OMRON

3D Vision Sensor
FZD Series

A New Era of 3D Sensing

realizing

World's First
3D
Inline Image Sensing

We are pleased to introduce
the world’s first Vision Sensor
capable of inline measurement of 3D data.
OMRON’s unique advanced technology now makes it possible
to achieve accurate inline measurement
even with workpieces that come down
the production line at a variety of locations and angles.

World's First

3D Long-distance Camera

This camera has a field of view of 75 mm, a resolution of 0.1 mm, and a maximum installation distance of 2 m.
The resolution is not affected even if the camera is mounted at an angle, so assembled car body inspections can now be conducted using a single Sensor.

Hole Positions and Diameters

World's First

3D Space Calibration

By combining advanced 3D sensing technology with our own unique calibration technology, OMRON has succeeded in creating a high-speed 3D measurement system.
With 3D image sensing, workpieces with complex shapes that cannot be laid horizontally can now be measured easily using calculations based on space coordinates.

Gaps and Bumps

World's First

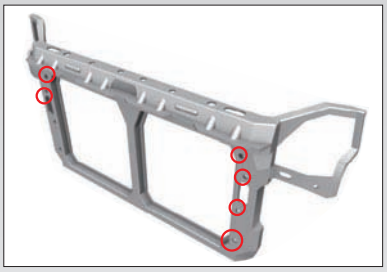
3D Measurement Algorithm

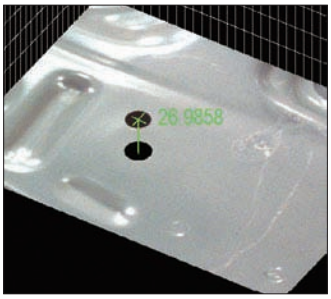
3D image sensing makes it possible to instantaneously measure length, width, and height inline without stopping the production line. Moreover, multiple locations can be measured simultaneously within a single visual field.

REAL 3D Measurement from Parts t

Modular Composite Parts

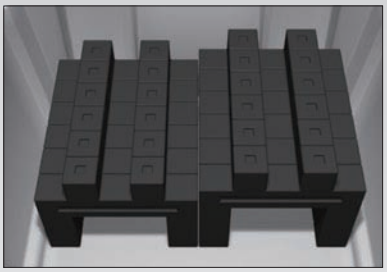
Hole Position and Diameter Inspections

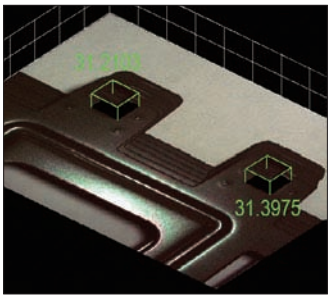




Hole positions and diameters can be measured accurately even for parts with complex shapes that cannot be laid horizontally.
Subtle differences in hole location or diameter can be measured instantaneously, so accurate discrimination is possible even with modular parts of similar shapes.
This sensing system is also perfect for pre-shipping inspections.

Part Selection



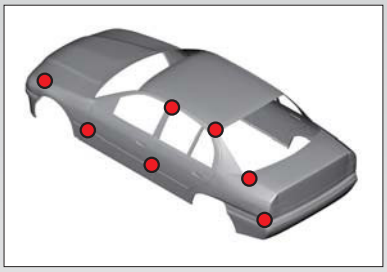


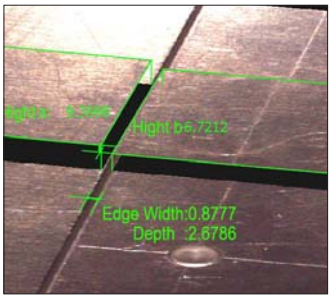
This application enables a robot to select desired part from the parts lined up in a box. The FZD Sensor can automatically calculate the heights within the designed measurement region.
Even if the parts have no distinctive characteristics, such as surface irregularities or patterns, the Sensor can use custom pattern illumination to accurately determine the heights.

