AI-based defect detection that exceeds the ability of expert inspectors
A better option for inspections requiring high sensitivity

Meeting sensory inspection needs amid a shortage of skilled inspectors

Skilled inspectors are hard to come by these days, and labor costs have risen sharply. Manufacturers are now facing intense pressure to automate processes that rely on the senses of experienced human workers. Particularly when it comes to visual inspection, it’s important to reliably identify subtle defects even on flexible lines producing a wide range of items. Traditionally, the sensitivity and knowledge of technicians with long-term experience has been key. However, artificial intelligence is now reaching the stage where it can recognize object features as well as humans and automatically learn criteria. While a lot of AI solutions faces challenges with large amounts of image data, specialized hardware and engineering expertise, Omron is making great progress in enabling its widespread use.
AI reproduces human sensibility and experience

To solve these challenges, Omron developed new defect detection AI that reproduces the techniques of skilled inspectors. This AI is now part of the FH Vision System.

Barriers to automation

1. Defect detection dependent on human senses

2. Inspection criteria dependent on workers’ expertise

3. Shortage of engineers who examine automation

AI captures defects with human-like sensitivity

AI identifies good products as well as experienced inspectors

No special environment is required
AI captures defects with human-like sensitivity

Defect detection tasks that rely on human sensibility are a challenge to automate. Fortunately, powerful new AI technology can match the skills and capabilities of experienced inspectors.

The latest capabilities of the FH Vision System include a new AI-based image filter that reproduces the technique that skilled inspectors use to identify a defect on any product background. Scratches and blemishes that were once difficult to capture can now be identified even without the use of samples or adjustment.
AI reproduces human expertise through learned criteria

**AI Scratch Detect Filter**

The AI Scratch Defect Filter learns by means of images in which human inspectors noticed defects. Whereas previous inspection methods found the unexpected size, shape or color of a particular defect to be a barrier to automation, AI successfully extracts abnormalities by judging their features without definition. The learned data facilitates defect detection on processed surfaces and other uneven backgrounds that previously posed an insurmountable challenge.

![Captured image](image1.png) ![Extracted scratch (internal image)](image2.png)

*1. The FH-UMAI1 Scratch Detect AI Software Installer is required to use AI Scratch Detect Filter.

**Automatic detection of various defects without definition and learning**

Regardless of material type, color, or size, defects can be extracted reliably without previously required definition and adjustment.

<table>
<thead>
<tr>
<th>Scratch on sandblasted metal</th>
<th>Scratch on resin products</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Black scratch on hairline finish</th>
<th>White scratch on shaded hairline finish</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image5.png" alt="Image" /></td>
<td><img src="image6.png" alt="Image" /></td>
</tr>
</tbody>
</table>
### AI identifies good products as well as experienced inspectors

Sensory inspection requires a certain tolerance for variations that don’t pass a certain threshold. Determining what variations are acceptable is a key capability of expert inspectors and poses a challenge for automated inspection systems.

The FH Series can determine acceptable variation tolerances.

Omron’s AI Fine Matching tool learns from the image data of non-defective products to quickly acquire the "expertise" that inspectors develop over the course of many years. This reduces costs and boosts productivity through automation.

### Target inspection level: Reduce overdetection

<table>
<thead>
<tr>
<th>Contamination inspection of LED modules</th>
<th>Captured image</th>
<th>Previous automation method</th>
<th>Difference image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defective product</td>
<td><img src="image1" alt="Defective product" /></td>
<td>Detects position differences, not foreign materials, as defects</td>
<td><img src="image2" alt="Overdetection" /> -&gt; <img src="image3" alt="Detections foreign material only" /></td>
</tr>
<tr>
<td>With foreign materials</td>
<td><img src="image1" alt="Defective product" /></td>
<td>Detects foreign materials only and ignores position differences</td>
<td></td>
</tr>
<tr>
<td>Non-defective product</td>
<td><img src="image1" alt="Non-defective product" /></td>
<td>Previous automation method</td>
<td><img src="image2" alt="Overdetection" /> -&gt; <img src="image3" alt="Judges as non-defective product" /></td>
</tr>
<tr>
<td>Position difference of die</td>
<td><img src="image1" alt="Non-defective product" /></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-defective product</td>
<td><img src="image1" alt="Non-defective product" /></td>
<td></td>
<td><img src="image2" alt="Overdetection" /> -&gt; <img src="image3" alt="Judges as non-defective product" /></td>
</tr>
<tr>
<td>Position difference and light variation of surrounding part</td>
<td><img src="image1" alt="Non-defective product" /></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Correct judgment rate

AI adjusts to target level in a short period of time

Target level

Time-consuming, endless adjustment

Time

Overdetection

Judges as non-defective product

AI

Captured image

Previous automation method

Detects foreign materials only and ignores position differences

Correct judgment rate

AI adjusts to target level in a short period of time

Target level

Time-consuming, endless adjustment

Time
AI reduces overdetection

**AI Fine Matching**

AI Fine Matching identifies a future that is not included in good products as a defect. AI learns images of good products with variations, and generates an AI model. Every time an inspection is carried out, AI reconstructs a model that is presumed to be a good product. AI extracts a difference between the reconstructed good product image and a captured image to identify a defect, reducing overdetection.

**AI makes it easy to avoid overdetection**

Three quick steps on the settings screen guide the user through the process of creating the good product model with the minimum number of images.

1. **Prepare images**
   
   Although standard AI processing requires a huge number of images for learning, the FH Series requires only 100 to 200 images.

2. **Create model**
   
   The system suggests images to learn, helping to complete the good product model.

3. **Check results**
   
   Test is automatically performed using images prepared in Step 1. You don't need to adjust parameters for differential inspections.

*1. "Patent pending" means that we applied for a patent in Japan, and "Patented" means that we obtained a patent in Japan. (as of May 2020)
**No special environment is required**

With the FH Series, there’s no need for high-end hardware or specialized engineers who can configure the system to suit your needs. Our general-purpose vision system makes it easier than ever to introduce AI into production sites.

**Vision controller with AI functionality**

Artificial intelligence has traditionally required a high-end environment, but our lightweight solution comes in the form of user-friendly processing items that have been integrated into our popular FH Series hardware.

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**No special hardware for AI required**

It is difficult to introduce AI technology to many inspection processes because it needs workstation-level hardware. The FH Series does not require special hardware, facilitating introduction.

**No AI engineer required**

In order to reliably use AI technology in processes, the engineer used to have not only image processing skills but also programming and maintenance skills. With the FH Series, however, you can use AI technology just like operating a standard vision sensor. No dedicated AI engineer is required.

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**FH-5550/5550**  
High-speed, Large-capacity Controller

**Intel® Core™ i7 processor**

| Outstanding processing speed |  
|-------------------------------|---|
| Ultra-high-speed CPU | Large-capacity RAM |

- **Machine control network**  
  Cycle: 125 μs

- **Data output**  
  High-speed interface: USB 3.0

*1. The FH-5550 Controller is compared with the FH-3050 Controller.
High-resolution cameras

We offer a range of cameras that can capture high-resolution images suitable for sensory inspection at high speeds.

Ultra-high-speed sensing technology in a compact design

There was a trade-off between high-resolution image capture like the human eye and inspection processing speed. We use new CMOS image elements and dual transfer technology to capture high-resolution images while transferring images at high speeds. This facilitates applications that previously required multiple cameras or a mechanism to move a camera.

MDMC light with flexible lighting patterns

This light can be adjusted to defects by combining the illumination colors and angles like humans do. 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 illumination patterns can be registered as settings, facilitating duplicating production lines.

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

*2. MDMC...Multi-Direction Multi-Color
Software for flexible automation

Flexible image capture

**Multi-Trigger Imaging**
captures long objects at high speeds

The Multi-Trigger Imaging function can capture images and process them in parallel, leveraging the speed of the multi-core processor to capture long objects at high speeds.

<table>
<thead>
<tr>
<th>Conventional vision sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capture 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FH Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capture 1</td>
</tr>
<tr>
<td>Parallel processing</td>
</tr>
</tbody>
</table>

Camera Image Input HDR optimizes contrast

Camera Image Input HDR helps create optimized HDR images under variable ambient conditions. Once you specify the optimum area to capture on the image, the FH Series automatically adjusts the shutter speed while capturing images and combining the images.

Adjusts brightness to suit your specified area

**Optimized for the entire field of view**

While the contrast around the pins is low, reduced reflection enables capturing a clear image of the entire connector.

**Optimized for the connector**

Although reflection occurs at the surrounding part, a clear image of the pins can be captured.

Detects low-contrast defects in high-contrast mode

**Previously**

Low contrast makes the surface appear uniform.

**HDR high-contrast image**

Increased contrast reveals many scratches and blemishes.
Parallel processing for different inspections

Multi-Line Random-Trigger inspects at up to four different timings

A single controller can perform inspections at different points at different timings. Controllers installed for each process can be integrated into one, reducing initial costs and saving space.

Packaging process of pharmaceuticals

Contamination inspection of beverage containers
A single controller that can control each line saves initial costs and space.

Appearance inspection of rechargeable battery cells
Four cameras can be connected to one controller, enabling simultaneous inspection of dents and scratches from four directions.
High-speed, high-precision positioning

Shape Search III is robust against shape variations

High-precision and robust positioning is possible even under the adverse conditions, such as changes in environments and materials. A 20.4 Mpix camera can search a positioning mark in as fast as 12 ms\(^*2\), and a 5 Mpix camera, widely used for alignment applications, in as fast as 2 ms.

Circular Scan Edge Position accurately estimates the center and radius of a circle

The new algorithm accurately detects a whole circle from a part of the circle. A 20.4 Mpix camera can search a positioning mark in as fast as 12 ms\(^*2\), and a 5 Mpix camera, widely used for alignment applications, in as fast as 2 ms.

Scan Edge Position removes noise to detect edges

This algorithm accurately estimates lines even when the edges are unclear due to variations in objects or disturbance.

*1. The value measured under our specified conditions is provided for reference. *2. The value measured under our specified conditions is provided for reference. 20.4 Mpix camera.
Stage Data calculates for various stages

The popular single axis + \( \theta \) axis stages as well as UVW stages can be used. The use of the same axis for both handling and positioning simplifies machine configuration.

Robot Setting Tool simplifies connecting robots

Communication programs to connect robots from various vendors and FH flowcharts required for robot applications are provided free of charge. You can quickly set up robot vision applications.

Applications

<table>
<thead>
<tr>
<th>Pick</th>
<th>Offset compensation</th>
<th>Simple set-up steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place</td>
<td>Combination</td>
<td>You can download the verified robot communication programs from the following URL: <a href="http://www.omron-cxone.com/fh">http://www.omron-cxone.com/fh</a></td>
</tr>
</tbody>
</table>

Calibrate

Check operations

There is no need to create a program for robot calibration. Move the robot for calibration from the FH Series.

You don’t need to create a robot program for verification. Set the coordinates of the robot and check robot operations from the FH Series.
Unique identification and quality control

Unique ID associated with inspection image and result

The FH Series can associate a unique ID with the inspection image and result, and then output them to the host device. You can immediately find required inspection images and quickly identify causes of fails.

<table>
<thead>
<tr>
<th>Unique ID</th>
<th>Inspection image</th>
<th>Inspection result</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>![QR Code]</td>
<td>OK</td>
</tr>
<tr>
<td>002</td>
<td>![QR Code]</td>
<td>OK</td>
</tr>
<tr>
<td>003</td>
<td>![QR Code]</td>
<td>NG</td>
</tr>
</tbody>
</table>

Database
Analyze with inspection images to quickly identify defect causes

PLC for data collection
No need for a program to associate items with unique ID.

FH Controller

High-speed image storage

The amount of inspection image data required for defect cause analysis can be so large that conventional controllers are unable to store it given their storage time and capacity constraints.

The high-speed, large-capacity controller has USB 3.0 ports and the improved algorithm to compress image data at high speeds, enabling all images to be stored to meet increasing needs in quality control.

The times in the right figure 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

<table>
<thead>
<tr>
<th>Storage time</th>
<th>Compression time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approx. 200 ms</td>
<td>Approx. 100 ms</td>
</tr>
<tr>
<td>Reduced to 1/2</td>
<td>Reduced to 1/3</td>
</tr>
</tbody>
</table>

USB 2.0 + ifz file (not compressed)
USB 3.0 + ifz file (not compressed)
USB 3.0 + JPEG file
2D Code II provides powerful code reading

The FH Series incorporates a dedicated algorithm for reliable and fast 2D code reading even under variable ambient brightness or adverse conditions such as after processing or washing.

