OMRON

Vision Sensor

F440-F/430-F/F420-F Series

Smart Camera

User's Manual for Communication Settings

Z444-E-05

NOTE

Trademarks

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Introduction

Thank you for purchasing the F440-F/F430-F/F420-F Series.
This manual contains information that is necessary for using F440-F/F430-F/F420-F Series.
Please read this manual and make sure you understand the functions and capabilities before you attempt to use it in a control system.
Keep this manual in a safe place where it will be available for reference during operation.

Intended Audience

This manual is intended for the following personnel, who must also have knowledge of electrical systems (an electrical engineer or the equivalent).

- Personnel in charge of introducing barcoding systems.
- Personnel in charge of designing barcoding systems.
- Personnel in charge of installing and maintaining barcoding systems.
- Personnel in charge of managing barcoding systems and facilities.

Applicable Products

This manual covers the following products:

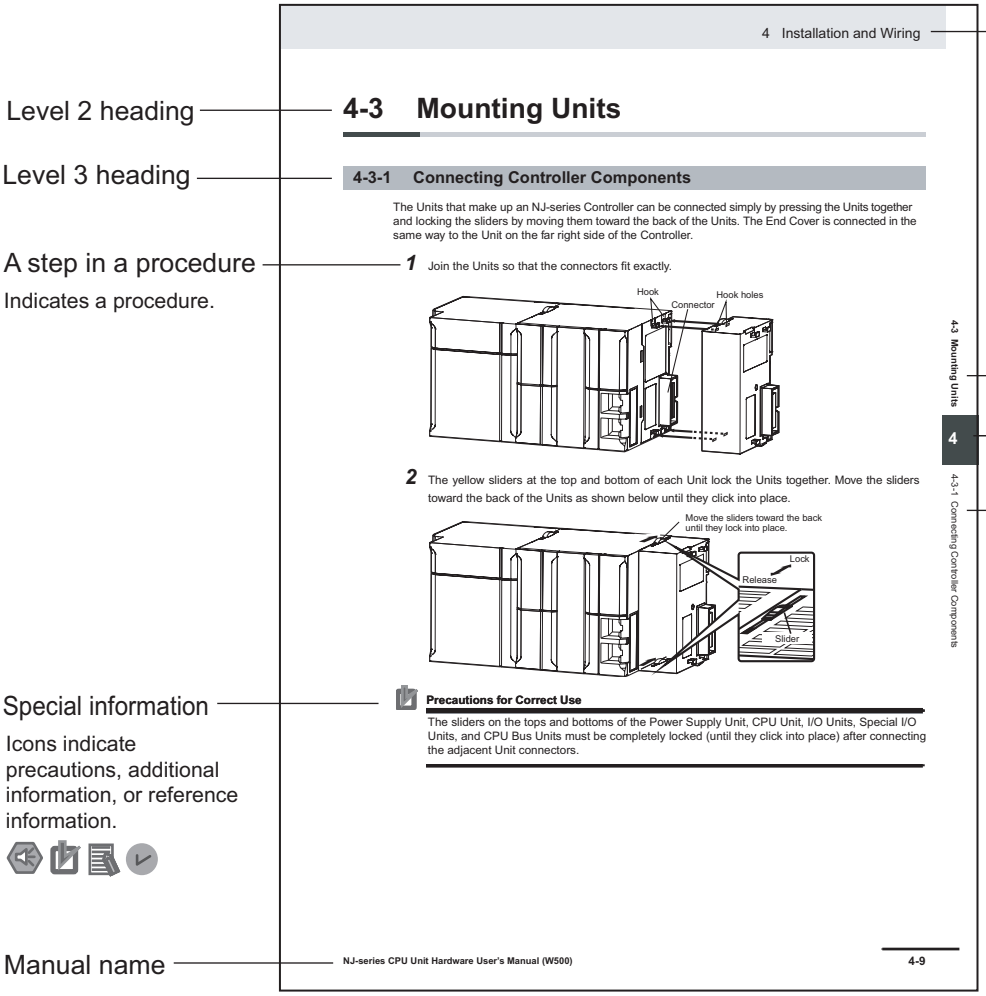
- F440-F/F430-F/F420-F Series

Parts of the specifications and restrictions for each product may be listed in other manuals. Please refer to *Related Manuals* on page 15.

Manual Structure

Page Structure

The following page structure is used in this manual.



Note : This page is a sample for the purpose of describing the page structure. It differs in its actual content.

Icons

The icons used in this manual have the following meanings.

Precautions for Safe Use

Precautions on what to do and what to avoid doing to ensure the safe use of the product.

Precautions for Correct Use

Precautions on what to do and what to avoid doing to ensure proper operation and performance.

Additional Information

Additional information to read as required.
This information is provided to increase understanding or make operation easier.

Sections in This Manual

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Section 3 Controlling Operation and Data Output with Ethernet

Section 4 Controlling Operation and Data Output with RS-232C

Appendices

Terms and Conditions Agreement

Warranty, Limitations of Liability

Warranties

- **Exclusive Warranty**

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Change in Specifications

Product specifications and accessories may be changed at any time based on improvements and other reasons. It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may

be changed without any notice. When in doubt, special part numbers may be assigned to fix or establish key specifications for your application. Please consult with your Omron's representative at any time to confirm actual specifications of purchased Product.

Errors and Omissions

Information presented by Omron Companies has been checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical or proofreading errors or omissions.

Safety Precautions

For details on Safety Precautions, please refer to *Safety Precautions* in *MicroHAWK F320-F/F330-F/F420-F/F430-F Series Smart Camera User's Manual (Z433)* and *F440-F Series Smart Camera User's Manual (Z475)*.

Precautions for Safe Use

For details on Precautions for Safe Use, please refer to *Precautions for Safe Use* in *MicroHAWK F320-F/F330-F/F420-F/F430-F Series Smart Camera User's Manual (Z433)* and *F440-F Series Smart Camera User's Manual (Z475)*.

Precautions for Correct Use

For detailed precautions on the correct use of the product, please refer to *Precautions for Correct Use* in *MicroHAWK F320-F/F330-F/F420-F/F430-F Series Smart Camera User's Manual (Z433)* and *F440-F Series Smart Camera User's Manual (Z475)*.

Regulations and Standards

For details on Regulations and Standards, please refer to *Regulations and Standards* in *MicroHAWK F320-F/F330-F/F420-F/F430-F Series Smart Camera User's Manual (Z433)* and *F440-F Series Smart Camera User's Manual (Z475)*.

Related Manuals

The followings are the manuals related to this manual. Use these manuals for reference.

Name of Manual	Man.No.	Model	Purpose	Contents
MicroHAWK F320-F/F330-F/F420-F/F430-F Series Smart Camera User's Manual	Z433	F320-F/F330-F/F420-F/ F430-F series	When User confirm the product specifications and basic settings for using the MicroHAWK F320-F/ F330-F/F420-F/ F430-F series	Describes the specifications, quick start, setting method of the MicroHAWK F320-F/F330-F/F420-F/F430-F series.
F440-F Series Smart Camera User's Manual	Z475	F440-F series	When User confirm the product specifications and basic settings for using the F440-F series	Describes introduction, installation and connections, general specifications, and firmware update of the F440-F series.
F440-F/F430-F/F420-F Series Smart Camera User's Manual for Communications Settings	Z444	F440-F/F430-F/F420-F series	When User confirm the setting of communication functions of F440-F/F430-F/ F420-F series.	Describes the system configuration, control method, input / output specifications, network type, communication settings, and command parameters for using F440-F/F430-F/F420-F series.

Revision History

A manual revision code appears as a suffix to the catalog number on the front and back covers of the manual.

Rev. Code	Rev. Date	Revision Contents
01	Nov. 2021	First edition
02	Feb. 2022	Corrected mistakes.
03	Aug. 2022	Security Measures updates.
04	Nov. 2022	Added to F440-F series.
05	Jun. 2023	Corrected mistakes.

1

Communication Specifications Overview

This section provides a basic overview of the communications specifications and methods for controlling the smart cameras. This information is required before performing communications between the Smart Camera and an external device.

1-1 Confirming the System Configuration

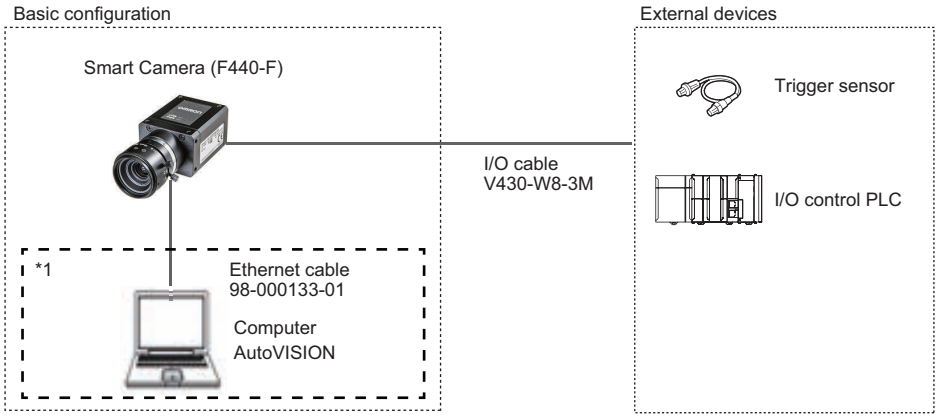
The F440-F/F430-F/F420-F series are smart camera that performs image-processing based inspections on captured images.
In a system configuration in which it is connected to a PLC, PC, or other external device, serial commands can be received from, and reading results can be output to the external device.

1-1-1 F440-F Series System Configuration

The F440-F can be used in the following types of system configurations.

Connection using Parallel I/O Interface

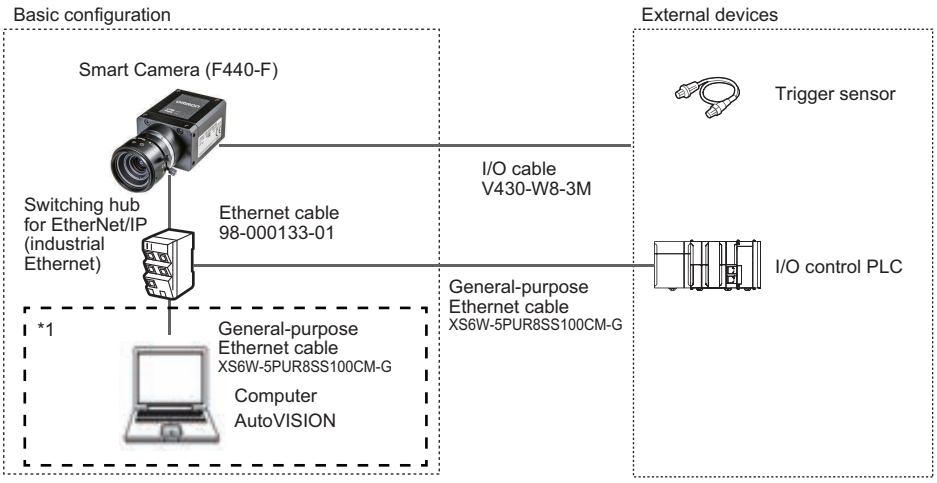
Trigger inputs and OK/NG Judgement result outputs are received and sent over I/O cable.



*1 If monitor display is not required, it is not necessary to connect with a PC during operation.

Connecting over Ethernet (EtherNet/IP, Serial (TCP), PROFINET)

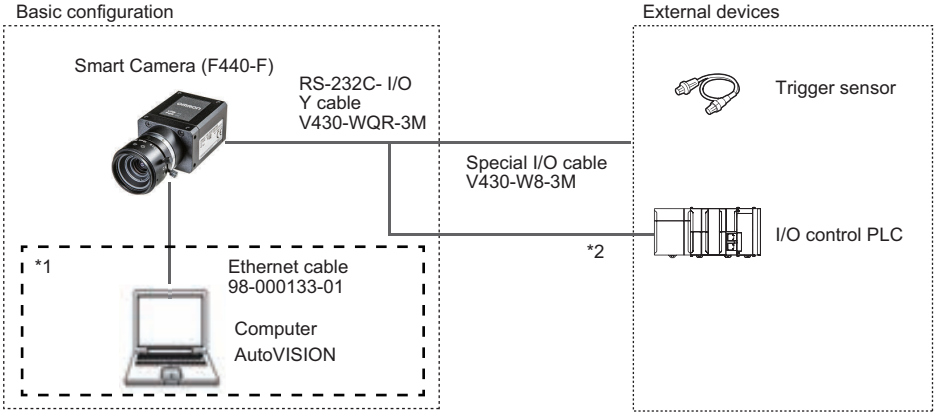
Establish network connections via an Ethernet cable to input triggers and communication commands and to output reading results (Judgment results and decoded content). Only the selected trigger can be used (*2-1-4 Change the Type of Trigger* on page 2-6). Using the data link function for each network (excluding Serial), data transfer can be done periodically between the smart camera and the external device.



*1 If monitor display is not required, it is not necessary to connect with a PC during operation.

Connecting by Serial (RS-232)

Triggers and Serial command input, as well as Read result judgement and Read string content data output is transmitted over RS-232C cable. Triggers can also be input over parallel I/O.



*1 If monitor display is not required, it is not necessary to connect with a PC during operation.

Additional Information

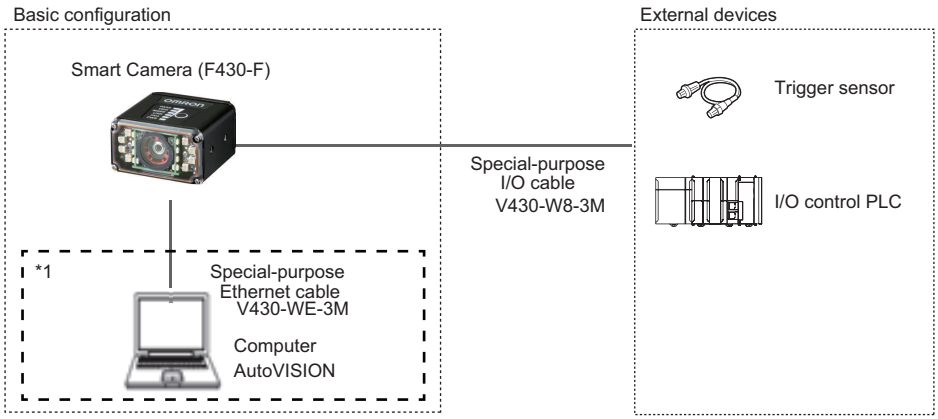
The cable to use for Serial (RS-232C) communication is RS-232C-I/O Y cable (V430-WQR-3M). Please use this cable when connecting to a PC by RS-232C.
When connecting with OMRON CS/CJ/NJ series controller, connect OMRON Programmable Controller (CS/CJ/NJ) RS-232C cable (V430-WPLC-2M) between RS-232C-I/O Y cable (V430-WQR-3M) and I/O control PLC (*2 in the figure).
For wiring different from the above, either make your own converter cable, or use the discrete wire cable type (V430-W8□ Series) with its RxD signal and TxD signal converted.

1-1-2 F430-F Series System Configuration

The F430-F can be used in the following types of system configurations.

Connection using Parallel I/O Interface

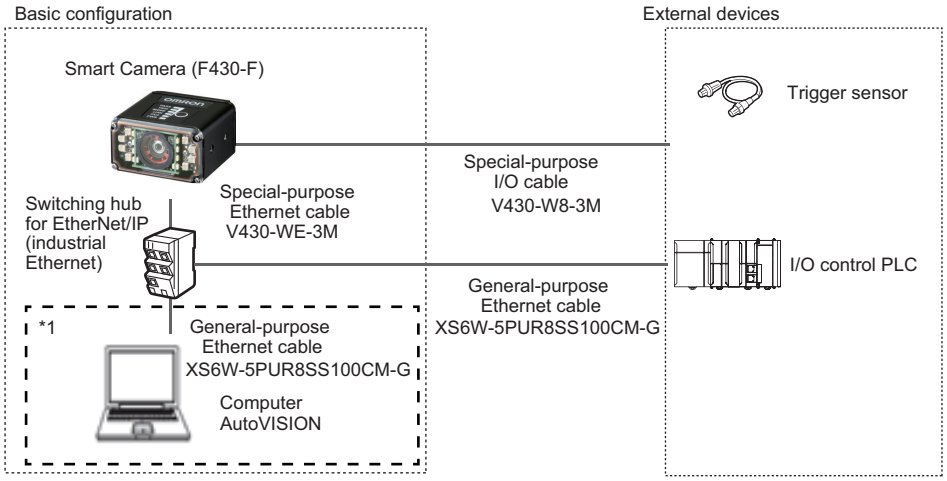
Trigger inputs and OK/NG Judgement result outputs are received and sent over I/O cable.



*1 If monitor display is not required, it is not necessary to connect with a PC during operation.

Connecting over Ethernet (EtherNet/IP, Serial (TCP), PROFINET)

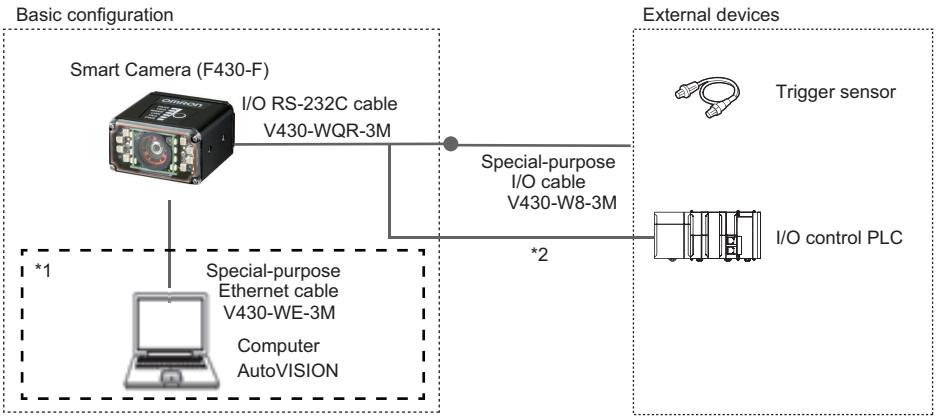
Establish network connections via an Ethernet cable to input triggers and communication commands and to output reading results (Judgment results and decoded content). Only the selected trigger can be used. (*2-1-4 Change the Type of Trigger* on page 2-6) Using the data link function for each network (excluding Serial), data transfer can be done periodically between the smart camera and the external device.



*1 If monitor display is not required, it is not necessary to connect with a PC during operation.

Connecting by Serial (RS-232)

Triggers and Serial command input, as well as Read result judgement and Read string content data output is transmitted over RS-232C cable. Triggers can also be input over parallel I/O.



*1 If monitor display is not required, it is not necessary to connect with a PC during operation.

Additional Information

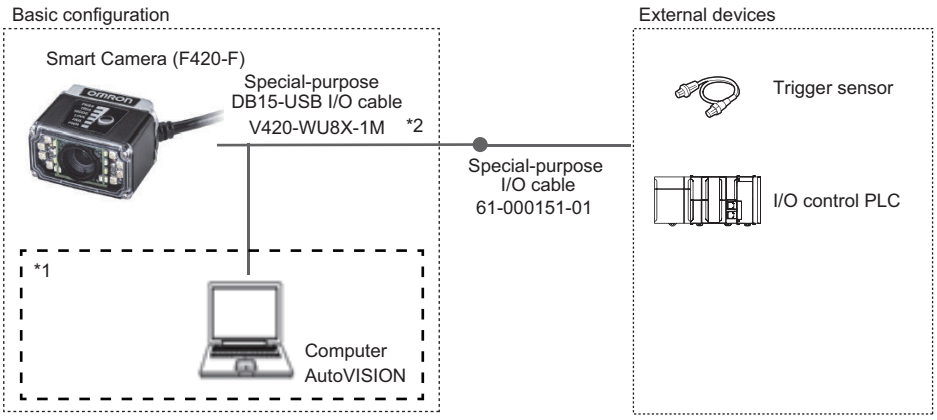
The cable to use for Serial (RS-232C) communication is RS-232C-I/O Y cable (V430-WQR-3M). Please use this cable when connecting to a PC by RS-232C.
When connecting with OMRON CS/CJ/NJ series controller, connect OMRON Programmable Controller (CS/CJ/NJ) RS-232C cable (V430-WPLC-2M) between RS-232C-I/O Y cable (V430-WQR-3M) and I/O control PLC (*2 in the figure).
For wiring different from the above, either make your own converter cable, or use the discrete wire cable type (V430-W8□ Series) with its RxD signal and TxD signal converted.

1-1-3 F420-F Series System Configuration

The F420-F can be used in the following types of system configurations.

Connection using Parallel I/O Interface

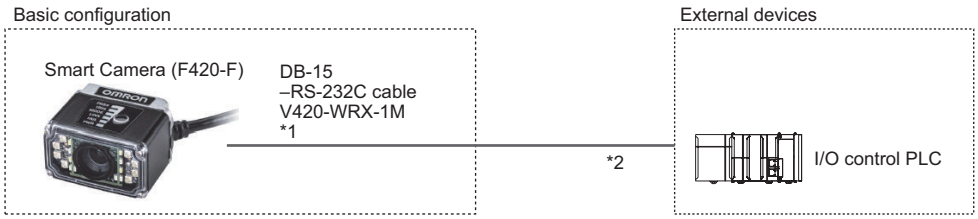
Trigger inputs and OK/NG Judgement result outputs are received and sent over I/O cable.



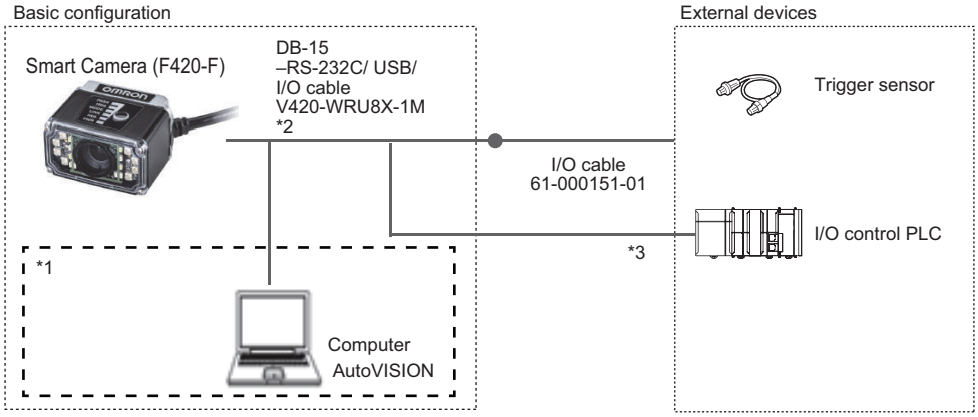
*1 If monitor display is not required, it is not necessary to connect with a PC during operation.
*2 The V420-WU8X-1M requires power supply from the external power source (97-000011-02).