o Finished Goods

Assembly and Finished Products

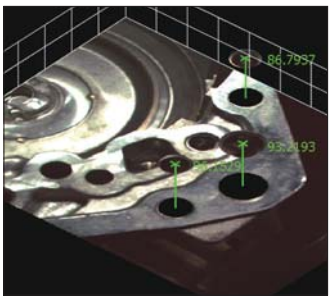
Gap and Bump Inspections





Gaps and bumps between edges can be measured simultaneously. Moreover, multiple locations within the same field of vision can also be measured simultaneously.
3D edge detection has reached a new level of stability thanks to real color processing. Even for workpieces with edges that are difficult to detect, the use of 3D sensing in combination with custom pattern illumination enables accurate detection of gaps and bumps.

Part Orientation Measurement: Hole Positions



OMRON's unique EC algorithm makes it possible to search for hole positions regardless of the background.
By analyzing 3-point position data (X, Y, Z), the part's orientation (θ, ϕ, ψ) can be determined.
It can also be used with a robot for picking work.

REAL 3D Sensing Technology That's

A variety of functions have been added to make 3D sensing technology commercially applicable.
All of OMRON's image processing technologies have been crystallized into this new Sensor.

Installation

3D measurement requires the use of two cameras, just like people need two eyes.

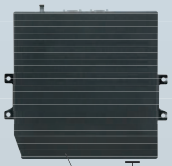
World's First

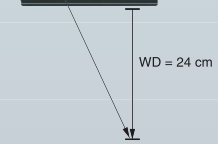
3D Vision Camera System

Introducing a new camera system that allows for the easy installation of two Cameras. In our Integrated Camera, two Cameras are mounted inside the same housing, so all you have to do is install a single unit. Also available are Separate Cameras that can be used simply by attaching two of them to a single Camera Base Plate.

Choose your Camera depending on the installation distance

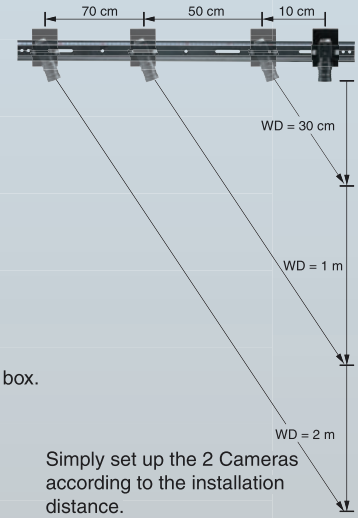
(Installation distances of 24 cm or less)
Integrated Camera





OMRON takes care of the calibration prior to shipment. It's ready to install out of the box.

(Installation distances up to 2m)
Separate Cameras



Simply set up the 2 Cameras according to the installation distance.

World's First

High-luminance Pattern Lighting

OMRON has developed a 3-W miniature high-intensity LED that can be used even at a work distance of 2 m. When edges are difficult to distinguish on the image, Line Pattern LED Lighting is used, and when the height of objects without feature points is required, our Custom Pattern Lighting provides powerful support for high-luminance 3D measurement.

s Practical to Use

Settings

Coordinates from images obtained from the two Cameras are combined to generate 3D coordinates. The synchronization of these coordinates is referred to as “Calibration.”
The more precise the calibration, the more accurate the 3D measurements.

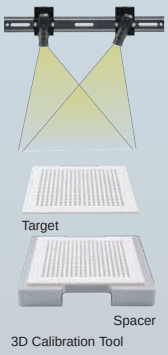
World’s First

3D Calibration

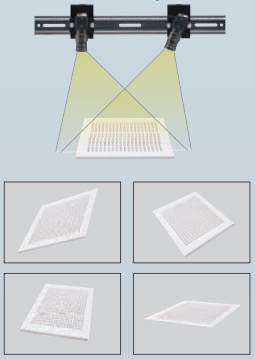
This Sensor features the world’s most advanced calibration technology. Our calibration resolution (0.025 mm) is the highest in the world, and enables precise 3D measurement. What is more, the settings are quite simple. The functions of this Sensor allow it to be used in any work environment.

