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

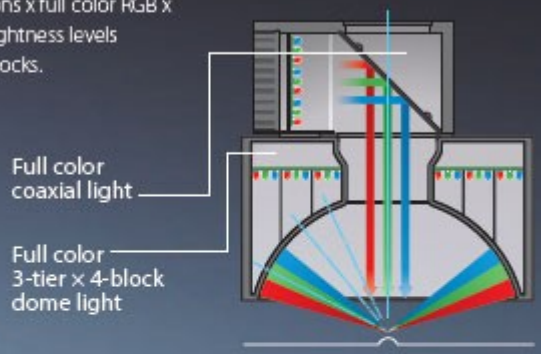
Many cameras are installed in almost all production processes to automate quality inspections and ensure security and safety. This means that the amount of image information is increasing. Moreover, changes in products require higher levels of performance for vision systems used for automation. In these circumstances, Omron further developed our FH Series to meet rapidly growing automation needs and higher performance requirements.
We help you solve your inspection and measurement issues through integration of high-speed, high-resolution compact cameras jointly developed with Omron Sentech Co., Ltd. and our unique algorithms.
Packed with technologies, this vision system will enable more customers to easily employ image processing.
We offer products which bring automation to manufacturing sites, contributing to manufacturing around the world.

Clearly shows defects by flexibly changing illumination colors and angles

This light can be adjusted to defects by freely combining the illumination directions, colors, and light intensities. Even if new objects or inspection items are added after installation, there is no need to add or change the light—just change the illumination pattern.
The lighting patterns can be registered as setting data, facilitating duplicating production lines.
*1. Based on Omron investigation in June 2018.
*2. MDMC…Multi-Direction Multi-Color

Illumination structure

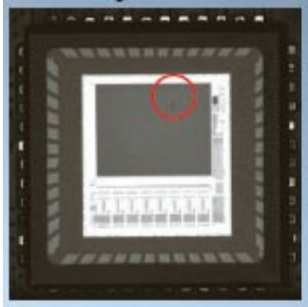
You can choose the best pattern by combining illumination directions x full color RGB x 128 brightness levels of 13 blocks.

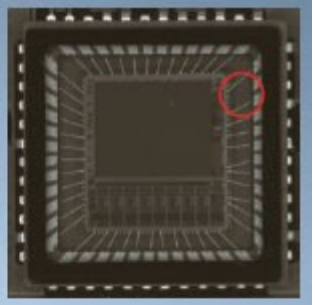


Standard light

Different lights are required for different defects

Glass surface inspection	Wire inspection
Coaxial light	Low angle light

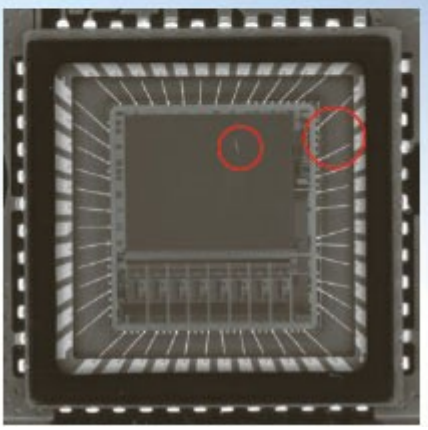




MDMC Light

One light clearly shows both broken wires and dirt on elements

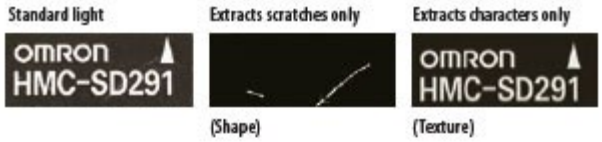
Inspection for broken wires and dirt on elements



Photometric Stereo Light

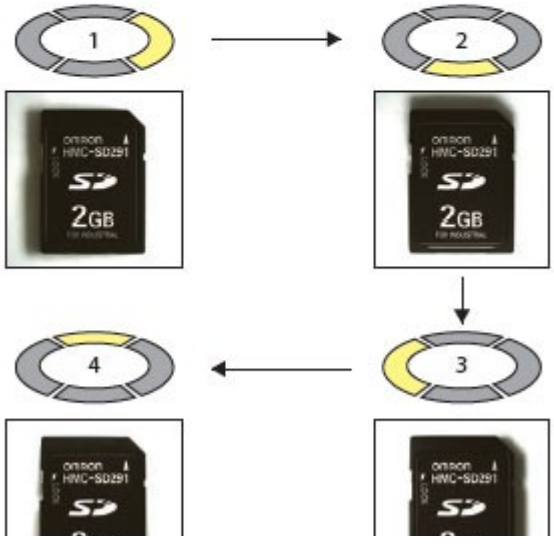
Shows defects accurately

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



Principle explanation

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



Industry's highest*1 image resolution of 80 Mpix*2 by new high resolution cameras

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

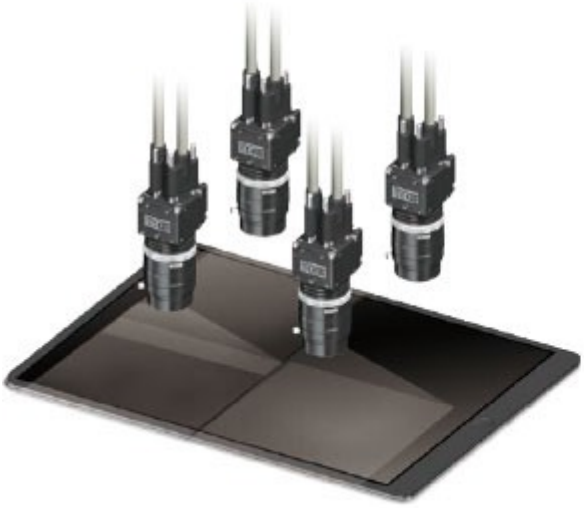
Ultra-high-speed sensing technology in a compact design

High-resolution cameras capture a wide field of view, which can cause image transfer bottlenecks that increase production cycle times. We use a new CMOS image element and dual transfer technology to capture high-resolution images and transfer images at high speeds.
This facilitates applications that previously required multiple cameras or a mechanism to move a camera.

