OMRON

Vision Sensors for Pick & Place

FZM1-series

High speed and Precise Positioning

EtherCAT®

» High-speed Processing

» Superior Detection Stability

» Easy Set-up of Connectivity and Quick Startup

realizing

Vision - tailored for pick & place

The Omron Vision Sensor FZM1 is optimized to detect in high speed and high accuracy the position and orientation of any object inside a machine. This helps to increase the production efficiency.

New generation image processing technologies and an intuitive user interface optimized for positioning applications. High speed communication via EtherCAT or UDP enables an easy interworking with motion components from Omron and other vendors. This increases the overall performance from positioning through control.

Precise

Increased Yield

Stable inspections under challenging environmental conditions. Increase productivity and don't care about:
- differences of the work piece
- dust and dirt
- changing ambient environment

Easy

Reduce the cost of operation

Omron FZM1 does not require troublesome configuration and calculation for positioning. Interactive menus and automatic calculations enable an easy setup for the connection to motion devices.

Fast
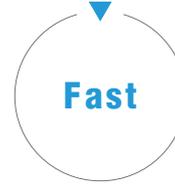
Increased Throughput

High speed image acquisition and processing optimized for positioning tasks is supported by FZM1. This enables non-stop, undelayed positioning, which means Vision is not limiting anymore, the overall production speed.
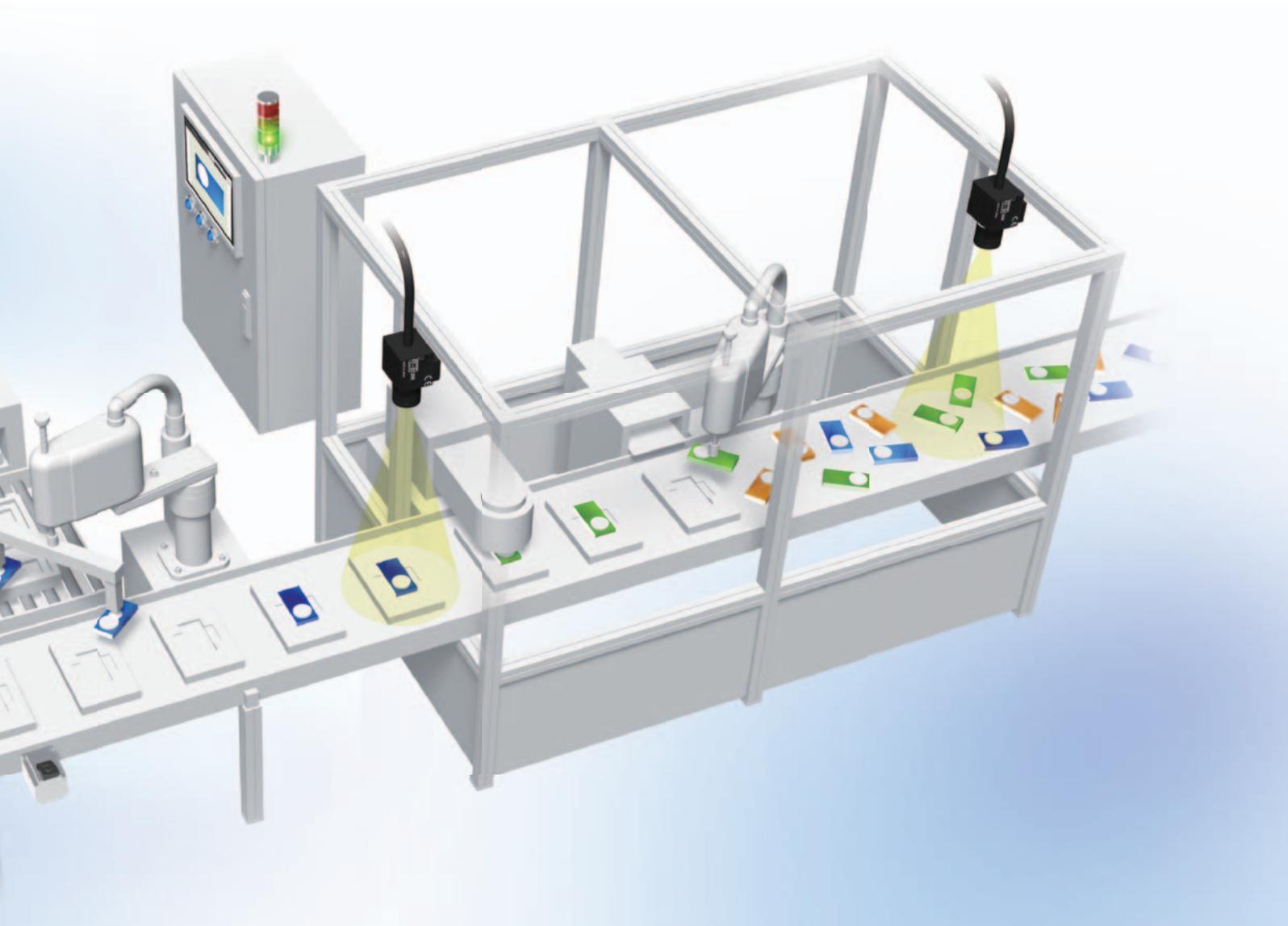
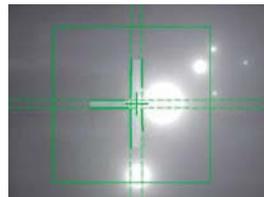# Stable Measurements Under Changing Conditions

More-robust operation means less stopping for detection mistakes and increased yield. This more than meets on-site needs and increases system performance.

Resists Light Interference

Resists Fluctuations

[Detecting Alignment Marks with Light Interference]

Previously
Position incorrectly detected.

FZM1
Position detected accurately.

Highest Detection Performance in the Industry

Optimized processing items for positioning have been included to handle a wide range of measurement objects. Just select the right processing item for the target object to enable stable inspection without complicated calculations and settings.
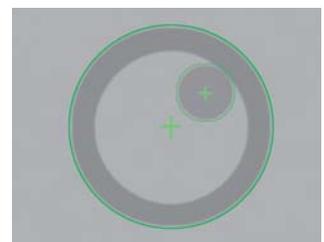
Positioning with Alignment Marks

The alignment marks commonly used in manufacturing of LCD panels and PCBs can be precisely detected. Accurate detection is possible even if the marks are dirty or partially hidden.
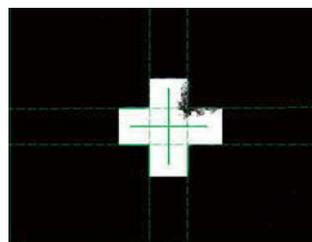
| EC Cross	EC Circle
Dirty	Overlapping

Positioning with Corner Detection

Positioning can be performed by detecting a corner of the measurement object. Now, stable detection is possible even for rounded corners or when the edge is broken. This is ideal for glass plates, LCDs and other objects on which alignment marks cannot be printed.

