

Smart Camera for Machine Vision

FHV7 Series

Bring advanced product inspection within reach

A powerful, all-in-one camera system with advanced image processing functions



The functionality and speed that your production site demands packed in an all-in-one device

The FHV7 Smart Camera is an all-in-one camera with the capabilities of the high performance FH Series vision system packed in a compact and configurable package that is easy to deploy.

It provides the most popular inspection and measurement functions of the FH Series, while allowing for comprehensive product quality inspection in many applications where inspection was previously not practical due to restrictions in durability, space, and deployment costs.

Integrated controller structure

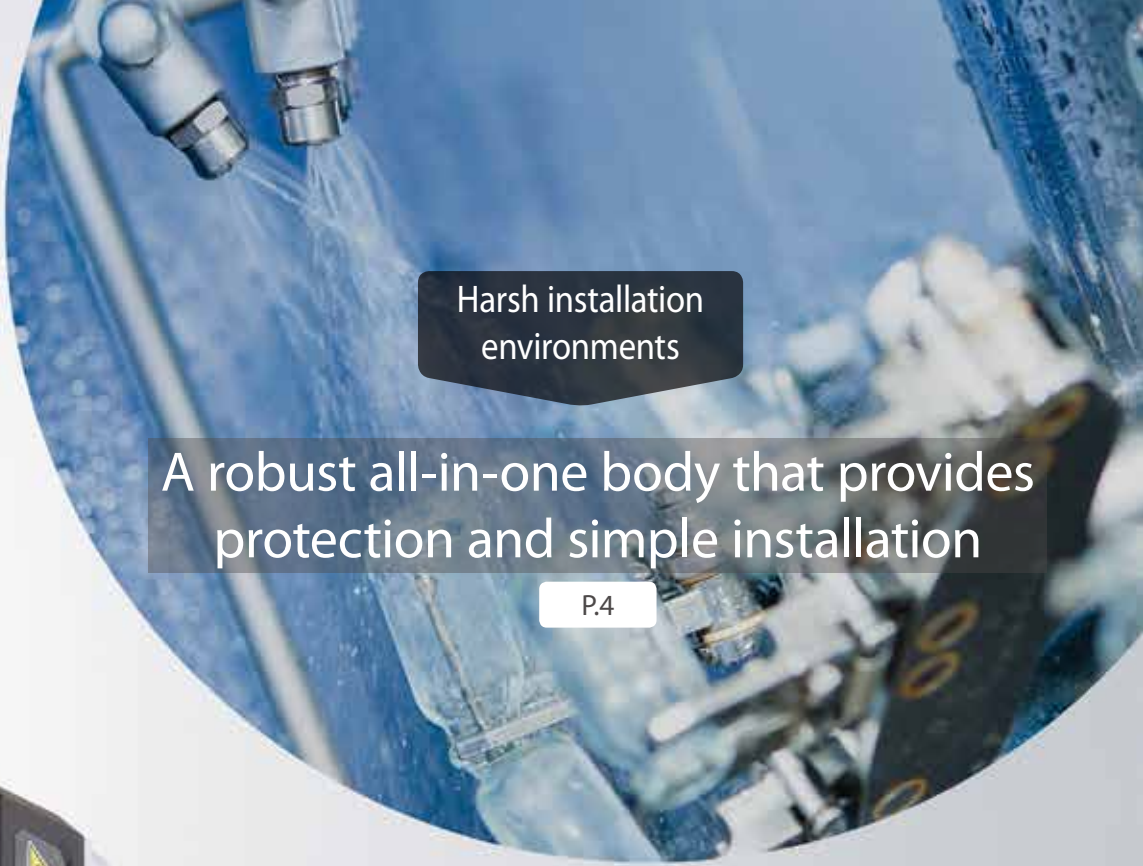
Smart camera
FHV7 Series



Challenges in adjusting to product variation

Rapidly responds to inspection target changes

P.6



Harsh installation environments

A robust all-in-one body that provides protection and simple installation

P.4



Constant requirement to improve manufacturing agility, speed, and quality

Processing power that facilitates rapid inspection

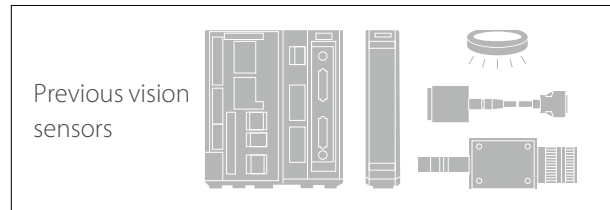
P.8

A robust all-in-one body that makes it easy to install

Installable anywhere

Integrated camera/controller structure

Integrates everything you need for image processing. All-in-one structure includes not only the controller but also the lens and lighting, allowing for simple and compact installation, without additional cabling, bracketry, external I/O, or control panel space.