Connecting by Serial (RS-232)

Triggers and Serial command input, as well as Read result judgement and Read string content data output is transmitted over RS-232C cable. Triggers can also be input over parallel I/O.



*1 The V420-WRX-1M requires power supply from the external power source (97-900006-01).
*2 When connecting with OMRON CS/CJ/NJ series controller, connect OMRON Programmable Controller (CS/CJ/NJ) RS-232C cable (V430-WPLC-2M) between Special DB-15 - RS-232C cable (V420-WRX-1M) and I/O control PLC (*2 in the figure).



*1 If monitor display is not required, it is not necessary to connect with a PC during operation.
*2 The V420-WRU8X-1M requires power supply from the external power source (97-000011-02).
*3 When connecting with OMRON CS/CJ/NJ series controller, connect OMRON Programmable Controller (CS/CJ/NJ) RS-232C cable (V430-WPLC-2M) between Special DB-15 - RS-232C/USB/ I/O cable (V420-WRU8X-1M) and I/O control PLC (*3 in the figure).

1-2 Communicating with an External Device

This section gives the communications specifications, describes the control methods that you can use for communications, and describes the settings that are required before starting communications with an external device.

1-2-1 Basic Control Operations of the Smart Camera

The following figure shows basic communications between an external device and the smart camera and the flow of signals and data.

The following methods can be used to exchange data between an external device and the smart camera.

Commands that can be input to the smart camera from an external device

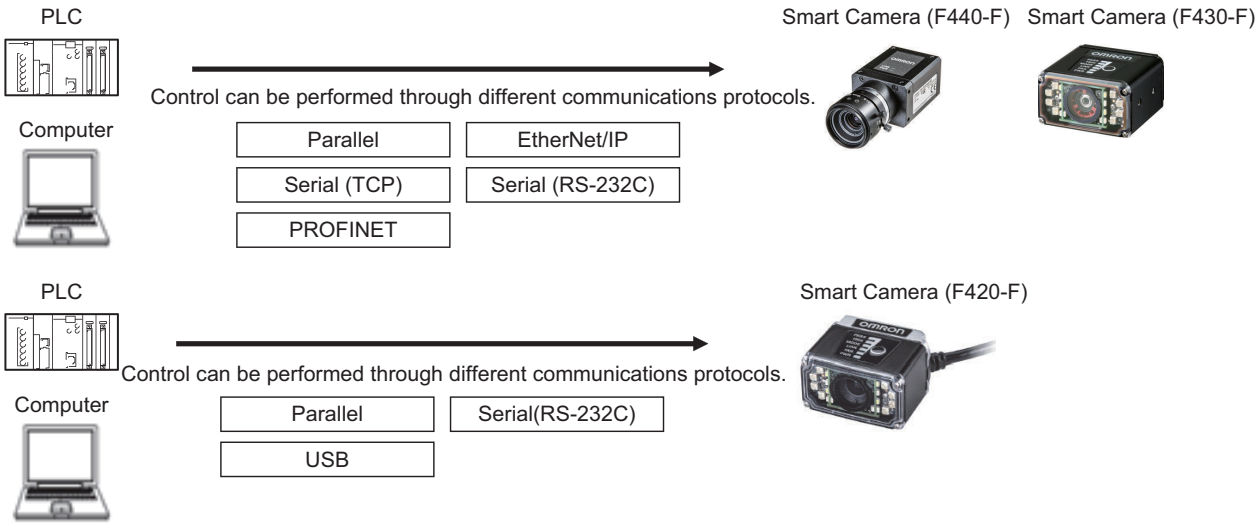
Type		Description
Control commands	Control Signals (Input Signals)	Online, offline, trigger (TRIG signal: ON), job change, counter reset, data save, set
	Communication Command Input	Various commands can be executed. The communication commands differ depending on the communications protocol that you use.

Data output from the smart camera to an external device

Type	Description
Status signals	The status of the smart camera is notified to an external device.
Result data	Inspection results
State	The operating status of the smart camera is displayed.
Command execution result	The result of the executed command is output from the smart camera to an external device.

1-2-2 Applicable Communications Protocols for the F440-F/F430-F/F420-F Series

The F440-F/F430-F/F420-F Series can be controlled from a PLC, computer, or other external device using various communication protocols.
The following types of communication protocols can be used for controlling the F440-F/F430-F/F420-F Series from an external device.



Applicable Communications Protocols

○: Supported -: Not supported

Communication Method	Communication Protocol	Description	Communication Cable Type		
			Parallel I/O	Ethernet	RS-232C
Contact Input Interface	Parallel I/O	Data is exchanged between an external device and the smart camera through combinations of ON/OFF signals from multiple physical contacts.	○	-	-
Data Sharing	EtherNet/IP	This is an open communications protocol. Tag Data Links are used for communication with the smart camera. On the PLC, structured variables are created that correspond to the control signals, Command/Response data, and Read data. These variables are then used as I/O Tag Data Links to exchange data between the PLC and the smart camera.	-	○	-
	PROFINET	This is an open communications protocol. Software-based RT (Real-time) communications, (SRT) is used for communication with the smart camera. The control signals, Command Area/Response Area, and area to store Read result data are assigned in the I/O memory of the PLC, and data is exchanged cyclically between the PLC and the smart camera.	-	○	-
Frame Transmission	Serial (TCP)	Command frames are sent to the smart camera and Response frames are received from the smart camera without the use of any specific protocol. Data can be exchanged between the PLC, computer, or other external device and the smart camera in ASCII or binary format.	-	○	-
	Serial (RS-232C)	Data can be exchanged in ASCII format over the RS-232C cable connection between the smart camera and its controlling device (PLC, PC, or other external device).	-	-	○

Simultaneous Use of Communication Methods and Connections

○: Supported -: Not supported

Connection Method	Simultaneous Connection Method				
	EtherNet/IP	PROFINET	Serial (TCP)	Serial (RS-232C)	Parallel I/O
EtherNet/IP	N/A	-	○	○	○
PROFINET	-	N/A	○	○	○
Serial (TCP)	○	○	N/A	○	○
Serial (RS-232C)	○	○	○	N/A	○
Parallel I/O	○	○	○	○	N/A

Additional Information

About connections over network routers
AutoVISION can connect to smart cameras on different networks across routers.
- To connect to the smart camera, enter smart camera's IP address from the browser.
- Set a fixed IP address for the smart camera you wish to connect to.

2

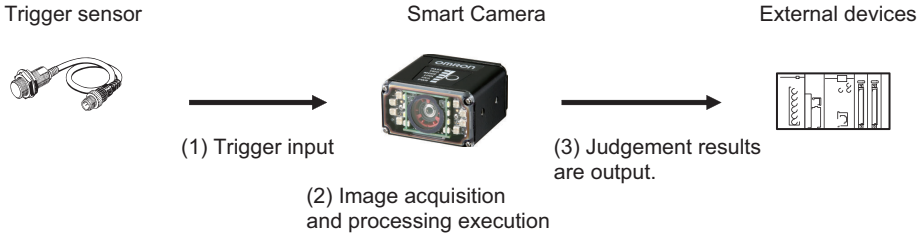
Controlling Operation and Data Output with Parallel

2-1 Controlling Operation and Data Output with Parallel I/O

This section explains how to connect the smart camera to an external device by the I/O cable and the methods that you can use to control the smart camera from the external device.

2-1-1 Basic Operation with a Parallel I/O Connection

This section describes the basic connections and signal flow with external devices.
Operation for one of the primary uses is described in the example below.

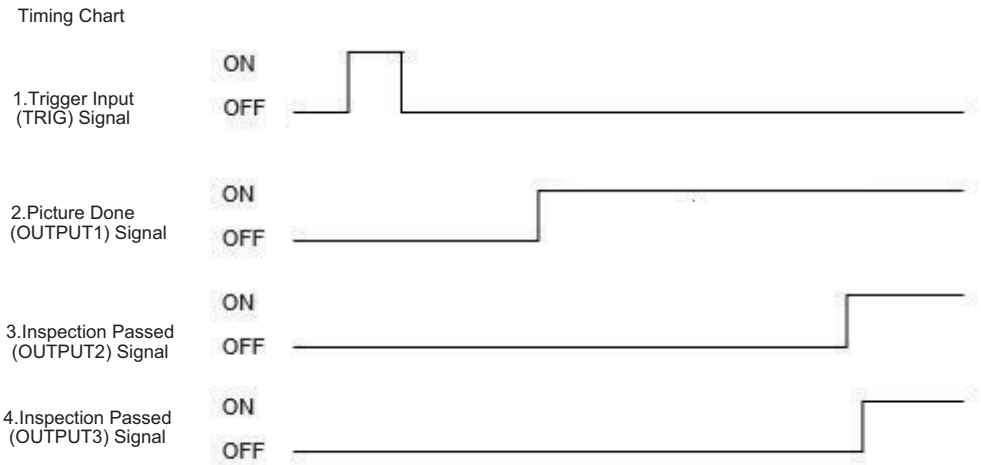


Example of Trigger Input and OUTPUT signal

Below is an Output assignment example and Timing chart.
[Example assignment of OUTPUT signals]

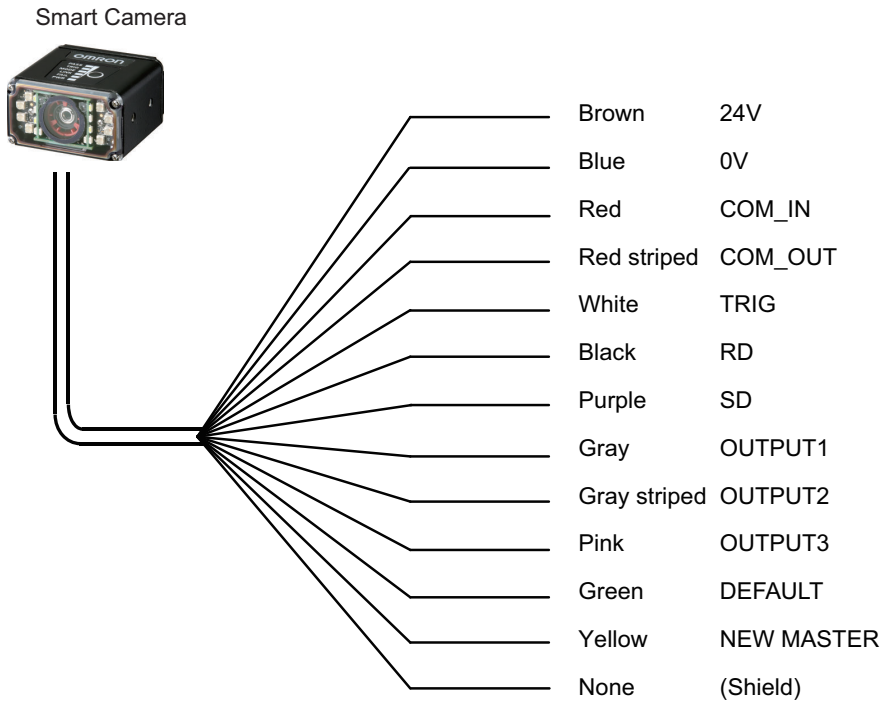
- Output 1: Image Acquisition Done
  This signal turns ON when the smart camera has completed image acquisition.
- Output 2: Reading Successful
  This signal turns ON when the Symbol Decode Tool has read the code correctly.
- Output 3: Inspection Done
  This signal turns ON when all inspections have been completed.

For how to set up the Output signal assignments, please refer to *2-1-7 Change the Assignments for the Output Signal (Output 1 to 3) ON Condition* on page 2-9.



2-1-2 Wiring and Electrical Specifications for Parallel I/O [F440-F/F430-F]

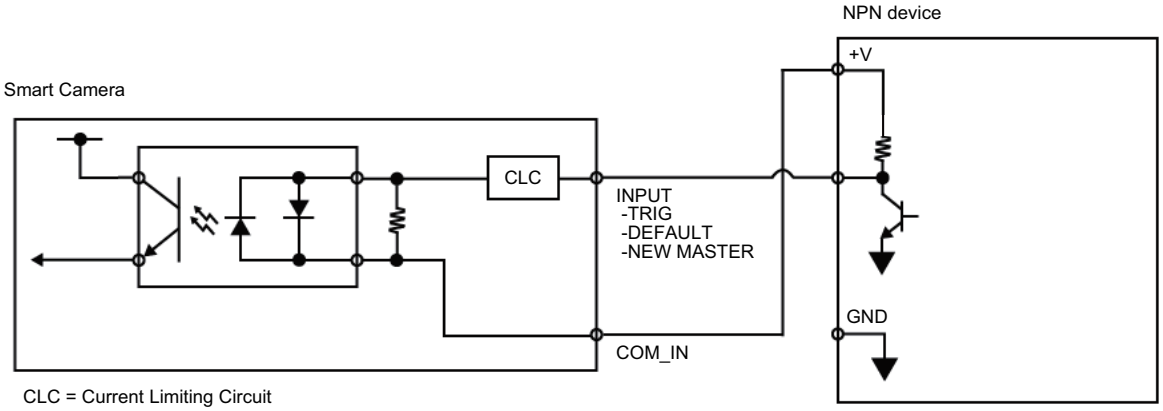
The following is the wiring diagram of the power cable to connect to the smart camera (All V430-W8).



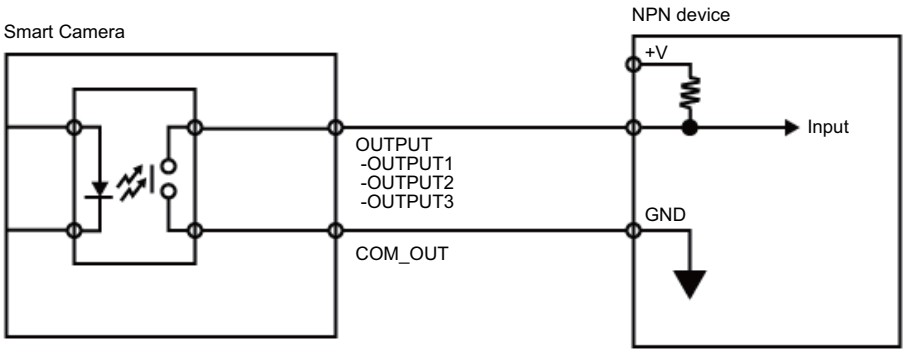
Colors for each wire

Wire color	Pin No.	Signal Name	Function
Brown	2	24V	Power supply
Blue	7	0V	GND
Red	8	COM_IN	Common Input Signals (Input Common)
Red striped	12	COM_OUT	Common Output Signals (Output Common)
White	1	TRIG	Measurement Trigger Input (When the trigger setting is selected sensor)
Black	9	RD	Receive Data
Purple	10	SD	Send Data
Gray	5	OUTPUT1	Output1
Gray striped	11	OUTPUT2	Output2
Pink	6	OUTPUT3	Output3
Green	3	DEFAULT	Default This is not used for the F440-F/F430-F.
Yellow	4	NEW MASTER	New Master This pin is used when the Decode Tool is used to learn new match strings. To enable the learning function, turn ON pin number 4 with the Auto Teaching option set to “Learn Match Strings” in the Advanced Settings of the decoder tool. If the trigger setting is digital, a measurement trigger is also entered.
None	-	(Shield)	Shield

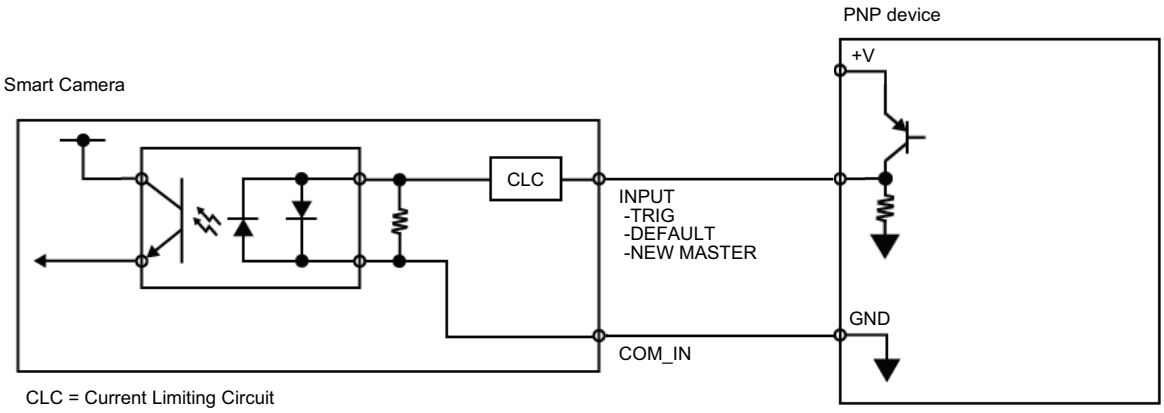
- Input circuit diagram (F440-F/F430-F ⇔ External device) when NPN connected



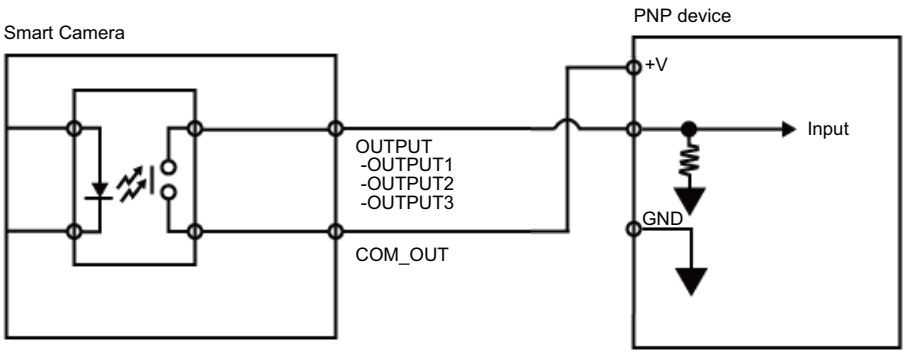
- Output circuit diagram (F440-F/F430-F ⇔ External device) when NPN connected



- Input circuit diagram (F440-F/F430-F ⇔ External device) when PNP connected



- Output circuit diagram (F440-F/F430-F ⇔ External device) when PNP connected



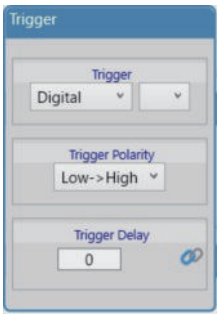
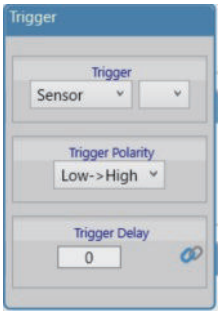
2-1-3 Change the Behavior of Operation

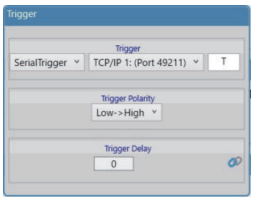
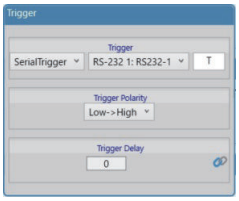
The following changes are possible depending on the system configuration and usage.

Type	Modification
Change the type of Trigger	You can change the method used to trigger a Read (Triggered, or Continuous).
Change the trigger delay of trigger	You can change the trigger delay of trigger.
Change the trigger polarity of trigger	You can change the trigger polarity of trigger.
Change the assignments for the Output Signal (Output 1 to 3) ON Condition	Change the ON condition for Output 1 to 3.
Change the ON/OFF timing of the Output Signal (Output 1 to 3)	Change the OFF timing of the Output 1 to 3 signals after they turn ON.
Change the Output polarity of Output Signal (Output 1 to 3)	Change the Output polarity for Output 1 to 3.

2-1-4 Change the Type of Trigger

It is possible to change the Input method for the trigger used by the Smart Camera to execute Image capture. For details, refer to the AutoVISION Software Help.

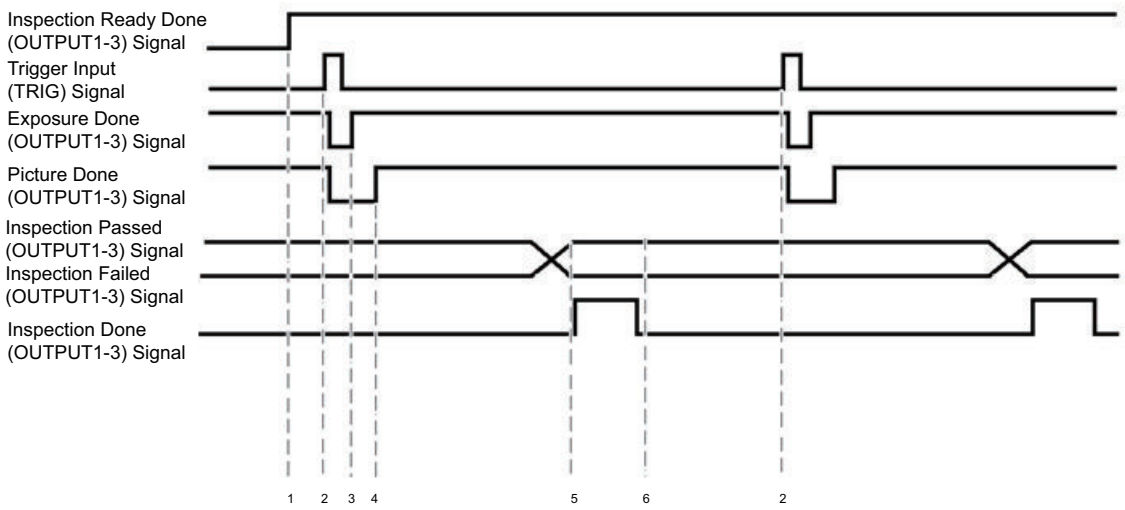
Setting item	I/O Type	Option	Description	Example
Trigger	None	• Trigger Polarity Low-> High High->Low • Trigger Delay	Select this option to perform continuous measurement based on internal timing.	
	Digital	• Trigger Polarity Low-> High High->Low • Trigger Delay	Use this option to update the decode tool's match string while entering a measurement trigger.	
	Virtual	• Trigger Polarity Low-> High High->Low • Trigger Delay	Select this option to perform measurement based on the measurement trigger generated in the smart camera. It is for testing.	
	Sensor	• Trigger Polarity Low-> High High->Low • Trigger Delay	Select this option to use an industrial protocol (Ethernet/IP, etc.) and parallel trigger signal for measurement trigger input.	

Setting item	I/O Type	Option	Description	Example
	Serial trigger	• Port • Trigger Character • Trigger Polarity Low-> High High->Low • Trigger Delay	Use this option to perform measurement based on input from an RS-232C port or TCP port.	 