Expand the field of view by combining images at high speeds

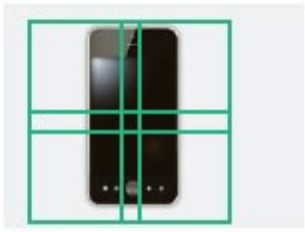
Panorama shooting with multiple cameras

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

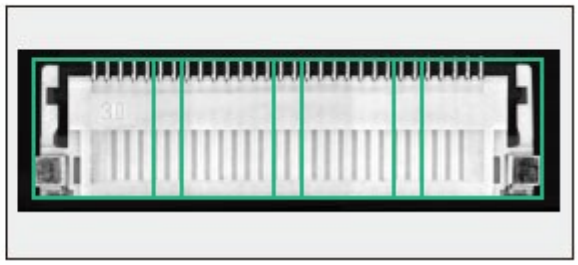


<Combining methods>

2x2 square

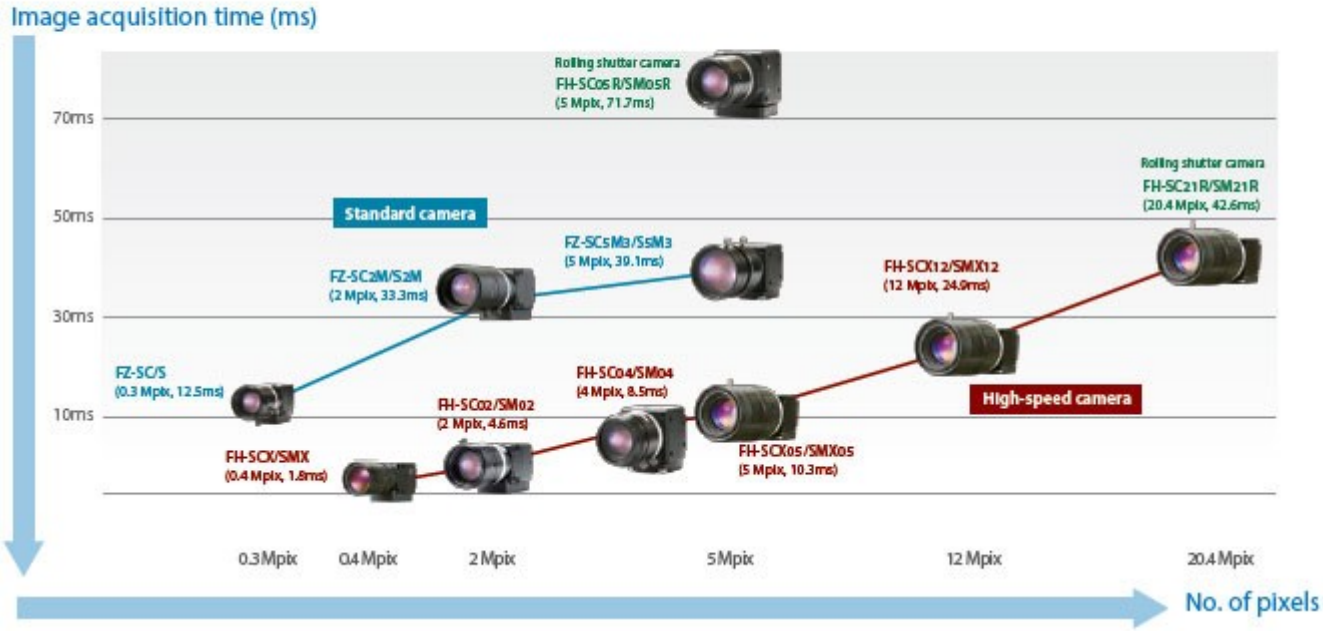


Panorama



A wide variety of cameras, from 0.3 to 20.4 Mpix

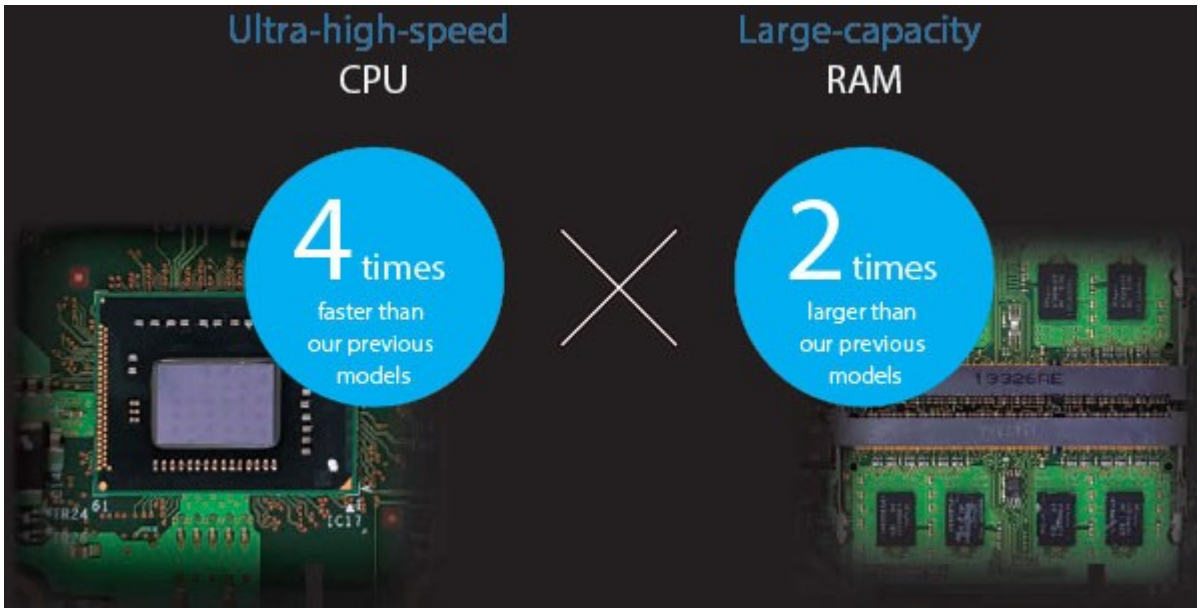
You can select the best combination of camera and lens for your application.



