# A compact device for thorough inspections

# Simplify multiple-device inspection systems by using a single camera

Traditional image inspections require one or more dedicated cameras to be paired with a code reader. Omron's F430/F420 Series Smart Camera bundles all this functionality into a single device, dramatically simplifying application design. The single-camera solution also reduces the initial investment, cuts down on wiring work and keeps maintenance costs to a minimum.

## Inspections | 01

A single camera achieving the precision managed by multiple devices

## Inspections | 02

A single camera performing powerful inspection tasks and code reading

## Inspections | 03

Long-life autofocus liquid lens provides long operational lifetime and multi-distance inspections

Inspection of parts with size variations

A single camera that achieves the precision managed by multiple devices

Parts presence/absence detection plus code reading

# A single camera achieving the precision managed by multiple devices

## Inspections | 01

**FROM**

8 cameras

**TO**
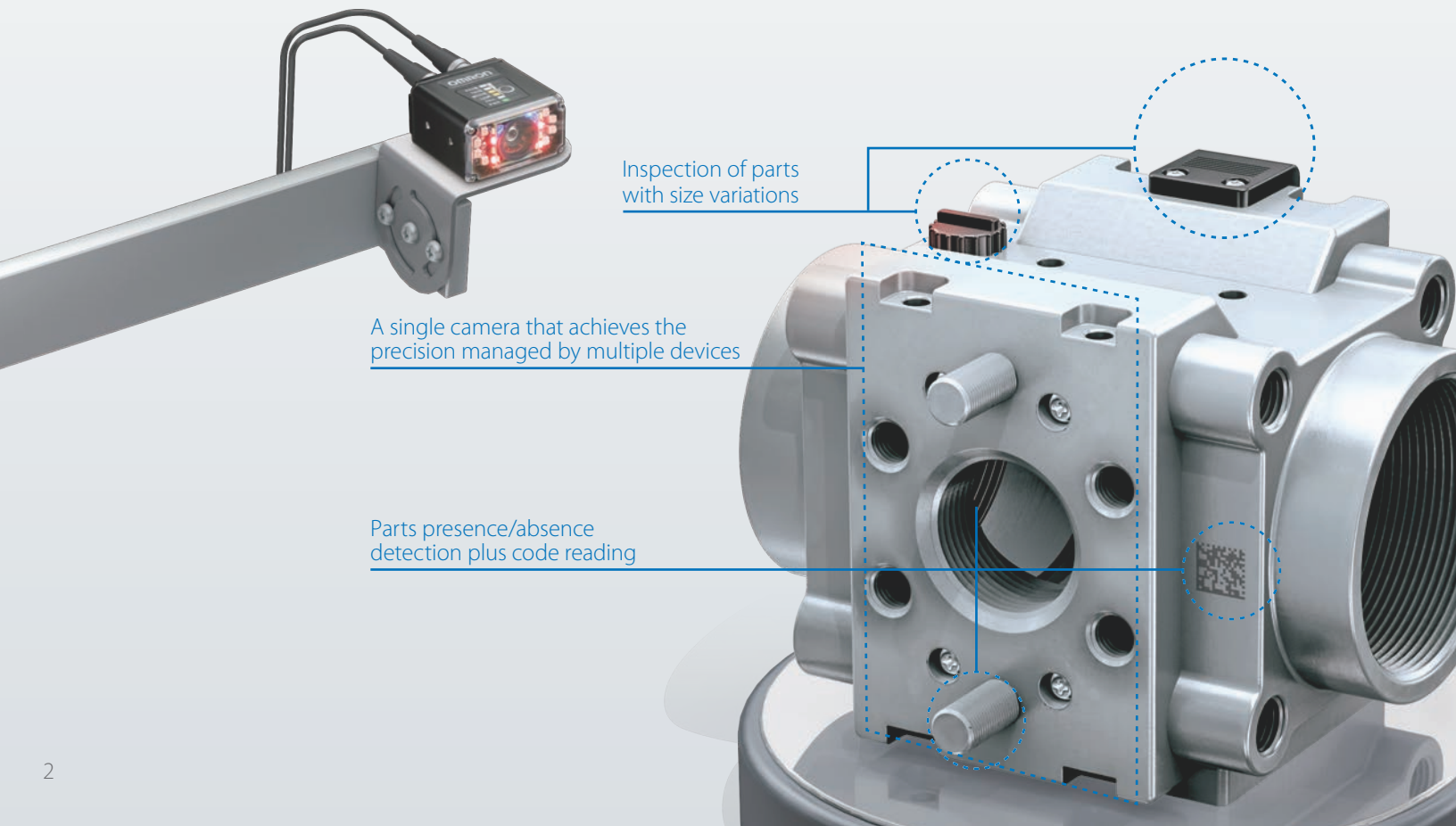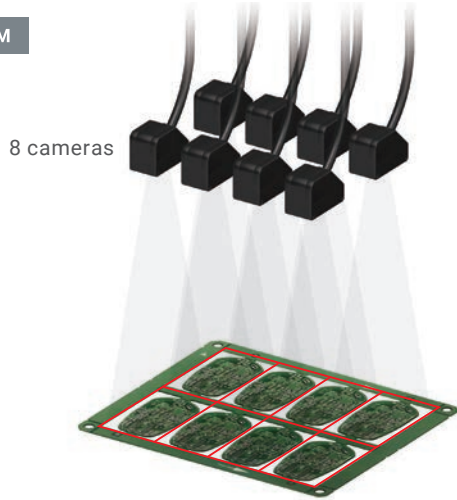
A single camera

Mechanical design is required for multiple cameras. Positioning of the mechanism and fine-tuning of software are time consuming.

Only a single camera is required for Omron's solution, which simplifies design and fine-tuning

When using low-resolution cameras, multiple cameras are needed to divide a view in several sections and achieve the resolution required for inspections. The 5-megapixel color camera of the F430-F/F420-F Series delivers high-resolution imaging of multiple points with a single device.

