Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

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OMRON

Vision System FH series

Industry's Fastest Compact Vision System

The Fastest FH

» Easy to Integrate in Machines

» Increase Machine Speed

» Perform High-precision Machine Operation

sysmac
always in control

Industry's Fastest* Compact Vision System
A New Concept in Image Processing That Considers

It's time to move beyond simply increasing the speed of image processing and start seriously shortening Machine cycle time. This is the concept that gave birth to OMRON's FH-series Vision System and its best-in-the-industry speed.

Manufacturing Machines are operated through the interaction of sensors, PLCs, servomotors, and other devices. Vision Systems measure positions and perform inspections, and the results are used to control the operation of Machines. The demand for faster, more precise Vision System operation is the primary requirement. The FH-series Vision System provides higher speed and precision for Machine cycle time and is loaded with all of the performance required to move Machines quickly and at high precision into a compact Controller for embedding into Machine. And even though the Camera/communications interfaces, image processing algorithms, and other features of this complete image processing system are built into one housing, the flexibility of a PC-based image processing system is also provided to help increase efficiency in the frequent reuse of Machine designs and in design changes.

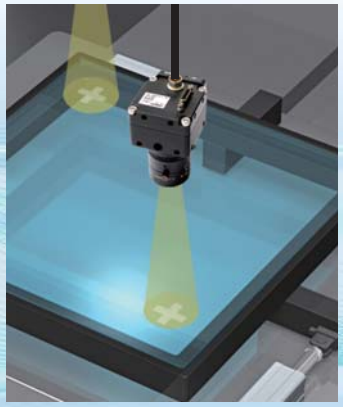
*Based on OMRON investigation in May 2013.

Machine Cycle Time

Increase Machine Speed » p4

- **High-speed Response to Execution Instructions from a PLC**
  A high-speed image bus and 4-core processing increase the speed at every step, from image input to data output.
- **Multiple camera inspections provide total judgement results**
  Calculations are easy to set for the results from four parallel tasks.
- **Quickly Outputting Measurement Results to a PLC**
  You can output results to an NJ-series Machine Automation Controller on an EtherCAT communications cycle of 500 µs.

Perform High-precision Machine Operation » p8



- **Measurements for Out-of-focus or Rotated Images**
  The new Shape Search III processing item provides superior stability.
- **No Worker-dependance in Calibration Accuracy**
  Vision master calibration is provided.

Easy to Integrate in Machines » p10

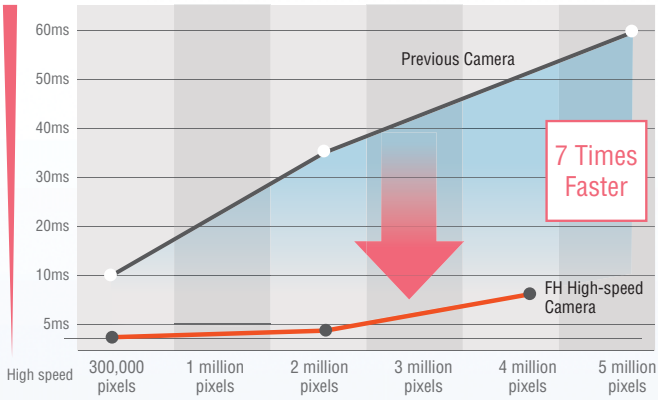
- **Shared Machine Interface**
  Microsoft® .NET is supported.
- **Display Only Required Menu Commands on the Operation Interface**
  User interface customization is supported.
- **Fast Support for Additional Measurement Needs**
  Complete processing item libraries are provided.

FH

Process Higher-resolution Images without Increasing the Machine Cycle Time

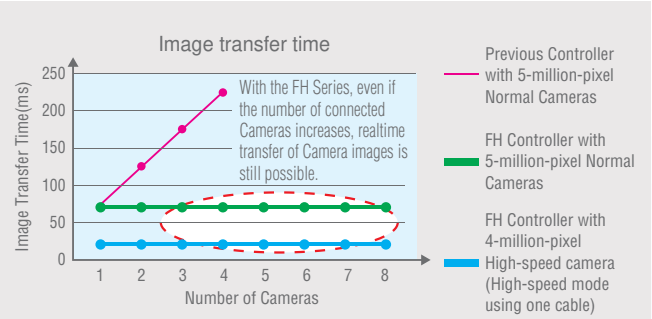
High-speed Image Input Fastest: 3.3 ms

Camera resolution, driven by higher expectations for quality, continues to increase. OMRON has greatly reduced the input time and image transfer time to provide high-speed processing to match the speed of Machine applications for high-resolution images. Even with more Cameras and higher resolution, high-speed image input will contribute to increasing throughput.



Realtime Image Transfer

High-resolution Cameras capture large amounts of data, which can make a bottleneck out of the transfer speed time in addition to the image input time bottleneck. An FH-series Controller provides a faster, multi-line image bus to enable realtime transfer of large amounts of image data for high-resolution Cameras or multiple Cameras. If high-precision measurements were sacrificed due to speed, the FH Series returns your precision without increasing cycle time.

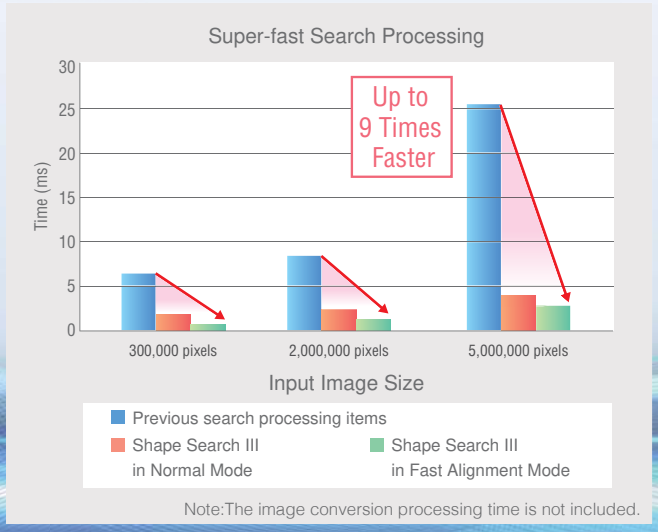


Note:The image conversion processing time is not included.

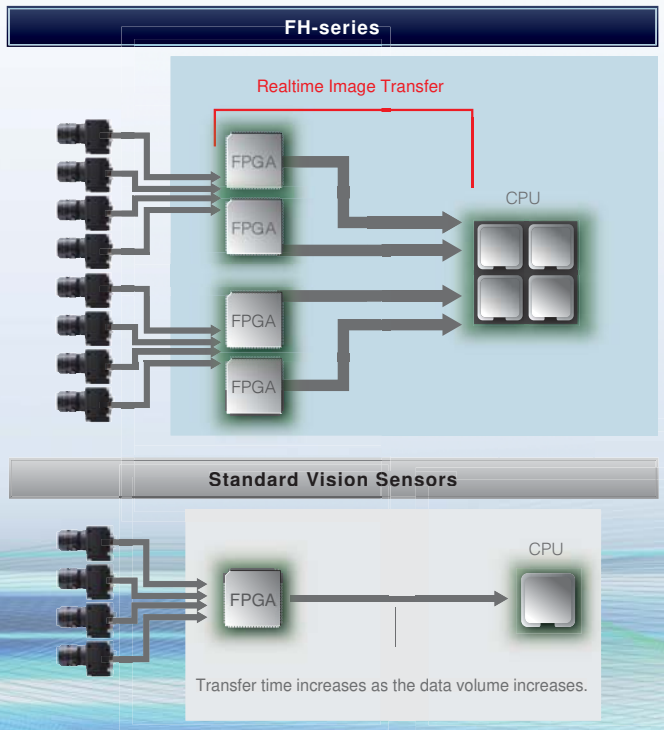
Ultra-high-speed Searching Shape Search III

Think & See

New technology makes search algorithms nine times faster than before. Even for unstable image conditions, including light interference, overlapping shapes, gloss, and incomplete images, stable searching is possible without reducing speed, resulting in a increased stability.



Note:The image conversion processing time is not included.



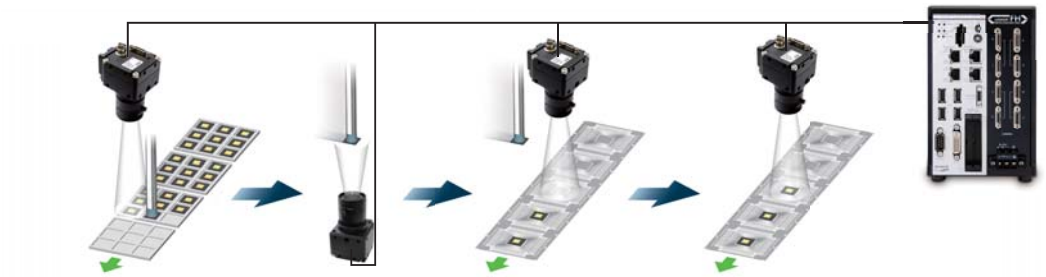
FH

Four-core CPU* to Meet High-speed Demands for Different Machines

*for high speed controllers only

Case1 Perform Calculations for Multiple Cameras without Delay

Even when the measurement results of sequential operations are dependent on the speed of the independent action, parallel processing allows high speed performance without any dwell time. The measurement results from four cores can be easily calculated on one Controller to achieve continuous interaction without any special programming.



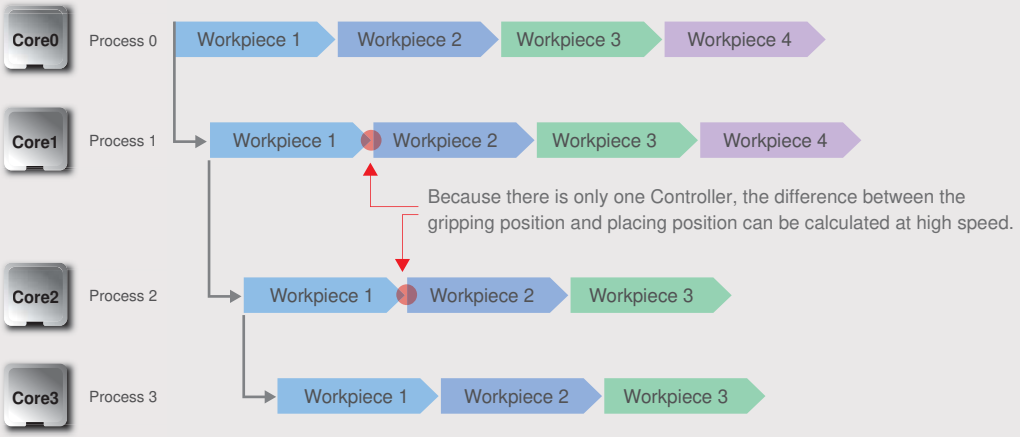
Process 0
Measuring chip position

Process 1
Measuring gripping position

Process 2
Determining placement position

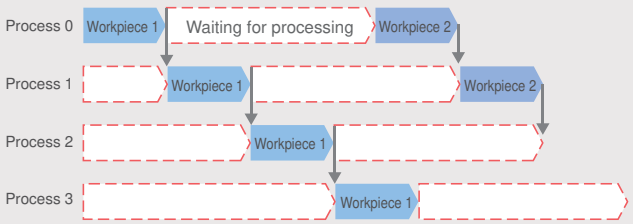
Process 3
Confirming placement position

Measuring the Next Workpiece without Waiting Time



Frequently Waiting for Processing with a Standard Vision Sensor

The lack of the ability for standard Vision Sensors to handle parallel processing creates waiting time everywhere. If the Machine cycle time cannot be increased, a Controller must be added for each process to perform parallel processing, increasing costs.