2-1-5 Standard Inspection Mode Operation

The timing chart for standard inspection mode is shown below. It is valid for all trigger types. In standard inspection mode, the next measurement trigger can be input after completion of an inspection. You can use the AutoVISION software to assign the signals shown in the figure to Output 1 to 3 for inspection output. For details, refer to the AutoVISION Software Help.

Standard Inspection Mode

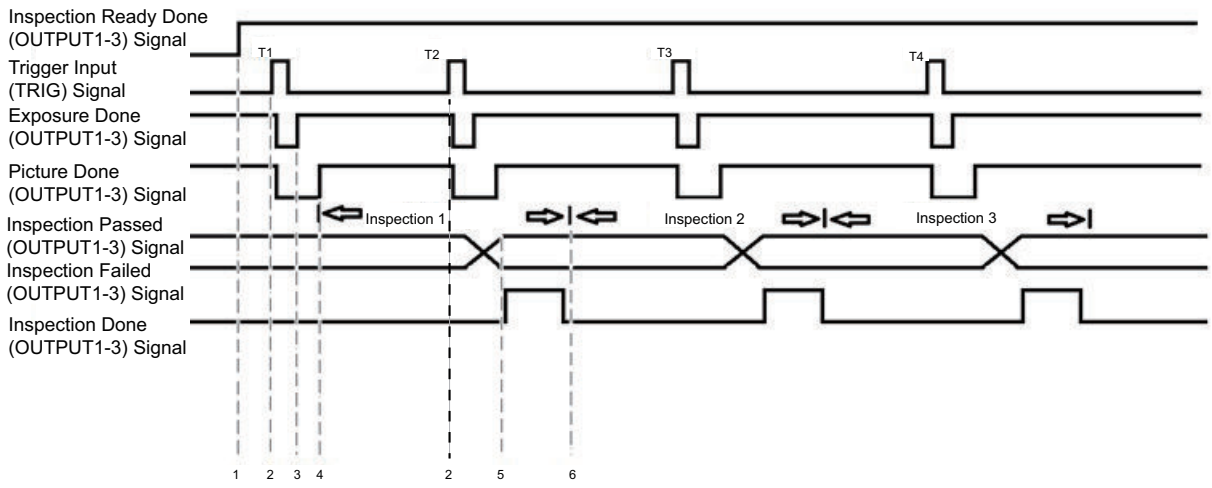


1. When the smart camera enters Run mode, the Inspection Ready signal turns ON.
2. Input the measurement trigger.
3. The Expose Done signal turns OFF while the sensor is exposed and turns ON when the exposure is completed. You can move the inspection object when the Expose Done signal turns ON.
4. The Picture Done signal turns OFF while the sensor acquires an image and turns ON when transfer of the image to memory is completed. When the Picture Done signal turns ON, inspection starts.
5. When processing of the image is completed, the Inspection Passed/Failed signal is set and the Inspection Done signal turns ON. This indicates that the I/O line is prepared for sampling and ready to read data.
6. The Inspection Done signal turns OFF to indicate that the inspection is completed.

2-1-6 Pipeline Inspection Mode Operation

The pipeline inspection mode allows the smart camera to start acquiring a new image before completion of the previous inspection. When capture of an image is completed, the next measurement trigger can be accepted. Since acquisition and processing of the next image can be performed in parallel, takt time can be reduced.
You can use the AutoVISION software to assign the signals shown in the figure to Output 1 to 3 for inspection output. For details, refer to the AutoVISION Software Help.

Pipeline Inspection Mode



1. When the smart camera enters Run mode, the Inspection Ready signal turns ON.
2. Input the measurement trigger.
3. The Expose Done signal turns OFF while the sensor is exposed and turns ON when the exposure is completed. You can move the inspection object when the Expose Done signal turns ON.
4. The Picture Done signal turns OFF while the sensor acquires an image and turns ON when transfer of the image to memory is completed. When the Picture Done signal turns ON, inspection starts.
5. When processing of the image is completed, the Inspection Passed/Failed signal is set and the Inspection Done signal turns ON. This indicates that the I/O line is prepared for sampling and ready to read data.
6. The Inspection Done signal turns OFF to indicate that the inspection is completed.

2-1-7 Change the Assignments for the Output Signal (Output 1 to 3) ON Condition

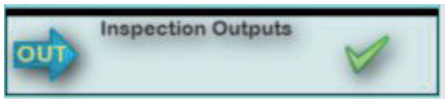
The condition for turning the Output signals, Output 1, 2, 3 to ON can be set. The following conditions for output can be set.

How to Assign the Output Signals

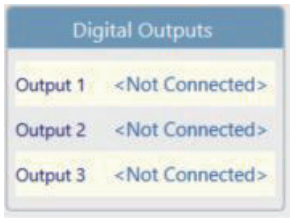
1 Launch the AutoVISION software.

2 Click **Edit** tab.

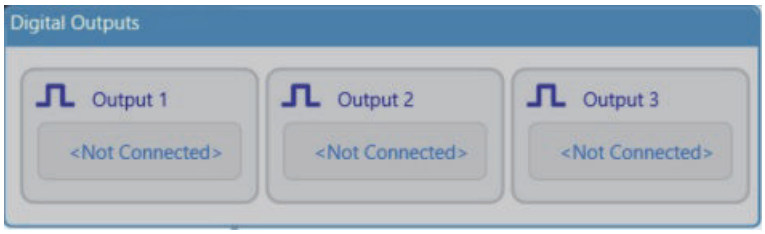
3 Click on the **Inspection Outputs** bar.



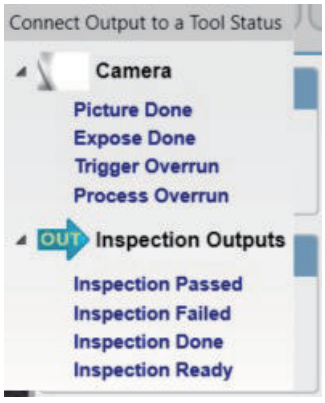
The **Digital Outputs** tab is displayed on the right of the window.



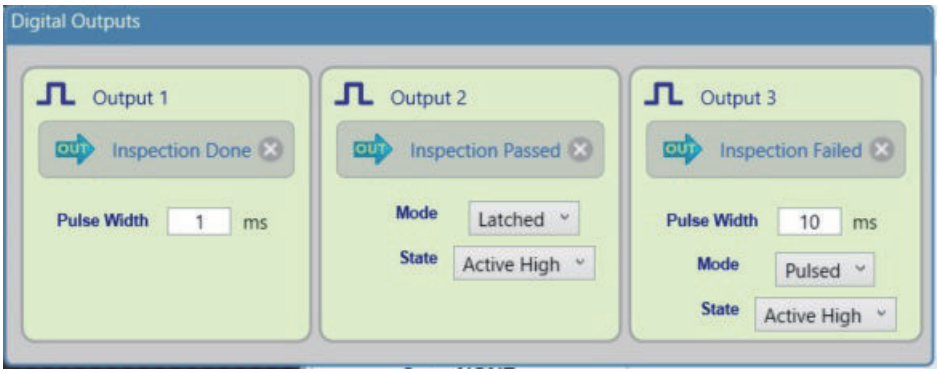
4 Click anywhere in the **Digital Outputs** tab.
The following screen is displayed.



5 Click **Output 1**.
The following screen is displayed.

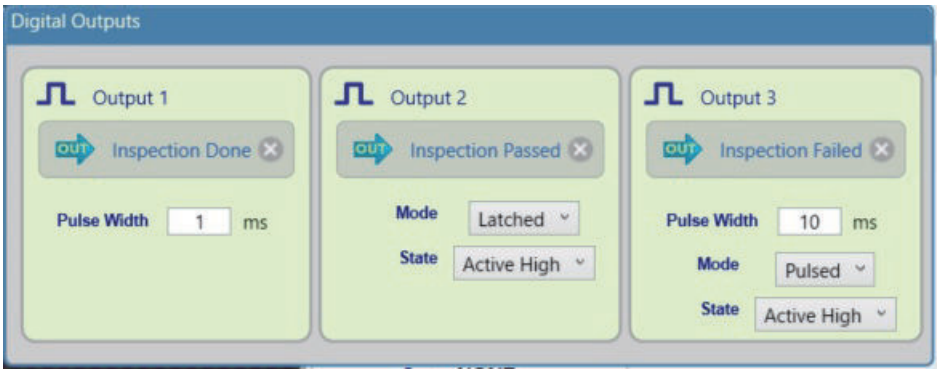


Select the output to use for **Output 1**. In this example, select *Inspection Done*. Enter the pulse width at which the output turns ON.



Setting item	Setting value	Description
Pulse Width	1 to 10000 (ms)	Enter the time during which the ON state is held.

6 Select the outputs to use for **Output 2** and **Output 3**.
In this example, select *Inspection Passed* for Output 2 and *Inspection Failed* for Output 3. Set the **Pulse Width**, **Mode**, and **State** for the outputs.



Setting item	Setting value	Description
Pulse Width	1 to 10000 (ms)	Set this only when the **Mode** is *Pulse*. Enter the time during which the ON state is held.
Mode	• Latched • Pulsed	The output status will be set at the end of inspection cycles. • Latched The status will remain latched until the end of the next inspection cycle. • Pulsed The output will be ON during the time set in Pulse Width.
State	• Active High • Active Low	• Active High The state will be Low when output is OFF. The state will be High when output is ON. • Active Low The state will be High when output is OFF. The state will be Low when output is ON.

7 Save the settings and download the job to the smart camera.

2-1-8 Use as Ext.Illumination Strobe

Outputs the signal used to illuminate with external lighting.

When **Output 3** is set to turn ON external lighting, the output will be ON while the smart camera is exposed. In this mode, changing the exposure time also changes the ON time for **Output 3**.

- In the **Image** view of the AutoVISION software, select **External Strobe** in **Lighting Mode**. For details, refer to the AutoVISION Software Help.

3

Controlling Operation and Data Output with Ethernet

3-1 Controlling Operation and Data Output with EtherNet/IP

3-1-1 EtherNet/IP Overview

EtherNet/IP is an industrial multi-vendor network that uses Ethernet. The EtherNet/IP specifications are open standards managed by the ODVA (OpenDeviceNet Vendor Association). EtherNet/IP is used by a wide range of industrial devices.
Because EtherNet/IP uses standard Ethernet technology, various general-purpose Ethernet devices can be used in the network.
EtherNet/IP has mainly the following features.

- **High-speed, High-capacity Data Exchange through Tag Data Links (Cyclic Communications)**
  The EtherNet/IP protocol supports implicit communications, which allows cyclic communications (called Tag Data Links) with EtherNet/IP devices.

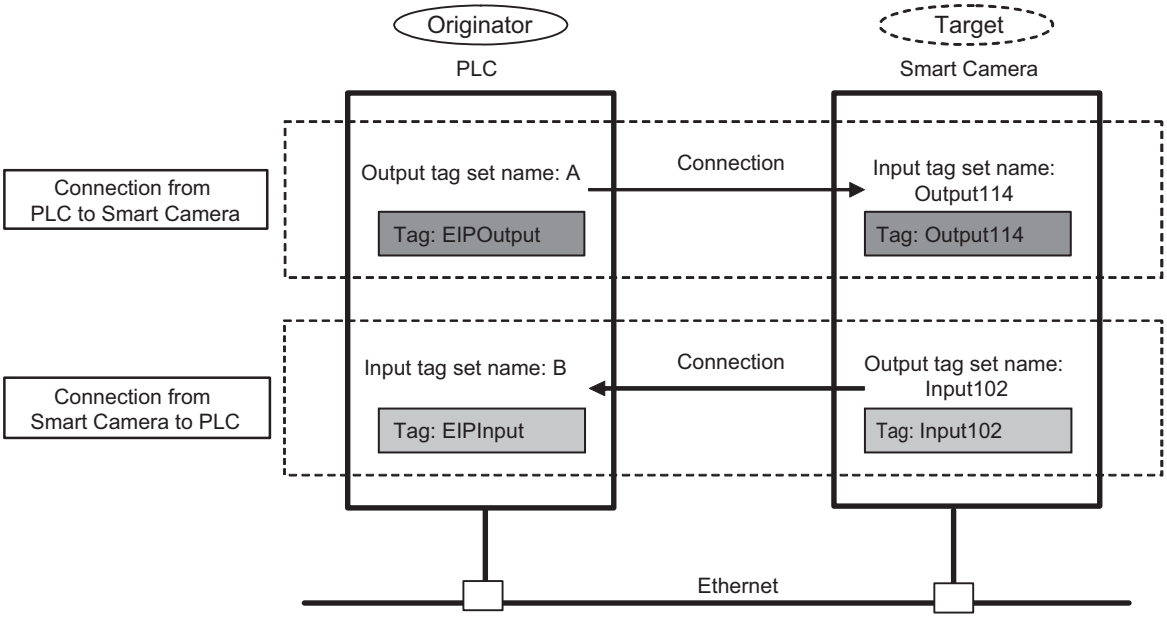
- **Tag Data Links are set at the specified communication cycle for each application regardless of the number of nodes**
  Because the data is exchanged over the network at the refresh cycle that is set for each connection regardless of the number of nodes, that refresh cycle will not increase even if the number of nodes increases. (Data exchange in the connection is kept in synch)
  Because the refresh cycle can be set for each connection, each application can communicate at its ideal refresh cycle. (For example, interprocess interlocks can be transferred at high speed, while the production commands and the status monitor information are transferred at low speed.)

Precautions for Correct Use

On a network to which many devices are connected, performance may drop (e.g., responses may be delayed or packets lost) or communications errors may occur when there is temporarily high traffic on the network.
Test the operation under actual conditions before you start actual operation of the system.

Data Exchange with EtherNet/IP (Implicit Communications)

Data is exchanged cyclically between Ethernet devices on the EtherNet/IP network using Tag Data Links as shown below.



- **Data Exchange Method**
  To exchange data, a connection is opened between two EtherNet/IP devices.
  One of the nodes requests the connection to open a connection with a remote node.
  The node that requests the connection is called the *Originator* and the node that receives the request is called the *Target*.

- **Data Exchange Memory Locations**
  The memory locations that are used to exchange data across a connection are specified as tags.
  You can specify memory addresses or variables for tags.
  A group of tags consists of an output tag set and an input tag set.

Additional Information

Message communications are used when communicating over EtherNet/IP with a PLC that does not support Tag Data Link communications (*3-1-9 Connection Properties: Class 3 Explicit Messaging* on page 3-24).

3-1-2 Communication with the Smart Camera over EtherNet/IP Connection

With commands and responses via communications between the PLC and the Sensor Controller using EtherNet/IP tag data link, the PLC can control the Sensor Controller and make it output data after measurements.

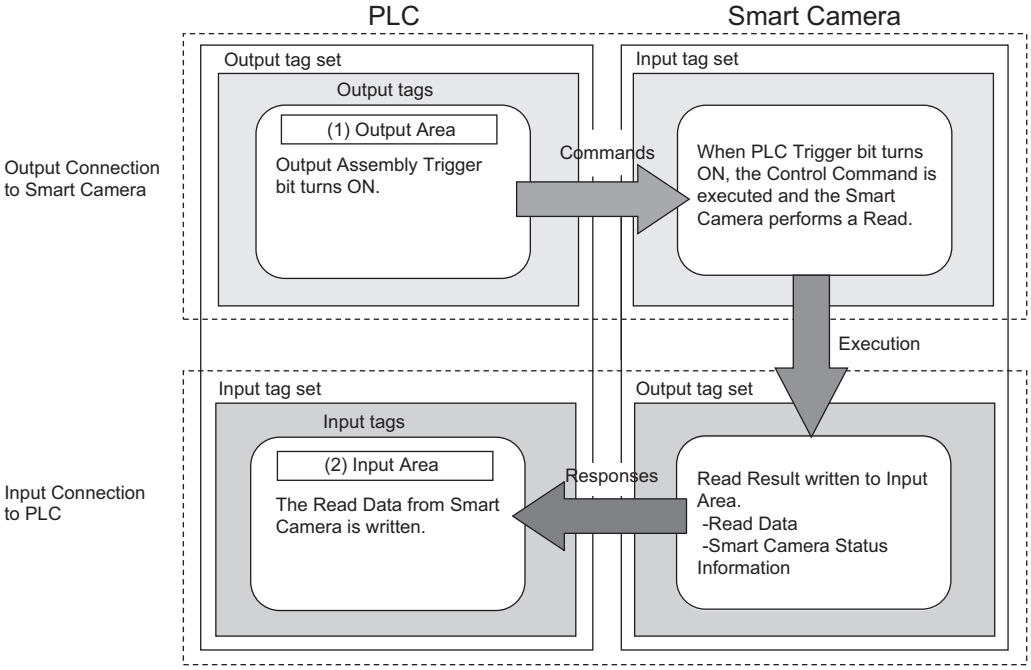
When you connect to an OMRON Controller to communicate with it via EtherNet/IP, use the Network Configurator to perform the tag data link settings such as tag, tag set, and connection setting.

This section describes how to use the Network Configurator to perform tag data link settings.

- *NJ-series CPU Unit Built-in EtherNet/IP Port User's Manual (Cat. No. W506)*
- *CS/CJ series EtherNet/IP Units Operation Manual (Cat. No. W465)*
- *CJ-series EtherNet/IP Units Operation Manual for NJ-series CPU Unit (Cat. No. W495)*

Types of Communication Areas

For EtherNet/IP, communication with a PLC, the communication is performed using two communication areas on the PLC, the Input Field and the Output Field. The Smart Camera has Input Field Assembly (Input Assembly) and Output Field Assembly (Output Assembly).



3-1-3 Communications Settings

The following settings are required to use EtherNet/IP communications.

1. Communications specifications settings
↓
2. Tag data link settings
↓
3. Output data settings

… Set the IP address and industrial protocol.
For details, refer to*3-1-4 Communication Specifications Settings [EtherNet/IP]* on page 3-6.

… Set tag data links to exchange data with external devices.
For details, refer to*3-1-5 Tag Data Link Setting Methods* on page 3-12.

… Set output data.
For details, refer to*3-1-6 Output Setting Example* on page 3-13.

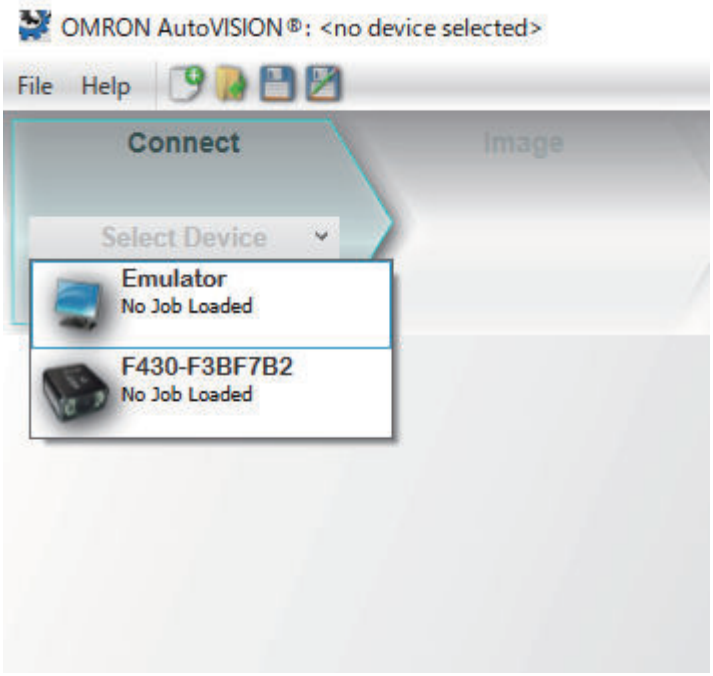
3-1-4 Communication Specifications Settings [EtherNet/IP]

Setting IP Address and Industrial Protocol

In the AutoVISION software, set the IP address and industrial protocol for the smart camera according to your network of external devices such as the PLC.

1 From the Windows **Start** menu, click **Omron AutoVISION**.
This launches the **OMRON AutoVISION** software.

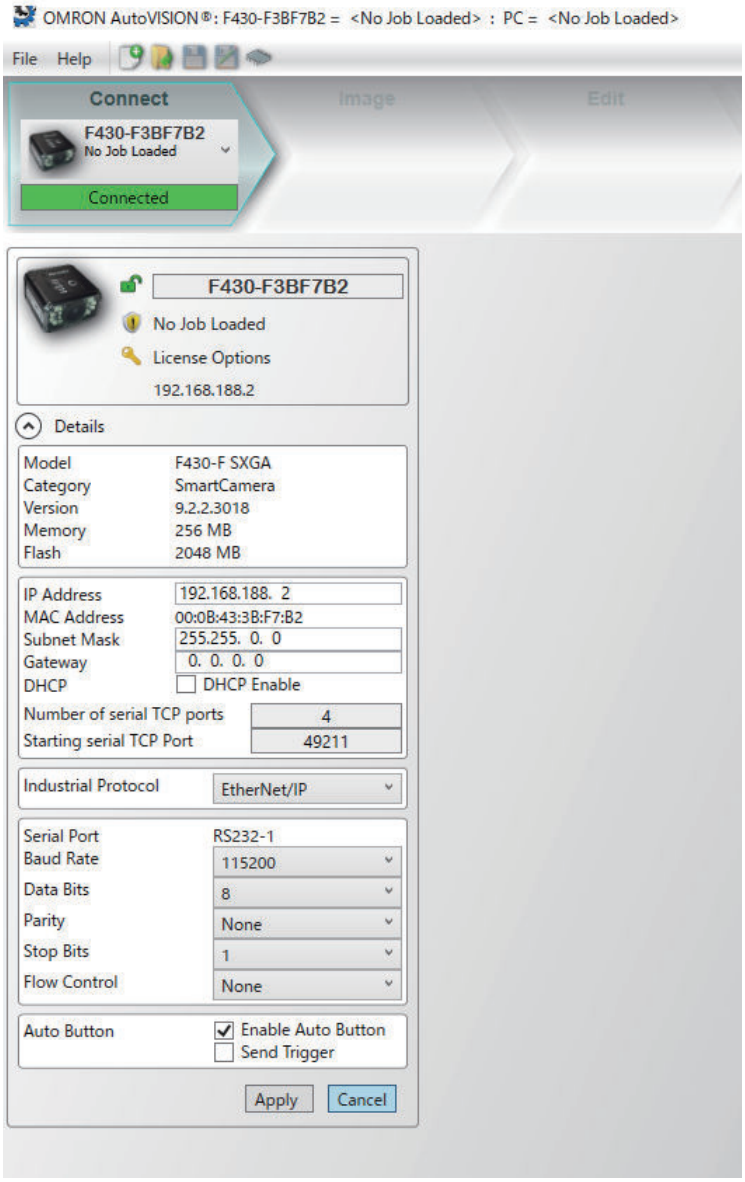
2 Click **Select Device**.