Calibration Method

Target placed horizontally



Targets that can’t be placed on a reference plane

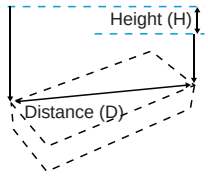


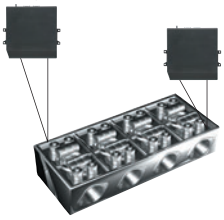
Obtain images from near and distant perspectives.
Place calibration target on reference plane and capture first image. Then place a spacer underneath the calibration target and obtain a second image. That’s all there is to it, only two images are needed to complete the calibration.

Capture 10 rough images.
This is the first technology in the world to make it possible to complete the calibration by simply holding up the calibration target by hand and capturing images from 5 different directions and 2 different heights (a total of 10 images).

Compatible with World Coordinates

World coordinates are needed for systems using robots for picking, or for measurement of two different locations on large-sized parts. This new Sensor system is, of course, compatible with these types of coordinate conversions.





This calibration technology makes use of techniques developed by 3D MEDiA Co., Ltd.

Measurement

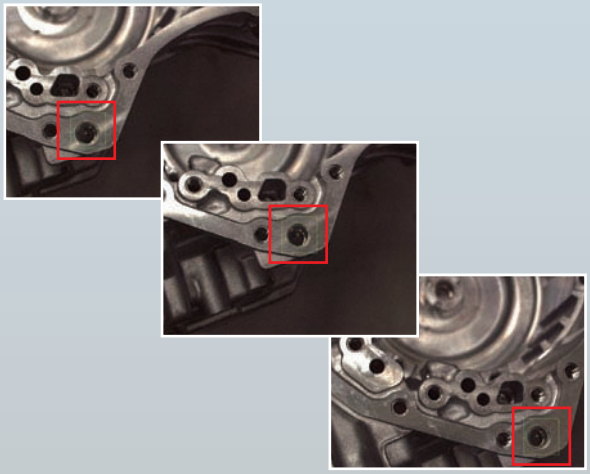
The actual 3D shape of the workpiece is measured.

World’s First

Simultaneous 2D and 3D Measurement

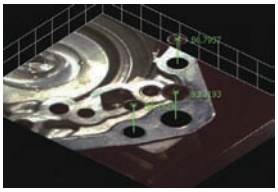
2D and 3D image processing can be carried out simultaneously using a single Controller.
For example, inspections for the presence of specified marks, or for surface scratches and dirt, can be conducted in 2D mode, while using 3D processing to determine the XYZ coordinates of hole positions.
Also, because 3D measurements can be made after compensating for position displacement using 2D processing, measurement results are more stable than with laser displacement sensors, even when position determination is rough.

Measurements can be made after compensating for position displacement.



3D Graphic Displays

It is possible to display measurement results, text, or figures in 3D format in the image display area. Even on a 2D monitor, one can tell at a glance what segment is being measured, so the system can be used with confidence at the worksite.



Basic Configuration

Controllers

Controller Integrated with LCD

FZD-500-10/FZD-505-10

Touch Pen (accessory)

Box-type Controller

FZD-550-10/FZD-555-10

LCD Monitor

FZ-M08

Monitor Cable

FZ-VM

Input Devices

Mouse or Trackball (commercially available devices with USB interface)

Camera Cable

Camera Cable	FZ-VS
Bend-resistant Camera Cable	FZ-VSB
Right-angle Camera Cable	FZ-VSL
Long-distance Camera Cable	FZ-VS2
Long-distance Right-angle Camera Cable	FZ-VSL2

(Two Cables required.)

Cameras

Integrated Camera

3D Vision Camera
FZD-STC2M

Separate Cameras

3D Camera Base Plate
FZD-CBS
FZD-CBM
FZD-CBL

Digital Camera
FZ-SC2M/FZ-S2M

(Two Cameras of the same model are required.)