Industry's highest*

Controller

Industry's fastest* processing speed



Large capacity for image processing

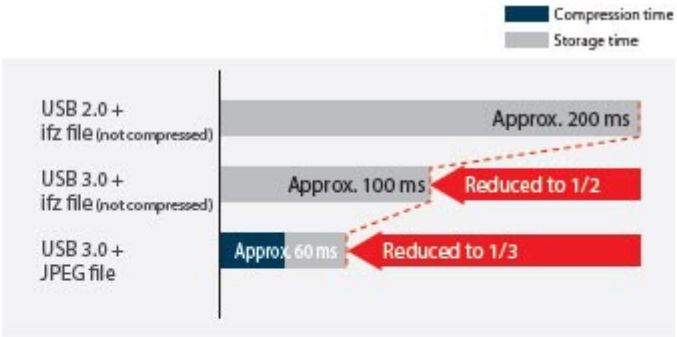
As the use of high-resolution cameras or multiple images for high-quality inspections or wide-field inspections is increasing, vision sensors that can handle increasing data volumes are required. The FH-5050 High-speed, Large-capacity Controller has two times the RAM capacity of our previous models,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

Controller	Camera	
	12 Mpix x 4	**20.4 Mpix x 4**
FH-1050 Series FH-3050 Series	✓	–
FH-2050 Series FH-5050 Series	✓	✔

High-speed image storage

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

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

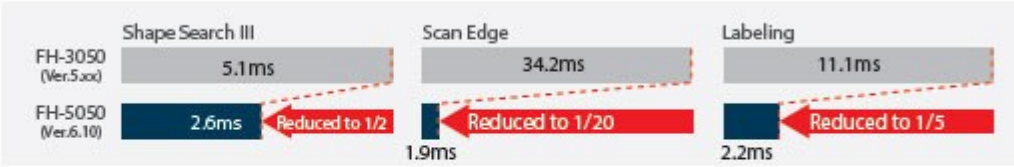


The times in the figure above are provided for reference only and their accuracy cannot be guaranteed.
They are measured under the following conditions:
- FH-5050 Controller
- 5 Mpix monochrome images
- Size of converted JPEG file: 0.6 MB

* Based on Omron investigation in June 2018.

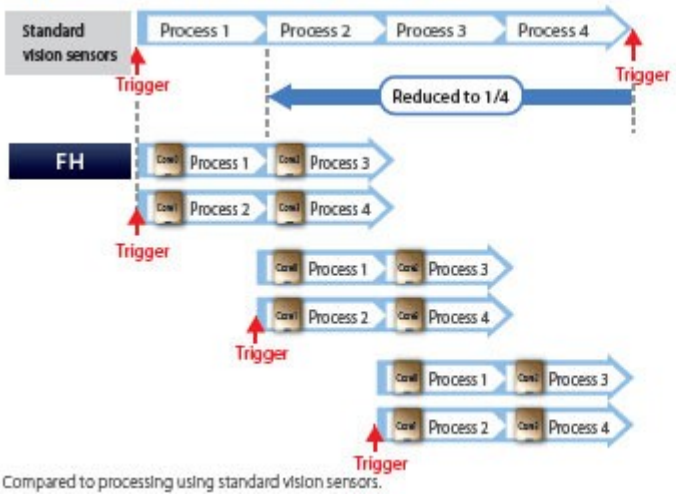
High-speed measurement

The improved algorithms of processing items significantly increase processing speed.



Parallel processing of multiple lines

Trigger interval reduced by up to 75%*



* Compared to processing using standard vision sensors.

Process multiple lines without waiting

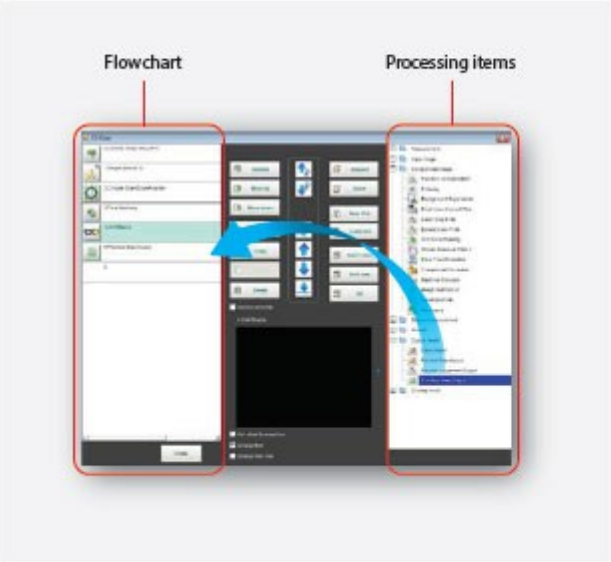
GUI for designers

Intuitive design interface reduces complexity

Build measurement process with flowchart programming

Inspection and measurement flow design

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

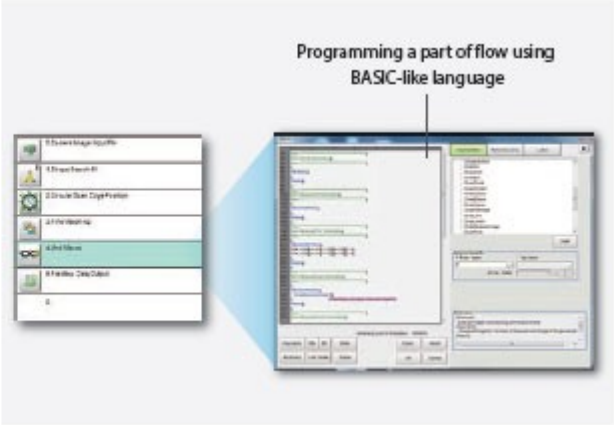


Unit Macro

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

Example:

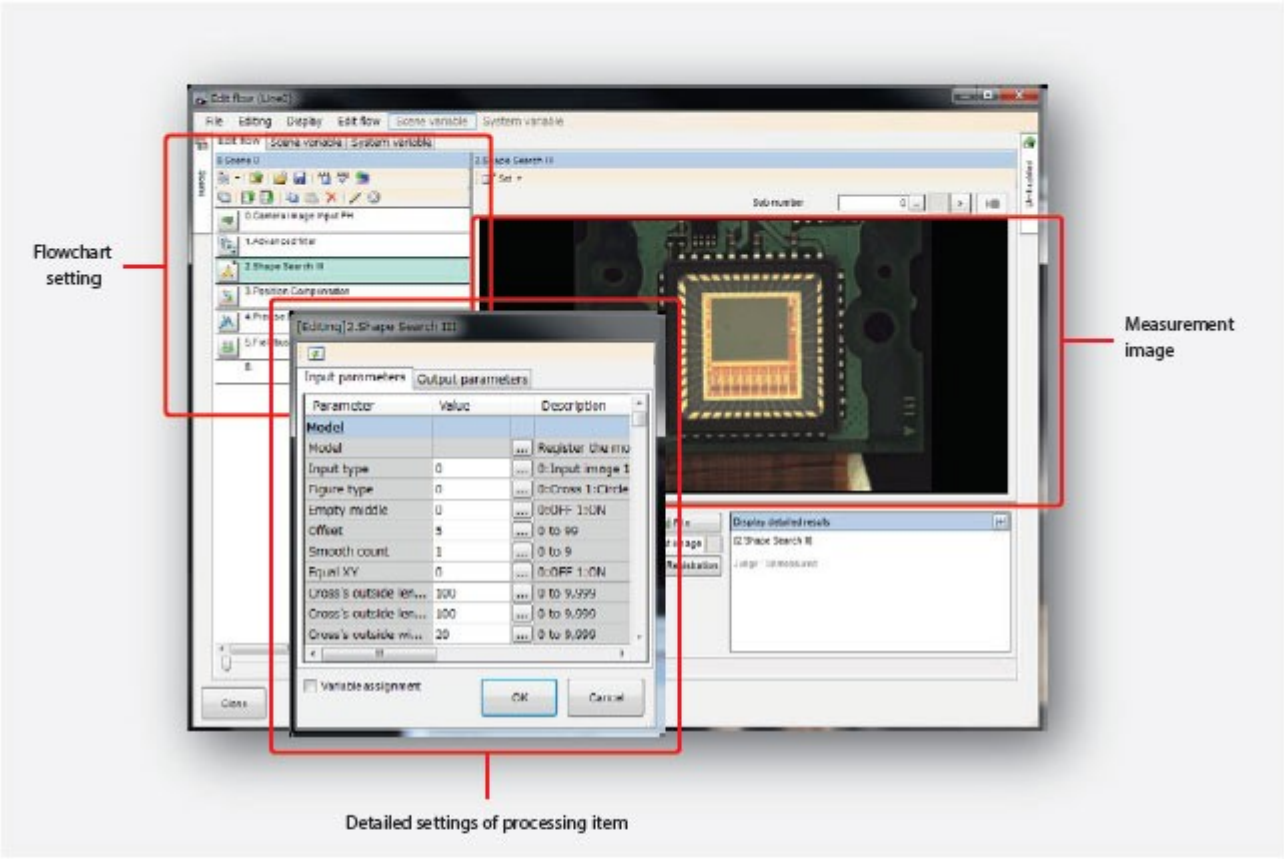
Some of the often-used processing (e.g., scene change + measurement start, data read + save) can be combined into one unit. This unit can be reused for other controllers.



Simple setting with menus

Total Design Management Editor

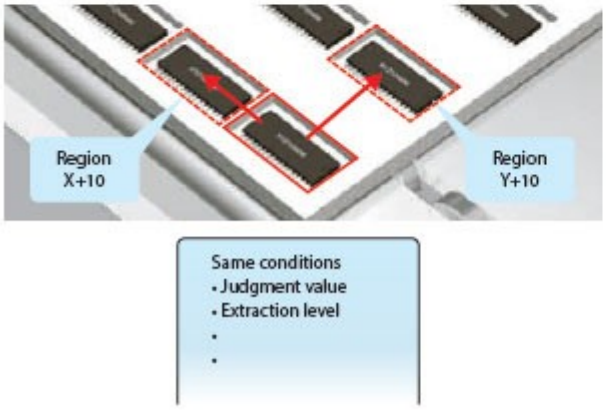
The FH Series has a new design interface that allows you to design complex measurement processes while managing variables.
This simple GUI manages complicated branching processes and data sharing across measurement scenes and eliminates the need to switch screens.



Example 1: Repeat same measurement while shifting region

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

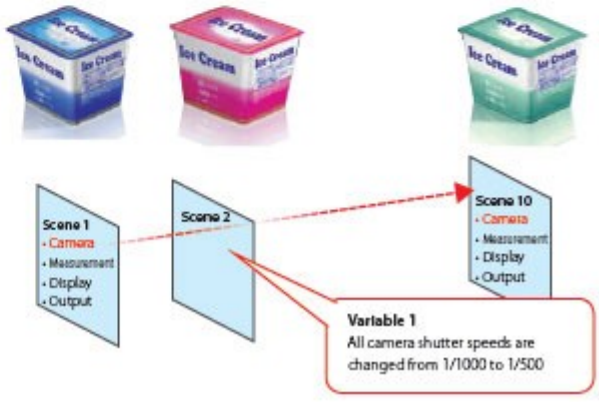
External inspection of all electronic parts on a pallet



Example 2: Set a common value for scenes

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

External inspection of objects with different colors



GUI for operators

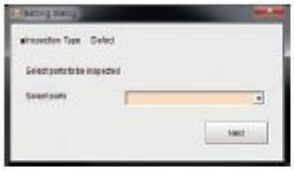
Operation interface optimized for use at production sites

Prevent incorrect operation at production site

Show only parameters you change everyday

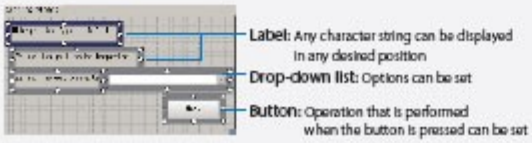
The processing item setting window includes parameters for initial setting and for daily adjustments. To prevent incorrect operation, you can customize the adjustment window to show only parameters that are required for your daily operation.

Example 1:
Show only necessary parameters



Example 2: Show a wizard

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



Show only menus you need

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

Customized operation interface

Enlarge the result to see it more easily

The display size can be changed by dragging.

Add short-cut buttons to daily functions

Buttons can be added easily from the menu.