3 Click the smart camera for which you want to change the settings.
The following screen is displayed.

4 Click the Lock icon ( ) to enable changing the settings.
The smart camera's settings are unlocked and the **Modify** button is displayed.

5 Click **Modify** and enter information such as the **IP Address**.



6 From the **Industrial Protocol** drop-down menu, select **EtherNet/IP**.

Setting item	Setting value	Description
Industrial Protocol	• <none> • EtherNet/IP • PROFINET	Select the industrial protocol to use.

Precautions for Correct Use

To connect the smart camera to external devices via EtherNet/IP, the IP address must be set in the same network segment.

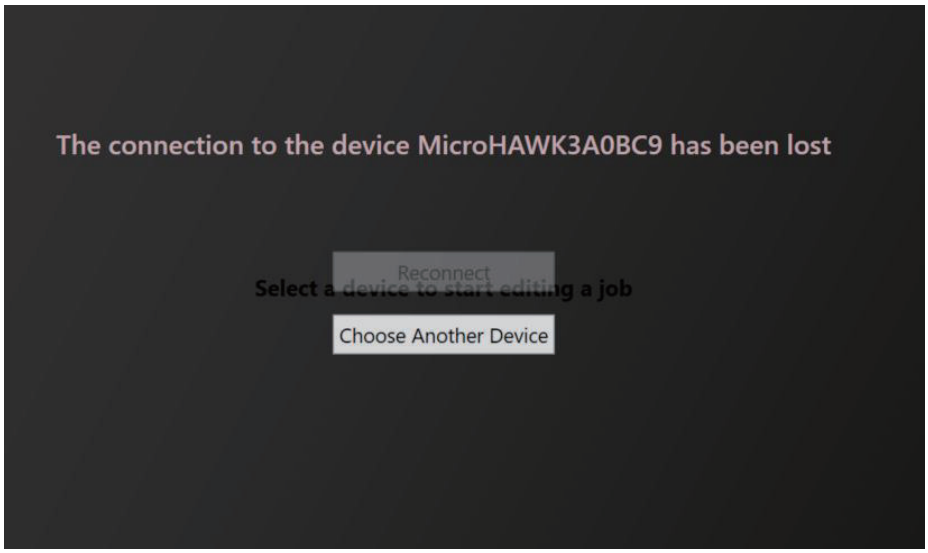
7 Click **Apply**. Then, the **Reboot Required** dialog box is displayed.

Precautions for Correct Use

After you change the industrial protocol, you need to reboot the smart camera to have the new setting take effect.

8 Click the **Yes** button to reboot the smart camera.
The AutoVISION software is disabled while the smart camera is rebooting.

9 Click the **Reconnect** button to reconnect it.



10 The connection is completed.


OMRON AutoVISION®: F430-F3BF7B2 = <No Job Loaded> : PC = <No Job Loaded>
File Help
Connect
Image
Edit
F430-F3BF7B2
No Job Loaded
Connected
F430-F3BF7B2
No Job Loaded
License Options
192.168.188.2
Details
Model F430-F SXGA
Category SmartCamera
Version 9.2.2.3018
Memory 256 MB
Flash 2048 MB
IP Address 192.168.188.2
MAC Address 00:0B:43:3B:F7:B2
Subnet Mask 255.255.0.0
Gateway 0.0.0.0
DHCP Disabled
Number of serial TCP ports 4
Starting serial TCP Port 49211
Industrial Protocol EtherNet/IP
Serial Port RS232-1
Baud Rate 115200
Data Bits 8
Parity None
Stop Bits 1
Flow Control None
Auto Button True
Modify

3-1-5 Tag Data Link Setting Methods

This section describes how to set data links for EtherNet/IP.
The communications areas in the PLC for which data links to the smart camera are created are specified as tags and tag sets, and the connections are set for tag data link communications.

Precautions for Correct Use

When connecting to an NJ-series or CJ-series CPU Unit, install the EDS file that defines the connection information for the smart camera in to Sysmac Studio.
Download the EDS file from OMRON's website.

Tags, Tag Sets, and Connection Settings

The tag data link data for the smart camera has been assigned to global variables in the Controller.

Assembly list

Assembly name	Input / Output	Size (byte)	Instance ID	Assembly information	Details of data structure
INPUT320	Input	320	102	This is the standard input assembly.	*1
OUTPUT320	Output	320	114	This is the standard output assembly.	

*1. For details, refer to *3-1-7 Status and Control Signals for Each Input and Output Assembly* on page 3-14.

Tag Sett Settings

Setting item	Description
Input	
Tag set name	Tag set name in the PLC
Size	• 320 bytes
Output	
Tag set name	Tag set name in the PLC
Size	• 320 bytes

Connection Settings

Setting item	Description
Input	
Target variable	INPUT320, Instance102
Size (Target variable)	• 320 bytes
Originator variable	Variable defined on the PLC
Size (Originator variable)	• 320 bytes
Connection type	Point to Point connection
RPI (Requested Packet Interval)	10 ms to 3.2 s 20 ms or more is recommended.
Timeout	RPI × (4 to 512) (Default: RPI × 4)
Output	
Target variable	OUTPUT320, Instance114
Size (Target variable)	• 320 bytes

Setting item	Description
Originator variable	Variable defined on the PLC
Size (Originator variable)	• 320 bytes
Connection type	Point to Point connection

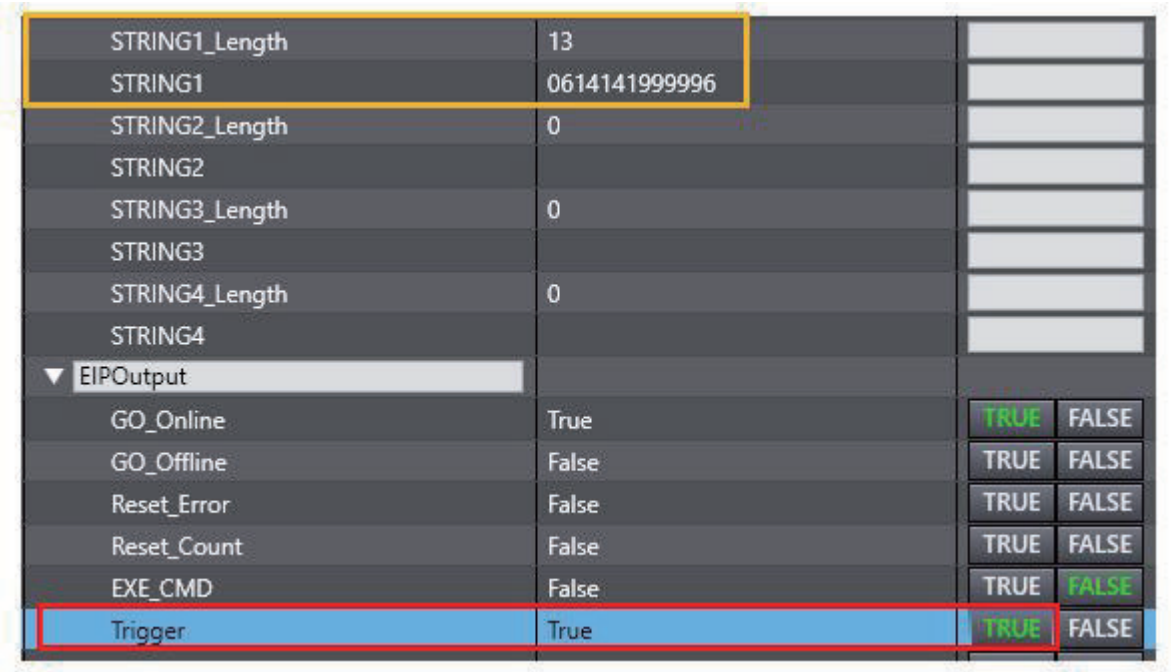
Precautions for Correct Use

If the CIO memory area that holds contents were not specified when I/O memory addresses are specified for communication areas, the information in each communication area will be cleared when the operating mode of the PLC is changed.

3-1-6 Output Setting Example

1. Set the GO_Online bit to TRUE to be ready to start measurement.
2. The PLC (User) changes the Trigger bit assigned to the memory area (Output Area) of the PLC in advance from FALSE to TRUE.
3. When the PLC changes the Trigger bit to TRUE, the smart camera executes an imaging process.
4. After completion of the imaging process the smart camera stores the data in the specified memory area (Input Area) of the PLC.

[Output Data Example]
The number of read characters is output to STRING1_Length and the read characters are output to STRING1.



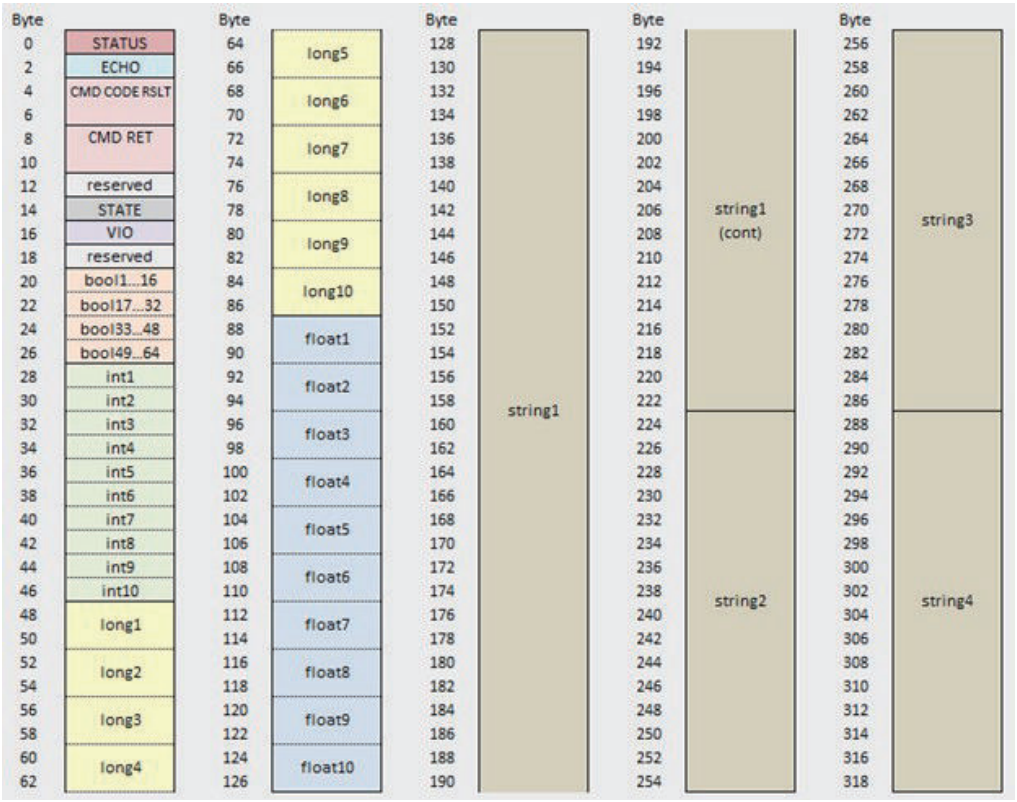
3-1-7 Status and Control Signals for Each Input and Output Assembly

Input Assembly

The input assembly layout is described below.

Bytes	Name	Description
0-1	STATUS	Status register of the smart camera. Each bit of this register represents a different state item. See *Status: Camera Status Register (16-bit)* on page 3-15 for bit descriptions.
2-3	ECHO	This 16 bit word value reflects back to the PLC the value that the PLC wrote to the output assembly ECHO register. The PLC can verify the output assembly has been written to the smart camera when this value matches the written value.
4-7	CmdCodeRslt	When Status.ExeCmdAck goes active in response to Control.ExeCmd, CmdCodeRslt contain the data returned from the command invoked by CmdCode.See *CmdCodeRslt (32-bit)* on page 3-16 for definitions.
8-11	CmdRet	When Status.ExeCmdAck goes active in response to Control.ExeCmd, CmdRet contains the data returned from the command invoked by Control.CmdCode.See *CmdRet (32-bit)* on page 3-16 for definitions.
12-13	reserved	Reserved for future use.
14-15	State	Device State register. Depending on the current state of the smart camera, certain STATUS and CONTROL features may or may not be operated. See *State (16-bit)* on page 3-16 for definitions.
16-17	VIO	Each bit reflects the state of virtual IO point. The least significant bit reflects vio point 145, the most significant bit vio point 160.
18-19	reserved	Reserved for future use.
20-27	bool1-64	Each bit represents a bool value. the least significant bit of byte 20 reads the value of bool1. The most significant bit of byte 27 reads bool64.
28-47	int1-10	Each pair of sequential bytes represents a 16 bit signed integer value. the20 bytes represents 10 integers. From bytes 28 & 29 for the value of int1 through bytes 46 & 47 for the value of int10.
48-87	long1-10	Each group of 4 bytes represents a 32 bit signed integer value. the 40 bytes represents 10 long integers. From bytes 48 -51 for the value of long1 through bytes 84-87 for the value of long10.
88-127	float1-10	Each group of 4 bytes represents a 32 bit signed integer value. the 40 bytes represents 10 floating point values. From bytes 88 -91 for the value of float1 through bytes 124-127 for the value of float10.
128-223	string1	These 96 bytes can store a string of up to 92, 8 bit characters, with the first 4 bytes containing the length value.
224-255	string2	Each of these 32 bytes group can store a string of up to 28, 8 bit characters, with the first 4 bytes containing the length value.
256-287	string3	
288-319	string4	

The input assembly layout is shown here.



● Status: Camera Status Register (16-bit)

Each bit of this register represents a different state of the camera's operation. A high value of 1 indicates that state is active (true).

Bit	Name	Description
0	ONLINE	Inspections are running.
1	EXP BUSY	The smart camera is busy capturing an image. The smart camera should not be triggered or the part under inspection moved during this time if illuminated.
2	ACQ BUSY	The smart camera is busy acquiring an image. The smart camera cannot be triggered while busy.
3	TRIGGER READY	The smart camera is ready to be triggered. This is equivalent to ONLINE == 1 and ACQBUSY== 0.
4	ERROR	An error has occurred. Set the RESET ERROR control bit high to clear.
5	RESET COUNT ACK	This bit mirrors the RESET COUNT control bit. The PLC can be certain the reset command was received by the smart camera when this goes high. The PLC can then bring the RESET COUNT control signal back low.
7	EXE CMD ACK	This bit mirrors the EXE CMD control bit.
8	TRIGGER ACK	This bit mirrors the TRIGGER control bit.

Bit	Name	Description
9	INSP BUSY	This bit is high when inspection 1 is busy processing an image.
10	INSP STAT	This bit represents the inspection 1 status result. It is 1 if the inspection passes. It is only calid when DataValid goes high.
11	DATA VALID	This bit goes high when the inspection 1 is complete. The PLC should clear this signal by setting RESET DV high once it has read results.

● CmdCodeRslt (32-bit)

The value of CmdCodeRslt is only valid when ExeCmdAck is active (1), in response to ExeCmd being active.

CmdCodeRslt value (base 16 hex)	Meaning
0x0000_0000	Success
0x0100_0000	Fail. Possible reasons: Camera under PC control. Job cannot be changed.
0x0200_0000	Fail: No job in slot.
0x0300_0000	Fail: Unknown cmd.

● CmdRet (32-bit)

The value of CmdRet is only valid when ExeCmdAck is active (1), in response to ExeCmd being active, and CmdCodeRslt is 0 (Success). The following table shows which CmdCodes return data in the CmdRet register.

CmdRet value (32 bit)	Associated CmdCode	Meaning
0	0x0100_0000 to 0x1300_0000 (Job Change type)	na
1-255	0x1800_0000 (Query Active Job slot)	Active Job Slot #

● State (16-bit)

State reflects the following operational condition of the camera.

State value (16 bit)	Meaning	Typical action required by the client (plc), or system operator
0	Offline*1	Perform job change or put camera online.
1	Online*2	Normal runtime operation: Monitor TriggerReady and DataValid signals. Trigger the smart camera.
2	Changing Vision Job	If camera is under pc control: Wait until State changes to Offline or Online. If PLC is controlling the job change: Use ExeCmd, CmdCode, ExeCmdAck, and CmdCodeRslt to complete the operation.

State value (16 bit)	Meaning	Typical action required by the client (plc), or system operator
3	Booting*3	Wait for camera to transition to Online or Offline.
4	Empty (no Vision Job)	Load a new job from AutoVISION or FrontRunner.

*1. If the camera does not have any saved jobs, then after the reboot the camera will be offline.
*2. During a power cycle or reboot the camera will be online when completed if the camera has a saved job that can be loaded.
*3. This will rarely be seen by the PLC.

The value of State determines which Control and Status signals are available:

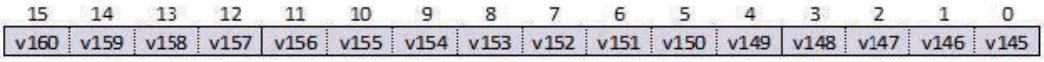
Control/Status Signal	State				
	0	1	2	3	4
	(Offline)	(Online)	(Job Change)	(Booting)	(Empty)
Control.GO ON-LINE	Y				
Control.GO OFF-LINE		Y			
Control.RESET ERROR	Y	Y			Y
Control.RESET COUNT	Y	Y			
Control.EXE CMD	Y	Y	Y		Y
Control.TRIGGER		Y			
Control.RESET DATA VALID		Y			
Status.ONLINE	Y	Y	Y	Y	Y
Status.ERROR	Y	Y			Y
Status.RESET COUNT ACK	Y	Y			
Status.EXE CMD ACK	Y	Y	Y		Y
Status.EXP BUSY		Y			
Status.ACQ BUSY		Y			
Status.TRIGGER READY	Y				
Status.TRIGGER ACK		Y			
Status.INSP BUSY		Y			
Status.INSP STAT		Y			
Status.DATA VALID		Y			

Where:

Y = Signal is valid for this State

Empty cell = Signal is not valid for this State

● VIO Register Bits



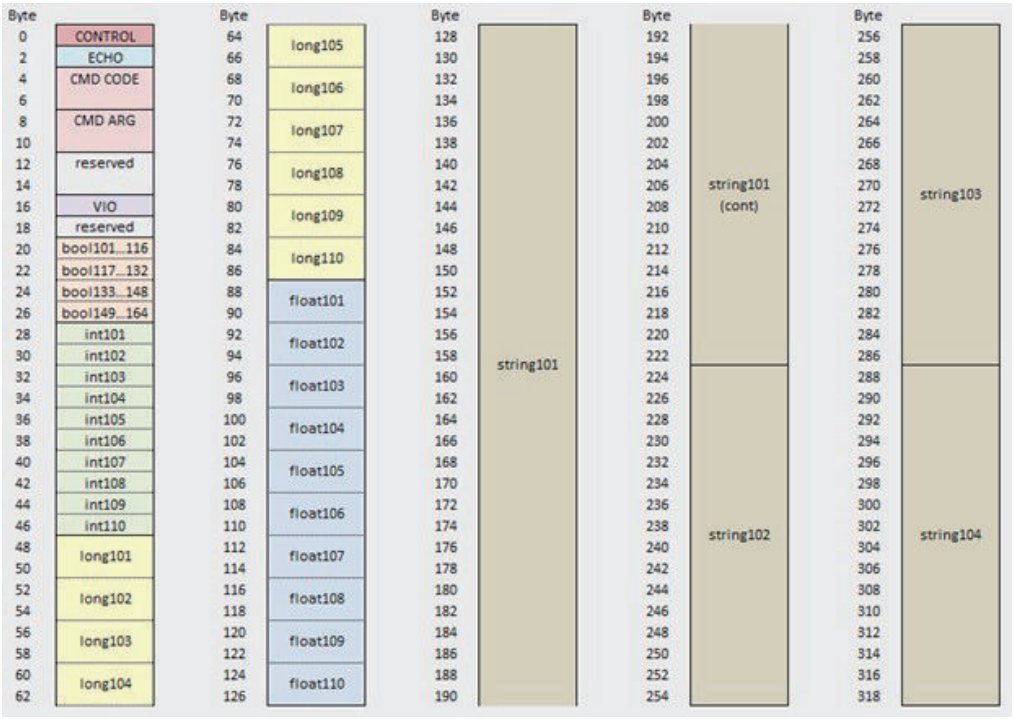
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
v160	v159	v158	v157	v156	v155	v154	v153	v152	v151	v150	v149	v148	v147	v146	v145

Output Assembly

The output assembly layout is described below and shown in the following diagram.

Bytes	Name	Description
0-1	CONTROL	Control register of smart camera. Each bit of this register represents a different status item. See *Control:Camera Control Register (16-bit)* on page 3-19 for bit descriptions.
2-3	ECHO	This 16 bit value reflects back to the PLC in the input assembly ECHO register. The PLC can verify the output assembly has been written to the smart camera when the input assembly matches this written value.
4-7	CmdCode	Specifies the process invoked in the smart camera when Control.ExeCmd goes active. See *CmdCode and CmdArg(32-bit)* on page 3-19 for difinition.
8-11	CmdArg	Additional argument data for the CmdCode. See *CmdCode and CmdArg(32-bit)* on page 3-19 for definition.
12-15	reserved	Reserved for future use.
16-17	VIO	Each bit reflects the state of virtual IO point. The least significant bit reflects vio point 129, the most significant bit vio point 144.
18-19	reserved	Reserved for future use.
20-27	bool	Each bit represents a bool value. the least significant bit of byte 20 reads the value of bool101. The most significant bit of byte 27 reads bool164.
28-47	int101-110	Each pair of sequential bytes represents a 16 bit signed integer value. the20 bytes represents 10 integers. From bytes 28 & 29 for the value of int101 through bytes 46 & 47 for the value of int110.
48-87	long101-110	Each group of 4 bytes represents a 32 bit signed integer value. the 40 bytes represents 10 long integers. From bytes 48 -51 for the value of long101 through bytes 84-87 for the value of long110.
88-127	float101-110	Each group of 4 bytes represents a 32 bit signed integer value. the 40 bytes represents 10 floating point values. From bytes 88 -91 for the value of float101 through bytes 124-127 for the value of float110.
128-223	string101	These 96 bytes can store a string of up to 92, 8 bit characters, with the first 4 bytes containing the length value.
224-255	string102	Each of these 32 bytes group can store a string of up to 28, 8 bit characters, with the first 4 bytes containing the length value.
256-287	string103	
288-319	string104	

The output assembly layout is shown here:



● Control:Camera Control Register (16-bit)

Each bit of this register controls a function on the camera. Transitions from a low state of 0 to a high state of 1, initiates the associate operation. The PLC should return the state of the control bit back to 0 after it has acknowledged the camera has processed the control. Unused bits should remain 0. Setting the Reset Data Valid bit (bit 11) will also reset the Error bit (bit 4) in the Camera Status Register.