Easy-to-replace modular structure

Lens and lights are available as modules. Easily serviceable and upgradeable in the event of damage or inspection requirements changes.

Robust structure

IP67 waterproof housing and connectors

IP67 rating allows for use in harsh conditions, such as regular wash-downs of the area where the cameras are installed.



Captive screws

Serviceable components use captive screws, preventing problems caused by the screws falling into the production line and not properly re-sealing the camera housing.



Replaceable covers

The light cover and optical filter are easy to remove and clean, or replace, providing effective camera protection against dirt.



Dirty cover filters can be removed separately for replacement

High scalability

External lights supported

The Omron FLV and FL Lighting Series consist of a wide offering of more than 150 models, and can easily be attached as external lights to FHV7 Smart Cameras.

By connecting the lighting controller, you can, via the FHV7 configuration setting menu, easily adjust the lighting intensity and set strobing to synchronize with the activation of the camera shutter.



Rapidly responds to inspection target changes



Multi-color Light

Accommodates color variations

Multi-color light provides a quick solution to the issue of optimizing image capture for different colors. For example, objects with different colored packages on a production line are best illuminated with lighting that can change its color based on the color of the target object. When a product design is changed or new products are added, you can simply change a camera parameter instead of replacing or fine-tuning lights. The vision inspection system is always ready for a broad variety of products.



Autofocus Lens

Accommodates size variations

The autofocus lens covers a focal length range from 59 mm to 2,000 mm^{*1}. Even when products in different sizes are produced, the focus range can be changed easily by parameters.^{*2} This feature eliminates mechanical operation for changeover during product replacement, leading to a simpler system with higher productivity and error proofing.

^{*1}. Differs depending on the lens type. See the optical chart on page 32 for details.
^{*2}. Set focuses for different product heights in advance and switch between them when you perform a changeover.



Best-in-class resolution^{*3}:

Large inspection area capabilities

The high resolution image sensor enables high precision inspections of large fields of view. This eliminates the need for installing multiple cameras or a mechanism to move a camera to capture different inspection points of different products produced on the same production line

^{*3}. Based on Omron investigation in October 2018.



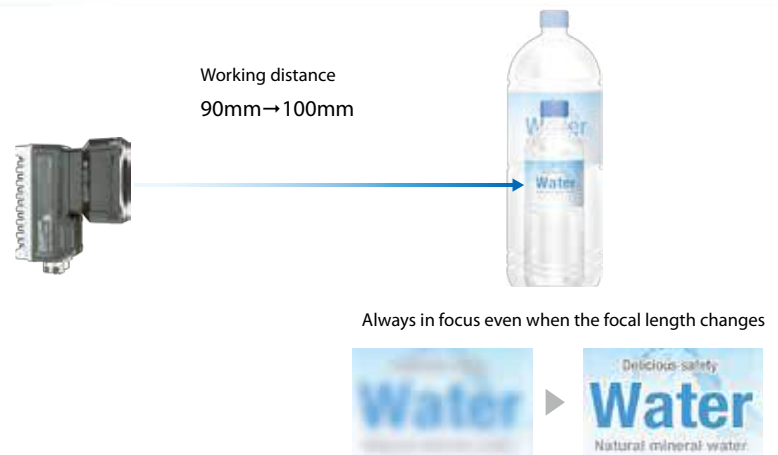
When inspecting products of different colors

As a product has more color options, some of the colors may cause low contrast under a single color illumination. The multi-color illumination allows switching colors for different product color options, ensuring stable inspections.



When inspecting products of different sizes

When inspecting products such as plastic bottles that come in different sizes, you can perform a changeover only by switching the setting of the autofocus lens. The autofocus lens does not require mechanical adjustment..