EC Corner

Rounded or Broken Corner
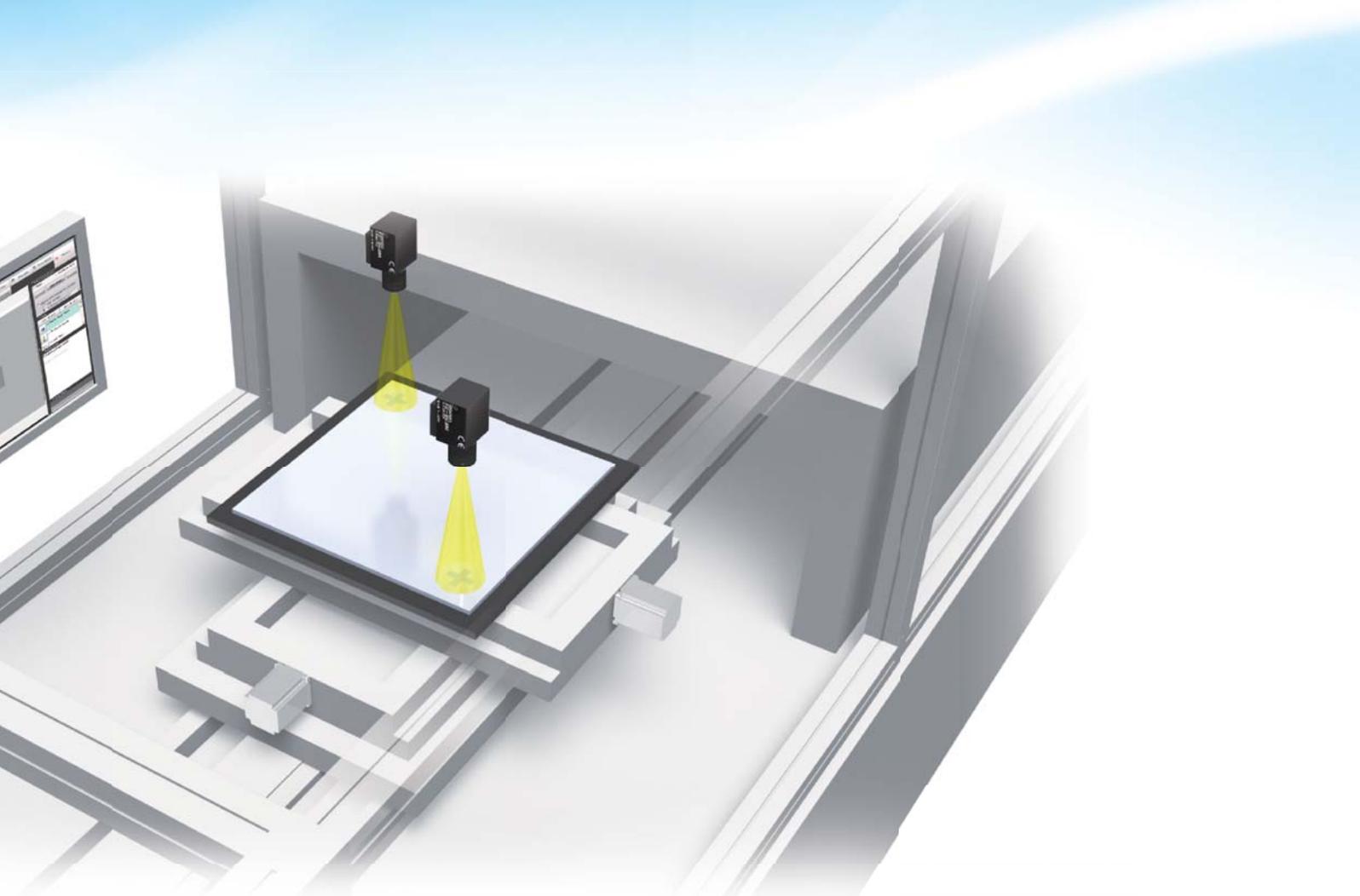
Positioning by Shape of object

When picking electronic components or food items, unclear printing and dirt can make stable inspections impossible. FZM1 can identify the position and orientation of objects from their shapes. The use of ECM search processing enables precise position and attitude measurements without being affected by surface conditions.
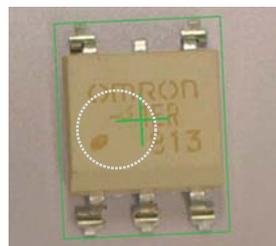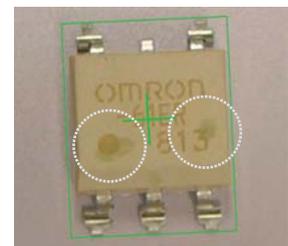
Printing Mistake   Dirt

## Superior Performance Under Severe Conditions
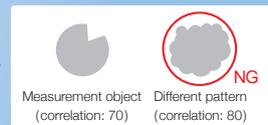### EC: Edge Code
Image Processing Technique

patent number 11-550303

Conventional search processing and pattern matching detect objects based on density differences or feature points registered on model images. This produced unstable detection when the measurement object was changed or the shape was not consistent. With EC image processing, the measurement object is recognized as a geometric shape to minimize offsets in the detection position caused by light interference or dirt. This achieves stable, accurate position detection.
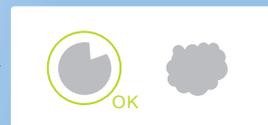
Conventional Search Processing

Model

Measurement object (correlation: 70)   Different pattern (correlation: 80)   NG
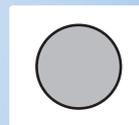
The shape is imperfect, producing a low correlation. Dirt of the same size and color within the measurement region is incorrectly detected.

EC Image Processing

OK

Changes in brightness are recognized as an edge code and geometric calculations determine the center of the circle and circumference edge. Even if the circle is broken, it is recognized as a circle, i.e., as the measurement object. Dirt and other abnormalities in the measurement region are differentiated so that they are not falsely detected.

Get Relief from the Difficulties of Positioning

Next-generation High-speed Communications with EtherCAT

Support for the EtherCAT open network enables realtime remote I/O control. Connect to OMRON PLCs or other EtherCAT components through EtherCAT communications to perform high-speed motion control.

Less Wiring with Ethernet Cables

All trigger inputs and result outputs are performed using only an Ethernet cable. This eliminates wasted wiring work and helps prevent wiring mistakes when launching the system. With EtherCAT you can wire up to 100 m without a repeater to easily connect to Vision Sensors and Servo Drives.

From
Complex Wiring

To
Wiring with One Cable

EtherCAT

100m

EtherCAT
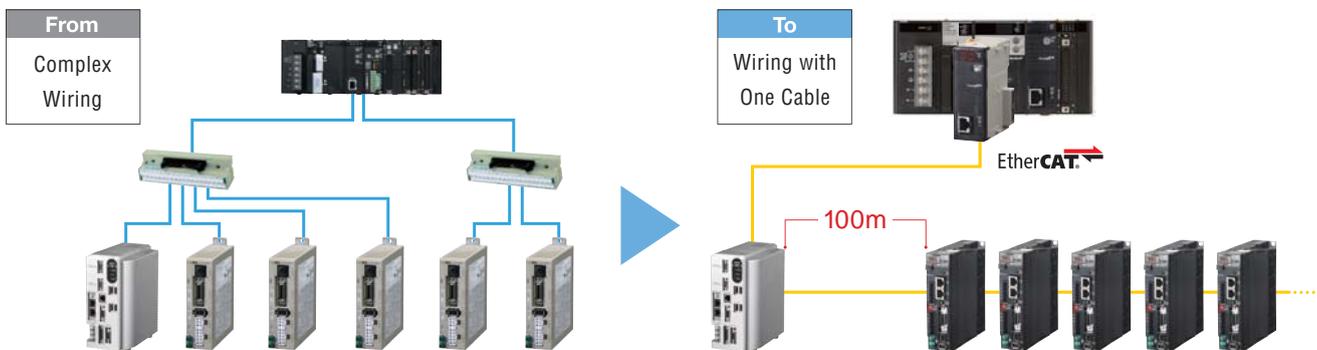
Reduced Ladder Programming

The PLC Link function communicates using three link areas: the command area, response area, and data output area.The PLC can control communications with the sensor simply by reading and writing words allocated in the I/O memory in the PLC. This greatly reduces the amount of ladder programming required for communications.

Easily set up reading and writing I/O memory with special menu commands.

EtherCAT

What is EtherCAT?

EtherCAT is an open network based on Ethernet that enables realtime control. It is ideal for machine-control networks that include motion control. EtherCAT provides the operating principles and architecture required to achieve ultra-high-speed sync control and a bus topology that provides wiring efficiency. It solves the traditional complex wiring problems of Ethernet, which required many hubs and switches. OMRON applies EtherCAT to the high-speed, high-precision machine control networks required in FA sites, and will be releasing more EtherCAT products in the future.

Focus and Aperture Adjustments

Focus and brightness, which use to be adjusted based on experience and instinct, have been expressed numerically and displayed in graphs so that you can literally see them. The ideal focus and aperture can be adjusted quickly by essentially anyone. Variations between different operators are eliminated and greater inspection precision can be achieved.