FH

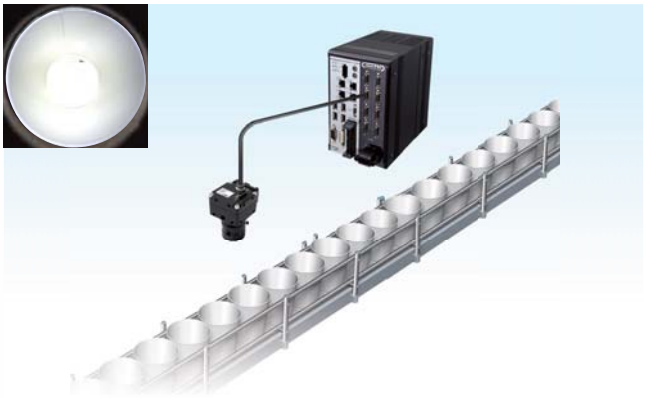
Four-core CPU* to Meet High-speed Demands for Different Machines

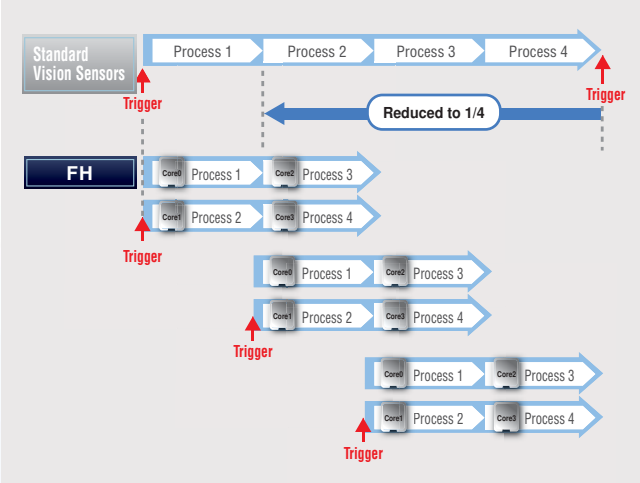
*for high speed controllers only

Case2 Machine Cycle Time Reduced to 1/4* of Previous Time

Four cores process triggers, so the trigger interval can be 1/4th* of previous models.

*In-house comparison.

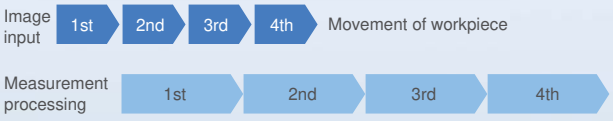




Multi-input Function | Continuous High-speed Image Capture

Higher Speed from Advanced Image Capture and Parallel Measurements

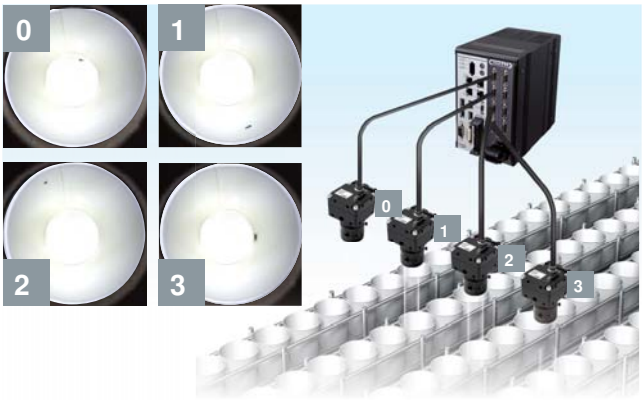
Each camera has its own image buffer for storing image data that is separate from the main memory used for measurement processing. This allows for up to 256 frames of continuous high-speed image capture even while the main memory is processing measurement data.

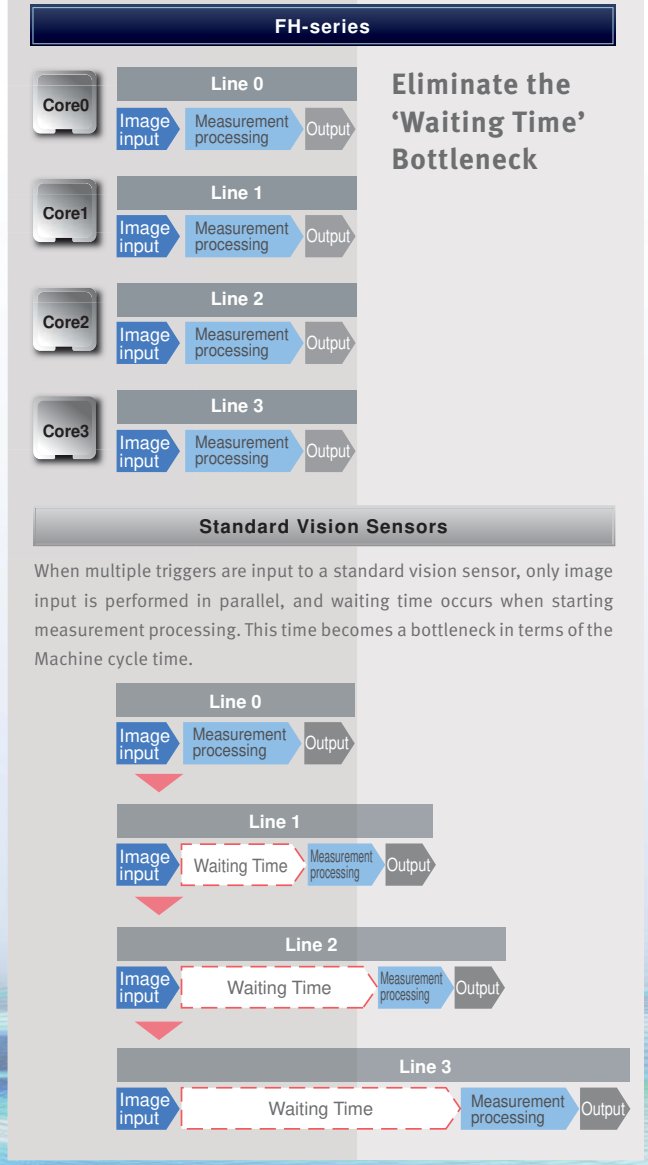


*The number of images that can be captured depends on the Controller and the Camera that is connected to it. Refer to the user's manual for details.

Case3 Process Multiple Lines in Parallel without Any Waiting Time

Four controllers are compressed into one without increasing the line cycle time. You can greatly reduce costs for processes that involve many lines.





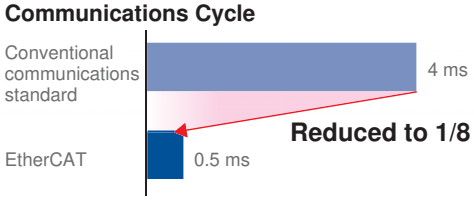
FH

Fast Output of Measurement Results to Reduce Machine Cycle Time

EtherCAT Machine Control Network

EtherCAT is a high-speed open network that is ideal for Machine control. You can use EtherCAT to connect to NJ-series Machine Automation Controllers and motion control G5-series Servomotors and Servo Drives to increase the control speed over everyday communications protocols from workpiece detection to starting axis motion.

Communications Cycle



Time from Trigger Input to Producing Measurement Results

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

■ **Features**

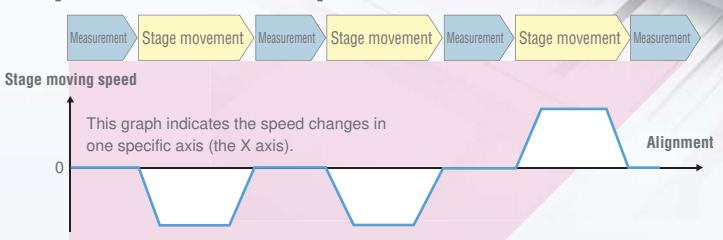
- **Communications cycle as low as 500 μs**
- **Motion control that is synchronized with the communications cycle**

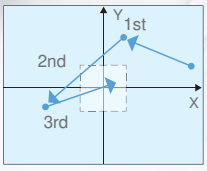
Positioning Solution That Eliminates Workpiece Dwell Time: Continuous Alignment

Patent Pending

For a Machine that requires micron precision, one alignment is not always enough to obtain an acceptable error level, but executing multiple alignments greatly increases the processing time. OMRON provides control methods that eliminate workpiece dwell time, the main cause of increased processing time. Our Sysmac Automation Platform achieves high-speed, high-precision control that continuously detects workpiece positions and successively updates the travel distance to quickly approach the target position.

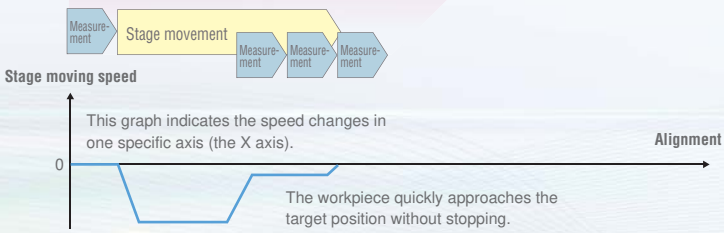
[Previous Vision Sensors]

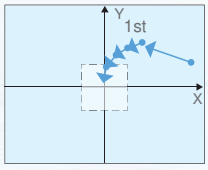




The dotted box indicates the target precision range.

[Sysmac]





The dotted box indicates the target precision range.

Note:Please ask your OMRON representative for details.