OCR reliably reads difficult-to-read characters

OCR can reliably read characters printed too close to each other or on curved surfaces. Also plus signs can be read.

Character Inspection reads special fonts

Character Inspection recognizes special fonts and non-alphanumeric characters based on pattern search using the dictionary set up by the user.
Design interface for quick setup

Integrated development environment Sysmac Studio

Sysmac Studio is a unique environment that integrates logic, motion and drives, robotics, safety, visualization, and information technologies in a single project, thus reducing the learning curve and the intra-operative software costs.

Advanced machine control can be easily achieved.

EtherCAT® for high-speed data transfer to control various devices

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.

<table>
<thead>
<tr>
<th>Communications cycle</th>
<th>Time from trigger input to producing measurement results</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 ms</td>
<td>Measurement results</td>
</tr>
<tr>
<td>0.125 ms</td>
<td>Trigger input</td>
</tr>
<tr>
<td>Reduced to 1/32</td>
<td>Data communications cycle: 125 μs</td>
</tr>
<tr>
<td>Shortened by approx. 6 ms</td>
<td>EtherCAT</td>
</tr>
</tbody>
</table>

Note: The times given above are typical times. They depend on parameter settings.
Total Design Management Editor simplifies complex processing design

This design interface includes pre-installed screens for all phases, from design through to setting and operation. Just select processing items and determine the order to manage variables. Time-consuming calculations and inputs are no longer required.

**Easy setting**
All the common settings of multiple scenes can be made at once. Simplified inspection flowcharts reduce setting errors and prevent from forgetting to change settings.

**Efficient setting**
To inspect aligned parts, the FH Series can repeat the same measurements while shifting the measurement region within the same image. This reduces setting times.

Customizable user interface simplifies operations at production sites

Showing only necessary screens for production makes the interface easier to use. Screen layout can be customized just by selecting and placing objects, without programming.
**Vision System**

**FH-Series**

**AI-based automated visual inspection**

- AI reproduces human sensibility and experience
- Software for flexible automation
- Design interface for quick setup

**System configuration**

**EtherCAT connections for FH series**

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

1. **Vision System FH Sensor Controllers**
2. **Cameras**
3. **special cable for cameras**
4. **Lights**
5. **Touch Panel Monitor FH-MT12**

*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.
(1) Controllers
Select a controller based on the required processing speed and network.

<table>
<thead>
<tr>
<th>Series</th>
<th>CPU</th>
<th>Performance</th>
<th>Memory</th>
<th>No. of connectable cameras</th>
<th>Fieldbus</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-speed, Large-capacity Controller FH-5550 Series</td>
<td>Intel® Core™ i7 processor 4 cores</td>
<td>4 stars</td>
<td>RAM 32 GB, ROM 64 GB</td>
<td>8 max.</td>
<td>PROFINET, EtherNet/IP™, EtherCAT</td>
</tr>
<tr>
<td>High-speed Controller FH-5050 Series</td>
<td>Intel® Core™ i7 processor 4 cores</td>
<td>4 stars</td>
<td>RAM 8 GB, ROM 32 GB</td>
<td>8 max.</td>
<td>PROFINET, EtherNet/IP™, EtherCAT</td>
</tr>
<tr>
<td>Standard Controller FH-2050 Series</td>
<td>Intel® Celeron® processor 2 cores</td>
<td>3 stars</td>
<td>RAM 8 GB, ROM 32 GB</td>
<td>8 max.</td>
<td>PROFINET, EtherNet/IP™, EtherCAT</td>
</tr>
<tr>
<td>Lite Controller FH-L550 Series</td>
<td>Intel® Atom® processor 2 cores</td>
<td>2 stars</td>
<td>RAM 4 GB, ROM 4 GB</td>
<td>4 max.</td>
<td>PROFINET, EtherNet/IP™</td>
</tr>
</tbody>
</table>

Optional product (sold separately)

Scratch Detect AI Software Installer* FH-UMAI1

* This product can be installed on the FH-5..50-series Controller (version 6.40 or later).

(2) Cameras
Choose the right camera to suit your required number of pixels. Easy-to-use cameras with built-in light are also available.

<table>
<thead>
<tr>
<th>No. of pixels</th>
<th>High-speed camera</th>
<th>Standard camera</th>
<th>Rolling shutter camera</th>
<th>Camera with built-in light</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.4 Mpix*</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>FH-S-  '21R</td>
</tr>
<tr>
<td>12 Mpix</td>
<td>FH-S:’X12</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>5 Mpix</td>
<td>FH-S:’X05</td>
<td>FZ-S:’5M3</td>
<td>FH-S:’05R</td>
<td>...</td>
</tr>
<tr>
<td>2 Mpix</td>
<td>FH-S:’02</td>
<td>FZ-S:’2M</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>0.4 Mpix/0.3 Mpix</td>
<td>FH-S:’X</td>
<td>FZ-S:’M</td>
<td>...</td>
<td>FZ-SQ:’M</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Description</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camera Cable</td>
<td>FZ-VSJM</td>
</tr>
<tr>
<td>Right-angle Camera Cable</td>
<td>FZ-VSLM</td>
</tr>
<tr>
<td>Bend-resistant Camera Cable</td>
<td>FZ-VSBLM</td>
</tr>
<tr>
<td>Bend-resistant Right-angle Camera Cable</td>
<td>FZ-VSBLRM</td>
</tr>
<tr>
<td>Cable Extension Unit</td>
<td>FZ-VSJ</td>
</tr>
</tbody>
</table>

(4) 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

<table>
<thead>
<tr>
<th>Description</th>
<th>LED</th>
<th>High-brightness LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camera-mount Lighting Controller</td>
<td>FLV-TCC</td>
<td>FLV-TCC</td>
</tr>
<tr>
<td>Bar Light</td>
<td>FLV-BR</td>
<td>FLV-BR</td>
</tr>
<tr>
<td>Direct Ring Light</td>
<td>FLV-DR</td>
<td>FLV-DR</td>
</tr>
<tr>
<td>Low Angle Ring Light</td>
<td>FLV-DL</td>
<td>...</td>
</tr>
<tr>
<td>Coaxial Light</td>
<td>FLV-CL</td>
<td>...</td>
</tr>
<tr>
<td>Shadowless Light</td>
<td>FLV-FR/FP/FS/FQ</td>
<td>...</td>
</tr>
<tr>
<td>Spot Light</td>
<td>FLV-EP</td>
<td>...</td>
</tr>
<tr>
<td>Direct Back/Edge Type Light</td>
<td>FLV-DB/BB</td>
<td>...</td>
</tr>
<tr>
<td>Dome Light</td>
<td>FLV-DD</td>
<td>...</td>
</tr>
<tr>
<td>Photometric Stereo Light *</td>
<td>...</td>
<td>FL-PS</td>
</tr>
</tbody>
</table>

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

Built-in lighting controller

<table>
<thead>
<tr>
<th>Description</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDMC Light</td>
<td>FL-MD</td>
</tr>
</tbody>
</table>

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

(5) Touch panel monitor
The touch panel monitor is optimized for the operation of the FH Series.

<table>
<thead>
<tr>
<th>Description</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Touch Panel Monitor 12.1 inches</td>
<td>FH-MT12</td>
</tr>
<tr>
<td>DVI-Analog Conversion Cable for Touch Panel Monitor</td>
<td>FH-VMDA</td>
</tr>
<tr>
<td>USB Cable for Touch Panel Monitor</td>
<td>FH-VUAB</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Description</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVD for installation</td>
<td>SYSMAC-SE200D</td>
</tr>
<tr>
<td>Software license (Vision Edition)</td>
<td>SYSMAC-VE501L</td>
</tr>
</tbody>
</table>

(7) 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.

<table>
<thead>
<tr>
<th>Description</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>DVD for installation</td>
<td>FH-AP1</td>
</tr>
<tr>
<td>Software license</td>
<td>FH-AP1L</td>
</tr>
</tbody>
</table>
## FH-Series

### Ordering Information

#### FH Series Sensor Controllers

<table>
<thead>
<tr>
<th>Item</th>
<th>CPU</th>
<th>AI function</th>
<th>No. of cameras</th>
<th>Output</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High-speed, Large-capacity Controller</strong></td>
<td>Intel® Core™ i7 processor 4 cores</td>
<td>Available</td>
<td>2</td>
<td>NPN/PNP</td>
<td>FH-5550</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Available</td>
<td>4</td>
<td>NPN/PNP</td>
<td>FH-5550-10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Available</td>
<td>8</td>
<td>NPN/PNP</td>
<td>FH-5550-20</td>
</tr>
<tr>
<td><strong>High-speed Controller</strong></td>
<td>Intel® Core™ i7 processor 4 cores</td>
<td>Available</td>
<td>2</td>
<td>NPN/PNP</td>
<td>FH-5050</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Available</td>
<td>4</td>
<td>NPN/PNP</td>
<td>FH-5050-10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Available</td>
<td>8</td>
<td>NPN/PNP</td>
<td>FH-5050-20</td>
</tr>
<tr>
<td><strong>Standard Controller</strong></td>
<td>Intel® Celeron® processor 2 cores</td>
<td>Not available</td>
<td>4</td>
<td>NPN/PNP</td>
<td>FH-2050-10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Available</td>
<td>8</td>
<td>NPN/PNP</td>
<td>FH-2050-20</td>
</tr>
<tr>
<td><strong>Box-type controllers</strong></td>
<td>Intel® Atom® processor 2 cores</td>
<td>Not available</td>
<td>2</td>
<td>NPN/PNP</td>
<td>FH-L550</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not available</td>
<td>4</td>
<td>NPN/PNP</td>
<td>FH-L550-10</td>
</tr>
</tbody>
</table>

* Optional FH-UMAI1 Scratch Detect AI Software Installer is required.

#### Optional Products (Sold Separately)

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scratch Detect AI Software Installer *</td>
<td>FH-UMAI1</td>
</tr>
</tbody>
</table>

* This product can be installed on the FH-5-50-series Controller (version 6.40 or later).

### Cameras

<table>
<thead>
<tr>
<th>Item</th>
<th>Lens mount</th>
<th>Descriptions</th>
<th>Color</th>
<th>Image Acquisition Time</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital CMOS Cameras (Lens required)</td>
<td>C mount</td>
<td>20.4 million pixels (Supported controller: FH-5-50(-5) and FH-5-2050(-5) Series) *2</td>
<td>Color</td>
<td>42.6 ms *3</td>
<td>FH-SC21R</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Monochrome</td>
<td></td>
<td>FH-SM21R</td>
</tr>
<tr>
<td>High-speed Digital CMOS Cameras (Lens required)</td>
<td>C mount</td>
<td>12 million pixels *2</td>
<td>Color</td>
<td>24.9 ms *3</td>
<td>FH-SCX12</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Monochrome</td>
<td></td>
<td>FH-SMX12</td>
</tr>
<tr>
<td></td>
<td>M42 mount</td>
<td>12 million pixels *2</td>
<td>Color</td>
<td>25.7 ms *3</td>
<td>FH-SCX12</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Monochrome</td>
<td></td>
<td>FH-SMX12</td>
</tr>
<tr>
<td>High-speed Digital CMOS Cameras (Lens required)</td>
<td>C mount</td>
<td>4 million pixels</td>
<td>Color</td>
<td>8.5 ms *3</td>
<td>FH-SC04</td>
</tr>
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<td></td>
<td></td>
<td>Monochrome</td>
<td></td>
<td>FH-SM04</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 million pixels</td>
<td>Color</td>
<td>4.6 ms *3</td>
<td>FH-SC02</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>Monochrome</td>
<td></td>
<td>FH-SM02</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.3 million pixels</td>
<td>Color</td>
<td>3.3 ms</td>
<td>FH-SC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Monochrome</td>
<td></td>
<td>FH-SM</td>
</tr>
<tr>
<td>Digital CMOS Cameras (Lens required)</td>
<td>C mount</td>
<td>5 million pixels</td>
<td>Color</td>
<td>71.7ms</td>
<td>FH-SC05R</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Monochrome</td>
<td></td>
<td>FH-SM05R</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 million pixels</td>
<td>Color</td>
<td>38.2 ms</td>
<td>FZ-SC5M3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Monochrome</td>
<td></td>
<td>FZ-SC5M3</td>
</tr>
<tr>
<td>Digital CCD Cameras (Lens required)</td>
<td>C mount</td>
<td>2 million pixels</td>
<td>Color</td>
<td>33.3 ms</td>
<td>FZ-SC2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Monochrome</td>
<td></td>
<td>FZ-S2M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.3 million pixels</td>
<td>Color</td>
<td>12.5 ms</td>
<td>FZ-SC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Monochrome</td>
<td></td>
<td>FZ-S</td>
</tr>
<tr>
<td>Small Digital CCD Cameras (Lens required)</td>
<td>Lenses for small camera required</td>
<td>300,000-pixel flat type</td>
<td>Color</td>
<td>12.5 ms</td>
<td>FZ-SFC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Monochrome</td>
<td></td>
<td>FZ-SF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>300,000-pixel pen type</td>
<td>Color</td>
<td>12.5 ms</td>
<td>FZ-SPC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Monochrome</td>
<td></td>
<td>FZ-SP</td>
</tr>
</tbody>
</table>
*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-5550-20, 5050-20 or 2050-20.