More customization for machine monitors

Supports .NET controls for integration into user applications

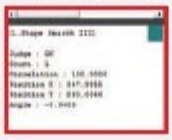
Microsoft.Net controls are supported to integrate the FH Interfaces into a PC-based HMI. You can display FH screens and measurement results by dragging the controls to your HMI software.

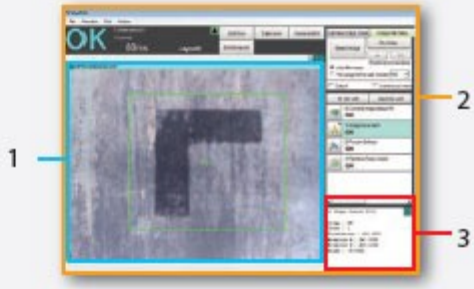
Examples of controls

1. Control to display a measurement image

2. Control to display the entire screen

3. Control to display measurement results





Note. Ask your Omron representative about obtaining controls.

Application Producer development environment to develop original interfaces

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

Example: Show your desired logo on startup screen

Development environment
Application Producer

Change configuration files for the FH Controller and create installation files

Install the created files on the FH Controller

The customized interface can be used

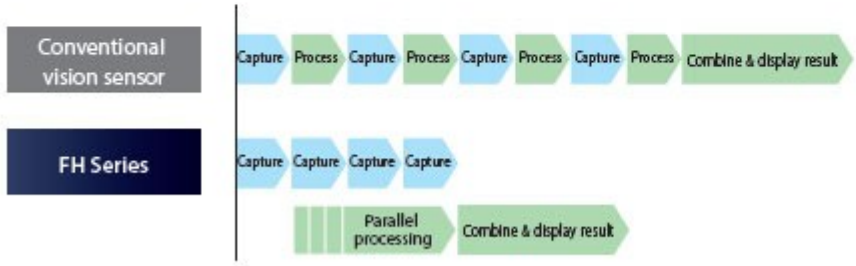
Software for high-speed, high-precision inspections and measurements

Image input

8 processing items

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

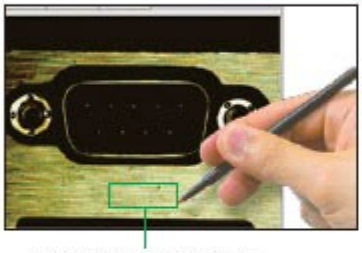
When multiple images are used for measurement, the conventional vision sensor repeats processing after image capture until all images are processed because only one trigger can be input in one flow. In contrast, the Multi-trigger Imaging function to input multiple shutter triggers in one flow allows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



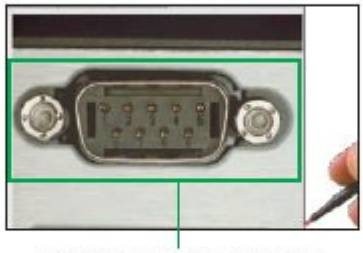
Easy to create HDR images

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

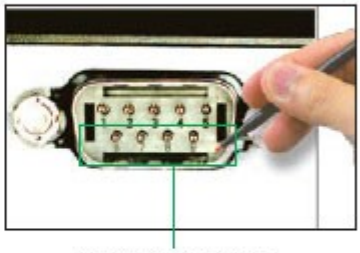
Image optimized for the specified area



Optimized for the bright part



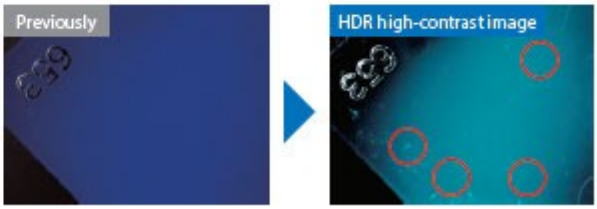
Optimized for the entire field of view



Optimized for the dark part

High-Contrast Mode

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



Low contrast makes the surface appear uniform.

Many scratches and soiled areas can be found.