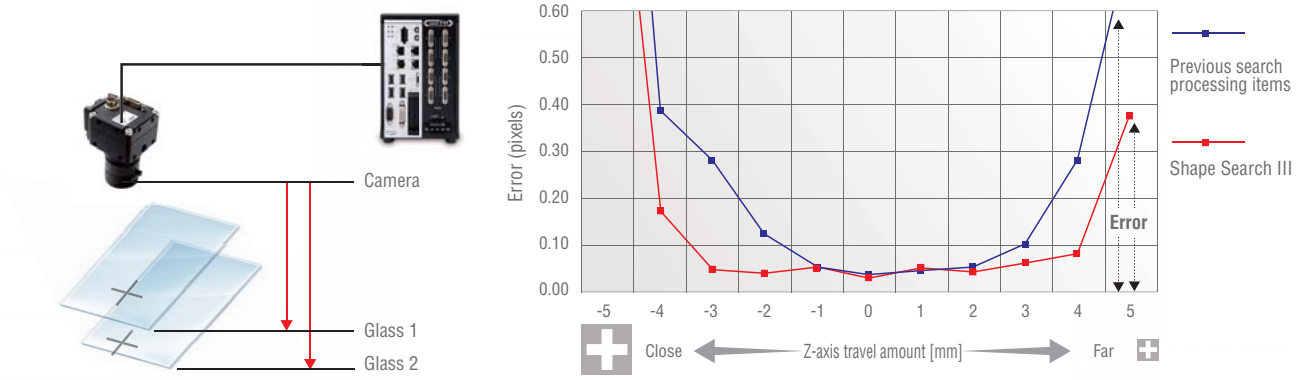
FH FZ5

The High-precision Image Processing Required for Positioning

Shape Search III

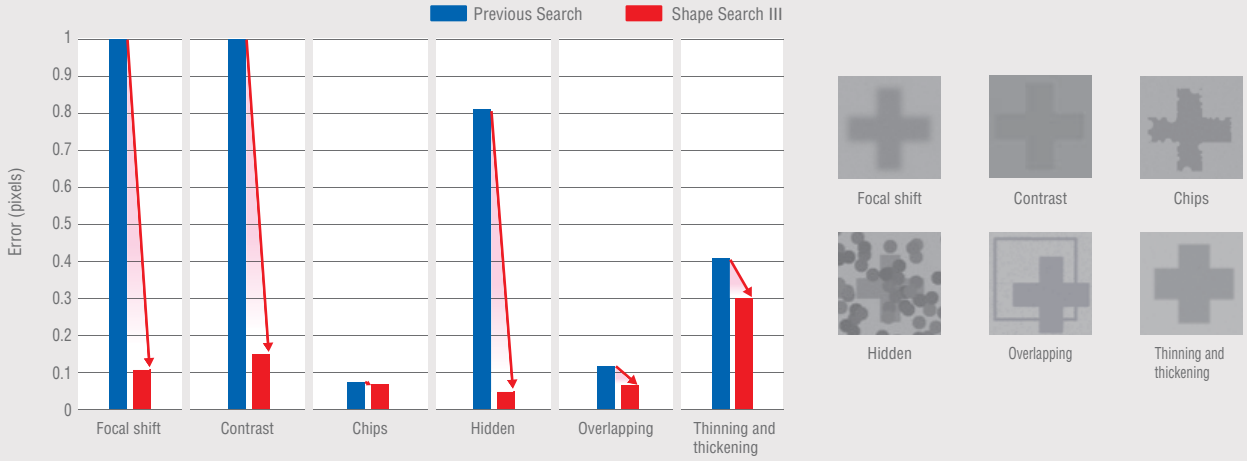
Low-error Position Detection Even with Blurry Images

Over the years, OMRON has perfected techniques to search for and match templates at high speed. From these techniques Shape Search III provides advanced robustness, which is critical on FA sites. When measuring lamination of glass or other processes where the distance to the workpiece from the Camera varies, size differences and focal shifts can occur. Even in cases like this, the new Shape Search III algorithm detects positions with limited error.



Stable Searching with Limited Error Even under Adverse Conditions

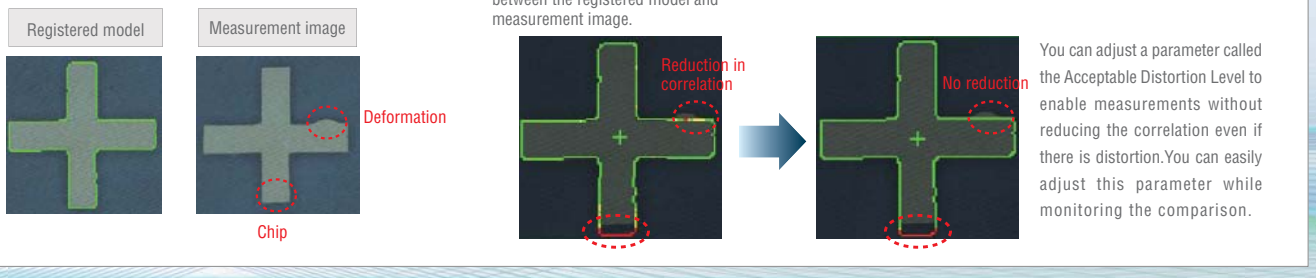
Stable searching is possible even under the following adverse conditions, which occur far too often in actual measurement applications.



Visualization of Comparisons Enables Easy Setup of High-precision Searching

Patent Pending

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. Extensive time is required to make the most of tool performance. 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 matched well for the inspection. Visualization of the comparison level, allows for parameters to be adjusted simply to obtain the best performance.



FH FZ5

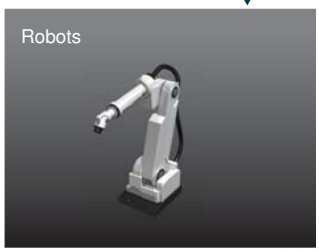
Converting Measurement Results to Output User Units

Support for the Main Stages and Robots Used for 2D Positioning

The FH Controllers contain special setup displays for the stages and robots that are commonly used on FA sites. You just fill in the settings to easily output axis travel amounts for stages and robots.

User Interface Example

Application Examples



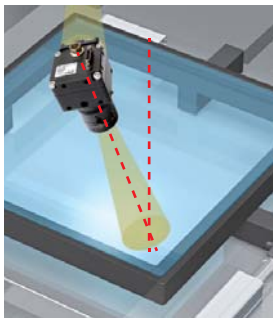
Item			
Stages	XY		
	XYθ	θ axis: Direct drive	Camera axis movement: None
			Camera axis movement: X axis
			Camera axis movement: Y axis
			Camera axis movement: XY axes
		θ axis: Linear drive	Camera axis movement: None
			Camera axis movement: X axis
			Camera axis movement: Y axis
			Camera axis movement: XY axes
	θXY	θ axis: Direct drive	Camera axis movement: None
			Camera axis movement: X axis
			Camera axis movement: Y axis
			Camera axis movement: XY axes
		θ axis: Linear drive	Camera axis movement: None
			Camera axis movement: X axis
			Camera axis movement: Y axis
			Camera axis movement: XY axes
	UVW	Direct fulcrum motion	
		Rotary fulcrum motion	
	UVWR	Direct fulcrum motion	
		Rotary fulcrum motion	
Robots	3 axes		
	4 axes	Control method: Fixed positions	
		Control method: Measured positions	

Vision Master Calibration for High-precision Positioning Even with Normal Lenses

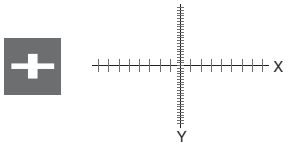
To perform high-precision positioning, the coordinate system must be accurately aligned between image processing and the stage or robot. Calibration is used to achieve this. Normally trial and error in the actual application environment is necessary, which requires experience in moving sampling points and a experience with the influence of minor tilt in the Camera installation, the influence of lens distortion, and other factors. With an FH Controller, all you need to do is set a minimum number of conditions. Movement patterns for the sampling points are automatically calculated to optimize the stage/robot axis travel ranges, imaging processing field of view, and other factors, and the required axis travel amounts are sent to the PLC. By moving the system according to the instructions, optimum sampling is achieved and the coordinate systems for image processing and the stage/robot are accurately aligned. Correction coefficients are simultaneously calculated for Camera tilt and lens distortion. If you use the calibration conversion parameters that are made with this function, you can easily achieve high-precision positioning even for normal lenses with high distortion rates.

› Page 15: Setup Flow for Vision Master Calibration

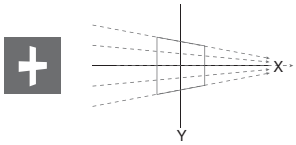
Distortion Caused by Camera angle



Coordinate System



Different X and Y magnifications cause distortion.

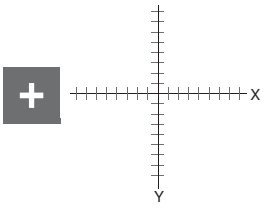


The installation can cause trapezoidal distortion. This distortion is even greater with a normal lens.

Three Types of Automatic Calibration

Affine transformation

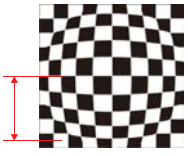
Trapezoidal distortion correction



Converted to a coordinate system with correct X and Y factors.

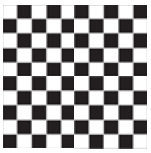
Distortion due to lens performance

The influence of distortion increases towards the edges of the field of view.



If sampling is performed away from the center of the field of view, distortion reduces the calibration accuracy.

Lens distortion correction



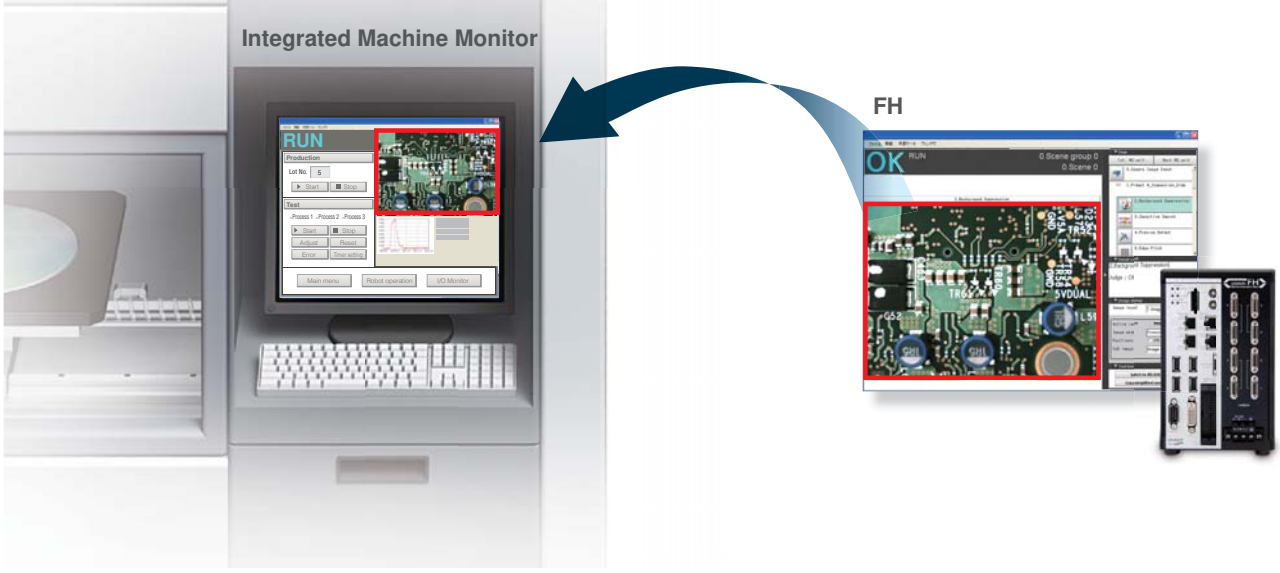
Conversion is made to the coordinate system even at the edges of the field of view.

