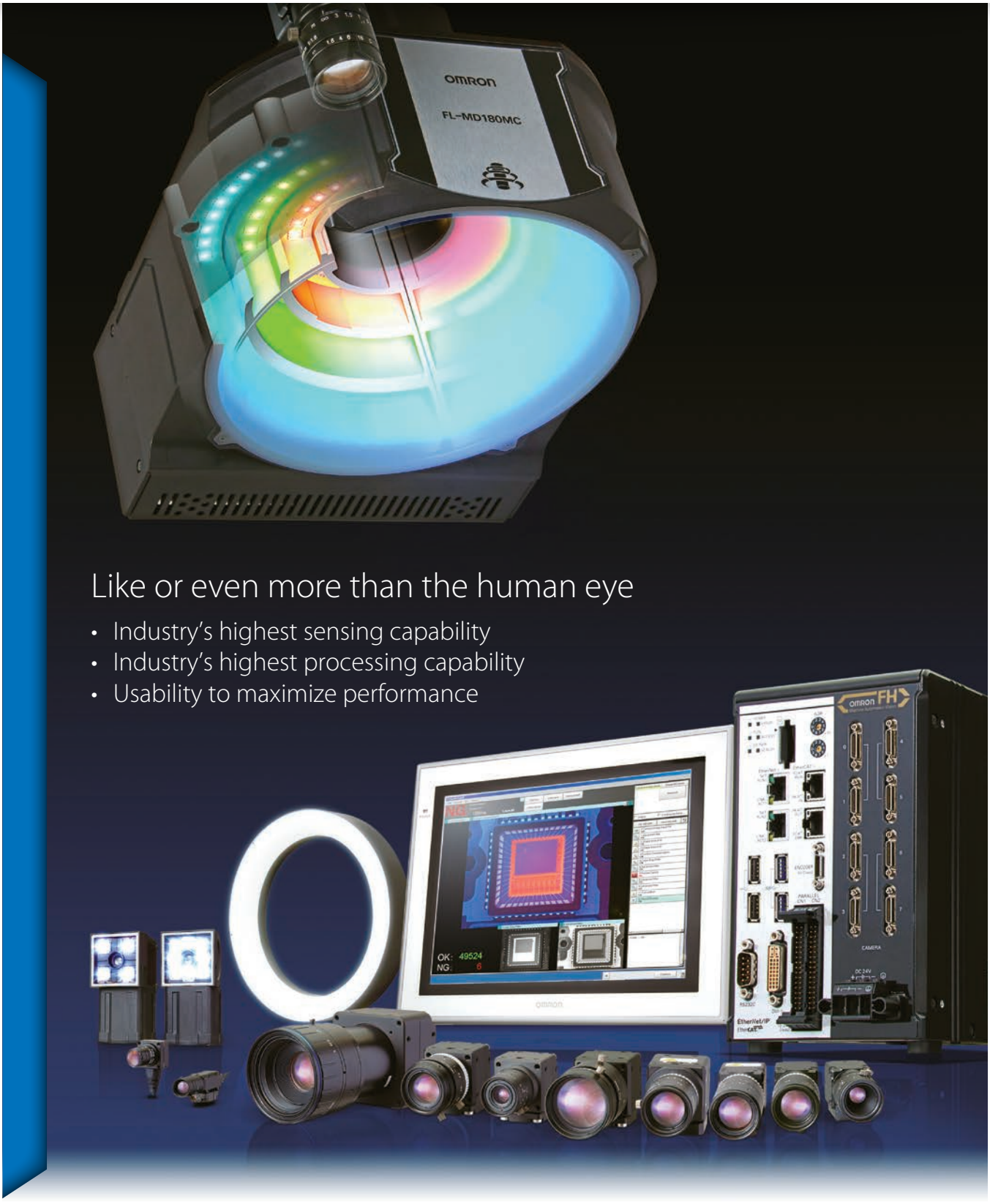
OMRON

# Vision System

## FH Series




SYSMAC
always in control

# High-speed, high-accuracy inspection and - like or even more than the human eye

Many cameras are installed in almost all production processes to automate quality inspections and ensure security and safety. This means that the amount of image information is increasing. Moreover, changes in products require higher levels of performance for vision systems used for automation.

In these circumstances, Omron further developed our FH Series to meet rapidly growing automation needs and higher performance requirements.

We help you solve your inspection and measurement issues through integration of high-speed, high-resolution compact cameras jointly developed with Omron Sentech Co., Ltd. and our unique algorithms.

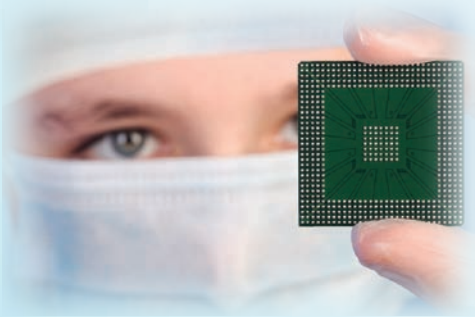
Packed with technologies, this vision system will enable more customers to easily employ image processing.

We offer products which bring automation to manufacturing sites, contributing to manufacturing around the world.

# measurement

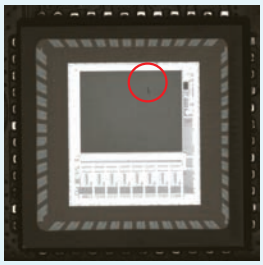
## Automation of external inspection

New lights and new filtering technologies make difficult-to-see defects visible

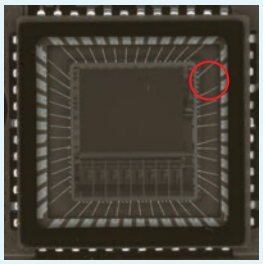


Industry's first*1
**MDMC Light**

**Scratches and dirt on surface**



**Broken wires**



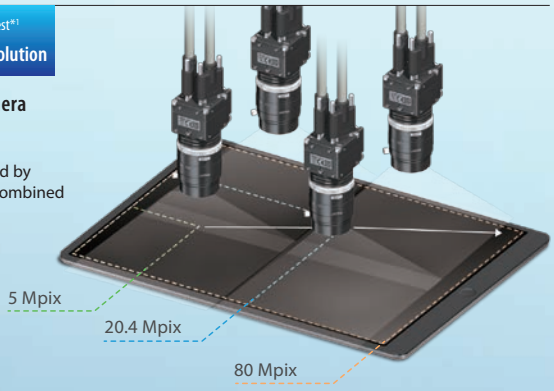
## Wide field of view for positioning

Up to 80 Mpix*2 cameras provide a wide field of view and high resolution to capture objects with size variations or complex shapes

Industry's highest*1
**Speed and Resolution**

**20.4 Mpix camera**

Images captured by
4 cameras are combined
at high speeds




## Storing all inspection images

Large-volume image data for complex applications and quality control can be processed at extremely high speeds

Industry's fastest*1
**controller**

Intel® Core™ i7
processor

High-speed,
Large-capacity Controller
FH-5050 Series

*1. Based on Omron investigation in June 2018.
*2. The resolution of overlapped sections in a panorama image will be lower when overlapping parts of a captured image are combined using the feature point function.

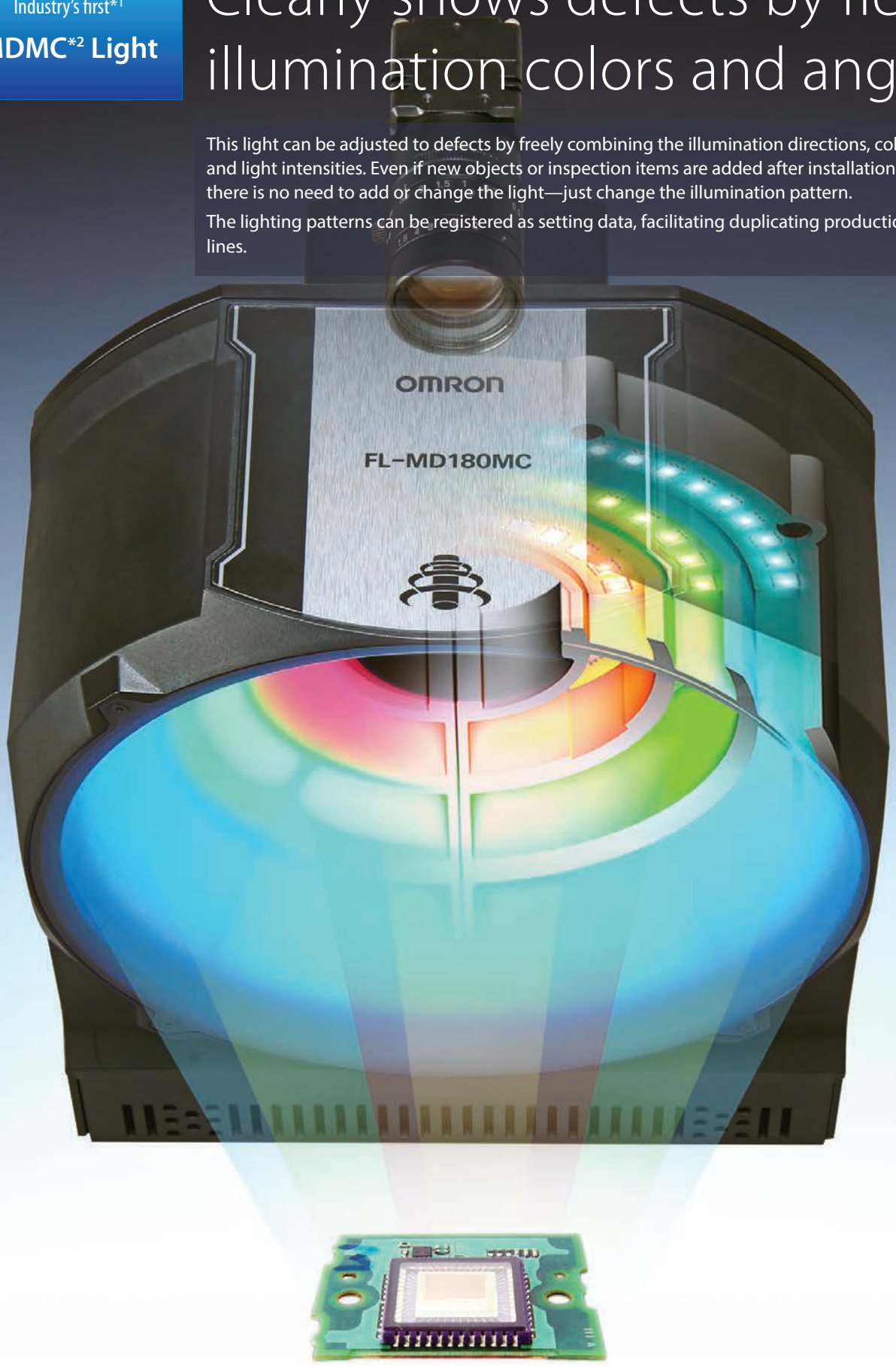
Industry's first*1

**MDMC*2 Light**

# Clearly shows defects by flexibly illumination colors and angles

This light can be adjusted to defects by freely combining the illumination directions, colors, and light intensities. Even if new objects or inspection items are added after installation, there is no need to add or change the light—just change the illumination pattern.

The lighting patterns can be registered as setting data, facilitating duplicating production lines.

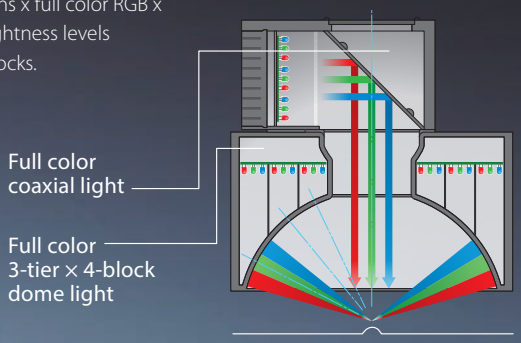



*1. Based on Omron investigation in June 2018.
*2. MDMC…Multi-Direction Multi-Color

changing

## Illumination structure

You can choose the best pattern by combining illumination directions x full color RGB x 128 brightness levels of 13 blocks.

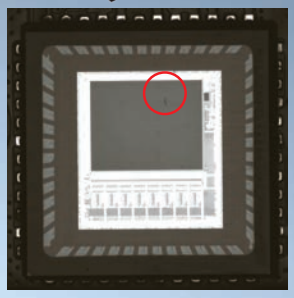



## Standard light

Different lights are required for different defects

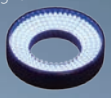
### Glass surface inspection

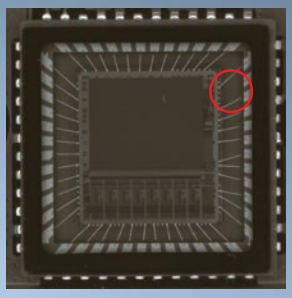
Coaxial light



### Wire inspection

Low angle light

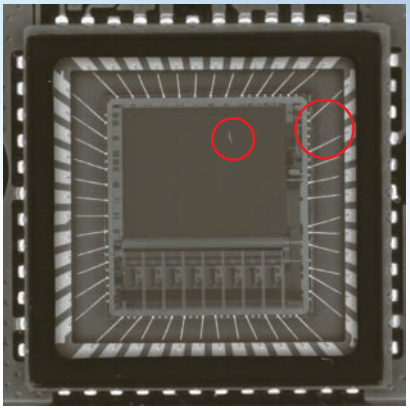




## MDMC Light

One light clearly shows both broken wires and dirt on elements

**Inspection for broken wires and dirt on elements**



# Photometric Stereo Light

## Shows defects accurately

The new FH Photometric Stereo Light can be used with standard or high-resolution cameras up to 20.4 Mpix. To detect dents and surface damages with high accuracy choose a 5, 12 or 20.4 Mpix high-speed camera.


**Standard light**


**Extracts scratches only**

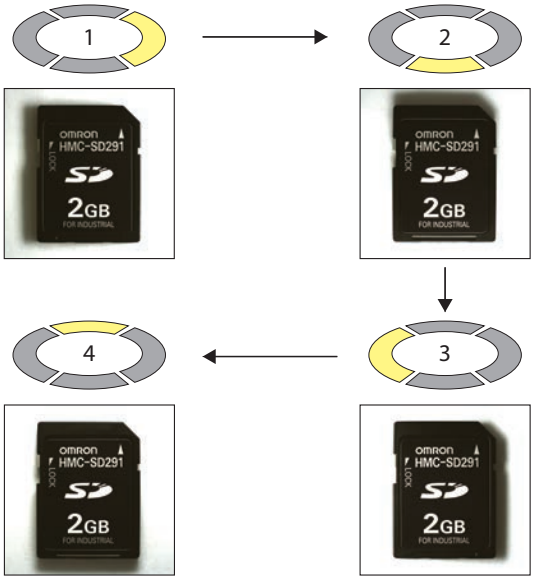
**(Shape)**

**Extracts characters only**


**(Texture)**

## Principle explanation

Four lights are lit in turn, and variations in brightness are analyzed. Printed characters with little variation in brightness even under different illumination directions are extracted as texture, and a dent with huge variation in brightness is extracted as a shape.



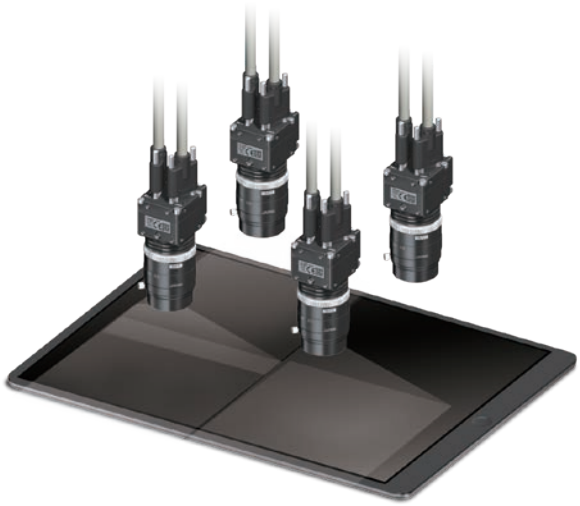
Industry's highest*1
**Speed and Resolution**

# Industry's highest*1 image resolution by new high resolution cameras


## Expand the field of view by combining images at high speeds

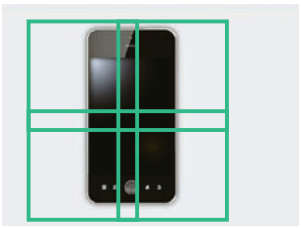
### Panorama shooting with multiple cameras

Our unique panorama image processing enables images shot by up to four cameras to be combined into one image. An overall image of a wide or large object can be captured, which is impossible using a conventional method that simultaneously transfers images from multiple cameras.

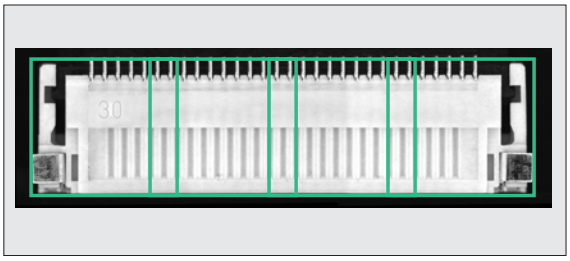


**<Combining methods>**

**2x2 square**

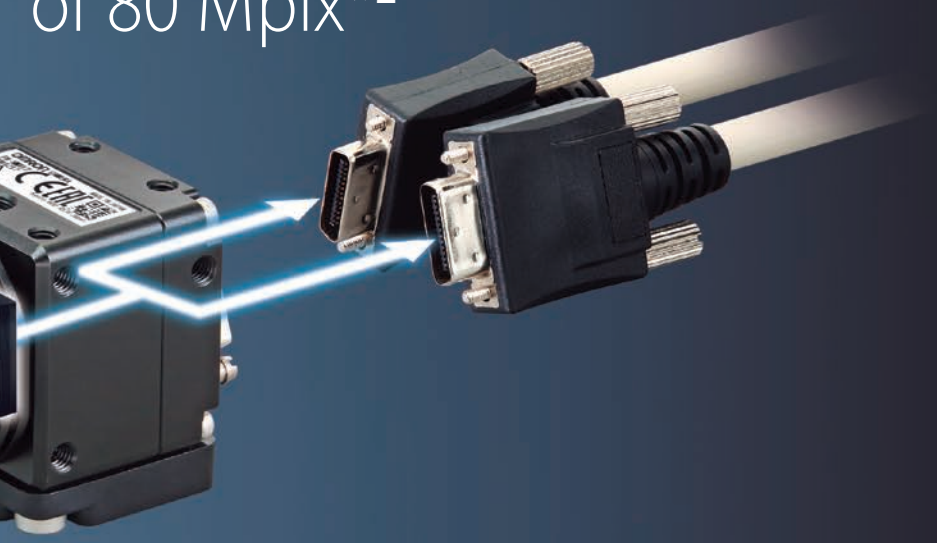


**Panorama**



*1. Based on Omron investigation in June 2018.
*2. The resolution of overlapped sections in a panorama image will be lower when overlapping parts of a captured image are combined using the feature point function.

of 80 Mpix*2



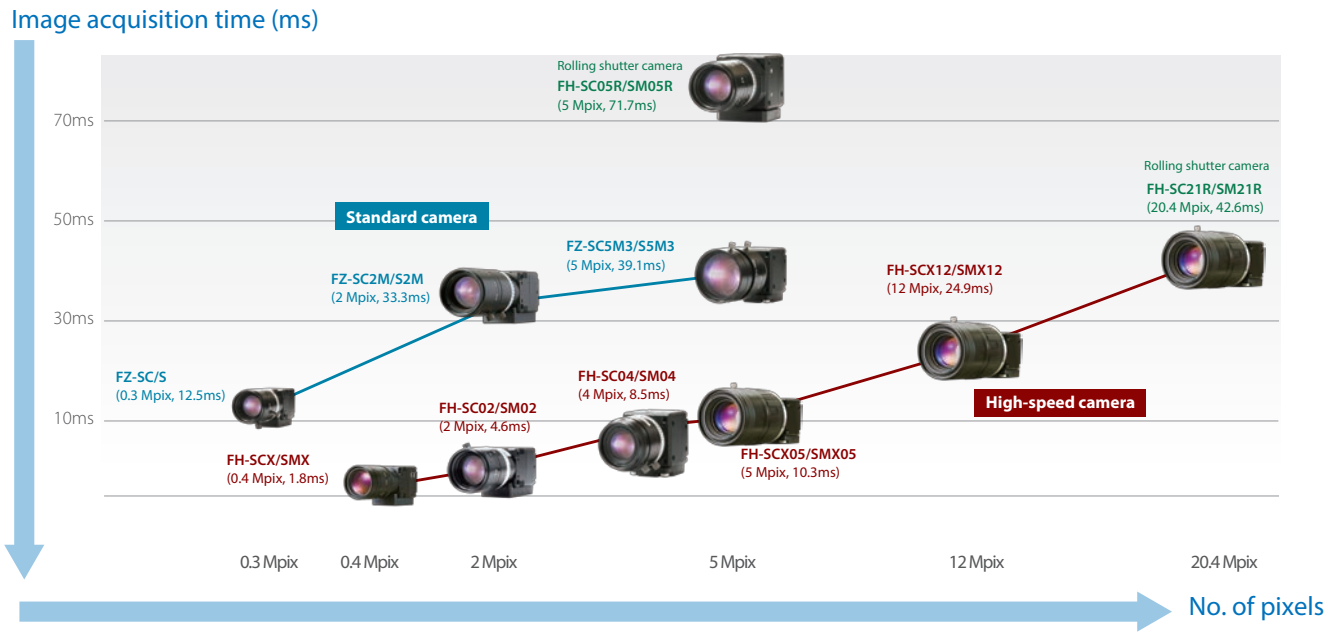
## Ultra-high-speed sensing technology in a compact design

High-resolution cameras capture a wide field of view, which can cause image transfer bottlenecks that increase production cycle times. We use a new CMOS image element and dual transfer technology to capture high-resolution images and transfer images at high speeds.

This facilitates applications that previously required multiple cameras or a mechanism to move a camera.

## A wide variety of cameras, from 0.3 to 20.4 Mpix

You can select the best combination of camera and lens for your application.



Industry's highest*
**Controller**

# Industry's fastest* processing speed

## Ultra-high-speed CPU

4 times faster than our previous models

×

## Large-capacity RAM

2 times larger than our previous models

## Large capacity for image processing

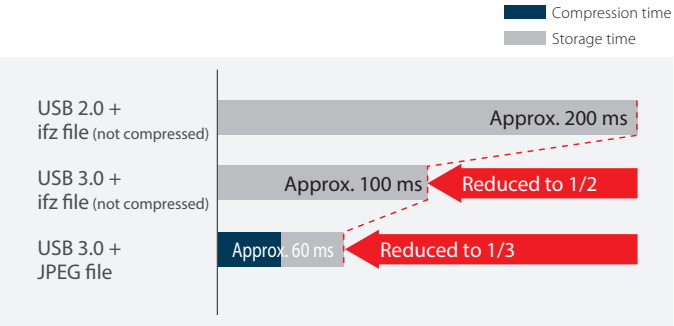
As the use of high-resolution cameras or multiple images for high-quality inspections or wide-field inspections is increasing, vision sensors that can handle increasing data volumes are required. The FH-5050 High-speed, Large-capacity Controller has two times the RAM capacity of our previous models, enabling up to four 20.4 Mpix cameras to be connected. In addition, its CPU processes captured images 4 times faster than our previous models.

| Controller | Camera | |
|---|---|---|
| | 12 Mpix x 4 | **20.4 Mpix x 4** |
| FH-1050 Series<br>FH-3050 Series | ✓ | – |
| FH-2050 Series<br>FH-5050 Series | ✓ | ✓ |

## High-speed image storage

[USB 3.0 ports] [High-speed image compression]

Image data is so large that conventional controllers could not store all images due to limited storage time and capacity. The new high-speed, large-capacity controller has USB 3.0 ports and algorithms improved to compress image data at high speed, enabling all images to be stored to meet increasing needs in quality control.

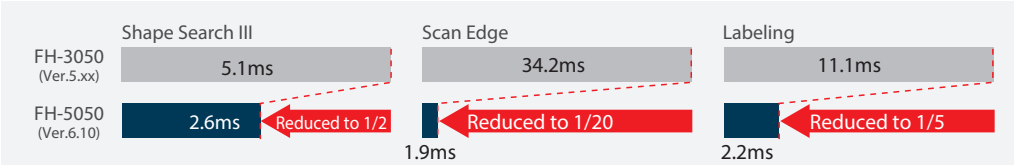



The times in the figure above are provided for reference only and their accuracy cannot be guaranteed.
They are measured under the following conditions:
- FH-5050 Controller
- 5 Mpix monochrome images
- Size of converted JPEG file: 0.6 MB

* Based on Omron investigation in June 2018.

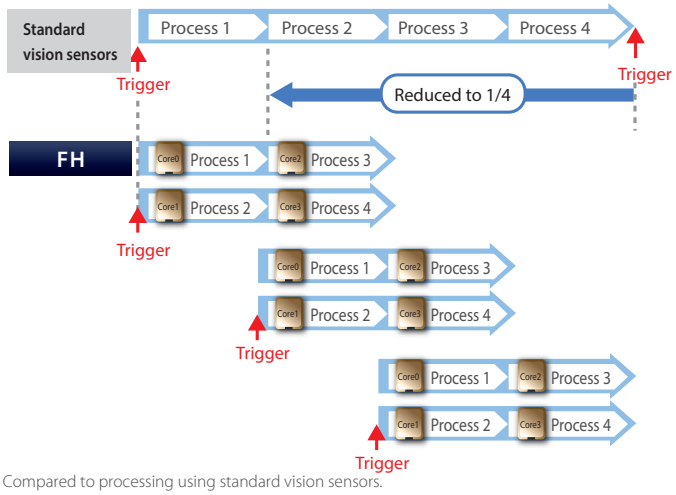

## High-speed measurement

The improved algorithms of processing items significantly increase processing speed.

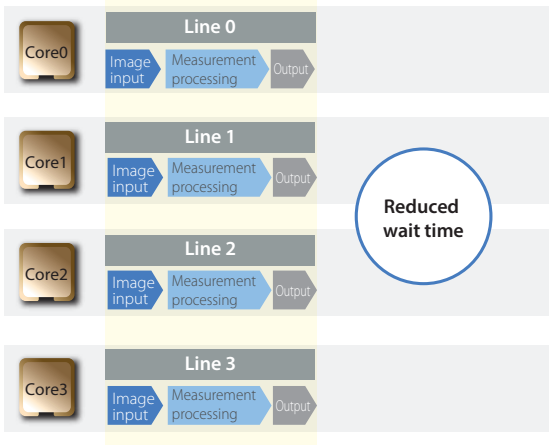



## Parallel processing of multiple lines

### Trigger interval reduced by up to 75%*



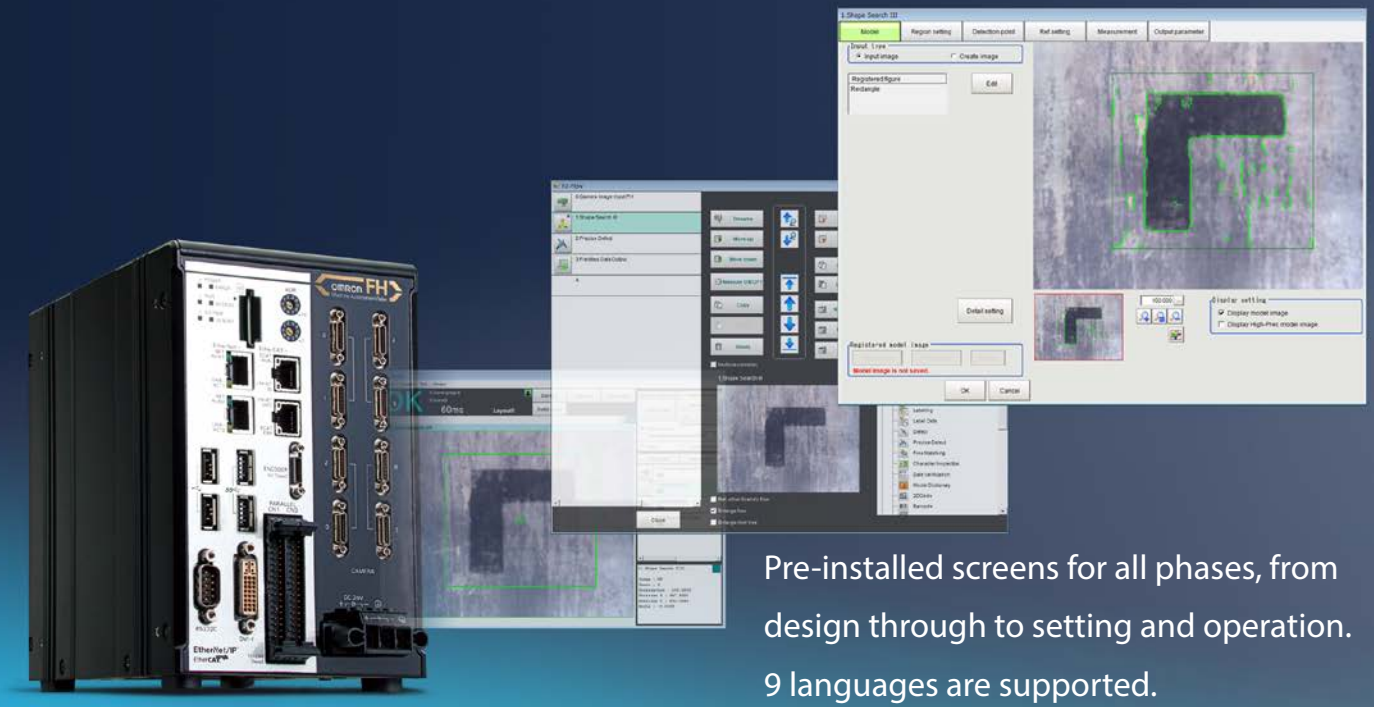

### Process multiple lines without waiting




* Compared to processing using standard vision sensors.