High-resolution, low-distortion Lenses
FZ-LEH Series

3D Calibration Tool

FZD-CAL

Illumination

High-luminance Pattern Lighting
FZD-LTW
FZD-LTPW

CCTV Lenses
3Z4S-LE Series

Note: The Intelligent Camera and Autofocus Camera can be connected for 2D measurements.

CCTV Lenses

For High-luminance Pattern Lighting

Model

Lens model	3Z4S-LE SV-5018V	3Z4S-LE SV-7527V	3Z4S-LE SV-10035V
Appearance			
Focal length	50 mm	75 mm	100 mm
Brightness	F1.8	F2.7	F3.5
Filter size	M30.5 P0.5	M30.5 P0.5	M30.5 P0.5

Extension Tubes

Model	3Z4S-LE SV-EXR
Contents	Set of 7 tubes (40 mm, 20 mm, 10 mm, 5 mm, 2.0 mm, 1.0 mm, and 0.5 mm) Maximum outer diameter: 30 mm dia.

■ Precautions

- Do not use the 0.5-mm, 1.0-mm, and 2.0-mm Extension Tubes attached to each other. Since these Extension Tubes are placed over the threaded section of the Lens or other Extension Tube, the connection may loosen when more than one 0.5-mm, 1.0-mm or 2.0-mm Extension Tube are used together.
- Reinforcement is required to protect against vibration when Extension Tubes exceeding 30 mm are used.

High-resolution, Low-distortion Lenses

Model

Lens model	3Z4S-LE SV-0614H	3Z4S-LE SV-0814H	3Z4S-LE SV-1214H	3Z4S-LE SV-1614H	3Z4S-LE SV-2514H	3Z4S-LE SV-3514H	3Z4S-LE SV-5014H	3Z4S-LE SV-7525H	3Z4S-LE SV-10028H
Appearance									
Focal length	6 mm	8 mm	12 mm	16 mm	25 mm	35 mm	50 mm	75 mm	100 mm
Brightness	F1.4	F1.4	F1.4	F1.4	F1.4	F1.4	F1.4	F2.5	F2.8
Filter size	M40.5 P0.5	M35.5 P0.5	M27.0 P0.5	M27.0 P0.5	M27.0 P0.5	M35.5 P0.5	M40.5 P0.5	M34.0 P0.5	M37.5 P0.5