Filtering

14 processing items

30 filters in Advanced Filter

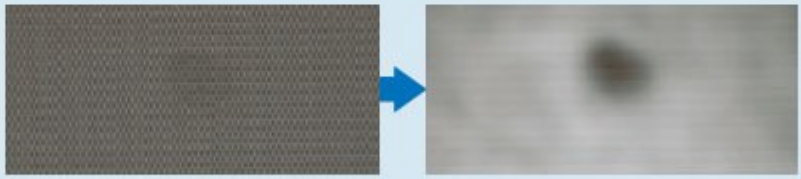
Filters to detect low-contrast defects

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

Even Emphasis Unevenness

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

Example of inspection to detect unevenness in LCD

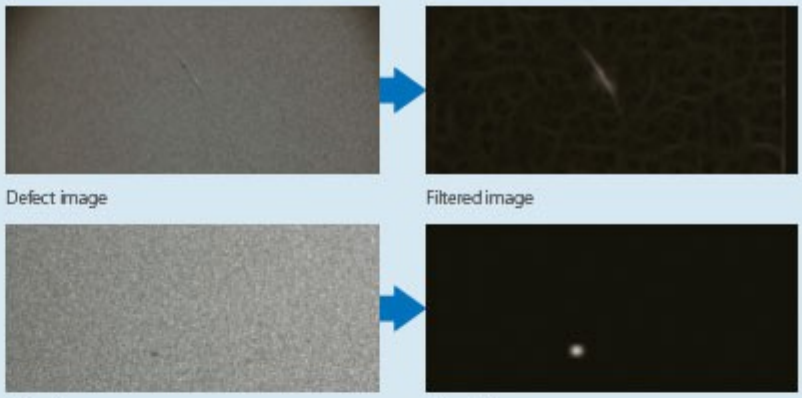


Defect image　　Filtered image

Emphasis Line Defect, Emphasis Circle Defect

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

Example of inspection to detect scratches on smartphones



Defect image　　Filtered image

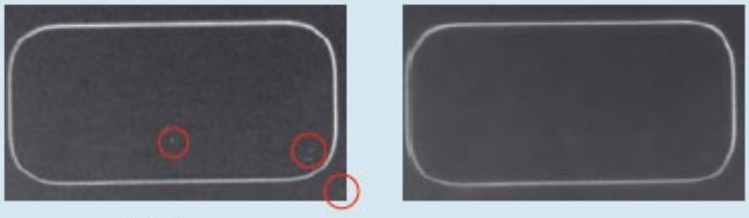
Defect image　　Filtered image

Filters widely used for image processing

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

Guided Filter

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



Noise image　　Filtered image

Inspection & measurement

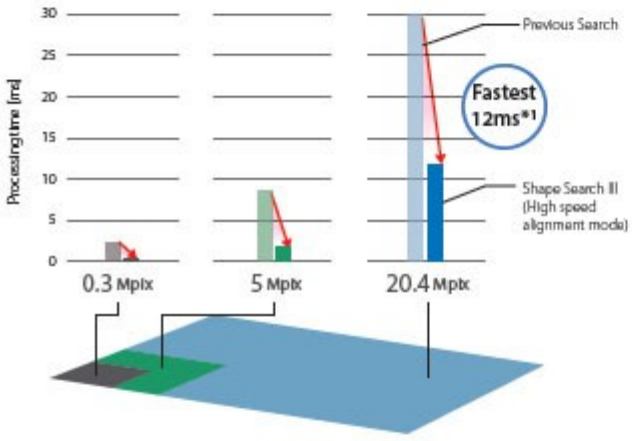
34 processing items

Object detection algorithm Shape Search III

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

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

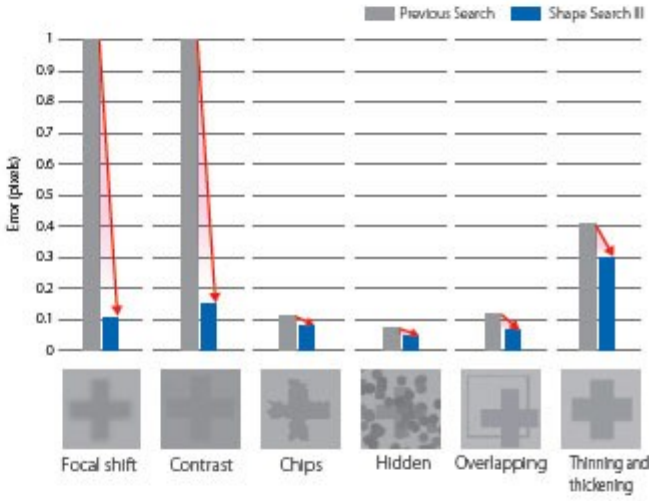
A 20.4 Mpix camera can search a positioning mark in as fast as 12 ms *1 and a 5 Mpix camera, which is mostly used for alignment applications, in as fast as 2 ms.



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

Ultra-high-accuracy, robust positioning

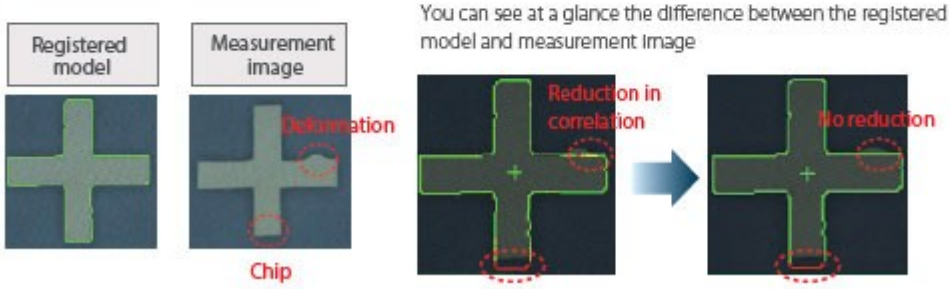
Stable position detection required for ultra-high-accuracy, robust positioning is possible even under the adverse conditions, such as changes of environments and materials, which occur far too often in actual measurement applications.



Visualization of comparisons enables easy setting of high-precision searching

Patented/Patent Pending *2

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



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

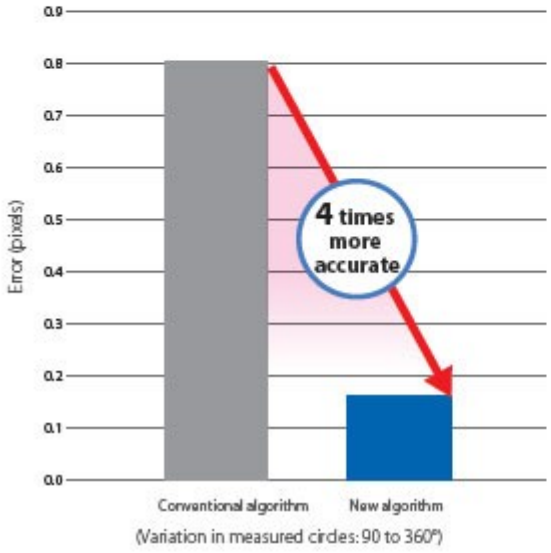
*2. Patent status as of June 2018
US:US9286669, Europe:Pending, China:ZL201410138793.3, Japan:JP6197340

Circular Scan Edge Position accurately detects a circle

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

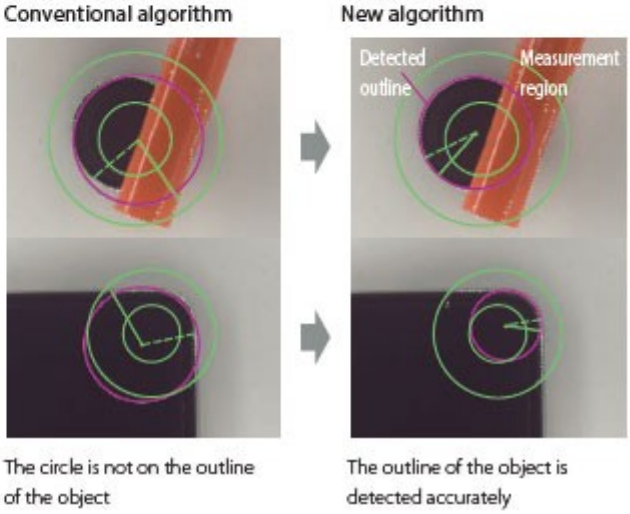
High accuracy

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



Robustness

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



The circle is not on the outline of the object

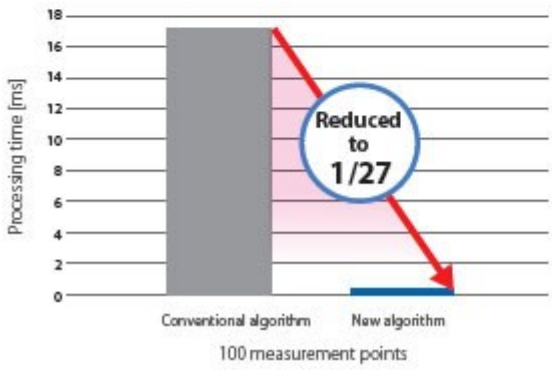
The outline of the object is detected accurately