FH FZ5

Easily Connect the Components That Configure the Machine

Easy Integration into an Machine Monitor
Support for .NET User Interface Controls

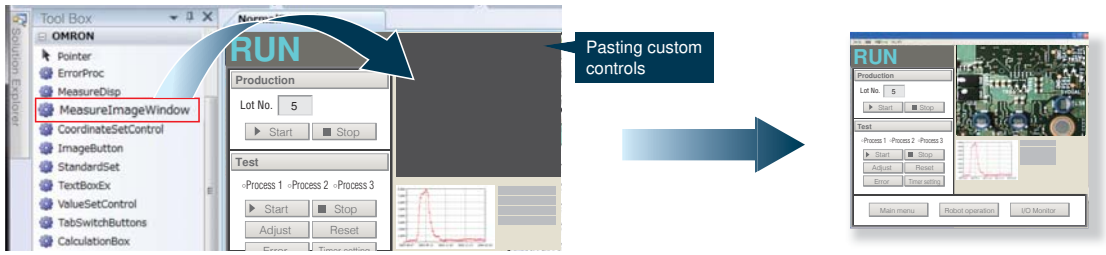
Custom .NET controls are supported so that you can easily display FH Controller measurement images and measurement results on a Machine PC.



Easy Customization

① Custom controls for FH measurement images and measurement results are laid out on Microsoft Visual Studio®.

② Instead of writing the program code from scratch to build interfaces, you can easily build the interfaces simply by pasting custom controls.



Output to HMI or High-resolution Monitor

FH

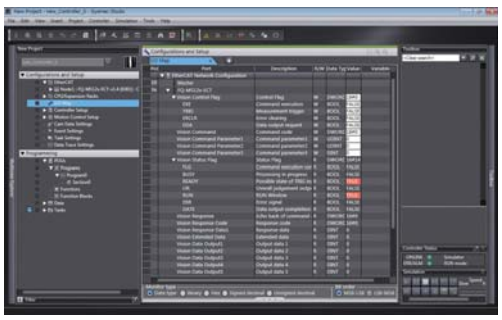
Design the Connected Components with One Software Application

Develop Machine Control Programs with One Software Application: Sysmac Studio

Use the Automation Software Sysmac Studio to set up all of the slaves connected via EtherCAT. Simulate and debug motion control, logic, drives, and sensing on an integrated platform to reduce the work required for Machine design.

Minimize Commissioning and Adjustment Work with Simulations

Integrated simulations linked to an NJ-series Machine Automation Controller lets you verify the NJ-series program logic.
You can directly edit the EtherCAT I/O map to send measurement commands to FH-series Vision Sensors.



FH FZ5

Easy Setup with Program Scalability

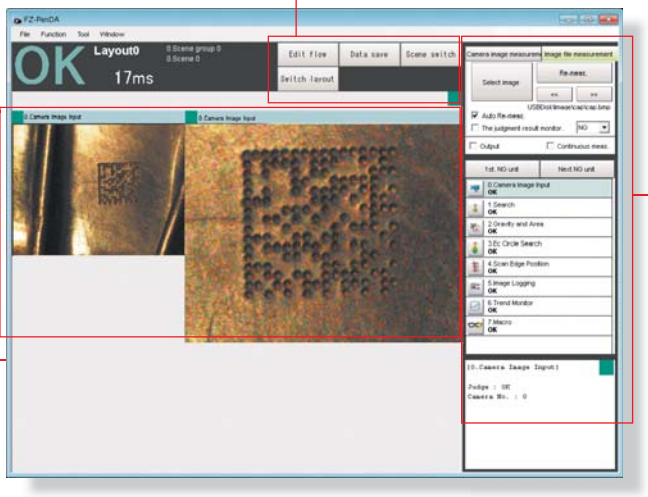
Customize Original Operation Interfaces

Show only the buttons you need

Choose from our library of buttons and position them anywhere on-screen to best support your daily operation, without 'screen clutter".

Arrange the Interface Elements Flexibly

You can flexibly change the image display composition to display an entire image, enlarge part of an image, or display images from different Cameras.



Move windows freely

Drag and drop windows where you want. You can also change the box size and delete.

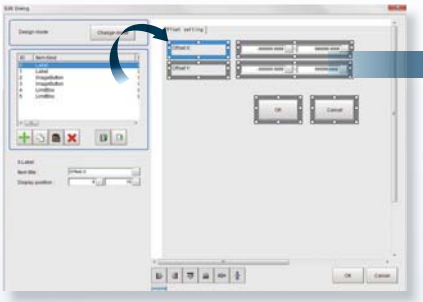
Nine screen layout

Up to 9 screens can be stored depending on the application or user classification.

Hide Unnecessary Adjustment Commands

With only menu operations on the Controller, you can customize the setting displays in dialog boxes for processing items. For example, you can set up the interface to hide any parameters from the operator.

Freely Lay Out Dialog Box Contents

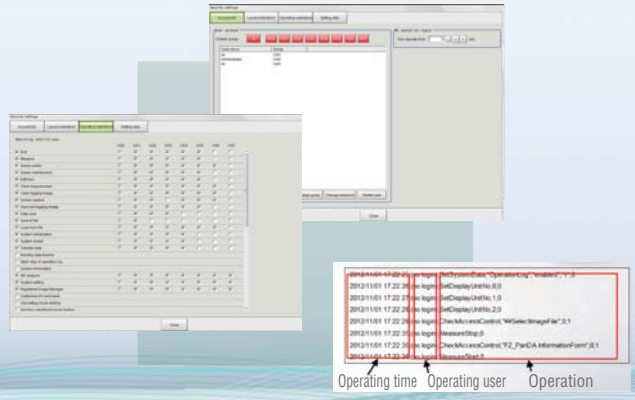


Completed

Only a parameter required for daily operation can be displayed.

Completely Different Operation Interfaces for the Designer and Operator

Accounts can be used to keep completely different operation interfaces for the designer and the operator. You can set up to eight levels of security for up to 50 items for each account. You can record operation logs for each account to enable smoothly isolating problems when troubleshooting.

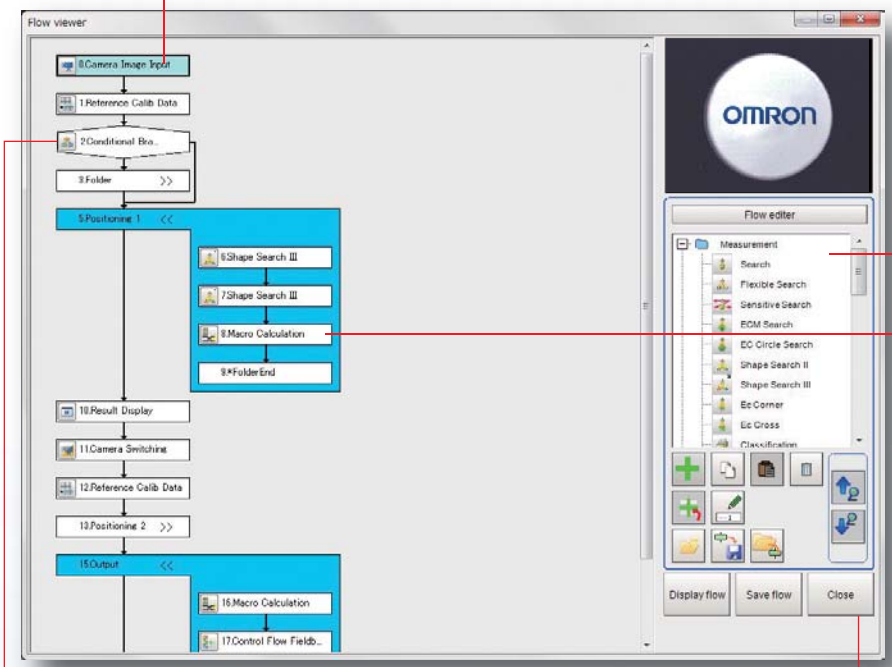


Flow Viewer Builds the Measurement Process with Flow Chart Programming

Just add any of the large variety of processing items to the measurement flow to build the basic program for image processing.
All processing items have menus for easy setup and adjustment.
Easily build the best imaging processing for each application to smoothly complete testing and adjustments without programming.

Flowchart

Just add processing items from the processing item list to visually edit the flow.



Processing Item List

Folders

You can group processing units into named folders. By managing related processing together and hiding lower levels, you can display even long measurement flows in a way that easily shows the overall flow.

Flowchart Output

You can save the flowchart as an image file.

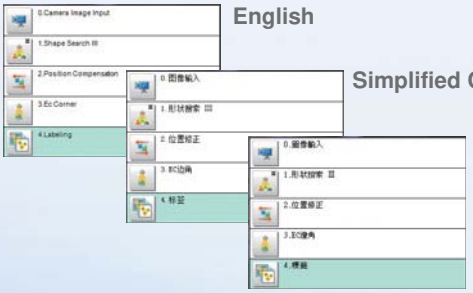
Branching

You can use conditional branching to branch according to the execution results of the previous processing units or you can use branching controls with external commands through parallel I/O, PLC Links, or no-protocol communications.

›Page 25: Controlling Flow Branching Conditions from an External Device.

Easy Multi-language Support: Change between 9 Languages

You can change display messages between nine different languages: English, Chinese (traditional or simplified), German, French, Italian, Spanish, Korean, and Japanese. You can display the best language for the user for applications in other countries.



English

Simplified Chinese

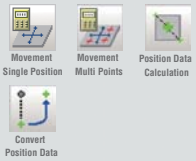
Traditional Chinese

Korean
German
French
Italian
Spanish
Japanese

FH FZ5

High-precision Alignment Library

Alignment Calculations



Four specialized types of alignment calculations are supported. These can be combined to easily execute alignments that require complex calculations on previous systems models or computers.

Movement Single Position
The axis movement that is required to match the measured position angle to the reference position angle is calculated.

Convert Position Data
The position angle after the specified axis movement is calculated.

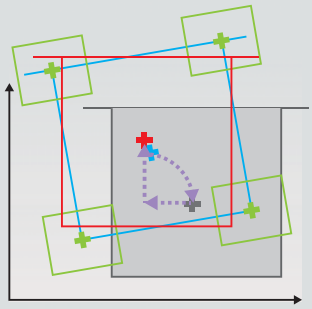
Movement Multi Points
The axis movements that are required to match the measured position angles to the corresponding reference position angles are calculated.

Position Data Calculation
The specified position angle is calculated from the measured position.