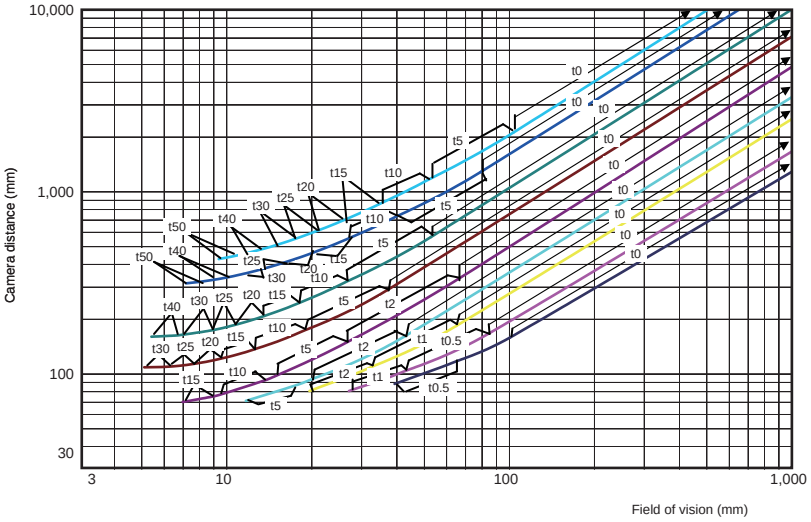
Ordering Information

Item		Description	Model	Remarks
Controllers	Controller Integrated with LCD	NPN	FZD-500-10	---
		PNP	FZD-505-10	
	Box-type Controller	NPN	FZD-550-10	
		PNP	FZD-555-10	
Cameras	3D Vision Camera	Color	FZD-STC2M	Integrated Camera (installation distance: 24 cm max.)
	Digital Camera	Monochrome	FZ-S2M	2-million-pixels (lens required)
		Color	FZ-SC2M	2-million-pixels (lens required)
3D Camera Base Plate		Short-distance Version	FZD-CBS	Installation distance of up to 30 cm
		Medium-distance Version	FZD-CBM	Installation distance of 30 cm to 1 m
		Long-distance Version	FZD-CBL	Installation distance of 1 m to 2 m
Lenses	High-resolution, Low-distortion Lenses		3Z4S-LE SV-0614H/SV-0814H/SV-1214H/ SV-1614H/SV-2514H/SV-3514H/SV-5014H/ SV-7525H/SV-10028H	For 2-million-pixel camera
	CCTV Lenses		3Z4S-LE Series	For High-luminance Pattern Lighting
3D Calibration Tool			FZD-CAL	---
High-luminance lighting	Line pattern		FZD-LTW	White LEDs
	Custom pattern		FZD-LTPW	White LEDs
Cable	Camera Cable		FZ-VS	Cable length: 2 m, 5 m, or 10 m
	Bend-resistant Camera Cable		FZ-VSB	Cable length: 2 m, 5 m, or 10 m (See note 2.)
	Right-angle Camera Cable (See note 1.)		FZ-VSL	Cable length: 2 m, 5 m, or 10 m
	Long-distance Camera Cable		FZ-VS2	Cable length: 15 m
	Long-distance Right-angle Camera Cable		FZ-VSL2	Cable length: 15 m
	Cable Extension Unit		FZ-VSJ	Up to two Extension Units and three Cables can be connected. (Maximum cable length: 45 m (See note 3.))
	Monitor Cable		FZ-VM	Cable length: 2 m or 5 m
	Parallel Cable		FZ-VP	Cable length: 2 m or 5 m
Peripheral Devices	LCD Monitor		FZ-M08	For Box-type Controllers
	USB Memory	2 GB	FZ-MEM2G	Capacity: 2 GB
		8 GB	FZ-MEM8G	Capacity: 8 GB
	VESA attachment		FZ-VESA	For installing Controller Integrated with LCD
	Desktop Stand		FZ-DS	For installing Controller Integrated with LCD
Mouse			---	Recommended Products (Optical Mouse) • Microsoft Corporation: Compact Optical Mouse, U81 Series
External Lighting			3Z4S-LT series	---
Strobe Controller (for FZ Series Vision Sensors)			3Z4S-LT MLEK-C100E1TS2	• Required when using a Separate Camera and High-luminance Pattern Lighting. • Required when controlling the 3Z4L-LT External Lighting with the Controller.

Note:
1. This Cable has an L-shaped connector on the Camera end.
2. The 10-m Cable cannot be connected to the FZD-STC2M or FZ-S□2M.
3. The maximum cable length depends on the Camera being connected, and the model and length of the Cable being used.

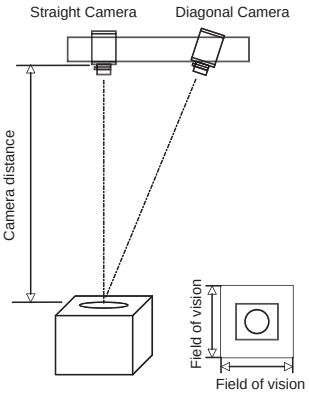
Optical Chart

Standalone Digital Camera



Meaning of Optical Chart

Select a lens for the Straight Camera according to the field of vision and camera installation distance.
Fit the Diagonal Camera with the same lens as the Straight Camera.