**GUI for designers**

# Intuitive design interface reduces complexity

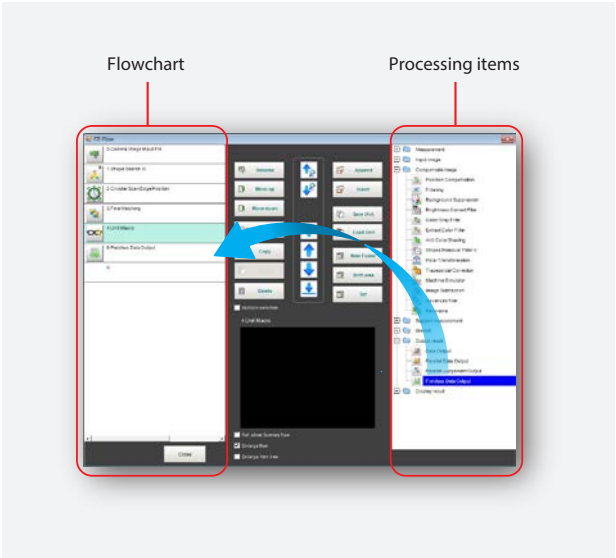


Pre-installed screens for all phases, from design through to setting and operation.
9 languages are supported.

## Build measurement process with flowchart programming

### Inspection and measurement flow design

Just drag and drop pre-installed processing items to build a measurement process.
The processing order can be defined, facilitating conditional branching.

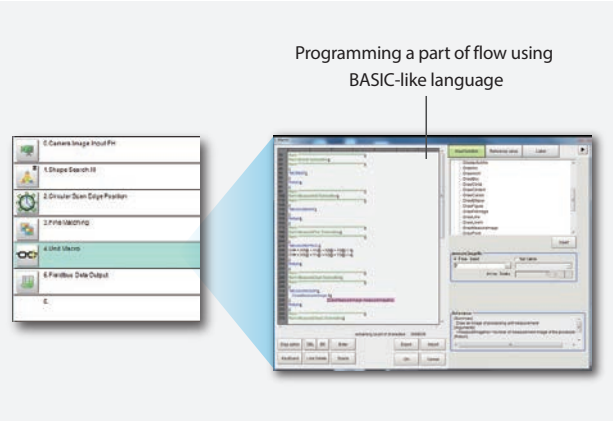



### Unit Macro

Macros let you easily achieve flow control that normally requires complex programming from the user interface.
The BASIC-like programming language facilitates the macro creation.

**Example:**

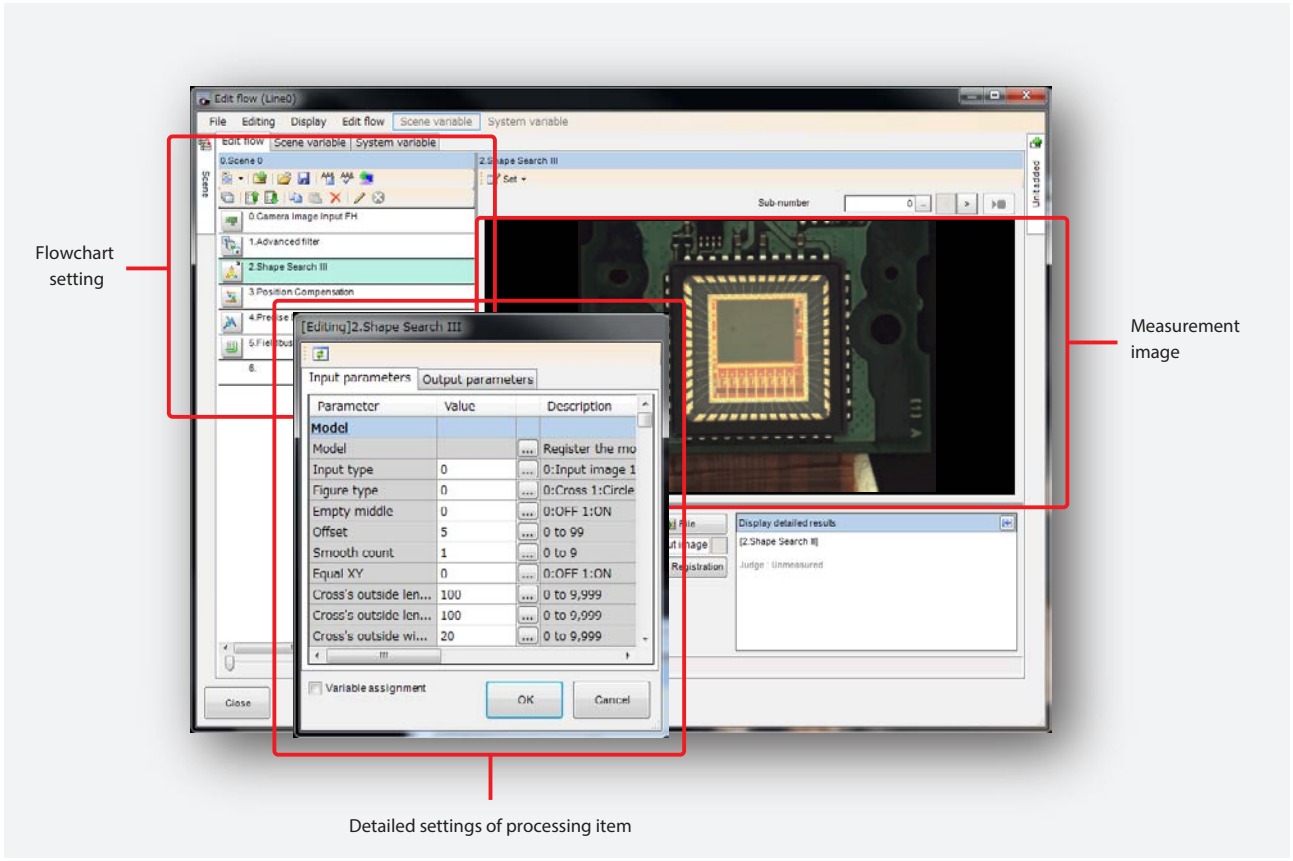
Some of the often-used processing (e.g., scene change + measurement start, data read + save) can be combined into one unit. This unit can be reused for other controllers.



# Simple setting with menus

## Total Design Management Editor

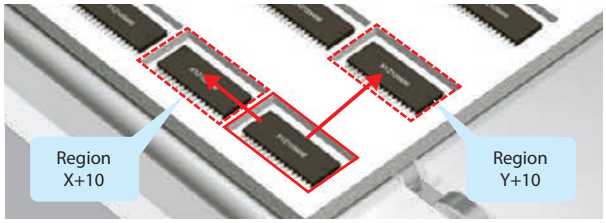
The FH Series has a new design interface that allows you to design complex measurement processes while managing variables.
This simple GUI manages complicated branching processes and data sharing across measurement scenes and eliminates the need to switch screens.




### Example 1: Repeat same measurement while shifting region

Previously, to inspect aligned parts or divided regions, the same processing items needed to be set many times, which made the inspection flowchart long. The FH Series allows you to combine variables and calculation to refer the same processing item repeatedly while shifting the measurement region.

External inspection of all electronic parts on a pallet

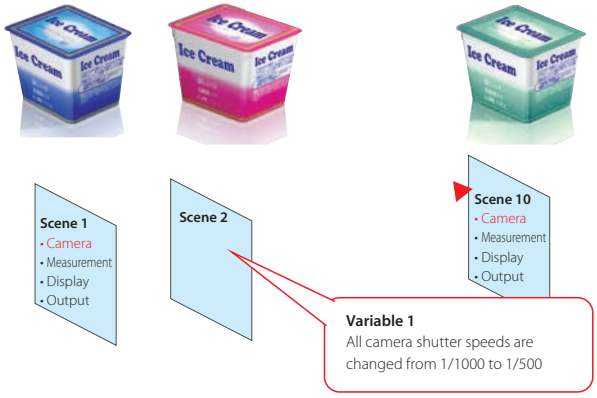



Same conditions
- Judgment value
- Extraction level
-
-

### Example 2: Set a common value for scenes

A variable can be used when the same parameter is used for two or more scenes or processing items, such as camera shutter speed and reference point for positioning. This simplifies the inspection flowchart, reducing setting errors and preventing you from forgetting to change settings.

External inspection of objects with different colors



**GUI for operators**

# Operation interface optimized for use at production sites

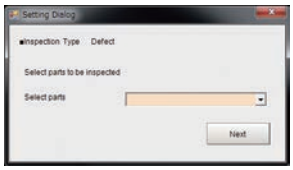
Drag & drop pre-installed interface to easily customize to your needs.

## Prevent incorrect operation at production site

### Show only parameters you change everyday

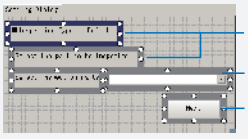
The processing item setting window includes parameters for initial setting and for daily adjustments. To prevent incorrect operation, you can customize the adjustment window to show only parameters that are required for your daily operation.

Example 1:
Show only necessary parameters




Example 2: Show a wizard


**Easy setting** Just select objects from the list of dialog boxes and place them. No programming required.



**Label:** Any character string can be displayed in any desired position

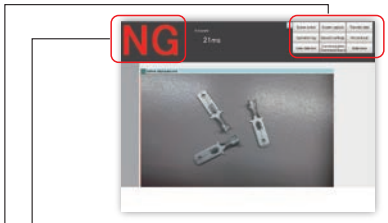
**Drop-down list:** Options can be set

**Button:** Operation that is performed when the button is pressed can be set

### Show only menus you need

Hide unnecessary windows to make operation easy and avoid problems due to incorrect operations.

Customized operation interface




**Enlarge the result to see it more easily**

The display size can be changed by dragging.

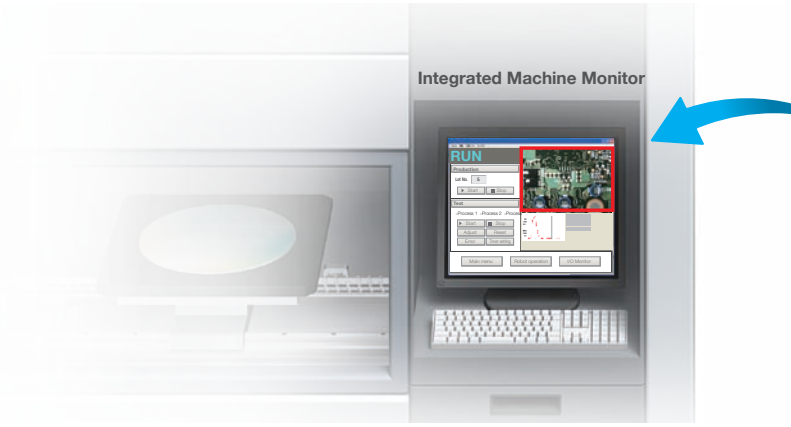

**Add short-cut buttons to daily functions**

Buttons can be added easily from the menu.

# More customization for machine monitors

## Supports .NET controls for integration into user applications

Microsoft.Net controls are supported to integrate the FH interfaces into a PC-based HMI. You can display FH screens and measurement results by dragging the controls to your HMI software.



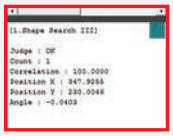


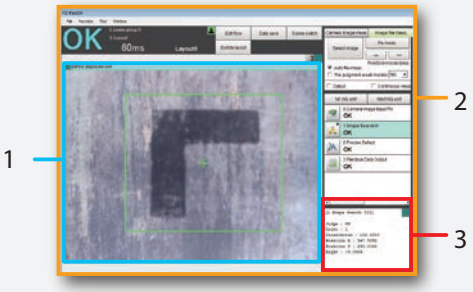
**Examples of controls**

1. Control to display a measurement image

2. Control to display the entire screen

3. Control to display measurement results






Note. Ask your Omron representative about obtaining controls.

## Application Producer development environment to develop original interfaces

The Application Producer (FH-AP1) provides a development environment that lets you customize software pre-installed in the FH Controller. Original interfaces can be created and used with the FH Controller.

Example: Show your desired logo on startup screen

Development environment
Application Producer

Change configuration files for the FH Controller and create installation files

Install the created files on the FH Controller


The customized interface can be used

# Processing item library

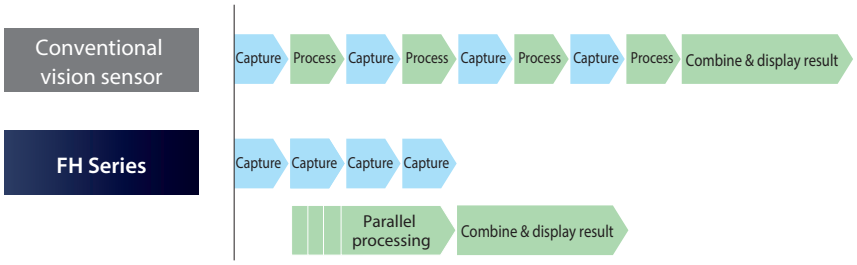
# Software for high-speed, high-precision inspections and measurements

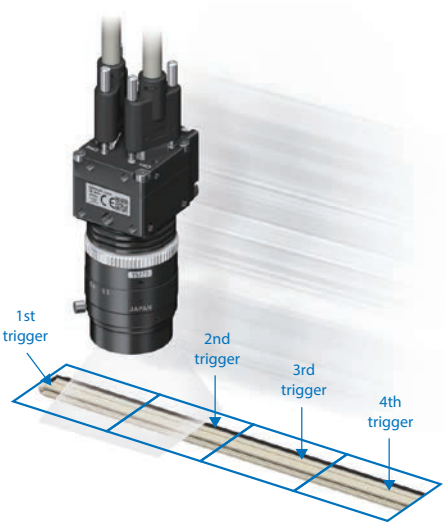
## Image input

**8** processing items

### Multi-trigger Imaging combines measurements fully using multi-core processor

When multiple images are used for measurement, the conventional vision sensor repeats processing after image capture until all images are processed because only one trigger can be input in one flow. In contrast, the Multi-trigger Imaging function to input multiple shutter triggers in one flow allows the FH Series to capture images and process them in parallel, leveraging the speed of the multi-core processor.

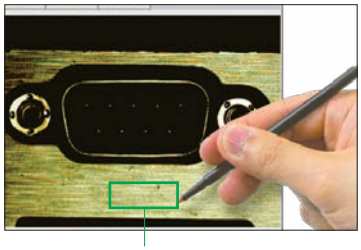


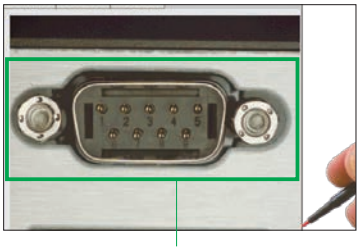

### Easy to create HDR images

The Camera Image Input HDR processing item can create optimized HDR images under variable ambient conditions. Normally, to create an HDR image, you must set the imaging conditions for each shooting. However with the FH Series, once you specify the optimum area to capture on the image, the vision system automatically adjusts the shutter speed while capturing images and combines the images.

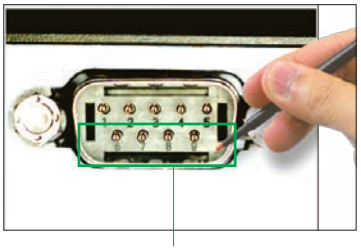
**Image optimized for the specified area**



Optimized for the bright part



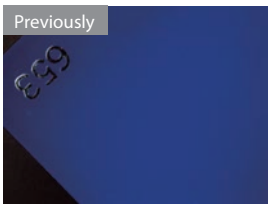
Optimized for the entire field of view



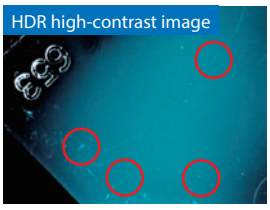
Optimized for the dark part

#### High-Contrast Mode

Multiple images are combined together and then averaged to reduce their noise component, after which the images are enlarged. This way, only the contrast of the area of interest and its background can be increased.




Low contrast makes the surface appear uniform.




Many scratches and soiled areas can be found.

For other processing items, see P.46

Filtering | 14 processing items

## 30 filters in Advanced Filter

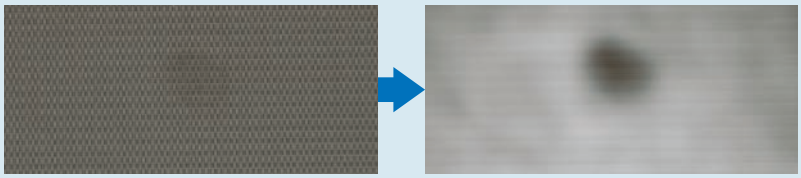
### Filters to detect low-contrast defects

The FH Series provides various filters to enhance linear defects in noise and low-contrast defects which cannot be detected by conventional image processing. High-quality external inspection can be achieved by combining filters.

**Even Emphasis Unevenness**

This filter removes background pattern and enhances low-contrast unevenness.

Example of inspection to detect unevenness in LCD

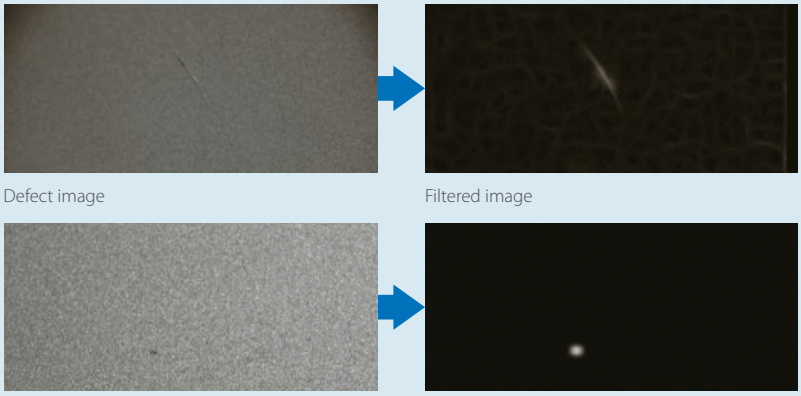


Defect image | Filtered image

**Emphasis Line Defect, Emphasis Circle Defect**

These filters enhance defects in high background noise or scratches on embossed surfaces.

Example of inspection to detect scratches on smartphones



Defect image | Filtered image

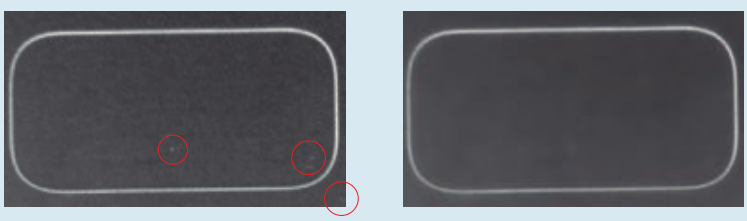
Defect image | Filtered image

### Filters widely used for image processing

Guided Filter, LoG (Laplacian of Gaussian) Filter, and other new filters that are widely used for image processing are added.

**Guided Filter**

This filter preserves edges while smoothing the background.
Even if an image contains significant noise, the filtered image can be registered as a model for Fine Matching.



Noise image | Filtered image

For other processing items, see P.46

## Inspection & measurement

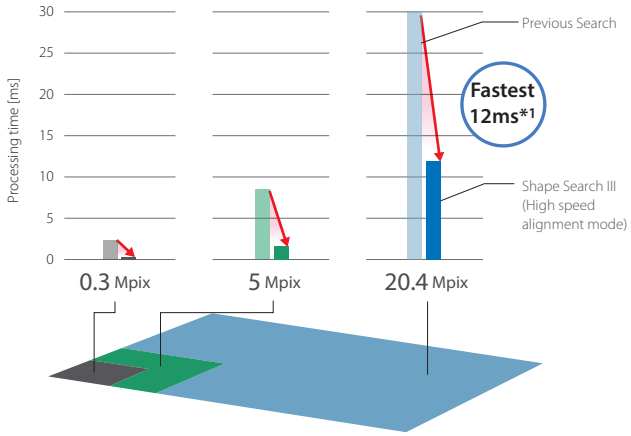
**34 processing items**

# Object detection algorithm Shape Search III

The Shape Search III provides both speed and robustness that are required for high-accuracy positioning. The processing speed of the FH-5050 Controller was further increased.

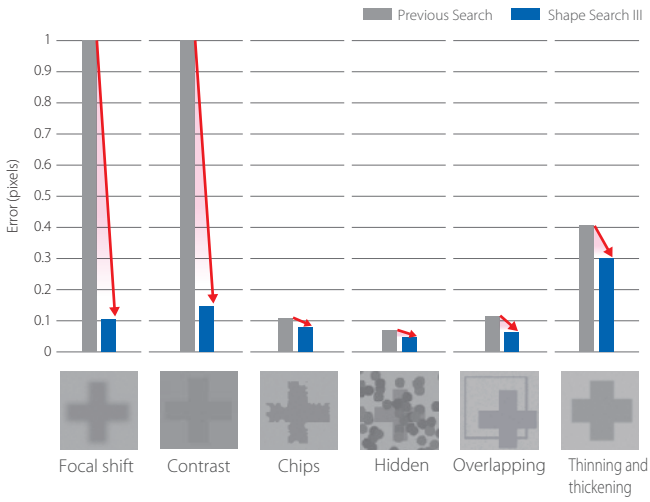
### Fastest searching time of 12 ms*1 with 20.4 Mpix camera

A 20.4 Mpix camera can search a positioning mark in as fast as 12 ms *1 and a 5 Mpix camera, which is mostly used for alignment applications, in as fast as 2 ms.




### Ultra-high-accuracy, robust positioning

Stable position detection required for ultra-high-accuracy, robust positioning is possible even under the adverse conditions, such as changes of environments and materials, which occur far too often in actual measurement applications.

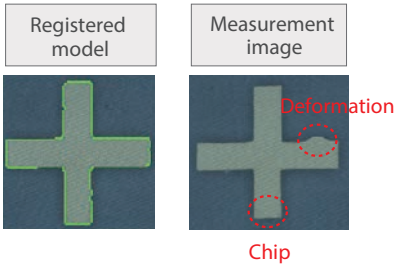



*1. The value measured under our specified conditions is provided for reference.

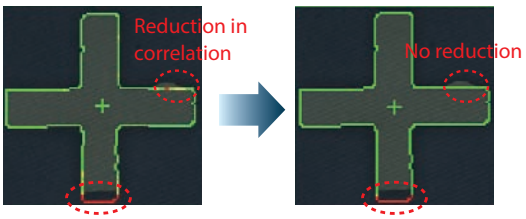
### Visualization of comparisons enables easy setting of high-precision searching

Patented/Patent Pending *2

Advanced searching is accompanied by many parameters that must be tuned to match the application. However, it is difficult for the person making the settings to see the internal process. Normally, a lot of time and effort is required to maximize tool performance. But with Shape Search III, you can visualize comparisons between the model data and a part of the measurement object to easily see when comparisons are not optimally matched. Visualization of the comparison level allows for parameters to be adjusted to quickly obtain the best performance.




You can see at a glance the difference between the registered model and measurement image




You can adjust a parameter called the Acceptable Distortion Level to enable measurements without reducing the correlation even if there is distortion. You can easily adjust this parameter while monitoring the comparison.

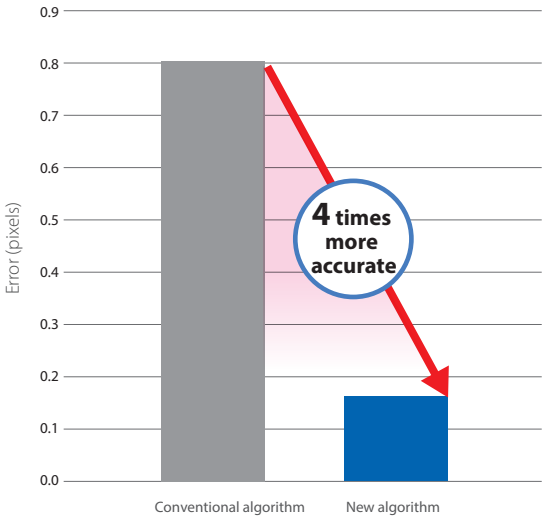
*2. Patent status as of June 2018
US:US9286669, Europe:Pending, China:ZL201410138793.3, Japan:JP6197340

# Circular Scan Edge Position accurately detects a circle

The new noise removal algorithm significantly increased robustness. The center and radius of a circle can be obtained accurately from a part of the circle.

## High accuracy

The new algorithm achieves four times higher accuracy than our previous models.



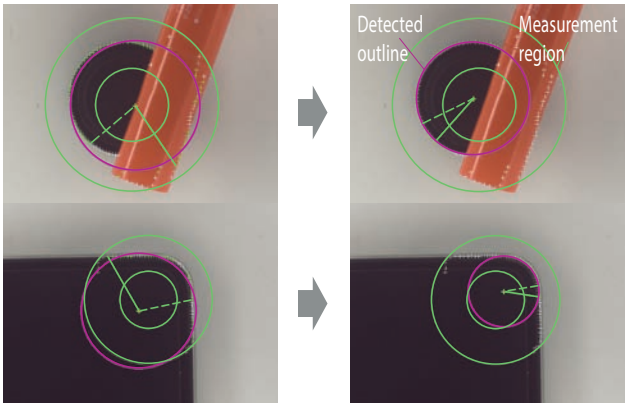

(Variation in measured circles: 90 to 360°)

## Robustness

The new noise removal algorithm accurately detects a whole circle from a part of the circle.

Conventional algorithm

New algorithm




The circle is not on the outline of the object

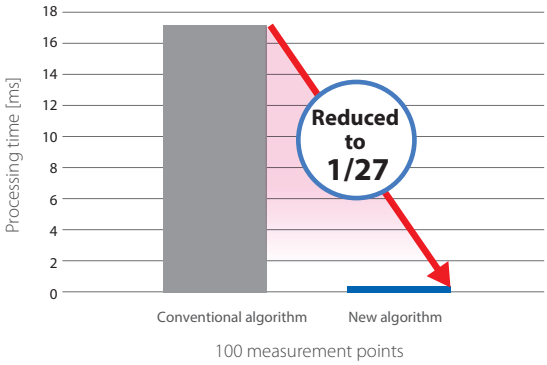
The outline of the object is detected accurately

# Scan Edge Position increases speed and stability

The algorithm has been completely redeveloped to drastically increase processing speed and noise removal capability.

## High speed

Processing time is reduced to 1/27 of our previous models. Even when measurement points increase, the processing time is within 10 ms.



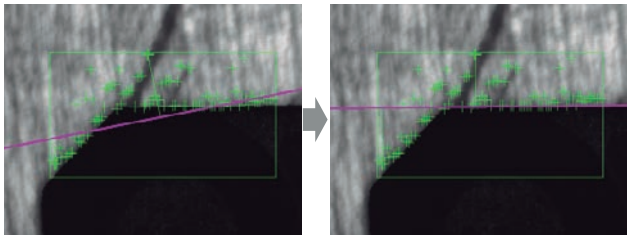

100 measurement points

## Stability

The new noise removal algorithm accurately estimates lines even when the edges are unclear due to variations in objects or disturbance.

Conventional algorithm

New algorithm



# Powerful 2D code reading

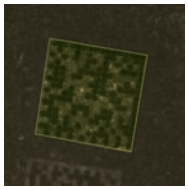
The dedicated algorithm for stable 2D code reading under adverse conditions is implemented. Data based on the print quality specifications can be output, which contributes to stable printing.

**Print Quality Grading Function** • ISO/IEC 15415 • ISO/IEC TR29158

## Changing ambient brightness

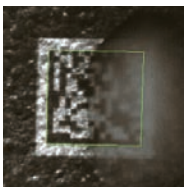
Chips due to reflection

Low contrast



## After processing/washing

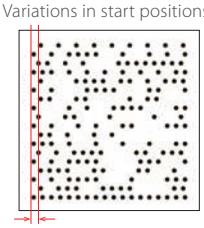
Waterdrops and dirt



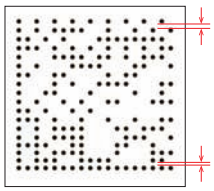
Scratched damage

## Poor printing quality in high-speed line

Variations in start positions

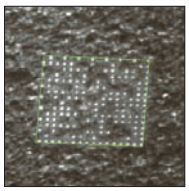


Uneven line spacing

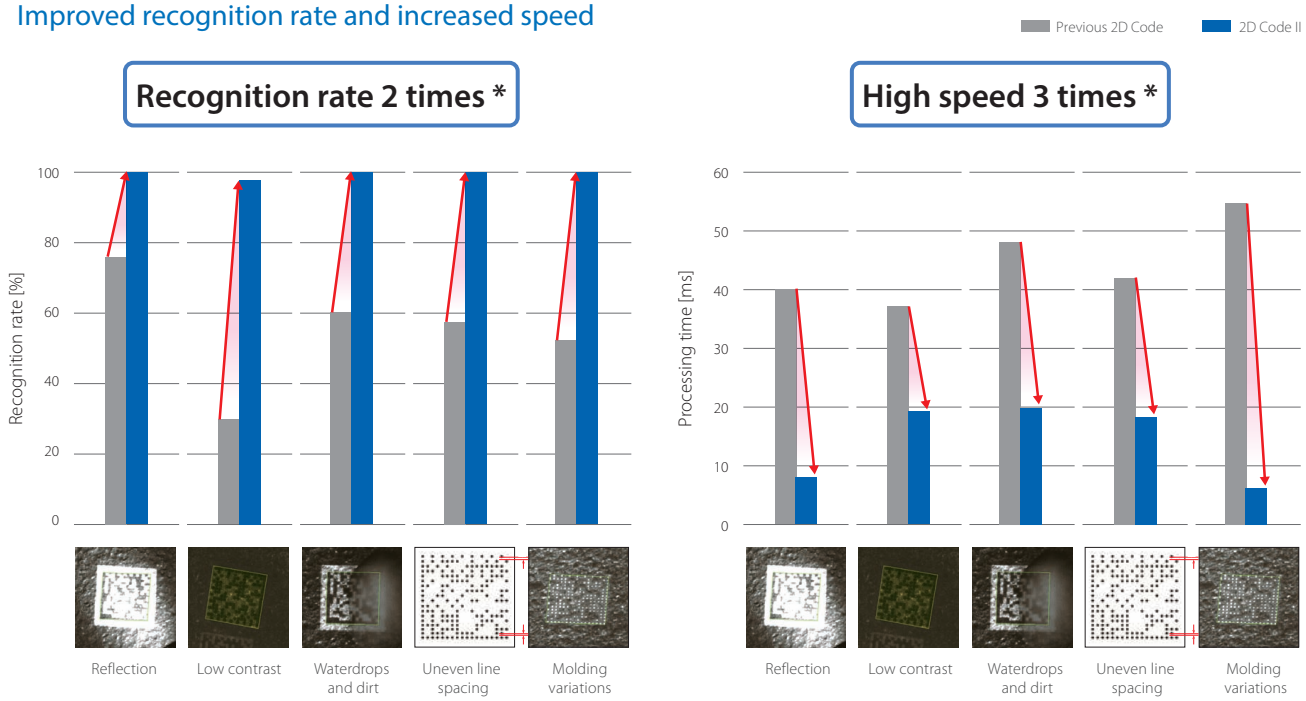


## Poorly printed on coarse surface

Molding variations of forged object



## Improved recognition rate and increased speed



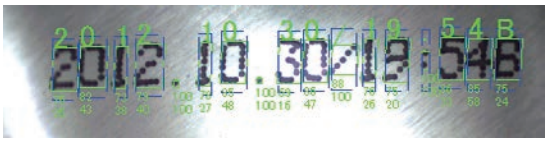

*. The average value measured under our specified conditions is provided for reference.