*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.

---

## Camera Cables

<table>
<thead>
<tr>
<th>Item</th>
<th>Descriptions</th>
<th>Model *3</th>
</tr>
</thead>
</table>
| ![Camera Cable](image1) | Camera Cable  
Cable length: 2 m, 3 m, 5m, or 10 m *2 | FZ-VS3 □□M |
| ![Bend resistant Camera Cable](image2) | Bend resistant Camera Cable  
Cable length: 2 m, 3 m, 5m, or 10 m *2 | FZ-VS83 □□M |
| ![Right-angle Camera Cable](image3) | Right-angle Camera Cable *1  
Cable length: 2 m, 3 m, 5m, or 10 m *2 | FZ-VSL3 □□M |
| ![Bend resistant Right-angle Camera Cable](image4) | Bend resistant Right-angle Camera Cable *1  
Cable length: 2 m, 3 m, 5m, or 10 m *2 | FZ-VSL83 □□M |
| ![Long-distance Camera Cable](image5) | Long-distance Camera Cable  
Cable length: 15 m *2 | FZ-VS4 15M |
| ![Long-distance Right-angle Camera Cable](image6) | Long-distance Right-angle Camera Cable *1  
Cable length: 15 m *2 | FZ-VSL4 15M |
| ![Cable Extension Unit](image7) | Cable Extension Unit  
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-□□/□□/□□/□□/□□ 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

---

### FH-Series

<table>
<thead>
<tr>
<th>Item</th>
<th>Lens mount</th>
<th>Descriptions</th>
<th>Color / Monochrome</th>
<th>Image Acquisition Time *1</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image8" alt="Intelligent Compact Digital CMOS Camera" /></td>
<td>Built-in lens</td>
<td>Narrow view</td>
<td>Color</td>
<td>16.7 ms</td>
<td>FZ-SG100F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Standard view</td>
<td>Color</td>
<td></td>
<td>FZ-SQ050F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wide View (long-distance)</td>
<td>Color</td>
<td></td>
<td>FZ-SQ100F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wide View (short-distance)</td>
<td>Color</td>
<td></td>
<td>FZ-SQ100N</td>
</tr>
</tbody>
</table>

---

*Footnotes:

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

*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-5550-20, 5050-20 or 2050-20.

*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.

---

## Camera Cables

<table>
<thead>
<tr>
<th>Item</th>
<th>Descriptions</th>
<th>Model *3</th>
</tr>
</thead>
</table>
| ![Camera Cable](image1) | Camera Cable  
Cable length: 2 m, 3 m, 5m, or 10 m *2 | FZ-VS3 □□M |
| ![Bend resistant Camera Cable](image2) | Bend resistant Camera Cable  
Cable length: 2 m, 3 m, 5m, or 10 m *2 | FZ-VS83 □□M |
| ![Right-angle Camera Cable](image3) | Right-angle Camera Cable *1  
Cable length: 2 m, 3 m, 5m, or 10 m *2 | FZ-VSL3 □□M |
| ![Bend resistant Right-angle Camera Cable](image4) | Bend resistant Right-angle Camera Cable *1  
Cable length: 2 m, 3 m, 5m, or 10 m *2 | FZ-VSL83 □□M |
| ![Long-distance Camera Cable](image5) | Long-distance Camera Cable  
Cable length: 15 m *2 | FZ-VS4 15M |
| ![Long-distance Right-angle Camera Cable](image6) | Long-distance Right-angle Camera Cable *1  
Cable length: 15 m *2 | FZ-VSL4 15M |
| ![Cable Extension Unit](image7) | Cable Extension Unit  
Up to two Extension Units and three Cables can be connected. (Maximum cable length: 45 m *2) | FZ-VSJ |

---

*Footnotes:

*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-□□/□□/□□/□□/□□ 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

#### High-speed Digital CMOS cameras

<table>
<thead>
<tr>
<th>Camera Cables</th>
<th>Model</th>
<th>Cable length</th>
<th>Model</th>
<th>Cable length</th>
<th>Model</th>
<th>Cable length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right-angle camera cables</td>
<td>FZ-VSL3</td>
<td>FH-SM3/SC</td>
<td>FZ-VSL3</td>
<td>FH-SM03/SC03</td>
<td>FZ-VSL3</td>
<td>FH-SM12/SC12</td>
</tr>
<tr>
<td>Bend resistant camera cables</td>
<td>FZ-VSB3</td>
<td>FH-SM3/SC</td>
<td>FZ-VSB3</td>
<td>FH-SM03/SC03</td>
<td>FZ-VSB3</td>
<td>FH-SM12/SC12</td>
</tr>
<tr>
<td>Bend resistant camera cables</td>
<td>FZ-VSLB3</td>
<td>FH-SM3/SC</td>
<td>FZ-VSLB3</td>
<td>FH-SM03/SC03</td>
<td>FZ-VSLB3</td>
<td>FH-SM12/SC12</td>
</tr>
</tbody>
</table>

#### Digital CMOS Camera

<table>
<thead>
<tr>
<th>Camera Cables</th>
<th>Model</th>
<th>Cable length</th>
<th>Pen type</th>
<th>Flat type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right-angle camera cables</td>
<td>FZ-VS3</td>
<td>FH-SM3/SC</td>
<td>FZ-S5M3</td>
<td>FZ-S/SC</td>
</tr>
<tr>
<td>Right-angle camera cables</td>
<td>FZ-VSL3</td>
<td>FH-SM3/SC</td>
<td>FZ-S5M3</td>
<td>FZ-S/SC</td>
</tr>
<tr>
<td>Right-angle camera cables</td>
<td>FZ-VS4</td>
<td>FH-SM3/SC</td>
<td>FZ-S5M3</td>
<td>FZ-S/SC</td>
</tr>
<tr>
<td>Right-angle camera cables</td>
<td>FZ-VSL4</td>
<td>FH-SM3/SC</td>
<td>FZ-S5M3</td>
<td>FZ-S/SC</td>
</tr>
</tbody>
</table>

#### Long-distance right-angle camera cable

<table>
<thead>
<tr>
<th>Camera Cables</th>
<th>Model</th>
<th>Cable length</th>
<th>Pen type</th>
<th>Flat type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right-angle camera cables</td>
<td>FZ-VS3</td>
<td>FH-SM3/SC</td>
<td>FZ-S5M3</td>
<td>FZ-S/SC</td>
</tr>
<tr>
<td>Right-angle camera cables</td>
<td>FZ-VSL3</td>
<td>FH-SM3/SC</td>
<td>FZ-S5M3</td>
<td>FZ-S/SC</td>
</tr>
<tr>
<td>Right-angle camera cables</td>
<td>FZ-VS4</td>
<td>FH-SM3/SC</td>
<td>FZ-S5M3</td>
<td>FZ-S/SC</td>
</tr>
<tr>
<td>Right-angle camera cables</td>
<td>FZ-VSL4</td>
<td>FH-SM3/SC</td>
<td>FZ-S5M3</td>
<td>FZ-S/SC</td>
</tr>
</tbody>
</table>

---

### Intelligent Compact Digital CMOS Camera

<table>
<thead>
<tr>
<th>Camera Cables</th>
<th>Model</th>
<th>Cable length</th>
<th>Pen type</th>
<th>Flat type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right-angle camera cables</td>
<td>FZ-VS3</td>
<td>FH-SM3/SC</td>
<td>FZ-S5M3</td>
<td>FZ-S/SC</td>
</tr>
<tr>
<td>Right-angle camera cables</td>
<td>FZ-VSL3</td>
<td>FH-SM3/SC</td>
<td>FZ-S5M3</td>
<td>FZ-S/SC</td>
</tr>
<tr>
<td>Right-angle camera cables</td>
<td>FZ-VS4</td>
<td>FH-SM3/SC</td>
<td>FZ-S5M3</td>
<td>FZ-S/SC</td>
</tr>
<tr>
<td>Right-angle camera cables</td>
<td>FZ-VSL4</td>
<td>FH-SM3/SC</td>
<td>FZ-S5M3</td>
<td>FZ-S/SC</td>
</tr>
</tbody>
</table>

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### Long-distance right-angle camera cable

<table>
<thead>
<tr>
<th>Camera Cables</th>
<th>Model</th>
<th>Cable length</th>
<th>Pen type</th>
<th>Flat type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right-angle camera cables</td>
<td>FZ-VS3</td>
<td>FH-SM3/SC</td>
<td>FZ-S5M3</td>
<td>FZ-S/SC</td>
</tr>
<tr>
<td>Right-angle camera cables</td>
<td>FZ-VSL3</td>
<td>FH-SM3/SC</td>
<td>FZ-S5M3</td>
<td>FZ-S/SC</td>
</tr>
<tr>
<td>Right-angle camera cables</td>
<td>FZ-VS4</td>
<td>FH-SM3/SC</td>
<td>FZ-S5M3</td>
<td>FZ-S/SC</td>
</tr>
<tr>
<td>Right-angle camera cables</td>
<td>FZ-VSL4</td>
<td>FH-SM3/SC</td>
<td>FZ-S5M3</td>
<td>FZ-S/SC</td>
</tr>
</tbody>
</table>
### Maximum Extension Length Using Cable Extension Units FZ-VSJ

<table>
<thead>
<tr>
<th>Item</th>
<th>Model</th>
<th>Transmission speed (*1)</th>
<th>No. of CH used for connection (*2)</th>
<th>Maximum cable length using 1 Camera Cable (m)</th>
<th>Max. number of connectable Extension Units</th>
<th>Max. cable length (m)</th>
<th>Connection configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FH-SM/SC</td>
<td>---</td>
<td>---</td>
<td>15 (Using FZ-VS4/VSL4)</td>
<td>2</td>
<td>45</td>
<td>[Configuration 1] Camera cable: 15 m x 3 Extension Unit: 2</td>
</tr>
<tr>
<td>High-speed CMOS Cameras</td>
<td>FH-SMX/SCX</td>
<td>Standard</td>
<td>---</td>
<td>15 (Using FZ-VS4/VSL4)</td>
<td>2</td>
<td>45</td>
<td>[Configuration 1] Camera cable: 15 m x 3 Extension Unit: 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High speed</td>
<td>---</td>
<td>5 (Using FZ-VS4/VSL4)</td>
<td>2</td>
<td>15</td>
<td>[Configuration 2] Camera cable: 5 m x 3 Extension Unit: 2</td>
</tr>
<tr>
<td></td>
<td>FH-SM02/SC02 FH-SM12/SC12 FH-SMX05/SCX05 FH-SMX12/SCX12</td>
<td>Standard</td>
<td>1</td>
<td>15 (Using FZ-VS4/VSL4)</td>
<td>2</td>
<td>45</td>
<td>[Configuration 1] Camera cable: 15 m x 3 Extension Unit: 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>15 (Using FZ-VS4/VSL4)</td>
<td>4 (*3)</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High speed</td>
<td>1</td>
<td>5 (Using FZ-VS4/VSL4)</td>
<td>2</td>
<td>15</td>
<td>[Configuration 3] Camera cable: 5 m x 3 Extension Unit: 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>5 (Using FZ-VS4/VSL4)</td>
<td>4 (*3)</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>FH-SM21R/SC21R</td>
<td>Standard</td>
<td>1</td>
<td>15 (Using FZ-VS4/VSL4)</td>
<td>2</td>
<td>45</td>
<td>[Configuration 1] Camera cable: 15 m x 3 Extension Unit: 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>15 (Using FZ-VS4/VSL4)</td>
<td>4 (*3)</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High speed</td>
<td>1</td>
<td>5 (Using FZ-VS4/VSL4)</td>
<td>2</td>
<td>15</td>
<td>[Configuration 3] Camera cable: 5 m x 3 Extension Unit: 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>5 (Using FZ-VS4/VSL4)</td>
<td>4 (*3)</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>FH-SM05R/SC05R</td>
<td>---</td>
<td>---</td>
<td>15 (Using FZ-VS4/VSL4)</td>
<td>2</td>
<td>45</td>
<td>[Configuration 1] Camera cable: 15 m x 3 Extension Unit: 2</td>
</tr>
<tr>
<td></td>
<td>FZ-5SM3/SC5M3</td>
<td>---</td>
<td>---</td>
<td>5 (Using FZ-VS4/VSL4)</td>
<td>2</td>
<td>15</td>
<td>[Configuration 3] Camera cable: 5 m x 3 Extension Unit: 2</td>
</tr>
<tr>
<td></td>
<td>Small Digital CCD Cameras Flat type/ Pen type</td>
<td>FZ-SF/FC FZ-SP/SPC</td>
<td>---</td>
<td>15 (Using FZ-VS4/VSL4)</td>
<td>2</td>
<td>45</td>
<td>[Configuration 1] Camera cable: 15 m x 3 Extension Unit: 2</td>
</tr>
<tr>
<td></td>
<td>Intelligent Compact Digital CMOS Camera</td>
<td>FZ-SQ</td>
<td>---</td>
<td>15 (Using FZ-VS4/VSL4)</td>
<td>2</td>
<td>45</td>
<td>[Configuration 1] Camera cable: 15 m x 3 Extension Unit: 2</td>
</tr>
</tbody>
</table>