Bit	Name	Description
0	GO ONLINE	Start all inspections running
1	GO OFFLINE	Stop all inspections
4	RESET ERROR	Rest ERROR in the Status register
5	RESET COUNT	Reset all inspection counts*1
7	EXE CMD	Execute the command specified by Coontrol.CmdCode
8	TRIGGER	Trigger Inspection1. The inspection must be configured for a triggerd image acquisition.
11	RESET DATA VALID	Rest the DataValid signal of the Status register.

*1. The inspection counts for Inspected, Passed, Failed, Cycle, Cycle Worst, PPM, PPM Worst, and Overrun will be reset.

● CmdCode and CmdArg(32-bit)

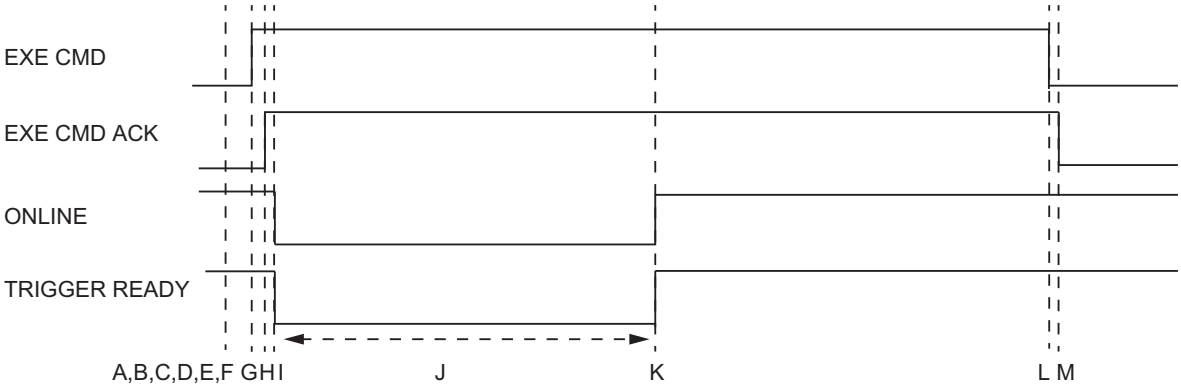
Specifies the process invoked in the camera when Control.ExeCmd goes active.

The CmdCode and CmdArg must beset, at least 2 RPI, before setting the EXE CMD bit in the control register. Do not set all the values within the same RPI.
List of available CmdCode, and associated CmdArg:

CmdCode value	CmdArg	Operations performed
0x1000_0000	Job Slot (1-255)	Go Offline, Load job from specified slot
0x1100_0000	Job Slot (1-255)	Go Offline, Load job from specified slot, Go Online
0x1200_0000	Job Slot (1-255)	Go Offline, Load job from specified slot, Make it the boot job
0x1300_0000	Job Slot (1-255)	Go Offline, Load job from specified slot, Make it the boot job, and Go Online
0x1800_0000	na	Query active job slot. CmdRet will contain the active job slot number when the operation is done.

● CmdCode and ExeCmd Operation

Example: Job change

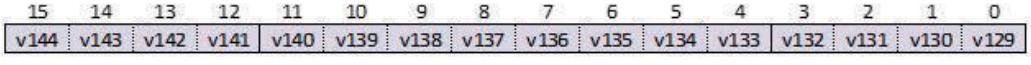


Task	Description	EIP Output Assembly	EIP Input Assembly
Prerequisite	The Smart Camera must not be controlled by AutoVISION, FrontRunner, Web Monitor, or Custom User Interface.		
A	Stop triggering the inspection. If running a continuous inspection (without triggers), it is recommended to go offline before starting job change.	GO OFFLINE = TRUE	
B	If Data Valid or Error is TRUE, clear these outputs.	RESET DATA VALID = TRUE RESET ERROR = TRUE	
C	Wait until Data Valid or Error is FALSE.		DATA VALID = FALSE ERROR = FALSE

Task	Description	EIP Output Assembly	EIP Input Assembly
D	Confirm the following bits are FALSE. GO OFFLINE, GO ONLINE, RESET ERROR, RESET COUNT, RESET DATA VALID, TRIGGER DO NOT CHANGE these bits during job change.	GO OFFLINE = FALSE GO ONLINE = FALSE RESET ERROR = FALSE RESET COUNT = FALSE TRIGGER= FALSE RESET DATA VALID= FALSE	
E	Set Command Code (0x1100_0000) to tell the Smart Camera to Go Offline, Load Job from specified slot, Go Online. Set Command Arg to tell the Smart Camera to load job in slot 1.	CmdCode = 0x1100_0000 CmdArg = 1	
F	Wait at least 1 RPI between Command Code, Command Arg assignment and Execute Command.		
G	Set Execute Command bit to TRUE to start job change.	EXE CMD = TRUE	
H	Execute Command Acknowledge bit = TRUE to show that Smart Camera received the command.		EXE CMD ACK = TRUE
I	Smart Camera is Offline. Smart Camera is not ready for trigger. State=0 indicates the Smart Camera is offline.		ONLINE = FALSE TRIGGER READY = FALSE State = 0
J	State=2 indicates unit is changing the vision job.		State = 2
K	The Smart Camera is Online. Smart Camera is ready for trigger. State=1 indicates Smart Camera is online. Command Code Result indicates successful job change. (This must be checked while the ExeCmd is still TRUE.)		ONLINE = TRUE TRIGGER READY = TRUE State = 1 CmdCodeRslt = 0x0000_0000 (successful job change)
L	Set Execute Command bit to FALSE to finish job change.	EXE CMD = FALSE	
M	Execute Command Acknowledge bit = FALSE.		EXE CMD ACK = FALSE

You need to monitor the value of State to know when the job changes are complete.

● VIO Register Bits



3-1-8 Accessing Communication Areas Using Variables by NJ/NX Series Controllers

In Controllers of the NJ series, I/O memory addresses assigned to each communication area can be accessed from the user program only via variables.
Here is an example of using the input assembly and output assembly for that purpose.
For more detailed information about the data structure of each assembly, please refer to *3-1-7 Status and Control Signals for Each Input and Output Assembly* on page 3-14.

Access Using Network Variables

Customize and define variables based on the structure of each communication area of the smart camera. Use Sysmac Studio to define the variables.
For operations of Sysmac Studio, refer to *Sysmac Studio Version1 Operation manual (Cat. No.W504)*.

1 Define the data types for the variables.
Define the data types for the variables based on the structure of each communication area of the smart camera.

- Definition of data type to access a signal
  Data type for handling control signals and status signals.

Name of data type		Data type
U_EIPFlag16		STRUCT
	F	BOOL[16]
	W	WORD
U_EIPFlag32		STRUCT
	F	BOOL[32]
	W	DWORD

- Definition of data type to access the Output Area (Structure)
  It is the data type for accessing the Output Area.

Name of data type		Data type	Description
S_EIPOutput		STRUCT	-
	CONTROL	U_EIPFlag16	Control signal (16-bit)
	ECHO	WORD	Echo
	CmdCode	DWORD	Command code
	CmdArg	DWORD	Command parameter
	reserved1	U_EIPFlag32	Reserved for future use
	VIO	U_EIPFlag16	Virtual IO
	reserved2	U_EIPFlag16	Reserved for future use
	bool_val	BOOL[64]	Global Data Service (GDS[*1]) bool101 to bool164
	int_val	INT[10]	GDS int101 to int110
	long_val	DINT[10]	GDS long101 to long110
	float_val	REAL[10]	GDS float101 to float110
	string101_length	DINT	GDS string101 String length
	string101	STRING[92]	GDS string101
	string102_length	DINT	GDS string102 String length

Name of data type		Data type	Description
	string102	STRING[28]	GDS string102
	string103_length	DINT	GDS string103 String length
	string103	STRING[28]	GDS string103
	string104_length	DINT	GDS string104 String length
	string104	STRING[28]	GDS string104

*1. For more detailed GDS information, please refer to Edit - Omron Microscan link in the Help file of the AutoVISION software.

- Definition of data type to access the Input Area (Structure)
  It is the data type for accessing the Input Area.

Name of data type		Data type	Description
S_EIPInput		STRUCT	-
	STATUS	U_EIPFlag16	Control signal (16-bit)
	ECHO	WORD	Echo
	CmdCodeRslt	DWORD	Execution result of CmdCode
	CmdRet	DWORD	Value returned for CmdCode
	reserved1	U_EIPFlag16	Reserved for future use
	State	U_EIPFlag16	State
	VIO	U_EIPFlag16	Virtual IO
	reserved2	U_EIPFlag16	Reserved for future use
	bool_val	BOOL[64]	Global Data Service (GDS*1) bool1 to bool64
	int_val	INT[10]	GDS int1 to int10
	long_val	DINT[10]	GDS long1 to long10
	float_val	REAL[10]	GDS float1 to float10
	string1_length	DINT	GDS string1 String length
	string1	STRING[92]	GDS string1
	string2_length	DINT	GDS string2 String length
	string2	STRING[28]	GDS string2
	string3_length	DINT	GDS string3 String length
	string3	STRING[28]	GDS string3
	string4_length	DINT	GDS string4 String length
	string4	STRING[28]	GDS string4

*1. For more detailed GDS information, please refer to **Edit** - **Omron Microscan link** in the Help file of the AutoVISION software.

Additional Information

For a description of how to use each bit, please refer to *3-1-7 Status and Control Signals for Each Input and Output Assembly* on page 3-14.

2 Define variables.

Define variables to perform data links for data in each communication area through EtherNet/IP communications.

For these variables, use the data types defined in step 1.

Variable	Variable type	Network publish attribute	Data type	Application
EIPOutput	Global variable	Output	S_EIPOutput	For data links for the Output Area
EIPInput	Global variable	Input	S_EIPInput	For data links for the Input Area

3 Access each communication area from user program.
Open the reference table and add EIPInput and EIPOutput. The values will be updated by the corresponding assemblies during operation.

3-1-9 Connection Properties: Class 3 Explicit Messaging

All Class 1 I/O assembly data and additional data are accessible via Explicit message. Input data (camera to PLC/Client) occupies attributes 1 to 100 of the classes. Output data (PLC/Client to camera) occupies attributes 101 to 200.

● Service:

- Get Attribute Single (0xE)
- Set Attribute Single (0x10)

● Class:

- bool = 104 (0x68)
- int = 105 (0x69)
- long = 106 (0x6A)
- float = 107 (0x6B)
- string = 108 (0x6C)
- Control/Status (mixed data type) = 109 (0x6D)

● Instance:

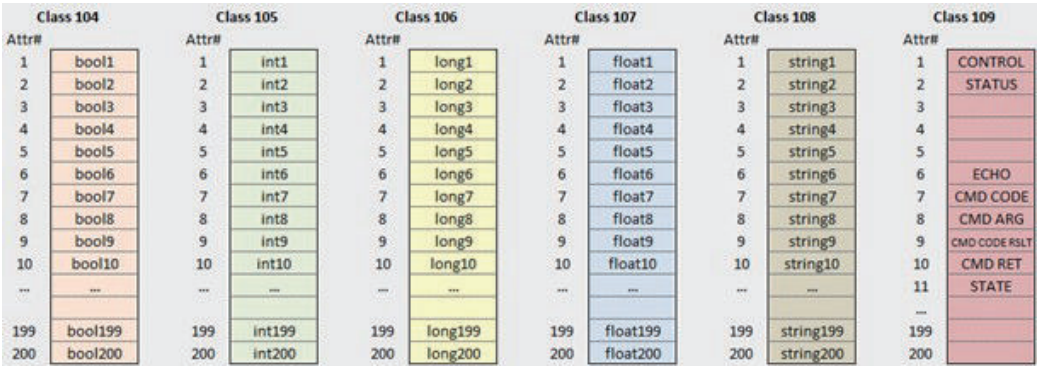
- 1

● Attribute:

- 1 to 100 = In to PLC/Client
- 101 to 200 = Out to Smart Camera

● Attribute Layout

When using explicit EtherNet/IP messaging, all global data objects can be read or written.
Each data type is stored in its own class object and an instance of 1 to read the global data. For example, to read float2, the EtherNet/IP request would be for Service Code 14 (0xE), Class 107 (0x6B), Instance 1, Attribute 2.



Class 104		Class 105		Class 106		Class 107		Class 108		Class 109	
Attr#		Attr#		Attr#		Attr#		Attr#		Attr#	
1	bool1	1	int1	1	long1	1	float1	1	string1	1	CONTROL
2	bool2	2	int2	2	long2	2	float2	2	string2	2	STATUS
3	bool3	3	int3	3	long3	3	float3	3	string3	3	
4	bool4	4	int4	4	long4	4	float4	4	string4	4	
5	bool5	5	int5	5	long5	5	float5	5	string5	5	
6	bool6	6	int6	6	long6	6	float6	6	string6	6	ECHO
7	bool7	7	int7	7	long7	7	float7	7	string7	7	CMD CODE
8	bool8	8	int8	8	long8	8	float8	8	string8	8	CMD ARG
9	bool9	9	int9	9	long9	9	float9	9	string9	9	CMD CODE RSLT
10	bool10	10	int10	10	long10	10	float10	10	string10	10	CMD RET
...	...	...	...	...	...	...	...	...	...	11	STATE
										...	
199	bool199	199	int199	199	long199	199	float199	199	string199	199	
200	bool200	200	int200	200	long200	200	float200	200	string200	200	

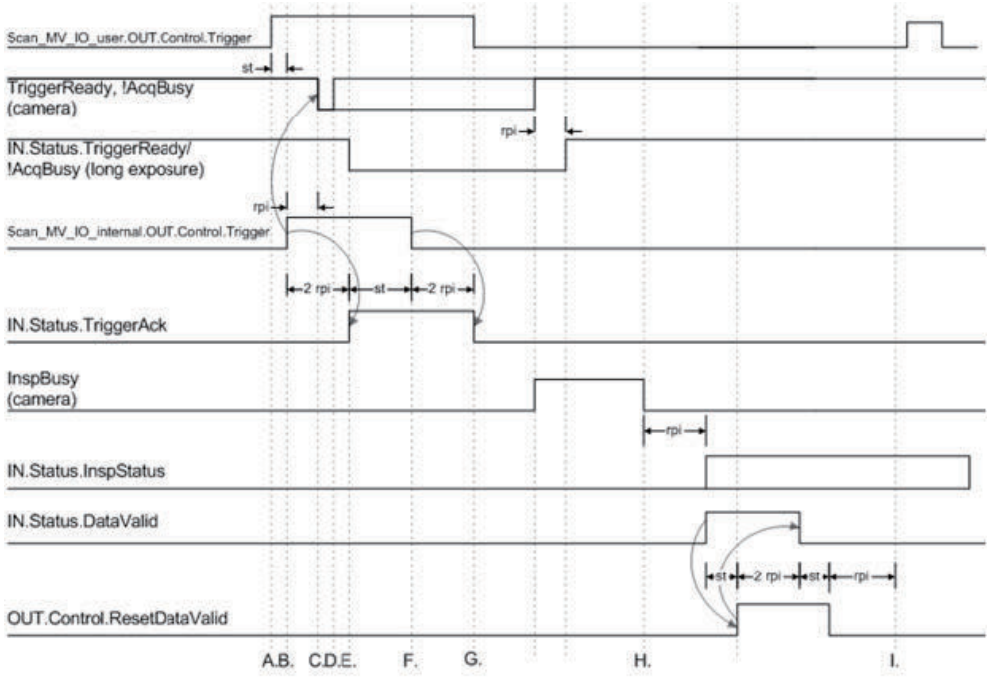
The value received in response to Get Attribute Single depends on the type:

- Bool will return a 16-bit word with 0 for false or 1 for true.
- Ints will return a 16-bit signed integer.
- Longs will return a 32-bit signed integer.
- Floats will return a 32-bit floating point number.
- Strings will return a counted string. Total size of a string data item is 2048 bytes. This includes a 4 byte “length” field followed by 2044 eight bit characters. When accessing strings explicitly, they are not limited to the size in the I/O assemblies. For example, string3 is limited to 28 bytes in the input assembly. If the actual string is longer than 28 bytes, it will be truncated when reading via the assembly, but not truncated when reading the same string via an attribute explicitly.

Assembly Class 109 can be used to read and write special EtherNet/IP-specific registers.

Attr#	Name	Description
1	CONTROL	The control register (16 bit). See *Control:Camera Control Register (16-bit)* on page 3-19 for bit definitions.
2	STATUS	The status register (16 bit). See *Status: Camera Status Register (16-bit)* on page 3-15 for bit definition.
6	ECHO	The ECHO register (16 bit). (read only if implicit write is enabled)
7	CMD CODE	The command code register (32 bit). See *CmdCode and CmdArg(32-bit)* on page 3-19 .
8	CMD ARG	The command argument register (32 bit). See *CmdCode and CmdArg(32-bit)* on page 3-19.
9	CMD CODE RSLT	The command code result register (32 bit). See *CmdCodeRslt (32-bit)* on page 3-16.
10	CMD RET	The command return register (32 bit). See *CmdRet (32-bit)* on page 3-16.
11	STATE	The device state register (32 bit). See *State (16-bit)* on page 3-16.

3-1-10 Control/Status Signal Operation



Refer to *3-1-7 Status and Control Signals for Each Input and Output Assembly* on page 3-14 for detail of Input assembly and Output assembly.

1. The following describes the signals used in the timing chart.
   - Scan_MV_IO_user.OUT.Control.Trigger:
     This is the trigger in the control register.
   - TriggerReady, !AcqBusy(camera):
     TriggerReady(camera) is the smart camera's internal signal for TRIGGER READY.
     !AcqBusy(camera) indicates logical negation (NOT) of the smart camera's internal signal for ACQ BUSY.
     The timing chart shows the signals in two cases, one where the exposure time is shorter than rpi and the other where the exposure time is sufficiently long.
   - IN.Status.TriggerReady/!AcqBusy(long exposure):
     IN.Status.TriggerReady is TRIGGER READY in the status register. IN.Status.!AcqBusy indicates logical negation (NOT) of ACQ BUSY in the status register.
     For IN.Status.TriggerReady/!AcqBusy(long exposure), a case where the exposure time is sufficiently longer than rpi is shown.
     If the exposure time is shorter than rpi, TRIGGER READY remains ON and ACQ BUSY remains OFF.
     The pulse width of EXP BUSY depends on the exposure time set for the inspection executed in the smart camera.
   - Scan_MV_IO_internal.OUT.Control.Trigger:
     This is the smart camera's internal signal for TRIGGER.
   - IN.Status.TriggerAck:
     This is TRIGGER ACK in the status register.
   - InspBusy(camera):
     This is the smart camera's internal signal for INSP BUSY.
   - IN.Status.InspStatus:

This is INSP STAT in the status register.
The timing chart shows the signal in cases where the inspection has been passed and where the inspection has been failed. It turns ON when the inspection has been passed and turns OFF when it has been failed.
The signal retains its status until the next test result is available.

- IN.Status.DataValid:
  This is DATA VALID in the status register.
- OUT.Control.ResetDataValid:
  This is RESET DATA VALID in the control register.

2. st = PLC program scan time.
3. rpi = Requested Packet Interval. Configured in the PLC's EIP module connection properties. Allowed rpi is t0 ms to 3.2 s.
4. The PLC tag is delayed by at least 1 or 2 rpi from the status of the smart camera's internal signal.

A. On rising edge of system trigger, the user app activates Scan_MV_IO_user.OUT.Control.Trigger.
B. If the smart camera is ready when the rising edge of Scan_MV_IO_user.OUT.Control.Trigger is detected, Scan_MV_IO_internal.OUT.Control.Trigger turns ON.
C. Camera acquisition begins (may be delayed be one rpi) and then TriggerReady, !AcqBusy(camera) turns to OFF.
D. IF the smart camera's exposure time is shorter than the rpi, no change will be seen in IN.Status.TriggerReady and IN.Status.!AcqBusy.
E. After Scan_MV_IO_internal.OUT.Control.Trigger turns ON, IN.Status.TriggerAck turns ON.
There may be a delay of 2 rpi from the timing of B until IN.Status.TriggerAck turns ON after Scan_MV_IO_internal.OUT.Control.Trigger turns ON.
F. Detects IN.Status.TriggerAck and clears Scan_MV_IO_internal.OUT.Control.Trigger.
G. Detests falling edge of IN.Status.TriggerAck and clears Scan_MV_IO_user.OUT.Control.Trigger.
H. Camera internal signal IN.Status.DataValid will go ON when InspBusy(camera) goes OFF.
I. PLC logic must delay one rpi time before resetting OUT.Control.ResetDataValid.

3-1-11 Data Type Descriptions and Equivalents in PLC and EDS/CIP Environments

AV	Description	RSLogix equivalent	Description	EDS/EIP equivalent	Description
Bool	1 bit	BOOL	1 bit	BOOL	1 bit
-	-	-	-	WORD	16 BOOLs
-	-	-	-	LWORD	64 BOOLs
Int	16 bit signal integer	INT	16 bit signal integer	INT	16 bit signed integer
Long	32 bit signal integer	DINT	32 bit signal integer	DINT	32 bit signal integer
Float	32 bit floating point	REAL	32 bit floating point	REAL	32 bit floating point
String	32bit length field followed by 8 bit ASCII characters	STRING	32bit length field followed by 8 bit ASCII characters	DINT+USINT[]	DINT(length) +USINT array of characters. USINT=8 bit integer

3-1-12 PLC Tags and Serial Command Names

PLC tags are separated into IN and OUT for data direction. Within the IN and OUT groups, the tags are sub-divided into fixed Status and Control fields, plus user-defined linked data fields. This table shows how PLC tag names correspond to serial commands.