Ratings and Specifications

Controllers

Model			
	NPN Output	FZD-500-10	FZD-550-10
	PNP Output	FZD-505-10	FZD-555-10
Connected Camera		FZD-STC2M, FZ-S2M, FZ-SC2M, FZ-S, or FZ-SC	
No. of Cameras		4 Cameras (Two Integrated Cameras)	
Processing resolution		1,600 × 1,200 (H × V) (When connected to a 2-million-pixel Camera)	
No. of scenes		32	
Number of logged images (See note 1.)		With Two Cameras (one Integrated Camera) connected: 19, With Four Cameras (two Integrated Cameras) connected: 9	
Operation		Touch pen, mouse, etc.	Mouse or similar device
Settings		Create series of processing steps by editing the flowchart (Help messages provided).	
Serial communications		RS-232C/422: 1 channel	
Network communications		Ethernet 100BASE-TX/10BASE-T	
Parallel I/O		11 inputs (RESET, STEP, DSA, and DI 0 to 7), 26 outputs (RUN, BUSY, GATE, OR, READY, ERROR, STGOUT 0 to 3, and DO 0 to 15)	
Monitor interface		Integrated Controller and LCD 12.1 inch TFT color LCD (Resolution: XGA 1,024 × 768 dots)	Analog RGB video output, 1 channel (Resolution: XGA 1,024 × 768 dots)
USB interface		4 channels (supports USB 1.1 and 2.0)	
Power supply voltage		20.4 to 26.4 VDC	
Current consumption	Connected to FZD-STC2M	4.9 A max.	
	Connected to FZ-S□2M		
Ambient temperature range		Operating: 0 to 45°C, 0 to 50°C (See note 2.), Storage: −20 to 65°C (with no icing or condensation)	
Ambient humidity range		Operating and storage: 35% to 85% (with no condensation)	
Weight		Approx. 3.4 kg	Approx. 1.9 kg
Accessories		Touch pen (one, inside the front panel), Please Read First, Instruction Manual (Setup), 6 mounting brackets	Please Read First, Instruction Manual (Setup)

Note:
1: The number of logged images will vary when connecting multiple Cameras with different models.
2: The operating mode can be switched from the Controller Menu settings.

Cameras

	FZD-STC2M	FZ-S2M	FZ-SC2M
Measurements	3D measurements	3D and 2D measurements	
Image elements	Interline transfer reading all pixels, 1/1.8-inch CCD image elements		
Color/Monochrome	Color	Monochrome	Color
Effective pixels	1600 × 1200 (H × V)		
Pixel size	4.4 × 4.4 μm		
Shutter function	Electronic shutter; select shutter speeds from 1/10 to 1/50,000 s		
Partial function	12 to 1200 lines		
Frame rate (image read time)	30 fps (33.3 ms)		
Field of vision	84.8 mm (See note 1.)	Select a lens according to the field of vision and installation distance.	
Installation distance	240 mm		
XYZ measurement precision	±0.1 mm (See note 2.)	---	
Ambient temperature range	Operating: 0 to 40°C, Storage: −25 to 65°C (with no icing or condensation)		
Ambient humidity range	Operating and storage: 35% to 85% (with no condensation)		
Weight	Approx. 1.3 kg	Approx. 76 g	
Accessories	Instruction Sheet		

Note:
1: Tolerance: ±5% max. The vertical field of vision of camera 0 at an installation distance of 240 mm.
2: When 3D calibration is performed with an OMRON standard target and measurements are taken using the same environment (reference value).