Expanding the range of parts inspection

Accurate and extensive inspection of fasteners locations for different automobile models is enabled without moving or adding cameras.



Excellent productivity performance



Best-in-class speed*¹
Image capture
Maximum speed 2.3 ms
×
Distributed processing
across 2 cores
×
High-speed algorithm

Processing power that facilitates rapid inspection

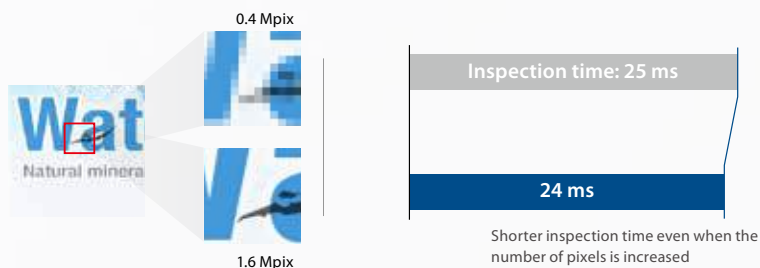
The all-in-one FHV7 Smart Camera is packed with capabilities carried over from the FH Series.

Its high performance, comparable to a dedicated image processing system, enables advanced applications.



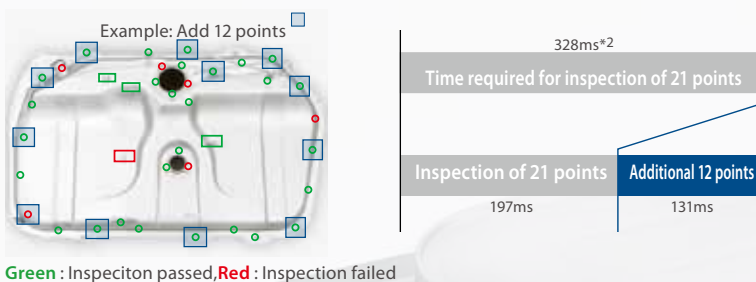
Clear images facilitate inspection

The FHV7 Smart Camera can inspect a 1.6 megapixels image in 24 ms. It can perform high-resolution inspections without compromising speed capabilities, and can be used in places where image processing systems are currently deployed.



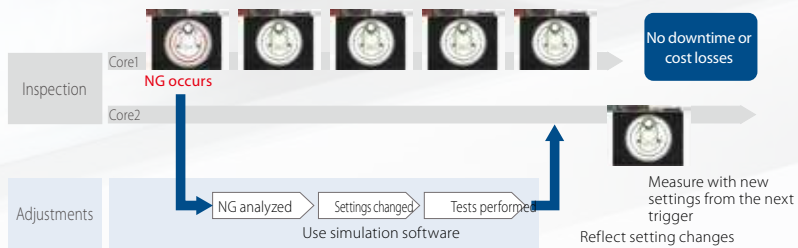
More inspection points

FHV7's high processing performance enables you to easily conduct inspections equivalent to an image processing system. It is optimal for multipoint inspections that would significantly compromise speed when conducted with traditional smart cameras.



Settings can be adjusted with zero downtime

Measured values may change gradually due to product variation or changes in external conditions. Even in such cases, distributed processing across 2 cores allows you to perform cause analysis and make setting adjustments while you continue to operate. This helps eliminate false rejects and eliminates production downtime associated with making setting changes.



*1. Based on Omron investigation in October 2018.

*2. Sample comparison to inspection time using vision sensors installed in customer's machine. Based on Omron investigation in October 2018

Traceability and serial number management

Application Examples

The FHV7 Smart Camera is suitable for applications in which inspection results and images are managed by product serial numbers.

Stable reading regardless of printing quality

2D Code II algorithm delivers powerful code reading

A robust algorithm for stable 2D code reading under adverse conditions is included. Barcode quality data based on relevant ISO standards can be output, identifying changes to barcode printing or direct part mark quality.

Changing ambient brightness

Chips due to reflection Low contrast

After processing/washing

Waterdrops and dirt Scatched damage

Poor printing quality in high-speed line **Poor printing quality on coarse surface**

Variations in start positions

Uneven line spacing

Molding variations of forged object

Print Quality Grading Function

- ISO/IEC 15415
- ISO/IEC TR29158

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

Printed characters with close spacing and characters printed on curved surfaces can be reliably identified.