Available Alignment Methods

Position Angle Alignment

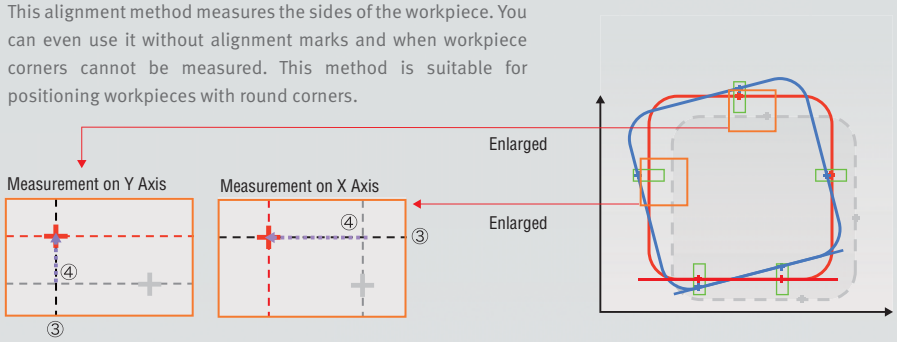
Offsets are suitable for aligning the positions of workpieces with different sizes.
Position angle alignment allows the use of offsets to achieve flexible positioning.



1. The Position Data Calculation processing item is used to calculate the position and angle to use in the axis movement based on measurement results (shown in green).
2. The rotational movement on the θ axis is calculated as the reference angle minus the measured angle.
3. The measurement position is rotated by the rotational movement for the θ axis (gray).
4. The reference positions X and Y minus the measured positions X and Y after rotation are used as the X-axis movement and Y-axis movement.

Alignment with Side Measurements

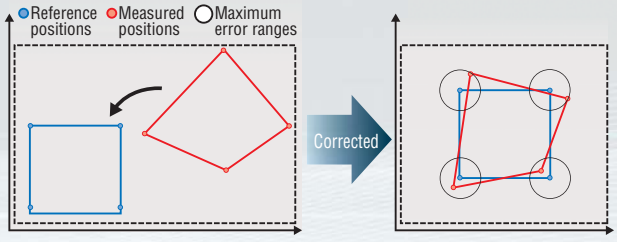
This alignment method measures the sides of the workpiece. You can even use it without alignment marks and when workpiece corners cannot be measured. This method is suitable for positioning workpieces with round corners.



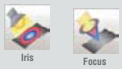
1. The angle is calculated from the side where two points are measured. The rotational movement on the θ axis is calculated as the reference angle minus the measured angle.
2. The measurement position is rotated by the rotational movement for the θ axis (gray).
3. A straight line that goes through the positions calculated in step 2 and that has the same direction as the reference angle (for the X axis) is calculated. (The direction on the Y axis is the reference angle plus 90°.)
4. The intersecting point between the straight line calculated in step 3 and the same axis as the measure direction that goes through the reference position is calculated.
5. The difference between the reference point and the intersecting point calculated in step 4 is the movement in the measurement direction. The above calculations are performed for each point and the average values are used as the X-axis movement and Y-axis movement.

Corresponding Point Alignment

The axis movements from the measured positions to the reference positions are calculated based on relational position information. This method is suitable for aligning all points within certain distances so that small deviations in the distances do not result in continuity failures, such as they can when aligning electronic substrates.

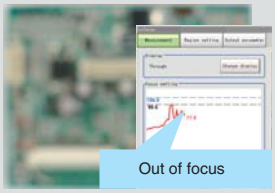


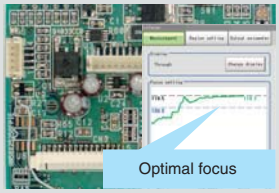
Setup Aids



Optimum Focus and Aperture Settings

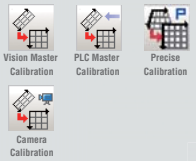
Until now, focus and brightness settings were adjusted according to experience and intuition. But now they can be evaluated numerically and visually on graphs. This allows quick verification of optimum focus and aperture settings to eliminate inconsistencies in settings caused by worker differences so that you can achieve even higher levels of measurement accuracy.





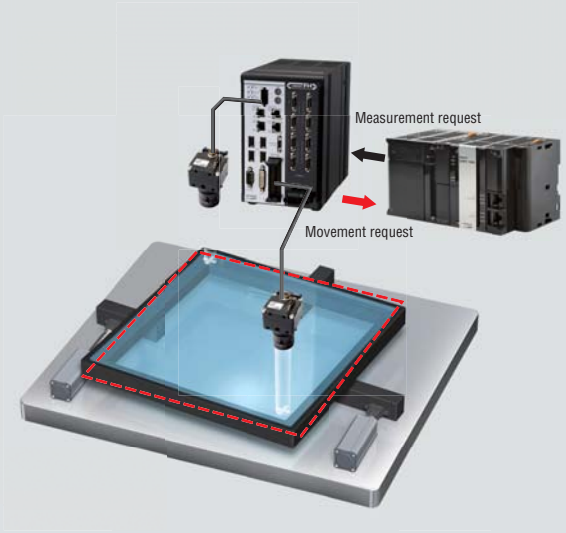
- Camera installation and setup are easy.
- Errors can be generated when the focus or aperture changes.
- You can determine the numerical values for the focus and aperture for the master workpiece so that essentially anyone can reproduce the same conditions.

Calibration



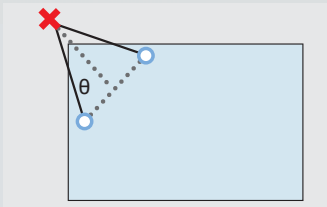
Vision Master Calibration

With Vision Master Calibration, the FH-series Vision System automatically calculates the movement patterns for sampling points to optimize the stage/robot axis travel ranges, imaging processing field of view, and other factors, and the required axis movements are sent to the PLC. By moving the system accordingly, optimum sampling is achieved and the coordinate systems for image processing and the stage/robot are accurately aligned. Correction coefficients are simultaneously calculated for Camera tilt and lens distortion. If you use the calibration conversion parameters that are made with this function, you can easily achieve high-precision positioning even for normal lenses with high distortion rates.



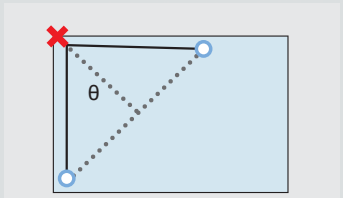
Precise Rotational Position Estimation

Previous Methods



The sampling points are picked at random, so the rotational range is not sufficient.

FH Series



The FH-series Vision System automatically extracts sampling points in the field of view to ensure a large rotational angle in the θ direction on the stage and sends movement requests to the PLC. Parallel movement and rotational movement are combined to achieve the optimum calculations from information on many rotational sampling points.

Automatically Calculated Calibration Data

Both affine transformation parameters and distortion correction parameters are calculated at the same time.

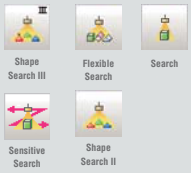
Affine Transformation	Distortion Correction
Camera and stage magnification	Distortion Correction
Stage axis perpendicularity	Lens distortion correction
Camera and stage rotation	

FH FZ5

Inspection and Measurement Process Library

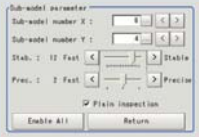
Search

A complete array of search tools are provided to meet an array of requirements.
Minute difference detection is supported without false detection.



Sensitive Search

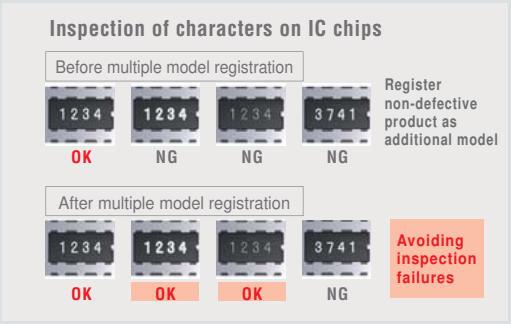
This allows the recognition of very subtle differences that cannot be detected through ordinary search processes, by dividing the registered model image into several regions and carefully matching them. Delicate threshold setting is not required saving time in the registration process.



Different conditions for dividing the model image can be set.

Flexible Search

When inspecting workpieces with some variations in shape, these characteristics are sometimes recognized erroneously as defects. Flexible Search ensures accurate searches regardless of some variations in print quality or shape, by registering several images of non-defective products as models. It helps you decrease your inspection failure rate by rejecting defective products only.

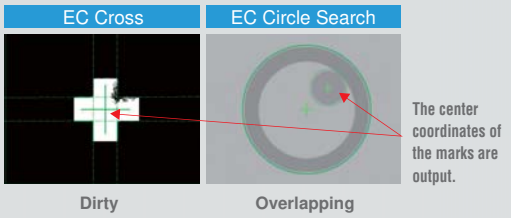


EC

These processing items use EC (edge codes) for superior performance even under poor conditions.

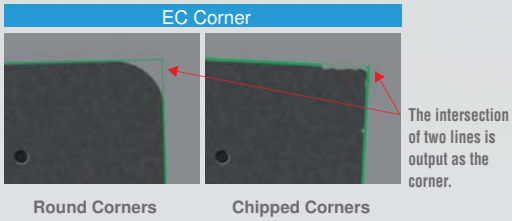
EC Cross, EC Circle Search

The alignment marks commonly used in manufacturing of LCD panels and PCBs can be precisely detected. Accurate detection is possible even if the marks are dirty or partially hidden. The output coordinates give the center of the cross or circle. There is no need to set the output coordinates, so inconsistent precision caused by worker differences is eliminated.



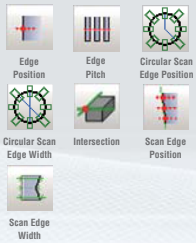
EC Corner

Two straight lines are detected to output the point of intersection between them as the corner. Stable detection is possible even for rounded corners or when the edge is broken. This is ideal for glass plates, LCDs and other objects on which alignment marks cannot be printed.



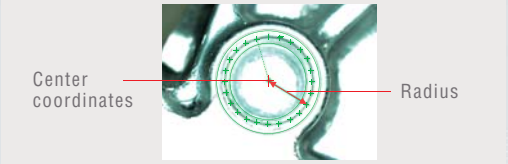
Edges

These processing items let you measure positions, widths, and the number of edges from edge extraction.



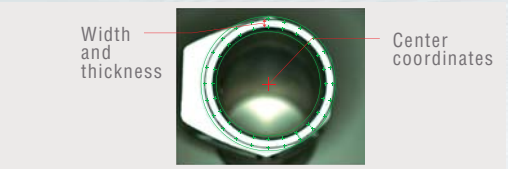
Circular Scan Edge Position

You can measure the center coordinates, diameter, and radius of a round workpiece without performing any calculations simply by drawing one measurement region.

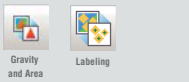


Circular Scan Edge Width

You can measure the center coordinates, width, and thickness of a ring-shaped workpiece without requiring additional calculation.



Areas



These processing items let you measure sizes, center of gravity positions, and the number of objects.

Defects

These processing items are ideal for external appearance inspections for damage, foreign matter, etc.

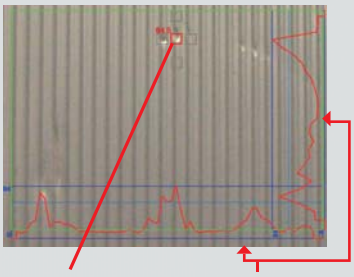
Inspections of Scratches and Dirt

Subtle scratches and dirt can be detected with more fine-tuned conditions compared to conventional inspections. Since you can clearly distinguish defects to be detected from the background, the failure detection rate can be decreased. Profiles of defects and comparison elements can be displayed on the screen in real time. You can adjust by confirming the settings and detection results on the image. Fine parameters for defect detection allow fine settings at the pixel level.