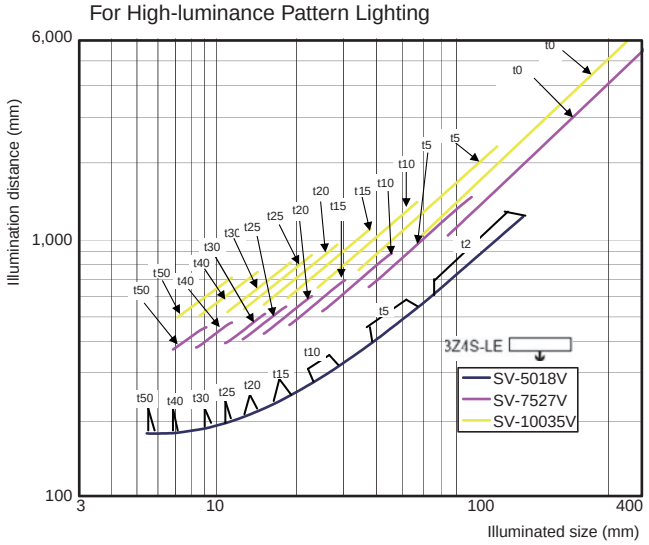
High-luminance Pattern Lighting

	FZD-LTW	FZD-LTPW
Power consumption	11 W	
Ambient temperature range	Operating: 0 to 50°C, Storage: −25 to 60°C (with no icing or condensation)	
Ambient humidity range	Operating and storage: 35% to 85% (with no condensation)	
Installation distance	Select the CCTV lens according to the field of vision and installation distance (See note 1).	
LED Class (See note 2.) (light section)	Class 2	
Weight	Approx. 470 g (Including installation base)	
Accessories	Instruction Sheet, Two base set screws, One LED warning label (for IEC), hexagonal wrench.	

Note:
1: Refer to *Optical Chart*.
2: Applicable standards: JIS C6802：2005
IEC 60825-1:1993 + A1:1997 + A2:2001,
EN 60825-1:1994 + A1:2002 + A2:2001.

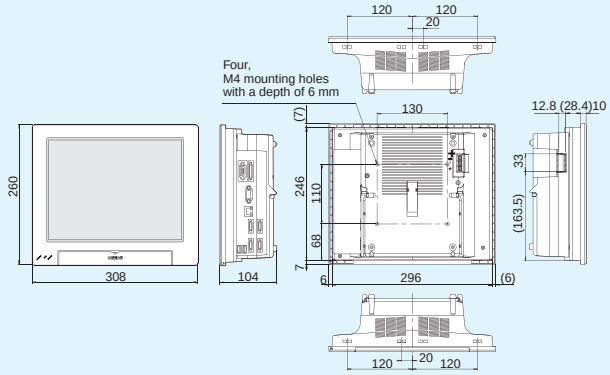
Optical Chart

For High-luminance Pattern Lighting

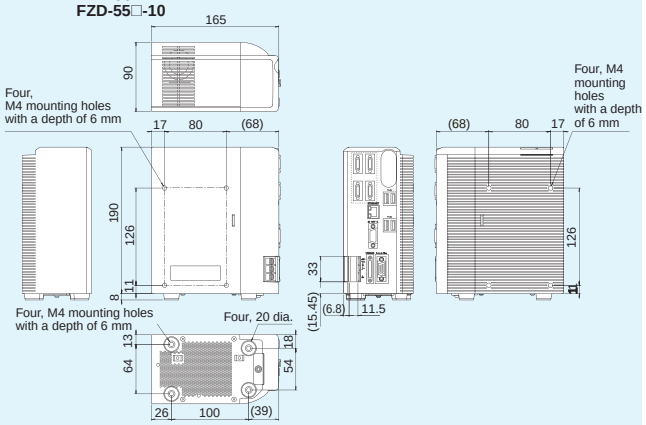


Dimensions (Unit: mm)

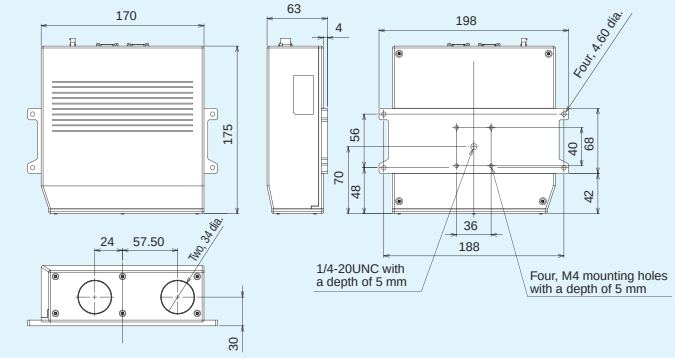
Controller Integrated with LCD
FZD-50□-10