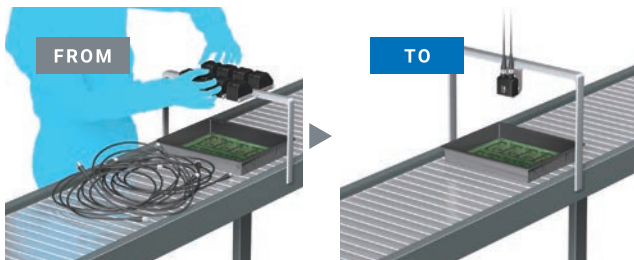Inspection scope examples

0.3 Megapixel color camera: 1 PCB

5 Megapixel color camera: 8 PCBs

## Positioning a single camera is easier

A single camera can capture a wide view, eliminating the need to combine multiple cameras that require time-consuming positioning design and fine-tuning.

**FROM**

**TO**

## Presence, color, shape detection and reading at the same time

The F430-F/F420-F Series can simultaneously perform detection tasks (presence, color, and shape) and code reading within the field of view. You can easily increase inspection points for quality enhancement.

Presence detection    Code reading    Color detection    Shape detection

Code reading    Presence detection
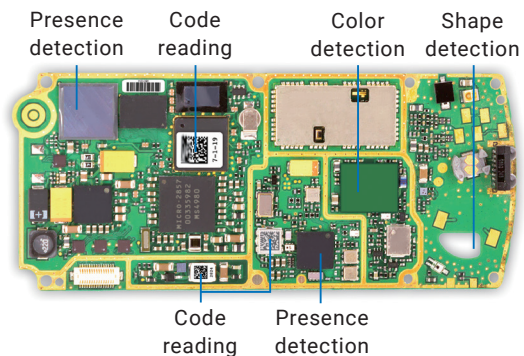
# A single camera performing powerful inspection tasks and code reading

## Inspections | 02

**FROM**
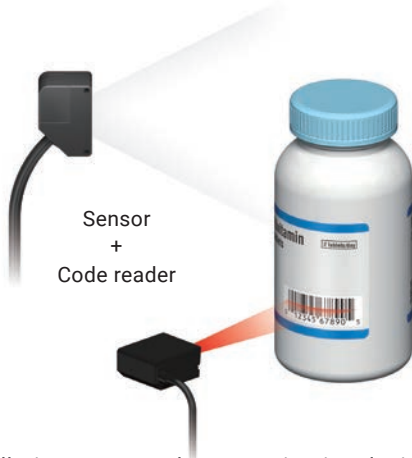
Sensor
+
Code reader

Installation space and communication design are required for both the sensor and code reader.

▶

**TO**

A single camera

Installation space and communication design are required for a single smart camera only.

To perform a simple inspection task - such as presence/absence detection, color detection, etc. - along with a code or character reading, a highly-functional sensor or a sensor combined with a code reader for each purpose would be required. The F430-F/F420-F Series successfully performs both functions, simplifying inspection tasks overall.

Code reading

Multivitamin
200 tablets

Cap presence/ absence inspection

Cap present OK    Cap absent NG

Multivitamin    Multivitamin
200 tablets     200 tablets

## Wiring and installation space reduced by half

A single camera with smart camera and code reader functionalities halves the number of cables to the host device and the installation space.

**FROM**

Sensor

Code reader

▶

**TO**

Smart camera

PLC
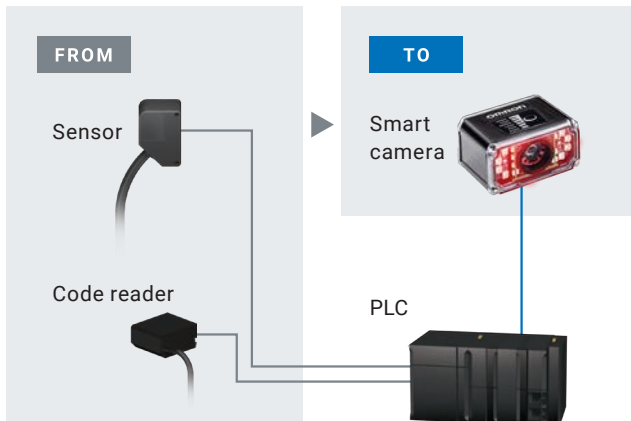
## Text and verification result output

The F430-F/F420-F Series can output character strings and code quality verification results, which is difficult with standard smart cameras. The output information can be used for traceability.
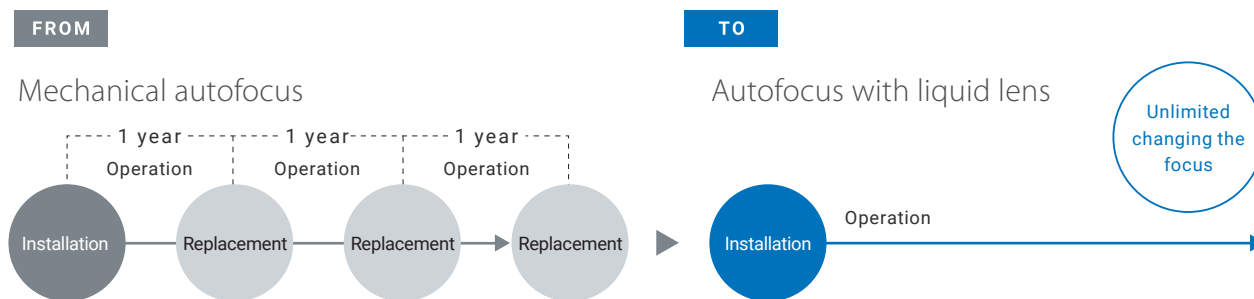
**Example of output data**
1. Result of inspection: OK/NG
2. Result of code reading: Character string
3. Result of verification: Quality grade of code

# Long-life autofocus liquid lens provides long operational lifetime and multi-distance inspections

## Inspections | 03

How long until the camera is replaced due to failure caused by focus changes?