*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

<table>
<thead>
<tr>
<th>Connection configuration using the maximum length of Camera Cables</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Configuration 1" /></td>
<td>*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).</td>
</tr>
<tr>
<td><img src="image2" alt="Configuration 2" /></td>
<td><img src="image3" alt="Configuration 3" /></td>
</tr>
</tbody>
</table>

### Monitor

<table>
<thead>
<tr>
<th>Item</th>
<th>Descriptions</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image5" alt="Monitor" /></td>
<td>Touch Panel Monitor 12.1 inches For FH Sensor Controllers</td>
<td>FH-MT12</td>
</tr>
<tr>
<td><img src="image6" alt="Monitor" /></td>
<td>LCD Monitor 8.4 inches</td>
<td>FZ-M08</td>
</tr>
</tbody>
</table>

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

### Monitor Cables

<table>
<thead>
<tr>
<th>Item</th>
<th>Descriptions</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image7" alt="Cables" /></td>
<td>DVI-Analog Conversion Cable for Touch Panel Monitor/LCD Monitor Cable length: 2 m, 5 m or 10 m</td>
<td>FH-VMDA [M] *1</td>
</tr>
<tr>
<td><img src="image8" alt="Cables" /></td>
<td>RS-232C Cable for Touch Panel Monitor Cable length: 2 m, 5 m or 10 m</td>
<td>XW2Z-[@@]PP--1 *2</td>
</tr>
<tr>
<td><img src="image9" alt="Cables" /></td>
<td>USB Cable for Touch Panel Monitor Cable length: 2 m or 5 m</td>
<td>FH-VUAB [M] *1</td>
</tr>
</tbody>
</table>

*1 Insert the cables length into [M] 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

<table>
<thead>
<tr>
<th>Signal</th>
<th>Cable</th>
<th>2 m</th>
<th>5 m</th>
<th>10 m</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image10" alt="Signal" /></td>
<td>DVI-Analog Conversion Cable</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td><img src="image11" alt="Signal" /></td>
<td>USB Cable</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><img src="image12" alt="Signal" /></td>
<td>RS-232C Cable</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Parallel I/O Cables/Encoder Cable

<table>
<thead>
<tr>
<th>Item</th>
<th>Descriptions</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image13" alt="Cables" /></td>
<td>Parallel I/O Cable *1 Cable length: 2m, 5m or 15m</td>
<td>XW2Z-S013[@] *2</td>
</tr>
<tr>
<td><img src="image14" alt="Cables" /></td>
<td>Parallel I/O Cable for Connector-terminal Conversion Unit *1 Cable length: 0.5 m, 1 m, 1.5 m, 2 m, 3 m, 5 m Connector-Terminal Block Conversion Units can be connected (Terminal Blocks Recommended Products: OMRON XW2R-34G-T)</td>
<td>XW2Z-[@@]EE *3</td>
</tr>
<tr>
<td><img src="image15" alt="Cables" /></td>
<td>Connector-Terminal Block Conversion Units, General-purpose devices</td>
<td>XW2R-34GD-T *4</td>
</tr>
<tr>
<td><img src="image16" alt="Cables" /></td>
<td>Encoder Cable for line-driver Cable length: 1.5 m</td>
<td>FH-VR 1.5M</td>
</tr>
</tbody>
</table>

*1 2 Cables are required for all I/O signals.
*2 Insert the cables length into [M] in the model number as follows. 2 m = 2, 5 m = 5, 10 m = 10
*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.

- 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

<table>
<thead>
<tr>
<th>Item</th>
<th>Appearance</th>
<th>Recommended manufacturer</th>
<th>Cable length (m)</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable with Connectors on Both Ends (RJ45/RJ45) Standard RJ45 plugs type *1</td>
<td></td>
<td>OMRON</td>
<td>0.3</td>
<td>XS5W-6LSZH8SS30CM-Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.5</td>
<td>XS5W-6LSZH8SS50CM-Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>XS5W-6LSZH8SS100CM-Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>XS5W-6LSZH8SS200CM-Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>XS5W-6LSZH8SS300CM-Y</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>XS5W-6LSZH8SS500CM-Y</td>
</tr>
<tr>
<td>Cable with Connectors on Both Ends (RJ45/RJ45) Rugged RJ45 plugs type *1</td>
<td></td>
<td>OMRON</td>
<td>0.3</td>
<td>XS5W-T421-AMD-K</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.5</td>
<td>XS5W-T421-BMD-K</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>XS5W-T421-CMD-K</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>XS5W-T421-DMD-K</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>XS5W-T421-GMD-K</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10</td>
<td>XS5W-T421-JMD-K</td>
</tr>
<tr>
<td>Cable with Connectors on Both Ends (M12 Straight/M12 Straight) Shield Strengthening Connector cable *4</td>
<td></td>
<td>OMRON</td>
<td>0.5</td>
<td>XS5W-T421-BM2-SS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>XS5W-T421-CM2-SS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>XS5W-T421-DM2-SS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>XS5W-T421-EM2-SS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>XS5W-T421-GM2-SS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10</td>
<td>XS5W-T421-JM2-SS</td>
</tr>
<tr>
<td>Cable with Connectors on Both Ends (M12 Straight/RJ45) Shield Strengthening Connector cable *4</td>
<td></td>
<td>OMRON</td>
<td>0.5</td>
<td>XS5W-T421-BMC-SS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>XS5W-T421-CMC-SS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>XS5W-T421-DMC-SS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>XS5W-T421-EMC-SS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>XS5W-T421-GMC-SS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>10</td>
<td>XS5W-T421-JMC-SS</td>
</tr>
</tbody>
</table>

*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.

*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**

<table>
<thead>
<tr>
<th>Item</th>
<th>Recommended manufacturer</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Products for EtherCAT or EtherNet/IP (1000BASE-T/100BASE-TX)</strong> Wire gauge and number of pairs: AWG24, 4-pair cable</td>
<td>Cable</td>
<td>Hitachi Metals, Ltd.</td>
</tr>
<tr>
<td></td>
<td>RJ45 Connector</td>
<td>Kuramo Electric Co.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SWCC Showa Cable Systems Co.</td>
</tr>
<tr>
<td><strong>Products for EtherCAT or EtherNet/IP (100BASE-TX/10BASE-T)</strong> Wire gauge and number of pairs: AWG22, 2-pair cable</td>
<td>Cable</td>
<td>Kuramo Electric Co.</td>
</tr>
<tr>
<td></td>
<td>RJ45 Assembly Connector</td>
<td>JMACS Japan Co., Ltd.</td>
</tr>
</tbody>
</table>

*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.

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
<th>Number of licenses</th>
<th>Media</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sysmac Studio Standard Edition Ver.1.07</td>
<td>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, NV-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</td>
<td>1 license</td>
<td>-- (Media only)</td>
<td>Sysmac Studio (32bit) DVD *2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sysmac Studio (64bit) DVD *2</td>
</tr>
<tr>
<td></td>
<td>This software provides functions of the Vision Edition. Refer to OMRON website for details such as supported models and functions.</td>
<td>3 license</td>
<td>--</td>
<td>SYSMAC-SE201L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 license</td>
<td>--</td>
<td>SYSMAC-SE210L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30 license</td>
<td>--</td>
<td>SYSMAC-SE230L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50 license</td>
<td>--</td>
<td>SYSMAC-SE250L</td>
</tr>
<tr>
<td>Sysmac Studio Vision Edition Ver.1.07 *3 *4</td>
<td>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.</td>
<td>1 license</td>
<td>--</td>
<td>SYSMAC-VE001L</td>
</tr>
<tr>
<td>Sysmac Studio Robot Additional Option *4</td>
<td>Sysmac Studio Robot Additional Option is a license to enable the Vision &amp; Robot integrated simulation.</td>
<td>1 license</td>
<td>--</td>
<td>SYSMAC-RA401L</td>
</tr>
</tbody>
</table>

**Notes:**

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.
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.

<table>
<thead>
<tr>
<th>Product</th>
<th>Specifications</th>
<th>Number of Model Standards licenses</th>
<th>Media</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application Producer</td>
<td>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 x 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</td>
<td>1 license</td>
<td>--</td>
<td>FH-AP1L</td>
</tr>
</tbody>
</table>
## Accessories