Out of Focus
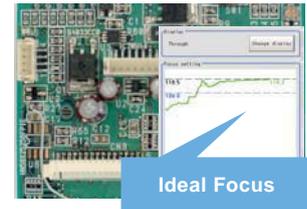
Ideal Focus

Simple Auto Calibration

The Vision Sensor provides a coordinate conversion function for different stages and robots. Coordinates can be converted for the Vision Sensor and output device without troublesome calculations.

Handles Various Stages and Robots

| Robot control	XY,XYθ
Stage control	XYθ,θXY,UVW,UVWR

Flexible Camera Mounting

There are no Camera mounting restrictions even with alignment systems that use two Cameras. Differences between Camera angles and fields of vision can be calculated and coordinates converted without performing complex calculations in a PLC or other external device.

Use Different Fields of Vision
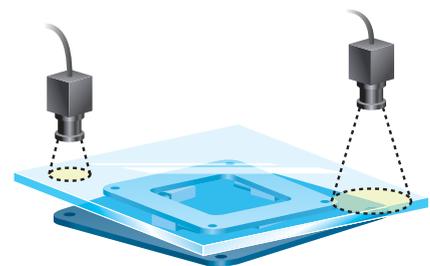
Mount at Any Angle
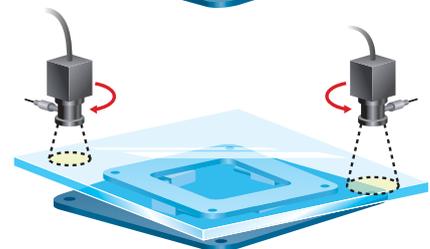
Easy Setup and configuration by an Application Wizard

Calibration between the Cameras and stage or robot can be easily set up using a wizard. Simply select the type of inspection to easily generate the calibration parameters. Automatically input sampling data from an external device via EtherCAT or UDP to eliminate mistakes that can occur in manual input. Fine-tuning can also be quickly and accurately performed for production changes or adjustments of the setup is required on-site.
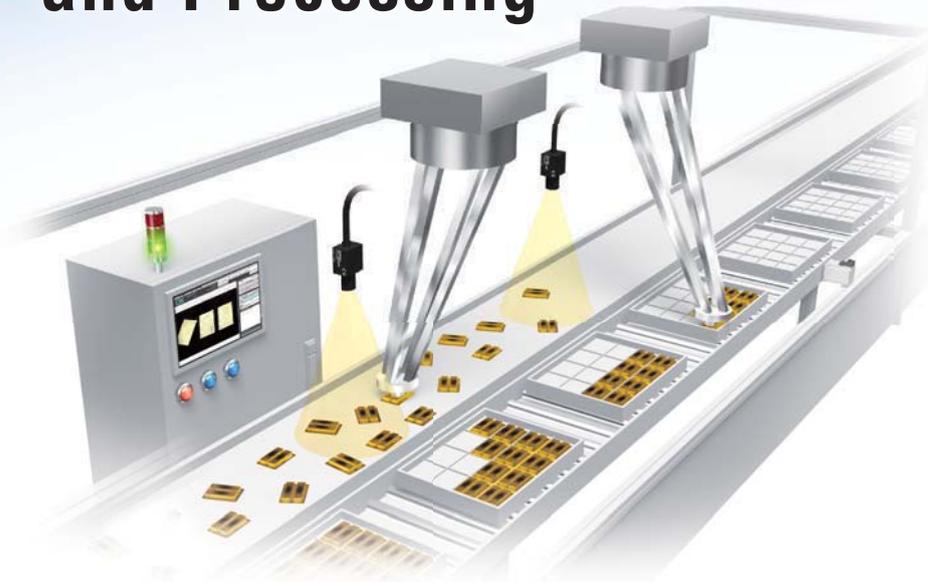
STEP 1 **Communications Setup**

STEP 2 **Camera Setup**

STEP 3 **External Device Setup**

STEP 4 **Sampling**

STEP 5 **Calibration Parameter Creation**

Automatically input these with communications.

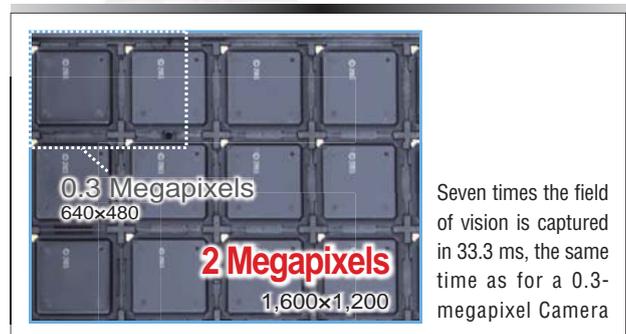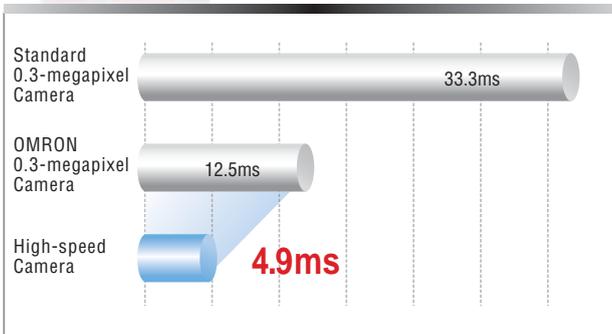# Faster Image acquisition and Processing

A Lineup of High-speed Cameras

The speed of capturing images by a 0.3-megapixel Camera has been greatly increased.Even with a 2-megapixel Camera, the image capturing speed is equivalent to that of a standard 0.3-megapixel Camera.The difference is most obvious in applications requiring a wide field of vision, high precision, and high speed.

NEW

High-speed Camera
0.3 Megapixels

Camera
2 Megapixels

Standard 0.3-megapixel Camera — 33.3ms

OMRON 0.3-megapixel Camera — 12.5ms

High-speed Camera — **4.9ms**

0.3 Megapixels
640×480

2 Megapixels
1,600×1,200

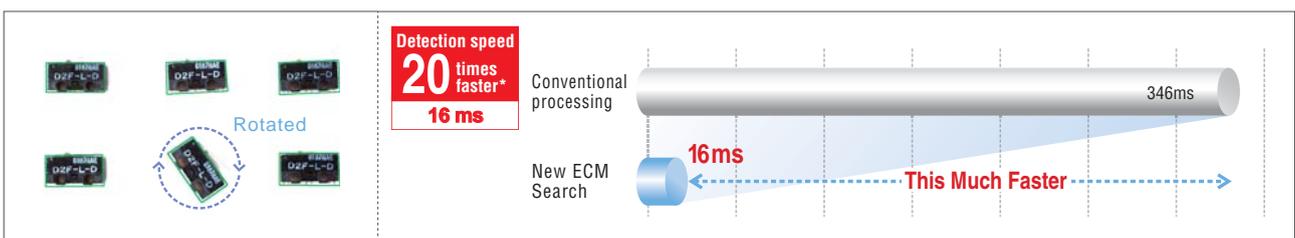Seven times the field of vision is captured in 33.3 ms, the same time as for a 0.3-megapixel Camera

ECM Searches at 20 Times the Speed

The FZM1 provides an advanced version of OMRON's unique high-speed search processing, ECM. High-speed search processing is now possible for multiple measurement objects that are conveyed in different orientations. This enables high speed pick-and-place processing for moving objects.
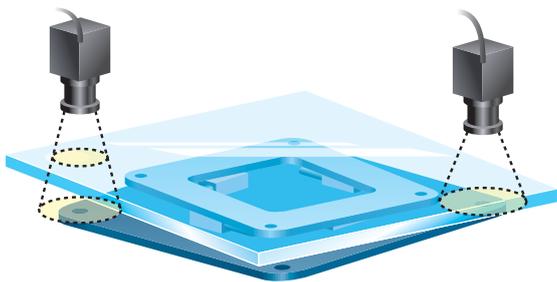
[Search Speed for Rotated Objects]

Rotated

Detection speed
20 times faster*
16 ms

Conventional processing — 346ms

New ECM Search — **16ms**

This Much Faster

*Individual workpieces under OMRON test conditions.