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 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 fonts are supported

Laser printer

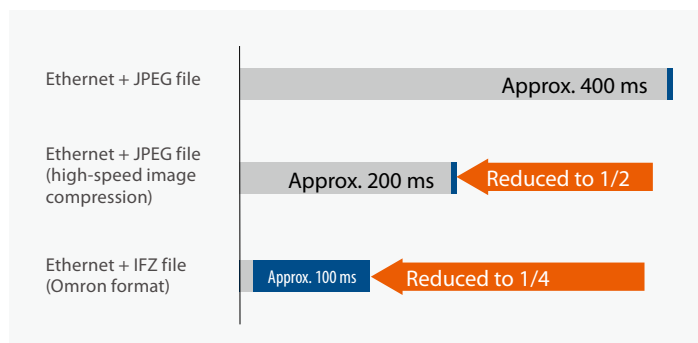
Inkjet printer

Thermal printer

Laser marker

High-speed image storage and image compression

Image data is so large that conventional controllers could not store all images due to limited storage time and storage capacity. The FHV7 Smart Camera has algorithms and hardware that can save images in Omron formats and compress image data at high speed, enabling all images to be stored to meet increasing needs in quality control.



The times in the figure on the left are provided for reference only and their accuracy cannot be guaranteed. They are measured under the following conditions:

- FHV7H-M050 Smart Camera
- 5 Mpix monochrome images
- Size of converted JPEG file: 0.1 MB

■ Compression time
■ Storage time

High-speed image storage

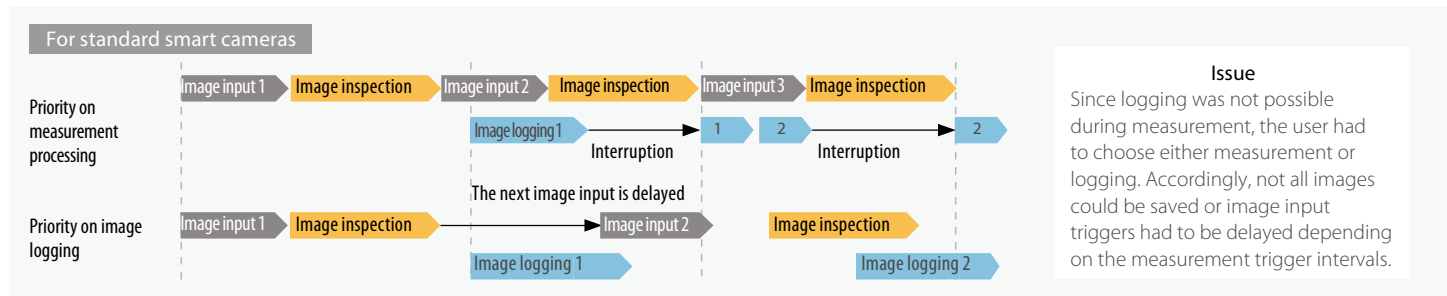
Images are saved in parallel with image inspection

Distributed processing across 2 cores allows the CPU to perform parallel processing of inspections and image logging. With connection to a high-speed, large-capacity network storage device, all images on the high-speed line can be saved, previously difficult to achieve.*

Trend analysis of all saved images quickly isolates errors and facilitates countermeasures.

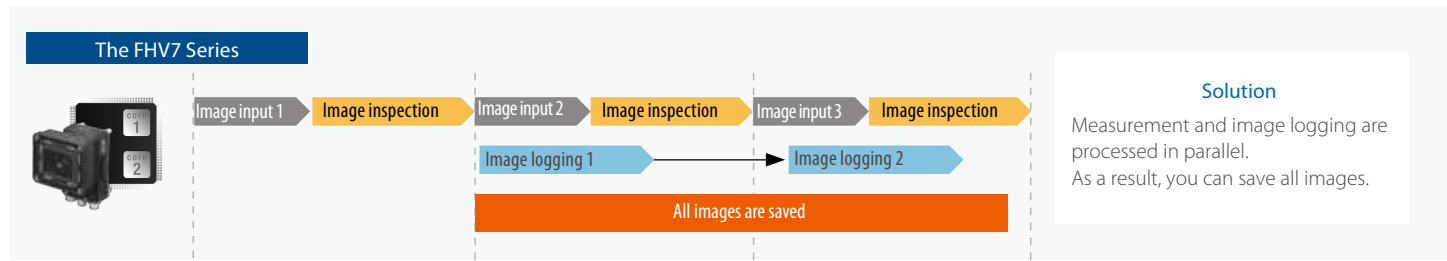
* All images can be saved under the following conditions:

- One 0.4 Mpix camera
- Measurement time of 30 ms
- JPEG file
- Images can be saved continuously for approx. 380 days when a 3 TB NAS is used (based on 8 hours of operation a day)



Issue

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.



Solution

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

Pick and place

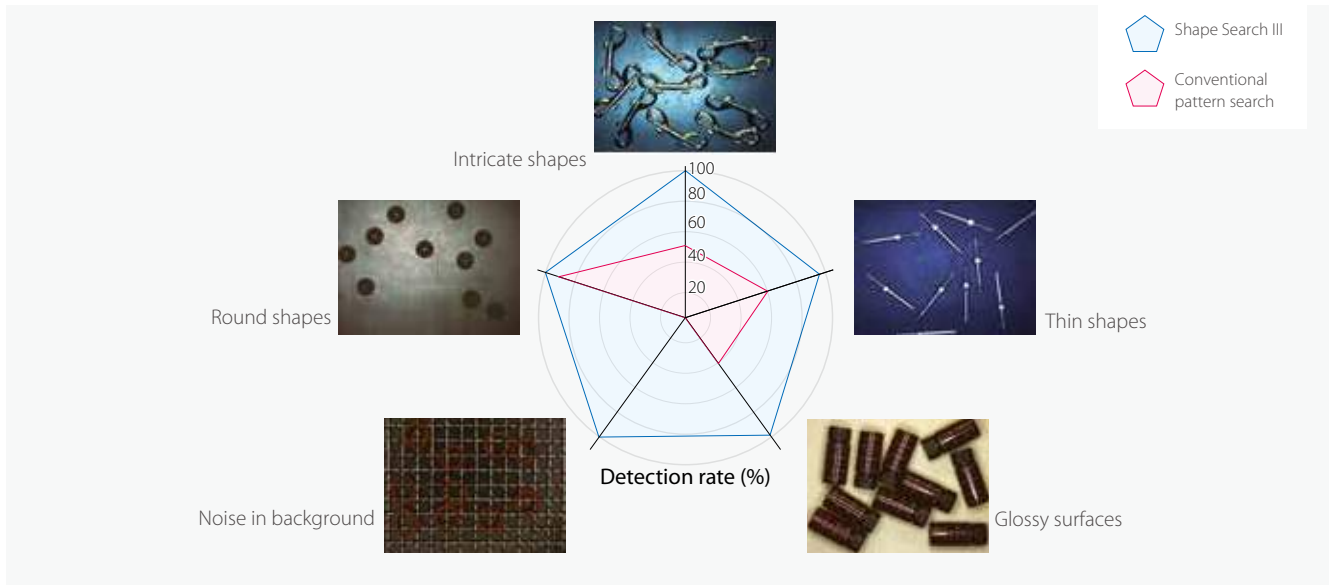


Application Examples

The FHV7 Smart Camera can be combined with robots for picking and assembling applications.

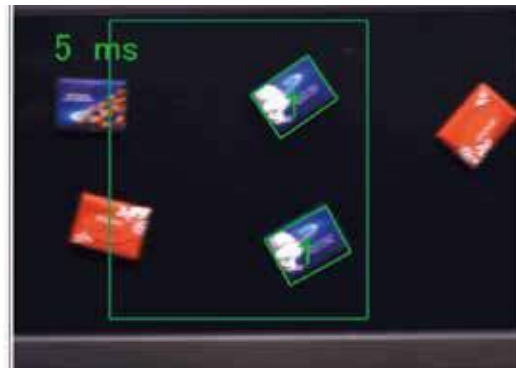
Shape Search III stably detects all types of objects

Stable position detection is performed regardless of shape, material, or background.