For other processing items, see P.46

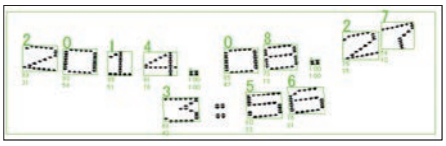
# Stable reading of difficult-to-read characters (OCR)

Printed characters can be too close to each other, and characters can be printed on curved surfaces. Even in these cases, stable reading is possible.

Touching characters



Curved character strings

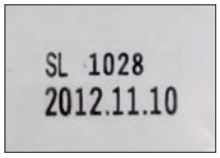


## Easy installation with built-in dictionary

Many previous character reading methods required dictionary setup before usage, which was a tedious step. The built-in dictionary developed through our long and rich experiences on FA sites includes a variety of fonts and possible character variations, eliminating the need of dictionary setup. You can also add non-conventional characters when special fonts are read.

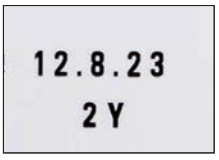
**Characters from most printers can be read, including dot and impact printers.**

Approx. 80 different fonts




Hot printer


Inkjet printer




Thermal printer


Laser marker

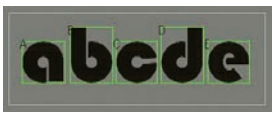
For other processing items, see P.47

# Character Inspection for special fonts

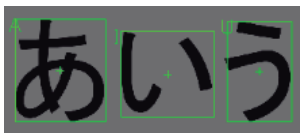
Character Inspection recognizes characters based on pattern search using the dictionary set up by the user. This search-based reading enables special fonts and non-alphanumeric characters to be inspected. Automatically extracting a model and selecting an index from the list help you easily set up your dictionary.

## Inspection of special fonts

Special fonts



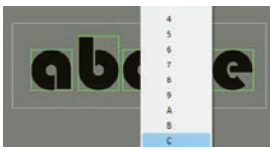

Japanese characters




## Easy dictionary setup

Automatic model extraction


Index selection from list

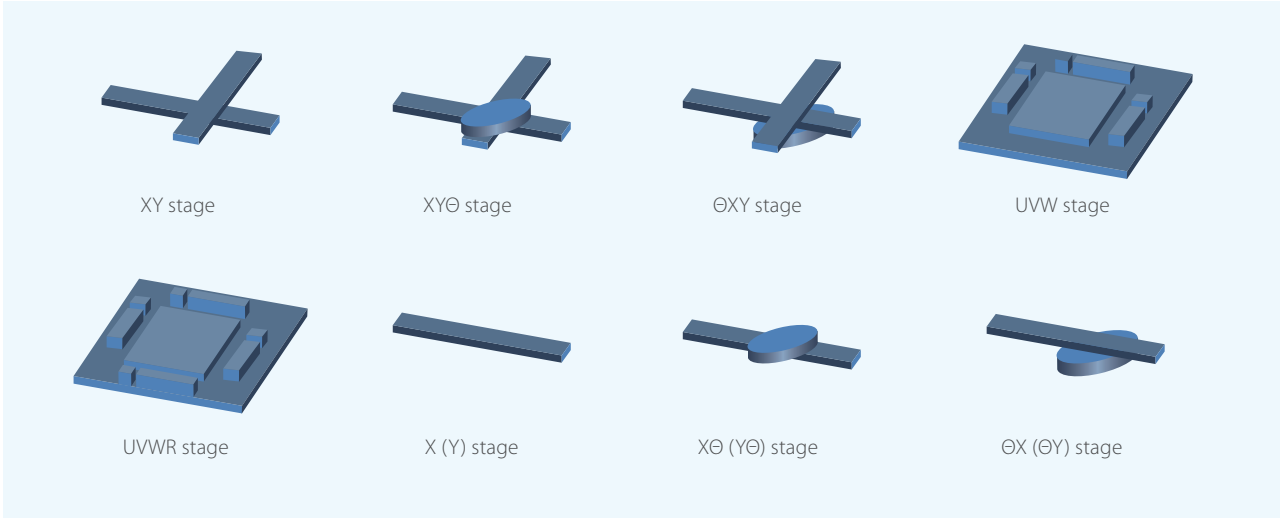


For other processing items, see P.47

**Inspection & measurement support** | **39 processing items**

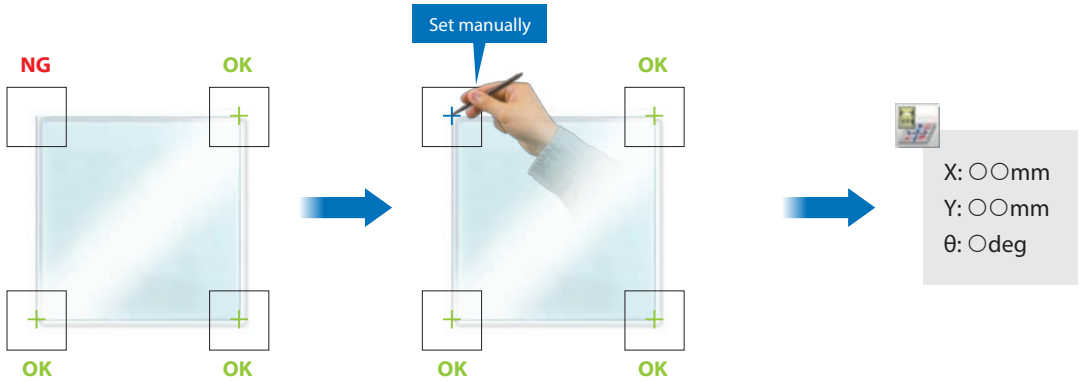
## Stage Data for single axis + θ axis stage alignment

The single axis + θ axis stages which are popular today as well as UVW stages can be used. The use of the same axis for both handling and positioning simplifies machine configuration.




## Manual Position Setting avoids stopping a machine

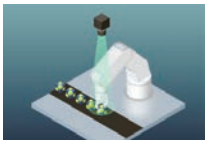
When an object cannot be detected, you can set the mark positions manually. The FH Series outputs the travel distance of the external device by referring the manually set values and measured coordinates. Manual Position Setting allows the FH Series to continue positioning without stopping the production line.

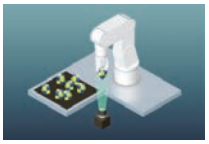


# Connecting robots

The dialog boxes for the FH Series and programs for various vendors' robots greatly reduce set-up time for robot applications.

**Robot applications**


Pick


Offset compensation


Place


Combination

## Setting FH Vision System

## Robot Setting Tool

Verified robot communication programs and flowcharts required for robot applications are provided.
You don't need to design communications and create a flowchart to set up a robot application.

# Easy 3-step robot connection

**Obtain robot program and flowchart**

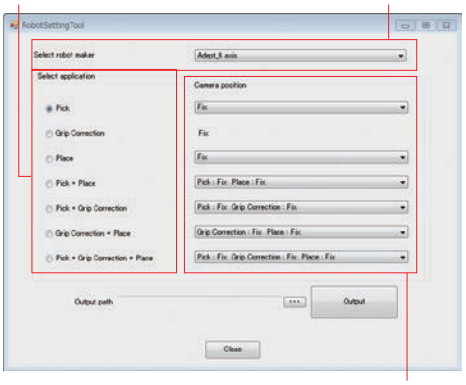
### Just a few clicks in Robot Setting Tool

Select 3 items to obtain the communication program and flowchart you need.

You can download the Robot Setting Tool from the following URL:
http://www.omron-cxone.com/fh

Application

Robot manufacturer



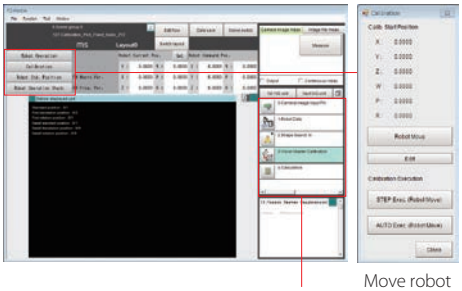

Robot Setting Tool

camera position

**Calibrate**

### Move robot for calibration from FH Series

The obtained flowchart can be used to move the robot for calibration from the FH Series. There is no need to create a program for robot calibration.



Flowchart

Move robot

**Check operations**

### Set up and check application from FH Series

Set the coordinates of the robot and check robot operations using the dialog boxes.

Set the coordinates of the robot

Check robot operations

**Flexible machine control**

# Seamless connection with Omron

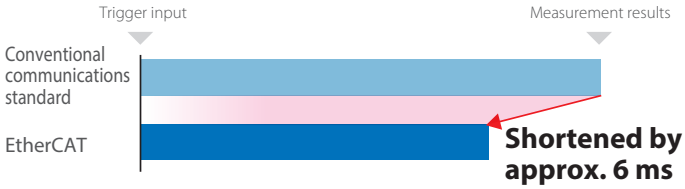
## EtherCAT® for high-speed data transfer, from position detection to starting axis motion

You can use EtherCAT to connect NJ/NX Machine Automation Controllers and 1S/G5 AC Servo System to increase the control speed of everyday communications protocols from position detection to starting axis motion.

**Data communications cycle: 125 µs**

### Communications cycle


### Time from trigger input to producing measurement results




Note: The times given above are typical times. They depend on parameter settings.

## Integrated development

### Design

#### Reusable programs

**Vision system configuration and simulation**

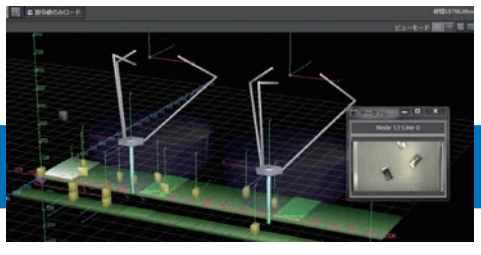
The Integrated Development Environment can be used to configure and simulate the FH Series.


Integrated Development Environment
Automation Software
Sysmac Studio

### Verification

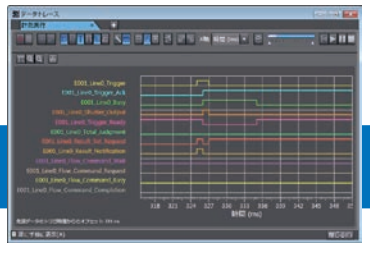
#### Advanced system debugging

**3D Simulation**



Machine movement can be simulated based on measurement results of vision systems.

**Data tracing**

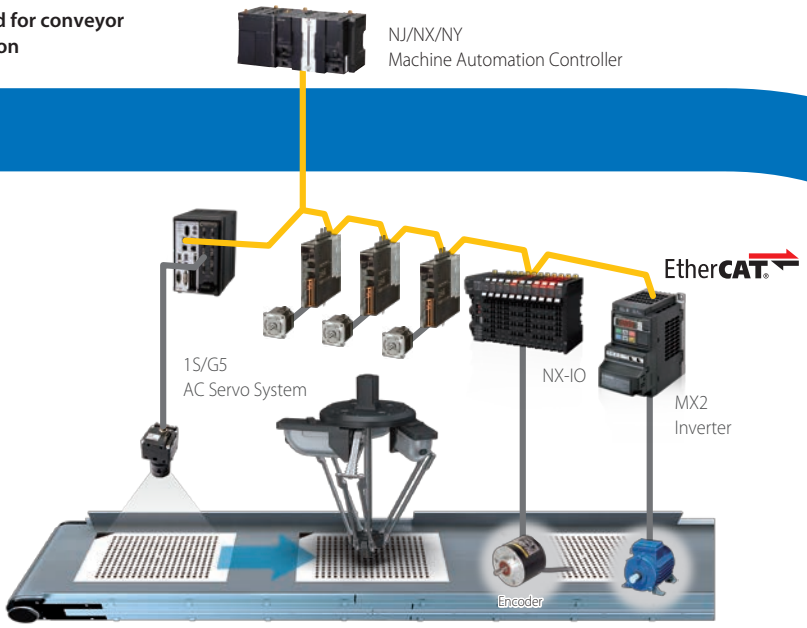


Inputs and outputs of vision systems can be traced as a time series.

# products makes production lines more efficient


## For advanced machine control

**Calibration Wizard for conveyor tracking application**




The Sysmac platform facilitates calibration between vision and machine control for conveyor tracking and other applications.
The dedicated Calibration Wizard reduces engineering time.

**Versatile selection**

# Select the best combination for

Software assets can be shared between controllers. This allows you to install devices with the capabilities you need, anywhere

## Cameras

Choose the right camera to suit your required number of pixels.

Easy-to-use cameras with built-in light are also available.

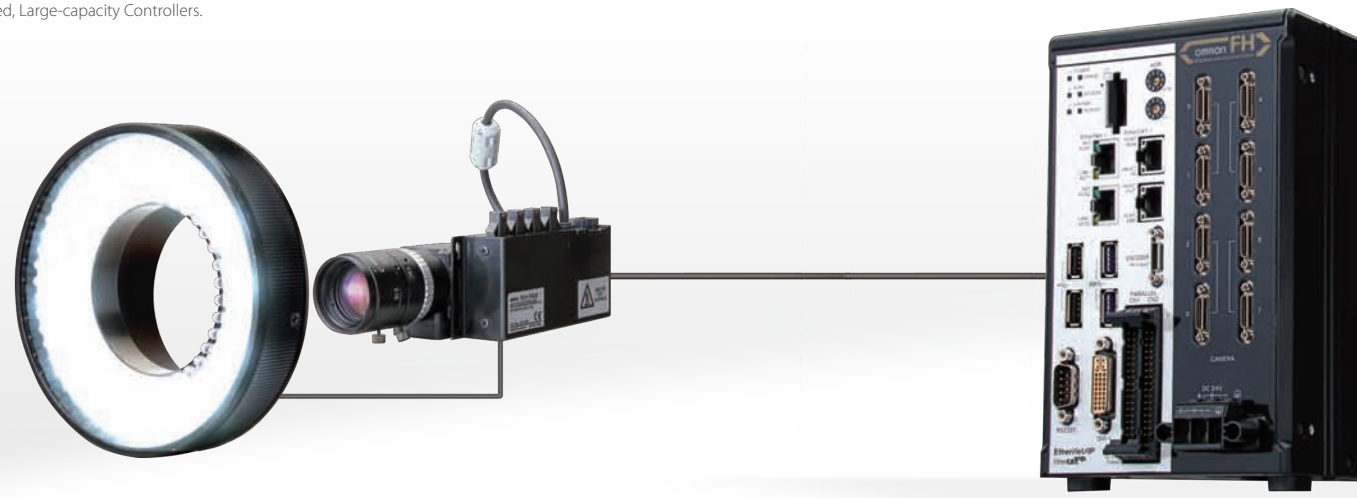
| No. of pixels | High-speed camera | Standard camera | Rolling shutter camera | Camera with built-in light |
|---|---|---|---|---|
| 20.4 Mpix* | – | – | FH-S□21R | – |
| 12 Mpix | FH-S□X12 | – | – | – |
| 5 Mpix | FH-S□X05 | FZ-S□5M3 | FH-S□05R | – |
| 2 Mpix | FH-S□02 | FZ-S□2M | – | – |
| 0.4 Mpix/ 0.3 Mpix | FH-S□X | FZ-S□ | – | FZ-SQ□□□□ |

* 20.4 Mpix Cameras can be used with the FH-5050/2050-series High-speed, Large-capacity Controllers.

## Controllers

Select a controller based on the required processing speed and network.

| | Series | CPU |
|---|---|---|
| High-speed, Large-capacity Controller | FH-5050 Series | Intel® Core™ i7 processor 4 cores |
| | FH-2050 Series | Intel® Celeron® processor 2 cores |
| Standard Controller | FH-3050 Series | Intel® Core™ i7 processor 4 cores |
| | FH-1050 Series | Intel® Celeron® processor 2 cores |
| Lite Controller | FH-L550 Series | Intel® Atom® processor 2 cores |



## Lights

Omron offers a complete line-up of lights required for image processing. The use of the camera-mount lighting controller allows you to control lighting conditions from the FH Controller, making system configuration simple.

### External lighting controller

| Description | LED | High-brightness LED |
|---|---|---|
| Camera-mount Lighting Controller | FLV-TCC | FL-TCC |
| Bar Light | FLV-BR | FL-BR |
| Direct Ring Light | FLV-DR | FL-DR |
| Low Angle Ring Light | FLV-DL | – |
| Coaxial Light | FLV-CL | – |
| Shadowless Light | FLV-FR/FP/FS/FQ | – |
| Spot Light | FLV-EP | – |
| Direct Back/Edge Type Light | FLV-DB/FB | – |
| Dome Light | FLV-DD | – |
| Photometric Stereo Light* | – | FL-PS |

* The FL-TCC Camera-mount Lighting Controller cannot be used. Use the FL-TCC1PS Lighting Controller for Photometric Stereo Light.

### Built-in lighting controller

| Description | Model |
|---|---|
| MDMC Light | FLD-MD |

Refer to the Vision Accessory Catalog (Cat. No. Q198) for details.

## Camera cables

The cable line-up includes bend-resistant cables and right-angle cables. Use the FZ-VSJ Cable Extension Unit for cable extensions.

| Description | Model |
|---|---|
| Camera Cable | FZ-VS□ □□M |
| Right-angle Camera Cable | FZ-VSL□ □□M |
| Bend-resistant Camera Cable | FZ-VSB3 □□M |
| Bend-resistant Right-angle Camera Cable | FZ-VSLB3 □□M |
| Cable Extension Unit | FZ-VSJ |

# your application

you need them.

| | Performance | Memory | No. of connectable cameras | Fieldbus |
|---|---|---|---|---|
| | ★★★★★ | RAM 8 GB, ROM 32 GB | 8 max. | PROFINET, EtherNet/IP™, EtherCAT |
| | ★★★ | RAM 8 GB, ROM 32 GB | 8 max. | PROFINET, EtherNet/IP™, EtherCAT |
| | ★★★★ | RAM 3 GB, ROM 4 GB | 8 max. | PROFINET, EtherNet/IP™, EtherCAT |
| | ★★ | RAM 3 GB, ROM 4 GB | 8 max. | PROFINET, EtherNet/IP™, EtherCAT |
| | ★ | RAM 3 GB, ROM 4 GB | 4 max. | PROFINET, EtherNet/IP™ |

★: The more starts, the higher the performance.

## Application producer

This development environment enables you to customize FH functions. It includes sample codes and wizards that will help you develop your own interfaces and processing items.

| Description | Model |
|---|---|
| DVD for installation | FH-AP1 |
| Software license | FH-AP1L |


EtherCAT

EtherNet/IP

PROFINET

## Touch panel monitor

The touch panel monitor is optimized for the operation of the FH Series.

| Description | Model |
|---|---|
| Touch Panel Monitor 12.1 inches | FH-MT12 |
| DVI-Analog Conversion Cable for Touch Panel Monitor | FH-VMDA □□ |
| USB Cable for Touch Panel Monitor | FH-VUAB □□ |

* RS-232C cables for long-distance connections are also available. Refer to Ordering Information for details.

## Sysmac Studio

The development environment for the Sysmac platform allows you to configure and simulate the FH Series on your PC.


Automation Software
Sysmac Studio

| Description | Model |
|---|---|
| DVD for installation | SYSMAC-SE200D |
| Software license (Vision Edition) | SYSMAC-VE001L |

Vision System

# FH-Series

## High-speed, high-accuracy inspection and measurement - like or even more than the human eye

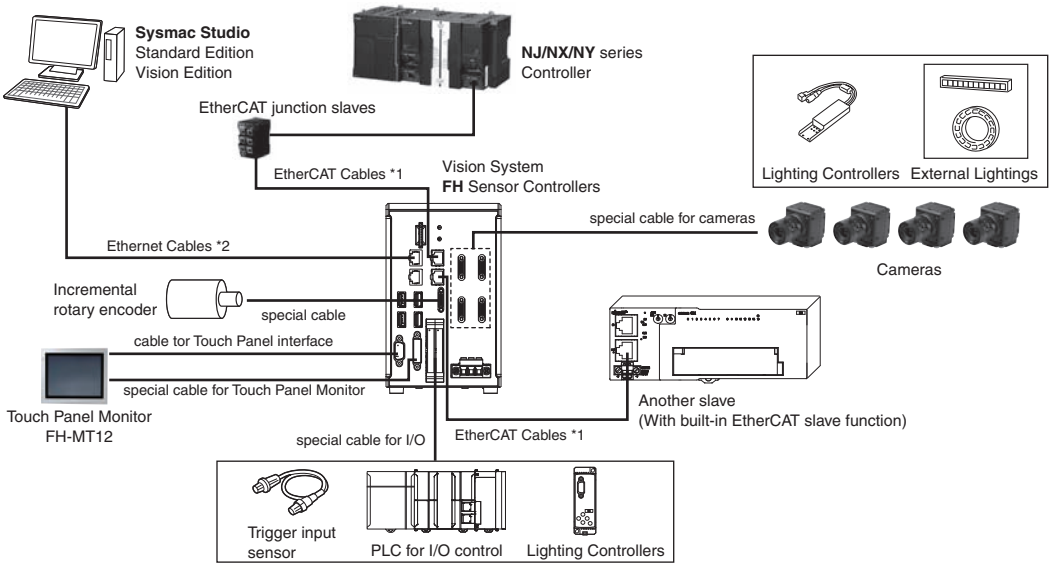
- Industry's highest sensing capability *
- Industry's highest processing capability *
- Usability to maximize performance

* Based on Omron investigation in June 2018.

## System configuration

### EtherCAT connections for FH series

Example of the FH Sensor Controllers (4-camera type)




*1. To use STP (shielded twisted-pair) cable of category 5 or higher with double shielding (braiding and aluminum foil tape) for EtherCAT and RJ45 connector.
*2. To use STP (shielded twisted-pair) cable of category 5 or higher for Ethernet and RJ45 connector.

## Ordering Information

### FH Series Sensor Controllers

| Item | | CPU | No. of cameras | Output | Model |
|---|---|---|---|---|---|
|  | High-speed, Large-capacity Controller | Intel® Core™ i7 processor 4 cores | 2 | NPN/PNP | **FH-5050** |
| | | | 4 | NPN/PNP | **FH-5050-10** |
| | | | 8 | NPN/PNP | **FH-5050-20** |
| | | Intel® Celeron® processor 2 cores | 2 | NPN/PNP | **FH-2050** |
| | | | 4 | NPN/PNP | **FH-2050-10** |
| | | | 8 | NPN/PNP | **FH-2050-20** |
| | Standard Controller | Intel® Core™ i7 processor 4 cores | 2 | NPN/PNP | **FH-3050** |
| | | | 4 | NPN/PNP | **FH-3050-10** |
| | | | 8 | NPN/PNP | **FH-3050-20** |
| | | Intel® Celeron® processor 2 cores | 2 | NPN/PNP | **FH-1050** |
| | | | 4 | NPN/PNP | **FH-1050-10** |
| | | | 8 | NPN/PNP | **FH-1050-20** |

| Item | | CPU | No. of cameras | Output | Model |
|---|---|---|---|---|---|
|  | Box-type controllers | Intel® Atom® processor 2 cores | 2 | NPN/PNP | **FH-L550** |
| | | | 4 | NPN/PNP | **FH-L550-10** |

## Cameras

| Item | | Lens mount | Descriptions | Color / Monochrome | Image Acquisition Time *1 | Model |
|---|---|---|---|---|---|---|
|  | Digital CMOS Cameras (Lens required) | C mount | 20.4 million pixels (Supported controller: FH-5050(-□)/2050(-□) Series) *2 | Color | 42.6 ms *3 | **FH-SC21R** |
| | | | | Monochrome | | **FH-SM21R** |
| | High-speed Digital CMOS Cameras (Lens required) | C mount | 12 million pixels *2 | Color | 24.9 ms *3 | **FH-SCX12** |
| | | | | Monochrome | | **FH-SMX12** |
| | | | 5 million pixels | Color | 10.3 ms *3 | **FH-SCX05** |
| | | | | Monochrome | | **FH-SMX05** |
|  | | | 0.4 million pixels | Color | 1.9ms | **FH-SCX** |
| | | | | Monochrome | | **FH-SMX** |
|  | High-speed Digital CMOS Cameras (Lens required) | M42 mount | 12 million pixels *2 | Color | 25.7 ms *3 | **FH-SC12** |
| | | | | Monochrome | | **FH-SM12** |
|  | High-speed Digital CMOS Cameras (Lens required) | C mount | 4 million pixels | Color | 8.5 ms *3 | **FH-SC04** |
| | | | | Monochrome | | **FH-SM04** |
| | | | 2 million pixels | Color | 4.6 ms *3 | **FH-SC02** |
| | | | | Monochrome | | **FH-SM02** |
|  | | | 0.3 million pixels | Color | 3.3 ms | **FH-SC** |
| | | | | Monochrome | | **FH-SM** |
|  | Digital CMOS Cameras (Lens required) | C mount | 5 million pixels | Color | 71.7ms | **FH-SC05R** |
| | | | | Monochrome | | **FH-SM05R** |
|  | | | 5 million pixels | Color | 38.2 ms | **FZ-SC5M3** |
| | | | | Monochrome | | **FZ-S5M3** |
|  | Digital CCD Cameras (Lens required) | C mount | 2 million pixels | Color | 33.3 ms | **FZ-SC2M** |
| | | | | Monochrome | | **FZ-S2M** |
|  | | | 0.3 million pixels | Color | 12.5 ms | **FZ-SC** |
| | | | | Monochrome | | **FZ-S** |
|  | Small Digital CCD Cameras (Lens required) | Lenses for small camera required | 300,000-pixel flat type | Color | 12.5 ms | **FZ-SFC** |
| | | | | Monochrome | | **FZ-SF** |
|  | | | 300,000-pixel pen type | Color | 12.5 ms | **FZ-SPC** |
| | | | | Monochrome | | **FZ-SP** |
|  | Intelligent Compact Digital CMOS Camera | Built-in lens | Narrow view | Color | 16.7 ms | **FZ-SQ010F** |
| | | | Standard view | Color | | **FZ-SQ050F** |
|  | | | Wide View (long-distance) | Color | | **FZ-SQ100F** |
| | | | Wide View (short-distance) | Color | | **FZ-SQ100N** |

*1 The image acquisition time does not include the image conversion processing time of the sensor controller.
The camera image input time varies depending on the sensor controller model, number of cameras, and camera settings. Check before you use the camera.
*2 Up to four cameras of this model can be connected to one controller. Up to eight cameras including other models can be connected to an FH-5050-20, 3050-20, 2050-20 or 1050-20.
*3 Frame rate in high speed mode when the camera is connected using two camera cables. For other conditions, refer to the table on the next page.

| Model | | | FH-SM02 | FH-SC02 | FH-SM04 | FH-SC04 | FH-SM12 | FH-SC12 | FH-SMX | FH-SCX | FH-SMX05 | FH-SCX05 | FH-SMX12 | FH-SCX12 | FH-SM21R | FH-SC21R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Image Acquisition Time *4 | 2 Cables *5 | High Speed Mode *6 | 4.6 ms | | 8.5 ms | | 25.7 ms | | --- | | 10.3 ms | | 24.9 ms | | 42.6 ms | |
| | | Standard Mode | 9.7 ms | | 17.9 ms | | 51.3 ms | | --- | | 22.1 ms | | 53.5 ms | | 90.1 ms | |
| | 1 Cables | High Speed Mode *6 | 9.2 ms | | 17.0 ms | | 51.3 ms | | 1.9 ms | | 20.6 ms | | 50.0 ms | | 83.3 ms | |
| | | Standard Mode | 19.3 ms | | 35.8 ms | | 102.0 ms | | 3.8 ms | | 44.1 ms | | 106.4 ms | | 175.4 ms | |

*4 The image acquisition time does not include the image conversion processing time of the sensor controller.
*5 Two Camera ports of the controller are used per one camera.
*6 Up to 5 m Camera Cable length.

