KEYENCE

NEW Machine Vision System/LED Illumination Unit
CV-700/CA-D

LED Illumination for Machine Vision
Selection Guide & Lighting Techniques

Clearly see targets that were not visible using conventional lighting

Lighting Techniques by Application

Field-proven Technique 1
Glossy/Plated surface

- Detecting defective plating of terminals 
- Detecting imprints on press-molded parts 

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Field-proven Technique 2
Low-contrast surface

- Detecting chips on rubber packaging 
- Differentiating between flat and uneven surfaces 

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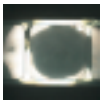
Field-proven Technique 3
Transparent surface

- Detecting the level of transparent liquid 
- Detecting transparent sheet width 

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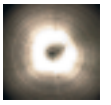
Field-proven Technique 4
Uneven/Curved surface

- Detecting print on aluminum packaging material 
- Detecting holes and mill scales on curved surfaces 

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Specifications, Dimensions & Options

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Controller/Power Supply

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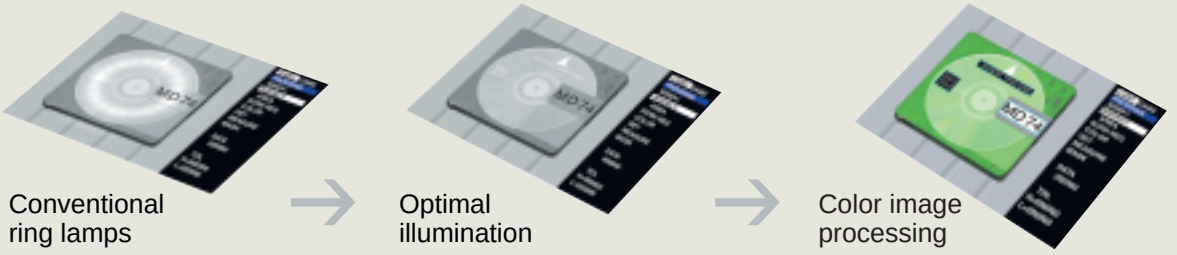
Image inspection techniques using a color vision system and LED illuminator

Selecting an optimal image sensor and proper lighting are the keys to successful image inspection.



Field-proven Technique 1

Detection of plating and imprinting on glossy surfaces

Indirect lighting eliminates glare and applies even illumination

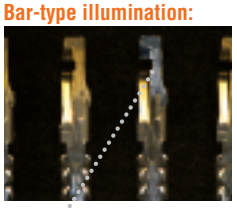
Detecting defective plating of terminals

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

Direct reflection:

Color differences are small due to variations in illumination.

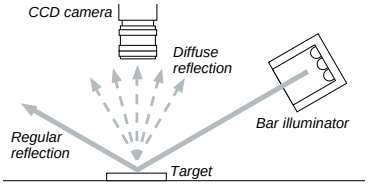
Bar-type illumination:



Illumination variations caused by the glossy surface are eliminated.

Lighting technique using bar-type

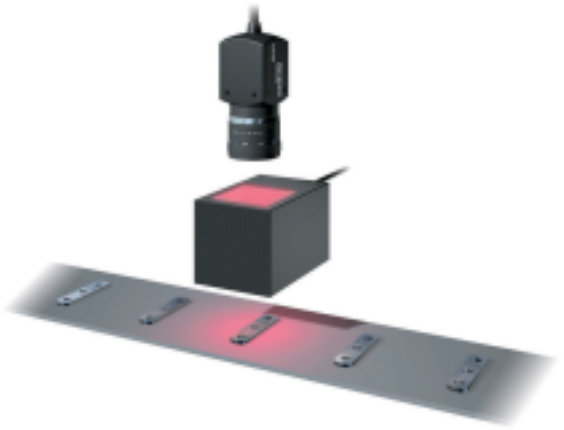
The bar-type illuminator applies uniform light on long targets. Applying the light from an angle creates diffuse reflection, enabling easy differentiation.
If the surface is very glossy, a polarizing filter is recommended.