Sorting mixed products

Different types of objects can be sorted.



Think & See,
the core technology of Shape Search III



"Think & See" is Omron's powerful core technology for image sensing. Omron is continuously developing technologies to measure, detect, or identify the positions, orientations, shapes, materials, colors, status, or attributes of things, people, vehicles, or other objects faster, more precisely, and more easily than the human eye under various conditions.

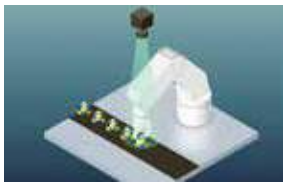


See the details of
Think & See.

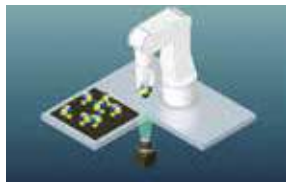
<https://www.fa.omron.co.jp/tse>

Easy output to major robot manufacturers' devices

The configuration settings for FHV7 interface to programs for various robot suppliers, greatly reducing the set-up time for robot applications.



Pick



Offset compensation



Place

3-step easy setting

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.

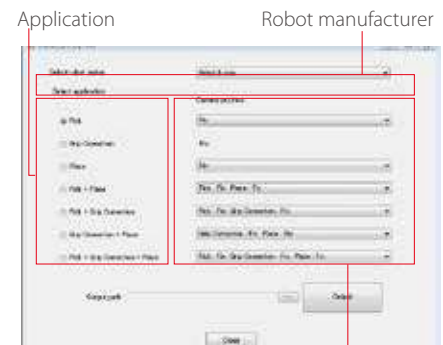
STEP 1

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.ia.omron.com/fhv>



Robot Setting Tool

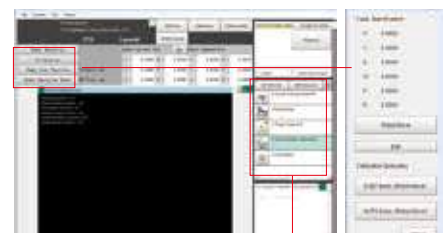
Camera position

STEP 2

Calibrate

Move robot for calibration from the FHV7 Series

The obtained flowchart can be used to move the robot for calibration from the FHV7 Smart Camera. There is no need to create a program for robot calibration.



Flowchart

Move robot

STEP 3

Check operations

Set up and check application from the FHV7 Series

Set the coordinates of the robot and check robot operations using the setting selection boxes.



Set the coordinates of the robot

Check robot operations

FH Vision series product range

The product range includes general-use Smart Cameras and high-speed, high-accuracy vision systems. You can choose the right one according to your requirements for speed and accuracy of each process. Both FH Series and FHV7 Series have the common user interface and operating procedures, so it is possible to share the same image inspection method across the production line. This reduces the time for operator training. The compatibility of setting data enables you to upgrade hardware easily when speed and accuracy enhancement is needed.

		For various types of inspections			For processes requiring high speed and high resolution		
		Smart Camera FHV7 Series			Vision System FH Series		
							
		FHV7H			FH-2050	FH-5050	
Hardware Grade	Performance ^{*1}	★			★★	★★★	
	No. of cameras	1			8	8	
	Resolution	0.4 Mpix	1.6 Mpix	3.2 Mpix	0.3 Mpix	0.4 Mpix	2 Mpix
		5 Mpix	6.3 Mpix	12 Mpix	5 Mpix	12 Mpix	20.4 Mpix
One Software	Screens	Main screen 			Measurement flow setting screen 	Measurement condition setting screen 	
	Image logging format	JPEG			BMP	IFZ (Omron format)	
	Setting data	Compatible ^{*2}					

*1. ★: The more stars, the higher the performance.

*2. Settings for the common functions can be shared between series.

Inspection features/processing items

Most frequently used inspection features are in the FHV7, based on typical usage of the FH Series.