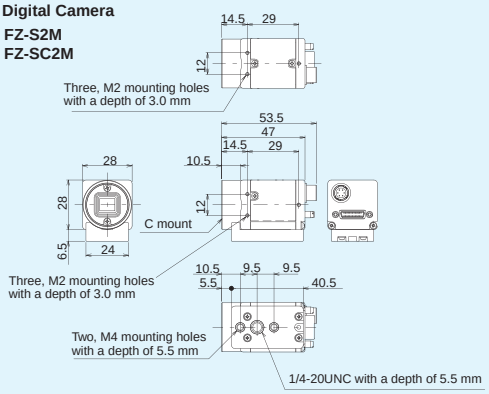
Box-type Controller
FZD-55□-10



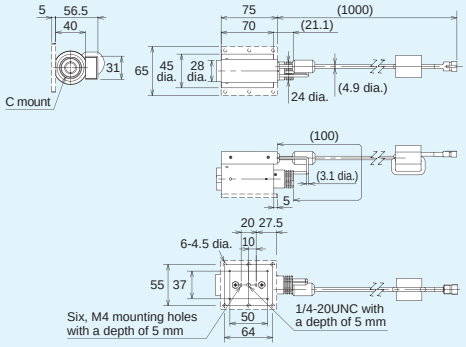
3D Vision Camera
FZD-STC2M



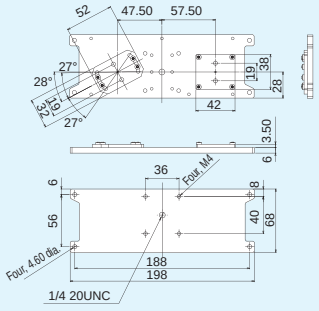
Digital Camera
FZ-S2M
FZ-SC2M



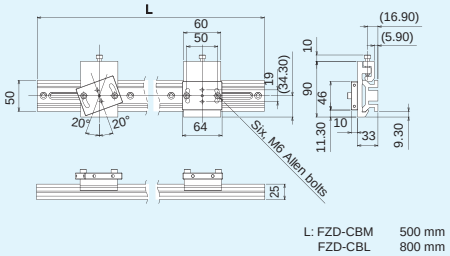
High-luminance Pattern Lighting
FZD-LTW/LTPW



3D Camera Base Plate
FZD-CBS



FZD-CBM/CBL



L: FZD-CBM 500 mm
FZD-CBL 800 mm

Note: For information on LCD Monitor specifications and dimensions, refer to the *FZ2 Series Catalog* (Cat. No. Q155).

This document provides information mainly for selecting suitable models. Please read the *User's Manual* (Z275) carefully for information that the user must understand and accept before purchase, including information on warranty, limitations of liability, and precautions.

OMRON Corporation
Industrial Automation Company
Sensing Devices Division H.Q.
Application Sensors Division
Shiokoji Horikawa, Shimogyo-ku,
Kyoto, 600-8530 Japan
Tel: (81) 75-344-7068/Fax: (81) 75-344-7107

Regional Headquarters
OMRON EUROPE B.V.
Sensor Business Unit
Carl-Benz-Str. 4, D-71154 Nufringen,
Germany
Tel: (49) 7032-811-0/Fax: (49) 7032-811-199

OMRON ELECTRONICS LLC
One Commerce Drive Schaumburg,
IL 60173-5302 U.S.A.
Tel: (1) 847-843-7900/Fax: (1) 847-843-7787

OMRON ASIA PACIFIC PTE. LTD.
No. 438A Alexandra Road # 05-05/08 (Lobby 2),
Alexandra Technopark, Singapore 119967
Tel: (65) 6835-3011/Fax: (65) 6835-2711

OMRON (CHINA) CO., LTD.
Room 2211, Bank of China Tower,
200 Yin Cheng Zhong Road,
PuDong New Area, Shanghai, 200120, China
Tel: (86) 21-5037-2222/Fax: (86) 21-5037-2200

Authorized Distributor:

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