**FROM**

### Mechanical autofocus

1 year — 1 year — 1 year
Operation — Operation — Operation

Installation → Replacement → Replacement → Replacement

The camera needs to be replaced due to failure of the mechanical structure about once a year*.

**TO**

### Autofocus with liquid lens

Unlimited changing the focus

Installation — Operation →

Focus alterations during changeovers have less risk of failure, and the replacement frequency is significantly reduced.
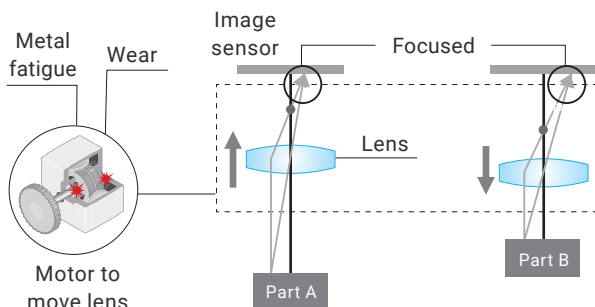
The F430-F/F420-F Series with a long-life liquid lens provides unlimited autofocus, easily focusing on different items just by switching the focus. The liquid lens greatly reduces the replacement frequency that is once every several months to several years with the mechanical autofocus lens.
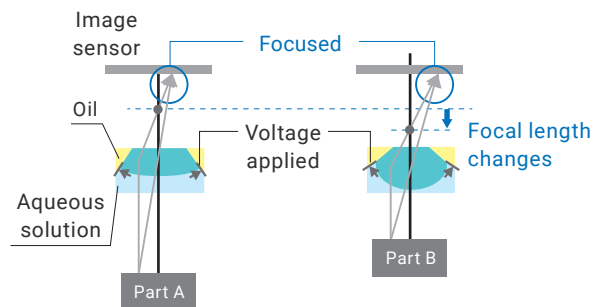
Inspection of type A

Inspection of type B
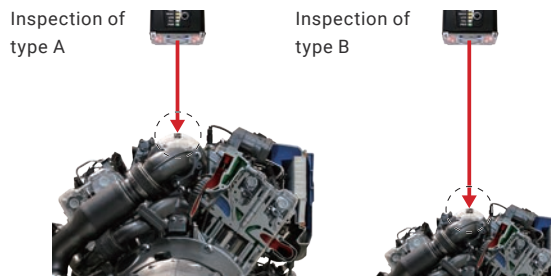
## Difference between mechanical autofocus and liquid lens autofocus

Mechanical autofocus uses a small motor as a major component. Metal fatigue and wear shorten the life of the camera, which requires replacement every year. The liquid autofocus lens can flexibly change its focal length without mechanical wear by applying voltage to change the internal oil and water shape.

### Mechanical autofocus

Metal fatigue
Wear
Image sensor
Focused
Lens
Part A
Part B
Motor to move lens

### Autofocus with liquid lens

Image sensor
Focused
Oil
Voltage applied
Focal length changes
Aqueous solution
Part A
Part B

\* Calculated using Omron's condition below.
Limit of standard mechanical autofocus : 50,000 operations
Usage condition: Focus is changed 200 times a day for 20 days a month. 200 operations x 20 days x 12 months = 48,000 operations » approximately 1 year.
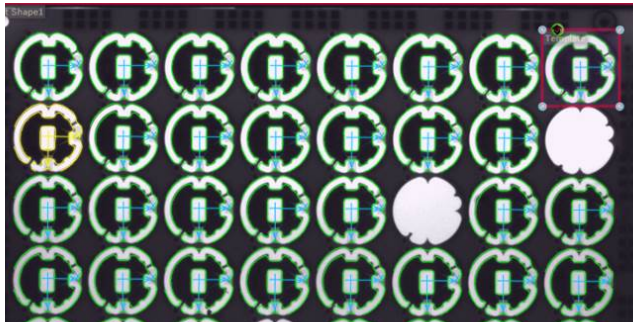
# Tools

Twelve tools are provided.
These vary depending on the model, so please refer to the datasheet for details.
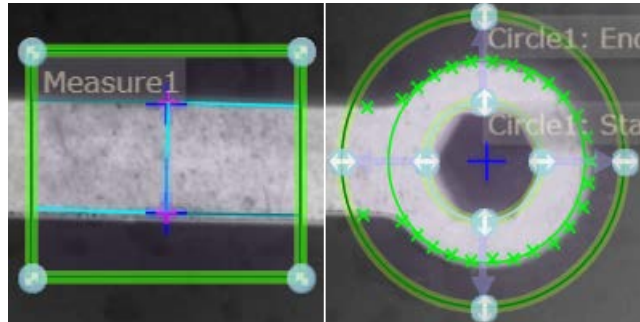
## Count



Counts objects detected within the inspection area.
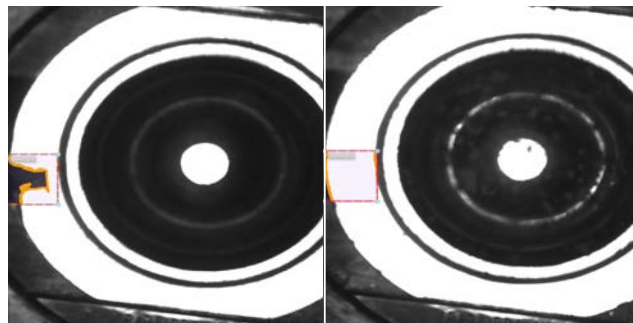(Method: Select from Blob Count and Shape Count)

## Measure



Measures width or height between two edges.
(Method: Select from Width Measure, Height Measure, Circle Measure, Point to Point Measure, Point to Line Measure, and Angle Measure)

## Presence/Absence



Inspects the presence of objects.
(Method: Select from Count Gray Pixels and Count Edge Pixels)

## Color (5 Mpix camera)



Judges whether the color matches the registered one. The degree of match can be adjusted in percent. Speed can be increased by setting the precision parameter.