Target Applications

FPD

LCD Glass Plate Alignment

Problem

Yield was decreased because alignment marks could not be detected due to dirt and defects. Also, it was necessary to use a PLC to calculate the movement amounts of the stage from the measurement results from two Cameras, and the ladder program design and adjustment processes required excessive time.

Solution

Alignment mark detection using the EC algorithm suppressed the effects of dirt and defects to enable stable detection. Calibration between the Cameras and stage could be achieved without complex settings or calculations, greatly reducing setup work.

Food and Packaging

## Pick and Place for Shiny Packages

Problem
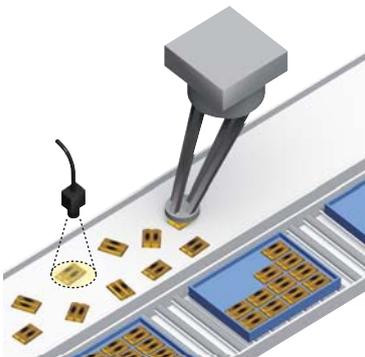
Reflections from the shiny packages made measurements unstable can caused frequent mistakes. To increase stability, precise parameter settings were required, increasing setup work. The increased number of parameters increased the processing time, which reduced throughput.

Solution

The new ECM Search, which resists light interference, greatly reduced the time required to set up lighting and adjust the parameters, creating stable, high-speed inspections. System throughput was increased.

Electronic Components

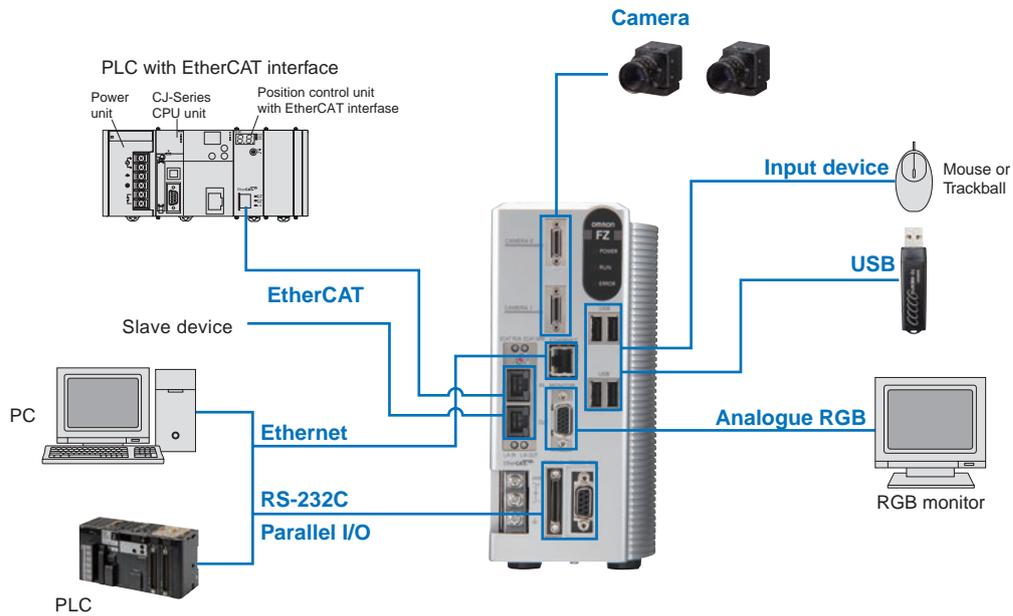## High-speed Palletizing

Problem
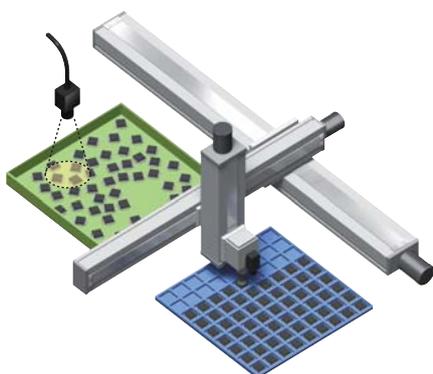
The robot was kept waiting because of the long time required from image input to positioning output. This made it impossible to increase system throughput.

Solution

Using a high-speed Camera and faster image processing achieved high-speed processing. By further combining an OMRON Servo Drive and Position Control Unit that support EtherCAT communications, the time from inputting the image to starting the servo was greatly minimized.

MEMO

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FZM1-Series

System configuration

Camera

PLC with EtherCAT interface

Power unit | CJ-Series CPU unit | Position control unit with EtherCAT interfase

Input device — Mouse or Trackball

EtherCAT

Slave device

USB

PC

Ethernet

Analogue RGB

RS-232C

RGB monitor

Parallel I/O

PLC

FZM1-Series

Ordering Information

Item				Descriptions		Model	Remarks	
Controllers	Standard Controllers with EtherCAT interfase	Box-type Controllers	Two-camera controllers	NPN		**FZM1-350-ECT**	–	
				PNP		**FZM1-355-ECT**		
Cameras	High-speed Cameras	300,000 Pixels	Monochrome			**FZ-SH**	Lens required	
			Color			**FZ-SHC**		
	Digital cameras	300,000 Pixels	Monochrome			**FZ-S**		
			Color			**FZ-SC**		
		2 million pixels	Monochrome			**FZ-S2M**		
			Color			**FZ-SC2M**		
	Small digital cameras	300,000-pixel flat type	Monochrome			**FZ-SF**	CCTV lens required	
			Color			**FZ-SFC**		
		300,000-pixel pen type	Monochrome			**FZ-SP**		
			Color			**FZ-SPC**		
	Intelligent cameras	Wide field of vision	Color			**FZ-SLC100**	Camera + Zoom, Autofocus Lens + Intelligent Lighting	
Cameras peripheral devices	Intelligent camera diffusion plate	Wide field of vision				**FZ-SLC100-DL**	–	
	CCTV Lenses					**3Z4S-LE Series**	–	
	Extension Tubes						–	
	Low-distortion Lenses					**3Z4S-LE SV-0614H/ SV-0814H/SV-1214H/ SV-1614H/SV-2514H/ SV-3514H/SV-5014H/ SV-7525H/SV-10028H**	Low distortion lens for 2-million pixel cameras	
	Lenses for small camera					**FZ-LES3/LES6/LES16/ LES30**	Lens for 300,000-pixel small cameras	
	Extension Tubes for small camera					**FZ-LESR**	Extension Tubes for 300,000-pixel small cameras	
Cables	Camera Cable					**FZ-VS**	Cable length: 2 m, 5 m, or 10 m (See note 2.)	
	Bend resistant Camera Cables					**FZ-VSB**	Cable length: 2 m, 5 m, or 10 m (See note 3.)	
	Right-angle Camera Cable (See note 1.)					**FZ-VSL**	Cable length: 2 m, 5 m, or 10 m (See note 2.)	
	Long-distance camera cable					**FZ-VS2**	Cable length: 15 m (See note 4.)	
	Long-distance right-angle camera cable					**FZ-VSL2**	Cable length: 15 m (See note 4.)	
	Cable extension unit					**FZ-VSJ**	Up to two Extension Units and three Cables can be connected.(Maximum cable length: 45 m (See note 5.))	
	Monitor cable					**FZ-VM**	Cable length: 2 m or 5 m	
	Parallel cable					**FZ-VP**	Cable length: 2 m or 5 m	
						FZ-VPX (See note 6.)	Cable length: 2 m or 5 m, Connector type	
Peripheral devices	LCD monitor					**FZ-M08**	For Box-type Controllers	
	USB memory	2GB				**FZ-MEM2G**	Capacity: 2 GB	
		8GB				**FZ-MEM8G**	Capacity: 8 GB	
Mouse						–	Mouse Recommended Products Driverless wired mouse (A mouse that requires the mouse driver to be installed is not supported.)	
External Lightings						**3Z4S-LT Series**	–	
						FZ-LT Series		
						FL Series		
Strobe Controllers	For 3Z4S-LT Series					Manufactured by MORITEX Corporation **3Z4S-LT MLEK-C100E1TS2**	Required to control external lighting from a Controller	One channel
	For FZ-LT Series					**FZ-LTA100**		
						FZ-LTA200		Two channels
Lighting Controller	For FL Series					**FL-TCC1**	–	