<table>
<thead>
<tr>
<th>Item</th>
<th>Descriptions</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>USB Memory</td>
<td>2 GB</td>
<td>FZ-MEM2G</td>
</tr>
<tr>
<td></td>
<td>8 GB</td>
<td>FZ-MEM8G</td>
</tr>
<tr>
<td>SD Card</td>
<td>2 GB</td>
<td>HMC-SD291</td>
</tr>
<tr>
<td></td>
<td>4 GB</td>
<td>HMC-SD491</td>
</tr>
<tr>
<td>Display/USB Switcher</td>
<td></td>
<td>FZ-DU</td>
</tr>
<tr>
<td>Mouse</td>
<td>Recommended Products</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>Driverless wired mouse</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>(A mouse that requires the mouse driver to be installed is not supported.)</td>
<td>---</td>
</tr>
<tr>
<td>EtherCAT junction slaves</td>
<td>3 port</td>
<td>GX-JC03</td>
</tr>
<tr>
<td></td>
<td>6 port</td>
<td>GX-JC06</td>
</tr>
<tr>
<td>Industrial Switching Hubs for EtherNet/IP and Ethernet</td>
<td>3 port</td>
<td>W4S1-03B</td>
</tr>
<tr>
<td></td>
<td>5 port</td>
<td>W4S1-05B</td>
</tr>
<tr>
<td></td>
<td>5 port</td>
<td>W4S1-05C</td>
</tr>
<tr>
<td>Calibration Plate</td>
<td></td>
<td>FZD-CAL</td>
</tr>
<tr>
<td>Common items related to DIN rail (for FH-L550/-L550-10)</td>
<td>DIN rail mounting bracket (For Lite Controllers)</td>
<td>FH-XDM-L</td>
</tr>
<tr>
<td></td>
<td>DIN 35mm rail</td>
<td>PHOENIX CONTACT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Length: 75.5/95.5/115.5/200 cm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Height: 7.5mm</td>
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<tr>
<td></td>
<td></td>
<td>• Material: Iron</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Surface: Conductive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NS 35/7.5 PERF</td>
</tr>
<tr>
<td></td>
<td>End plate</td>
<td>PHOENIX CONTACT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Need 2 pieces each Sensor Controller</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LED</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FLV Series</td>
</tr>
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<td></td>
<td>FL-BR/DR Series</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Photometric Stereo Light</td>
</tr>
<tr>
<td></td>
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<td>FL-PS Series</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MDMC Light</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FL-MD Series</td>
</tr>
<tr>
<td>External Lights</td>
<td>External lighting controller</td>
<td>FLV Series</td>
</tr>
<tr>
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<td></td>
<td>FL-BR/DR Series</td>
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<td>Photometric Stereo Light</td>
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<tr>
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<td></td>
<td>FL-PS Series</td>
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<td></td>
<td>MDMC Light</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FL-MD Series</td>
</tr>
<tr>
<td>Mounting Bracket for FH-S/-X</td>
<td>Mounting Bracket</td>
<td>FZ-S-XLC</td>
</tr>
<tr>
<td>Mounting Bracket for FH-S/-X</td>
<td>Mounting Bracket for FH-S/-X</td>
<td>FZ-SM-XLC</td>
</tr>
<tr>
<td>Mounting Bracket for FH-S/-X</td>
<td>Mounting Bracket for FH-S/-X</td>
<td>FH-SM12-XLC</td>
</tr>
<tr>
<td>M42 - F Mount Conversion Adapter</td>
<td></td>
<td>FH-ADF/M42-10</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Resolution</th>
<th>Camera Model</th>
<th>Size of image element</th>
<th>Recommended lens</th>
<th>Standard Lens</th>
<th>Telecentric Lens</th>
<th>Vibrations and Shocks Resistant Lens</th>
</tr>
</thead>
<tbody>
<tr>
<td>300,000-pixel</td>
<td>FZ-SF/SFC</td>
<td>1/3” equivalent</td>
<td>FZ-LES Series</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>FZ-SP/SPC</td>
<td></td>
<td>SV-V Series</td>
<td>VS-TCH Series</td>
<td>VS-MCA Series</td>
<td>Non-telecentric Macro</td>
</tr>
<tr>
<td></td>
<td>FZ-S/SC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VS-MC Series</td>
</tr>
<tr>
<td></td>
<td>FH-SM/SC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>400,000-pixel</td>
<td>FH-SMX/SCX</td>
<td>1/2.9” equivalent</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 million-pixel</td>
<td>FZ-S2M/SC2M</td>
<td>1/1.8” equivalent</td>
<td>SV-H Series</td>
<td>VS-H1 Series</td>
<td>VS-TEV Series</td>
<td>VS-MCA Series</td>
</tr>
<tr>
<td></td>
<td>FH-SM02/SC02</td>
<td>2/3” equivalent</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 million-pixel</td>
<td>FH-SM04/SC04</td>
<td>1” equivalent</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 million-pixel</td>
<td>FZ-SM05R/SC05R</td>
<td>1/2.5” equivalent</td>
<td>SV-H Series</td>
<td>VS-TCH Series</td>
<td>VS-MCA Series</td>
<td>Non-telecentric Macro</td>
</tr>
<tr>
<td></td>
<td>FZ-SM3/SC5M3</td>
<td>2/3” equivalent</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>FH-SMX05/SCX05</td>
<td>2/3” equivalent</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 million-pixel</td>
<td>FH-SMX12/SCX12</td>
<td>1.1” equivalent</td>
<td>VS-LLD Series</td>
<td>VS-TEV Series</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FH-SM12/SC12</td>
<td>1.76” equivalent</td>
<td>VS-L/M42-10 Series</td>
<td></td>
<td></td>
<td>VS-MCL/M42-10 Series</td>
</tr>
<tr>
<td>20.4 million-pixel</td>
<td>FH-SM21R/SC21R</td>
<td>1” equivalent</td>
<td>VS-LLD Series</td>
<td>VS-TEV Series</td>
<td>VS-MCH Series</td>
<td></td>
</tr>
</tbody>
</table>
Ratings and Specifications (FH Sensor Controllers)

High-speed, Large-capacity Controller

<table>
<thead>
<tr>
<th>Sensor Controller Series</th>
<th>FH-5550/5050 Series</th>
<th>FH-2050 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor Controller Model</td>
<td>FH-5550/5050</td>
<td>FH-2050</td>
</tr>
<tr>
<td></td>
<td>FH-5550/5050-10</td>
<td>FH-2050-10</td>
</tr>
<tr>
<td></td>
<td>FH-5550/5050-20</td>
<td>FH-2050-20</td>
</tr>
<tr>
<td>Parallel I/O</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Memory, Storage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FH-5550 series: 32GB RAM, 64GB ROM</td>
<td>8GB RAM, 32GB ROM</td>
<td></td>
</tr>
<tr>
<td>Number of cores</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 cores</td>
<td>4 cores</td>
<td></td>
</tr>
</tbody>
</table>

Main Functions

<table>
<thead>
<tr>
<th>Operation Mode</th>
<th>Standard</th>
<th>Double Speed Multi-input</th>
<th>Non-stop adjustment mode</th>
<th>Multi-line random-trigger mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation Mode</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Connectable Camera</td>
<td>FH-S series cameras</td>
<td>FH-T series cameras</td>
<td>All of the FH-S series cameras are connectable.</td>
<td>All of the FH-S series cameras are connectable.</td>
</tr>
</tbody>
</table>

Parallel Processing

<table>
<thead>
<tr>
<th>Supported Camera</th>
<th>FH-S series camera</th>
<th>FH-T series camera</th>
<th>All of the FH-S series cameras are connectable.</th>
<th>All of the FH-S series cameras are connectable.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supported Camera</td>
<td></td>
<td></td>
<td>All of the FH-S series cameras are connectable.</td>
<td>All of the FH-S series cameras are connectable.</td>
</tr>
</tbody>
</table>

Camera I/F

<table>
<thead>
<tr>
<th>Camera I/F</th>
<th>OMRON IF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible Number of Connectable Images</td>
<td>Refer to page 31.</td>
</tr>
<tr>
<td>Possible Number of Scenarios</td>
<td>8 cameras</td>
</tr>
<tr>
<td>Operating on UI</td>
<td>USB Mouse</td>
</tr>
<tr>
<td>Touch Panel</td>
<td>Yes (wired USB and driver is unnecessary type)</td>
</tr>
<tr>
<td>Setup</td>
<td>Child the processing flow using Flow editor.</td>
</tr>
</tbody>
</table>

External Interface

<table>
<thead>
<tr>
<th>Serial Communication</th>
<th>RS-232C - 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet Protocol</td>
<td>1000BASE-T - 2</td>
</tr>
<tr>
<td>EtherNet/IP Communication</td>
<td>Yes (Target/Ethernet port)</td>
</tr>
<tr>
<td>PROFINET Communication</td>
<td>Yes (Target/Ethernet port)</td>
</tr>
<tr>
<td>EtherCAT Communication</td>
<td>Yes (Slave) Refer to page 36 about EtherCAT Communications Specifications.</td>
</tr>
<tr>
<td></td>
<td>19 inputs/34 outputs:</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Encoder Interface</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitor Interface</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>SD Card I/F</td>
<td>SDHC: 1</td>
</tr>
</tbody>
</table>

Lamps

<table>
<thead>
<tr>
<th>Indicator Lamps</th>
<th>Main</th>
<th>Ethernet</th>
<th>EtherCAT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>POWER: Green</td>
<td>ERROR: Red</td>
<td>RUN: Green</td>
</tr>
<tr>
<td></td>
<td>NET: Green</td>
<td>LINK/ACT1: Yellow</td>
<td>NET: RUN: Green</td>
</tr>
<tr>
<td></td>
<td>SD POWER: green</td>
<td>SD BUSY: Yellow</td>
<td>SD POWER: Green</td>
</tr>
<tr>
<td></td>
<td>ECAT RDR: Green</td>
<td>LINK/ACT1: Green</td>
<td>ECAT RDR: Green</td>
</tr>
</tbody>
</table>

Power-supply voltage

| Power-supply voltage | 20.4 VDC to 26.4 VDC |

Current consumption

<table>
<thead>
<tr>
<th>When connecting an intelligent compact digital camera</th>
<th>5.6 A max.</th>
<th>7.7 A max.</th>
<th>12.2 A max.</th>
<th>4.6 A max.</th>
<th>6.6 A max.</th>
<th>11.2 A max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>When connecting a model of camera</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>When connecting a model of camera</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Usage Environment

<table>
<thead>
<tr>
<th>Ambient temperature</th>
<th>Operating: 0 °C to +50 °C (with no icing or condensation)</th>
<th>Storage: -20 to +60 °C (with no icing or condensation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient humidity</td>
<td>Operating: 20 to 80% RH (with no condensation)</td>
<td>Storage: 20 to 80% RH (with no condensation)</td>
</tr>
<tr>
<td>Air pollution</td>
<td>No condensable gases</td>
<td></td>
</tr>
<tr>
<td>Vibration tolerance</td>
<td>Oscillation frequency: 10 to 150 Hz</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Half amplitude: 0.1 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Acceleration: 15 m/s</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Slew time: 8 minutes/count</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Slew count: 10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vibration direction: up and down/forward and backward</td>
<td></td>
</tr>
</tbody>
</table>

Noise immunity

<table>
<thead>
<tr>
<th>Fast Transient Burst</th>
<th>DC power Direct interruption: 2kV, Pulse rising: 5ms, Pulse width: 50ms, Burst continuation time: 15ms/0.75ms, Period: 300ms, Application time: 3 min</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AC line Direct interruption: 1kV, Pulse rising: 5ms, Pulse width: 50ms, Burst continuation time: 15ms/0.75ms, Period: 300ms, Application time: 1 min</td>
</tr>
</tbody>
</table>

Grounding

<table>
<thead>
<tr>
<th>Type of grounding</th>
<th>B1 (grounding 100 ohm or less grounding resistance) *3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions</td>
<td>140 mm x 140 mm x 18.5 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 3.4 kg</td>
</tr>
<tr>
<td>Degree of protection</td>
<td>IEC/UL 505-2 (IP50)</td>
</tr>
</tbody>
</table>

Accessories

| Case material | Cover: zinc-plated steel plate Side plate: aluminum (A6083) |

*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
## Lite Controllers

### FH-L550 Series

#### Sensor Controller Model
- FH-L550
- FH-L550-10

#### Parallel IO
- 30-pin (80-pin) NPN/PNP (common)

#### Memory, Storage
- 4GB RAM, 4GB ROM

### Main Functions

<table>
<thead>
<tr>
<th>Operation Mode</th>
<th>Standard</th>
<th>Double Speed Multi-input</th>
<th>Non-slip adjustment mode</th>
<th>Multi-line random-trigger mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation Processing</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

### Number of Connectable 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 Interface
- OMRON I/F

### Possible Number of Captured Images
- Refer to page 31.

### UI Operations
- USB Mouse: Yes (series USB driver-less type)
- Touch Panel: Yes (RS-232C/USB connection: FH-MT12)

### Setup
- Create the processing flow using Flow edit.

#### 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)
- IP: 1000BASE-T × 1

#### PROFINET Communication
- Yes (Slave/Ethernet port)

#### EtherCAT Communication
- No

#### Parallel I/O
  - High-speed input: 1
  - Normal speed: 9
  - High-speed output: 4
  - 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
- USB3.0 × 1: BUS Power: Port 5 V/0.5 A

#### SD Card I/F
- SDHC × 1

### Indicator Lamps

#### Main
- POWER: Green
- ERROR: Red
- RUN: Green
- ACCESS: Yellow

#### Ethernet
- NET: Green
- LINK/ACT: Yellow

#### SD Card
- SD POWER: Green
- SD BUSY: Yellow

#### EtherCAT
- None

### Power-supply voltage
- 20.4 VDC to 26.4 VDC

### Current consumption

<table>
<thead>
<tr>
<th>Operating conditions</th>
<th>Current (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>When connecting an intelligent compact digital camera</td>
<td>2.7 A max.</td>
</tr>
<tr>
<td>When connecting the following light or lighting controller without an external power supply</td>
<td>4.4 A max.</td>
</tr>
<tr>
<td>FLV-TCC1, FLV-TCC3HB, FLV-TCC1EP, FL-TCC1</td>
<td></td>
</tr>
<tr>
<td>When connecting the following light or lighting controller</td>
<td></td>
</tr>
<tr>
<td>FL-TCC1PS, FL-MD</td>
<td></td>
</tr>
<tr>
<td>Other than above</td>
<td></td>
</tr>
</tbody>
</table>

### Built-in FAN
- No

### Ambient temperature range
- Operating: 0°C to 50°C
- 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 55 Hz with 1.5 mm amplitude, 8 to 150 Hz, acceleration of 8.8 m/s²
- 100 m/s² each in X, Y, and Z directions (10 sweeps of 10 min each = 100 min total)