Scan Edge Position increases speed and stability

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

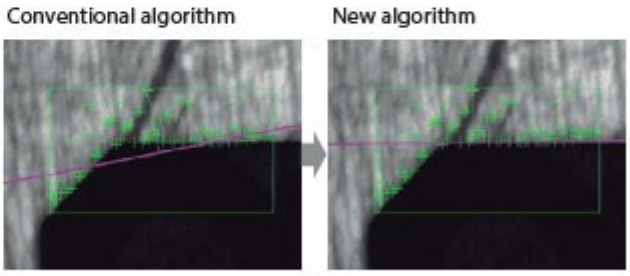
High speed

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



Stability

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



Powerful 2D code reading

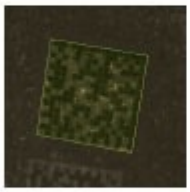
The dedicated algorithm for stable 2D code reading under adverse conditions is implemented. Data based on the print quality specifications can be output, which contributes to stable printing.

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

Changing ambient brightness

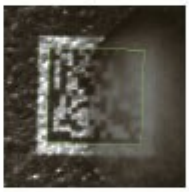
Chips due to reflection

Low contrast



After processing/washing

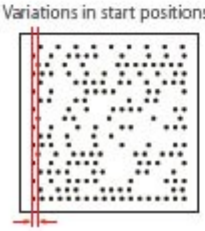
Waterdrops and dirt



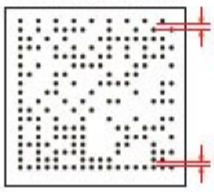
Scratched damage

Poor printing quality in high-speed line

Variations in start positions

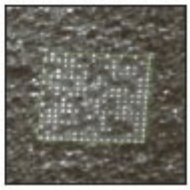


Uneven line spacing

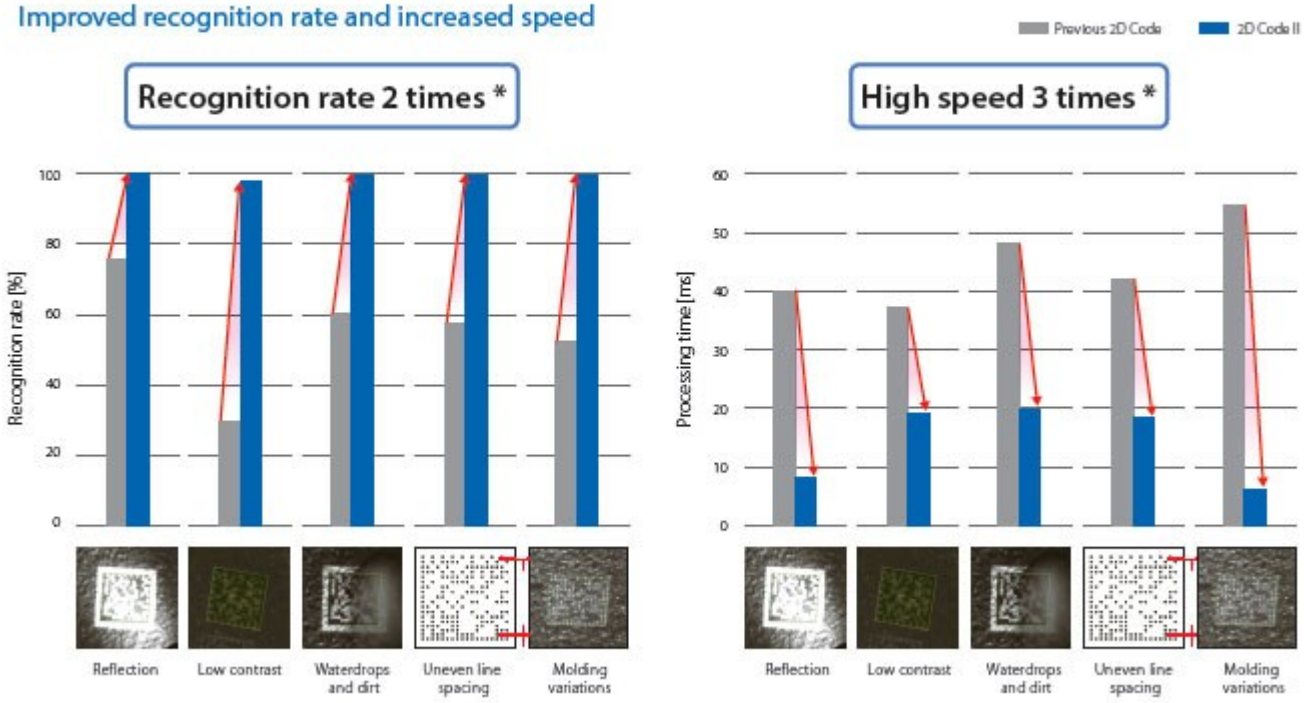


Poorly printed on coarse surface

Molding variations of forged object



Improved recognition rate and increased speed



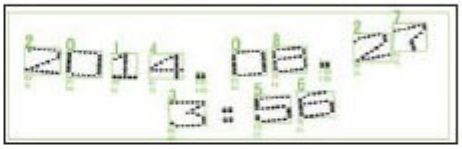
*. The average value measured under our specified conditions is provided for reference.