IN			OUT		
PLC tag prefix	Serial cmd prefix	Tag name	PLC tag prefix	Serial cmd prefix	Tag name
IN.Status.	eip.status.	Online (1)	OUT.Control.	eip.control.	GoOnline [i]
IN.Status.	eip.status.	Online (0)	OUT.Control.	eip.control.	GoOffline [ii]
IN.Status.	eip.status.	Error	OUT.Control.	eip.control.	ResetError
IN.Status.	eip.status.	ResetCountAck	OUT.Control.	eip.control.	ResetCount
IN.Status.	eip.status.	TriggerAck	OUT.Control.	eip.control.	Trigger
IN.Status.	eip.status.	DataValid	OUT.Control.	eip.control.	ResetDataValid
IN.Status.	eip.status.	ExeCmdAck	OUT.Control.	eip.control.	ExeCmd
IN.Status.	eip.status.	TrigReady [iii]	-	-	-
IN.Status.	eip.status.	AcqBusy	-	-	-
IN.Status.	eip.status.	ExpBusy	-	-	-
IN.Status.	eip.status.	InspBusy	-	-	-
IN.Status.	eip.status.	InspStat	-	-	-
IN.Status.	eip.	Echo	OUT.Control.	eip.	Echo
IN.Status.	eip.	CmdCodeRslt	OUT.Control	eip.	CmdCode
IN.Status	eip.	CmdRet	OUT.Control	eip.	CmdArg
IN.Status.	eip.	State	-	-	-
IN.vio.	io.	v[145-160]	OUT.vio.	io.	v[129-144]
IN.bool.	eip.	bool[1-100]	OUT.bool.	eip.	bool[101-200] [iv]
IN.int.	eip.	int[1-100]	OUT.int.	eip.	int[101-200] [v]
IN.long.	eip.	long[1-100]	OUT.long.	eip.	long[101-200]
IN.float.	eip.	float[1-100]	OUT.float.	eip.	float[101-200]
IN.string.	eip.	string[1-100]	OUT.string.	eip.	string[101-200]

i When GoOnline is changed from 0 to 1, Online goes to 1.

ii When GoOffline is changed from 0 to 1, Online goes to 0.

iii TrigReady, AcqBusy, ExpBusy, InspBusy, and InspStat are all IN-direction data only.

iv Bool1-Bool64 are mapped to PLC tags in the IN assembly. Bool101-Bool164 are mapped to PLC tags in the OUT assembly. Bool members numbered 65-100 and 165-200 are accessible via Explicit Message only.

v For int, long, float, and string data:
Data members numbered 1-10 are mapped to PLC tags in the IN assembly.
Data members numbered 101-110 are mapped to PLC tags in the OUT assembly.
Data members numbered 11-100 and 111-200 are accessible via Explicit Message only.

3-2 Controlling Operation and Data Output with Serial (TCP)

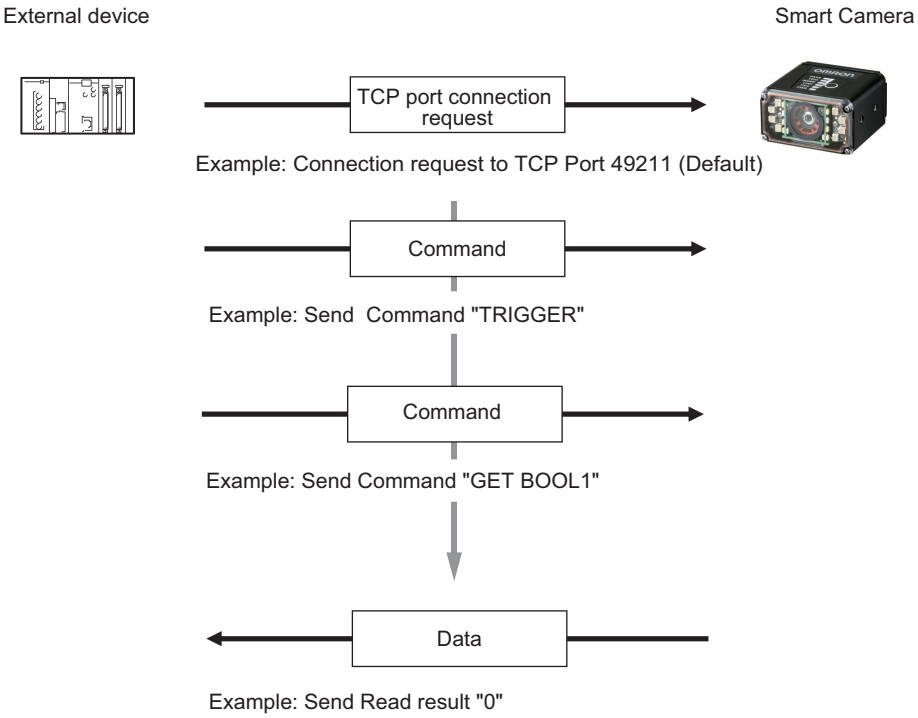
This section explains the communications settings required for using Serial (TCP) communications between the smart camera and an external device.

3-2-1 Serial (TCP) Overview

Serial (TCP) conforms to the TCP/IP communication protocols. It can be used with any Ethernet communication equipment compatible with TCP/IP communication protocol. Since this smart camera communicates as a TCP server, the external device to be connected must be connected to this smart camera as a TCP client. If you intend to use with an Omron PLC, please verify that it supports Socket Services (TCP Client).

3-2-2 Communications Processing Flow

In a system configuration in which the smart camera is connected by Serial (TCP) communications to an external device (such as PLC), serial commands can be received and reading results can be output to the external device.
Below is the basic flow for establishing the Serial (TCP) communications, executing a Read command and outputting the Read result.



3-2-3 Communications Setup Procedures

The following settings are required to communicate with Serial (TCP).

1. Communications specifications settings … The communications specifications are set.
For details, refer to *3-2-4 Communications specifications settings (Serial (TCP))* on page 3-31.

↓

2. Output data settings … Set output data.
For details, refer to *3-2-5 Output data settings* on page 3-36.

↓

3. Communications test … Check the communications setup.
For details, refer to *3-2-6 Communications test* on page 3-39.

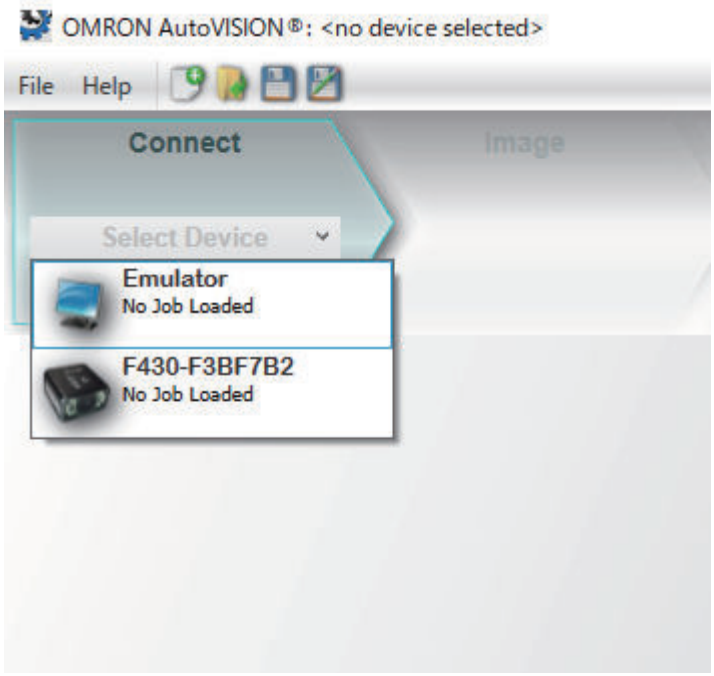
3-2-4 Communications specifications settings (Serial (TCP))

Network Settings on the Smart Camera

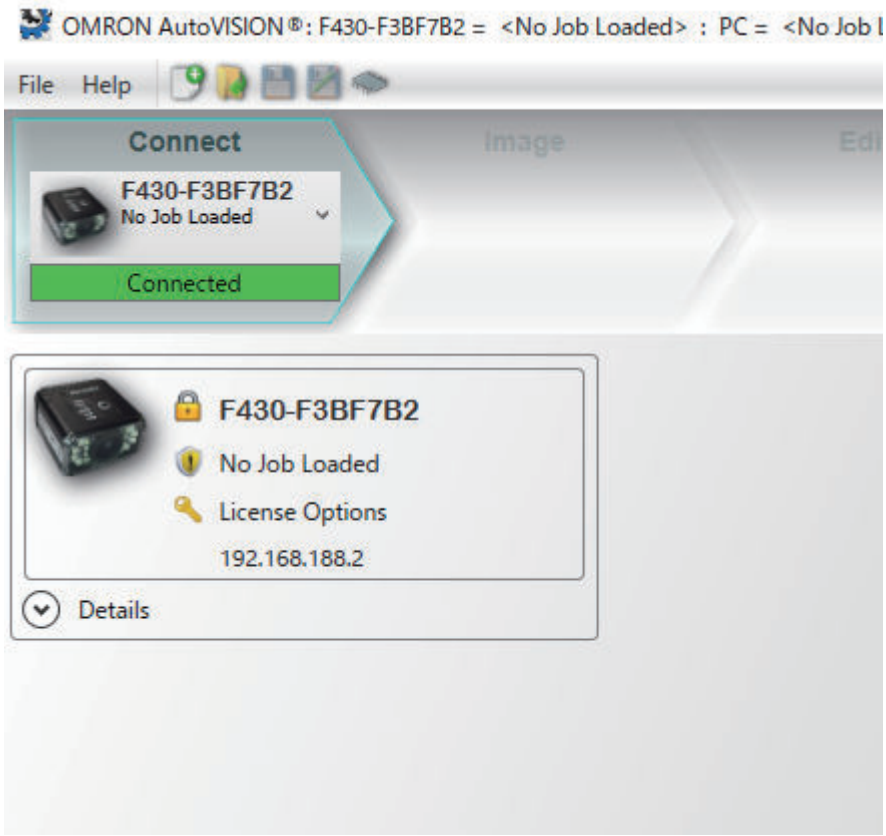
Set the Number of serial TCP ports and Starting serial TCP Port of the device.

1 From the Windows **Start** menu, click **OMRON AutoVISION**.
This launches the **OMRON AutoVISION** software.

2 Click on **Select Device**.

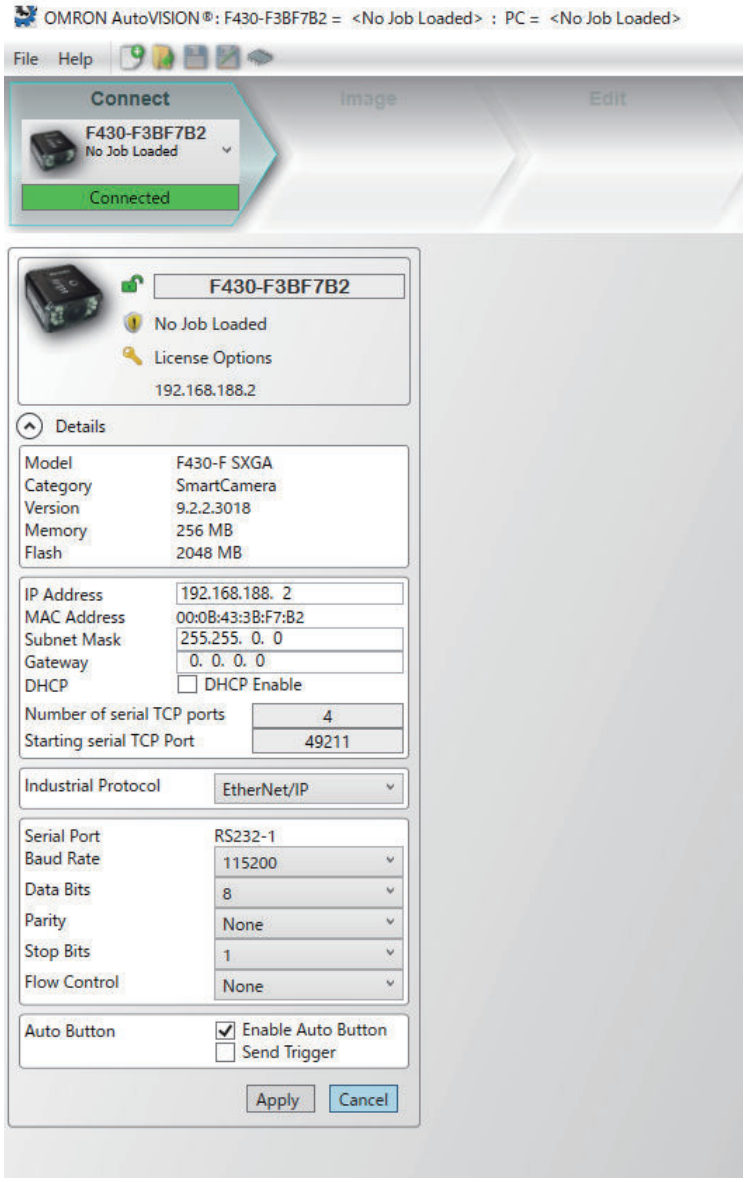


3 Click the smart camera for which you want to change the settings.
The following screen is displayed.



4 Click the Lock icon ( ) to enable changing the settings.
The smart camera's settings are unlocked and the **Modify** button is displayed.

5 Click the **Modify** button and then set the **Number of serial TCP ports** and **Starting serial TCP Port**.



Setting item	Setting value	Description
Number of serial TCP ports	1 to 4	Set the number of serial TCP ports.
Starting serial TCP Port	49211 to 49214	Set the starting serial TCP port number.

The smart camera will use the specified number of serial TCP ports that starts from the set serial TCP port start number. If you set the number of serial TCP ports to 4 and the serial TCP port start number to 49214, it will use TCP ports 49214 to 49217.

6 Click **Apply**. Then, the **Reboot Required** dialog box is displayed.

Precautions for Correct Use

After you change the industrial protocol, you need to reboot the smart camera to have the new setting take effect.

7 Click the **Yes** button to reboot the smart camera.
The AutoVISION software is disabled while the smart camera is rebooting.

8 Click the **Reconnect** button to reconnect it.

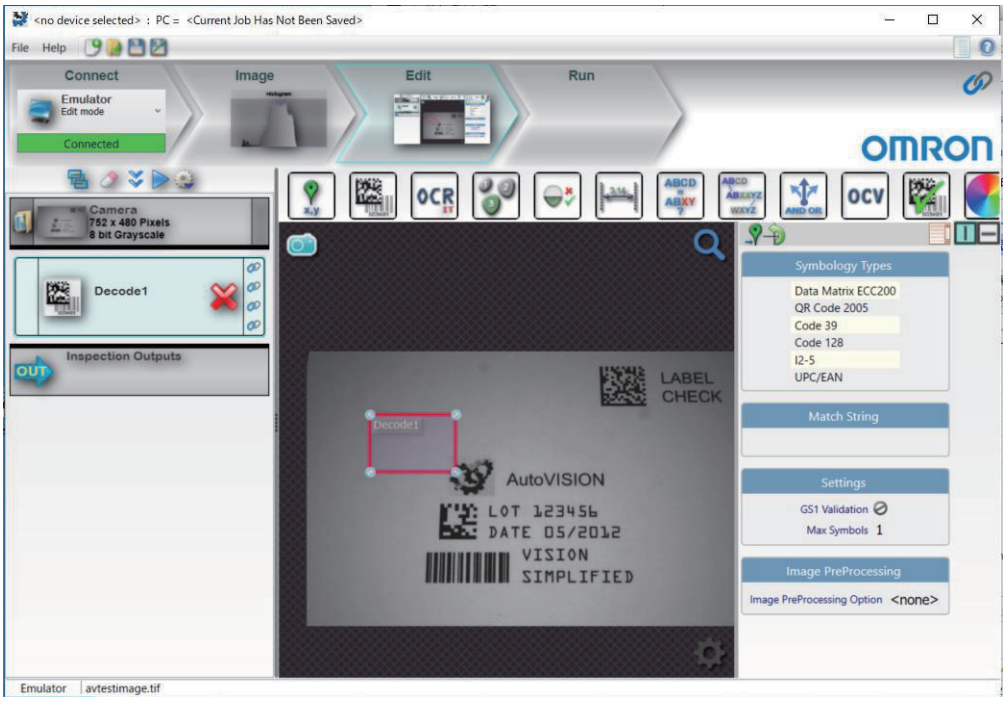
9 The connection is completed.

3-2-5 Output data settings

The following shows he procedure to output a string that you read using the Decode Tool, as an example.

- Use any TCIP/IP Tool to configure the IP address, port, and other settings, and then connect to the smart camera.
- Input the measurement trigger to the smart camera.
- The smart camera outputs the read string (decoded text) to the TCP/IP tool.

1 Register the read string in the Decode Tool.

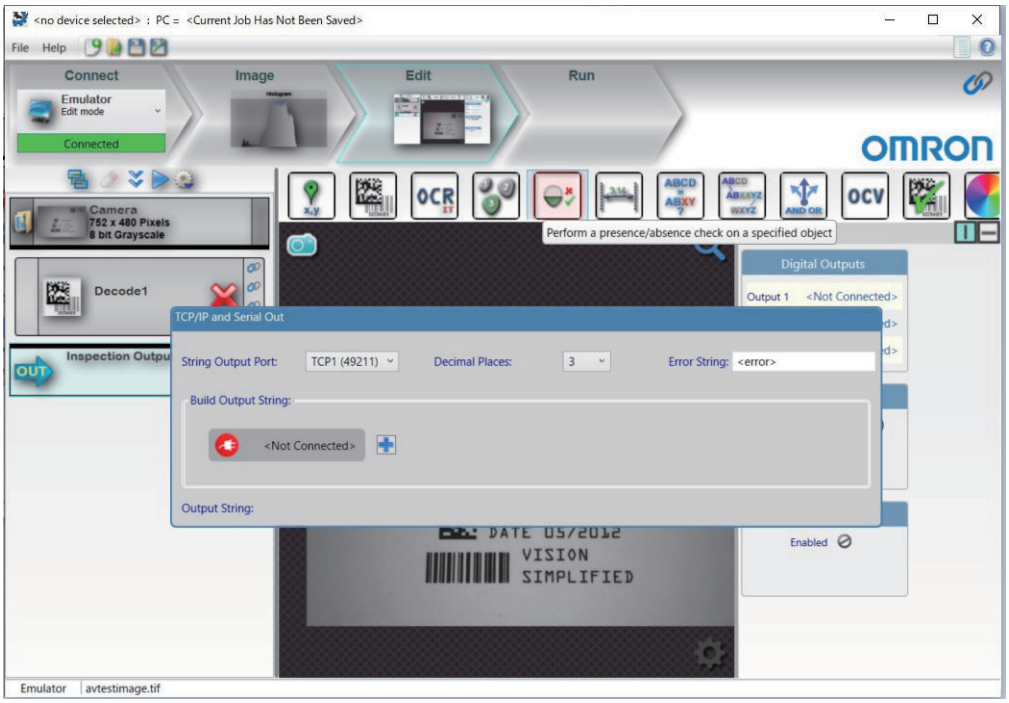


2 Open the “TCP/IP and Serial Out” settings in the Test Outputs Tool.

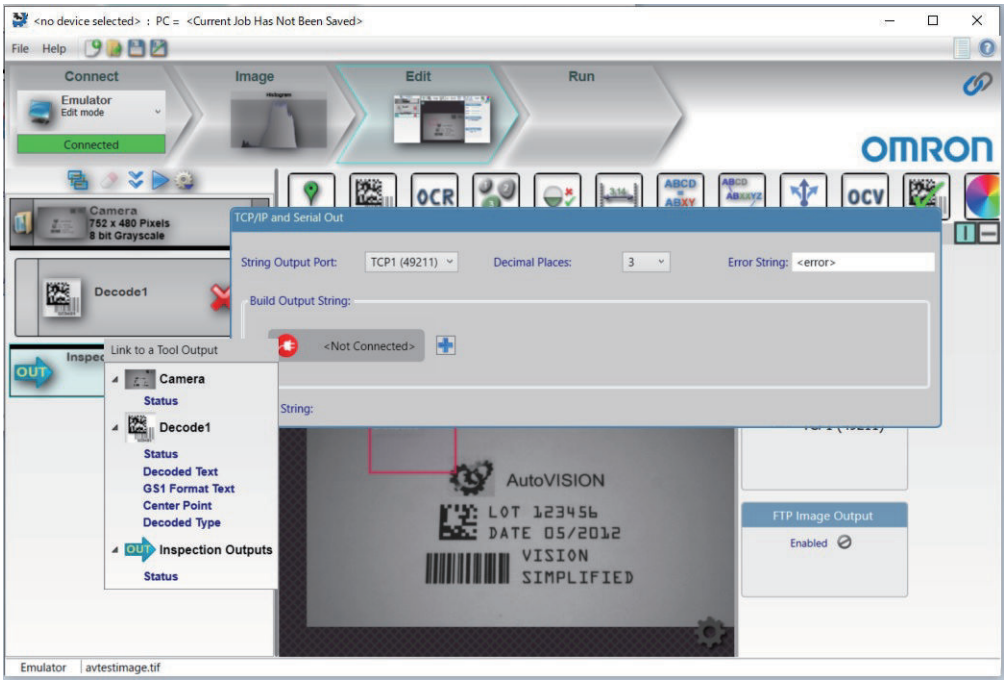
3 Select the port to use for string output.

4 Click the “+” icon in the Build Output String area and then select the “Tool Output Value” option.

5 Click “<Not Connected>” in the Build Output String area.



6 Select the “Decode Text” option of the Decode Tool.



3-2-6 Communications test

1 Use any TCIP/IP Tool to configure the IP address, port, and other settings, and then connect to the smart camera.

2 Input the measurement trigger to the smart camera.

3 The smart camera outputs the read string (decoded text) to the TCP/IP tool.

3-2-7 Serial command list

Refer to *A-3 Serial Command* on page A-4 for serial commands.

3-3 Controlling Operation and DataOutput with PROFINET

3-3-1 Overview of PROFINET

PROFINET is a network for industrial use that applies industrial Ethernet (100 Mbps, full duplex) to PROFIBUS DP.
PROFINET is an open standard that is managed by PI (PROFIBUS and PROFINET International) and is used in a variety of types of industrial equipment. Because PROFINET uses standard Ethernet technology, a variety of general-purpose Ethernet devices can be included in the network.
This section provides an overview sufficient to use this smart camera with PROFINET.
Refer to the standards IEC61158, IEC61784, and PI for detailed PROFINET specifications.

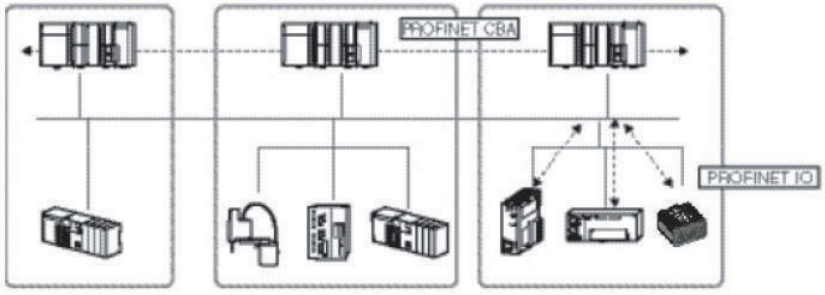
Precautions for Correct Use

PROFINET is supported in firmware version 9.2.2.3018 and later.
If an earlier version than 9.2.2.3018 is used, please update the firmware.
Check the version in the Connect view of the AutoVISION software.
For how to update the firmware, refer to *Firmware Upgrade and License Information in the AutoVISION Software Help*.

Types of PROFINET

There are two PROFINET standards: PROFINET CBA and PROFINET IO.