## Camera Cables

| Item | Descriptions | Model *3 |
|---|---|---|
|  | Camera Cable<br>Cable length: 2 m, 3 m, 5m, or 10 m *2 | **FZ-VS3 □M** |
|  | Bend resistant Camera Cable<br>Cable length: 2 m, 3 m, 5m, or 10 m *2 | **FZ-VSB3 □M** |
|  | Right-angle Camera Cable *1<br>Cable length: 2 m, 3 m, 5m, or 10 m *2 | **FZ-VSL3 □M** |
|  | Bend resistant Right-angle Camera Cable *1<br>Cable length: 2 m, 3 m, 5 m, or 10 m *2 | **FZ-VSLB3 □M** |
|  | Long-distance Camera Cable<br>Cable length: 15 m *2 | **FZ-VS4 15M** |
|  | Long-distance Right-angle Camera Cable *1<br>Cable length: 15 m *2 | **FZ-VSL4 15M** |
|  | Cable Extension Unit<br>Up to two Extension Units and three Cables can be connected. (Maximum cable length: 45 m *2) | **FZ-VSJ** |

*1 This Cable has an L-shaped connector on the Camera end.
*2 The maximum cable length depends on the camera being connected, and the model and length of the cable being used. For further information, refer to the *Cameras / Cables Connection Table and Maximum Extension Length Using Cable Extension Units FZ-VSJ* table.
When a High-speed Digital CMOS Camera FH-S□02/-S□04/-S□12/-S□21R is used in the high speed mode of transmission speed, two camera cables are required.
*3 Insert the cables length into □ in the model number as follows. 2 m = 2, 3 m = 3, 5 m = 5, 10 m = 10

## Cameras / Cables Connection Table

| Camera Cables | Model | Cable length | High-speed Digital CMOS cameras | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 300,000-pixel | 2 million-pixel | | 4 million-pixel | | 12 million-pixel | |
| | | | FH-SM/SC | FH-SM02/SC02 | | FH-SM04/SC04 | | FH-SM12/SC12 | |
| | | | – | High speed mode of transmission speed select | Standard mode of transmission speed select | High speed mode of transmission speed select | Standard mode of transmission speed select | High speed mode of transmission speed select | Standard mode of transmission speed select |
| Camera Cables Right-angle camera cables | FZ-VS3 FZ-VSL3 | 2 m | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | | 3 m | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | | 5 m | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | | 10 m | Yes | No | Yes | No | Yes | No | Yes |
| Bend resistant camera cables Bend resistant Right-angle Camera Cable | FZ-VSB3 FZ-VSLB3 | 2 m | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | | 3 m | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | | 5 m | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| | | 10 m | Yes | No | Yes | No | Yes | No | Yes |
| Long-distance camera cable Long-distance right-angle camera cable | FZ-VS4 FZ-VSL4 | 15 m | Yes | No | Yes | No | Yes | No | Yes |

| Camera Cables | Model | Cable length | High-speed Digital CMOS cameras | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 400,000-pixel | | 5 million-pixel | | 12 million-pixel | |
| | | | FH-SMX/SCX | | FH-SMX05/SCX05 | | FH-SMX12/SCX12 | |
| | | | High speed mode of transmission speed select | Standard mode of transmission speed select | High speed mode of transmission speed select | Standard mode of transmission speed select | High speed mode of transmission speed select | Standard mode of transmission speed select |
| Camera Cables Right-angle camera cables | FZ-VS3 FZ-VSL3 | 2 m | Yes | Yes | Yes | Yes | Yes | Yes |
| | | 3 m | Yes | Yes | Yes | Yes | Yes | Yes |
| | | 5 m | Yes | Yes | Yes | Yes | Yes | Yes |
| | | 10 m | No | Yes | No | Yes | No | Yes |
| Bend resistant camera cables Bend resistant Right-angle Camera Cable | FZ-VSB3 FZ-VSLB3 | 2 m | Yes | Yes | Yes | Yes | Yes | Yes |
| | | 3 m | Yes | Yes | Yes | Yes | Yes | Yes |
| | | 5 m | Yes | Yes | Yes | Yes | Yes | Yes |
| | | 10 m | No | Yes | No | Yes | No | Yes |
| Long-distance camera cable Long-distance right-angle camera cable | FZ-VS4 FZ-VSL4 | 15 m | No | Yes | No | Yes | No | Yes |

| Camera Cables | Model | Cable length | Digital CMOS Camera | | | | Digital CCD cameras | |
|---|---|---|---|---|---|---|---|---|
| | | | 5 million-pixel | 20.4 million-pixel | | 5 million-pixel | 300,000-pixel | 2 million-pixel |
| | | | FH-SM05R/ SC05R | FH-SM21R/SC21R | | FZ-S5M3/ SC5M3 | FZ-S/SC | FZ-S2M/SC2M |
| | | | – | High speed mode of transmission speed select | Standard mode of transmission speed select | – | – | – |
| Camera Cables Right-angle camera cables | FZ-VS3 FZ-VSL3 | 2 m | Yes | Yes | Yes | Yes | Yes | Yes |
| | | 3 m | Yes | Yes | Yes | Yes | Yes | Yes |
| | | 5 m | Yes | Yes | Yes | Yes | Yes | Yes |
| | | 10 m | Yes | No | Yes | No | Yes | Yes |
| Bend resistant camera cables Bend resistant Right-angle Camera Cable | FZ-VSB3 FZ-VSLB3 | 2 m | Yes | Yes | Yes | Yes | Yes | Yes |
| | | 3 m | Yes | Yes | Yes | Yes | Yes | Yes |
| | | 5 m | Yes | Yes | Yes | Yes | Yes | Yes |
| | | 10 m | Yes | No | Yes | No | Yes | Yes |
| Long-distance camera cable Long-distance right-angle camera cable | FZ-VS4 FZ-VSL4 | 15 m | Yes | No | Yes | No | Yes | Yes |

| Camera Cables | Model | Cable length | Small digital CCD cameras Pen type / flat type | Intelligent Compact Digital CMOS Camera |
|---|---|---|---|---|
| | | | FZ-SF/SFC FZ-SP/SPC | FZ-SQ□ |
| Camera Cables Right-angle camera cables | FZ-VS3 FZ-VSL3 | 2 m | Yes | Yes |
| | | 3 m | Yes | Yes |
| | | 5 m | Yes | Yes |
| | | 10 m | Yes | Yes |
| Bend resistant camera cables Bend resistant Right-angle Camera Cable | FZ-VSB3 FZ-VSLB3 | 2 m | Yes | Yes |
| | | 3 m | Yes | Yes |
| | | 5 m | Yes | Yes |
| | | 10 m | Yes | Yes |
| Long-distance camera cable Long-distance right-angle camera cable | FZ-VS4 FZ-VSL4 | 15 m | Yes | Yes |

## Maximum Extension Length Using Cable Extension Units FZ-VSJ

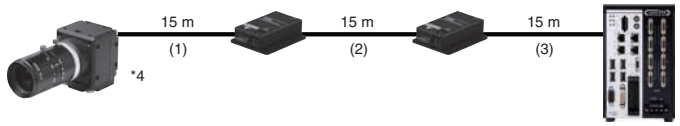
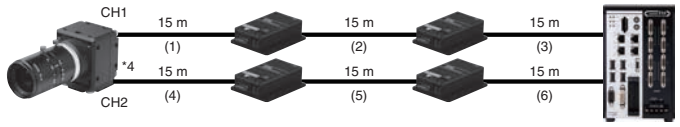
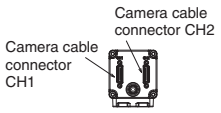
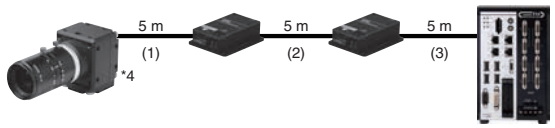
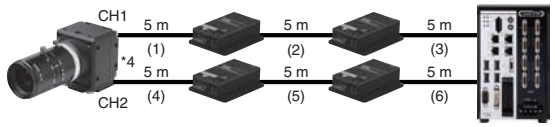
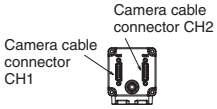
| Item | Model | Transmission speed (*1) | No. of CH used for connection (*2) | Maximum cable length using 1 Camera Cable (*1) | Max. number of connectable Extension Units | Using Cable Extension Units FZ-VSJ | |
|---|---|---|---|---|---|---|---|
| | | | | | | Max. cable length | Connection configuration |
| High-speed Digital CMOS Cameras | FH-SM/SC | --- | --- | 15 m (Using FZ-VS4/VSL4) | 2 | 45 m | [Configuration 1] Camera cable: 15 m × 3 Extension Unit: 2 |
| | FH-SMX/SCX | Standard | --- | 15 m (Using FZ-VS4/VSL4) | 2 | 45 m | [Configuration 1] Camera cable: 15 m × 3 Extension Unit: 2 |
| | | High speed | --- | 5 m (Using FZ-VS□/VSL□) | 2 | 15 m | [Configuration 3] Camera cable: 5 m × 3 Extension Unit: 2 |
| | FH-SM02/SC02 FH-SM04/SC04 FH-SM12/SC12 FH-SMX05/SCX05 FH-SMX12/SCX12 | Standard | 1 | 15 m (Using FZ-VS4/VSL4) | 2 | 45 m | [Configuration 1] Camera cable: 15 m × 3 Extension Unit: 2 |
| | | | 2 | 15 m (Using FZ-VS4/VSL4) | 4 (*3) | 45 m | [Configuration 2] Camera cable: 15 m × 6 Extension Unit: 4 |
| | | High speed | 1 | 5 m (Using FZ-VS□/VSL□) | 2 | 15 m | [Configuration 3] Camera cable: 5 m × 3 Extension Unit: 2 |
| | | | 2 | 5 m (Using FZ-VS□/VSL□) | 4 (*3) | 15 m | [Configuration 4] Camera cable: 5 m × 6 Extension Unit: 4 |
| Digital CMOS Cameras | FH-SM21R/SC21R | Standard | 1 | 15 m (Using FZ-VS4/VSL4) | 2 | 45 m | [Configuration 1] Camera cable: 15 m × 3 Extension Unit: 2 |
| | | | 2 | 15 m (Using FZ-VS4/VSL4) | 4 (*3) | 45 m | [Configuration 2] Camera cable: 15 m × 6 Extension Unit: 4 |
| | | High speed | 1 | 15 m (Using FZ-VS4/VSL4) | 2 | 15 m | [Configuration 3] Camera cable: 5 m × 3 Extension Unit: 2 |
| | | | 2 | 5 m (Using FZ-VS□/VSL□) | 4 (*3) | 15 m | [Configuration 4] Camera cable: 5 m × 6 Extension Unit: 4 |
| | FH-SM05R/SC05R | --- | --- | 15 m (Using FZ-VS□/VSL□) | 2 | 45 m | [Configuration 1] Camera cable: 15 m × 3 Extension Unit: 2 |
| | FZ-S5M3/SC5M3 | --- | --- | 5 m (Using FZ-VS□/VSL□) | 2 | 15 m | [Configuration 3] Camera cable: 5 m × 3 Extension Unit: 2 |
| Digital CCD Cameras | FZ-S/SC FZ-S2M/SC2M | --- | --- | 15 m (Using FZ-VS4/VSL4) | 2 | 45 m | [Configuration 1] Camera cable: 15 m × 3 Extension Unit: 2 |
| Small Digital CCD Cameras Flat type/ Pen type | FZ-SF/SFC FZ-SP/SPC | --- | --- | 15 m (Using FZ-VS4/VSL4) | 2 | 45 m | [Configuration 1] Camera cable: 15 m × 3 Extension Unit: 2 |
| Intelligent Compact Digital CMOS Camera | FZ-SQ□ | --- | --- | 15 m (Using FZ-VS4/VSL4) | 2 | 45 m | [Configuration 1] Camera cable: 15 m × 3 Extension Unit: 2 |

*1 The FH-S□□□ enables switching between standard and high speed modes. In high speed mode, images can be transferred approximately two times faster than in standard mode, but the connectable cable length will be shorter.

*2 The FH-S□□□ has two channels to connect Camera Cables. Connection to two channels makes image transfer two times faster than connection to one channel: high speed mode using two channels can transfer approximately four times as many images as standard mode using one channel.

*3 Each channel can be used to connect up to two Cable Extension Units: up to four extension units, two channels x two units, can be connected by using two channels.

## Connection Configuration

| | Connection configuration using the maximum length of Camera Cables | Remarks |
|---|---|---|
| Configuration 1 |  | |
| Configuration 2 |  |  |
| Configuration 3 |  | |
| Configuration 4 |  |  |

*4 Select the Camera Cables between the Controller and Extension Unit, between the Extension Units, and between the Extension Unit and Camera according to the connected Camera.
Different types or lengths of Camera Cables can be used for (1), (2), and (3) as well as for (4), (5), and (6). However, the type and length of Camera Cable (1) must be the same as those of Camera Cable (4), (2) must be the same as (5), and (3) must be the same as (6).

## Monitor

| Item | Descriptions | Model |
|---|---|---|
|  | Touch Panel Monitor 12.1 inches<br>For FH Sensor Controllers * | **FH-MT12** |
|  | LCD Monitor 8.4 inches | **FZ-M08** |

* FH Series Sensor Controllers version 5.32 or higher is required.

## Monitor Cables

| Item | Descriptions | Model |
|---|---|---|
|  | DVI-Analog Conversion Cable for Touch Panel Monitor/LCD Monitor<br>Cable length: 2 m, 5 m or 10 m | **FH-VMDA □M *1** |
|  | RS-232C Cable for Touch Panel Monitor<br>Cable length: 2 m, 5 m or 10 m | **XW2Z-□□□PP-1 *2** |
|  | USB Cable for Touch Panel Monitor<br>Cable length: 2 m or 5 m | **FH-VUAB □M *1** |

*1 Insert the cables length into □ in the model number as follows. 2 m = 2, 5 m = 5, 10 m = 10
*2 Insert the cables length into □□□ in the model number as follows. 2 m = 200, 5 m = 500, 10 m = 010.

A video signal cable and an operation signal cable are required to connect the Touch Panel Monitor.

| Signal | Cable | 2 m | 5 m | 10 m |
|---|---|---|---|---|
| **Video signal** | DVI-Analog Conversion Cable | Yes | Yes | Yes |
| **Touch panel operation signal** | USB Cable | Yes | Yes | No |
| | RS-232C Cable | Yes | Yes | Yes |

## Parallel I/O Cables/Encoder Cable

| Item | Descriptions | Model |
|---|---|---|
|  | Parallel I/O Cable *1<br>Cable length: 2m, 5m or 15m | **XW2Z-S013-□** *2 |
|  | Parallel I/O Cable for Connector-terminal Conversion Unit *1<br>Cable length: 0.5 m, 1 m, 1.5 m, 2 m, 3 m, 5 m<br>Connector-Terminal Block Conversion Units can be connected<br>(Terminal Blocks Recommended Products: OMRON XW2R-□34G-T) | **XW2Z-□□□EE** *3 |
|  | Connector-Terminal Block Conversion Units, General-purpose devices | **XW2R-□34GD-T** *4 |
|  | Encoder Cable for line-driver<br>Cable length: 1.5 m | **FH-VR 1.5M** |

*1 2 Cables are required for all I/O signals.
*2 Insert the cables length into □ in the model number as follows. 2 m = 2, 5 m = 5, 15 m = 15
*3 Insert the cables length into □□□ in the model number as follows. 0.5 m = 050, 1 m = 100, 1.5 m = 150, 2 m = 200, 3 m = 300, 5 m = 500
*4 Insert the wiring method into □ in the model number as follows. Phillips screw = J, Slotted screw (rise up) = E, Push-in spring = P
Refer to the XW2R Series catalog (Cat. No. G077) for details.

## Parallel Converter Cable

**When you change to connect the F series, FZ5 series, or FZ5-L series to FH series Sensor Controller, you can convert by using the appropriate parallel converter cable of FH-VPX series under the usable condition.**

| Item | Applicable Model | | Usable Condition | Model |
|---|---|---|---|---|
|  | FZ□ series | | • Do not use RESET signal. *<br>• Use with COMIN and COMUT are same power source. | **FH-VPX-FZ** |
|  | FZ□-L35x series | | • Do not use RESET signal. * | **FH-VPX-FZL** |
|  | F160 series | F160-C10 | • Do not use RESET signal. *<br>• Use with COMIN and COMOUT are same power source.<br>• Do not use DI5 and DI6. | **FH-VPX-F160** |
|  | F210 series | F210-C10 | • Do not use RESET signal. *<br>• Use with COMIN and COMOUT are same power source.<br>• Do not use DI8 and DI9. | **FH-VPX-F210** |
| | | F210-C10-ETN | | |
| | F500 series | F500-C10 | | |

* Even if RESET signal cannot be use by conversion, conversion is possible to convert satisfying other usable condition.
**Note:** Cannot be used for the F160-C10CP/-C10CF.

## Recommended EtherCAT and EtherNet/IP Communications Cables

**Use Straight STP (shielded twisted-pair) cable of category 5 or higher with double shielding (braiding and aluminum foil tape) for EtherCAT.**
**Use Straight or cross STP (shielded twisted-pair) cable of category 5 or higher for EtherNet/IP.**

### Cable with Connectors

| Item | Appearance | Recommended manufacturer | Cable length (m) | Model |
|---|---|---|---|---|
| Cable with Connectors on Both Ends (RJ45/RJ45)<br>Standard RJ45 plugs type *1<br>Wire Gauge and Number of Pairs: AWG26, 4-pair Cable<br>Cable Sheath material: LSZH *2<br>Cable color: Yellow *3 |  | OMRON | 0.3 | **XS6W-6LSZH8SS30CM-Y** |
| | | | 0.5 | **XS6W-6LSZH8SS50CM-Y** |
| | | | 1 | **XS6W-6LSZH8SS100CM-Y** |
| | | | 2 | **XS6W-6LSZH8SS200CM-Y** |
| | | | 3 | **XS6W-6LSZH8SS300CM-Y** |
| | | | 5 | **XS6W-6LSZH8SS500CM-Y** |
| Cable with Connectors on Both Ends (RJ45/RJ45)<br>Rugged RJ45 plugs type *1<br>Wire Gauge and Number of Pairs: AWG22, 2-pair Cable<br>Cable color: Light blue |  | OMRON | 0.3 | **XS5W-T421-AMD-K** |
| | | | 0.5 | **XS5W-T421-BMD-K** |
| | | | 1 | **XS5W-T421-CMD-K** |
| | | | 2 | **XS5W-T421-DMD-K** |
| | | | 5 | **XS5W-T421-GMD-K** |
| | | | 10 | **XS5W-T421-JMD-K** |
| Cable with Connectors on Both Ends<br>(M12 Straight/M12 Straight)<br>Shield Strengthening Connector cable *4<br>M12/Smartclick Connectors<br>Wire Gauge and Number of Pairs: AWG22, 2-pair Cable<br>Cable color: Black |  | OMRON | 0.5 | **XS5W-T421-BM2-SS** |
| | | | 1 | **XS5W-T421-CM2-SS** |
| | | | 2 | **XS5W-T421-DM2-SS** |
| | | | 3 | **XS5W-T421-EM2-SS** |
| | | | 5 | **XS5W-T421-GM2-SS** |
| | | | 10 | **XS5W-T421-JM2-SS** |
| Cable with Connectors on Both Ends (M12 Straight/RJ45)<br>Shield Strengthening Connector cable *4<br>M12/Smartclick Connectors<br>Rugged RJ45 plugs type<br>Wire Gauge and Number of Pairs: AWG22, 2-pair Cable<br>Cable color: Black |  | OMRON | 0.5 | **XS5W-T421-BMC-SS** |
| | | | 1 | **XS5W-T421-CMC-SS** |
| | | | 2 | **XS5W-T421-DMC-SS** |
| | | | 3 | **XS5W-T421-EMC-SS** |
| | | | 5 | **XS5W-T421-GMC-SS** |
| | | | 10 | **XS5W-T421-JMC-SS** |

*1 Cables with standard RJ45 plugs are available in the following lengths: 0.2 m, 0.3 m, 0.5 m, 1 m, 1.5 m, 2 m, 3 m, 5 m, 7.5 m, 10 m, 15 m, 20 m. Cables with rugged RJ45 plugs are available in the following lengths: 0.3 m, 0.5 m, 1 m, 2 m, 3 m, 5 m, 10 m, 15 m. For details, refer to the Industrial Ethernet Connectors Catalog (Cat. No. G019).
*2 The lineup features Low Smoke Zero Halogen cables for in-cabinet use and PUR cables for out-of-cabinet use. Although the LSZH cable is single shielded, its communications and noise characteristics meet the standards.
*3 Cables colors are available in yellow, green, and blue.
*4 For details, contact your OMRON representative.

### Cables / Connectors

| Item | | Recommended manufacturer | Model |
|---|---|---|---|
| Products for EtherCAT or EtherNet/IP (1000BASE-T/100BASE-TX) Wire gauge and number of pairs: AWG24, 4-pair cable | Cable | Hitachi Metals, Ltd. | **NETSTAR-C5E SAB 0.5 x 4P CP** *1 |
| | | Kuramo Electric Co. | **KETH-SB ✻1** |
| | | SWCC Showa Cable Systems Co. | **FAE-5004 ✻1** |
| | RJ45 Connector | Panduit Corporation | **MPS588-C ✻1** |
| Products for EtherCAT or EtherNet/IP (100BASE-TX/10BASE-T) Wire gauge and number of pairs: AWG22, 2-pair cable | Cable | Kuramo Electric Co. | **KETH-PSB-OMR ✻2** |
| | | JMACS Japan Co., Ltd. | **PNET/B ✻2** |
| | RJ45 Assembly Connector  | OMRON | **XS6G-T421-1 ✻2** |

*1 We recommend you to use the above Cable and RJ45 Connector together.
*2 We recommend you to use the above Cable and RJ45 Assembly Connector together.

## Automation Software Sysmac Studio

**Please purchase a DVD and licenses the first time you purchase the Sysmac Studio. DVDs and licenses are available individually. The license does not include the DVD.**

| Item | Specifications | Number of licenses | Media | Model |
|---|---|---|---|---|
| Sysmac Studio Standard Edition Ver.1.□□ | The Sysmac Studio is the software that provides an integrated environment for setting, programming, debugging and maintenance of machine automation controllers including the NJ/NX-series CPU Units, NY-series Industrial PC, EtherCat Slave, and the HMI. Sysmac Studio runs on the following OS. Windows 7 (32-bit/64-bit version) / Windows 8 (32-bit/64-bit version) / Windows 8.1 (32-bit/64-bit version) / Windows 10 Pro (32/64bit) or Enterprise (32/64bit) *1 This software provides functions of the Vision Edition. Refer to OMRON website for details such as supported models and functions. | -- (Media only) | Sysmac Studio (32bit) DVD *2 | **SYSMAC-SE200D** |
| | | -- (Media only) | Sysmac Studio (64bit) DVD *2 | **SYSMAC-SE200D-64** |
| | | 1 license | — | **SYSMAC-SE201L** |
| | | 3 license | — | **SYSMAC-SE203L** |
| | | 10 license | — | **SYSMAC-SE210L** |
| | | 30 license | — | **SYSMAC-SE230L** |
| | | 50 license | — | **SYSMAC-SE250L** |
| Sysmac Studio Vision Edition Ver.1.□□ *3 *4 | Sysmac Studio Vision Edition is a limited license that provides selected functions required for Vision Sensor FH-series/ Smart Camera FHV7-series/FQ-M-series settings. | 1 license | — | **SYSMAC-VE001L** |
| Sysmac Studio Robot Additional Option *4 | Sysmac Studio Robot Additional Option is a license to enable the Vision & Robot integrated simulation. | 1 license | — | **SYSMAC-RA401L** |

**Note:** **1.** Site licenses are available for users who will run Sysmac Studio on multiple computers. Ask your OMRON sales representative for details.
**2.** Sysmac Studio version 1.07 or higher supports the FH Series. Sysmac Studio does not support the FH-L550/-L550-10.

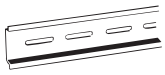
*1 Model "SYSMAC-SE200D-64" runs on Windows 10 (64bit).
*2 The same media is used for both the Standard Edition and the Vision Edition.
*3 With the Vision Edition, you can use only the setup functions for FH-series/FQ-M-series Vision Sensors.
*4 This product is a license only. You need the Sysmac Studio Standard Edition DVD media to install it.

## Development Environment

**Please purchase a CD-ROM and licenses the first time you purchase the Application Producer. CD-ROMs and licenses are available individually. The license does not include the CD-ROM.**

| Product | Specifications | Number of Model Standards licenses | Media | Model |
|---|---|---|---|---|
| Application Producer | Software components that provide a development environment to further customize the standard controller features of the FH Series. System requirements: CPU: Intel Pentium Processor (SSE2 or higher) OS: Windows 7 Professional (32/64bit) or Enterprise(32/64bit) or Ultimate (32/64bit), Windows 8 Pro (32/64bit) or Enterprise (32/64bit), Windows 8.1 Pro (32/64bit) or Enterprise (32/64bit), Windows 10 Pro (32/64bit) or Enterprise (32/64bit) .NET Framework: .NET Framework 3.5 SP1 or higher Memory: At least 2 GB RAM Available disk space: At least 2 GB Browser: Microsoft® Internet Explorer 6.0 or later Display: XGA (1024 × 768), True Color (32-bit) or higher Optical drive: CD/DVD drive The following software is required to customize the software: Microsoft® Visual Studio® 2008 Professional or Microsoft® Visual Studio® 2010 Professional or Microsoft® Visual Studio® 2012 Professional | — (Media only) | CD-ROM | **FH-AP1** |
| | | 1 license | — | **FH-AP1L** |

## Accessories

| Item | Descriptions | | | | Model |
|---|---|---|---|---|---|
|  | USB Memory | | 2 GB | | **FZ-MEM2G** |
| | | | 8 GB | | **FZ-MEM8G** |
|  | SD Card | | 2 GB | | **HMC-SD291** |
| | | | 4 GB | | **HMC-SD491** |
|  | Display/USB Switcher | | | | **FZ-DU** |
| – | Mouse Recommended Products<br>Driverless wired mouse<br>(A mouse that requires the mouse driver to be installed is not supported.) | | | | **---** |
|  | EtherCAT junction slaves | 3 port | Power supply voltage: 20.4 to 28.8 VDC (24 VDC -15 to 20%) | Current consumption: 0.08 A | **GX-JC03** |
|  | | 6 port | | Current consumption: 0.17 A | **GX-JC06** |
|  | Industrial Switching Hubs for EtherNet/IP and Ethernet | 3 port | Failure detection: None | Current consumption: 0.08 A | **W4S1-03B** |
|  | | 5 port | Failure detection: None | Current consumption: 0.12 A | **W4S1-05B** |
| | | 5 port | Failure detection: Supported | | **W4S1-05C** |
| – | Calibration Plate | | | | **FZD-CAL** |
|  | Common items related to DIN rail (for FH-L550/-L550-10) | DIN rail mounting bracket (For Lite Controllers) | | | **FH-XDM-L** |
|  | | DIN 35mm rail | PHOENIX CONTACT | • Length: 75.5/95.5/115.5/200 cm<br>• Height: 7.5mm<br>• Material: Iron<br>• Surface: Conductive | **NS 35/7,5 PERF** |
| | | | | • Length:75.5/95.5/115.5/200 cm<br>• Height: 15mm<br>• Material: Iron<br>• Surface: Conductive | **NS 35/15 PERF** |
|  | | End plate | PHOENIX CONTACT | Need 2 pieces each Sensor Controller | **CLIPFIX 35** |
| – | External Lights | | External lighting controller | LED | **FLV Series** |
| | | | | High-brightness LED | **FL-BR/DR Series** |
| | | | | Photometric Stereo Light | **FL-PS Series** |
| | | | Built-in lighting controller | MDMC Light | **FL-MD Series** |
|  | For Intelligent Compact Digital CMOS Camera | | | Mounting Bracket | **FQ-XL** |
|  | | | | Mounting Brackets | **FQ-XL2** |
|  | | | | Polarizing Filter Attachment | **FQ-XF1** |
| – | Mounting Bracket for FZ-S□, FH-S□05R, FZ-S□X | | | | **FZ-S-XLC** |
| | Mounting Bracket for FZ-S□2M | | | | **FZ-S2M-XLC** |
| | Mounting Bracket for FH-S□, FZ-S□5M□, FH-S□X05, FH-S□X12, FH-S□21R | | | | **FH-SM-XLC** |
| | Mounting Bracket for FH-S□12 | | | | **FH-SM12-XLC** |
| | M42 - F Mount Conversion Adapter | | | | **FH-ADF/M42-10** |

* Refer to the Vision Accessory Catalog (Cat. No. Q198) for details.