Group	Processing Item	FHV7 Series	FH Series
Inspection tool	Search	✓	✓
	Flexible Search	✓	✓
	Sensitive Search	✓	✓
	ECM Search	-	✓
	EC Circle Search	-	✓
	Shape Search II	-	✓
	Shape Search III	✓	✓
	EC Corner	-	✓
	Ec Cross	-	✓
	Classification	✓	✓
	Edge Position	✓	✓
	Edge Pitch	✓	✓
	Scan Edge Position	✓	✓
	Scan Edge Width	✓	✓
	Circular Scan Edge Position	✓	✓
	Circular Scan Edge Width	✓	✓
	Intersection	✓	✓
	Color Data	✓	✓
	Gravity and Area	✓	✓
	Labeling	✓	✓
	Label Data	-	✓
	Defect	-	✓
	Precise Defect	✓	✓
	Fine Matching	✓	✓
	Character Inspect	✓	✓
	Date Verification	✓	✓
	Model Dictionary	✓	✓
	2DCode II	✓	✓
	2DCode	✓	✓
	Barcode	✓	✓
OCR User Dictionary	✓	✓	
OCR	✓	✓	
Circle Angle	-	✓	
Glue Bead Inspection	✓	✓	
Input Image	Camera Image Input	-	✓
	Camera Image Input FH	-	✓
	Camera Image Input FHV	✓	✓
	Camera Image Input HDR	-	✓
	Camera Image Input HDR Lite	-	✓
	Photometric Stereo Image Input	-	✓
	Camera Switch	-	✓
	Measurement Image Switching	✓	✓
	Multi-trigger Imaging	✓	✓
	Multi-trigger Imaging Task	✓	✓
Compensate image	Position Compensation	✓	✓
	Filtering	✓	✓
	Background Suppression	✓	✓
	Brightness Correct Filter	✓	✓
	Color Gray Filter	✓	✓
	Extract Color Filter	✓	✓
	Anti Color Shading	✓	✓
	Stripes Removal Filter II	✓	✓
	Polar Transformation	✓	✓
	Trapezoidal Correction	✓	✓
	Machine Simulator	-	✓
	Image Subtraction	✓	✓
	Advanced filter	✓	✓
	Panorama	-	✓

Group	Processing Item	FHV7 Series	FH Series
Support measurement	Unit Macro	-	✓
	Unit Calculation Macro	-	✓
	Calculation	✓	✓
	Line Regression	✓	✓
	Circle Regression	✓	✓
	Precise Calibration	✓	✓
	User Data	-	✓
	Set Unit Data	-	✓
	Get Unit Data	-	✓
	Set Unit Figure	-	✓
	Get Unit Figure	-	✓
	Trend Monitor	✓	✓
	Image Logging	✓	✓
	Image Conversion Logging	✓	✓
	Data Logging	-	✓
	Elapsed Time	✓	✓
	Wait	✓	✓
	Focus	-	✓
	Iris	-	✓
	Parallelize	✓	✓
	Parallelize Task	✓	✓
	Statistics	✓	✓
	Reference Calib Data	✓	✓
	Position Data Calculation	✓	✓
	Stage Data	✓	✓
	Robot Data	✓	✓
	Vision Master Calibration	✓	✓
	PLC Master Calibration	-	✓
	Convert Position Data	✓	✓
	Movement Single Position	✓	✓
	Movement Multi Points	✓	✓
	Detection Point	-	✓
	Manual Position Setting	-	✓
	Camera Calibration	✓	✓
	Data Save	-	✓
Conveyor Calibration	-	✓	
Scene	✓	✓	
System Information	✓	✓	
Branch	Conditional Branch	-	✓
	End	✓	✓
	DI Branch	-	✓
	Control Flow Normal	-	✓
	Control Flow PLC Link	-	✓
	Control Flow Parallel	-	✓
	Control Flow Fieldbus	-	✓
	Selective Branch	-	✓
	Conditional Execution (If)	✓	✓
	Conditional Execution (Else)	✓	✓
	Loop	✓	✓
	Loop Suspension	✓	✓
	Select Execution(Select)	✓	✓
	Select Execution(Case)	✓	✓
	Output result	Result Output (I/O)	✓
Result Output(Message)		✓	✓
Data Output		-	✓
Parallel Data Output		-	✓
Parallel Judgement Output		-	✓
Fieldbus Data Output		-	✓
Display result	Result Display	✓	✓
	Display Image File	-	✓
	Display Last NG Image	✓	✓
	Conveyor Panorama Display	-	✓
	Display Image Hold	✓	✓

Note : Refer to page 28 for details of processing items.

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