### Shock resistance
- Impact force: 150 m/s²
- Test direction: up and down, front and back, left and right

### Noise immunity

#### Fast Transient Burst
- DC power
- Direct injection: 2kV, Pulse width: 50ns
- Burst continuation time: 15ms/0.75ms, Period: 300ms, Application time: 1 min
- I/O line
- Direct injection: 1kV, Pulse width: 50ns
- Burst continuation time: 15ms/0.75ms, Period: 300ms, Application time: 1 min

### Grounding
- Type B (grounding resistance 100 Ω or less grounding resistance)*

### Dimensions
- 200 mm × 80 mm × 130 mm

### Weight
- 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
- General Compliance Information and Instructions for EU: 1
- Member registration sheet: 1
- Power source (FH-XCN-L): 1 (male)

* Existing third class grounding
Maximum Number of Loading Images during Multi-input

<table>
<thead>
<tr>
<th>Camera</th>
<th>Model</th>
<th>Max. Number of Loading Images during Multi-input *1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intelligent Compact Digital CMOS Cameras *2</td>
<td>FZ-SQ010F/-SQ050F/-SQ100F/-SQ100N</td>
<td>256</td>
</tr>
<tr>
<td>0.3 million pixels CCD/CMOS Cameras</td>
<td>FZ-S/F/SC/-SF/SCF/-SH/-SHC/SP/-SPC FH-SM/-SC</td>
<td>256</td>
</tr>
<tr>
<td>0.4 million pixels CMOS Cameras</td>
<td>FH-SMX/-SCX</td>
<td>256</td>
</tr>
<tr>
<td>2 million pixels CCD Cameras</td>
<td>FZ-S2M/-SC2M</td>
<td>64</td>
</tr>
<tr>
<td>2 million pixels CMOS Cameras</td>
<td>FH-SM02/-SC02</td>
<td>51</td>
</tr>
<tr>
<td>4 million pixels CMOS Cameras</td>
<td>FH-SM04/-SC04</td>
<td>32</td>
</tr>
<tr>
<td>5 million pixels CCD/CMOS Cameras</td>
<td>FZ-S5M3/-SCM3/-S5M2 FH-SM05/-SCM05/-SM05R/-SC05R</td>
<td>25</td>
</tr>
<tr>
<td>12 million pixels CMOS Cameras</td>
<td>FH-SM12/-SC12/-SMX12/-SCX12</td>
<td>10</td>
</tr>
<tr>
<td>20.4 million pixels CMOS Cameras</td>
<td>FH-SM21R/-SC21R</td>
<td>6</td>
</tr>
</tbody>
</table>

*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.

# FH-Series

## Ratings and Specifications (Cameras)

### High-speed Digital CMOS cameras

#### Ratings and Specifications (Cameras) - FH-Series

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Image elements</strong></td>
<td>CMOS image elements (1/3-inch equivalent)</td>
<td>CMOS image elements (2/3-inch equivalent)</td>
<td>CMOS image elements (1-inch equivalent)</td>
<td>CMOS image elements (1-inch equivalent)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Color/Monochrome</strong></td>
<td>Monochrome</td>
<td>Color</td>
<td>Monochrome</td>
<td>Color</td>
<td>Monochrome</td>
<td>Color</td>
</tr>
<tr>
<td><strong>Effective pixels</strong></td>
<td>640 (H) × 480 (V)</td>
<td>2040 (H) × 1088 (V)</td>
<td>2040 (H) × 2048 (V)</td>
<td>4084 (H) × 3072 (V)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Image area H × V (opposing corner)</strong></td>
<td>4.8 × 3.6 (6.0 mm)</td>
<td>11.26 × 5.98 (12.76 mm)</td>
<td>11.26 × 11.26 (15.93 mm)</td>
<td>22.5 × 16.9 (28.14 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pixel size</strong></td>
<td>7.4 μm × 7.4 (μm)</td>
<td>5.5 (μm) × 5.5 (μm)</td>
<td>5.5 (μm) × 5.5 (μm)</td>
<td>5.5 (μm) × 5.5 (μm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Shutter function</strong></td>
<td>Electronic shutter; Shutter speeds can be set from 20 μs to 100 ms.</td>
<td>Electronic shutter; Shutter speeds can be set from 25 μs to 100 ms.</td>
<td>Electronic shutter; Shutter speeds can be set from 60 μs to 100 ms.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Partial function</strong></td>
<td>1 to 480 lines 2 to 480 lines</td>
<td>1 to 1088 lines 2 to 1088 lines 1 to 2048 lines 2 to 2048 lines</td>
<td>4 to 3072 lines (4-line increments)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*<em>Frame rate (Image Acquisition Time <em>1)</em></em></td>
<td>308 fps (3.3 ms)</td>
<td>219 fps (4.6 ms) *2</td>
<td>118 fps (8.5 ms) *2</td>
<td>38.9 fps (25.7 ms) *2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lens mounting</strong></td>
<td>C mount</td>
<td>M42 mount</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Field of vision, installation distance

- Selecting a lens according to the field of vision and installation distance

#### Ambient humidity range

- Operating: 0 to 50 °C, Storage: -25 to 65 °C (with no icing or condensation)
- Operating: 0 to 40 °C, Storage: -20 to 65 °C (with no icing or condensation)

#### Weight

- Approx. 105 g
- Approx. 110 g
- Approx. 320 g

#### Accessories

- Instruction manual, General Compliance Information and Instructions for EU

---

### Digital CMOS Cameras

<table>
<thead>
<tr>
<th>Model</th>
<th>FH-SM05R</th>
<th>FH-SC05R</th>
<th>FH-SM21R</th>
<th>FH-SC21R</th>
<th>FZ-SSM3</th>
<th>FZ-SCSM3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Image Elements</strong></td>
<td>CMOS image elements (1/2.9-inch equivalent)</td>
<td>CMOS image elements (2/3-inch equivalent)</td>
<td>CMOS image elements (1.1-inch equivalent)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Color/Monochrome</strong></td>
<td>Monochrome</td>
<td>Color</td>
<td>Monochrome</td>
<td>Color</td>
<td>Monochrome</td>
<td>Color</td>
</tr>
<tr>
<td><strong>Effective Pixels</strong></td>
<td>2592 (H) × 1944 (V)</td>
<td>5544 (H) × 3692 (V)</td>
<td>2448 (H) × 2048 (V)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Image area H × V (opposing corner)</strong></td>
<td>5.70 × 4.28 (7.13 mm)</td>
<td>13.31 × 8.86 (16.00 mm)</td>
<td>8.45 × 7.07 (11.01 mm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pixel size</strong></td>
<td>6.9 μm × 6.9 (μm)</td>
<td>3.45 (μm) × 3.45 (μm)</td>
<td>Electronic shutter; Shutter speeds can be set from 25 μs to 100 ms.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Partial function</strong></td>
<td>4 to 540 lines (4-line increments)</td>
<td>4 to 2048 lines (4-line increments)</td>
<td>4 to 3072 lines (4-line increments)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*<em>Frame rate (Image Acquisition Time <em>1)</em></em></td>
<td>523.6 fps (1.9 ms)</td>
<td>97.2 fps (10.3 ms) *2</td>
<td>40.1 fps (24.9 ms) *2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lens mounting</strong></td>
<td>C mount</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 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: -20 to 65 °C (with no icing or condensation)

#### Ambient humidity range

- Operating: 0 to 50 °C, Storage: -25 to 65 °C (with no icing or condensation)
- Operating: 0 to 40 °C, Storage: -20 to 65 °C (with no icing or condensation)

#### Weight

- Approx. 52 g
- Approx. 85 g

#### Accessories

- Instruction Sheet, 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 CCD Cameras

<table>
<thead>
<tr>
<th>Model</th>
<th>FZ-S</th>
<th>FZ-SC</th>
<th>FZ-S2M</th>
<th>FZ-SC2M</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Image elements</strong></td>
<td>Interline transfer reading all pixels, CCD image elements (1/3-inch equivalent)</td>
<td>Interline transfer reading all pixels, CCD image elements (1/1.8-inch equivalent)</td>
<td><strong>Color/Monochrome</strong></td>
<td><strong>Effective pixels</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Monochrome</td>
<td>Color</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Color</td>
<td>Monochrome</td>
</tr>
</tbody>
</table>

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

## Small CCD Digital Cameras

<table>
<thead>
<tr>
<th>Model</th>
<th>FZ-SF</th>
<th>FZ-SFC</th>
<th>FZ-SP</th>
<th>FZ-SPC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Image elements</strong></td>
<td>Interline transfer reading all pixels, CCD image elements (1/3-inch equivalent)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Monochrome</td>
<td>Color</td>
</tr>
<tr>
<td><strong>Effective pixels</strong></td>
<td>640 (H) x 480 (V)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Imaging area H x V (opposing corner)</strong></td>
<td>4.8 x 3.6 (6.0mm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pixel size</strong></td>
<td>7.4 (μm) x 7.4 (μm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Shutter function</strong></td>
<td>Electronic shutter; select shutter speeds from 20 μs to 100 ms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Partial function</strong></td>
<td>12 to 480 lines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*<em>Frame rate (Image Acquisition Time <em>)</em></em></td>
<td>80 fps (12.5ms)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lens mounting</strong></td>
<td>Special mount (M10.5 P0.5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Field of vision, installation distance</strong></td>
<td>Selecting a lens according to the field of vision and installation distance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ambient temperature range</strong></td>
<td>Operating: 0 to 50 °C (camera amp) Storage: -25 to 65 °C (camera head)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ambient humidity range</strong></td>
<td>Operating and storage: 35% to 85% (with no condensation)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>Approx. 150 g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Accessories</strong></td>
<td>Instruction manual, installation bracket, Four mounting brackets (M2)</td>
<td></td>
<td>Instruction manual</td>
<td></td>
</tr>
</tbody>
</table>

* The image acquisition time does not include the image conversion processing time of the sensor controller.
### FH-Series

#### Intelligent Compact Digital CMOS Cameras

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

*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**

Field of vision

**Standard**

**FZ-SQ050F**

Field of vision

---

**Wide View (Long-distance)**

**FZ-SQ100F**

Field of vision

**Wide View (Short-distance)**

**FZ-SQ100N**

Field of vision
## Ratings and Specifications (Cable, Monitor)

### Camera Cables

<table>
<thead>
<tr>
<th>Model</th>
<th>FZ-VS3 (2 m)</th>
<th>FZ-VSB3 (2 m)</th>
<th>FZ-VSL3 (2 m)</th>
<th>FZ-VSLB3 (2 m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Standard</td>
<td>Bend resistant</td>
<td>Bend resistant</td>
<td>Bend resistant</td>
</tr>
<tr>
<td>Shock resistance (durability)</td>
<td>10 to 150 Hz single amplitude 0.15 mm 3 directions, 8 strokes, 4 times</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>Operating and storage: 0 to 65 °C (with no icing or condensation)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient humidity range</td>
<td>Operating and storage: 40 to 70%RH (with no condensation)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient atmosphere</td>
<td>No corrosive gases</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Cable sheath, connector: PVC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum bending radius</td>
<td>65 mm 65 mm 65 mm 65 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 175 g Approx. 180 g Approx. 175 g Approx. 180 g</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Cable Extension Unit

<table>
<thead>
<tr>
<th>Model</th>
<th>FZ-VSJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply voltage</td>
<td>11.5 to 13.5 VDC</td>
</tr>
<tr>
<td>Current consumption</td>
<td>1.5 A max.</td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>Operating: 0 to 50 °C, Storage: -25 to 65 °C (with no icing or condensation)</td>
</tr>
<tr>
<td>Ambient humidity range</td>
<td>Operating and storage: 35 to 85% (with no condensation)</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 245 g</td>
</tr>
<tr>
<td>Accessories</td>
<td>Instruction Sheet and 4 mounting screws</td>
</tr>
</tbody>
</table>

### Touch Panel Monitor

#### Major Function

| Display area | 12.1 inch |
| Resolution | 1024 (V) × 768 (H) |
| Number of color | 16,700,000 colors (8 bit/color) |
| Brightness | 500cd/m² (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 100,000 hours |
| Touch panel | 4-wire resistive touch screen |
| 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) |
| 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/s²) 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 |
| Material | Front panel: PC/PBT, Front Sheet: PET, Rear case: SUS |