Fine Matching / Defect

With our Real Color Sensing technology, FH-series Vision System can accurately recognize and process subtle variations in color. This feature helps you detect unpredictable scratches and dirt. High precision defect inspections are possible by using both Fine Matching and Defect flexibly according to the background of each image.

Scratch detection profile displayed on the screen Patent Pending



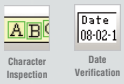
Comparison element display
Intervals and sizes of comparing elements are displayed.

Profile display
Defects of each direction for detection are displayed as wave profiles.

Fine Matching
It is useful for detecting scratches, chipped edges or subtle dirt in complex backgrounds.

Defect
It is useful for detecting scratches and dirt in plain backgrounds.

Character Inspections/OCR



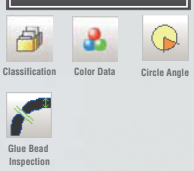
These processing items provide the functions that are required for character inspections of dates, lot numbers, etc.

Codes

These processing items can read bar codes and 2D codes from Camera images.

Printing quality evaluation based on ISO standards is supported.
Applicable standards: ISO/IEC 15415 (The data matrix standard in ECC 200 is supported) and ISO/IEC 15416
You can output judgements of the code quality according the the printing quality standards that are defined in the standard.

Special Processing



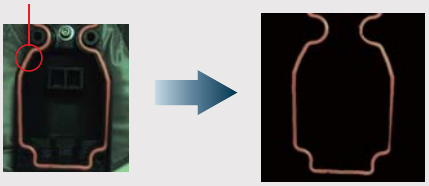
Custom functions are also provided in these convenient processing items.

Automatic Extraction of Complex Measurement Region Shapes

Measurement regions are no longer restricted to combinations of rectangles and circles. You can freely set the shape according to the outline of the workpiece. It's easy to set the measurement regions. Just specify one portion of the region to extract, and a continuous region with a similar color is extracted automatically. You can set precise regions for measurements even for scratch inspections or labeling on workpieces with complex shapes. This method to set measurement regions can be used for Gravity and Area, Color Data, Labeling, Defect, and Precise Defect processing items.

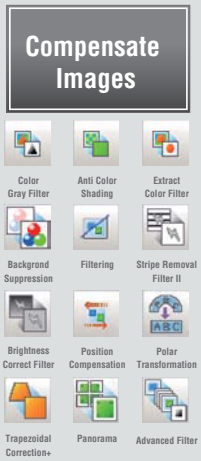
Specify part of the area to extract as the measurement region.

The region with a similar color to the specified area is extracted automatically.



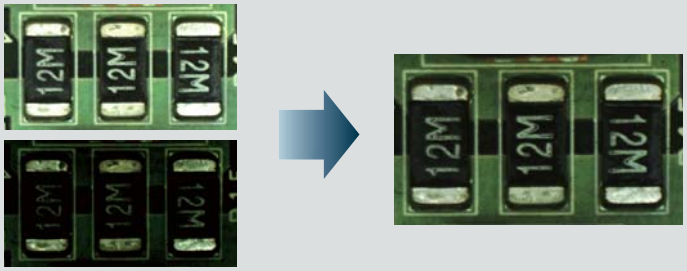
FH FZ5

Image Filter Library



Calculations between Images

You can perform arithmetic operations, bit operations, averaging, or maximum/minimum operations between two images.



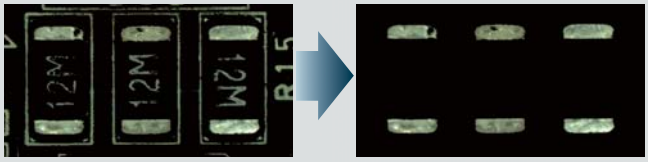
Example: You can get the average of two images that were taken under different imaging conditions.

Labeling Filter

This filter uses label processing to output an extracted image that contains only the specified characteristic labels.

External Appearance of Electronic Components

Previous Vision Sensors | Labeling Filter Image



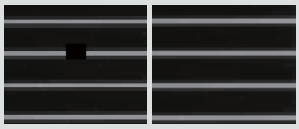
Extraction is possible only with color or brightness information.

Extraction of labels with specified areas or shapes is possible.

Custom Filter

You can set the mask coefficients as required for these filters. The mask size can be up to 21 × 21. You can more flexibly set image smoothing, edge extractions, dilation, and erosion.

Example:
Dilation/Erosion in One Direction



Before Filtering | After Filtering

Filter Coefficients

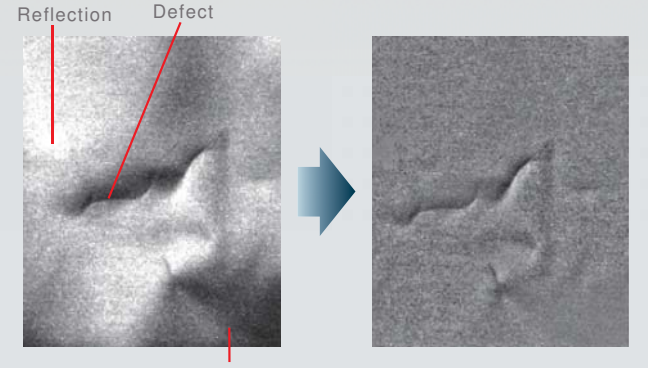
You can set the filter coefficients as required.

Brightness Correct Filter

These filter cut out uneven lighting and changes in brightness caused by workpiece surface irregularities to make characteristic features stand out clearly.

External Appearance of Battery Pack

Before Filtering | Image after Brightness Correct Filter



The wavy inconsistencies are judged as defects.

Uneven areas are removed so that only the defect appears in the inspection.

Stripe Removal Filter II

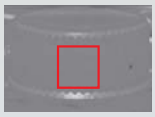
The stripped pattern is filtered out so that only required aspects are shown clearly.Vertical, horizontal, and diagonal stripes can be removed.

External Appearance of Bottle Cap

Unfiltered Image | Image after Stripe Removal Filter

Inspection is possible only in the small portion without stripes.

Due to the stripes, inspection is possible only in the very center of the image. To inspect the entire surface, the cap must be rotated and many images must be taken.

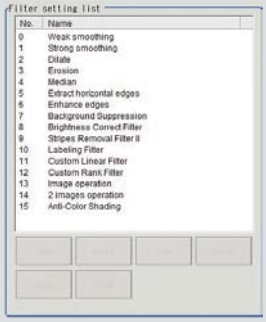


Even the defect at the edge of the image can be detected after stripe removal.

Because inspection is possible to the sides of the image, the number of images that is required to inspect the entire cap is greatly reduced.

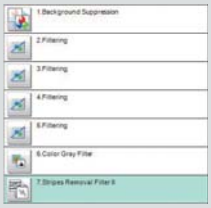
Advanced Filter

The image filter library has been condensed into one processing item. This allows you to easily set complex filtering as required for external inspections.



You set up to 16 of the 24 different filters.

Previous Vision Sensors



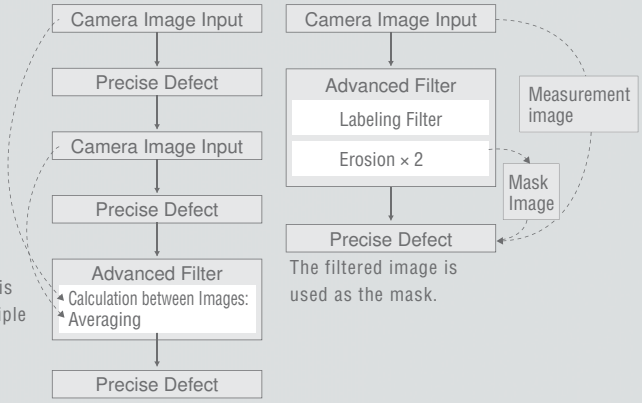
Units were added for each filter.

Advanced Filter

Many different filter functions can be set with just one processing unit.

The average image is obtained from multiple images.

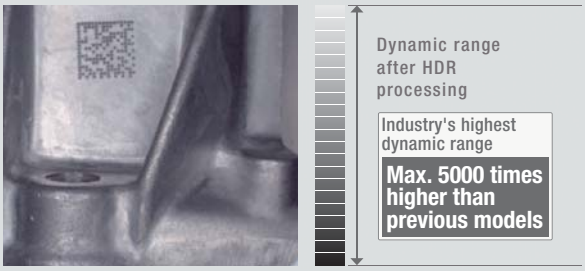
Application Flow Example



The filtered image is used as the mask.

High Dynamic Range to Easily Combine Images

To simply combine images, you must set the imaging conditions and create the images that you want to obtain. With OMRON's high dynamic range function, all you need to do is to set the upper and lower brightness images on a graph of the image brightness distribution to make the adjustments.



What is Real Color Sensing?

Patented

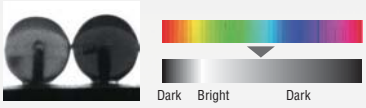
In order to secure stable measurements in different inspection environments, FH Series feature Omron's proprietary Real Color Sensing processing, in addition to the conventional color image processing.

Edges are detected reliably even when the contrast between the background and subject is low.

Color Segmentation Processing

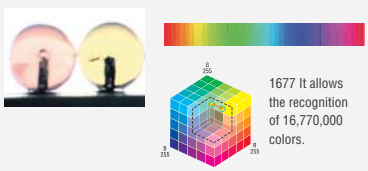
Color images taken by the camera are processed after being converted into black and white pixels. The color extracted is represented as white, and the other colors as black. Based on minimum information, high speed processing is possible. Since color data is limited only to brightness, however, it takes a long time to make optical adjustments for extracting color features.

Color Image Processing



Color images are converted into 256 levels of black-and-white brightness and the contrasts of specific colors is enhanced. More precise, stable results can be produced compared to color segmentation. However, this method has difficulty in capturing subtle variations in color because all colors are converted into black-and-white brightness levels. Therefore, it is difficult to detect subtle changes in images with low contrast.

Real Color Sensing



Different colors are represented as different positions in the 3D RGB space. Subtle variations in color can be recognized by representing them as distances between different color pixels comprising this space. Thus, scratches and dir t can be detected accurately even in images with low contrast.