Enhances the edge of the imprinting against the 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.



Direct reflection:

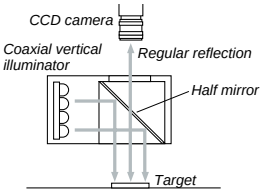
Imprint is unclear.

Coaxial vertical illumination:

The edge of the imprint is enhanced.

Lighting technique using coaxial vertical-type

The coaxial vertical-type 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.



Useful Tips

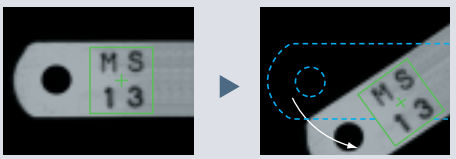
Color binary processing

Reliably detects only the color range of the target point. Enables reliable inspection of multi-color products and easily recognizes difficult color distinctions such as white/yellow and gold/silver.

Reliably extracts only the gold-plated area.

360° rotation adjustment function

Instantaneously adjusts for movement in target position and angle within the inspection window. Ensures continuous, reliable inspection of the same point even when targets appear in random positions.



Normal position

The inspection window adheres to the target.

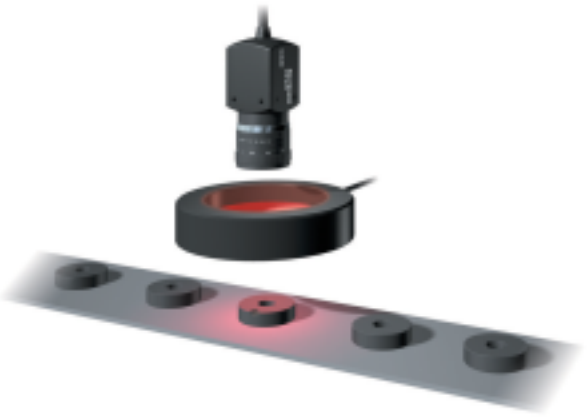
Field-proven Technique 2

Detection of defects on low-contrast surfaces

Sharpens the contrast of edges and uneven surfaces

Detecting chips on rubber packaging

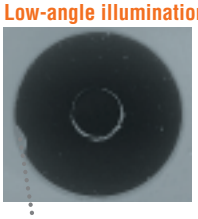
Detects minute defects such as chips on the perimeter edge, surface flaws, or deviations in thickness.



Direct reflection:

The chip on the perimeter cannot be detected.

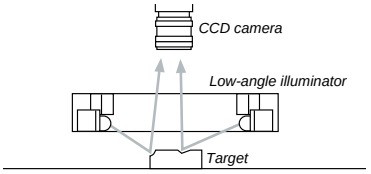
Low-angle illumination:



The chip on the edge is clearly differentiated in white.

Lighting technique using low-angle-type

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



Differentiates between flat and uneven surfaces

Detecting defects on the bottom of embossed tape cases

Detects defects such as crushed or ripped bottoms of the cases.

Direct reflection:

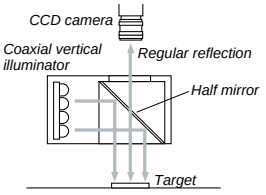
Detection is unstable due to inconsistent reflection.

Coaxial vertical illumination:

Only the defective areas are shaded.

Lighting technique using coaxial vertical-type

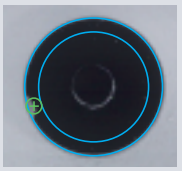
The coaxial vertical-type illuminator applies light on the same axis as the lens. The contrast between dark and bright parts is captured and differentiated by only allowing the regular reflection from the flat surface into the camera.