Note: 1. This Cable has an L-shaped connector on the Camera end.
2. The 10-m cable cannot be used for the intelligent camera and 5 million-pixel camera.
3. The 10-m cable cannot be used for the intelligent camera, 2 million-pixel camera and 5 million-pixel camera.
4. The 15-m cable cannot be used for the intelligent camera and 5 million-pixel camera.
5. The maximum cable length depends on the Camera being connected, and the model and length of the Cable being used.
For further information, please refer to the "Cameras / Cables" table in Page 17.
6. Connector-Terminal Block Conversion Units can be connected (Recommended Products: XW2R-J50G-T, XW2R-E50G-T, XW2R-P50G-T)

Lenses
High-resolution, Low-distortion Lenses

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/ Dimensions (mm)	42 dia. 57.5	39 dia. 52.5	30 dia. 51.0	30 dia. 47.5	30 dia. 36.0	44 dia. 45.5	44 dia. 57.5	36 dia. 42.0[WD:∞] to 54.6[WD:1200]	39 dia. 66.5[WD:∞] to 71.6[WD:2000]
Focal length	5mm	8mm	12mm	16mm	25mm	35mm	50mm	75mm	100mm
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

CCTV Lenses

Model	3Z4S-LE SV-03514V	3Z4S-LE SV-04514V	3Z4S-LE SV-0614V	3Z4S-LE SV-0814V	3Z4S-LE SV-1214V	3Z4S-LE SV-1614V
Appearance/ Dimensions (mm)	29.5 dia. 30.4	29.5 dia. 29.5	29 dia. 30	28 dia. 34.0	29 dia. 29.5	29 dia. 24.0
Focal length	3.5mm	4.5mm	6mm	8mm	12mm	16mm
Brightness	F1.4	F1.4	F1.4	F1.3	F1.4	F1.4
Filter size	—	—	M27 P0.5	M25.5 P0.5	M27 P0.5	M27 P0.5

Model	3Z4S-LE SV-2514V	3Z4S-LE SV-3518V	3Z4S-LE SV-5018V	3Z4S-LE SV-7527V	3Z4S-LE SV-10035V
Appearance/ Dimensions (mm)	29 dia. 24.5	29 dia. 33.5[WD:∞] to 37.5[WD:300]	32 dia. 37.0[WD:∞] to 39.4[WD:1000]	32 dia. 42.0[WD:∞] to 44.4[WD:1000]	32 dia. 43.9[WD:∞] to 46.3[WD:1000]
Focal length	25mm	35mm	50mm	75mm	100mm
Brightness	F1.4	F1.8	F1.8	F2.7	F3.5
Filter size	M27 P0.5	M27 P0.5	M30.5 P0.5	M30.5 P0.5	M30.5 P0.5

Lenses for small camera

Model	FZ-LES3	FZ-LES6	FZ-LES16	FZ-LES30
Appearance/ Dimensions (mm)	12 dia. 16.4	12 dia. 19.7	12 dia. 23.1	12 dia. 25.5
Focal length	3mm	6mm	16mm	30mm
Brightness	F2.0	F2.0	F3.4	F3.4

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.

Note: 1. 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.
2. Reinforcement is required to protect against vibration when Extension Tubes exceeding 30 mm are used.

Extension Tubes for small camera

Model	FZ-LESR
Contents	Set of 3 tubes (15 mm, 10 mm, 5 mm) Maximum outer diameter: 12 mm dia.

FZM1-Series

Ratings and Specifications

Standard Controllers with EtherCAT interface

Model	NPN Output		FZM1-350-ECT
	PNP Output		FZM1-355-ECT
Connected Camera			High-speed Cameras, Digital cameras, Small digital cameras, or Intelligent camera
No. of Cameras			2
Processing resolution	When connected to a 300,000-pixel camera		640 (H) × 480 (V)
	When connected to a 2 million-pixel camera		1600 (H) × 1200 (V)
No. of scenes			32
Number of logged images (See note 1.)	When connected to a 300,000-pixel camera	Connected to 1 camera	Color camera: 250, Monochrome Camera: 252
		Connected to 2 cameras	Color camera: 125, Monochrome Camera: 126
	When connected to a 2 million-pixel camera	Connected to 1 camera	Color camera: 40, Monochrome Camera: 40
		Connected to 2 cameras	Color camera: 20, Monochrome Camera: 20
Operation			Mouse or similar device
Settings			Create series of processing steps by editing the flowchart (Help messages provided).
Serial communications			RS-232C/422A: 1CH
Network communications			Ethernet 100BASE-TX/10BASE-T
EtherCAT communications			Protocol only for EtherCAT communication 100BASE-TX
Parallel I/O			13 input (RESET, ENCTRG_A, ENCTRG_B, STEP/ENCTRG_Z, DSA, and DI0 to 7) 24 output (RUN, BUSY, GATE, OR, READY, ERROR, STGPUT0 to 1, and DO0 to 15)
Monitor interface			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 (See note 3.)	When connected to an intelligent camera		5 A max.
	When connected to a 300,000-pixel camera		3.7 A max.
	When connected to a 2 million-pixel camera		
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. 1.9 kg
Accessories			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.
3. When the strobe controller is connected to the lights, the controller uses power as much as it does when connected to the intelligent camera.

High-speed Cameras

Model	FZ-SH	FZ-SHC
Image elements	Interline transfer reading all pixels, 1/3-inch CCD image elements	
Color/Monochrome	Monochrome	Color
Effective pixels	640 (H) × 480 (V)	
Pixel size	7.4 (μm) × 7.4 (μm)	
Shutter function	Electronic shutter; select shutter speeds from 1/10 to 1/50,000 s	
Partial function	12 to 480 lines	
Frame rate (image read time)	204 fps (4.9ms)	
Field of vision	Selecting a lens according to the field of vision and installation distance	
Installation distance		
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. 105 g	
Accessories	Instruction manual	

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Intelligent cameras

Model	FZ-SLC100
Image elements	Interline transfer reading all pixels, 1/3-inch CCD image elements
Color/Monochrome	Color
Effective pixels	659(H) × 494(V)
Pixel size	7.4 (μm) × 7.4 (μm)
Shutter function	Electronic shutter; select shutter speeds from 1/10 to 1/50,000 s
Partial function	12 to 480 lines
Frame rate (image read time)	80 fps (12.5 ms)
Field of vision (See note 2.)	13 to 100mm (See note1.)
Installation distance	70 to 190mm (See note1.)
LED class (See note 3.) (lighting)	Class 2
Ambient temperature range	Operating: 0 to 50 °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. 670 g
Accessories	Instruction manual and hexagonal wrench

Note: 1. Tolerance: ±5% max.
     2. The length of the visual field is the lengths along the Y axis.
     3. Applicable standards: IEC 62471-2

Digital cameras

Model	FZ-S	FZ-SC	FZ-S2M	FZ-SC2M
Image elements	Interline transfer reading all pixels			
	1/3-inch CCD image elements		1/1.8-inch CCD image elements	
Color/Monochrome	Monochrome	Color	Monochrome	Color
Effective pixels	640 (H) × 480 (V)		1600 (H) × 1200 (V)	
Pixel size	7.4 (μm) × 7.4 (μm)		4.4 (μm) × 4.4 (μm)	
Shutter function	Electronic shutter; select shutter speeds from 1/10 to 1/50,000 s			
Partial function	12 to 480 lines		12 to 1200 lines	
Frame rate (image read time)	80 fps (12.5 ms)		30 fps (33.3 ms)	
Field of vision, installation distance	Selecting a lens according to the field of vision and installation distance			
Ambient temperature range	Operating: 0 to 50 °C Storage: -25 to 65 °C (with no icing or condensation)		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.55 g		Approx. 76 g	
Accessories	Instruction manual			