Previous image processing

OMRON FH series

FH FZ5

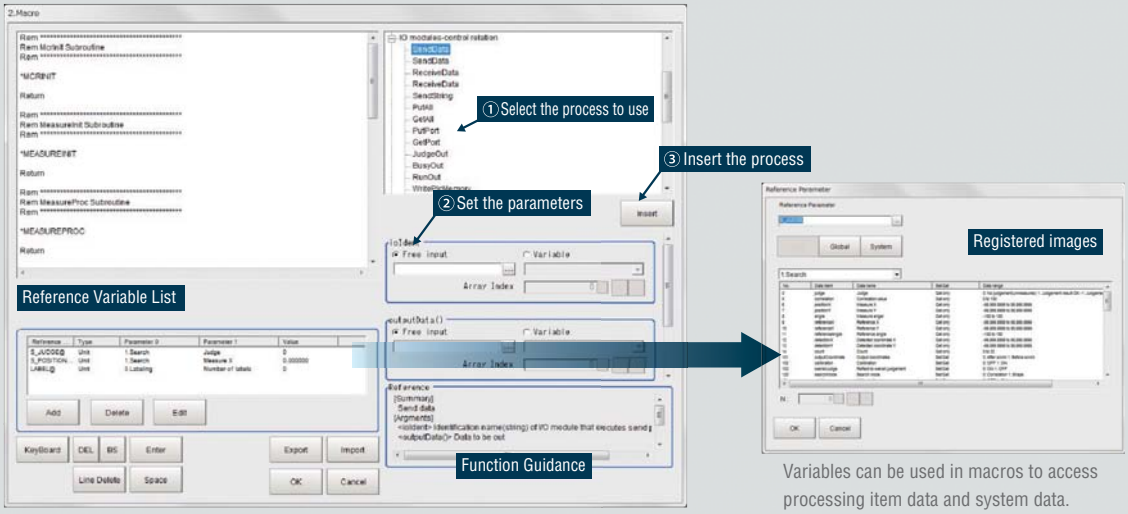
Utility Library

Macro/ Macro Calculation

Macro Macro Calculation

Macro

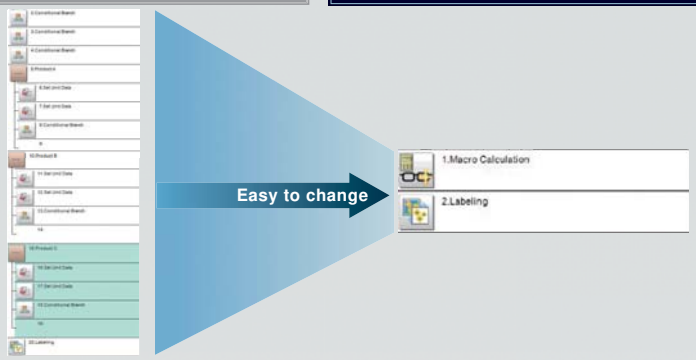
Macros let you easily achieve flow control that normally requires complex programming from the user interface.
Improvements to the setup from the user interface provides ease of selection and modification of the programming process.



Variables can be used in macros to access processing item data and system data.

For example, it would previously have been long and complicated to change the set parameters of a processing item for each product model. With a Macro Calculation processing item, the flow is shorter and setting changes are easy to achieve.

Previous Vision Sensors | **FH/FZ5-series Macros**

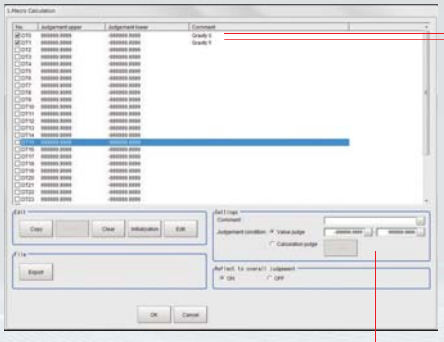


Just enter the values of the variables to update the parameters.

```
' Branching for each product model
Select INDEX@
Case 0
  ExtCond0@ = 1      ' Area
  ExtParam0@ = 0
  ExtParam1@ = 10000
Case 1
  ExtCond0@ = 4      ' Elliptic major axis
  ExtParam0@ = 0
  ExtParam1@ = 100
Case 2
  ExtCond0@ = 7      ' Rectangle width
  ExtParam0@ = 0
  ExtParam1@ = 200
End Select
```

Macro Calculation

You can create expressions that require multiple lines in one processing item.
In addition to making calculations, you can also make judgements based on the calculation results of the processing items.



Judgement condition for calculation results

Example 1: Multiline Expression

```
DET# = A0@ * B1@ - A1@ * B0@          ' Calculates intersection
CX# = (B0@ * C1@ - B1@ * C0@) / DET#  ' X coordinate of intersection
CY# = (A1@ * C0@ - A0@ * C1@) / DET#  ' Y coordinate of intersection
```

Example 2: Calculations to Drive Branching or Loops

```
Max# = 0
For i& = 0 To 10
  If (Max # < value#(I&)) Then
    Max# = value#(I&)
  EndIf
Next
RESULTDATA#(0) = Max#
```

User Data

Ideal for Managing Inspection Standards and for Statistical Analysis of Inspection Results

Shared data used within scene groups as constants and variables in the measurement flow can be set as user data. With the shared data, you can use the measurement flow in many new ways, including standard values, conditional branching flags, and counters.

Application Example 1 Unified Management of Judgment Values

When setting up complex scene data, such as the data required for inspection of many different models, you can unify management of important judgment values for inspections to easily manage and then adjust them later. Also, if you isolate in advance the settings that are critical to inspection performance (and normally known only to the designer) as user data, the locations that require adjustment can be clarified so that the user can more easily make adjustments.

Adjustment of All User Data in a List

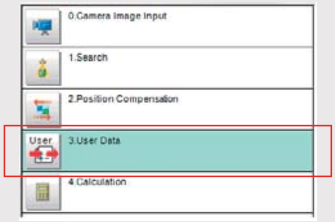
Application Example 2 Statistical Information on Productivity Indices

User data can be used as variables that can be read and written in the inspection flow. It can also be used for counters for the number of inspected workpieces or the number of NG workpieces. Math functions can be use to calculate failure rates and display them onscreen so that productivity can be checked at any time.

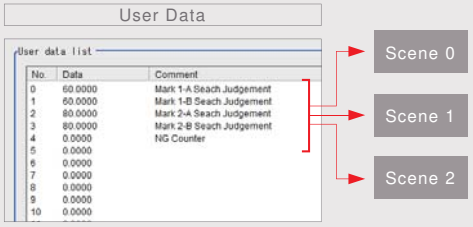
Indices Displayed Onscreen with the Result Display Function

Application Method

All you have to do is set a User Data processing item in the inspection flow.



The data that is set as user data is used as shared constants and variables in different scenes.



Trend Monitor

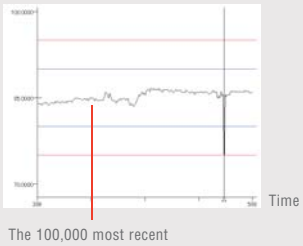
Results Analysis with Trend Monitors

You can graph trends in measurement values to output warnings before failures occur. This helps provide feedback to earlier processes to prevent NGs in advance and to analyze the causes of NGs.

Prevent High Defect Rates in Advance

You can set the warning range to output warnings before NGs become frequent to provide feedback to earlier processes.

Cause Analysis when Defects Occur



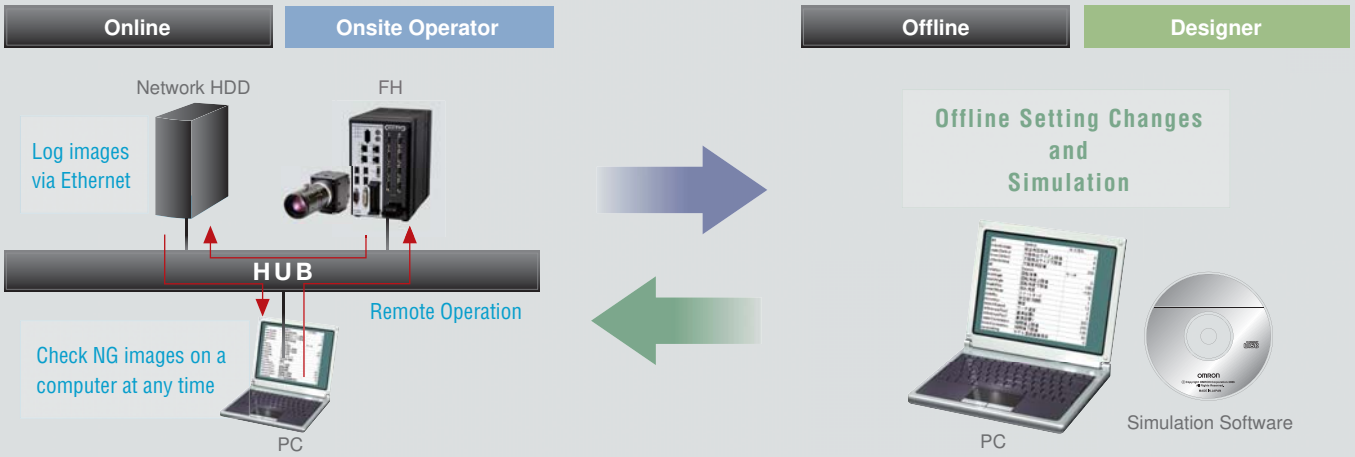
The 100,000 most recent measurement values are stored.

FH FZ5

Operation and Analysis

Optimum Operation both Online and Offline

Connections to a network hard disk drive or network computer enables a wide range of operation possibilities.
You can log measurement images longterm, or you can perform verifications and adjustments on a computer without stopping the FH-series Vision System.



Ask your OMRON representative about obtaining simulation software.

New Operation Schemes through Network Applications

1 Daily Monitoring

You can store NG image in a network HDD to check the NG images every day on a computer without reducing measurement performance. Or you can start simulation software on your computer to remeasure and analyze NG images.

2 Periodic Adjustments and Inspection Adjustments

The non-stop adjustment function lets you change Controller settings without stopping the production line. With remote operation, you can perform operations without going onsite.

3 Handling Unstable Inspections or Measurement Failure

The user sends the programmer the image data, setting data, and parameter settings. The programmer can use the simulation software on the computer to check the process and change the settings with the simulation software. The altered scene data can be returned to the user and loaded to the system to complete the adjustments. This enables modifications without requiring the programmer to be on site.

4 Adding Inspections or Making Changes for New Models

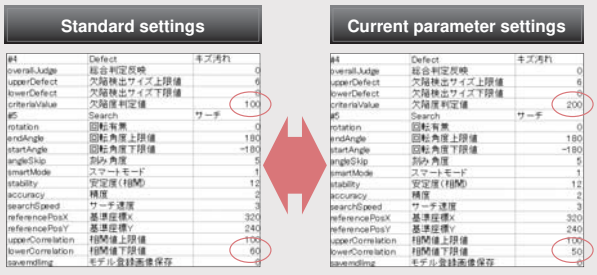
Based on the images to be inspected, settings are made on the simulation software on a PC running simulation software. The scene data is sent to the user to easily add the new settings.

Ideal for History Management

CSV files allow you to easily understand the parameter settings. Also, you can easily change any of the settings.

1 Comparisons

If you save the basic settings, you can easily extract any differences in settings caused by changes made incorrectly.