Useful Tips

STAIN Mode

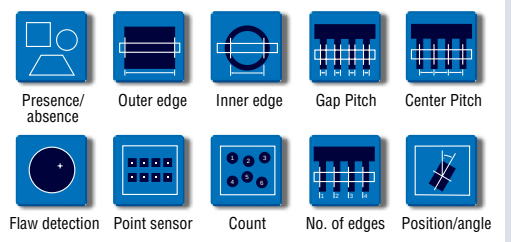
STAIN mode detects changes in contrast of adjacent pixels within the inspection area. This mode is suitable for detecting minute flaws and defects while being unaffected by the surface conditions and inconsistent illumination.



Reliably detects defects in random positions.

Inspection menus

The CV-700 comes pre-programmed with applications that can be selected via pull-down menus for simple setup.



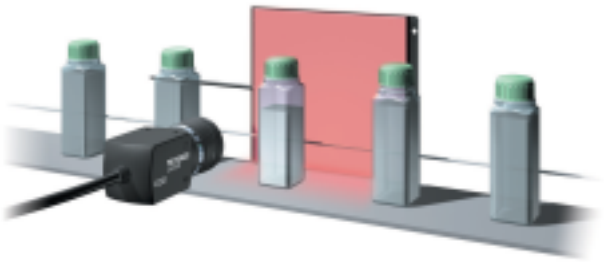
Field-proven Technique 3

Differentiation of size and shape of transparent objects

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.



Direct reflection:

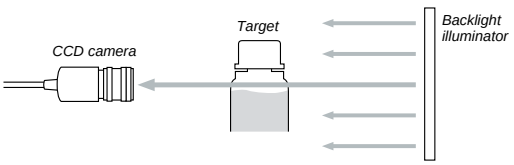
The light reflecting off the surface of the container creates interference.

Backlight illumination:

The liquid level is captured as a shaded edge.

Lighting technique using backlight-type

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

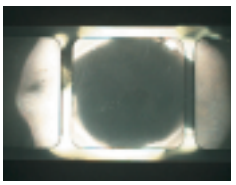


Recognizes the edge of a thin transparent film

Detecting transparent sheet width

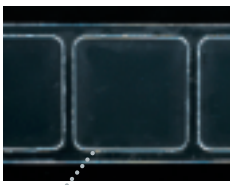
Detects the width of a thin transparent glass or plastic sheet.

Direct reflection:



The edges are unstable.

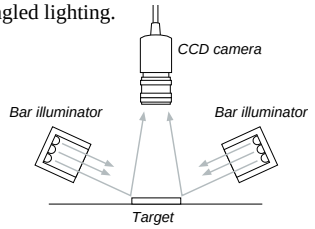
Bar illumination:



The edges are clearly illuminated.

Lighting technique using bar-type

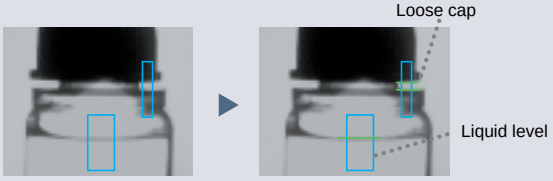
The bar-type illuminator allows the camera to capture and detect only the diffuse reflection of the edge generated by applying angled lighting.



Useful Tips

Easy-to-operate inspection menus

The CV-700 automatically recognizes edges by simply drawing an inspection window.

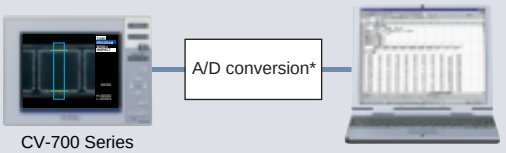


Draw inspection windows.

Edges are automatically recognized.

Analog output features

The CV-700 outputs measured values as an analog voltage (range of 0 to 4 V). This feature allows you to keep records of measurement and detection results in spreadsheet applications by connecting the CV-700 with a PC.



CV-700 Series

* A/D conversion software required.