- PROFINET CBA
  Inter-device communication using components. Mainly used between controllers.
- PROFINET IO
  Control by I/O data between a controller and devices.



This smart camera supports PROFINET IO. PROFINET IO uses the same device model as PROFINET DP.
The information of each device is described in a GSD (General Station Description) file based on XML (Extensible Markup Language).

● Communication Specifications of PROFINET IO

The communication specifications of PROFINET IO are described below.

Communication Specifications	Type	Details	Support
Periodic data communication method	RT (real-time) communication	Uses standard Ethernet hardware and achieves the same level of performance as the existing Fieldbus.	Supported
	IRT (Isochronous real-time) communication	This method provides a higher level of assurance than RT that communication will be executed within a specific time. Intended for use in systems such as motion control that require strict real-time.	Not supported

PROFINET IO specifies the supported functions by conformance class, with consideration given to the application.

Class	Overview	Support
Class A	Supports the basic functions of RT communication.	Supported
Class B	This class adds network diagnosis and redundancy functions used in process automation and other applications.	Not Supported
Class C	Supports IRT communication that realizes reliable synchronization.	Not Supported

The functions below are defined in Class A.

Function	Overview
Cyclic Data Exchange	Real-time data communication between the IO controller and IO devices at determined cycles. Set by IO data CR.
Acyclic Parameter Data / Device Identification	Used for parameter settings, IO device configuration, and reading of device information. Set by record data CR.
Device / Network Diagnosis	Communication for the purpose of sending alarms and statuses from IO devices to the IO controller. Set by Alarm CR.

The functions below are defined in Class B, which expands upon Class A.

Function	Overview
SNMP (Simple Network Management Protocol)	Allows additional Network Diagnostics via Management Information Base 2 (MIB2) and Lower Link Layer Discovery Protocol-MIB(LLDP-EXT-MIB).
PDEV (Physical Device Object)	Can also gather diagnostic information using acyclic PROFINET services.

● Device Types Used in PROFINET IO

The devices below are defined in PROFINET IO.

Type	Details
IO Controller	Controller for external and other devices.
IO Device	Sensor device connected to the IO controller. The F440-F/F430-F is an IO device.
IO Supervisor	PC or other device used for maintenance and diagnosis.

IO Devices

IO devices consist of DAPs and IO modules.

The functions and properties of these devices are described in a GSD file.

- **DAP (Device Access Point)**: This is an Ethernet access point and is used by means of a communication program.
- **IO Module**: Consists of the Slot, Subslot, and Index below. An IO module has one or multiple slots.
- **Slot**: Indicates the location of the IO module in the IO device.
- **Subslot**: IO interface inside the slot. This defines data types such as bit data and byte data, and the meanings of the data types.
- **Index**: Data in a Subslot.

The above information is described in the GSD file of this smart camera, and the IO controller uses the GSD file of this smart camera to build the system.

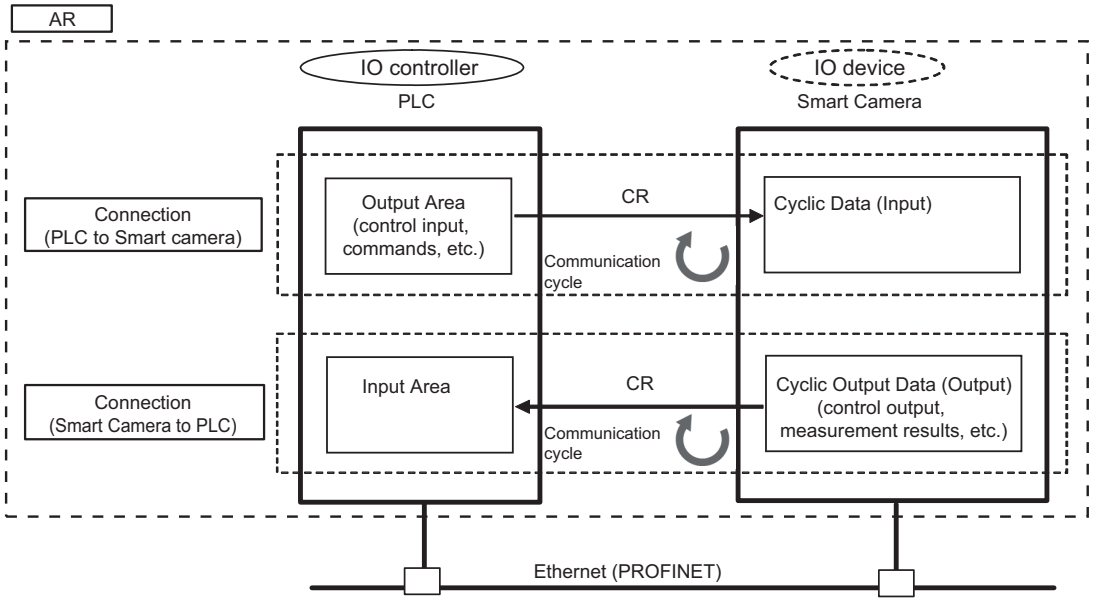
Additional Information

When an IO device is used in PROFINET, the GSD file that describes the device functions and properties is used to configure the network configuration settings.
When this smart camera is used in PROFINET as an IO device, the GSD file of this smart camera must be installed in the engineering tool.

Data Communication in PROFINET IO

For an IO controller and IO device to communicate, a connection called an AR (Application Relation) must first be established between the two devices. When the AR connection is established, data communication between the IO controller and IO device takes place by means of a CR (Communication Relation) that defines the content of the data communication. An IO device can establish AR relations with multiple communication devices. In addition, multiple CR relations can be defined inside one AR.

By establishing multiple CR relations inside one AR, communication that requires multiple profiles or differing Subslots can be performed. It is also possible to set a cycle time for each CR or IO.



CR is classified into IO data CR, record data CR, and alarm CR. Within the IO data CR, data communication is performed for each refreshing task period. Within CRs other than the IO data CR,

communication takes place between the periodic data communications. Within the record data CR, the I/O controller will send commands to the IO device(s) at any time. IO device(s) will send back responses to the IO controller.

3-3-2 Smart Camera Communications for PROFINET Connections

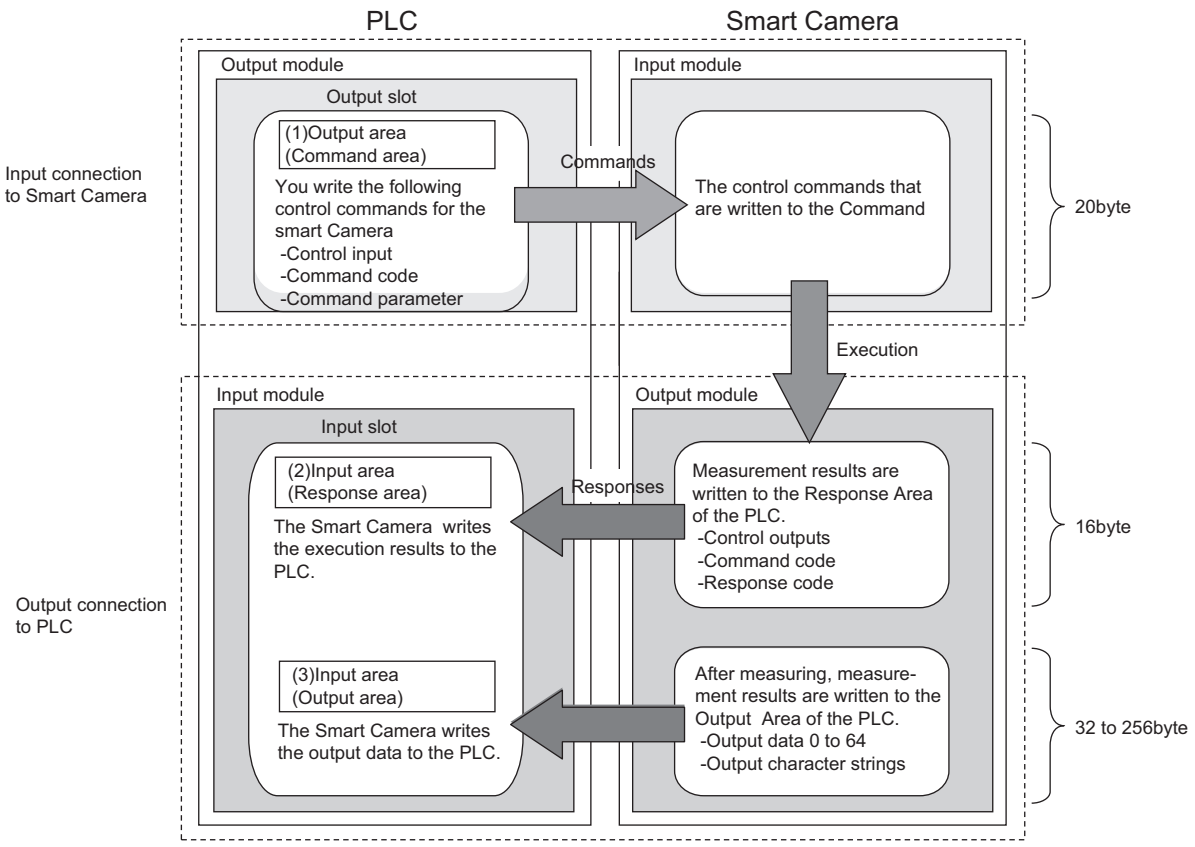
You can use PROFINET IO data CR to communicate between the PLC and the smart camera to perform control via command/response communications or to output data after measurements.
This smart camera complies with PROFINET conformance class A.
To connect to external devices and communicate using PROFINET, configure the PROFINET IO data CR settings with the engineering tool.
For details on the IO data CR settings in the engineering tool, refer to the manual for each engineering tool.

Types of Communications Areas

For PROFINET communications, the following three communications areas are used in the PLC to perform communications.

Command / Response Communications	(1) Output Area (Command Area)	This is the area to which you write control commands for this smart camera to execute.
	(2) Input Area (Response Area)	This is the area to which this smart camera writes the results of control commands executed from the command area.
Data Output after Measurements	(3) Input Area (Output Area)	This is the area to which this smart camera writes output data for measurements after an inspection is performed.

The Input Area (Response Area) (2) and Input Area (Output Area) (3) are assigned to continuous memory addresses or to a variable.

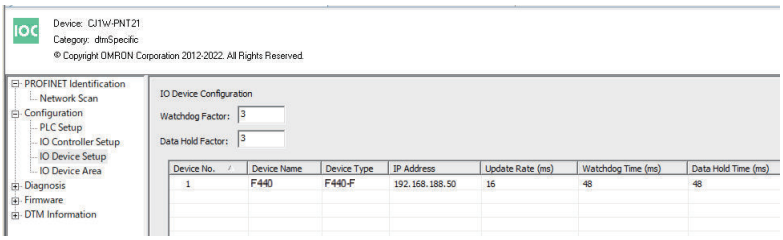

PLC
Smart Camera
Output module
Output slot
(1)Output area
(Command area)
You write the following control commands for the smart Camera
-Control input
-Command code
-Command parameter
Commands
Input module
The control commands that are written to the Command
20byte
Input connection to Smart Camera
Execution
Input module
Input slot
(2)Input area
(Response area)
The Smart Camera writes the execution results to the PLC.
Responses
Output module
Measurement results are written to the Response Area of the PLC.
-Control outputs
-Command code
-Response code
16byte
Output connection to PLC
(3)Input area
(Output area)
The Smart Camera writes the output data to the PLC.
After measuring, measure-ment results are written to the Output Area of the PLC.
-Output data 0 to 64
-Output character strings
32 to 256byte

3-3-3 Communications Settings

The following settings are required to use PROFINET communications.

Configure Network Settings of F440/F430	Set the IP address and industrial protocol. For details, refer to *Configuring Network Settings of F440/F430* on page 3-46.
⇩	
Configure Default PROFINET Settings	
⇩	
Configure IO Supervisor (Computer) Settings • IP Address Settings	
⇩	
Configure IO Controller Settings • IP Address Settings • PROFINET IO System Settings • IO Device Settings and Assignments*1 • Compile and Save Settings	Configure the settings with the engineering tool as Sysmac Studio. If you are setting the F440/F430 as an IO device, install a GSD file that defines the F440/F430 IO data CR connection information in the engineering tool. For PROFINET IO system settings, refer to applicable engineering tool manual(s).
⇩	
Transfer Settings and Check Connection • Check IO Controller Connection • Transfer Parameters • Check Connection Status • Check Data Assignments	Connect the computer (engineering tool), F440/F430, and external devices, and use the engineering tool to transfer settings and check communication.

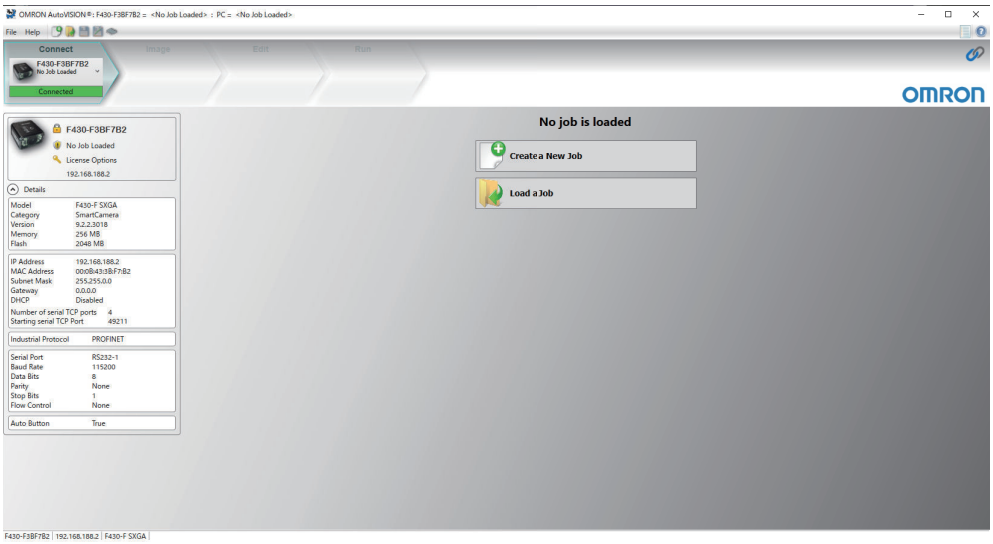
*1. If F440/F430 IP address is assigned in the PLC project and the PLC is not connected to the network when the F440/F430 is powered, it will revert to the default IP address "192.168.188.2", until the PLC is reconnected to the network.
The picture below shows the PROFINET configuration page for the Omron PLC, but this equally applies to other PLC vendors.



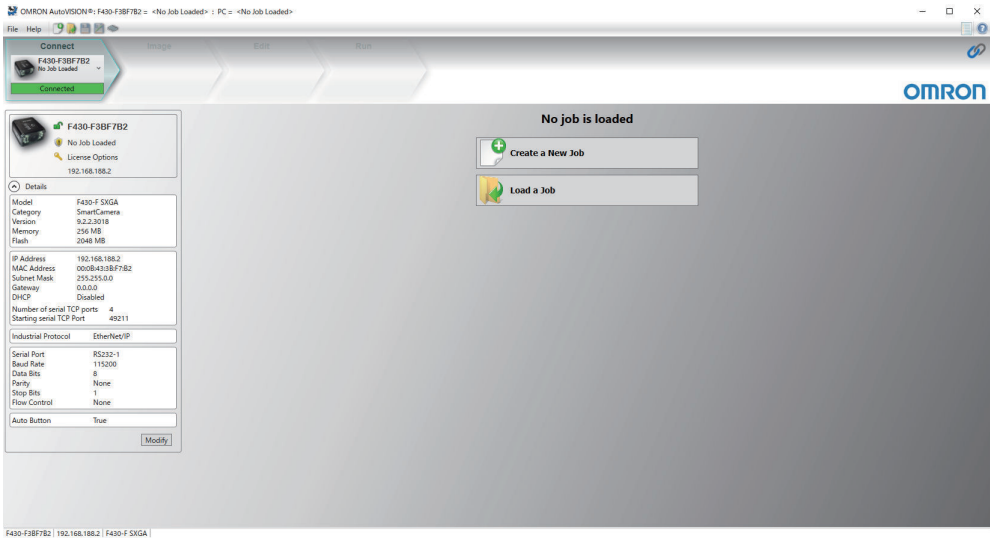
3-3-4 Communication Specifications Settings (PROFINET)

Configuring Network Settings of F440/F430

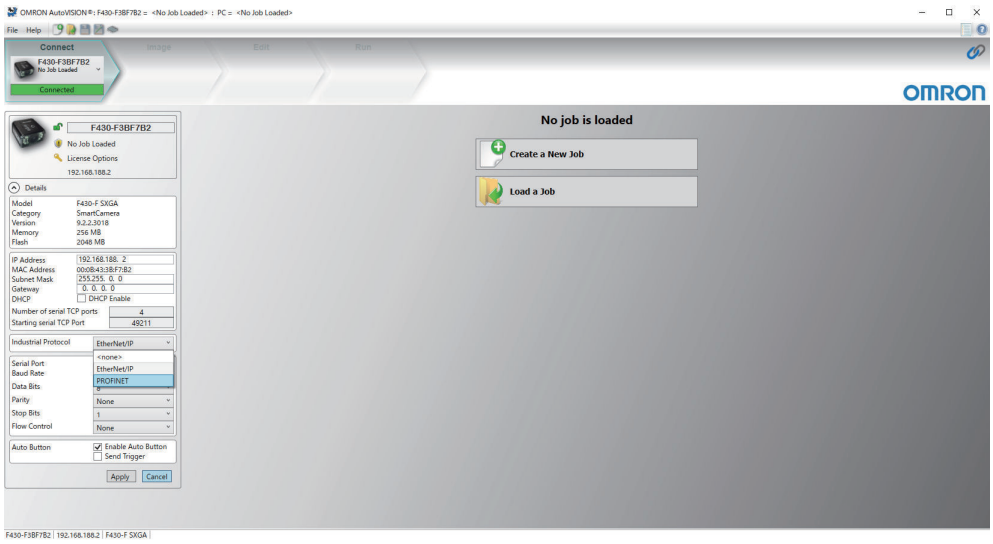
1 Launch the AutoVISION software.
The OMRON AutoVISION startup screen is displayed.



2 Select the F440/F430 to connect to in the Connect list.



3 Change Industrial Protocol selection to PROFINET.

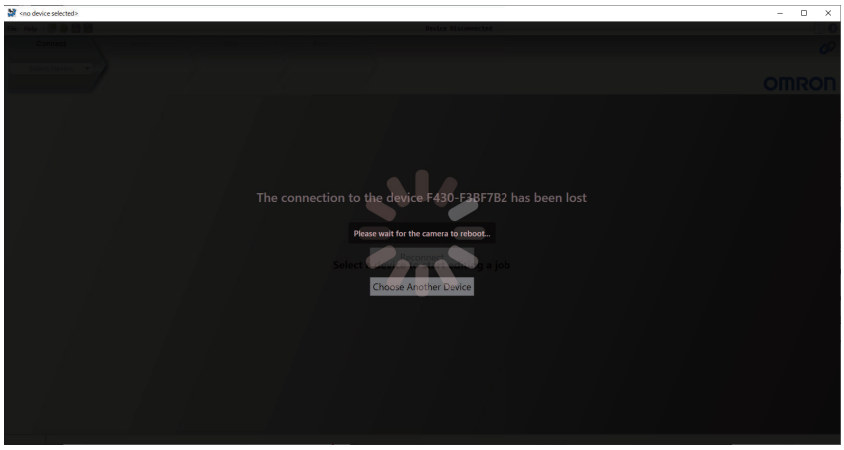


4 The Reboot Required dialog box is displayed. Reboot the smart camera according to the message.

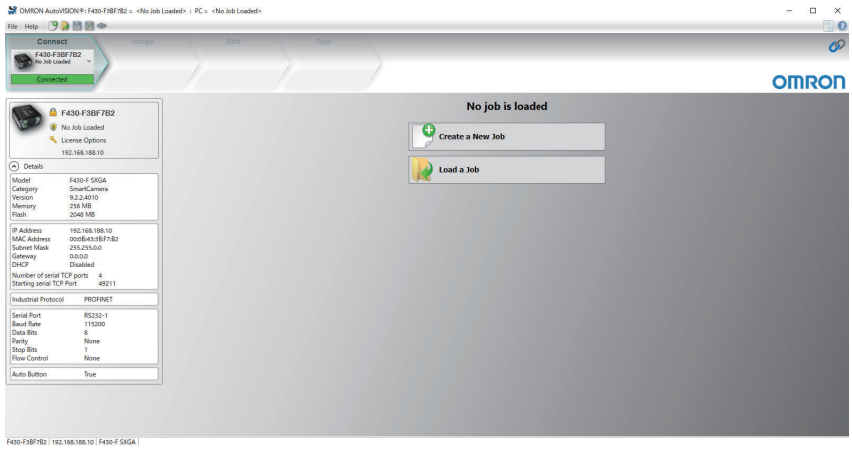
Precautions for Correct Use

After you change the industrial protocol, you need to reboot the smart camera to have the new setting take effect.

5 "The Connection to the device FXXX-XXXXXXX has been lost" screen is displayed. Click **Reconnect**.



6 Confirm that *PROFINET* is displayed for Industrial Protocol.



3-3-5 Slot/Subslot Layout Descriptions

The slot/subslot layout is shown below.

Slot	Dir	Bytes	Name	Description
1	In	2	STATUS	Status register of the smart camera. Each bit of this register represents a different state item. See *Status: Camera Status Register (16-bit)* on page 3-52 for bit definition.
3	In	2	ECHO	This 16 bit word value reflects back to the PLC the value that the PLC wrote to the output slot ECHO register. The PLC can verify the output slot has been written to the smart camera when this value matches the written value.
5	In	4	CmdCodeRslt	When Status.ExeCmdAck goes active in response to Control.ExeCmd, CmdCodeRslt contain the data returned from the command invoked by CmdCode.See *CmdCodeRslt (32-bit)* on page 3-53 for definition.
7	In	4	CmdRet	When Status.ExeCmdAck goes active in response to Control.ExeCmd, CmdRet contains the data returned from the command invoked by Control.CmdCode. See *CmdRet (32-bit)* on page 3-53 for definition.
9	In	2	State	Device State register. Depending on the current state of the smart camera, certain STATUS and CONTROL features may or may not be operated. See *State (16-bit)* on page 3-54 for definition.
2	Out	2	CONTROL	Control register of smart camera. Each bit of this register represents a different status item. See *Control:Camera Control Register (16-bit)* on page 3-55 for bit definition.
4	Out	2	ECHO	This 16 bit value reflects back to the PLC in the input slot ECHO register. The PLC can verify the output slot has been written to the smart camera when the input slot matches this written value.
6	Out	4	CmdCode	Specifies the process invoked in the smart camera when Control.ExeCmd goes active. See *CmdCode and CmdArg (32-bit)* on page 3-56 for definition.
8	Out	4	CmdArg	Additional argument data for CmdCode. See *CmdCode and CmdArg (32-bit)* on page 3-56 for definition.
11	In	2	VIO	Each bit reflects the state of virtual IO point. The least significant bit reflects vio point 145, the most significant bit vio point 160.