#### Long-distance Camera Cables

<table>
<thead>
<tr>
<th>Model</th>
<th>FZ-VS4 (15 m)</th>
<th>FZ-VSL4 (15 m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Standard</td>
<td>Right-angle</td>
</tr>
<tr>
<td>Shock resistance (durability)</td>
<td>10 to 150 Hz single amplitude 0.15 mm 3 directions, 8 strokes, 4 times</td>
<td></td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>Operation and storage: 0 to 65 °C (with no icing or condensation)</td>
<td></td>
</tr>
<tr>
<td>Ambient humidity range</td>
<td>Operation and storage: 40 to 70%RH (with no condensation)</td>
<td></td>
</tr>
<tr>
<td>Ambient atmosphere</td>
<td>No corrosive gases</td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Cable sheath, connector: PVC</td>
<td></td>
</tr>
<tr>
<td>Minimum bending radius</td>
<td>76 mm</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 1400 g</td>
<td></td>
</tr>
</tbody>
</table>

### Encoder Cable

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

### Notes

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

### Monitor Cables

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

<table>
<thead>
<tr>
<th>Model</th>
<th>FZ-M08</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>8.4 inches</td>
</tr>
<tr>
<td>Type</td>
<td>Liquid crystal color TFT</td>
</tr>
<tr>
<td>Resolution</td>
<td>1,024 (\times) 768 dots</td>
</tr>
<tr>
<td>Input signal</td>
<td>Analog RGB video input, 1 channel</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>21.6 to 26.4 VDC</td>
</tr>
<tr>
<td>Current consumption</td>
<td>Approx. 0.7 A max.</td>
</tr>
<tr>
<td>Ambient temperature range</td>
<td>Operating: 0 to 50 °C; Storage: -25 to 65 °C (with no icing or condensation)</td>
</tr>
<tr>
<td>Ambient humidity range</td>
<td>Operating and storage: 35 to 85% (with no condensation)</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 1.2 kg</td>
</tr>
<tr>
<td>Accessories</td>
<td>Instruction Sheet and 4 mounting brackets</td>
</tr>
</tbody>
</table>

### EtherCAT Communications Specifications

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

* This depends on the upper limit of the master.

### Version Information

#### FH Series and Programming Devices


<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FH-5550</td>
<td>Version 6.40</td>
<td>Supported by version 1.42* or higher.</td>
</tr>
<tr>
<td>FH-3050</td>
<td>Version 6.31</td>
<td>Supported by version 1.30 or higher.</td>
</tr>
<tr>
<td>FH-2050</td>
<td>Version 6.21</td>
<td>Supported by version 1.26 or higher.</td>
</tr>
<tr>
<td>FH-2050</td>
<td>Version 6.11</td>
<td>Supported by version 1.25 or higher.</td>
</tr>
<tr>
<td>FH-2050</td>
<td>Version 5.72</td>
<td>Supported by version 1.18 or higher.</td>
</tr>
<tr>
<td>FH-2050</td>
<td>Version 5.71</td>
<td>Supported by version 1.18 or higher.</td>
</tr>
<tr>
<td>FH-2050</td>
<td>Version 5.60</td>
<td>Supported by version 1.15 or higher.</td>
</tr>
<tr>
<td>FH-2050</td>
<td>Version 5.50</td>
<td>Supported by version 1.14.89 or higher.</td>
</tr>
<tr>
<td>FH-2050</td>
<td>Version 5.30</td>
<td>Supported by version 1.10.80 or higher.</td>
</tr>
<tr>
<td>FH-2050</td>
<td>Version 5.20</td>
<td>Supported by version 1.10 or higher.</td>
</tr>
<tr>
<td>FH-2050</td>
<td>Version 5.10</td>
<td>Supported by version 1.07.43 or higher.</td>
</tr>
<tr>
<td>FH-2050</td>
<td>Version 5.00</td>
<td>Supported by version 1.07 or higher. Not supported by version 1.06 or lower.</td>
</tr>
</tbody>
</table>

* Sysmac Studio Ver.1.42 will be supported soon.
## Components and Functions

### Sensor Controllers

**High-speed, Large-capacity Controller**

**Standard Controller (4-camera type)**

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

### 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.

<table>
<thead>
<tr>
<th>FH-2050 Series/FH-50 Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper port: Ethernet port</td>
</tr>
<tr>
<td>Lower port: Ethernet port, EtherNet/IP port, and PROFINET port are sharing use.</td>
</tr>
</tbody>
</table>

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).
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

<table>
<thead>
<tr>
<th>Group</th>
<th>Icon</th>
<th>Processing item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search</td>
<td></td>
<td>Used to identify the shapes and calculate the position of measurement objects.</td>
<td></td>
</tr>
<tr>
<td>Flexible Search</td>
<td></td>
<td>Recognizing the shapes of workpieces with variation and detecting their positions.</td>
<td></td>
</tr>
<tr>
<td>Sensitive Search</td>
<td></td>
<td>Search a small difference by dividing the search model in detail, and calculating the correlation.</td>
<td></td>
</tr>
<tr>
<td>ECM Search</td>
<td></td>
<td>Used to search the similar part of model from input image. Detect the evaluation value and position.</td>
<td></td>
</tr>
<tr>
<td>EC Circle Search</td>
<td></td>
<td>Extract contours using “round” shape information and get position, radius and quantity in high preciseness.</td>
<td></td>
</tr>
<tr>
<td>SHAPE Search</td>
<td></td>
<td>Used to search the similar part of model from input image regardless of environmental changes. Detect the evaluation value and position.</td>
<td></td>
</tr>
<tr>
<td>SHAPE Search</td>
<td></td>
<td>Robust detection of positions is possible at high-speed and with high precision in recognition, and detecting their positions.</td>
<td></td>
</tr>
<tr>
<td>EC Corner</td>
<td></td>
<td>The processing item measures a corner position (corner) of a workspace.</td>
<td></td>
</tr>
<tr>
<td>Sv Cross</td>
<td></td>
<td>The center position of a crosshair shape is measured using the lines created by the edge information on each side of the crosshair.</td>
<td></td>
</tr>
<tr>
<td>Classification</td>
<td></td>
<td>Used when various kinds of products on the assembly line need to be sorted and identified.</td>
<td></td>
</tr>
<tr>
<td>Edge Position</td>
<td></td>
<td>Measure position of measurement objects according to the color change in measurement area.</td>
<td></td>
</tr>
<tr>
<td>Edge Pitch</td>
<td></td>
<td>Detect edges by color change in measurement area. Used for calculating number of pixels of FC and connectors.</td>
<td></td>
</tr>
<tr>
<td>Scan Edge Position</td>
<td></td>
<td>Measure peak/bottom edge position of workpieces according to the color change in separated measurement area.</td>
<td></td>
</tr>
<tr>
<td>Scan Edge Width</td>
<td></td>
<td>Measure max/min/average width of workpieces according to the color change in separate measurement area.</td>
<td></td>
</tr>
<tr>
<td>Circular Scan Edge Position</td>
<td></td>
<td>Measure center axis, diameter and radius of circular workpieces.</td>
<td></td>
</tr>
<tr>
<td>Circular Scan Edge Width</td>
<td></td>
<td>Measure center axis, width and thickness of ring workpieces.</td>
<td></td>
</tr>
<tr>
<td>Intersection</td>
<td></td>
<td>Calculate approximate area from the edge information on two sides of a square workpiece to measure the angle formed at the intersection of the two lines.</td>
<td></td>
</tr>
<tr>
<td>Color Data</td>
<td></td>
<td>Used for detecting presence and mixed variables of products by using color average and deviation.</td>
<td></td>
</tr>
<tr>
<td>Gravity and Area</td>
<td></td>
<td>Used to measure area, center of gravity of workpieces by extracting the color to be measured.</td>
<td></td>
</tr>
<tr>
<td>Labeling</td>
<td></td>
<td>Used to measure number, area and gravity of workpieces by extracting registered data.</td>
<td></td>
</tr>
<tr>
<td>Label Data</td>
<td></td>
<td>Selecting one region of extracted Labeling, and get that measurement. Area and Gravity position can be got and judged.</td>
<td></td>
</tr>
<tr>
<td>Defect</td>
<td></td>
<td>Used for appearance measurement of plain-color measurement objects such as defects, stains and burns.</td>
<td></td>
</tr>
<tr>
<td>Precise Defect</td>
<td></td>
<td>Check the defect on the object. Parameters for extraction defect can be set precisely.</td>
<td></td>
</tr>
<tr>
<td>Fine Matching</td>
<td></td>
<td>Difference can be detected by overlapping and comparing (matching) registered fine images with input images.</td>
<td></td>
</tr>
<tr>
<td>Character Inspect</td>
<td></td>
<td>Recognize character according correlation search with model image registered in (Model Dictionary).</td>
<td></td>
</tr>
<tr>
<td>Date Verification</td>
<td></td>
<td>Reading character string is verified with internal data.</td>
<td></td>
</tr>
<tr>
<td>Model Dictionary</td>
<td></td>
<td>Register character pattern as dictionary. The pattern is used in (Character Inspection).</td>
<td></td>
</tr>
<tr>
<td>2DCode II</td>
<td></td>
<td>Recognize 2D code and display where the code quality is poor.</td>
<td></td>
</tr>
<tr>
<td>2DCode II</td>
<td></td>
<td>Recognize 2D code and display where the code quality is poor.</td>
<td></td>
</tr>
<tr>
<td>Barcode</td>
<td></td>
<td>Recognize barcode, verify and output decoded characters.</td>
<td></td>
</tr>
<tr>
<td>OCR</td>
<td></td>
<td>Recognize and read characters in images as character information.</td>
<td></td>
</tr>
<tr>
<td>OCR User Dictionary</td>
<td></td>
<td>Register dictionary data to use for OCR.</td>
<td></td>
</tr>
<tr>
<td>Circle Angle</td>
<td></td>
<td>Used for calculating angle of inclination of circular measurement objects.</td>
<td></td>
</tr>
</tbody>
</table>