## Decode



Reads a bar code or 2D code. The Match String function allows this smart camera to perform verification that is usually done by a PC or PLC.
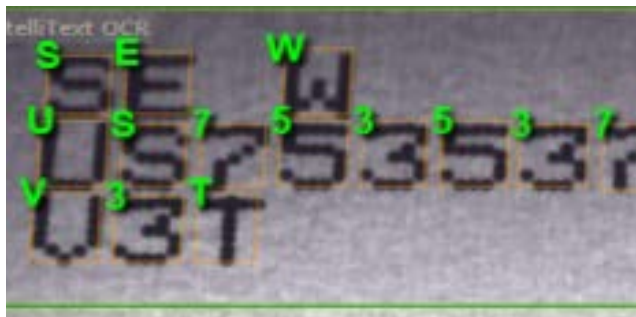
## Symbol Quality Verification



Enables simple print quality verification of codes to application standards such as ISO 15415, AIM DPM/ISO 29158, and ISO 15416. Also automatically generates reports.
Note: QR codes cannot be verified. The Calibration Card is required.

## OCR



Just draw a square around characters to read them using its built-in dictionary. Reads capital alphabets, numbers, and multi-row text and compares them with the character string received from the host device.

## OCV



Detects defects from measured character strings using the registered reference character string. Automatically focuses on a target character string even if its position differs.
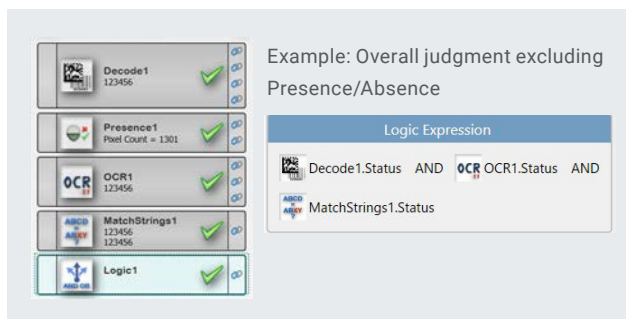* Up to ±15°

## Locate



Outputs the position and angle of the registered image. The inspection area of this tool can automatically be used for the processing following this tool.

## String Format



12345        ABCDE

12345ABCDE
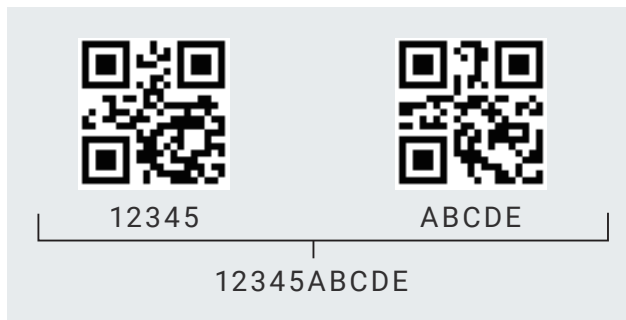
Outputs extracted character strings and combined two character strings, which is usually done by a PC or PLC.

## Match Strings Tool



GTIN 12345678901231
LOT 123456
DATE 2016-09-15

Compares a human-readable character string read by OCR with data contained in the code read by CR, which is mostly done by a PC or PLC.

## Logic Tool



Example: Overall judgment excluding Presence/Absence

Logic Expression

Decode1.Status AND OCR1.Status AND MatchStrings1.Status

Performs logical operation and compares sizes of tool results. Logical operation of "status" of each tool can be used to create individual judgment conditions instead of the overall condition.

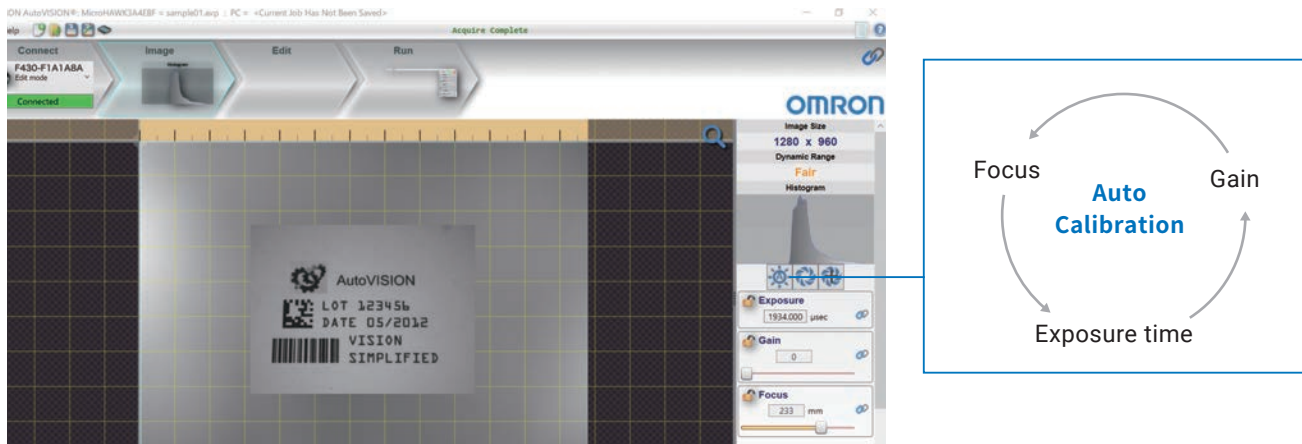# Simple setup on a single screen with AutoVISION Software