## Lenses

Refer to the *Vision Accessory Catalog* (Cat. No. Q198) for details.

| Resolution | Camera Model | Size of image element | Recommended lens | | |
|---|---|---|---|---|---|
| | | | Standard Lens | Telecentric Lens | Vibrations and Shocks Resistant Lens |
| 300,000-pixel | FZ-SF/SFC | 1/3" equivalent | FZ-LES Series | --- | --- |
| | FZ-SP/SPC | | | | |
| | FZ-S/SC | | SV-V Series | VS-TCH Series | VS-MCA Series<br>Non-telecentric Macro<br>VS-MC Series |
| | FH-SM/SC | | | | |
| 400,000-pixel | FH-SMX/SCX | 1/2.9" equivalent | | | |
| 2 million-pixel | FZ-S2M/SC2M | 1/1.8" equivalent | SV-H Series | | |
| | FH-SM02/SC02 | 2/3" equivalent | VS-H1 Series | VS-TEV Series | VS-MCA Series |
| 4 million-pixel | FH-SM04/SC04 | 1" equivalent | | | VS-MCH Series |
| 5 million-pixel | FH-SM05R/SC05R | 1/2.5" equivalent | SV-H Series | VS-TCH Series | VS-MCA Series<br>Non-telecentric Macro<br>VS-MC Series |
| | FZ-S5M3/SC5M3 | 2/3" equivalent | | | |
| | FH-SMX05/SCX05 | 2/3" equivalent | | | |
| 12 million-pixel | FH-SMX12/SCX12 | 1.1" equivalent | VS-LLD Series | VS-TEV Series | --- |
| | FH-SM12/SC12 | 1.76" equivalent | VS-L/M42-10 Series | --- | VS-MCL/M42-10 Series |
| 20.4 million-pixel | FH-SM21R/SC21R | 1" equivalent | VS-LLD Series | VS-TEV Series | VS-MCH Series |

# Ratings and Specifications (FH Sensor Controllers)

## High-speed, Large-capacity Controller

| Sensor Controller Series | | | FH-5050 Series | | | FH-2050 Series | | |
|---|---|---|---|---|---|---|---|---|
| Type | | | High-speed, Large-capacity Controller (4 cores) | | | High-speed, Large-capacity Controller (2 cores) | | |
| Sensor Controller Model | | | FH-5050 | FH-5050-10 | FH-5050-20 | FH-2050 | FH-2050-10 | FH-2050-20 |
| Parallel IO | | | NPN/PNP (common) | | | | | |
| Main Functions | Operation Mode | Standard | Yes | | | | | |
| | | Double Speed Multi-input | Yes | | | | | |
| | | Non-stop adjustment mode | Yes | | | | | |
| | | Multi-line random-trigger mode | Yes (Maximum 8 lines) *1 | | | | | |
| | Parallel Processing | | Yes | | | | | |
| | Number of Connectable Camera | | 2 | 4 | 8 | 2 | 4 | 8 |
| | Supported Camera | FH-S series camera | All of the FH-S series cameras are connectable. | | All of the FH-S series cameras are connectable. *2 | All of the FH-S series cameras are connectable. | | All of the FH-S series cameras are connectable. *2 |
| | | FZ-S series camera | All of the FZ-S series cameras are connectable. | | | | | |
| | Camera I/F | | OMRON I/F | | | | | |
| | Possible Number of Captured Images | | Refer to page 39. | | | | | |
| | Possible Number of Logging Images to Sensor Controller | | Refer to the *Vision System FH/FZ5 Series User's Manual* (Cat. No. Z365). | | | | | |
| | Possible Number of Scenes | | 128 | | | | | |
| | Operating on UI | USB Mouse | Yes (wired USB and driver is unnecessary type) | | | | | |
| | | Touch Panel | Yes (RS-232C/USB connection: FH-MT12) | | | | | |
| | Setup | | Create the processing flow using Flow editing. | | | | | |
| | Language | | Japanese, English, Simplified Chinese, Traditional Chinese, Korean, German, French, Spanish, Italian, Vietnamese, Polish | | | | | |
| External Interface | Serial Communication | | RS-232C × 1 | | | | | |
| | Ethernet Communication | Protocol | Non-procedure (TCP/UDP) | | | | | |
| | | I/F | 1000BASE-T × 2 | | | | | |
| | EtherNet/IP Communication | | Yes (Target/Ethernet port) | | | | | |
| | PROFINET Communication | | • Yes (Slave/Ethernet port)<br>• Conformance class A | | | | | |
| | EtherCAT Communication | | Yes (slave) Refer to page 44 about EtherCAT Communications Specifications. | | | | | |
| | Parallel I/O | | • 12 inputs/31 outputs:<br>• Use 1 Line.<br>• Operation mode: Except Multi-line random-trigger mode. | | | | | |
| | | | • 17 inputs/37 outputs:<br>• Use 2 Lines.<br>• Operation mode: Multi-line random-trigger mode. | | | | | |
| | | | • 14 inputs/29 outputs:<br>• Use 3 to 4 Lines.<br>• Operation mode: Multi-line random-trigger mode. | | | | | |
| | | | • 19 inputs/34 outputs:<br>• Use 5 to 8 Lines.<br>• Operation mode: Multi-line random-trigger mode. | | | | | |
| | Encoder Interface | | Input voltage: 5 V ± 5%<br>Signal: RS-422A Line Driver Level<br>Phase A/B/Z: 1 MHz | | | | | |
| | Monitor Interface | | DVI-I output (Analog RGB & DVI-D single link) × 1 | | | | | |
| | USB I/F | | USB3.0 host × 2 (BUS Power: Port5 V/0.5 A)<br>USB2.0 host × 4 (BUS Power: Port5 V/0.5 A) | | | | | |
| | SD Card I/F | | SDHC × 1 | | | | | |
| Indicator Lamps | Main | | POWER: Green<br>ERROR: Red<br>RUN: Green<br>ACCESS: Yellow | | | | | |
| | Ethernet | | NET RUN1: Green<br>LINK/ACT1: Yellow<br>NET RUN2: Green<br>LINK/ACT2: Yellow | | | | | |
| | SD Card | | SD POWER: Green<br>SD BUSY: Yellow | | | | | |
| | EtherCAT | | ECAT RUN: Green<br>LINK/ACT IN: Green<br>LINK/ACT OUT: Green<br>ECAT ERR: Red | | | | | |
| Power-supply voltage | | | 20.4 VDC to 26.4 VDC | | | | | |
| Current consumption | When connecting an intelligent compact digital camera<br>• When connecting the following light or lighting controller without an external power supply<br>FLV-TCC1, FLV-TCC4, FLV-TCC3HB<br>FLV-TCC1EP, FL-TCC1<br>• When connecting the following light or lighting controller<br>FL-TCC1PS, FL-MD□MC | | 5.6 A max. | 7.7 A max. | 12.2 A max. | 4.6 A max. | 6.6 A max. | 11.2 A max. |
| | Other than above | | 4.5 A max. | 5.5 A max. | 7.3 A max. | 3.5 A max. | 4.3 A max. | 6.3 A max. |
| Built-in FAN | | | Yes | | | | | |
| Usage Environment | Ambient temperature range | | Operating: 0°C to +45°C<br>Storage: -20 to +65°C (with no icing or condensation) | | | Operating: 0°C to +50°C<br>Storage: -20 to +65°C (with no icing or condensation) | | |
| | Ambient humidity range | | Operating:35 to 85%RH<br>Storage: 35 to 85%RH (with no condensation) | | | | | |
| | Ambient atmosphere | | No corrosive gases | | | | | |
| | Vibration tolerance | | Oscillation frequency: 10 to 150 Hz<br>Half amplitude: 0.1 mm<br>Acceleration: 15 m/s²<br>Sweep time: 8 minute/count<br>Sweep count: 10<br>Vibration direction: up and down/front and behind/left and right | | | | | |
| | Shock resistance | | Impact force: 150 m/s²<br>Test direction: up and down/front and behind/left and right | | | | | |
| | Noise immunity | Fast Transient Burst | • DC power<br>Direct infusion: 2kV, Pulse rising: 5ns, Pulse width: 50ns, Burst continuation time: 15ms/0.75ms, Period: 300ms, Application time: 1 min<br>• I/O line<br>Direct infusion: 1kV, Pulse rising: 5ns, Pulse width: 50ns, Burst continuation time: 15ms/0.75ms, Period: 300ms, Application time: 1 min | | | | | |
| | Grounding | | Type D grounding (100 Ω or less grounding resistance) *3 | | | | | |
| External Features | Dimensions | | 190 mm × 115 mm × 182.5 mm<br>Note Height: Including the feet at the base. | | | | | |
| | Weight | | Approx. 3.4 kg | Approx. 3.6 kg | Approx. 3.6 kg | Approx. 3.4 kg | Approx. 3.6 kg | Approx. 3.6 kg |
| | Degree of protection | | IEC60529 IP20 | | | | | |
| | Case material | | Cover: zinc-plated steel plate<br>Side plate: aluminum (A6063) | | | | | |
| Accessories | | | Instruction Sheet (Japanese and English): 1, Installation Instruction Manual for FH series:1,<br>General Compliance Information and Instructions for EU:1, Member registration sheet: 1, Power source (FH-XCN): 1 (male),<br>Ferrite core for camera cable: 2 (FH-5050, FH-2050), 4 (FH-5050-10, FH-2050-10), 8 (FH-5050-20, FH-2050-20) | | | | | |

*1 According to the CPU performance, FH-2050 series is recommended to use up to two lines in this mode.
*2 Up to eight cameras can be connected in total including up to four 12 or 20.4 million-pixel cameras.
*3 Existing third class grounding

## Standard Controller

| Sensor Controller Series | | | FH-3050 Series | | | FH-1050 Series | | |
|---|---|---|---|---|---|---|---|---|
| Type | | | Standard Controller (4 cores) | | | Standard Controller (2 cores) | | |
| Sensor Controller Model | | | FH-3050 | FH-3050-10 | FH-3050-20 | FH-1050 | FH-1050-10 | FH-1050-20 |
| Parallel IO | | | NPN/PNP (common) | | | | | |
| Main Functions | Operation Mode | Standard | Yes | | | | | |
| | | Double Speed Multi-input | Yes | | | | | |
| | | Non-stop adjustment mode | Yes | | | | | |
| | | Multi-line random-trigger mode | Yes (Maximum 8 lines) *1 | | | | | |
| | Parallel Processing | | Yes | | | | | |
| | Number of Connectable Camera | | 2 | 4 | 8 | 2 | 4 | 8 |
| | Supported Camera | FH-S series camera | All of the FH-S series cameras except FH-SM21R/SC21R | | All of the FH-S series cameras except FH-SM21R/SC21R *2 | All of the FH-S series cameras except FH-SM21R/SC21R | | All of the FH-S series cameras except FH-SM21R/SC21R *2 |
| | | FZ-S series camera | All of the FZ-S series cameras are connectable. | | | | | |
| | Camera I/F | | OMRON I/F | | | | | |
| | Possible Number of Captured Images | | Refer to page 39. | | | | | |
| | Possible Number of Logging Images to Sensor Controller | | Refer to the *Vision System FH/FZ5 Series User's Manual* (Cat. No. Z365). | | | | | |
| | Possible Number of Scenes | | 128 | | | | | |
| | Operating on UI | USB Mouse | Yes (wired USB and driver is unnecessary type) | | | | | |
| | | Touch Panel | Yes (RS-232C/USB connection: FH-MT12) | | | | | |
| | Setup | | Create the processing flow using Flow editing. | | | | | |
| | Language | | Japanese, English, Simplified Chinese, Traditional Chinese, Korean, German, French, Spanish, Italian, Vietnamese, Polish | | | | | |
| External Interface | Serial Communication | | RS-232C × 1 | | | | | |
| | Ethernet Communication | Protocol | Non-procedure (TCP/UDP) | | | | | |
| | | I/F | 1000BASE-T × 2 | | | | | |
| | EtherNet/IP Communication | | Yes (Target/Ethernet port) | | | | | |
| | PROFINET Communication | | • Yes (Slave/Ethernet port)<br>• Conformance class A | | | | | |
| | EtherCAT Communication | | Yes (slave) Refer to page 44 about EtherCAT Communications Specifications. | | | | | |
| | Parallel I/O | | • 12 inputs/31 outputs:<br>• Use 1 Line.<br>• Operation mode: Except Multi-line random-trigger mode. | | | | | |
| | | | • 17 inputs/37 outputs:<br>• Use 2 Lines.<br>• Operation mode: Multi-line random-trigger mode. | | | | | |
| | | | • 14 inputs/29 outputs:<br>• Use 3 to 4 Lines.<br>• Operation mode: Multi-line random-trigger mode. | | | | | |
| | | | • 19 inputs/34 outputs:<br>• Use 5 to 8 Lines.<br>• Operation mode: Multi-line random-trigger mode. | | | | | |
| | Encoder Interface | | Input voltage: 5 V ± 5%<br>Signal: RS-422A Line Driver Level<br>Phase A/B/Z: 1 MHz | | | | | |
| | Monitor Interface | | DVI-I output (Analog RGB & DVI-D single link) × 1 | | | | | |
| | USB I/F | | USB2.0 host × 4 (BUS Power: Port5 V/0.5 A) | | | | | |
| | SD Card I/F | | SDHC × 1 | | | | | |
| Indicator Lamps | Main | | POWER: Green<br>ERROR: Red<br>RUN: Green<br>ACCESS: Yellow | | | | | |
| | Ethernet | | NET RUN: Green<br>LINK/ACT: Yellow | NET RUN1: Green<br>LINK/ACT1: Yellow<br>NET RUN2: Green<br>LINK/ACT2: Yellow | | NET RUN: Green<br>LINK/ACT: Yellow | NET RUN1: Green<br>LINK/ACT1: Yellow<br>NET RUN2: Green<br>LINK/ACT2: Yellow | |
| | SD Card | | SD POWER: Green<br>SD BUSY: Yellow | | | | | |
| | EtherCAT | | ECAT RUN: Green<br>LINK/ACT IN: Green<br>LINK/ACT OUT: Green<br>ECAT ERR: Red | | | | | |
| Power-supply voltage | | | 20.4 VDC to 26.4 VDC | | | | | |
| Current consumption | When connecting an intelligent compact digital camera<br>• When connecting the following light or lighting controller without an external power supply<br>FLV-TCC1, FLV-TCC4, FLV-TCC3HB<br>FLV-TCC1EP, FL-TCC1<br>• When connecting the following light or lighting controller<br>FL-TCC1PS, FL-MD□MC | | 5.0 A max. | 7.0 A max. | 11.5 A max. | 4.7 A max. | 6.5 A max. | 10.9 A max. |
| | Other than above | | 4.1 A max. | 4.8 A max. | 6.8 A max. | 3.6 A max. | 4.3 A max. | 6.2 A max. |
| Built-in FAN | | | Yes | | | | | |
| Usage Environment | Ambient temperature range | | Operating: 0°C to +50°C<br>Storage: -20 to +65°C (with no icing or condensation) | | | | | |
| | Ambient humidity range | | Operating:35 to 85%RH<br>Storage: 35 to 85%RH (with no condensation) | | | | | |
| | Ambient atmosphere | | No corrosive gases | | | | | |
| | Vibration tolerance | | Oscillation frequency: 10 to 150 Hz<br>Half amplitude: 0.1 mm<br>Acceleration: 15 m/s$^2$<br>Sweep time: 8 minute/count<br>Sweep count: 10<br>Vibration direction: up and down/front and behind/left and right | | | | | |
| | Shock resistance | | Impact force: 150 m/s$^2$<br>Test direction: up and down/front and behind/left and right | | | | | |
| | Noise immunity | Fast Transient Burst | • DC power<br>Direct infusion: 2kV, Pulse rising: 5ns, Pulse width: 50ns, Burst continuation time: 15ms/0.75ms, Period: 300ms, Application time: 1 min<br>• I/O line<br>Direct infusion: 1kV, Pulse rising: 5ns, Pulse width: 50ns, Burst continuation time: 15ms/0.75ms, Period: 300ms, Application time: 1 min | | | | | |
| | Grounding | | Type D grounding (100 Ω or less grounding resistance) *3 | | | | | |
| External Features | Dimensions | | 190 mm × 115 mm × 182.5 mm<br>Note Height: Including the feet at the base. | | | | | |
| | Weight | | Approx. 3.2 kg | Approx. 3.4 kg | Approx. 3.4 kg | Approx. 3.2 kg | Approx. 3.4 kg | Approx. 3.4 kg |
| | Degree of protection | | IEC60529 IP20 | | | | | |
| | Case material | | Cover: zinc-plated steel plate<br>Side plate: aluminum (A6063) | | | | | |
| Accessories | | | Instruction Sheet (Japanese and English): 1, Installation Instruction Manual for FH series:1,<br>General Compliance Information and Instructions for EU:1, Member registration sheet: 1, Power source (FH-XCN): 1 (male),<br>Ferrite core for camera cable: 2 (FH-3050, FH-1050), 4 (FH-3050-10, FH-1050-10), 8 (FH-3050-20, FH-1050-20) | | | | | |

*1 According to the CPU performance, FH-1050 series is recommended to use up to two lines in this mode.
*2 When the 12 megapixels camera: Max. 4 cameras are connectable. When use except 12 megapixels cameras: Max. 8 cameras are connectable.
*3 Existing third class grounding

## Lite Controllers

| Sensor Controller Series | | | FH-L550 Series | |
|---|---|---|---|---|
| Type | | | Lite Controller | |
| Sensor Controller Model | | | FH-L550 | FH-L550-10 |
| Parallel IO | | | NPN/PNP (common) | |
| Main Functions | Operation Mode | Standard | Yes | |
| | | Double Speed Multi-input | Yes | |
| | | Non-stop adjustment mode | Yes | |
| | | Multi-line random-trigger mode | No | |
| | Parallel Processing | | Yes | |
| | Number of Connectable Camera | | 2 | 4 |
| | Supported Camera | FH-S series camera | All of the FH-S series cameras except FH-SM21R/SC21R | |
| | | FZ-S series camera | All of the FZ-S series cameras are connectable. | |
| | Camera I/F | | OMRON I/F | |
| | Possible Number of Captured Images | | Refer to page 39. | |
| | Possible Number of Logging Images to Sensor Controller | | Refer to the *Vision System FH/FZ5 Series User's Manual* (Cat. No. Z365). | |
| | Possible Number of Scenes | | 128 | |
| | UI Operations | USB Mouse | Yes (wired USB driver-less type) | |
| | | Touch Panel | Yes (RS-232C/USB connection: FH-MT12) | |
| | Setup | | Create the processing flow using Flow editing. | |
| | Language | | Japanese, English, Simplified Chinese, Traditional Chinese, Korean, German, French, Spanish, Italian, Vietnamese, Polish | |
| External Interface | Serial Communication | | RS-232C × 1 | |
| | Ethernet Communication | Protocol | Non-procedure (TCP/UDP) | |
| | | I/F | 1000BASE-T × 1 | |
| | EtherNet/IP Communication | | Yes (Target/Ethernet port) | |
| | PROFINET Communication | | • Yes (Slave/Ethernet port)<br>• Conformance class A | |
| | EtherCAT Communication | | No | |
| | Parallel I/O | | • High-speed input: 1<br>• Normal speed: 9<br>• High-speed output: 4<br>• Normal speed: 23 | |
| | Encoder Interface | | None | |
| | Monitor Interface | | DVI-I output (Analog RGB & DVI-D single link) × 1 | |
| | USB I/F | | USB2.0 host × 1: BUS Power: Port 5 V/0.5 A<br>USB3.0 × 1: BUS Power: Port 5 V/0.5 A | |
| | SD Card I/F | | SDHC × 1 | |
| Indicator Lamps | Main | | POWER: Green<br>ERROR: Red<br>RUN: Green<br>ACCESS: Yellow | |
| | Ethernet | | NET RUN: Green<br>LINK/ACT: Yellow | |
| | SD Card | | SD POWER: Green<br>SD BUSY: Yellow | |
| | EtherCAT | | None | |
| Power-supply voltage | | | 20.4 VDC to 26.4 VDC | |
| Current consumption | When connecting an intelligent compact digital camera<br>• When connecting the following light or lighting controller without an external power supply<br>FLV-TCC1, FLV-TCC4, FLV-TCC3HB<br>FLV-TCC1EP, FL-TCC1<br>• When connecting the following light or lighting controller<br>FL-TCC1PS, FL-MD□MC | | 2.7 A max. | 4.4 A max. |
| | Other than above | | 1.5 A max. | 2.0 A max. |
| Built-in FAN | | | No | |
| Usage Environment | Ambient temperature range | | Operating: 0°C to 55°C<br>Storage: -25 to +70°C | |
| | Ambient humidity range | | Operating and Storage: 10 to 90%RH (with no condensation) | |
| | Ambient atmosphere | | No corrosive gases | |
| | Vibration tolerance | | 5 to 8.4 Hz with 3.5 mm amplitude, 8.4 to 150 Hz, acceleration of 9.8 m/s$^2$<br>100 min each in X, Y, and Z directions (10 sweeps of 10 min each = 100 min total) | |
| | Shock resistance | | Impact force: 150 m/s$^2$<br>Test direction: up and down/front and behind/left and right | |
| | Noise immunity | Fast Transient Burst | • DC power<br>Direct infusion: 2kV, Pulse rising: 5ns, Pulse width: 50ns,<br>Burst continuation time: 15ms/0.75ms, Period: 300ms, Application time: 1 min<br>• I/O line<br>Direct infusion: 1kV, Pulse rising: 5ns, Pulse width: 50ns,<br>Burst continuation time: 15ms/0.75ms, Period: 300ms, Application time: 1 min | |
| | Grounding | | Type D grounding (100 Ω or less grounding resistance) * | |
| External Features | Dimensions | | 200 mm × 80 mm × 130 mm | |
| | Weight | | Approx. 1.5 kg | Approx. 1.5 kg |
| | Degree of protection | | IEC60529 IP20 | |
| | Case materials | | PC | |
| Accessories | | | Instruction Sheet (Japanese and English): 1, Installation Instruction Manual for FH-L series:1,<br>General Compliance Information and Instructions for EU:1, Member registration sheet: 1,<br>Power source (FH-XCN-L):1 (male) | |

* Existing third class grounding

### Maximum Number of Loading Images during Multi-input

| Camera | Model | Max. Number of Loading Images during Multi-input *1 |
|---|---|---|
| Intelligent Compact Digital CMOS Cameras *2 | FZ-SQ010F/-SQ050F/-SQ100F/-SQ100N | 256 |
| 0.3 million pixels CCD/CMOS Cameras | FZ-S/-SC/-SF/SFC/-SH/-SHC/-SP/-SPC<br>FH-SM/-SC | 256 |
| 0.4 million pixels CMOS Cameras | FH-SMX/-SCX | 256 |
| 2 million pixels CCD Cameras | FZ-S2M/-SC2M | 64 |
| 2 million pixels CMOS Cameras | FH-SM02/-SC02 | 51 |
| 4 million pixels CMOS Cameras | FH-SM04/-SC04 | 32 |
| 5 million pixels CCD/CMOS Cameras | FZ-S5M3/-SC5M3/-S5M2<br>FH-SMX05/-SCX05/-SM05R/-SC05R | 25 |
| 12 million pixels CMOS Cameras | FH-SM12/-SC12/-SMX12/-SCX12 | 10 |
| 20.4 million pixels CMOS Cameras | FH-SM21R/-SC21R | 6 |

*1 When using two camera cables for connection, the maximum number of loaded images during multi-input is twice the number given in the table.
*2 The multi-input function cannot be used when the built-in light of an intelligent compact digital camera is used.
Refer to the *Vision System FH/FZ5 Series User's Manual* (Cat. No. Z340) for details.

# FH-Series

# Ratings and Specifications (Cameras)

## High-speed Digital CMOS cameras

| Model | FH-SM | FH-SC | FH-SM02 | FH-SC02 | FH-SM04 | FH-SC04 | FH-SM12 | FH-SC12 |
|---|---|---|---|---|---|---|---|---|
| Image elements | CMOS image elements (1/3-inch equivalent) | | CMOS image elements (2/3-inch equivalent) | | CMOS image elements (1-inch equivalent) | | CMOS image elements (1.76-inch equivalent) | |
| Color/Monochrome | Monochrome | Color | Monochrome | Color | Monochrome | Color | Monochrome | Color |
| Effective pixels | 640 (H) × 480 (V) | | 2040 (H) × 1088 (V) | | 2040 (H) × 2048 (V) | | 4084 (H) × 3072 (V) | |
| Imaging area H x V (opposing corner) | 4.8 × 3.6 (6.0 mm) | | 11.26 × 5.98 (12.76 mm) | | 11.26 × 11.26 (15.93 mm) | | 22.5 × 16.9 (28.14 mm) | |
| Pixel size | 7.4 (μm) × 7.4 (μm) | | 5.5 (μm) × 5.5 (μm) | | 5.5 (μm) × 5.5 (μm) | | 5.5 (μm) × 5.5 (μm) | |
| Shutter function | Electronic shutter; Shutter speeds can be set from 20 ms to 100 ms. | | Electronic shutter; Shutter speeds can be set from 25 μs to 100 ms. | | | | Electronic shutter; Shutter speeds can be set from 60 μs to 100 ms. | |
| Partial function | 1 to 480 lines | 2 to 480 lines | 1 to 1088 lines | 2 to 1088 lines | 1 to 2048 lines | 2 to 2048 lines | 4 to 3072 lines (4-line increments) | |
| Frame rate (Image Acquisition Time *1) | 308 fps (3.3 ms) | | 219 fps (4.6 ms) *2 | | 118 fps (8.5 ms) *2 | | 38.9 fps (25.7 ms) *2 | |
| Lens mounting | C mount | | | | | | M42 mount | |
| Field of vision, installation distance | Selecting a lens according to the field of vision and 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 | | Approx.110 g | | | | Approx.320 g | |
| Accessories | Instruction manual | | | | | | | |

| Model | FH-SMX | FH-SCX | FH-SMX05 | FH-SCX05 | FH-SMX12 | FH-SCX12 |
|---|---|---|---|---|---|---|
| Image elements | CMOS image elements (1/2.9-inch equivalent) | | CMOS image elements (2/3-inch equivalent) | | CMOS image elements (1.1-inch equivalent) | |
| Color/Monochrome | Monochrome | Color | Monochrome | Color | Monochrome | Color |
| Effective pixels | 720 (H) × 540 (V) | | 2448 (H) × 2048 (V) | | 4092 (H) × 3000 (V) | |
| Imaging area H x V (opposing corner) | 4.97 × 3.73 (6.21 mm) | | 8.45 × 7.07 (11.01 mm) | | 14.12 × 10.35 (17.5 mm) | |
| Pixel size | 6.9 (μm) × 6.9 (μm) | | 3.45 (μm) × 3.45 (μm) | | | |
| Shutter function | Electronic shutter; Shutter speeds can be set from 1 ms to 100 ms. | | | | Electronic shutter; Shutter speeds can be set from 15 μs to 100 ms. | |
| Partial function | 4 to 540 lines (4-line increments) | | 4 to 2048 lines (4-line increments) | | 4 to 3000 lines (4-line increments) | |
| Frame rate (Image Acquisition Time *1) | 523.6 fps (1.9 ms) | | 97.2 fps (10.3 ms) *2 | | 40.1 fps (24.9 ms) *2 | |
| Lens mounting | C mount | | | | | |
| 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.48 g | | Approx.85 g | | | |
| Accessories | Instruction manual, General Compliance Information and Instructions for EU | | | | | |

*1 The image acquisition time does not include the image conversion processing time of the sensor controller.
*2 Frame rate in high speed mode when the camera is connected using two camera cables.

## Digital CMOS Cameras

| Model | FH-SM05R | FH-SC05R | FH-SM21R | FH-SC21R | FZ-S5M3 | FZ-SC5M3 |
|---|---|---|---|---|---|---|
| Image Elements | CMOS image elements (1/2.5-inch equivalent) | | CMOS image elements (1-inch equivalent) | | CMOS image elements (2/3-inch equivalent) | |
| Color/Monochrome | Monochrome | Color | Monochrome | Color | Monochrome | Color |
| Effective Pixels | 2592 (H) × 1944 (V) | | 5544 (H) × 3692 (V) | | 2448 (H) × 2048 (V) | |
| Imaging area H × V (opposing corner) | 5.70 × 4.28 (7.13 mm) | | 13.31 × 8.86 (16.00 mm) | | 8.45 × 7.07 (11.01 mm) | |
| Pixel Size | 2.2 (μm) × 2.2 (μm) | | 2.4 (μm) × 2.4 (μm) | | 3.45 (μm) × 3.45 (μm) | |
| Scan Type | Progressive | | | | | |
| Shutter Method | Rolling shutter (Global reset mode supported) | | | | Global shutter | |
| Shutter Function | Electronic shutter; Shutter speeds can be set from 500 to 10000 ms in multiples of 50 μs | | Electronic shutter; Shutter speeds can be set from 50 μs to 100 ms. | | Electronic shutter; Shutter speeds can be set from 20 μs to 100 ms. | |
| Partial function | 4 to 1944 lines (2-line increments) | | 1848 to 3692 lines | | 4 to 2048 lines | |
| Frame rate (Image Acquisition Time *) | 14 fps (71.7ms) | | 23.5 fps (42.6ms) | | 25.6 fps (38.2ms) | |
| Lens Mounting | C mount | | | | | |
| Field of vision, Installation distance | Selecting a lens according to the field of vision and installation distance | | | | | |
| Ambient temperature range | Operating: 0 to +40°C Storage: -30 to 65°C (with no icing or condensation) | | Operating: 0 to +40°C Storage: -20 to 65°C (with no icing or condensation) | | Operating: 0 to +40°C Storage: -30 to 65°C (with no icing or condensation) | |
| Ambient humidity range | Operating: 35 to 85%RH, Storage: 35 to 85%RH (with no condensation) | | | | | |
| Weight | Approx. 52 g | | Approx. 85 g | | | |
| Accessories | Instruction Sheet | | Instruction Sheet, General Compliance Information and Instructions for EU | | | |

* The image acquisition time does not include the image conversion processing time of the sensor controller.

## Digital CCD Cameras

| Model | FZ-S | FZ-SC | FZ-S2M | FZ-SC2M |
|---|---|---|---|---|
| Image elements | Interline transfer reading all pixels, CCD image elements (1/3-inch equivalent) | | Interline transfer reading all pixels, CCD image elements (1/1.8-inch equivalent) | |
| Color/Monochrome | Monochrome | Color | Monochrome | Color |
| Effective pixels | 640 (H) × 480 (V) | | 1600 (H) × 1200 (V) | |
| Imaging area H x V (opposing corner) | 4.8 × 3.6 (6.0mm) | | 7.1 × 5.4 (8.9mm) | |
| Pixel size | 7.4 (μm) × 7.4 (μm) | | 4.4 (μm) × 4.4 (μm) | |
| Shutter function | Electronic shutter; select shutter speeds from 20 μs to 100 ms | | | |
| Partial function | 12 to 480 lines | | 12 to 1200 lines | |
| Frame rate (Image Acquisition Time *) | 80 fps (12.5 ms) | | 30 fps (33.3 ms) | |
| Lens mounting | C mount | | | |
| 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<br>Storage: -25 to 65 °C<br>(with no icing or condensation) | | Operating: 0 to 40 °C<br>Storage: -25 to 65 °C<br>(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 | | | |

* The image acquisition time does not include the image conversion processing time of the sensor controller.

## Small CCD Digital Cameras

| Model | FZ-SF | FZ-SFC | FZ-SP | FZ-SPC |
|---|---|---|---|---|
| Image elements | Interline transfer reading all pixels, CCD image elements (1/3-inch equivalent) | | | |
| Color/Monochrome | Monochrome | Color | Monochrome | Color |
| Effective pixels | 640 (H) × 480 (V) | | | |
| Imaging area H x V (opposing corner) | 4.8 × 3.6 (6.0mm) | | | |
| Pixel size | 7.4 (μm) × 7.4 (μm) | | | |
| Shutter function | Electronic shutter; select shutter speeds from 20 μm to 100 ms | | | |
| Partial function | 12 to 480 lines | | | |
| Frame rate (Image Acquisition Time *) | 80 fps (12.5ms) | | | |
| Lens mounting | Special mount (M10.5 P0.5) | | | |
| 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)<br>0 to 45 °C (camera head)<br>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 | |

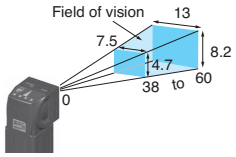
* The image acquisition time does not include the image conversion processing time of the sensor controller.