Small digital cameras

Model	FZ-SF	FZ-SFC	FZ-SP	FZ-SPC
Image elements	Interline transfer reading all pixels, 1/3-inch CCD image elements			
Color/Monochrome	Monochrome	Color	Monochrome	Color
Effective pixels	640(H) × 480(V)			
Pixel size	7.4 (μm) × 7.4 (μm)			
Shutter function	Electronic shutter; select shutter speeds from 1/10 to 1/50,000 s			
Partial function	12 to 480 lines			
Frame rate (image read time)	80 fps (12.5 ms)			
Field of vision, installation distance	Selecting a lens according to the field of vision and installation distance			
Ambient temperature range	Operating: 0 to 50 °C (camera amp) 0 to 45 °C (camera head) Storage: -25 to 65 °C (with no icing or condensation)			
Ambient humidity range	Operating and storage: 35% to 85% (with no condensation)			
Weight	Approx.150 g			
Accessories	Instruction manual, installation bracket, Four mounting brackets (M2)		Instruction manual	

FZM1-Series

LCD Monitor

Model	FZ-M08
Size	8.4 inches
Type	Liquid crystal color TFT
Resolution	1,024 × 768 dots
Input signal	Analog RGB video input, 1 channel
Power supply voltage	21.6 to 26.4 VDC
Current consumption	Approx. 0.7 A max.
Ambient temperature range	Operating: 0 to 50 °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. 1.2 kg
Accessories	Instruction manual and Four mounting brackets

Cable Extension Unit

Model	FZ-VSJ
Power supply voltage (See note 1.)	11.5 to 13.5 VDC
Current consumption (See note 2.)	1.5 A max.
Ambient temperature range	Operating: 0 to 50 °C Storage: -25 to 65 °C (with no icing or condensation)
Ambient humidity range	Operating and storage: 35% to 85% (with no condensation)
Maximum Units connectable	2 Units per Camera
Weight	Approx. 240 g
Accessories	Instruction manual and 4 mounting screws

Note: 1. A 12-VDC power supply must be provided to the Cable Extension Unit when connecting the Intelligent camera, the Intelligent Compact Camera, the Strobe controller, or the Lighting Controller.
2. The current consumption shows when connecting the Cable Extension Unit to an external power supply.

Camera Cables

Model	FZ-VS (2m)	FZ-VSB (2m)	FZ-VSL (2m)
Shock resistiveness (durability)	10 to 150 Hz single amplitude 0.15 mm 3 directions, 8 strokes, 4 times		
Ambient temperature range	Operation and storage: 0 to 65 °C (with no icing or condensation)		
Ambient humidity range	Operation and storage: 40% to 70% (with no condensation)		
Ambient atmosphere	No corrosive gases		
Material	Cable sheath, connector: PVC		
Minimum bending radius	69 mm	69 mm	69 mm
Weight	approx. 170g	approx. 220g	approx. 170g

Long-distance Camera Cables

Model	FZ-VS2 (15m)	FZ-VSL2 (15m)
Shock resistiveness (durability)	10 to 150 Hz single amplitude 0.15 mm 3 directions, 8 strokes, 4 times	
Ambient temperature range	Operation and storage: 0 to 65 °C (with no icing or condensation)	
Ambient humidity range	Operation and storage: 40% to 70% (with no condensation)	
Ambient atmosphere	No corrosive gases	
Material	Cable sheath, connector: PVC	
Minimum bending radius	93 mm	
Weight	approx. 1600g	

Monitor Cable

Model	FZ-VM
Vibration resistiveness	10 to 150 Hz single amplitude 0.15 mm 3 directions, 8 strokes, 4 times
Ambient temperature range	Operation: 0 to 50 °C Storage: -20 to 65 °C (with no icing or condensation)
Ambient humidity range	Operation and storage: 35% to 85% (with no condensation)
Ambient atmosphere	No corrosive gases
Material	Cable sheath: heat-resistant PVC Connector: PVC
Minimum bending radius	75 mm
Weight	approx. 170g

OMRON

Parallel Cable

Model	FZ-VP	FZ-VPX
Vibration resistiveness	10 to 150 Hz single amplitude 0.15 mm 3 directions, 8 strokes, 4 times	
Ambient temperature range	Operation: 0 to 50 °C Storage: -20 to 65 °C (with no icing or condensation)	
Ambient humidity range	Operation and storage: 35% to 85% (with no condensation)	
Ambient atmosphere	No corrosive gases	
Material	Cable sheath: heat-resistant PVC Connector: resin	
Minimum bending radius	75 mm	
Weight	approx. 160g	approx. 180g

Connection Table

Cameras / Cables Connection Table

Type of camera	Model	Cable length	Intelligent cameras	High-speed cameras	Digital cameras		Small digital cameras
					300,000-pixel	2 million-pixel	Pen type / flat type
Camera Cables Right-angle camera cables	FZ-VS FZ-VSL	2 m	○	○	○	○	○
		5 m	○	○	○	○	○
		10 m	×	○	○	○	○
Bend resistant camera cables	FZ-VSB	2 m	○	○	○	○	○
		5 m	○	○	○	○	○
		10 m	×	○	○	○	○
Long-distance camera cable Long-distance right-angle camera cable	FZ-VS2 FZ-VSL2	15 m	×	○	○	○	○

FZM1-Series

Dimentions (Unit: mm)

Controllers

FZM1-35☐-ECT
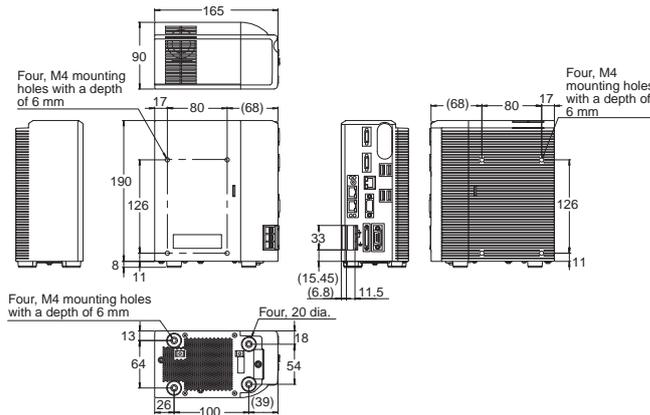
Cameras

•High-speed Cameras
FZ-SH
FZ-SHC
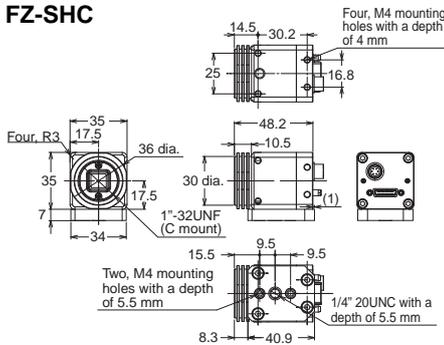
•Digital cameras
300,000-pixel camera
FZ-S
FZ-SC
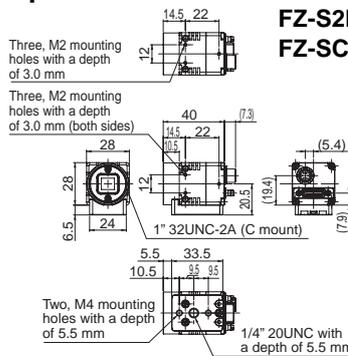
2 million-pixel camera
FZ-S2M
FZ-SC2M
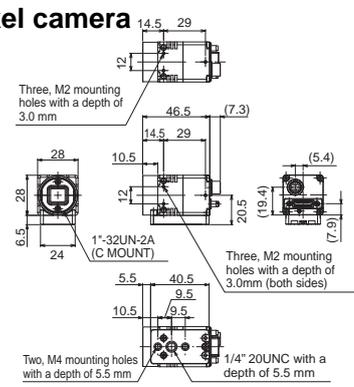
•Small digital cameras