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

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

Touching characters

Curved character strings

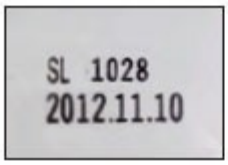


Easy installation with built-in dictionary

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

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

Approx. 80 different fonts



Hot printer

Inkjet printer

Thermal printer

Laser marker

Character Inspection for special fonts

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

Inspection of special fonts

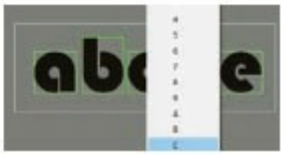
Special fonts

Japanese characters

Easy dictionary setup

Automatic model extraction

Index selection from list

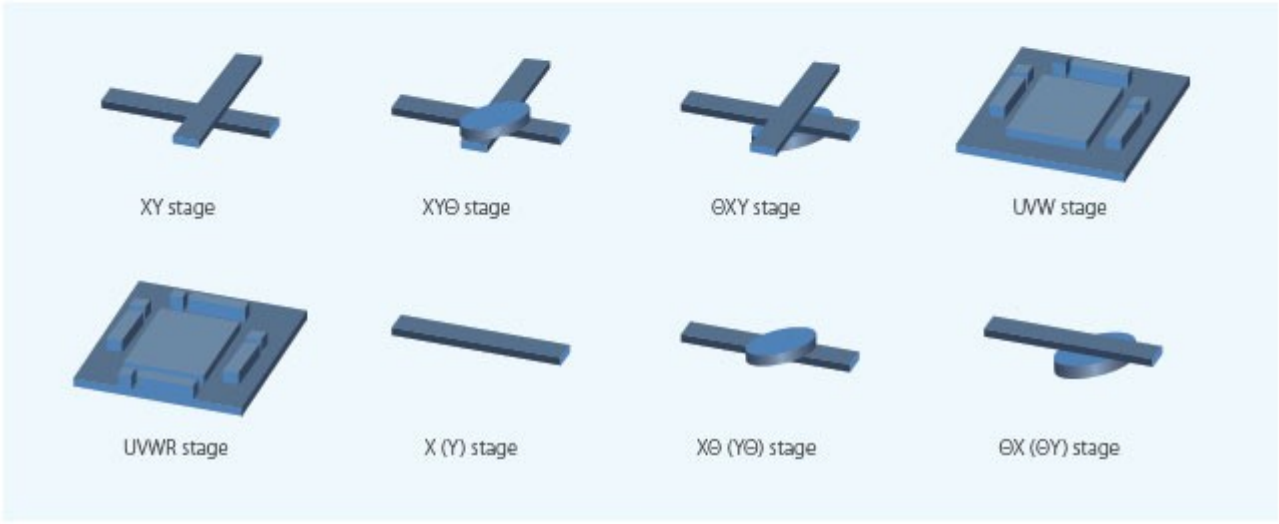


Inspection & measurement support

39 processing items

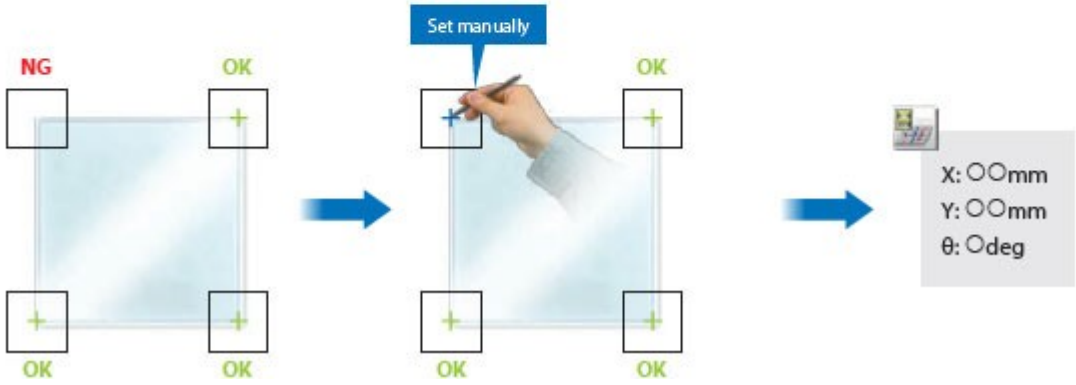
Stage Data for single axis + θ axis stage alignment

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



Manual Position Setting avoids stopping a machine

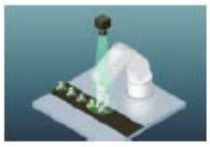
When an object cannot be detected, you can set the mark positions manually. The FH Series outputs the travel distance of the external device by referring the manually set values and measured coordinates. Manual Position Setting allows the FH Series to continue positioning without stopping the production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



Connecting robots

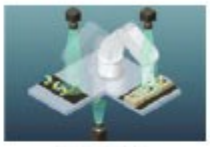
The dialog boxes for the FH Series and programs for various vendors' robots greatly reduce set-up time for robot applications.

Robot applications


Pick


Offset compensation


Place


Combination

Setting FH Vision System

Robot Setting Tool

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

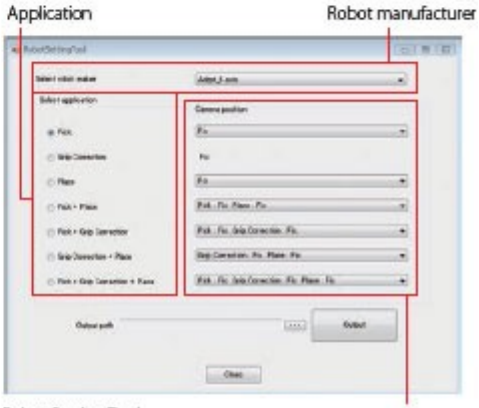
Easy 3-step robot connection

Obtain robot program and flowchart

Just a few clicks in Robot Setting Tool

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

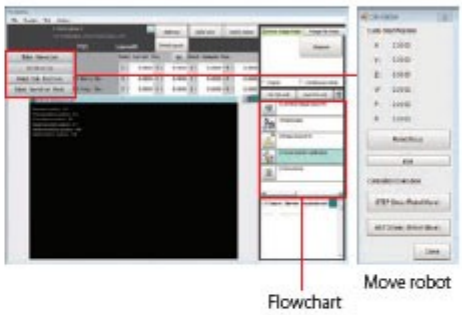
You can download the Robot Setting Tool from the following URL:
http://www.omron-cxone.com/fh



Calibrate

Move robot for calibration from FH Series

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



Check operations

Set up and check application from FH Series

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

Flexible machine control

Seamless connection with Omron products makes production lines more efficient

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

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

Data communications cycle: 125 µs

Communications cycle

Time from trigger input to producing measurement results

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

Integrated development