## Intelligent Compact Digital CMOS Cameras

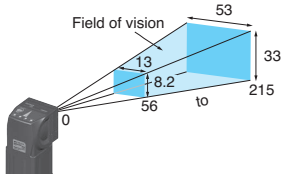
| Model | FZ-SQ010F | FZ-SQ050F | FZ-SQ100F | FZ-SQ100N |
|---|---|---|---|---|
| Image elements | CMOS color image elements (1/3-inch equivalent) | | | |
| Color/Monochrome | Color | | | |
| Effective pixels | 752 (H) × 480 (V) | | | |
| Imaging area H x V (opposing corner) | 4.51 × 2.88 (5.35mm) | | | |
| Pixel size | 6.0 (μm) × 6.0 (μm) | | | |
| Shutter function | 1/250 to 1/32,258 | | | |
| Partial function | 8 to 480 lines | | | |
| Frame rate (Image Acquisition Time *1) | 60 fps (16.7 ms) | | | |
| Field of vision | 7.5 × 4.7 to 13 × 8.2 mm | 13 × 8.2 to 53 × 33 mm | 53 × 33 to 240 × 153 mm | 29 × 18 to 300 × 191 mm |
| Installation distance | 38 to 60 mm | 56 to 215 mm | 220 to 970 mm | 32 to 380 mm |
| LED class *2 | Risk Group2 | | | |
| Ambient temperature range | Operating: 0 to 50 °C<br>Storage: -25 to 65 °C | | | |
| Ambient humidity range | Operating and storage: 35% to 85% (with no condensation) | | | |
| Weight | Approx. 150 g | | Approx. 140 g | |
| Accessories | Mounting bracket (FQ-XL), polarizing filter attachment (FQ-XF1), instruction manual and warning label | | | |

*1 The image acquisition time does not include the image conversion processing time of the sensor controller.
*2 Applicable standards: IEC62471-2

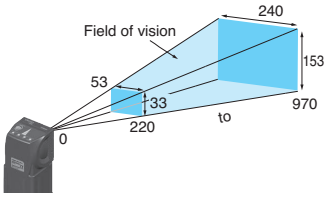
- **Narrow View**
  **FZ-SQ010F**



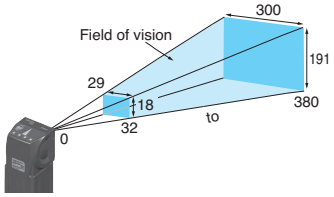

- **Standard**
  **FZ-SQ050F**




- **Wide View (Long-distance)**
  **FZ-SQ100F**




- **Wide View (Short-distance)**
  **FZ-SQ100N**



# Ratings and Specifications (Cable, Monitor)

## Camera Cables

| Model | FZ-VS3 (2 m) | FZ-VSB3 (2 m) | FZ-VSL3 (2 m) | FZ-VSLB3 (2 m) |
|---|---|---|---|---|
| Type | Standard | Bend resistant | Right-angle | Bend resistant Right-angle |
| 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%RH (with no condensation) | | | |
| Ambient atmosphere | No corrosive gases | | | |
| Material | Cable sheath, connector: PVC | | | |
| Minimum bending radius | 69mm | 69mm | 69mm | 69mm |
| Weight | Approx. 170 g | Approx. 180 g | Approx. 170 g | Approx. 180 g |

## Long-distance Camera Cables

| Model | FZ-VS4 (15 m) | FZ-VSL4 (15 m) |
|---|---|---|
| Type | Standard | Right-angle |
| 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%RH (with no condensation) | |
| Ambient atmosphere | No corrosive gases | |
| Material | Cable sheath, connector: PVC | |
| Minimum bending radius | 78 mm | |
| Weight | Approx. 1400 g | |

## Cable Extension Unit

| Model | FZ-VSJ |
|---|---|
| Power supply voltage *1 | 11.5 to 13.5 VDC |
| Current consumption *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) |
| Weight | Approx. 240 g |
| Accessories | Instruction Sheet and 4 mounting screws |

*1 A 12-VDC power supply must be provided to the Cable Extension Unit when connecting the Intelligent Compact Camera, or the Lighting Controller.

*2 The current consumption shows when connecting the Cable Extension Unit to an external power supply.

## Encoder Cable

| Model | FH-VR |
|---|---|
| Vibration resistiveness | 10 to 150 Hz single amplitude 0.1 mm 3 directions, 8 strokes, 10 times |
| Ambient temperature range | Operation: 0 to 50 °C; Storage: -10 to 60 °C (with no icing or condensation) |
| Ambient humidity range | Operation and storage: 35 to 85%RH (with no condensation) |
| Ambient atmosphere | No corrosive gases |
| Material | Cable Jacket: Heat, oil and flame resistant PVC Connector: polycarbonate resin |
| Minimum bending radius | 65 mm |
| Weight | Approx. 104 g |

## Touch Panel Monitor

| Model | | FH-MT12 |
|---|---|---|
| Major Function | Display area | 12.1 inch |
| | Resolution | 1024 (V) × 768 (H) |
| | Number of color | 16,700,000 colors (8 bit/color) |
| | Brightness | 500cd/m $^2$ (Typ) |
| | Contrast Ratio | 600:1 (Typ) |
| | Viewing angle | Left and right: each 80°, upward: 80°, downward: 60° |
| | Backlight Unit | LED, edge-light |
| | Backlight lifetime | About 100,000hour |
| | Touch panel | 4wire resistive touch screen |
| External interface | Video input | analog RGB |
| | Touch panel signal | USB |
| | | RS-232C |
| Ratings | Power supply voltage | 24 VDC (21.6 to 26.4 VDC) |
| | Current consumption | 0.5A |
| | Insulation resistance | Between DC power supply and Touch Panel Monitor FG: 20 MΩ or higher (rated voltage 250 V) |
| Operating environment | Ambient temperature range | Operating: 0 to 50°C, Storage: -20 to +65°C (with no icing or condensation) |
| | Ambient humidity range | Operating and Storage: 20 to 85 %RH (with no icing or condensation) |
| | Ambient environment | No corrosive gas |
| | Vibration resistance | 10 to 150 Hz, one-side amplitude 0.1 mm (Max. acceleration 15 m/s$^2$) 10 times for 8 minutes for each three direction |
| | Degree of protection | Panel mounting: IP65 on the front |
| Operation | | Touch pen |
| Structure | Mounting | Panel mounting, VESA mounting |
| | Weight | Approx.2.6 kg |
| | Material | Front panel: PC/PBT, Front Sheet: PET, Rear case: SUS |

**Note:** FH Series Sensor Controllers version 5.32 or higher is required.

## Monitor Cables

| Model | FH-VMDA (2 m) | FH-VUAB (2 m) | XW2Z-200PP-1 (2 m) |
|---|---|---|---|
| Cable type | DVI-Analog Conversion Cable | USB Cable | RS-232C Cable |
| Vibration resistance | 10 to 150 Hz, one-side amplitude 0.1 mm, 10 times for 8 minutes for each three direction | | |
| Ambient Temperature | Operating Condition: 0 to 50°C, Storage Condition: -10 to 60°C (with no icing or condensation) | | |
| Ambient Humidity | Operating Condition: 35 to 85%RH, Storage Condition: 35 to 85%RH (with no icing or condensation) | | |
| Ambient environment | No corrosive gases | | |
| Material | Cable outer sheath, Connector: PVC | | Cable outer sheath: PVC, Connector: ABS/Ni Plating |
| Minimum bend radius | 36 mm | 25 mm | 59 mm |
| Weight | Approx.220 g | Approx.75 g | Approx.162 g |

## 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 Sheet and 4 mounting brackets |

# EtherCAT Communications Specifications

| Item | | Specifications |
|---|---|---|
| Communications standard | | IEC61158 Type 12 |
| Physical layer | | 100 BASE-TX (IEEE802.3) |
| Modulation | | Base band |
| Baud rate | | 100 Mbps |
| Topology | | Depends on the specifications of the EtherCAT master. |
| Transmission Media | | Twisted-pair cable of category 5 or higher (double-shielded straight cable with aluminum tape and braiding) |
| Transmission Distance | | Distance between nodes: 100 m or less |
| Node address setting | | 00 to 99 |
| External connection terminals | | RJ45 × 2 (shielded) IN: EtherCAT input data, OUT: EtherCAT output data |
| Send/receive PDO data sizes | Input | 56 to 280 bytes/line (including input data, status, and unused areas) Up to 8 lines can be set. * |
| | Output | 28 bytes/line (including output data and unused areas) Up to 8 lines can be set. * |
| Mailbox data size | Input | 512 bytes |
| | Output | 512 bytes |
| Mailbox | | Emergency messages, SDO requests, and SDO information |
| Refreshing methods | | I/O-synchronized refreshing (DC) |

* This depends on the upper limit of the master.

# Version Information

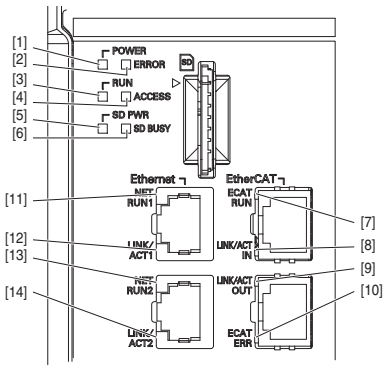
## FH Series and Programming Devices

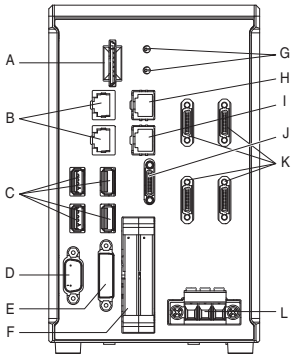
Use the latest version of Sysmac Studio Standard Edition/Vision Edition.

| FH Series | Version of FH Series | Corresponding version of Sysmac Studio Standard Edition/Vision Edition |
|---|---|---|
| FH-5050 (-□)<br>FH-3050 (-□)<br>FH-2050 (-□)<br>FH-1050 (-□) | Version 6.31 | Supported by version 1.30 or higher. |
| | Version 6.21 | Supported by version 1.26 or higher. |
| | Version 6.11 | Supported by version 1.25 or higher. |
| | Version 5.72 | Supported by version 1.18 or higher. |
| | Version 5.71 | Supported by version 1.18 or higher. |
| | Version 5.60 | Supported by version 1.15 or higher. |
| | Version 5.50 | Supported by version 1.14.89 or higher. |
| | Version 5.30 | Supported by version 1.10.80 or higher. |
| | Version 5.20 | Supported by version 1.10 or higher. |
| | Version 5.10 | Supported by version 1.07.43 or higher. |
| | Version 5.00 | Supported by version 1.07 or higher. Not supported by version 1.06 or lower. |

# Components and Functions

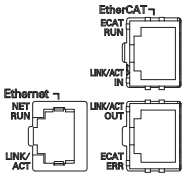
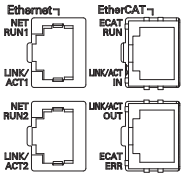
**Sensor Controllers**
**High-speed,**
**Large-capacity Controller**
**Standard Controller**
**(4-camera type)**




| | Name | Description |
|---|---|---|
| [1] | POWER LED | Lit while power is ON. |
| [2] | ERROR LED | Lit when an error has occurred. |
| [3] | RUN LED | Lit while the layout turned on output setting is displayed. |
| [4] | ACCESS LED | Blinks while the internal nonvolatile memory is accessed. |
| [5] | SD POWER LED | Blinks while power is supplied to the SD memory card and the card is usable. |
| [6] | SD BUSY LED | Blinks while the SD memory card is accessed. |
| [7] | EtherCAT RUN LED | Lit while EtherCAT communications are usable. |
| [8] | EtherCAT LINK/ACT IN LED | Lit when connected with an EtherCAT device, and blinks while performing communications. |
| [9] | EtherCAT LINK/ACT OUT LED | Lit when connected with an EtherCAT device, and blinks while performing communications. |
| [10] | EtherCAT ERR LED | Lit when EtherCAT communications have become abnormal. |
| [11] | EtherNet NET RUN1 LED | Lit while EtherNet communications are usable. |
| [12] | EtherNet LINK/ACK1 LED | Lit when connected with an EtherNet device, and blinks while performing communications. |
| [13] | EtherNet NET RUN2 LED | Lit when EtherNet communications are usable. |
| [14] | EtherNet LINK/ACK2 LED | Lit when connected with an EtherNet device, and blinks while performing communications. |

| | Name | Description |
|---|---|---|
| A | SD memory card installation connector | Install the SD memory card. Do not plug or unplug the SD memory card during measurement operation. Otherwise measurement time may be affected or data may be destroyed. |
| B | EtherNet connector | Connect an EtherNet device. |

| FH-1050/FH-3050 Series | FH-1050-10/FH-1050-20<br>FH-3050-10/FH-3050-20<br>FH-2050 Series/FH-5050 Series |
|---|---|
| Ethernet port, EtherNet/IP port, and PROFINET port are sharing use.  | Upper port : Ethernet port<br>Lower port : Ethernet port, EtherNet/IP port, and PROFINET port are sharing use.  |

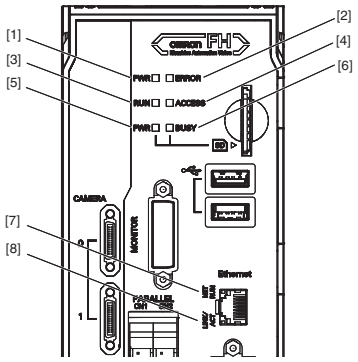


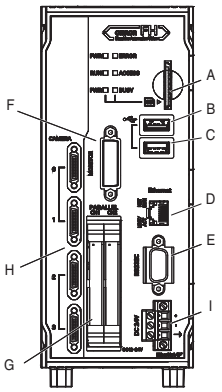


| | | |
|---|---|---|
| C | USB connector | Connect a USB device. Do not plug or unplug it during measurement operation. Otherwise measurement time may be affected or data may be destroyed. |
| D | RS-232C connector | Connect an external device such as a programmable controller. |
| E | DVI-I connector | Connect a monitor. |
| F | I/O connector (control lines, data lines) | Connect the controller to external devices such as a sync sensor and PLC. |
| G | EtherCAT address setup volume | Used to set a node address (00 to 99) as an EtherCAT communication device. |
| H | EtherCAT communication connector (IN) | Connect the opposed EtherCAT device. |
| I | EtherCAT communication connector (OUT) | Connect the opposed EtherCAT device. |
| J | Encoder connector | Connect an encoder. |
| K | Camera connector | Connect cameras. |
| L | Power supply terminal connector | Connect a DC power supply. Wire the controller independently on other devices. Wire * the ground line. Be sure to ground the controller alone. |

* Use the attachment power terminal connector (male) of FH-XCN series.
For details, refer to 5-3 Sensor Controller Installation on Vision System FH/FZ5 series Hardware Setup Manual (Z366).

**Lite Controllers (4-camera type)**




| | LED name | Description |
|---|---|---|
| **[1]** | PWR LED | Lit while power is ON. |
| **[2]** | ERROR LED | Lit when an error has occurred. |
| **[3]** | RUN LED | Lit while the layout turned on output setting is displayed. |
| **[4]** | ACCESS LED | Blinks while the internal nonvolatile memory is accessed. |
| **[5]** | SD PWR LED | Lit while power is supplied to the SD memory card and the card is usable. |
| **[6]** | SD BUSY LED | Lit when access to the SD memory card. |
| **[7]** | Ethernet NET RUN LED | Lit while Ethernet communications are usable. |
| **[8]** | Ethernet LINK/ACT LED | Blinks when connected with an Ethernet device, and blinks while performing communications. |

| | Connector name | Description |
|---|---|---|
| **A** | SD memory card installation connector | Install the SD memory card. Do not plug or unplug the SD memory card during measurement operation. Otherwise measurement time may be affected or data may be destroyed. |
| **B** | USB 2.0 connector | Connects to USB 2.0. Do not insert or remove during loading or writing of measurement or data. The measurement time can be longer or data can be damaged. |
| **C** | USB 3.0 connector | Connects to USB 3.0. Do not insert or remove during loading or writing of measurement or data. The measurement time can be longer or data can be damaged. USB 3.0 has a high ability to supply the bus power. Use the Sensor Controller by combining USB 3.0, faster transport can be realized. |
| **D** | Ethernet connector | Connect an Ethernet device. Ethernet port, EtherNet/IP port, and PROFINET port are sharing use. |
| **E** | RS-232C connector | Connect an external device such as a programmable controller. |
| **F** | DVI-I connector | Connect a monitor. |
| **G** | Parallel connector (control lines, data lines) | Connect the controller to external devices such as a sync sensor. |
| **H** | Camera connector | Connect a camera. |
| **I** | Power supply terminal connector | Connect a DC power supply. Wire the controller independently on other devices. Wire * the ground line. Be sure to ground the FH Sensor Controller alone. |

* Use the attachment power terminal connector (male) of FH-XCN-L series.
For details, refer to 5-3 Sensor Controller Installation on Vision System FH/FZ5 series Hardware Setup Manual(Z366).

# Processing Items

| Group | Icon | Processing Item | | Corresponding Page in the Catalog |
|---|---|---|---|---|
| Measurement |  | Search | Used to identify the shapes and calculate the position of measurement objects. | P16 |
| |  | Flexible Search | Recognizing the shapes of workpieces with variation and detecting their positions. | P16 |
| |  | Sensitive Search | Search a small difference by dividing the search model in detail, and calculating the correlation. | P16 |
| |  | ECM Search | Used to search the similar part of model form input image. Detect the evaluation value and position. | |
| |  | EC Circle Search | Extract circles using "round " shape information and get position, radius and quantity in high preciseness. | |
| |  | Shape Search Ⅱ | Used to search the similar part of model from input image regardless of environmental changes. Detect the evaluation value and position. | P16 |
| |  | Shape Search Ⅲ | Robust detection of positions is possible at high-speed and with high precision incorporating environmental fluctuations, such as differences in individual shapes of the workpieces, pose fluctuations, noise superimposition and shielding. | P16 |
| |  | EC Corner | This processing item measures a corner position (corner) of a workpiece. | |
| |  | Ec Cross | The center position of a crosshair shape is measured using the lines created by the edge information on each side of the crosshair. | |
| |  | Classification | Used when various kinds of products on the assembly line need to be sorted and identified. | P16 |
| |  | Edge Position | Measure position of measurement objects according to the color change in measurement area. | P16 |
| |  | Edge Pitch | Detect edges by color change in measurement area. Used for calculating number of pins of IC and connectors. | P16 |
| |  | Scan Edge Position | Measure peak/bottom edge position of workpieces according to the color change in separated measurement area. | P16 |
| |  | Scan Edge Width | Measure max/min/average width of workpieces according to the color change in separated measurement area. | P16 |
| |  | Circular Scan Edge Position | Measure center axis, diameter and radius of circular workpieces. | P16 |
| |  | Circular Scan Edge Width | Measure center axis, width and thickness of ring workpieces. | P16 |
| |  | Intersection | Calculate approximate lines from the edge information on two sides of a square workpiece to measure the angle formed at the intersection of the two lines. | P16 |
| |  | Color Data | Used for detecting presence and mixed varieties of products by using color average and deviation. | |
| |  | Gravity and Area | Used to measure area, center of gravity of workpices by extracting the color to be measured. | |
| |  | Labeling | Used to measure number, area and gravity of workpieces by extracting registered color. | |
| |  | Label Data | Selecting one region of extracted Labeling, and get that measurement. Area and Gravity position can be got and judged. | |
| |  | Defect | Used for appearance measurement of plain-color measurement objects such as defects, stains and burrs. | P16 |
| |  | Precise Defect | Check the defect on the object. Parameters for extraction defect can be set precisely. | P16 |
| |  | Fine Matching | Difference can be detected by overlapping and comparing (matching) registered fine images with input images. | P16 |
| |  | Character Inspect | Recognize character according correlation search with model image registered in [Model Dictionary]. | P17 |
| |  | Date Verification | Reading character string is verified with internal date. | P17 |
| |  | Model Dictionary | Register character pattern as dictionary. The pattern is used in [Character Inspection]. | |
| |  | 2DCode II *1 | Recognize 2D code and display where the code quality is poor. | P17 |
| |  | 2DCode *2 | Recognize 2D code and display where the code quality is poor. | P17 |
| |  | Barcode *3 | Recognize barcode, verify and output decoded characters. | P17 |
| |  | OCR | Recognize and read characters in images as character information. | P17 |
| |  | OCR User Dictionary | Register dictionary data to use for OCR. | P17 |
| |  | Circle Angle | Used for calculating angle of inclination of circular measurement objects. | |
| |  | Glue Bead Inspection | You can inspect coating of a specified color for gaps or runoffs along the coating path. | P17 |

| Group | Icon | Processing Item | | Corresponding Page in the Catalog |
|---|---|---|---|---|
| Input Image |  | Camera Image Input FH | To input images from cameras. And set up the conditions to input images from cameras. (For FH Sensor Controllers only) | |
| |  | Camera Image Input HDR | Create high-dynamic range images by acquiring several images with different conditions. | |
| |  | Camera Image Input HDRLite | HDR function for FZ-SQ□ Intelligent Compact Cameras. | |
| |  | Photometric Stereo Image Input | Capture images under different illumination directions using a photometric stereo light. | |
| |  | Camera Switch | To switch the cameras used for measurement. Not input images from cameras again. | |
| |  | Measurement Image Switching | To switch the images used for measurement. Not input images from camera again. | |
| |  | Multi-trigger Imaging | The Multi-trigger Imaging processing item captures multiple images at user-defined timings and executes parallel measurement for each image. Insert the Multi-trigger Imaging to the top of the flow. | |
| |  | Multi-trigger Imaging Task | The Multi-trigger Imaging processing item captures multiple images at user-defined timings and executes parallel measurement for each image. Insert this processing item to the top of the processing which requires imaging for multiple times. | |
| Compensate image |  | Position Compensation | Used when positions are differed. Correct measurement is performed by correcting position of input images. | P18 |
| |  | Filtering | Used for processing images input from cameras in order to make them easier to be measured. | P18 |
| |  | Background Suppression | To enhance contrast of images by extracting color in specified brightness. | P18 |
| |  | Brightness Correct Filter | Track brightness change of entire screen and remove gradual brightness change such as uneven brightness. | P18 |
| |  | Color Gray Filter | Color image is converted into monochrome images to emphasize specific color. | P18 |
| |  | Extract Color Filter | Convert color image to color extracted image or binary image. | P18 |
| |  | Anti Color Shading | To remove the irregular color/pattern by uniformizing max.2 specified colors. | P18 |
| |  | Stripes Removal Filter Ⅱ | Remove the background pattern of vertical, horizontal and diagonal stripes. | P19 |
| |  | Polar Transformation | Rectify the image by polar transformation. Useful for OCR or pattern inspection printed on circle. | P18 |
| |  | Trapezoidal Correction | Rectify the trapezoidal deformed image. | P18 |
| |  | Machine Simulator | How the alignment marks would move on the image when each stage or robot axis is controlled can be checked. | |
| |  | Image Subtraction | The registered model image and measurement image are compared and only the different pixels are extracted and converted to an image. | |
| |  | Advanced filter | Process the images acquired from cameras in order to make them easier to measure. This processing item consolidates existing image conversion filtering into one processing item and adds extra functions. | P18 |
| |  | Panorama | Combine multiple image to create one big image. | P18 |
| Support measurement |  | Unit Macro | Advanced arithmetic processing can be easily incorporated into workflow as Unit Macro processing items. | P20 |
| |  | Unit Calculation Macro | This function is convenient when the user wants to calculate a value using an original calculation formula or change the set value or system data of a processing item. | P20 |
| |  | Calculation | Used when using the judge results and measured values of ProcItem which are registered in processing units. | |
| |  | Line Regression | Used for calculating regression line from plural measurement coodinate. | |
| |  | Circle Regression | Used for calculating regression circle from plural measurement coordinate. | |
| |  | Precise Calibration | Used for calibration corresponding to trapezoidal distortion and lens distortion. | P15 |
| |  | User Data | Used for setting of the data that can be used as common constants and variables in scene group data. | P21 |
| |  | Set Unit Data | Used to change the ProcItem data (setting parameters,etc.) that has been set up in a scene. | |
| |  | Get Unit Data | Used to get one data (measured results, setting parameters,etc.) of ProcItem that has been set up in a scene. | |
| |  | Set Unit Figure | Used for re-setting the figure data (model, measurement area ) registered in an unit. | |
| |  | Get Unit Figure | Used for get the figure data (model, measurement area ) registered in an unit. | |
| |  | Trend Monitor | Used for displaying the information about results on the monitor, facilitating to avoid NG and analyze causes. | P21 |

| Group | Icon | Processing Item | | Corresponding Page in the Catalog |
|---|---|---|---|---|
| Support measurement | | Image Logging | Used for saving the measurement images to the memory and USB memory. | |
| | | Image Conversion Logging | Used for saving the measurement images in JPEG and BMP format. | |
| | | Data Logging | Used for saving the measurement data to the memory and USB memory. | |
| | | Elapsed Time | Used for calculating the elapsed time since the measurement trigger input. | |
| | | Wait | Processing is stopped only at the set time. The standby time is set by the unit of [ms]. | |
| | | Focus | Focus setting is supported. | P15 |
| | | Iris | Focus and aperture setting is supported. | P15 |
| | | Parallelize | A part of the measurement flow is divided into two or more tasks and processed in parallel to shorten the measurement time. This processing item is placed at the top of processing to be performed in parallel. | |
| | | Parallelize Task | A part of the measurement flow is divided into two or more tasks and processed in parallel to shorten the measurement time. This processing item is placed immediately before processing to be performed in parallel between Parallelize and Parallelize End. | |
| | | Statistics | Used when you need to calculate an average of multiple measurement results. | |
| | | Reference Calib Data | Calibration data and distortion compensation data held under other processing items can be referenced. | |
| | | Position Data Calculation | The specified position angle is calculated from the measured positions. | P14 |
| | | Stage Data | Sets and stores data related to stages. | |
| | | Robot Data | Sets and stores data related to robots. | |
| | | Vision Master Calibration | This processing item automatically calculates the entire axis movement amount of the control equipment necessary for calibration. | P15 |
| | | PLC Master Calibration | Calibration data is created using a communication command from PLC. | P15 |
| | | Convert Position Data | The position angle after the specified axis movement is calculated. | P14 |
| | | Movement Single Position | The axis movement that is required to match the measured position angle to the reference position angle is calculated. | P14 |
| | | Movement Multi Points | The axis movements that are required to match the measured position angles to the corresponding reference position angles are calculated. | P14 |
| | | Detection Point | Obtains position/angle information by referring to the coordinate values measured with the Measurement Processing Unit. | |
| | | Manual Position Setting | Used to change the measurement coordinates X and Y of the measurement processing unit. | |
| | | Camera Calibration | By setting the camera calibration, the measurement result can be converted and output as actual dimensions. | P15 |
| | | Data Save | The set data can be saved in the controller main unit or as scene data. The data is held even after the FH/FZ power is turned off. | |
| | | Conveyor Calibration | Conveyor Calibration is used to calibrate camera, conveyor, and robots for conveyor tracking application. | |
| | | Scene | The specified scene is copied to the current scene. | |
| | | System Information | Obtain system information (e.g., memory and disk space and I/O input signal status) of the Sensor Controller. | |

| Group | Icon | Processing Item | | Corresponding Page in the Catalog |
|---|---|---|---|---|
| Branch | | Conditional Branch | Used where more than two kinds of products on the production line need to detected separately. | |
| | | End | This ProcItem must be set up as the last processing unit of a branch. | |
| | | DI Branch | Same as ProcItem "Branch". But you can change the targets of conditional branching via external inputs. | |
| | | Control Flow Normal | Set the measurement flow processing into the wait state in which the specific no-protocol command can be executed. | |
| | | Control Flow PLC Link | Set the measurement flow processing into the wait state in which the specific PLC Link command can be executed. | |
| | | Control Flow Parallel | Set the measurement flow processing into the wait state in which the specific parallel command can be executed. | |
| | | Control Flow Fieldbus | Set the measurement flow processing into the wait state in which the specific Fieldbus command can be executed. | |
| | | Selective Branch | Easily branch to multiple destinations. | |
| | | Conditional Execution (If) | The measurement flow is divided according to the comparison result obtained using the set expressions and conditions. | |
| | | Conditional Execution (Else) | Insert between the Conditional Execution (If) processing item and End If processing item. The measurement flow is divided according to the comparison result obtained using the set expressions and conditions. | |
| | | Loop | The set processes are repeated until the loop count reaches the specified number, and then the next process starts. | |
| | | Loop Suspension | Insert between the Loop processing item and End Loop processing item. Used to stop the loop before the loop count reaches the specified number. | |
| | | Select Execution (Select) | Used to set conditions. The measurement flow is divided according to the comparison result obtained using the conditions given by expressions. | |
| | | Select Execution (Case) | Used to make a judgment. The measurement flow is divided according to the comparison result obtained using the conditions given by expressions. | |
| Output result | | Result Output (I/O) | Output data to the external devices such as a programmable controller or a PC via PLC Link, Parallel interface, Fieldbus interface (EtherCAT, EtherNet/IP (other than message communication), PROFINET). | |
| | | Result Output (Message) | Output data to the external devices such as a programmable controller or a PC with non-procedure mode via the serial interface or EtherNet/IP (message communication). This processing item allows you to save the logging data as a ".csv" file into the Sensor Controller as well. | |
| | | Data Output | Used when you need to output data to the external devices such as PLC or PC via serial ports. | |
| | | Parallel Data Output | Used when you need to output data to the external devices such as PLC or PC via parallel ports. | |
| | | Parallel Judgement Output | Used when you need to output judgement results to the external devices such as PLC or PC via parallel ports. | |
| | | Fieldbus Data Output | Outputs data to an external device, such as a Programmable Controller, through a fieldbus interface. | |
| Display result | | Result Display | Used for displaying the texts or the figures in the camera image. | |
| | | Display Image File | Display selected image file. | |
| | | Display Last NG Image | Display the last NG images. | |
| | | Conveyor Panorama Display | Display images of the tracking area as a panoramic image. | |
| | | Display Image Hold | Processing item to retain images, including measurement results. | |

*1 2D Codes that can be read : Data Matrix (ECC200)
*2 2D Codes that can be read : Data Matrix (ECC200), QR Code
*3 Bar Codes that can be read : JAN/EAN/UPC (including add-on codes), Code 39, Codabar (NW-7), ITF (Interleaved 2 of 5), Code 93, Code 128, GS1-128, GS1 DataBar (RSS-14 / RSS Limited / RSS Expanded), Pharmacode