Camera head
Flat camera
FZ-SF
FZ-SFC
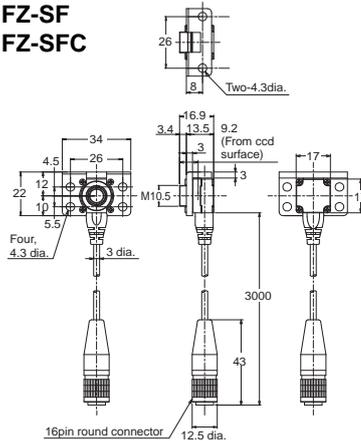
Pen-shaped camera
FZ-SP
FZ-SPC
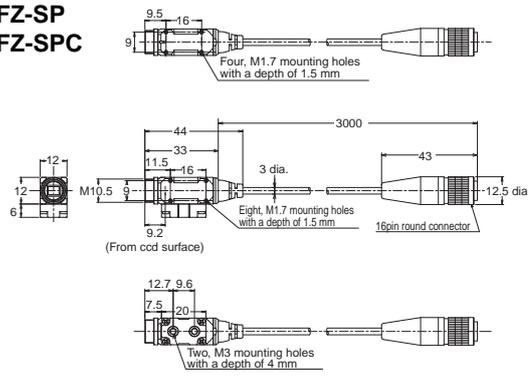
Camera amplifier
Can be used for both flat cameras and pen-shaped cameras
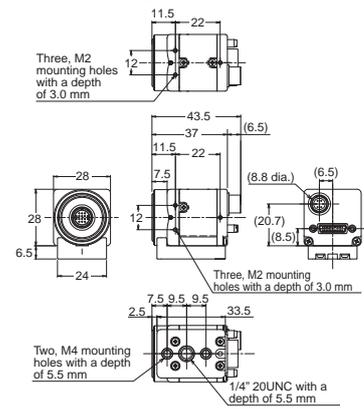
•Intelligent camera
FZ-SLC100
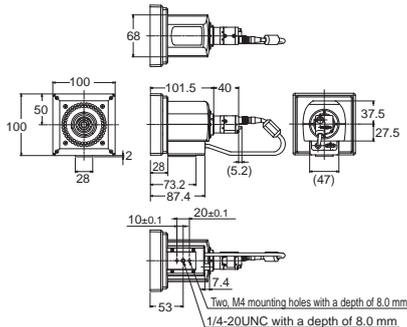
Cable

•Camera Cable

Camera Cable
FZ-VS
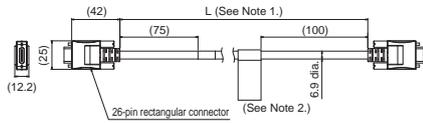
Long-distance Camera Cable
FZ-VS2
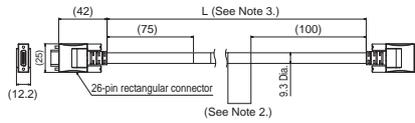
Bend resistant Cable
FZ-VSB
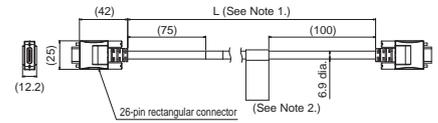
Long-distance Right-angle Camera Cable
FZ-VSL2
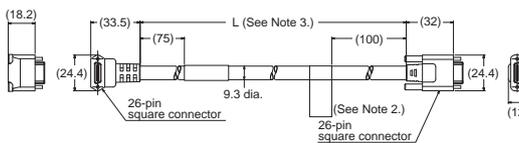
Right-angle Camera Cable
FZ-VSL
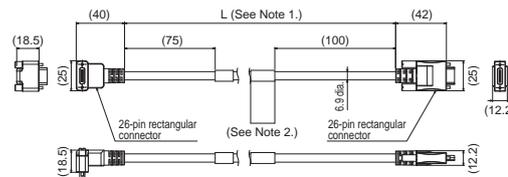
Note: 1. Cable is available in 2m/5m/10m. The FZ-VS, FZ-VSB, and FZ-VSL are also available with a cable length of 3.5 m.
2. Each camera cables has polarity. Please ensure that the name plate side of the cable is connected to the controller.
3. Cable is available in 15m.

Parallel Cable
FZ-VP
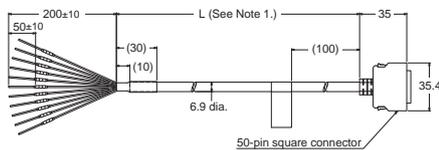
FZ-VPX
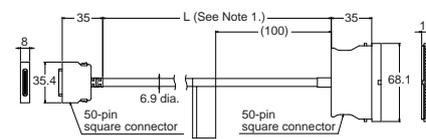
Monitor Cable
FZ-VM

Note: 1. cable is available in 2m/5m.

Note: 1. cable is available in 2m/5m.
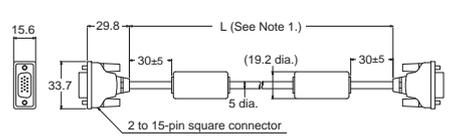
Note: 1. cable is available in 2m/5m.

LCD Monitor

FZ-M08
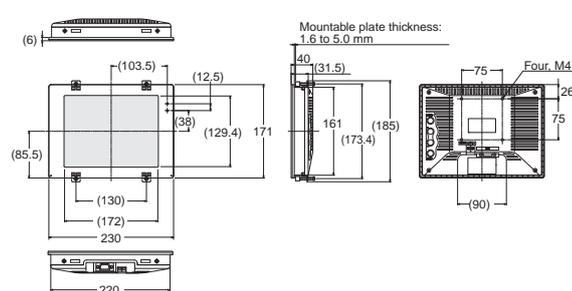
Camera Cable Extension Unit

FZ-VSJ
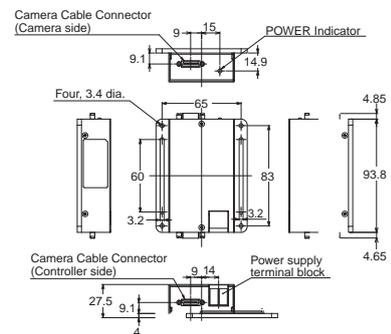
Lens for small camera

FZ-LES Series
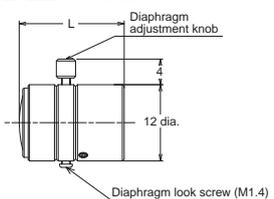
Lenses Model	Focal length	Brightness	Maximum outside diameter	Overall length
FZ-LES3	3 mm	F2.0	12 dia.	16.4 mm
FZ-LES6	6 mm	F2.0	12 dia.	19.7 mm
FZ-LES16	16 mm	F3.4	12 dia.	23.1mm
FZ-LES30	30 mm	F3.4	12 dia.	25.5 mm

Extension Tubes for small camera

FZ-LESR
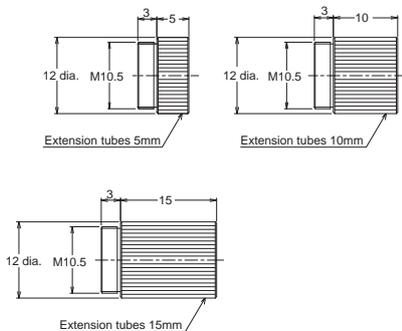
FZM1-Series

Optical Chart

2 million-pixel Digital camera FZ-S☐2M

Camera distance (mm) vs. Field of vision (mm)

3Z4S-LE
- SV-0614H
- SV-0814H
- SV-1214H
- SV-1614H
- SV-2514H
- SV-3514H
- SV-5014H
- SV-7525H
- SV-10028H

300,000-pixel Hight-speed camera FZ-SH☐, and Dijital camera FZ-S☐

Camera distance (mm) vs. Field of vision (mm)