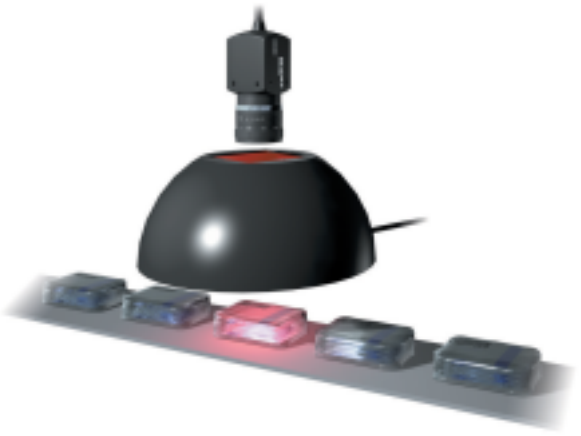
Field-proven Technique 4

Detection of print or stains on uneven or curved surfaces

Indirect light allows clear images without interference from hot spots

Detecting printing on aluminum packaging material

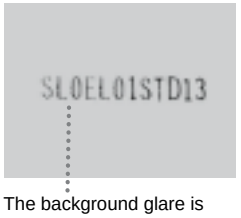
Detection is normally difficult or impossible due to the hot spots generated from surface irregularities or glare caused by the film sheet.



Direct reflection:

The light reflects irregularly, making recognition of the printing impossible.

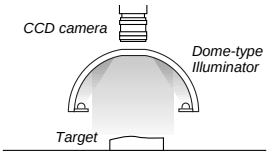
Dome illumination:



The background glare is eliminated and only the printing is visible.

Lighting technique using dome-type

The dome-type 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.

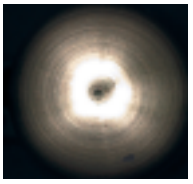


Uniform light allows for even illumination over a curved surface

Detecting holes and mill scales on a curved surface

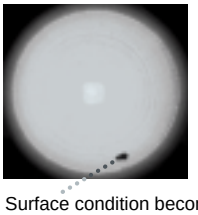
Detects the holes and traces of mill scales after processing die-cast parts.

Direct reflection:



Undesired variations in illumination are generated.

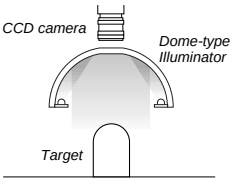
Dome illumination:



Surface condition becomes uniform, enabling the detection of defects.

Lighting technique using dome-types

The dome-type illuminator applies uniform irradiation to every point on the curved surface ensuring reliable detection. This eliminates surface glare normally caused by direct lighting.



Useful Tips

Inspection setting storage for 900 or more items

The CV-700 Series is the first in its class to feature a CompactFlash memory slot. Inspection settings for a large number of items can be stored on a memory card, simplifying programming for product changeovers.

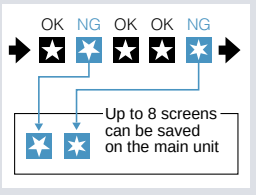
Maximum number of setting registrations

Main memory:
16 inspection settings
32 MB CompactFlash memory:
Approx. 100 inspection settings
256 MB CompactFlash memory:
Approx. 900 inspection settings

Screen-saving function to keep a record of defects

The CV-700 Series performs high-speed reading and saving of high-volume detection screens. Since the detection screens can be saved in bitmap format, the data can be used for preparing reports and documents.

Saving NG screens



Up to 1000 screens can be saved on a memory card

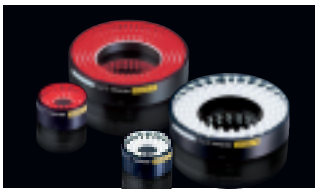
LED illumination unit

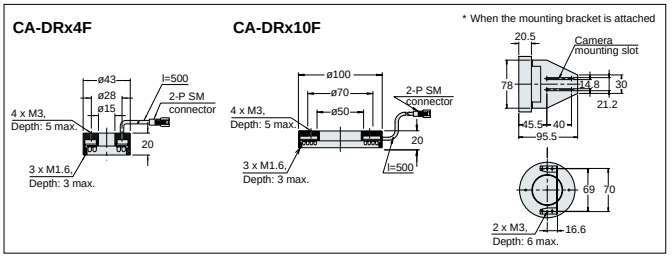
Unit: mm

Direct-ring type

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-DRR10F	Red	Approx. 90	8.3
CA-DRW10F	White	Approx. 80	7.9