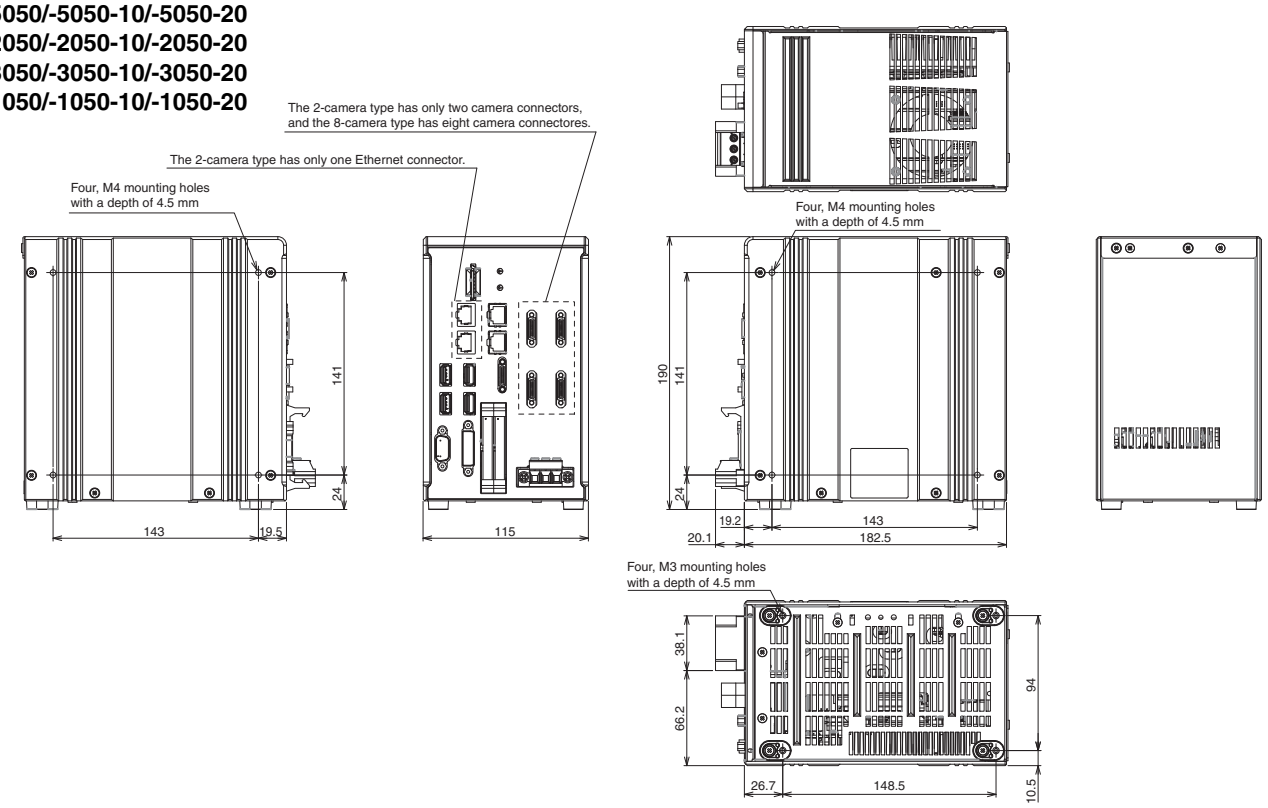
# Dimensions

(Unit: mm)

## Sensor Controllers

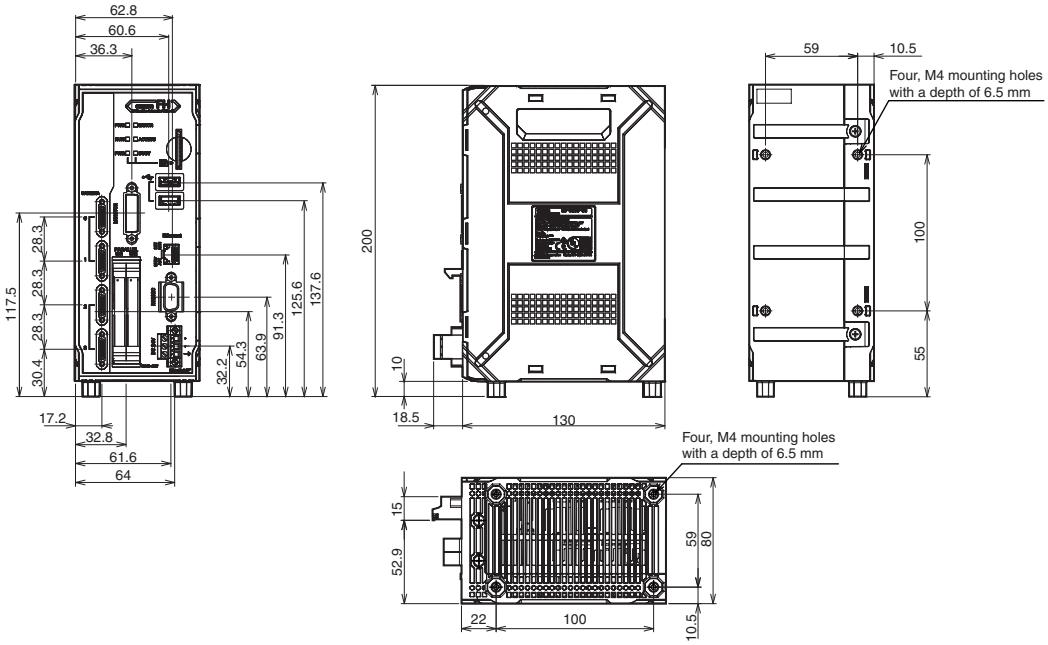
### High-speed, Large-capacity Controllers/Standard Controllers

**FH-5050/-5050-10/-5050-20**
**FH-2050/-2050-10/-2050-20**
**FH-3050/-3050-10/-3050-20**
**FH-1050/-1050-10/-1050-20**




### Lite Controllers

**FH-L550/-L550-10**

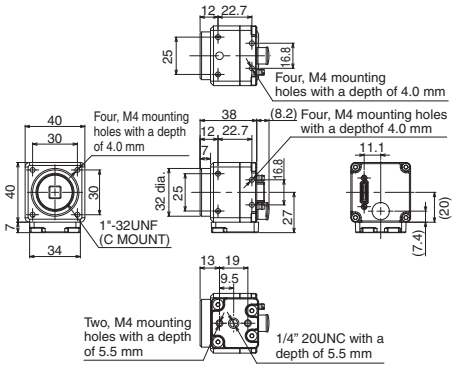


# Cameras

## High-speed Digital CMOS Camera/Digital CMOS Camera

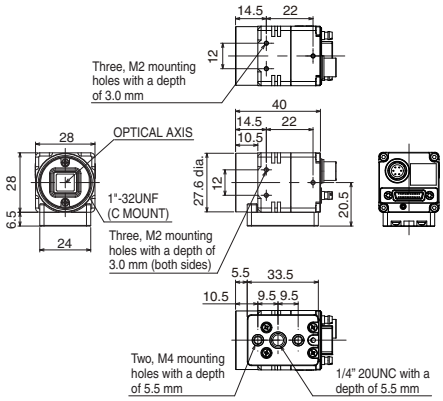
**300,000-pixel camera**

FH-SC
FH-SM




**400,000-pixel camera**

FH-SCX
FH-SMX

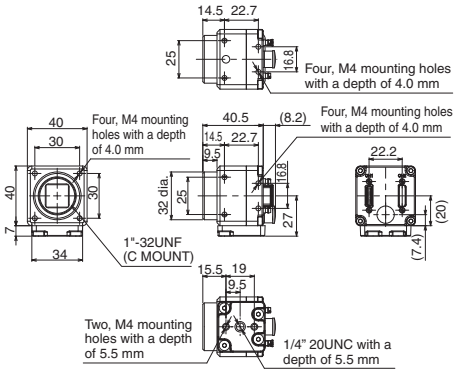



**2 million-pixel camera**

FH-SC02
FH-SM02

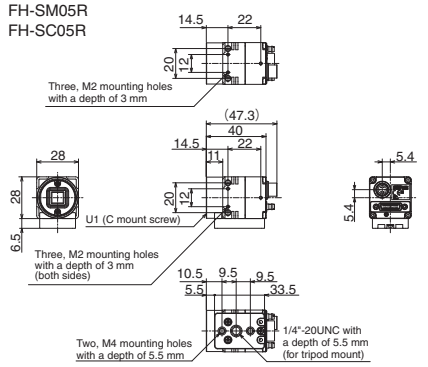
**4 million-pixel camera**

FH-SC04
FH-SM04

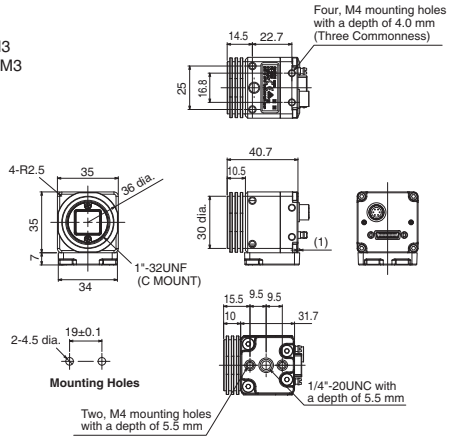



**5 million-pixel camera**

FH-SM05R
FH-SC05R




FZ-S5M3
FZ-SC5M3




**5 million-pixel camera**

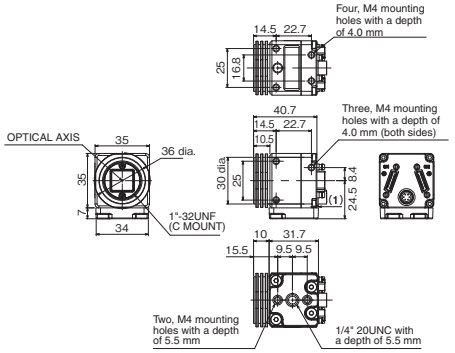
FH-SCX05
FH-SMX05

**12 million-pixel camera**

FH-SCX12
FH-SMX12

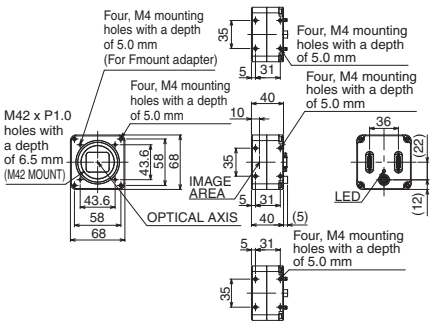
**20.4 million-pixel camera**

FH-SC21R
FH-SM21R




**12 million-pixel camera**

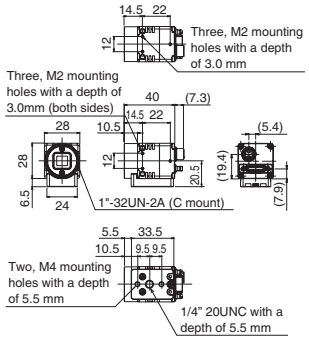
FH-SC12
FH-SM12



## Digital CCD/CMOS Cameras

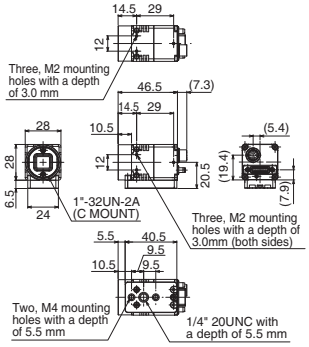
**300,000-pixel camera**

FZ-S
FZ-SC




**2 million-pixel camera**

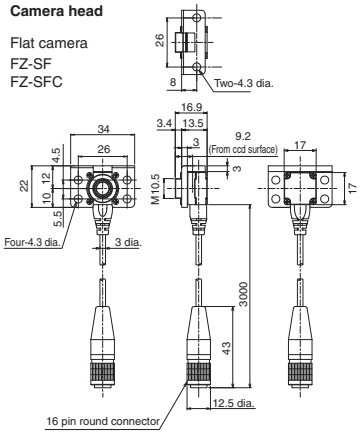
FZ-S2M
FZ-SC2M




## Small digital CCD cameras

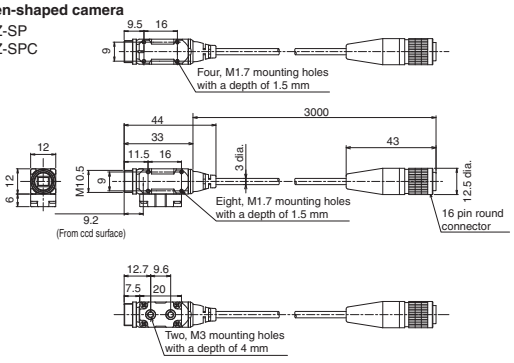
**Camera head**

Flat camera
FZ-SF
FZ-SFC



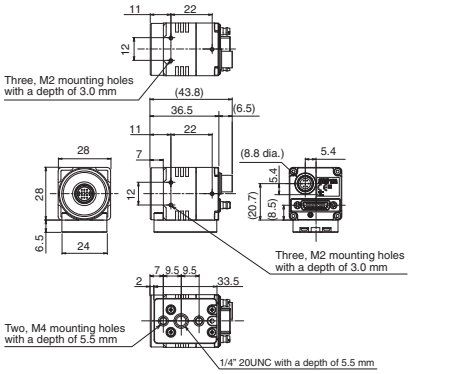

**Pen-shaped camera**

FZ-SP
FZ-SPC




**Camera amplifier**

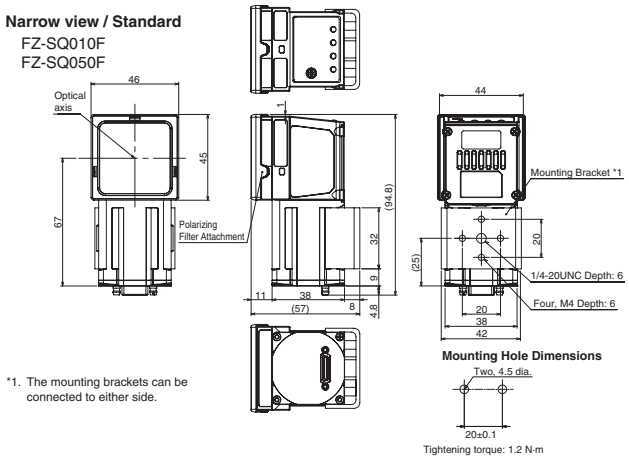
**Can be used for both flat cameras and pen-shaped cameras**




## Intelligent Compact Digital CMOS Cameras

**Narrow view / Standard**

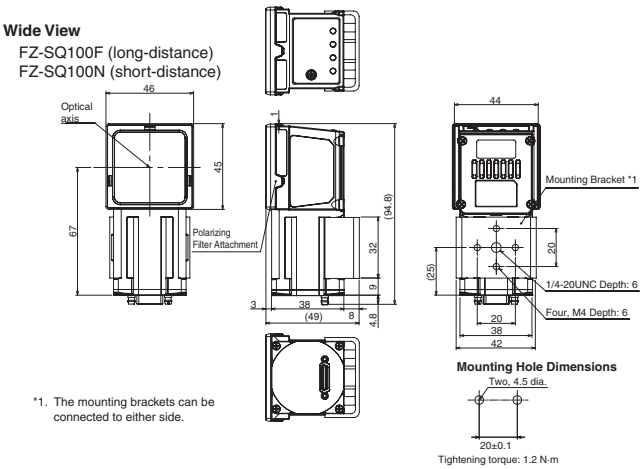
FZ-SQ010F
FZ-SQ050F




*1. The mounting brackets can be connected to either side.

**Wide View**

FZ-SQ100F (long-distance)
FZ-SQ100N (short-distance)



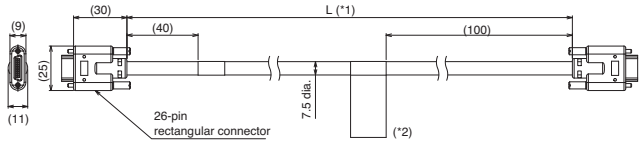

*1. The mounting brackets can be connected to either side.

# Cables

## Camera Cable

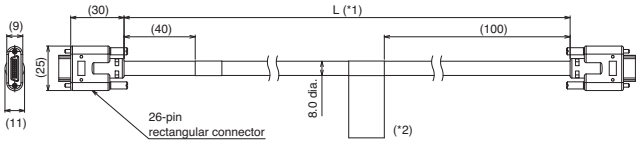
### Camera Cable

FZ-VS3



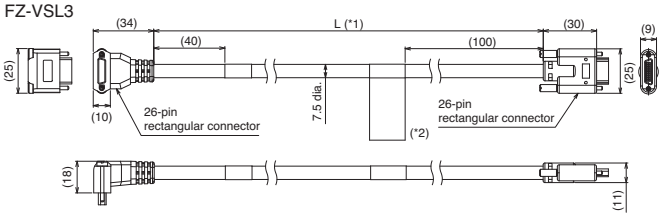

### Bend resistant Camera Cable

FZ-VSB3



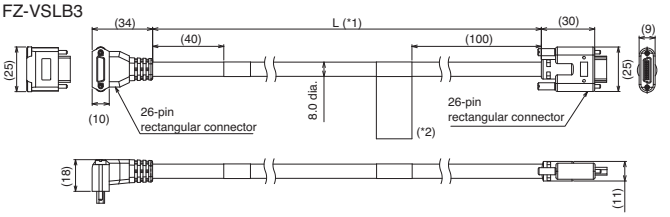

### Right-angle Camera Cable

FZ-VSL3



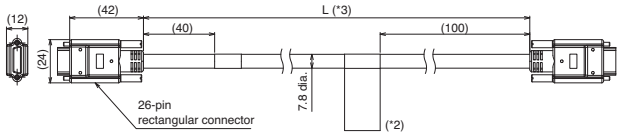

### Bend resistant Right-angle Camera Cable

FZ-VSLB3



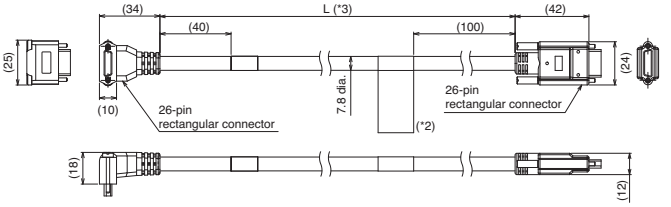

### Long-distance Camera Cable

FZ-VS4




### Long-distance Right-angle Camera Cable

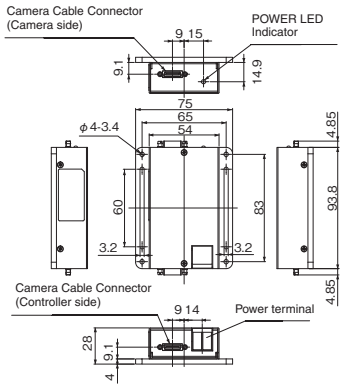
FZ-VSL4




*1. Cable is available in 2m/3m/5m/10m.
*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.

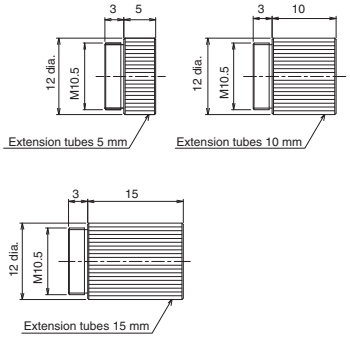
## Camera Cable Extension Unit

FZ-VSJ



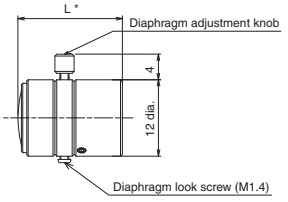

## Extension Tubes for Small Camera

FZ-LESR




## Lens for Small Camera

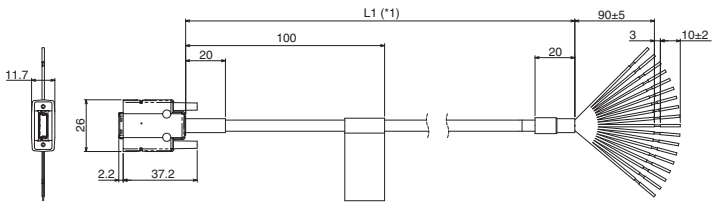
FZ-LES Series




* Overall length is available in 16.4mm/19.7mm/23.1mm/25.5mm.

## Encoder Cable

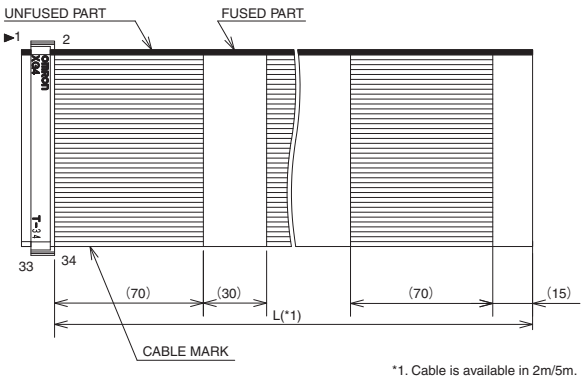
FH-VR




*1. Cable is available in 1.5 m.

## Parallel I/O Cable

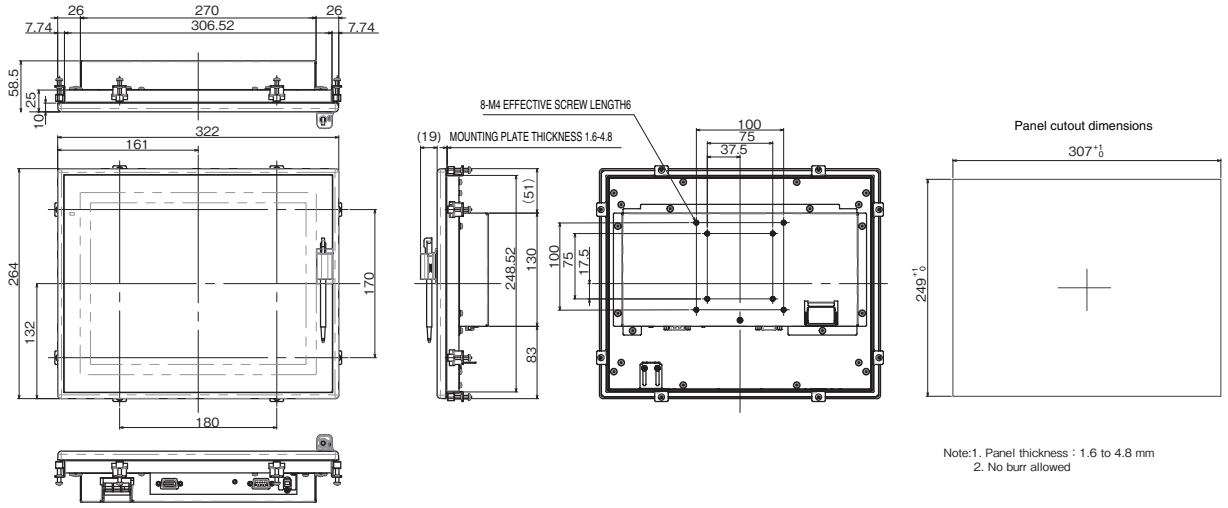
XW2Z-S013-□




*1. Cable is available in 2m/5m.

## Touch Panel Monitor

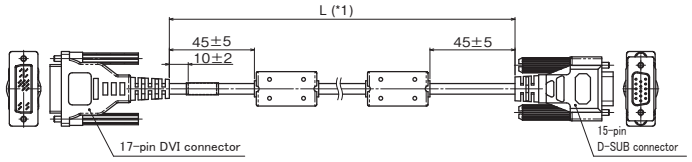
FH-MT12




Note:1. Panel thickness : 1.6 to 4.8 mm
2. No burr allowed

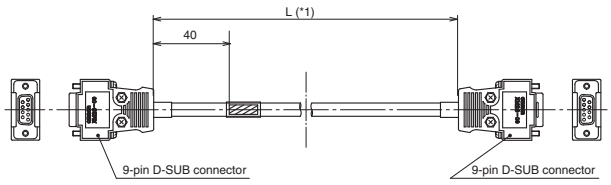
## DVI-Analog Conversion Cable for Touch Panel Monitor/LCD Monitor

FH-VMDA



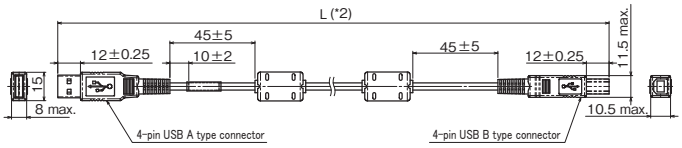

## RS-232C Cable for Touch Panel Monitor

XW2Z-□□□PP-1




## USB Cable for Touch Panel Monitor

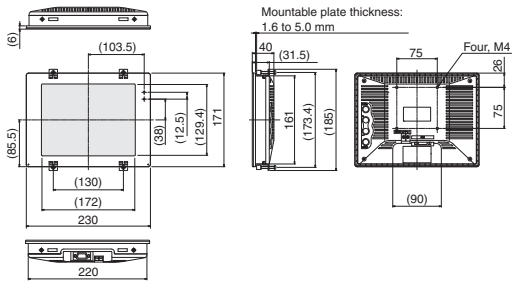
FH-VUAB




*1. Cable is available in 2m/5m/10m.
*2. Cable is available in 2m/5m.

## LCD Monitor

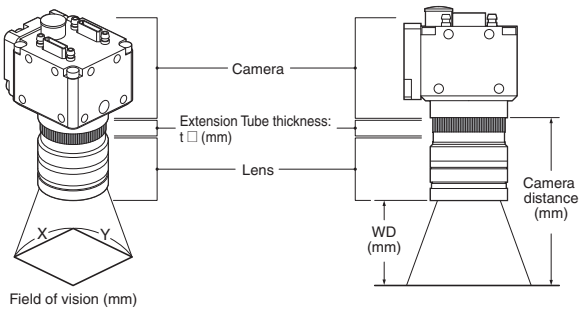
FZ-M08



# Optical Chart

### Meaning of Optical Chart

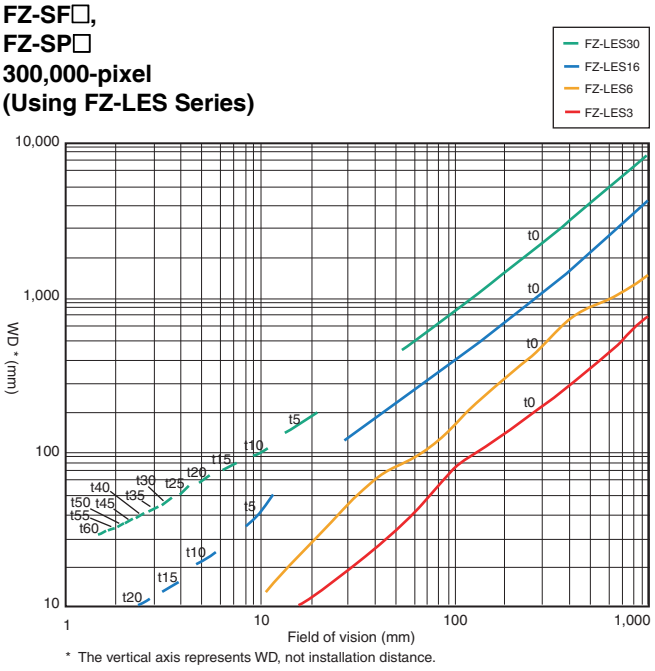
The X axis of the optical chart shows the field of vision (mm) (*1), and the Y axis of the optical chart shows the camera installation distance (mm) (*2).




*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.

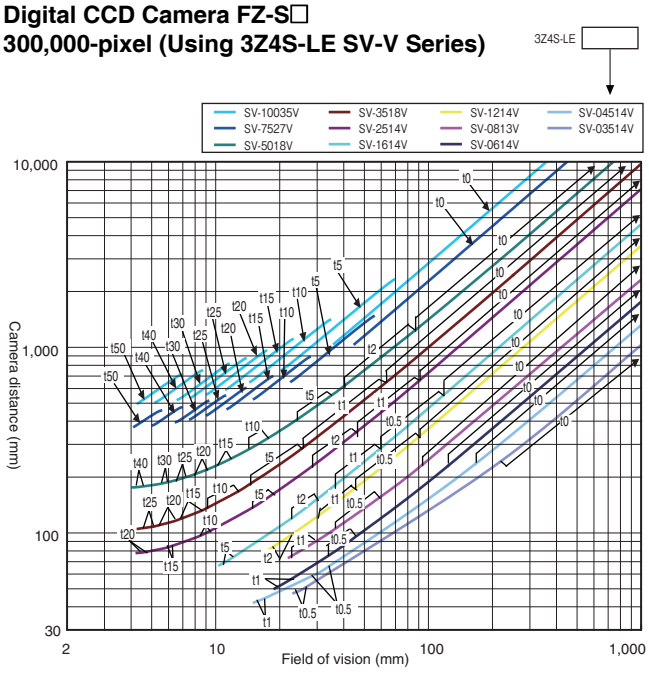
## Standard Lenses

### Small Digital CCD Cameras FZ-SF□, FZ-SP□ 300,000-pixel (Using FZ-LES Series)

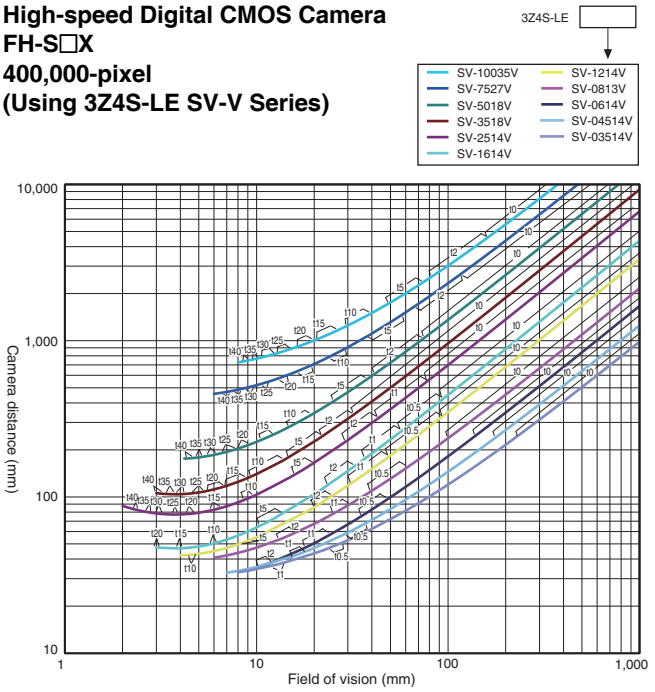



* The vertical axis represents WD, not installation distance.