### Measurement

<table>
<thead>
<tr>
<th>Group</th>
<th>Icon</th>
<th>Processing item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement</td>
<td></td>
<td>Glue Braid Inspection</td>
<td>You can inspect coating of a specified color or for gaps or runoffs along the coating path.</td>
</tr>
<tr>
<td>Input Image</td>
<td></td>
<td>AI FineMatching *4</td>
<td>Performs learning with “non-defective” product images and detects the difference between the input image and the non-defective image. Allows for variations in non-defective products and detects only defects.</td>
</tr>
<tr>
<td>Camera Image Input FH</td>
<td></td>
<td>Camera Image Input FH</td>
<td>To input images from cameras. And set up the conditions to input images from cameras. (For FHI Sensor Controllers only)</td>
</tr>
<tr>
<td>Camera Image Input HDR</td>
<td></td>
<td>Camera Image Input HDR</td>
<td>Create high-dynamic range images by acquiring several images with different conditions.</td>
</tr>
<tr>
<td>Camera Image Input CRD/RI</td>
<td></td>
<td>Camera Image Input CRD/RI</td>
<td>HDR function for FZ-SQ: Intelligent Compact Image.</td>
</tr>
<tr>
<td>Photometric Stereo Input</td>
<td></td>
<td>Photometric Stereo Input</td>
<td>Capture images under different illumination directions using a photometric stereo light.</td>
</tr>
<tr>
<td>Camera Switch</td>
<td></td>
<td>Camera Switch</td>
<td>To switch the cameras used for measurement. Not input images from cameras again.</td>
</tr>
<tr>
<td>Measurement Image Switching</td>
<td></td>
<td>Measurement Image Switching</td>
<td>To switch the images used for measurement. Not input images from camera again.</td>
</tr>
<tr>
<td>Multi-trigger imaging</td>
<td></td>
<td>Multi-trigger imaging</td>
<td>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.</td>
</tr>
<tr>
<td>Position Compensation</td>
<td></td>
<td>Position Compensation</td>
<td>Used when positions are different. Correct measurement is performed by correcting position of input images.</td>
</tr>
<tr>
<td>Filtering</td>
<td></td>
<td>Filtering</td>
<td>Used for processing images input from cameras in order to make them easier to be measured.</td>
</tr>
<tr>
<td>Anti Color Shading</td>
<td></td>
<td>Anti Color Shading</td>
<td>To remove the irregular color/pattern by uniformizing max.2 specified colors.</td>
</tr>
<tr>
<td>Stripes Removal Filter</td>
<td></td>
<td>Stripes Removal Filter</td>
<td>Remove the background pattern of vertical, horizontal and diagonal stripes.</td>
</tr>
<tr>
<td>Polar Transformation</td>
<td></td>
<td>Polar Transformation</td>
<td>Rectify the image by polar transformation. Useful for OCR or pattern inspection printed on circle.</td>
</tr>
<tr>
<td>Trapozidonal Correction</td>
<td></td>
<td>Trapozidonal Correction</td>
<td>Rectify the trapezoidal deformed image.</td>
</tr>
<tr>
<td>Machine Simulator</td>
<td></td>
<td>Machine Simulator</td>
<td>How the alignment marks would move on the image when each stage or robot axis is controllably be checked.</td>
</tr>
<tr>
<td>Image Subtraction</td>
<td></td>
<td>Image Subtraction</td>
<td>The registered model image and measurement image are compared and only the different pixels are extracted and converted to an image.</td>
</tr>
<tr>
<td>Advanced filter</td>
<td></td>
<td>Advanced filter</td>
<td>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.</td>
</tr>
<tr>
<td>Panorama</td>
<td></td>
<td>Panorama</td>
<td>Combine multiple image to create one big image.</td>
</tr>
<tr>
<td>AI Scratch Detect Filter *5</td>
<td></td>
<td>AI Scratch Detect Filter *5</td>
<td>Extracts defects in the set measurement area.</td>
</tr>
<tr>
<td>Unit Macro</td>
<td></td>
<td>Unit Macro</td>
<td>Advanced arithmetic processing can be easily incorporated into workpiece as Unit Macro processing items.</td>
</tr>
<tr>
<td>Unit Calculation Macro</td>
<td></td>
<td>Unit Calculation Macro</td>
<td>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.</td>
</tr>
<tr>
<td>Calculation</td>
<td></td>
<td>Calculation</td>
<td>Used when using the judge results and measured values of Footprint are registered in processing units.</td>
</tr>
<tr>
<td>Line Regression</td>
<td></td>
<td>Line Regression</td>
<td>Used for calculating regression line from plural measurement coordinate.</td>
</tr>
<tr>
<td>Circle regression</td>
<td></td>
<td>Circle regression</td>
<td>Used for calculating regression circle from plural measurement coordinate.</td>
</tr>
<tr>
<td>Precise Calibration</td>
<td></td>
<td>Precise Calibration</td>
<td>Used for calibration corresponding to trapezoidal distortion and lens distortion.</td>
</tr>
</tbody>
</table>
### Group: Support measurement

<table>
<thead>
<tr>
<th>Icon</th>
<th>Processing Item</th>
<th>Comparing Page in the Catalog</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="User Data Icon" /></td>
<td>Used for setting the data that can be used as common constants and variables in scene group data.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Set Unit Data Icon" /></td>
<td>Used to change the Progmem data (setting parameters, etc.) that has been set up in a scene.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Set Unit Figure Icon" /></td>
<td>Used for re-setting the figure data (model, measurement area) that has been set in an unit.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Extract Image Icon" /></td>
<td>Used for getting the data (image data) that is registered in an unit.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Image Logging Icon" /></td>
<td>Used for saving the measurement images in the memory and USB memory.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Data Logging Icon" /></td>
<td>Used for saving the measurement data in JPEG and BMP format.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Elapsed Time Icon" /></td>
<td>Used for calculating the elapsed time since the measurement trigger input.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Wait Icon" /></td>
<td>Processing is stopped only at the set time. The standby time is set by the unit of [ms].</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Focus Icon" /></td>
<td>Focus setting is supported.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Hts Icon" /></td>
<td>Focus and aperture setting is supported.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Parallelize Icon" /></td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Parallelize Task Icon" /></td>
<td>A part of the measurement flow is divided into two or more tasks and processed in parallel to shorten the measurement time. The measurement flow is divided according to the conditions given by expressions.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Statistics Icon" /></td>
<td>Used when you need to calculate an average of multiple measurement results.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Reference Data Icon" /></td>
<td>Calibration data and distortion compensation data can be used when the memory and USB memory is supported in a piece group.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Position Data Icon" /></td>
<td>The specified position angle is calculated from the measured positions.</td>
<td></td>
</tr>
</tbody>
</table>
| ![Stage Data Icon](image) | Sets and stores data related to stages. | P13

### Group: Vision Master Calibration

<table>
<thead>
<tr>
<th>Icon</th>
<th>Processing Item</th>
<th>Comparing Page in the Catalog</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="PLC Master Calibration Icon" /></td>
<td>Calibration data is created using a communication command from PLC.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Convert Position Data Icon" /></td>
<td>The position angle after the specified axis movement is calculated.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Movement Single Position Icon" /></td>
<td>The axis movement that is required to match the measured position angle to the reference position angle is calculated.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Movement Multi Points Icon" /></td>
<td>The axis movements that are required to match the measured position angles to the corresponding reference position angles are calculated.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Detection Point Icon" /></td>
<td>Obtains position/angle information by referring to the coordinate values measured with the Measurement Processing Unit.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Manual Position Setting Icon" /></td>
<td>Used to change the measurement coordinates X and Y of the measurement processing unit.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Camera Calibration Icon" /></td>
<td>Setting the camera calibration, the measurement result can be converted and output as actual dimensions.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Data Save Icon" /></td>
<td>The set data can be saved in the controller main unit as scene data. The data is not cleared even after the FH5 power is turned off.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Conveyor Calibration Icon" /></td>
<td>Conveyor Calibration is used to calibrate camera, conveyor, and robots for conveyor or tracking application.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Scene Icon" /></td>
<td>The specified scene is copied to the current scene.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="System Information Icon" /></td>
<td>Obtains system information (e.g., memory and disk space and I/O input signal status) of the Sensor Controller.</td>
<td></td>
</tr>
</tbody>
</table>

### Group: Conditional Branch

<table>
<thead>
<tr>
<th>Icon</th>
<th>Processing Item</th>
<th>Comparing Page in the Catalog</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Conditional Branch Icon" /></td>
<td>Used where more than two kinds of products on the production line need to be detected separately.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="End Icon" /></td>
<td>This procedure must be set up at the last processing unit of a branch.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Di Branch Icon" /></td>
<td>Same as Progmem “Branch”. But you can change the targets of conditional branching via external inputs.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Control Flow Normal Icon" /></td>
<td>Set the measurement flow processing into the state in which the specific protocol command can be executed.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Control Flow PLC Link Icon" /></td>
<td>Set the measurement flow processing into the state in which the specific PLC link command can be executed.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Control Flow Parallel Icon" /></td>
<td>Set the measurement flow processing into the state in which the specific parallel command can be executed.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Control Flow Fieldbus Icon" /></td>
<td>Set the measurement flow processing into the state in which the specific Fieldbus command can be executed.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Select Branch Icon" /></td>
<td>Easily branch to multiple destinations.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Conditional Execution (If) Icon" /></td>
<td>The measurement flow is divided according to the comparison result obtained using the set expressions and conditions.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Conditional Execution (Else) Icon" /></td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Select Execution (Select) Icon" /></td>
<td>Used to set conditions. The measurement flow is divided according to the comparison result obtained using the conditions given by expressions.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Select Execution (Case) Icon" /></td>
<td>Used to make a judgment. The measurement flow is divided according to the comparison result obtained using the conditions given by expressions.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Result Output (I/O) Icon" /></td>
<td>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), PROF- INET.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Result Output (Message) Icon" /></td>
<td>Output data to the external devices such as a programmable controller or a PC with non-procedure mode via the external interface or EtherNet/IP (message communication). This processing item allows you to save the logging data as a &quot;cas&quot; file into the Sensor Controller as well.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Data Output Icon" /></td>
<td>Used when you need to output data to the external devices such as PLC or PC via parallel ports.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Parallel Data Output Icon" /></td>
<td>Used when you need to output data to the external devices such as PLC or PC via parallel ports.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Parallel Data Output Icon" /></td>
<td>Used when you need to output data to the external devices such as PLC or PC via parallel ports.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Fieldbus Data Output Icon" /></td>
<td>Outputs data to an external device, such as a Programmable Controller, through a fieldbus interface.</td>
<td></td>
</tr>
</tbody>
</table>

### Display result

<table>
<thead>
<tr>
<th>Icon</th>
<th>Processing Item</th>
<th>Comparing Page in the Catalog</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Result Display Icon" /></td>
<td>Used for displaying the texts or the figures in the camera image.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Display Image File Icon" /></td>
<td>Display selected image file.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Display Last NG Icon" /></td>
<td>Display the last NG images.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Conveyor Panorama Display Icon" /></td>
<td>Display images of the tracking area as a panoramic image.</td>
<td></td>
</tr>
<tr>
<td><img src="image" alt="Image Display Icon" /></td>
<td>Processing item to retain images, including measurement results.</td>
<td></td>
</tr>
</tbody>
</table>

*1 2D Codes that can be read: Data Matrix (ECC200), QR Code *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 *4 Available on the FH-5, 50-series Controller (version 6.40 or later). *5 Available on the FH-5, 50-series Controller (version 6.40 or later). Optional FH-UMA1 Scratch Detect AI Software Installer is required.
Dimensions

Sensor Controllers

High-speed, Large-capacity Controllers/Standard Controllers
FH-5550/-5550-10/-5550-20
FH-5050/-5050-10/-5050-20
FH-2050/-2050-10/-2050-20

The 2-camera type has only two camera connectors, and the 8-camera type has eight camera connectors.

The 2-camera type has only one Ethernet connector.

Lite Controllers
FH-L550/-L550-10

Four, M4 mounting holes with a depth of 4.5 mm
Four, M3 mounting holes with a depth of 4.5 mm

Four, M4 mounting holes with a depth of 6.5 mm
Digital CCD/CMOS Cameras

300,000-pixel camera
FZ-SF
FZ-SFC

2 million-pixel camera
FZ-S2M
FZ-S2MC

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-S01OF
FZ-S05OF

Wide View
FZ-S100F (long-distance)
FZ-S100N (short-distance)

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

**Camera Cable**
- **Camera Cable**
  - **FZ-VS3**

**Right-angle Camera Cable**
- **FZ-VSL3**

**Long-distance Camera Cable**
- **FZ-VS4**

**Bend resistant Camera Cable**
- **FZ-VSB3**

**Bend resistant Right-angle Camera Cable**
- **FZ-VSLB3**

**Long-distance Right-angle Camera Cable**
- **FZ-VSL4**

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**Camera Cable Extension Unit**
- **FZ-VSJ**
  - Camera Cable Connector (Camera side)
  - Camera Cable Connector (Controller side)
  - POWER LED indicators

**Extension Tubes for Small Camera**
- **FZ-LES**
  - Extension tubes 5 mm
  - Extension tubes 10 mm

**Lens for Small Camera**
- **FZ-LES Series**
  - Diaphragm adjustment knob
  - Diaphragm look screw (M1.4)
  - 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**
- **XW22-S013**
  - UNFUSED PART
  - FUSED PART
  - CABLE MARK
  - *1. Cable is available in 2m/5m.
Touch Panel Monitor
FH-MT12

Panel cutout dimensions

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

LCD Monitor
FZ-M08
FH-Series

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, not installation distance.

Standard Lenses

Small Digital CCD Cameras
FZ-SF, FZ-SP
300,000-pixel
(Using FZ-LES 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□X12
12 million-pixel
(Using 3Z4S-LE VS-LLD Series)

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

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-SX

400,000-pixel
(Using 3Z4S-LE VS-MCA Series)

Digital CCD Camera
FZ-S2M

2 million-pixel
(Using 3Z4S-LE VS-MCA Series)

High-speed Digital CMOS Camera
FH-S02

2 million-pixel
(Using 3Z4S-LE VS-MCH Series)
FH-Series

High-speed Digital CMOS Camera
FH-S04
4 million-pixel
(Using 3Z4S-LE VS-MCH Series)

Digital CMOS Camera
FH-S05R
5 million-pixel
(Using 3Z4S-LE VS-MCA Series)

Digital CMOS Camera FZ-S5M3,
High-speed Digital CMOS Camera FH-SX05
5 million-pixel
(Using 3Z4S-LE VS-MCA Series)
Related Manuals

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<td>Z343</td>
<td>FH/FHV7</td>
<td>Vision System FH/FHV7 Series Operation Manual for Sysmac Studio</td>
<td>VS-MCL25A/M42-10</td>
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