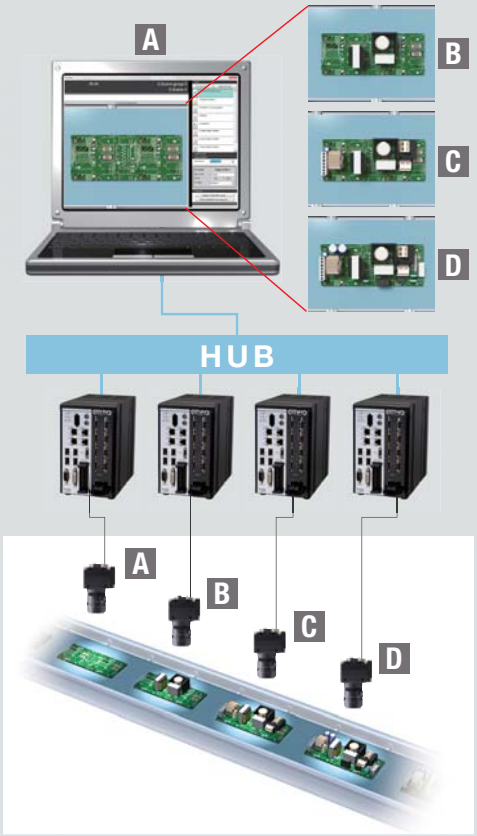


2 Remote Adjustment

You can attach CSV files to email and upload settings to the FH-series Vision System to easily make adjustments from remote locations when problems occur.

Remote Operation Centralizes Monitoring and Adjustment of multiple controllers

You can check the status and adjust the settings of multiple units on one computer.
This enables efficient adjustment of Camera images when commissioning a system and application of test adjustment results.



Application Example 1 Operating Several FH from One Location

1. When commissioning an installation from one location you can adjust the camera for all the controllers located along the line. There's no need to go to and from each Controllers, and you can compare Camera images under various conditions to adjust them.
2. If setting changes are necessary to add a new model, you can do all the required work at the same time without making trips to all of the Controllers.
3. You can easily balance the thresholds between Controllers when increasing inspection stability through testing at the production line.

Application Example 2 Display images from multiple controllers

1. Space savings with a single monitor installation.
2. Single location programming for multiple controllers facilitates adjustments and reduces programmer movement.

Note: Ask your OMRON representative about obtaining simulation software for a computer.

Saving and Using Measurement Images

Save Images Directly in JPEG or BMP Format

You can easily view images on a computer or attach them to reports. With BMP files, you can measure them again on the Vision controller.

Restricting the Areas of Saved Images

By restricting the areas that are saved, file sizes are smaller so you can continue to log even more files.

Save Both Filtered and Unfiltered Images

You can save both the filtered images that were actually measured and the raw images taken directly from the Camera. You can therefore tell if an NG was caused by the input image or by the filter settings.

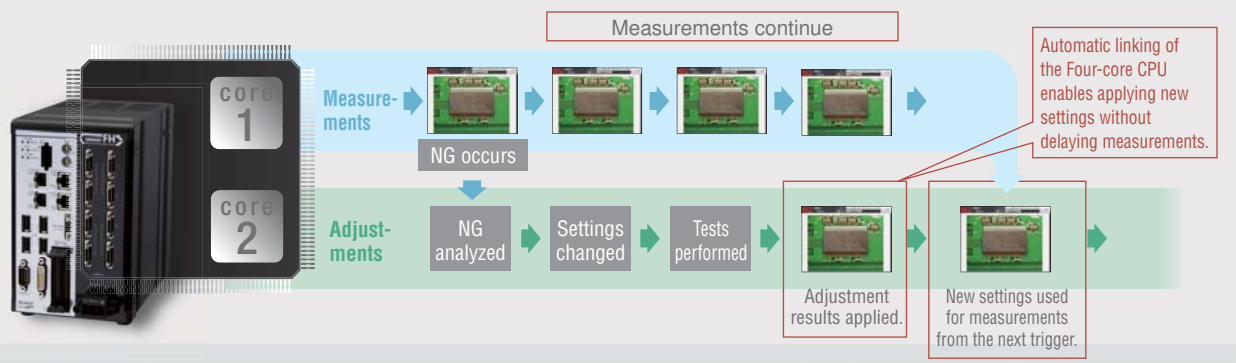
FH

Utilities That Don't Stop Your Machines

Making Confirmations and Adjustments without Stopping Production

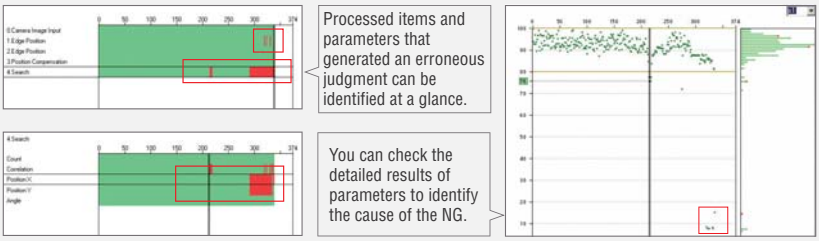
Non-stop adjustment

Parallel processing on Four-core CPU not only speeds up measurements, but it enables parallel processing of measurements and adjustments. Automatic distributed processing means that measurements are not delayed when adjustments are applied.



Doubly effective when combined with the Non-stop adjustment mode NG analyzer

You can display in a structured manner a graph showing the results measured at once on logging images. This lets you identify the cause of a given NG much more quickly. You can also measure all images again after changing a given setting, to check the reliability of the new setting. Adjustment and troubleshooting has never been so quick, simple and reliable.

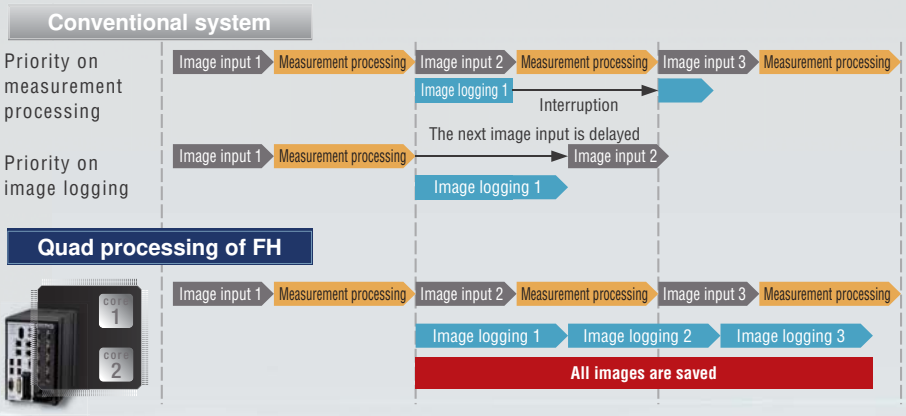


Save All Images Even during Measurements

High speed logging

The Four-core CPU can also perform parallel processing of measurements and image logging, with high-speed connection to a high-capacity hard disk (2terabytes). Trend analysis of saved images, quickly isolates NG's and facilitates countermeasures.

*1 All images can be saved under the following conditions:
- 300,000-pixel camera x 1 unit . Measurement time: 33 ms
- Images can be saved continuously for approx. one week when a 2-terabyte HDD is used (based on 8 hours of operation a day).



Issues

Since logging was not possible during measurement, the user had to choose either measurement or logging. Accordingly, not all images could be saved or image input triggers had to be delayed depending on the measurement trigger intervals.

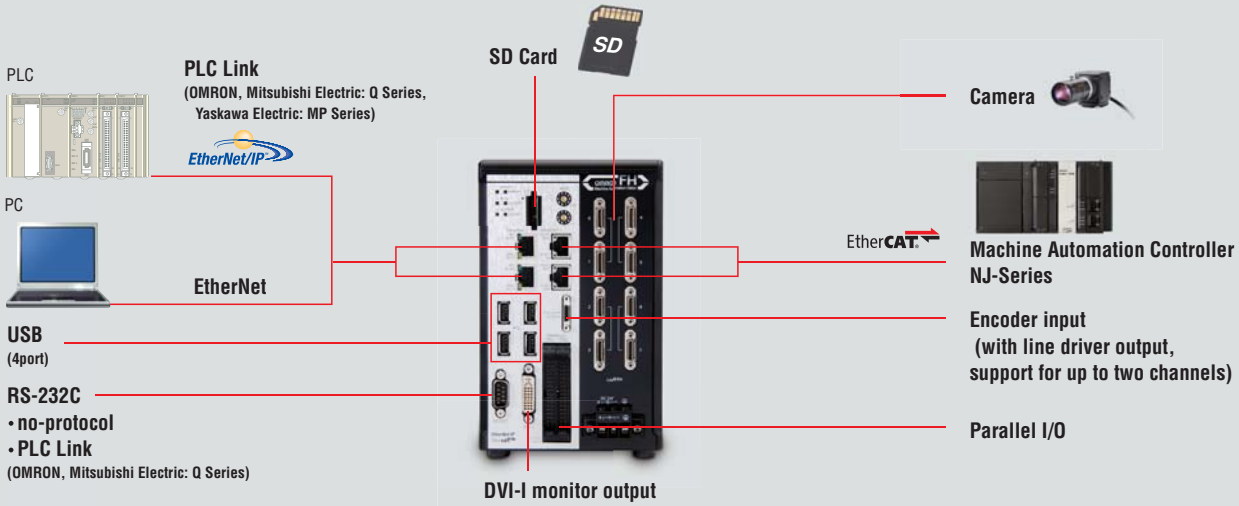
Resolution

Measurement and image logging are processed completely in parallel. As a result, you can save all images.

Seamless Communications with Peripheral Devices

Complete Interfaces for All Connected Devices

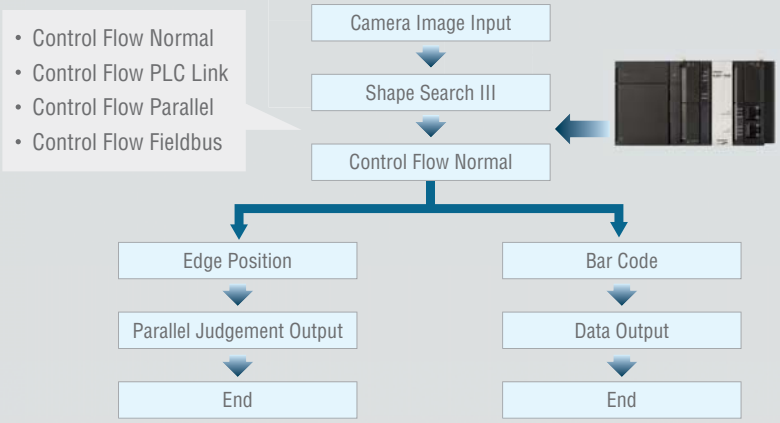
FH



Controlling Flow Branching Conditions from an External Device

FH FZ5

You can control branching by using commands and signal inputs from external devices as branching conditions for the measurement flow.



Customized Communications Commands

FH FZ5

You can shorten the communications time by using commands for complex controls or by shortening multiple commands. You can also define how the Vision System responds to the communications commands. For example, you can define one command to change both a scene and perform measurements.