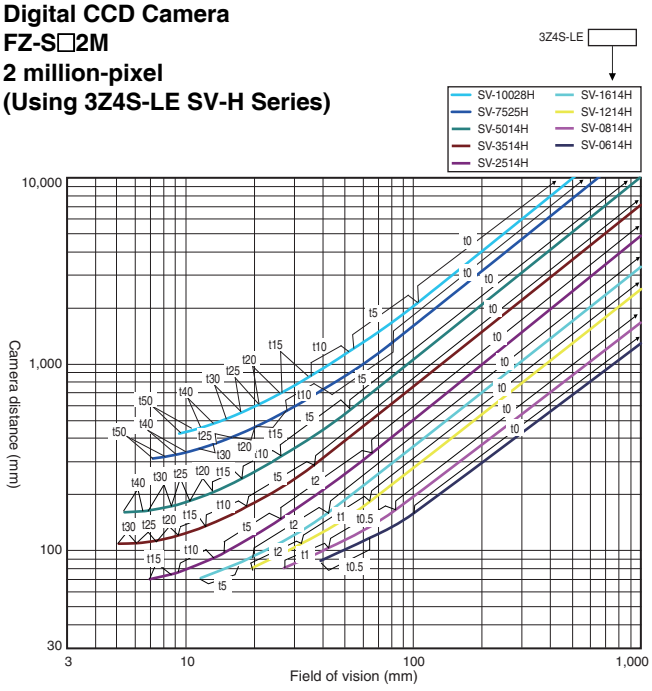
### High-speed Digital CMOS Camera FH-S□, Digital CCD Camera FZ-S□ 300,000-pixel (Using 3Z4S-LE SV-V Series)



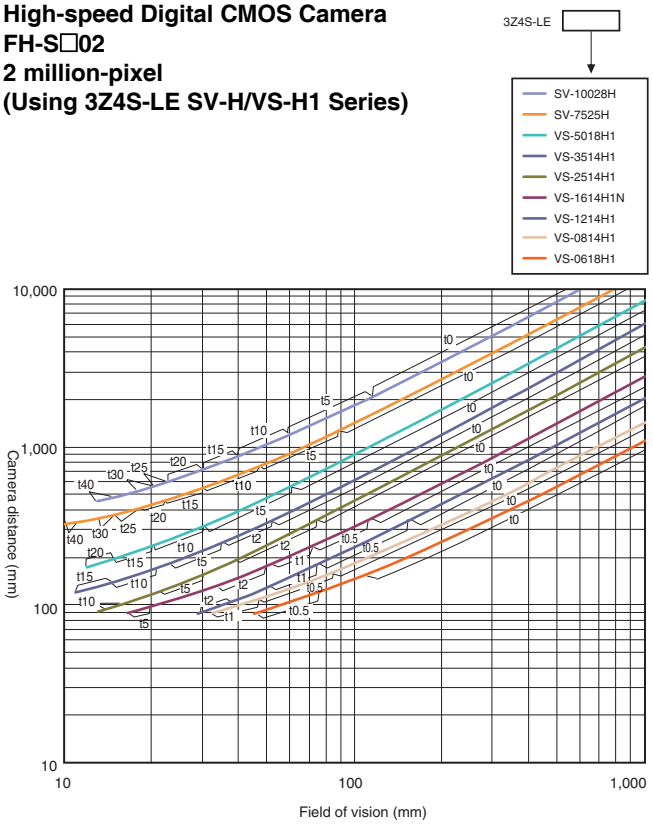

### High-speed Digital CMOS Camera FH-S□X 400,000-pixel (Using 3Z4S-LE SV-V Series)



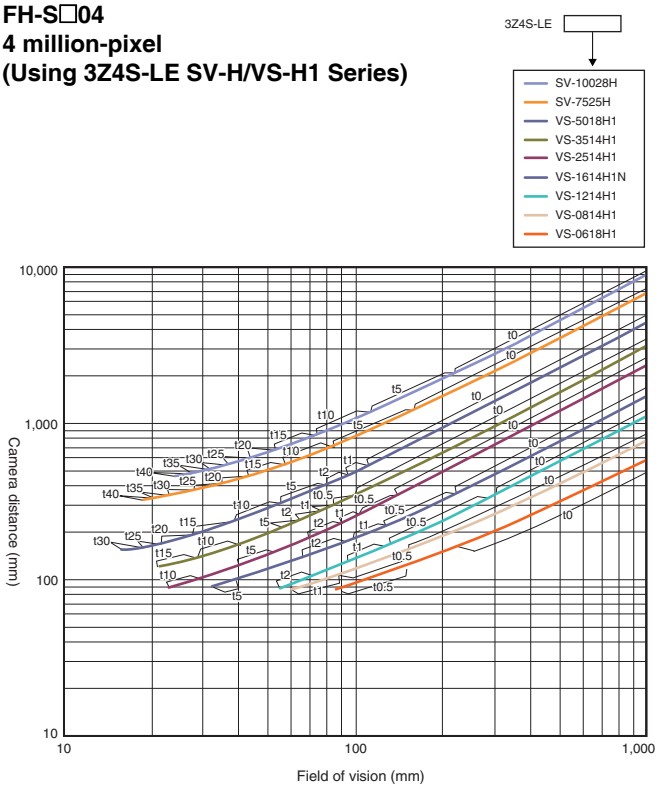

### Digital CCD Camera FZ-S□2M 2 million-pixel (Using 3Z4S-LE SV-H Series)



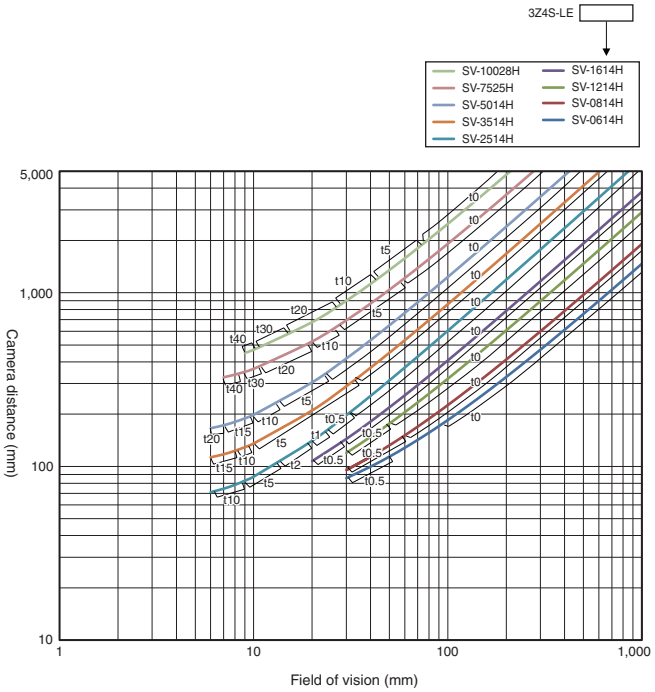
## High-speed Digital CMOS Camera FH-S□02 2 million-pixel (Using 3Z4S-LE SV-H/VS-H1 Series)



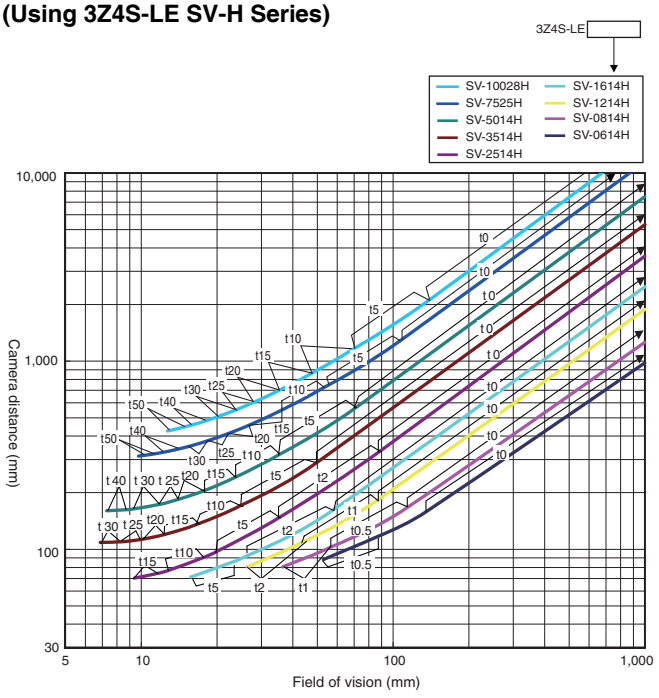

## High-speed Digital CMOS Camera FH-S□04 4 million-pixel (Using 3Z4S-LE SV-H/VS-H1 Series)




## Digital CMOS Camera FH-S□05R 5 million-pixel (Using 3Z4S-LE SV-H Series)

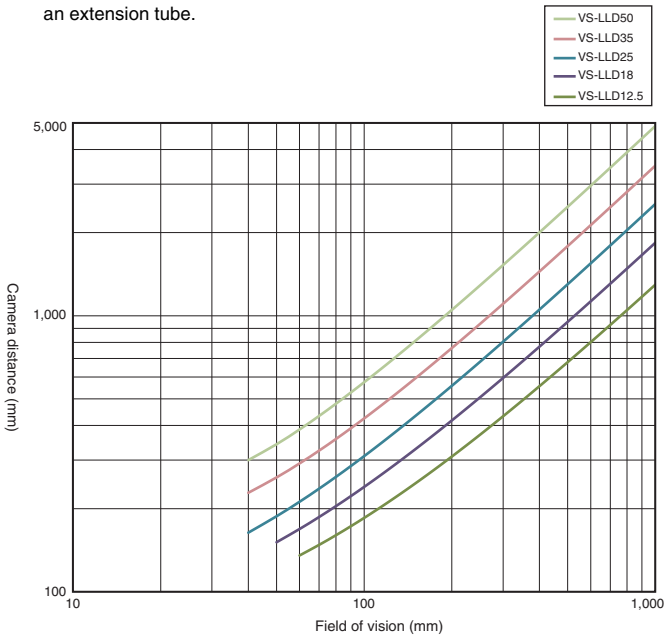



## Digital CMOS Camera FZ-S□5M3, High-speed Digital CMOS Camera FH-S□X05 5 million-pixel (Using 3Z4S-LE SV-H Series)

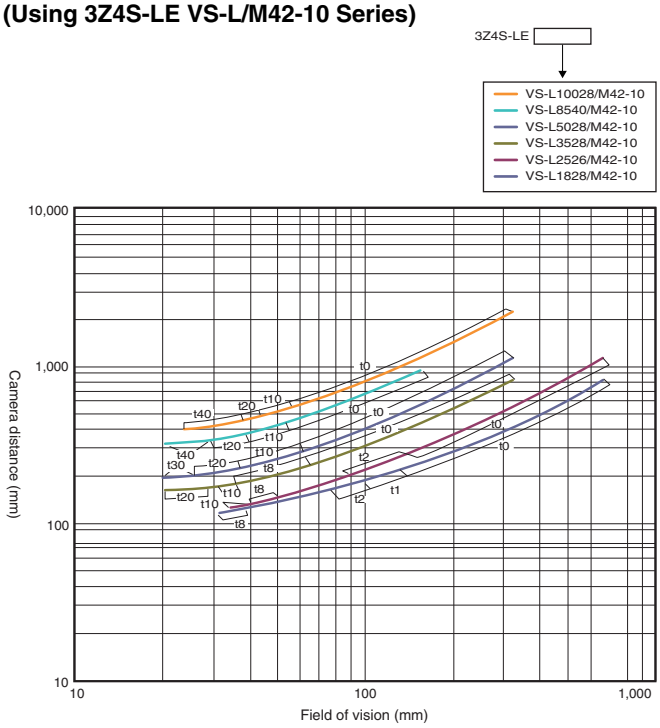


### High-speed Digital CMOS Camera
### FH-S□X12
### 12 million-pixel
### (Using 3Z4S-LE VS-LLD Series)

Note:The 3Z4S-LE VS-LDD Series cannot be used with an extension tube.

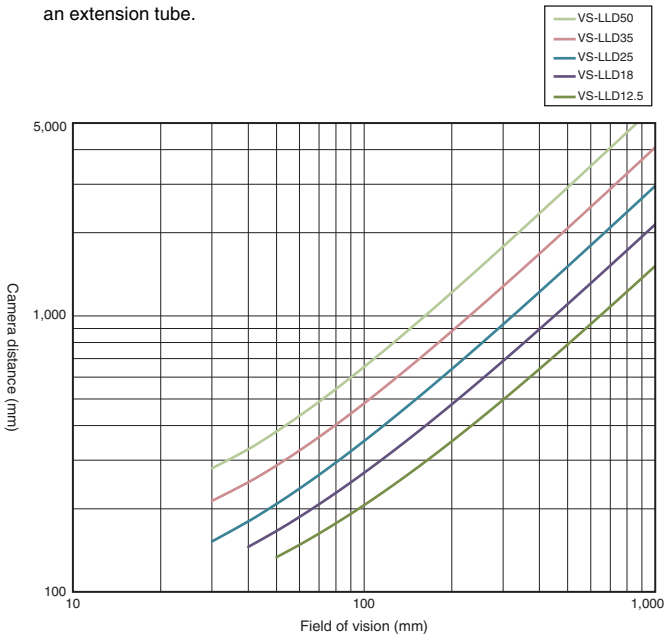



### High-speed Digital CMOS Camera
### FH-S□12
### 12 million-pixel
### (Using 3Z4S-LE VS-L/M42-10 Series)



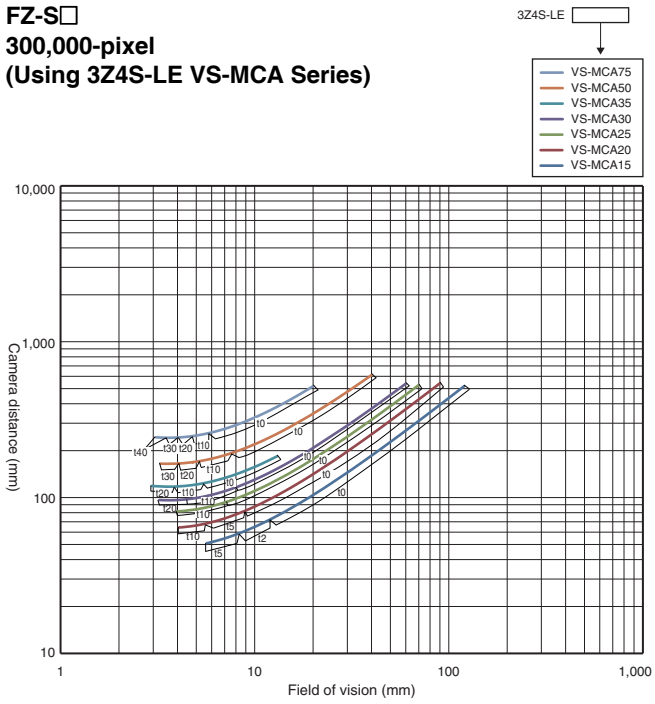

### Digital CMOS Camera
### FH-S□21R
### 20.4 million-pixel
### (Using 3Z4S-LE VS-LLD Series)

Note:The 3Z4S-LE VS-LDD Series cannot be used with an extension tube.

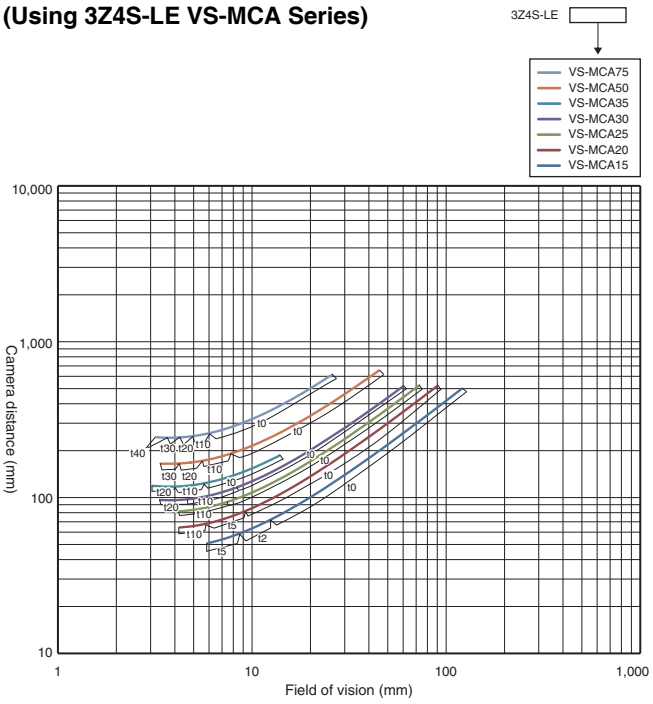


# Vibrations and Shocks Resistant Lenses/Telecentric Lenses

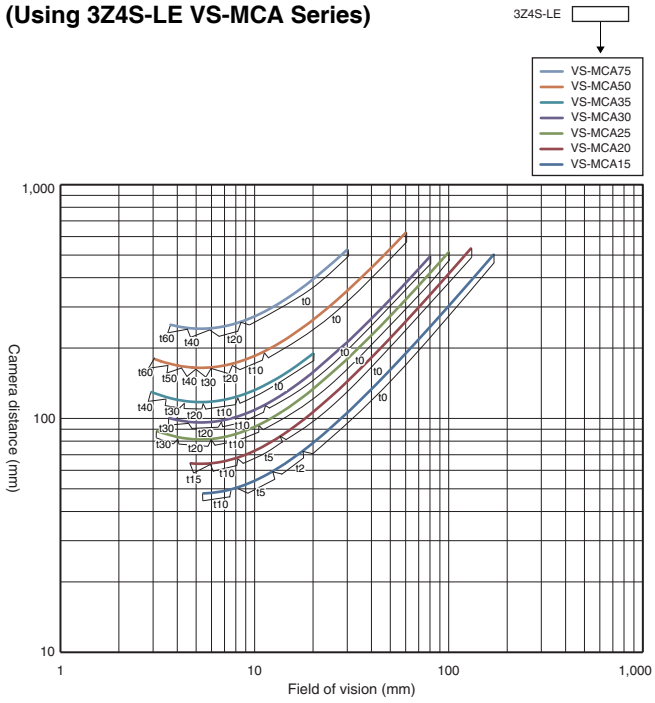
### High-speed Digital CMOS Camera FH-S□, Digital CCD Camera FZ-S□ 300,000-pixel (Using 3Z4S-LE VS-MCA Series)



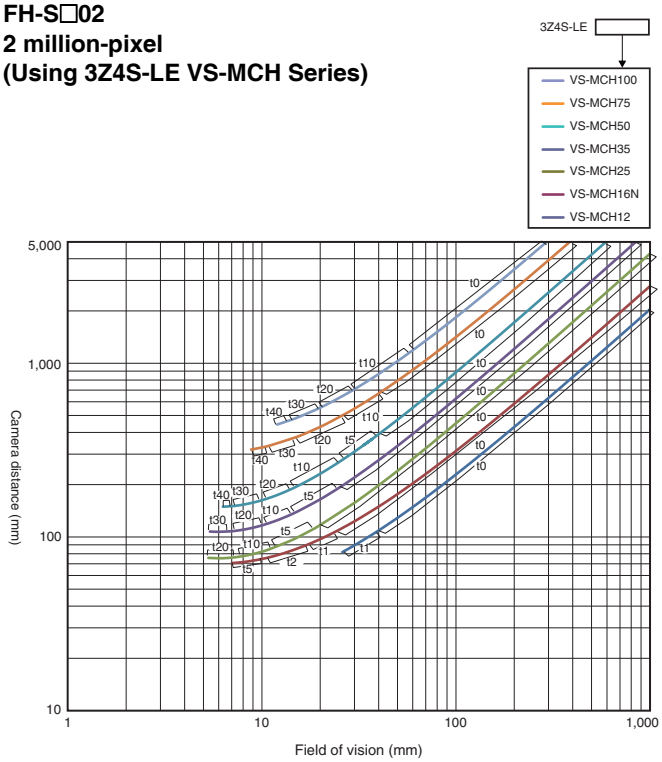

### High-speed Digital CMOS Camera FH-S□X 400,000-pixel (Using 3Z4S-LE VS-MCA Series)



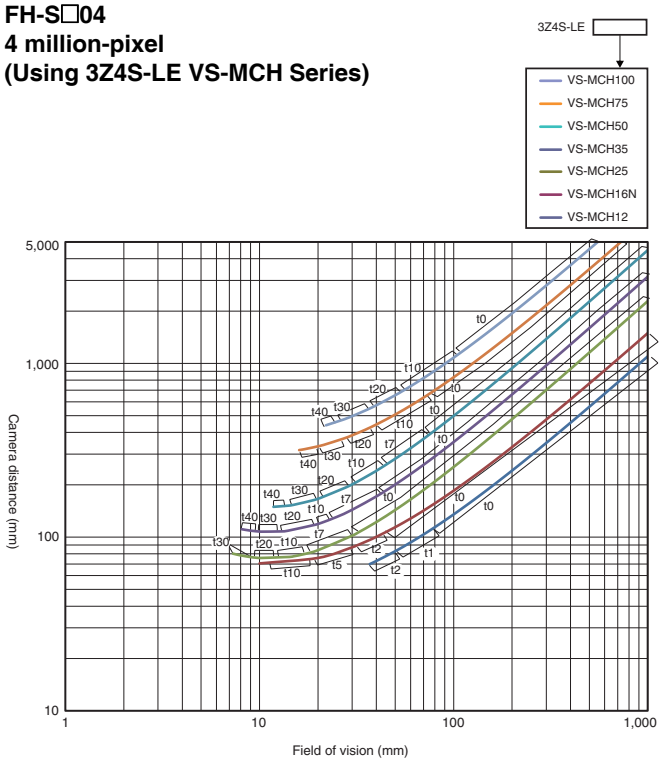

### Digital CCD Camera FZ-S□2M 2 million-pixel (Using 3Z4S-LE VS-MCA Series)



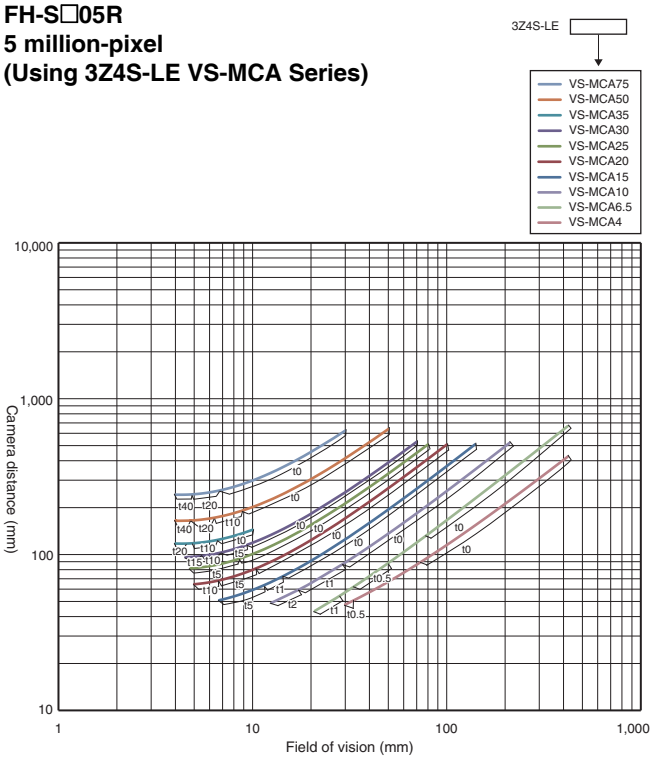

### High-speed Digital CMOS Camera FH-S□02 2 million-pixel (Using 3Z4S-LE VS-MCH Series)



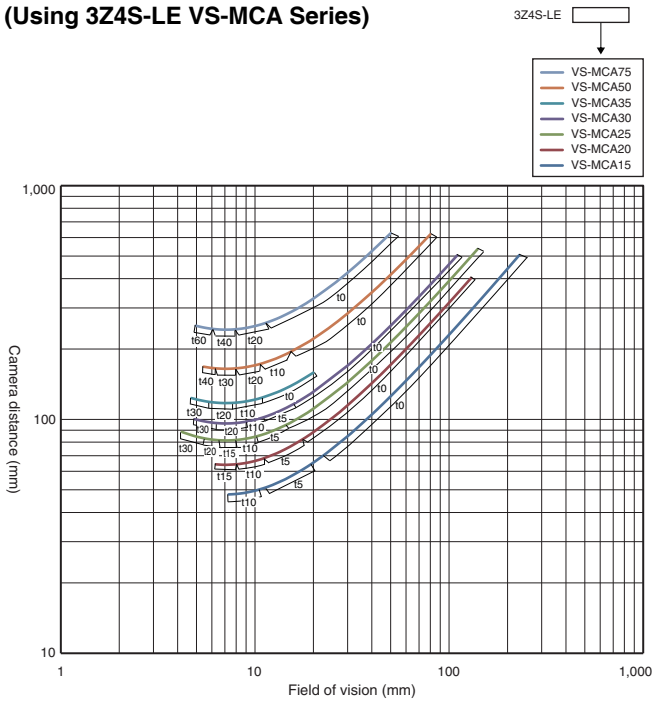
### High-speed Digital CMOS Camera FH-S□04 4 million-pixel (Using 3Z4S-LE VS-MCH Series)



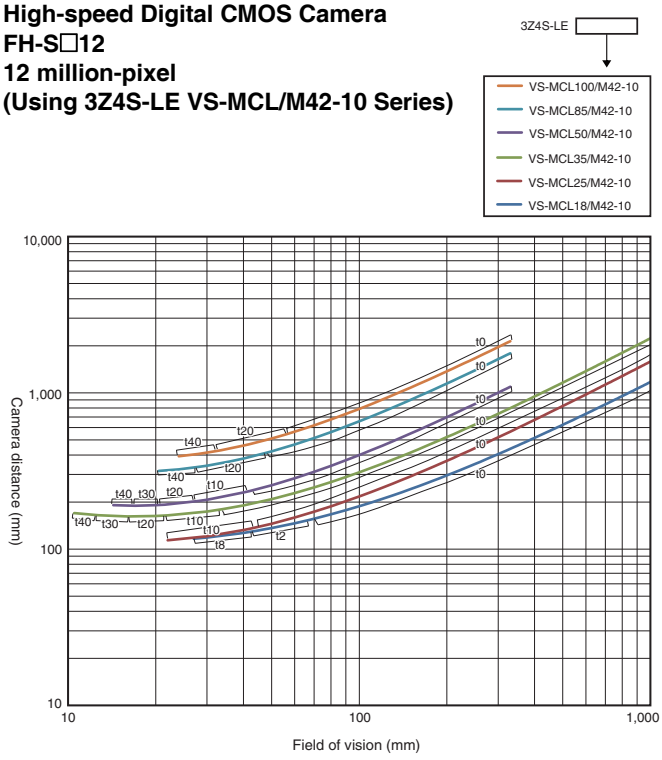

### Digital CMOS Camera FH-S□05R 5 million-pixel (Using 3Z4S-LE VS-MCA Series)



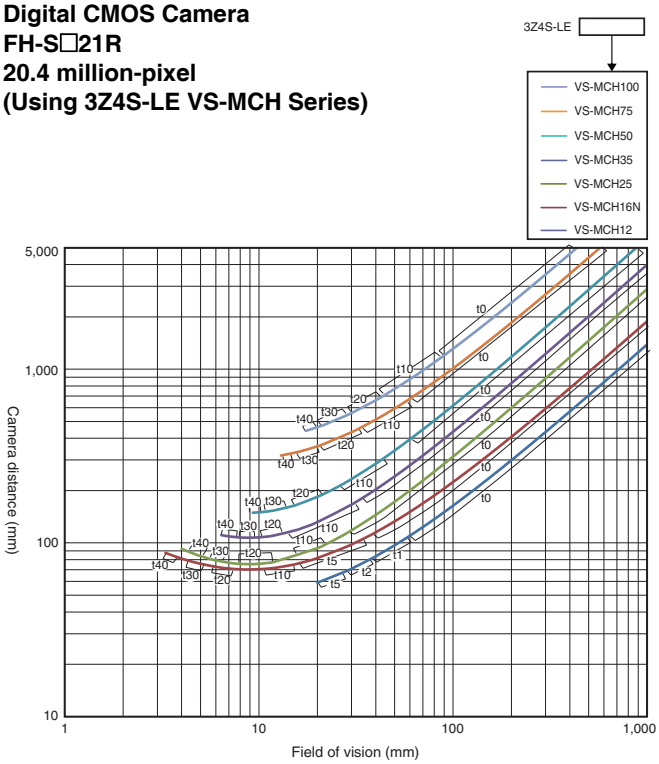

### Digital CMOS Camera FZ-S□5M3, High-speed Digital CMOS Camera FH-S□X05 5 million-pixel (Using 3Z4S-LE VS-MCA Series)



**High-speed Digital CMOS Camera**
**FH-S□12**
**12 million-pixel**
**(Using 3Z4S-LE VS-MCL/M42-10 Series)**




**Digital CMOS Camera**
**FH-S□21R**
**20.4 million-pixel**
**(Using 3Z4S-LE VS-MCH Series)**




# Related Manuals

| Man.No. | Model number | Manual |
|---|---|---|
| Z365 | FH/FHV7 | Vision System FH/FHV7 Series User's Manual |
| Z341 | FH/FHV7 | Vision System FH/FHV7 series Processing Item Function Reference Manual |
| Z342 | FH/FHV7 | Vision System FH/FHV7 Series User's Manual for Communications Settings |
| Z343 | FH | Vision System FH Series Operation Manual for Sysmac Studio |
| Z366 | FH | Vision System FH series Hardware Setup Manual |
| Z367 | FH | Vision System FH series Macro Customize Functions Programming Manual |

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* "Industry's highest" described on the front cover is based on Omron investigation in June 2018.



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