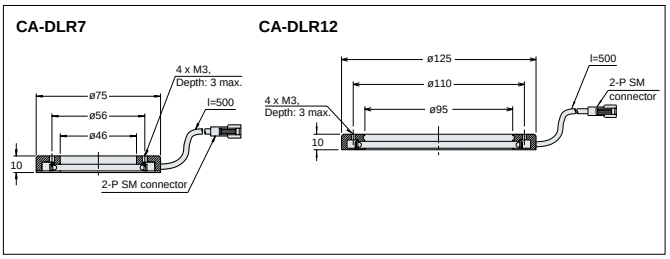




Low-angle type

CA-DL

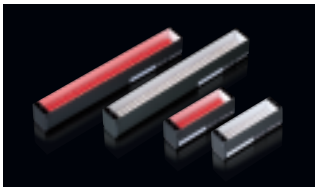
Model	LED color	Weight (g)	Power consumption (W)
CA-DLR7	Red	Approx. 40	2
CA-DLR12	Red	Approx. 80	7.7

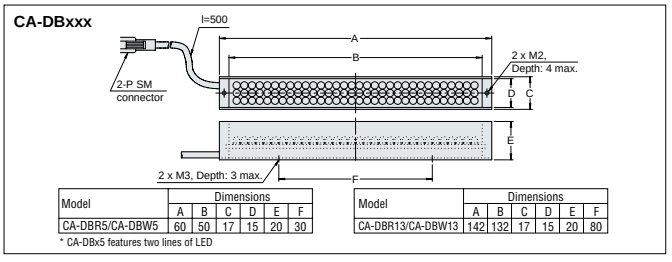


Bar type

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-DBR13	Red	Approx. 80	4.2
CA-DBW13	White	Approx. 90	7.3





Model	Dimensions					
	A	B	C	D	E	F
CA-DBR5/CA-DBW5	60	50	17	15	20	30

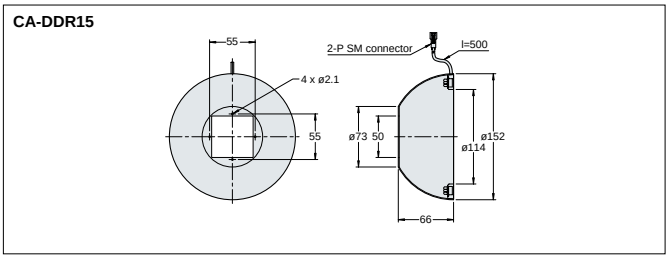
Model	Dimensions					
	A	B	C	D	E	F
CA-DBR13/CA-DBW13	142	132	17	15	20	80

* CA-DBx5 features two lines of LED

Dome type

CA-DD

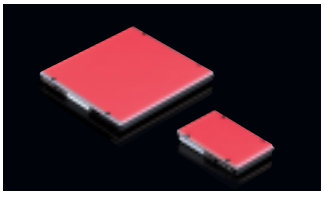
Model	LED color	Weight (g)	Power consumption (W)
CA-DDR15	Red	Approx. 130	11

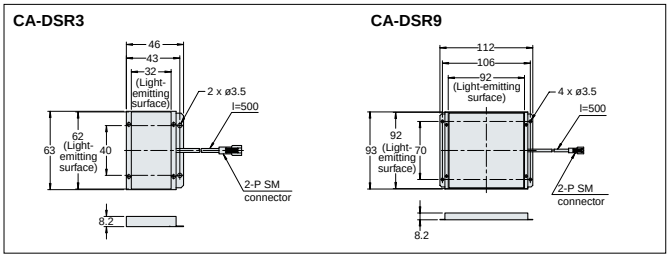


Backlight type

CA-DS

Model	LED color	Weight (g)	Power consumption (W)
CA-DSR3	Red	Approx. 40	3.6
CA-DSR9	Red	Approx. 110	14