3Z4S-LE
- SV-03514V
- SV-04514V
- SV-0614V
- SV-0813V
- SV-1214V
- SV-1614V
- SV-2514V
- SV-3518V
- SV-5018V
- SV-7527V
- SV-10035V
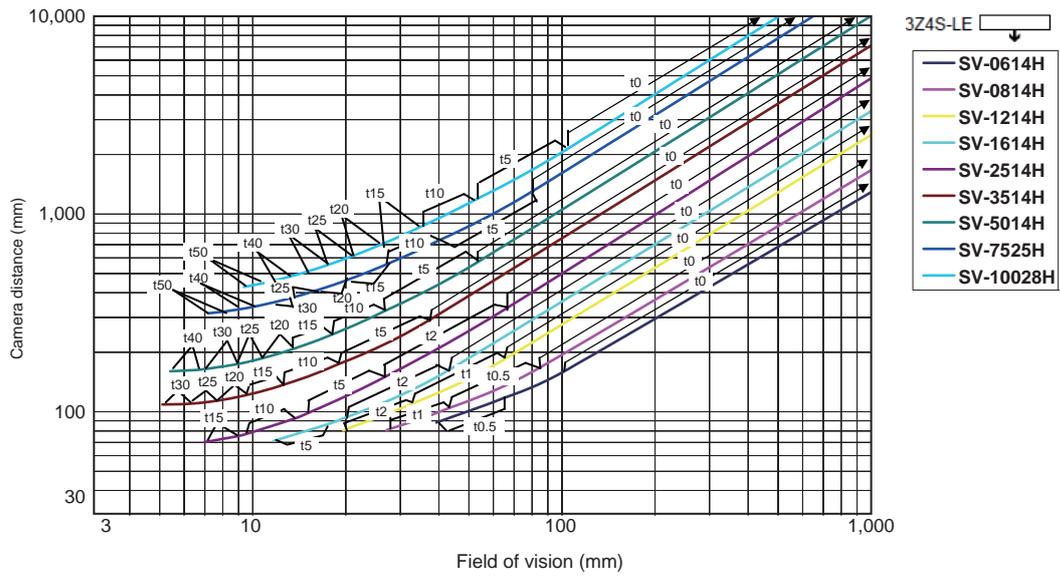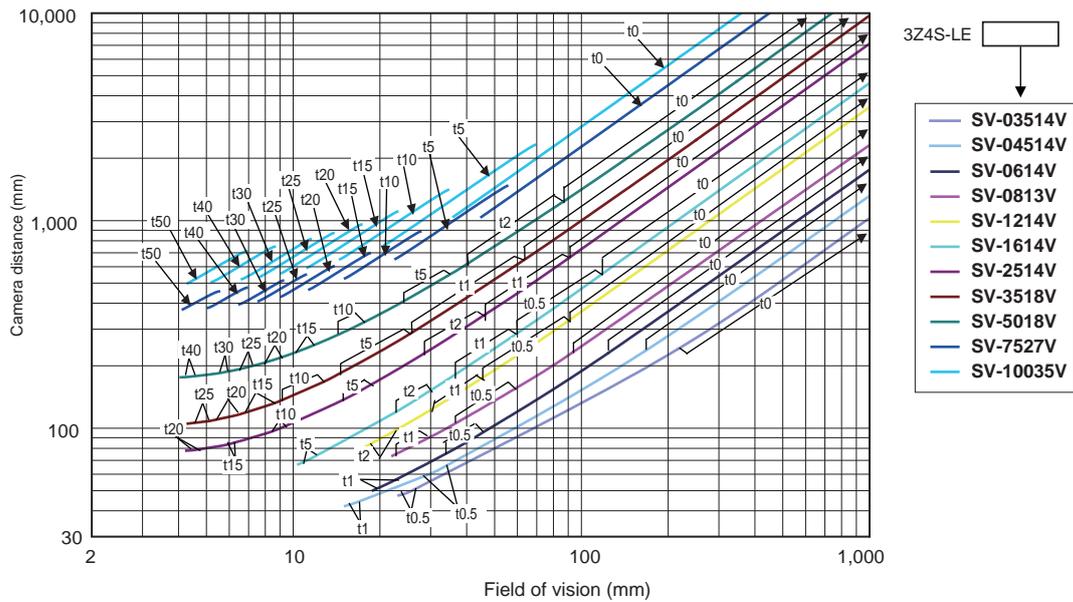
300,000-pixel Small digital cameras FZ-SF□, FZ-SP□

Legend:
- FZ-LES30
- FZ-LES16
- FZ-LES6
- FZ-LES3

X axis: Field of vision (mm); Y axis: WD (See Note.1) (mm)
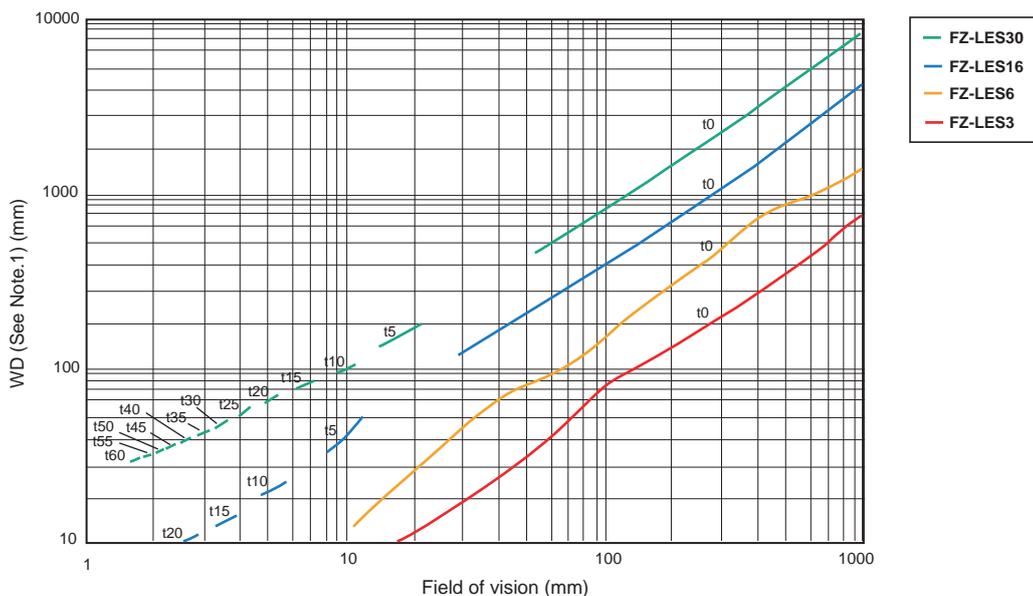
Note: The vertical axis represents WD, not installation distance.

Intelligent camera
with wide field of vision
FZ-S□C100

X axis: Field of vision (mm); Y axis: Camera distance (mm)
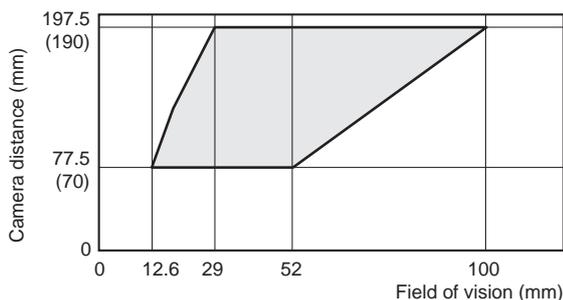
Note: The value in parentheses is for the camera installation distance when using an Intelligent Camera.

•Meaning of Optical Chart

The X axis of the optical chart shows the field of vision (mm) (Note1), and the Y axis of the optical chart shows the camera installation distance (mm) (Note2).

- Camera
- Extension Tube thickness: t (mm)
- Lens
- Camera distance (mm)
- WD (mm)
- Field of vision (mm)
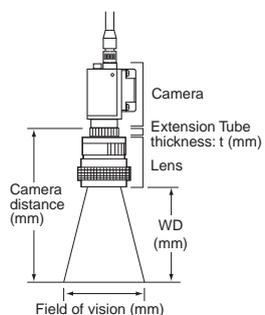
Note: **1.** The lengths of the fields of vision given in the optical charts are the lengths of the Y axis.
2. The vertical axis represents WD for small cameras.