## 3-step easy setting

Follow the guide on the screen to start inspection in three steps: Image, Edit, and Run.
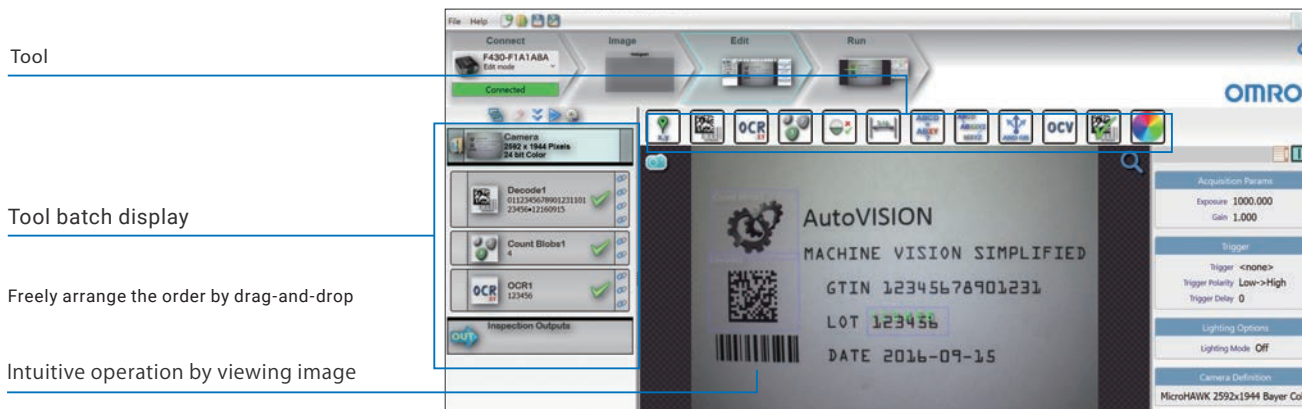


Step1      Step2      Step3
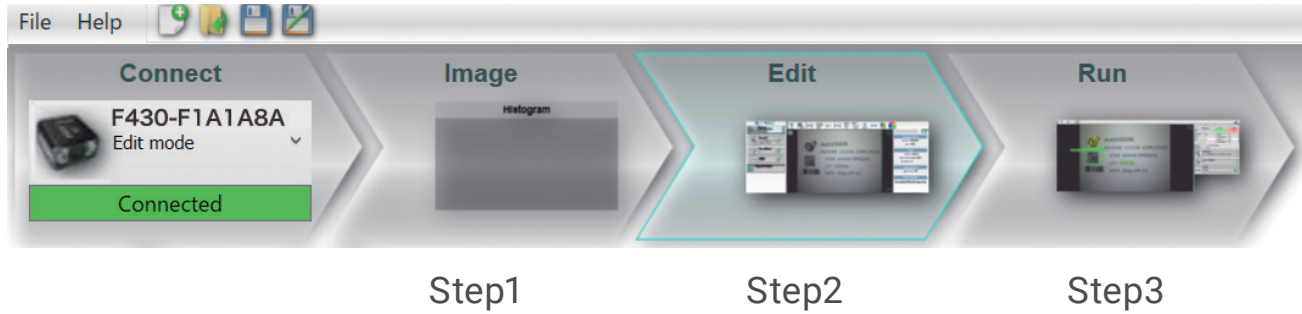
**Step 1. Image**  One click to optimize image

Place an object within a focal length and press the Autofocus button to optimize the focus and brightness of the inspection image.



**Step 2. Edit**  Just select tools and specify inspection areas

Setup can be done by simply selecting tools and specifying the inspection areas. You can check the test measurement results on this screen and adjust the inspection range and the threshold by viewing the screen.

Tool

Tool batch display

Freely arrange the order by drag-and-drop

Intuitive operation by viewing image

**Step 2. Edit** Allocate outputs

Select values and memory areas for each tool to allocate outputs, reducing PLC connection design time. In addition to OK/NG results, it's also possible to output measured values, code reading results and OCR results, which can be useful for data collection.

Example: Output of OCR results

Data that can be output is displayed as selections.
Example: OCR

Judgment result

Output character string

Number of detected characters

Memory to allocate

**Step 3. Run** One click to start inspection

Simply press the Run button to start the inspection. Inspection results are displayed on the screen in real time.

**Utilization** Free software and educational materials available

AutoVISION software is available for free. Visit your local omron website or ask to your omron representatives.

The quick start guide and sample image/job data attached with the software will help you use the software.
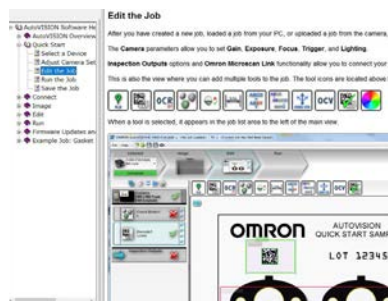The software includes the help file, allowing you to refer to help without connecting to a network.

## Examples of materials and data to support your learning

Quick start guide

Help file

Sample image/job data
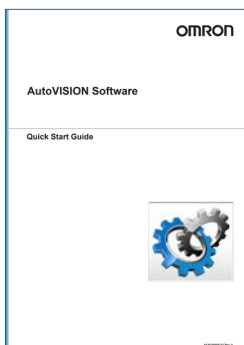
A quick guide showing how to start inspection is attached.

The help file can be easily opened from the help menu in AutoVISION. Offline help can be used without connecting to a network.
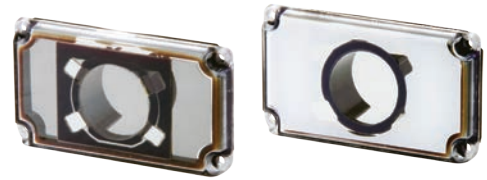
It contains sample images and job data that will be helpful for learning how to operate.