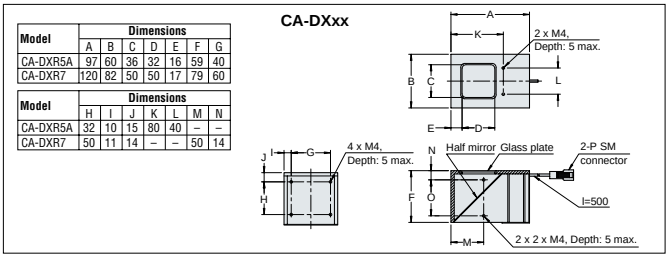




Coaxial vertical type

CA-DX

Model	LED color	Weight (g)	Power consumption (W)
CA-DXR5A	Red	Approx. 230	5
CA-DXR7	Red	Approx. 380	6.7



Model	Dimensions						
	A	B	C	D	E	F	G
CA-DXR5A	97	60	36	32	16	59	40
CA-DXR7	120	82	50	50	17	79	60

Model	Dimensions						
	H	I	J	K	L	M	N
CA-DXR5A	32	10	15	80	40	–	–
CA-DXR7	50	11	14	–	–	50	14

Options

Extension cable

Model	CA-D2	CA-D5
Cable length (m)	2	5

Diffuser

For LED reflection prevention

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

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

Polarizer

For glare prevention

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

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

LED Illumination Controller

CA-DC100

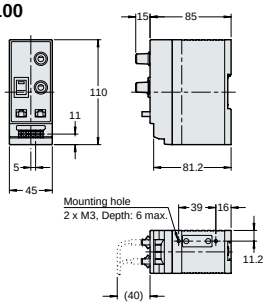
Designed for easy use in the field

- **High light-emitting frequency of 100 kHz**
  Ensures consistent image capture even under high-speed shutter settings on high-speed lines.
- **2-channel connection for a wide range of applications**
  Switching between two illuminators enables multiple inspections and 2-line inspections.
- **Limit function to extend LED life** Industry First
  Limits current flow through LEDs to prevent rapid deterioration.
- **DIN-rail mountable design** Industry First
- **Light adjustment trimmer for fine tuning**
- **External switching of ON/OFF status**

Dimensions

CA-DC100

Unit: mm



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
	Capacitance	30 W max. (20 W per channel)
Input		External control input (EXT), 2 contacts (non-voltage contact input)
Power supply voltage		24 VDC ±10%
Current consumption		1.8 A (under maximum load)
Ambient temperature		0 to +45°C
Relative humidity		35 to 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).

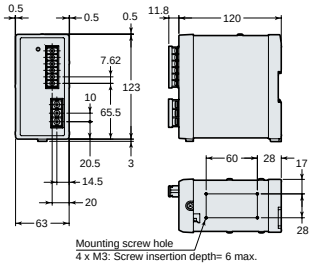
24 VDC Power Supply Unit

CA-U2

Dimensions

CA-U2

Unit: mm



Specifications

Model		CA-U2
Input conditions	Input voltage	100 to 240 VAC (±10%) 50/60 Hz
	Efficiency	78 to 80% (typical)
	Input current (100/200 VAC)	1.2 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 (77°F) cold start)
	Overvoltage category	II
Output conditions	Rated output voltage	24 VDC, Class2
	Rated output current	3.5 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 [1]	1500/1000 ms max.
	Output holding time	20 ms min. (100 to 240 VAC)
Protection	Overcurrent	Provided
	Overvoltage	Provided
Safety standards		UL60950, UL508, CAN/CSA C-22.2 60950-00, EN60950, EN50178
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

1. Specified with the rated input voltage (100 or 200 VAC) and 100% load applied.

Visit our website for other Keyence products at www.keyence.com

Specifications are subject to change without notice.

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