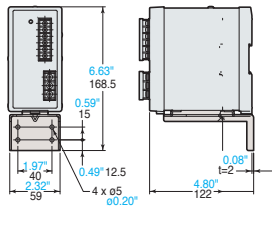
Dimensions

Unit: inch mm

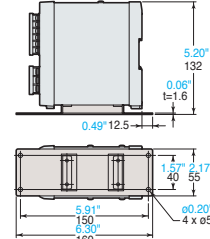
CA-U3



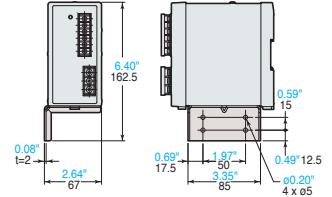
Front mounting (with OP-42174)



Bottom mounting (with OP-42175)



Side mounting (with OP-42176)



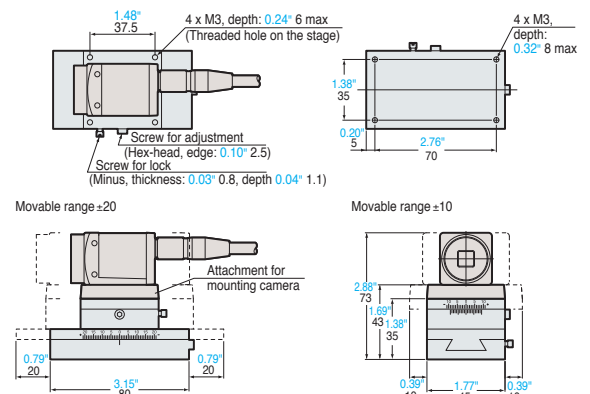
Camera Adjustment Stage CA-S2040

A compact and light XY stage mounted between the camera and the base. It allows easy, fine adjustment of the camera position when a high magnification lens is used.



Dimensions

Unit: inch mm



Specifications

MODEL		CA-S2040
Shift amount	Short axis	0.39" ±10 mm
	Long axis	0.79" ±20 mm
Scale display	Display resolution 1 mm (0.1 mm with a vernier scale)	
Thread pitch	0.7 mm/turn (both short and long axes)	
Maximum load	1.5 kgf	
Lock mechanism	Locking screw fixing, appropriate tightening torque: 30 cN·m	
Environmental resistance	Operating ambient temperature	0 to 50°C
	Operating ambient humidity	35 to 85% RH (No condensation)
Weight	250 g	

Camera Cable CV-C

High-flex camera cable

CV-C3R 9.8' (3 m)/
CV-C7R 23.0' (7 m)/
CV-C12R 39.4' (12 m)*



Camera cable

CV-C3 9.8' (3 m)/
CV-C10 33.0' (10 m)/
CV-C17 55.8' (17 m)/
OP-51499 3.3' (1 m)



L-Angled Cable

CV-C3L 9.8' (3 m)/
CV-C10L 33.0' (10 m)/
CV-C17L 55.8' (17 m)



NEW

High-Flex Camera Cable

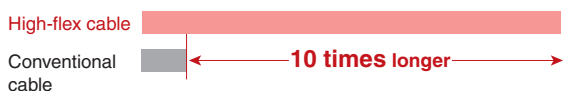
Ideal for connecting a camera to robots or other moving parts



Reliable for over 1million bend cycles.

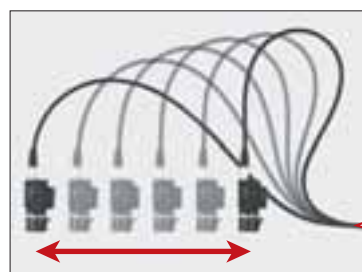
This high-flex cable broadens the current vast array of applications that the CV-2100 can be used for by allowing the camera to be mounted on robots or other moving parts.

A service life 10 times longer than that of conventional cables



No change in cable diameter

Re-engineering of the materials and structure has resulted in improved flexibility without increasing the cable diameter.



Reliable for over 1million bend cycles

* At a bend radius of 1.18" (30 mm) (typical data)

Specifications

Type	Model	CableLength(A)
Standard/ (L-Angle)	OP-51499	3.3' 1m
	CV-C3(L)	9.8' 3m
	CV-C10(L)	33.0' 10m
	CV-C17(L)	55.8' 17m
High-flex	CV-C3R	9.8' 3m
	CV-C7R	23.0' 7m
	CV-C12R*	39.4' 12m

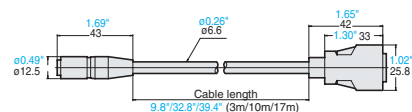
Applicable for CV-2100(camera:CV-020/022)

*Note: CV-C12R can be used for CV-2100(camera: CV-020) only

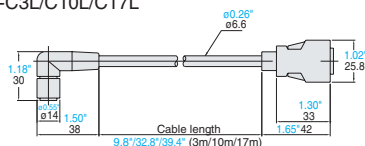
Dimensions

Unit: inch mm

CV-C3R/CV-C7R/CV-C12R



CV-C3L/C10L/C17L



Other

Monitor cable 9.8' (3 m)
OP-66842



Expansion I/O cable 9.8' (3 m) OP-51657



RS-232C communication cable 8.2' (2.5 m) OP-26487



Ethernet cable 9.8' (3 m) OP-66843



USB cable 8.2' (2 m) OP-66844



Communication cable conversion connector 9-pin: OP-26486 25-pin: OP-26485



Memory card 1GB CV-M1G 256MB GR-M256



ADDITIONAL USEFUL PRODUCTS

MERITS OF LASER MARKING

- It can clearly mark on curved, rough or soft objects.
- It minimizes shock, and does not damage products.
- It can mark small characters (less than 1 mm).
- It can mark on moving objects on high-speed production lines without stopping the line.

HIGH POWER LASER MARKER

ML-G9300 Series



- High power of 30 W output
- World's fastest making speed
- The horizontal marking head has an ultra-compact body with a total length of only 23.62" (60cm). A vertical type is also available. **Smallest in its class**

Harness



Material: Vinyl chloride (Color-developed)

PET bottle



Material: PET resin (Inscription)

COMPLETELY AIR-COOLED ULTRA-COMPACT LASER MARKER

MD-H9800 Series



- Environmental resistance
- Air-cooled method
- Clear marking equivalent to a 30 W water-cooled system

Light bulb



Bearing



Character size (Typical examples)

0123456789
ABCDEFGHIJKLMN O PQRSTU VWXYZ
abcdefghijklmnopqrstu vwxyz

Logo mark



bmp/jpg data



2D Code



Data Matrix



QR



MICRO QR

Bar code



CODE39



2 of 5



ITF

Arch/Angle alignment

0123456789ABCDEF G
0123456789ABCDEF G
0123456789

Specifications are subject to change without notice.

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