# Attachments to capture clear images

## Eliminate uneven lighting and halation
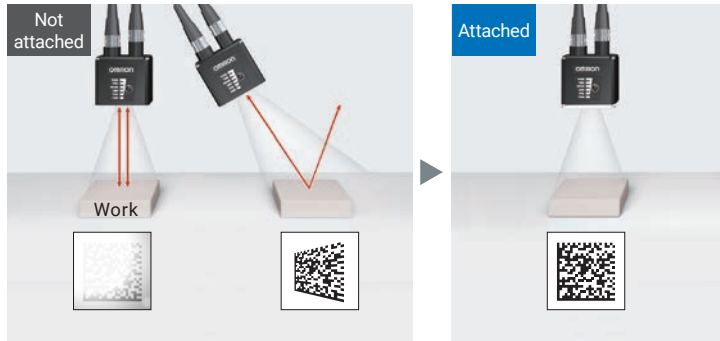### Polarizer and Diffuser

Attaching a polarizer or diffuser reduces halation and reflection without the need to install the camera at an angle.
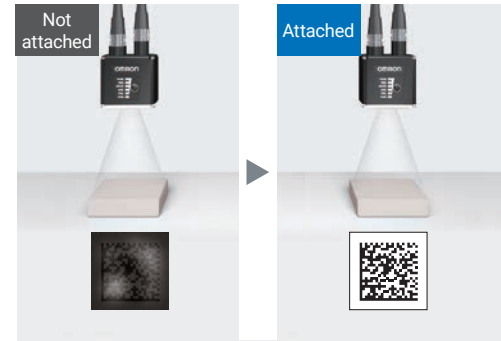
Polarizer    Diffuser

### Polarizer

Not attached

Work

Halation    Distortion of image

Attached

Eliminates distortion of image and cuts specular reflection

### Diffuser

Not attached

Uneven lighting

Attached

Reduces uneven lighting

## Protect against laser radiation
### YAG Filter

When the smart camera is installed near YAG laser equipment (e.g., laser marker, laser engraver, and laser cutter), the YAG filter is used to protect image elements against laser light.

Not attached

Image elements is damaged
Normal filter
YAG laser    Radiation

Attached

YAG filter protects image elements
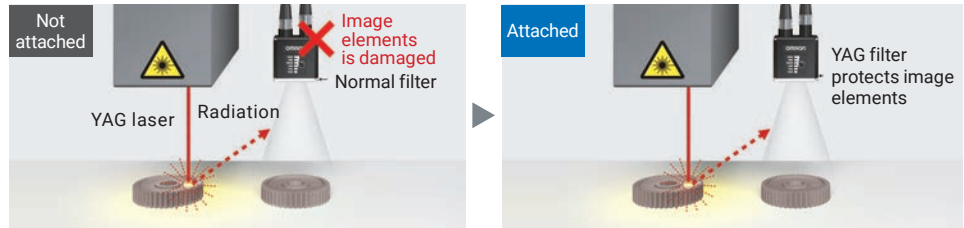
## Protect against static
### ESD Safe Window*

To prevent line or object problems caused by electrostatic discharge (ESD) of the smart camera, the ESD safe window is used.

Not attached

Static
Normal filter
Problem occurs on object

Attached

Static
ESD Safe Window cuts static

\* Coming soon.

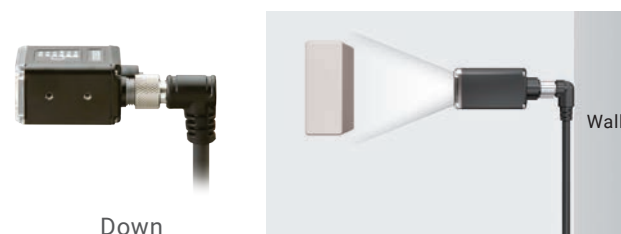# Install in a confined space

## Right Angle Mirror

The right angle mirror is used to install the smart camera in a space where the camera cannot face the object.

Wall

## Right Angle Connector

This connector can be used when there is no wiring space behind the smart camera.

Down

Wall

(Right angle down (photo above) and right angle up connectors are available.)

# Use under insufficient light

## Ring Light Model

This model can provide reliable inspection even under insufficient light conditions and maintain the shutter speed to focus on high-speed lines, which both are difficult with a standard light.

Standard light model

Ring light model

The ring light model is available with F430 1.2 Mpix Cameras.

# Enhance contrast

## Color Filters

The color filter is used with a monochrome camera with white light when you want to emphasize the area where the intensity of the red or blue component is high.
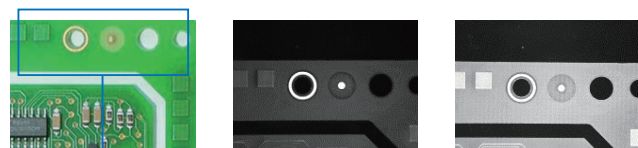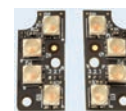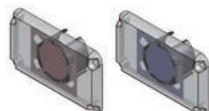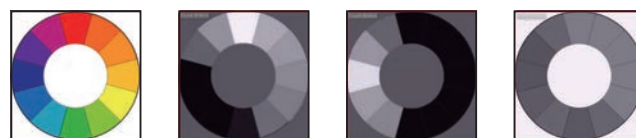
Inspection area

With Red Filter

With Blue Filter

## Additional Lighting Options

This option is used with a monochrome camera when you want to emphasize a specific color component or infrared ink. White, red, blue, and IR LEDs are available.
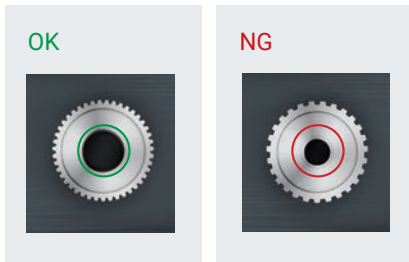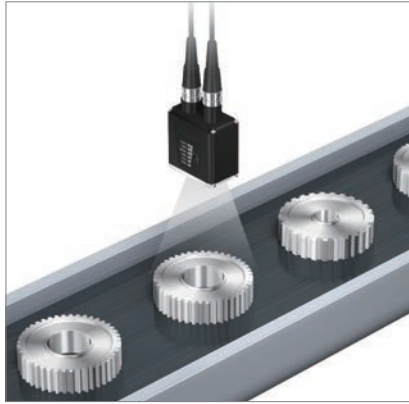
Color Camera
White LEDs

Mono Camera
Red LEDs

Mono Camera
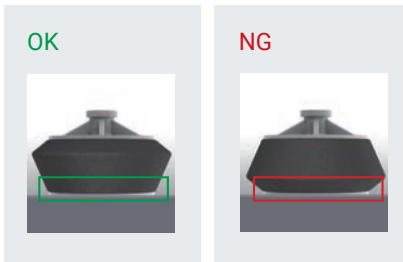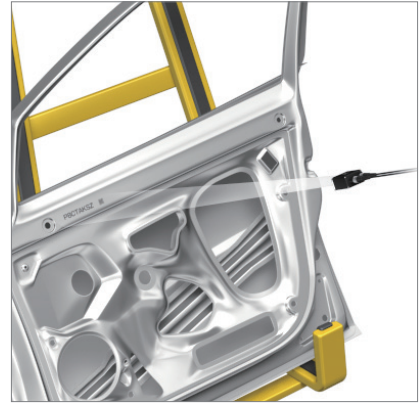Blue LEDs

Mono Camera
IR LEDs

# Applications

## Automotive

**Incorrect gear inspection**



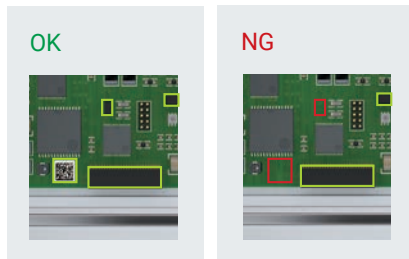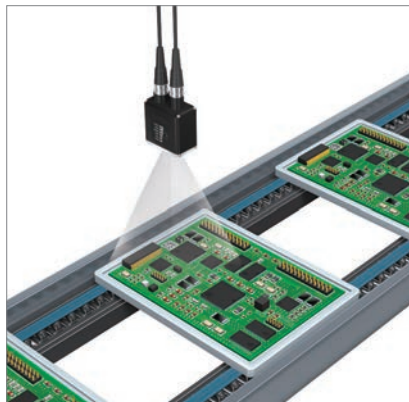| OK | NG |
|----|----|



**Orientation inspection of attached rubber**



| OK | NG |
|----|----|



**Reading lot numbers and codes on automotive body parts**



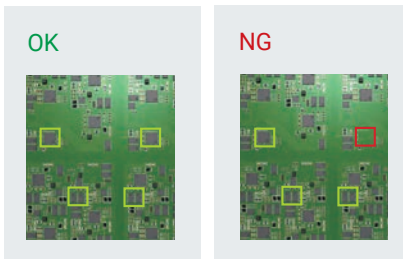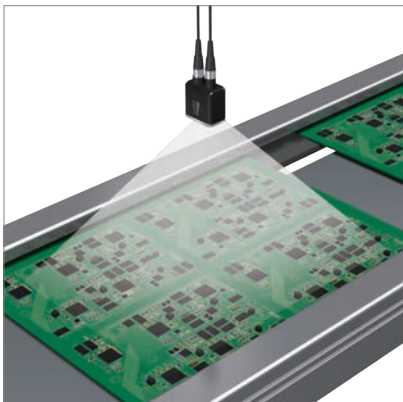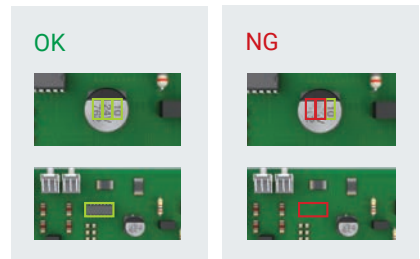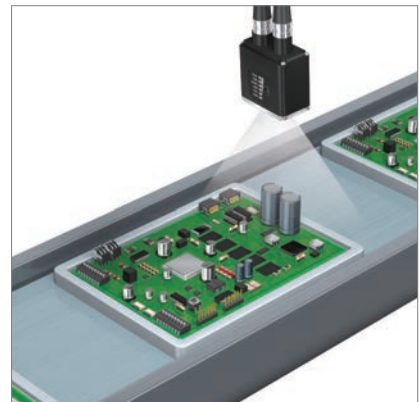| OK | P8CTAKSZ |
|----|----------|
| NG | P CTAKSZ |

## Digital

**Presence inspection and code reading of electronic components**



| OK | NG |
|----|----|



**Presence inspection of PCB mounted components**



| OK | NG |
|----|----|



**Identification of electronic components**



| OK | NG |
|----|----|

# Food, beverage, and pharmaceutical

**Label presence inspection**



| OK | NG |
|---|---|
|  |  |
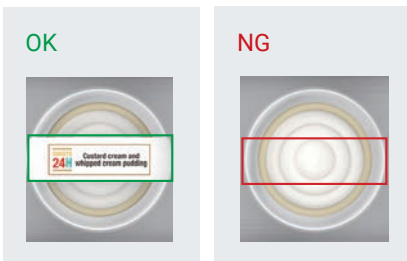
**Inspection for absence of medicines in blister packs**



| OK | NG |
|---|---|
|  |  |
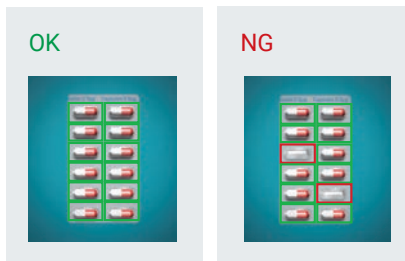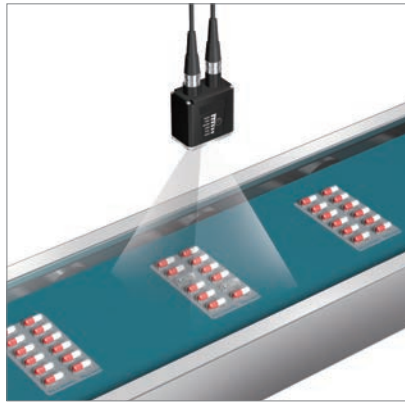
**Capping and label presence inspection of beverage bottles**
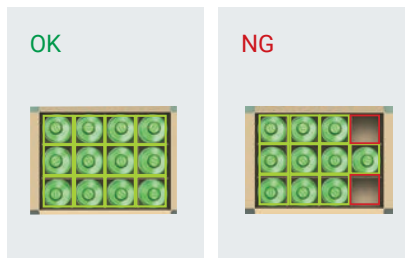


| OK | NG |
|---|---|
|  |  |
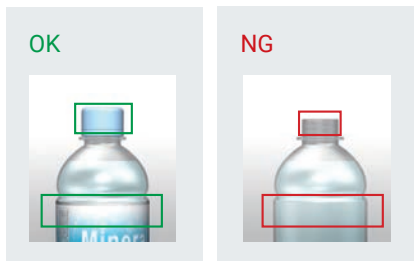
# Logistics

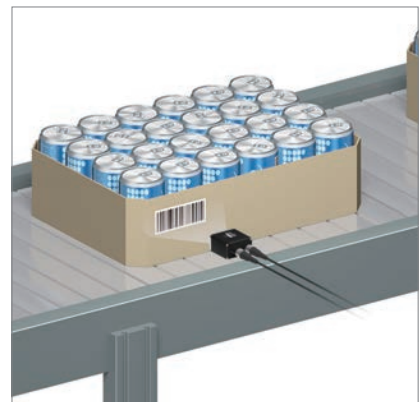**Label orientation inspection, and code and expiration date inspection**



| OK | NG |
|---|---|
|  |  |

**Product quantity inspection**



| OK | NG |
|---|---|
|  |  |
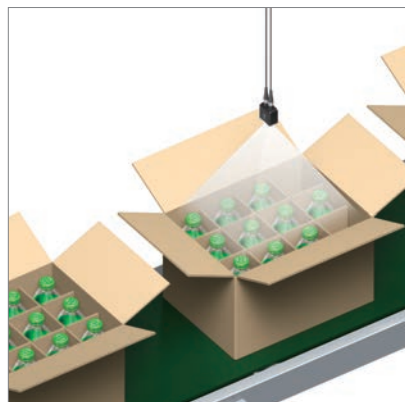
**Code print quality verification of packing boxes**



| OK (Grade A) | NG (Grade D) |
|---|---|
|  |  |
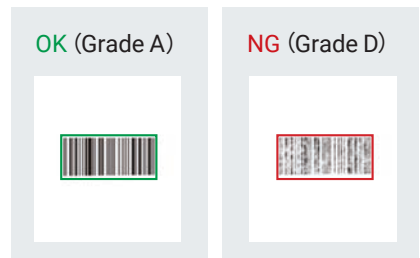
# Selection Guide

Take advantage of the F430-F/F420-F Series
to perform a variety of inspection tasks with less time and effort

## Choices with different I/O interfaces

• RS-232C
• Ethernet TCP/IP
• EtherNet/IP™
• Passive PoE
• IP65/67-rated

F430-F Series

(Refer to the
Datasheet for details)

• RS-232C
• USB
• Ethernet over USB
• IP54-rated

F420-F Series

(Refer to the
Datasheet for details)

## F330-F/F320-F Series for simpler solutions

Also available are simpler, easy-to-introduce types for the following applications.
Please ask your Omron representative for details.

• Auto-focus is not necessary as the objects are of the same type with no
  difference in height
• Used in a dry environment, IP40 is sufficient

Choices with different I/O interfaces

• Ethernet TCP/IP
• Active PoE

F330-F Series

(Refer to the
Datasheet for details)

• RS-232C
• Ethernet over USB

F320-F Series

(Refer to the
Datasheet for details)

# Omron's vision sensor series

High

Function

### FH Vision System

High-speed high-precision alignment

Provides high-performance inspections and measurements beyond human vision, covering from the detection of microscopic defects to the high-speed and high-precision alignment.

### FHV7 Smart Camera

High-speed appearance inspection, pre-alignment

The functionality and speed enabling appearance inspection, pre-alignment, and other inspection and measurements that your production site demands are packed in an all-in-one device.

### F430-F/F420-F Smart Camera

Simple discrimination

Brings simple inspections such as presence/absence or direction in a single compact device without hassle.

Note: V430-F/V420-F Series can be used if only code reading is necessary. Refer to the Code Reader Brochure (Cat. No. VS104-E-01) for details.

# OMRON

*Authorized Distributor:*

**Controllers & I/O**
• Machine Automation Controllers (MAC) • Motion Controllers
• Programmable Logic Controllers (PLC) • Temperature Controllers • Remote I/O

**Robotics**
• Industrial Robots • Mobile Robots

**Operator Interfaces**
• Human Machine Interface (HMI)

**Motion & Drives**
• Machine Automation Controllers (MAC) • Motion Controllers • Servo Systems
• Frequency Inverters

**Vision, Measurement & Identification**
• Vision Sensors & Systems • Measurement Sensors • Auto Identification Systems

**Sensing**
• Photoelectric Sensors • Fiber-Optic Sensors • Proximity Sensors
• Rotary Encoders • Ultrasonic Sensors

**Safety**
• Safety Light Curtains • Safety Laser Scanners • Programmable Safety Systems
• Safety Mats and Edges • Safety Door Switches • Emergency Stop Devices
• Safety Switches & Operator Controls • Safety Monitoring/Force-guided Relays

**Control Components**
• Power Supplies • Timers • Counters • Programmable Relays
• Digital Panel Meters • Monitoring Products

**Switches & Relays**
• Limit Switches • Pushbutton Switches • Electromechanical Relays
• Solid State Relays

**Software**
• Programming & Configuration  • Runtime