Slot	Dir	Bytes	Name	Description
10	Out	2	VIO	Each bit reflects the state of virtual IO point. The least significant bit reflects vio point 129, the most significant bit vio point 144.
13	In	8	bool1-64	Each bit represents a bool value. the least significant bit of byte 0 reads the value of bool1. The most significant bit of byte 7 reads bool64.
12	Out	8	bool101-164	Each bit represents a bool value. the least significant bit of byte 0 reads the value of bool101. The most significant bit of byte 7 reads bool164.
15	In	20	int1-10	Each pair of sequential bytes represents a 16 bit signed integer value. the20 bytes represents 10 integers. From bytes 0-1 for the value of int1 through bytes 18-19 for the value of int10.
14	Out	20	int101-110	Each pair of sequential bytes represents a 16 bit signed integer value. the20 bytes represents 10 integers. From bytes 0-1 for the value of int1 through bytes 18-19 for the value of int10.
17	In	64	long1-16	Each group of 4 bytes represents a 32 bit signed integer value. From bytes 0-1 for the value of long1 through bytes 60-63 for the value of long16.
16	Out	64	long101-116	Each group of 4 bytes represents a 32 bit signed integer value. The 64 bytes represents 16 long integers. From bytes 0-3 for the value of long101 through bytes 60-63 for the value of long116.
19	In	96	float1-24	Each group of 4 bytes represents a 32 bit signed integer value. The 96 bytes represents 24 long integers. From bytes offset 0-1 for the value of float1 through bytes offsets 92-95 for the value of float24.
18	Out	96	float101-124	Each group of 4 bytes represents a 32 bit signed integer value. The 96 bytes represents 24 long integers. From bytes offset 0-1 for the value of float101 through bytes offsets 92-95 for the value of float124.
21	In	96	string1	These 96 bytes can store a string of up to 94, 8 bit characters, with the first 2 bytes containing the length value.
20	Out	96	string101	These 96 bytes can store a string of up to 94, 8 bit characters, with the first 2 bytes containing the length value.
23	In	96	string2-string7	6 consecutive strings, each of these 32 bytes group can store a string of up to 30, 8 bit characters, with the first 2 bytes of each string group containing the storage length and string length value.
22	Out	96	string102-string107	6 consecutive strings, each of these 32 bytes group can store a string of up to 30, 8 bit characters, with the first 2 bytes of each string group containing the storage length and string length value.

Slot Data Layout Diagrams

The slot data layout is shown below.

PLC Input

Slot	Byte Offset	Data
1	0	STATUS
3	0	Echo In
5	0	CMD CODE RSLT
7	0	CMD RET
9	0	STATE
11	0	VIO 145.. 160
13	0	bool 1.. 16
	2	bool 17.. 32
	4	bool 33.. 48
	6	bool 49.. 64
15	0	int 1
	2	int 2
	4	int 3
	6	int 4
	8	int 5
	10	int 6
	12	int 7
	14	int 8
	16	int 9
	18	int 10
17	0	long 1
	4	long 2
	8	long 3
	12	long 4
	16	long 5
	20	long 6
	24	long 7
	28	long 8
	32	long 9
	36	long 10
	40	long 11
	44	long 12
	48	long 13
	52	long 14
	56	long 15
	60	long 16

PLC Output

Slot	Byte Offset	Data
2	0	CONTROL
4	0	Echo Out
6	0	CMD CODE
8	0	CMD ARG
10	0	VIO 129.. 144
12	0	bool 101.. 116
	2	bool 117.. 132
	4	bool 133.. 148
	6	bool 149.. 164
14	0	int 101
	2	int 102
	4	int 103
	6	int 104
	8	int 105
	10	int 106
	12	int 107
	14	int 108
	16	int 109
	18	int 110
16	0	long 101
	4	long 102
	8	long 103
	12	long 104
	16	long 105
	20	long 106
	24	long 107
	28	long 108
	32	long 109
	36	long 110
	40	long 111
	44	long 112
	48	long 113
	52	long 114
	56	long 115
	60	long 116

PLC Input

Slot	Byte Offset	Data
19	0	float 1
	4	float 2
	8	float 3
	12	float 4
	16	float 5
	20	float 6
	24	float 7
	28	float 8
	32	float 9
	36	float 10
	40	float 11
	44	float 12
	48	float 13
	52	float 14
	56	float 15
	60	float 16
	64	float 17
	68	float 18
	72	float 19
	76	float 20
	80	float 21
	84	float 22
	88	float 23
	92	float 24

PLC Output

Slot	Byte Offset	Data
18	0	float 101
	4	float 102
	8	float 103
	12	float 104
	16	float 105
	20	float 106
	24	float 107
	28	float 108
	32	float 109
	36	float 110
	40	float 111
	44	float 112
	48	float 113
	52	float 114
	56	float 115
	60	float 116
	64	float 117
	68	float 118
	72	float 119
	76	float 120
	80	float 121
	84	float 122
	88	float 123
	92	float 124

PLC Input

Slot	Byte Offset	Data
21	0	94
	1	<str 1 len>
	2	string 1
	95	
23	0	30
	1	<str 2 len>
	2	string 2
	31	
	32	30
	33	<str 3 len>
	34	string 3
	63	
	64	30
	65	<str 4 len>
	66	string 4
	95	
	96	30
	97	<str 5 len>
	98	string 5
	127	
	160	30
	161	<str 6 len>
	162	string 6
	191	

PLC Output

Slot	Byte Offset	Data
20	0	94
	1	<str 101 len>
	2	string 101
	95	
22	0	30
	1	<str 102 len>
	2	string 102
	31	
	32	30
	33	<str 103 len>
	34	string 103
	63	
	64	30
	65	<str 104 len>
	66	string 104
	95	
	96	30
	97	<str 105 len>
	98	string 105
	127	
	160	30
	161	<str 106 len>
	162	string 106
	191	

PLC Slot Layout for Omron Microscan Smart Cameras

The PLC slot layout for the smart camera is shown below.

dut	0	0
Interface	0	0 X1
Port 1	0	0 X1 P1
Status_1	0	1
Control_1	0	2
Echo In_1	0	3
Echo Out_1	0	4
Cmd Code Rslt_1	0	5
Cmd Code_1	0	6
Cmd Ret_1	0	7
Cmd Arg_1	0	8
State_1	0	9

● Status: Camera Status Register (16-bit)

Each bit of this register represents a different state of the camera's operation. A high value of 1 indicates that state is active (true).

Bit	Name	Description
0	ONLINE	Inspections are running.
1	EXP BUSY	The smart camera is busy capturing an image. The smart camera should not be triggered or the part under inspection moved during this time if illuminated.
2	ACQ BUSY	The smart camera is busy acquiring an image. The smart camera cannot be triggered while busy.
3	TRIGGER READY	The smart camera is ready to be triggered. This is equivalent to ONLINE == 1 and ACQBUSY== 0.
4	ERROR	An error has occurred. Set the RESET ERROR control bit high to clear.
5	RESET COUNT ACK	This bit mirrors the RESET COUNT control bit. The PLC can be certain the reset command was received by the smart camera when this goes high. The PLC can then bring the RESET COUNT control signal back low.
7	EXE CMD ACK	This bit mirrors the EXE CMD control bit.
8	TRIGGER ACK	This bit mirrors the TRIGGER control bit.
9	INSP BUSY	This bit is high when inspection 1 is busy processing an image.
10	INSP STAT	This bit represents the inspection 1 status result. It is 1 if the inspection passes. It is only calid when DataValid goes high.
11	DATA VALID	This bit goes high when the inspection 1 is complete. The PLC should clear this signal by setting RESET DV high once it has read results.

● CmdCodeRslt (32-bit)

The value of CmdCodeRslt is only valid when ExeCmdAck is active (1), in response to ExeCmd being active.

CmdCodeRslt value (base 16 hex)	Meaning
0x0000_0000	Success
0x0100_0000	Fail. Possible reasons: Camera under PC control. Job cannot be changed.
0x0200_0000	Fail: No job in slot.
0x0300_0000	Fail: Unknown cmd.

● CmdRet (32-bit)

The value of CmdRet is only valid when ExeCmdAck is active (1), in response to ExeCmd being active, and CmdCodeRslt is 0 (Success). The following table shows which CmdCodes return data in the CmdRet register.

CmdRet value (32 bit)	Associated CmdCode	Meaning
0	0x0100_0000 to 0x1300_0000 (Job Change type)	na
1-255	0x1800_0000 (Query Active Job slot)	Active Job Slot #

● State (16-bit)

State reflects the following operational condition of the camera.

State value (16 bit)	Meaning	Typical action required by the client (plc), or system operator
0	Offline*1	Perform job change or put camera online.
1	Online*2	Normal runtime operation: Monitor TriggerReady and DataValid signals. Trigger the smart camera.
2	Changing Vision Job	If camera is under pc control: Wait until State changes to Offline or Online. If PLC is controlling the job change: Use ExeCmd, CmdCode, ExeCmdAck, and CmdCodeRslt to complete the operation.
3	Booting*3	Wait for camera to transition to Online or Offline.
4	Empty (no Vision Job)	Load a new job from AutoVISION or FrontRunner.

*1. If the camera does not have any saved jobs, then after the reboot the camera will be offline.
*2. During a power cycle or reboot the camera will be online when completed if the camera has a saved job that can be loaded.
*3. This will rarely be seen by the PLC.

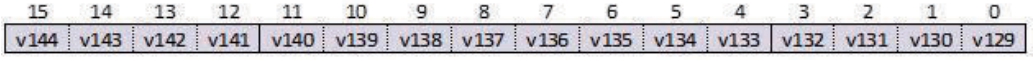
The value of State determines which Control and Status signals are available:

Control/Status Signal	State				
	0	1	2	3	4
	(Offline)	(Online)	(Job Change)	(Booting)	(Empty)
Control.GO ONLINE	Y				
Control.GO OFFLINE		Y			
Control.RESET ERROR	Y	Y			Y
Control.RESET COUNT	Y	Y			
Control.EXE CMD	Y	Y	Y		Y
Control.TRIGGER		Y			
Control.RESET DATA VALID		Y			
Status.ONLINE	Y	Y	Y	Y	Y
Status.ERROR	Y	Y			Y
Status.RESET COUNT ACK	Y	Y			
Status.EXE CMD ACK	Y	Y	Y		Y
Status.EXP BUSY		Y			
Status.ACQ BUSY		Y			
Status.TRIGGER READY	Y				

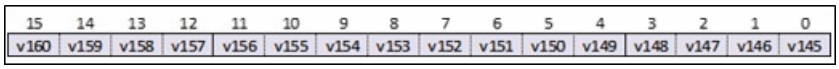
Control/Status Signal	State				
	0	1	2	3	4
	(Offline)	(Online)	(Job Change)	(Booting)	(Empty)
Status.TRIGGER ACK		Y			
Status.INSP BUSY		Y			
Status.INSP STAT		Y			
Status.DATA VAL-ID		Y			

Where:
Y = Signal is valid for this State
Empty cell = Signal is not valid for this State

● VIO Output Register Bits



● VIO Input Register Bits



● Control:Camera Control Register (16-bit)

Each bit of this register controls a function on the camera. Transitions from a low state of 0 to a high state of 1, initiates the associate operation. The PLC should return the state of the control bit back to 0 after it has acknowledged the camera has processed the control. Unused bits should remain 0. Setting the Reset Data Valid bit (bit 11) will also reset the Error bit (bit 4) in the Camera Status Register.

Bit	Name	Description
0	GO ONLINE	Start all inspections running
1	GO OFFLINE	Stop all inspections
4	RESET ERROR	Rest ERROR in the Status register
5	RESET COUNT	Reset all inspection counts*1
7	EXE CMD	Execute the command specified by Coontrol.CmdCode
8	TRIGGER	Trigger Inspection1. The inspection must be configured for a triggerd image acquisition.
11	RESET DATA VALID	Rest the DataValid signal of the Status register.

*1. The inspection counts for Inspected, Passed, Failed, Cycle, Cycle Worst, PPM, PPM Worst, and Overrun will be reset.

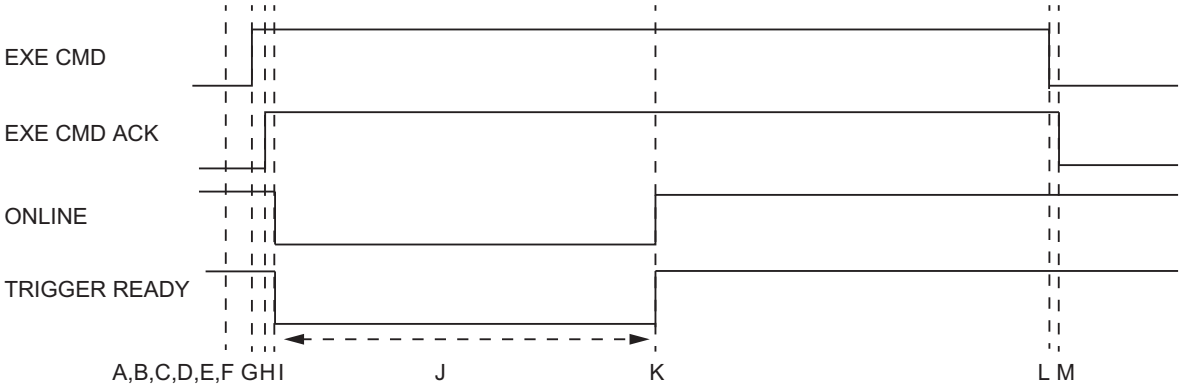
● CmdCode and CmdArg (32-bit)

Specifies the process invoked in the camera when Control.ExeCmd goes active.
The CmdCode and CmdArg must beset, at least 2 RPI, before setting the EXE CMD bit in the control register. Do not set all the values within the same RPI.
List of available CmdCode, and associated CmdArg:

CmdCode value	CmdArg	Operations performed
0x1000_0000	Job Slot (1-255)	Go Offline, Load job from specified slot
0x1100_0000	Job Slot (1-255)	Go Offline, Load job from specified slot, Go Online
0x1200_0000	Job Slot (1-255)	Go Offline, Load job from specified slot, Make it the boot job
0x1300_0000	Job Slot (1-255)	Go Offline, Load job from specified slot, Make it the boot job, and Go Online
0x1800_0000	na	Query active job slot. CmdRet will contain the active job slot number when the operation is done.

CmdCode and ExeCmd Operation

Example: Job change

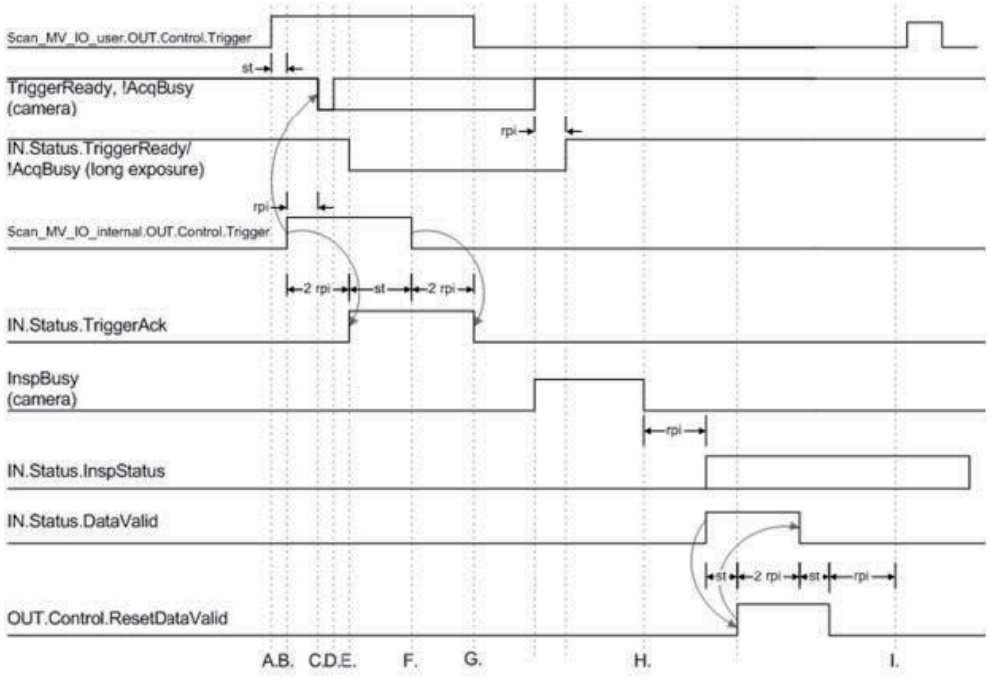


Task	Description	Output Slot	Input Slot
Prerequisite	The Smart Camera must not be controlled by AutoVISION, FrontRunner, Web Monitor, or Custom User Interface.		
A	Stop triggering the inspection. If running a continuous inspection (without triggers), it is recommended to go offline before starting job change.	GO OFFLINE = TRUE	
B	If Data Valid or Error is TRUE, clear these outputs.	RESET DATA VALID = TRUE RESET ERROR = TRUE	
C	Wait until Data Valid or Error is FALSE.		DATA VALID = FALSE ERROR = FALSE

Task	Description	Output Slot	Input Slot
D	Confirm the following bits are FALSE. GO OFFLINE, GO ONLINE, RESET ERROR, RESET COUNT, RESET DATA VALID, TRIGGER DO NOT CHANGE these bits during job change.	GO OFFLINE = FALSE GO ONLINE = FALSE RESET ERROR = FALSE RESET COUNT = FALSE TRIGGER= FALSE RESET DATA VALID= FALSE	
E	Set Command Code (0x1100_0000) to tell the Smart Camera to Go Offline, Load Job from specified slot, Go Online. Set Command Arg to tell the Smart Camera to load job in slot 1.	CmdCode = 0x1100_0000 CmdArg = 1	
F	Wait at least 1 RPI between Command Code, Command Arg assignment and Execute Command.		
G	Set Execute Command bit to TRUE to start job change.	EXE CMD = TRUE	
H	Set Execute Command bit to TRUE to start job change.		EXE CMD ACK = TRUE
I	Smart Camera is Offline. Smart Camera is not ready for trigger. State=0 indicates the Smart Camera is offline.		ONLINE = FALSE TRIGGER READY = FALSE State = 0
J	State=2 indicates unit is changing the vision job.		State = 2
K	The Smart Camera is Online. Smart Camera is ready for trigger. State=1 indicates Smart Camera is online. Command Code Result indicates successful job change. (This must be checked while the ExeCmd is still TRUE.)		ONLINE = TRUE TRIGGER READY = TRUE State = 1 CmdCodeRslt = 0x0000_0000 (successful job change)
L	Set Execute Command bit to FALSE to finish job change.	EXE CMD = FALSE	
M	Execute Command Acknowledge bit = FALSE.		EXE CMD ACK = FALSE

You need to monitor the value of State to know when the job changes are complete.

3-3-6 Control/Status Signal Operation



See *3-3-5 Slot/Subslot Layout Descriptions* on page 3-49 for details of Slot and Subslot.

1. The following describes the signals used in the timing chart.
   - Scan_MV_IO_user.OUT.Control.Trigger:
     This is the trigger in the control register.
   - TriggerReady, !AcqBusy(camera):
     TriggerReady(camera) is the smart camera's internal signal for TRIGGER READY.
     !AcqBusy(camera) indicates logical negation (NOT) of the smart camera's internal signal for ACQ BUSY.
     The timing chart shows the signals in two cases, one where the exposure time is shorter than rpi and the other where the exposure time is sufficiently long.
   - IN.Status.TriggerReady/!AcqBusy(long exposure):
     IN.Status.TriggerReady is TRIGGER READY in the status register. IN.Status.!AcqBusy indicates logical negation (NOT) of ACQ BUSY in the status register.
     For IN.Status.TriggerReady/!AcqBusy(long exposure), a case where the exposure time is sufficiently longer than rpi is shown.
     If the exposure time is shorter than rpi, TRIGGER READY remains ON and ACQ BUSY remains OFF.
     The pulse width of EXP BUSY depends on the exposure time set for the inspection executed in the smart camera.
   - Scan_MV_IO_internal.OUT.Control.Trigger:
     This is the smart camera's internal signal for TRIGGER.
   - IN.Status.TriggerAck:
     This is TRIGGER ACK in the status register.
   - InspBusy(camera):
     This is the smart camera's internal signal for INSP BUSY.
   - IN.Status.InspStatus:
     This is INSP STAT in the status register.

The timing chart shows the signal in cases where the inspection has been passed and where the inspection has been failed. It turns ON when the inspection has been passed and turns OFF when it has been failed.
The signal retains its status until the next test result is available.

- IN.Status.DataValid:
  This is DATA VALID in the status register.
- OUT.Control.ResetDataValid:
  This is RESET DATA VALID in the control register.

2. st = PLC program scan time.
3. rpi represents the packet interval of the PLC. Use the PLC project development software for the smart camera device PROFINET interface to set this. Set rpi between 16 and 512 ms.
4. The PLC tag is delayed by at least 1 or 2 rpi from the status of the smart camera's internal signal.

A. On rising edge of system trigger, the user app activates Scan_MV_IO_user.OUT.Control.Trigger.
B. If the smart camera is ready when the rising edge of Scan_MV_IO_user.OUT.Control.Trigger is detected, Scan_MV_IO_internal.OUT.Control.Trigger turns ON.
C. Camera acquisition begins (may be delayed be one rpi) and then TriggerReady, !AcqBusy(camera) turns to OFF.
D. IF the smart camera's exposure time is shorter than the rpi, no change will be seen in IN.Status.TriggerReady and IN.Status.!AcqBusy.
E. After Scan_MV_IO_internal.OUT.Control.Trigger turns ON, IN.Status.TriggerAck turns ON.
There may be a delay of 2 rpi from the timing of B until IN.Status.TriggerAck turns ON after Scan_MV_IO_internal.OUT.Control.Trigger turns ON.
F. Detects IN.Status.TriggerAck and clears Scan_MV_IO_internal.OUT.Control.Trigger.
G. Detests falling edge of IN.Status.TriggerAck and clears Scan_MV_IO_user.OUT.Control.Trigger.
H. Camera internal signal IN.Status.DataValid will go ON when InspBusy(camera) goes OFF.
I. PLC logic must delay one rpi time before resetting OUT.Control.ResetDataValid.

4

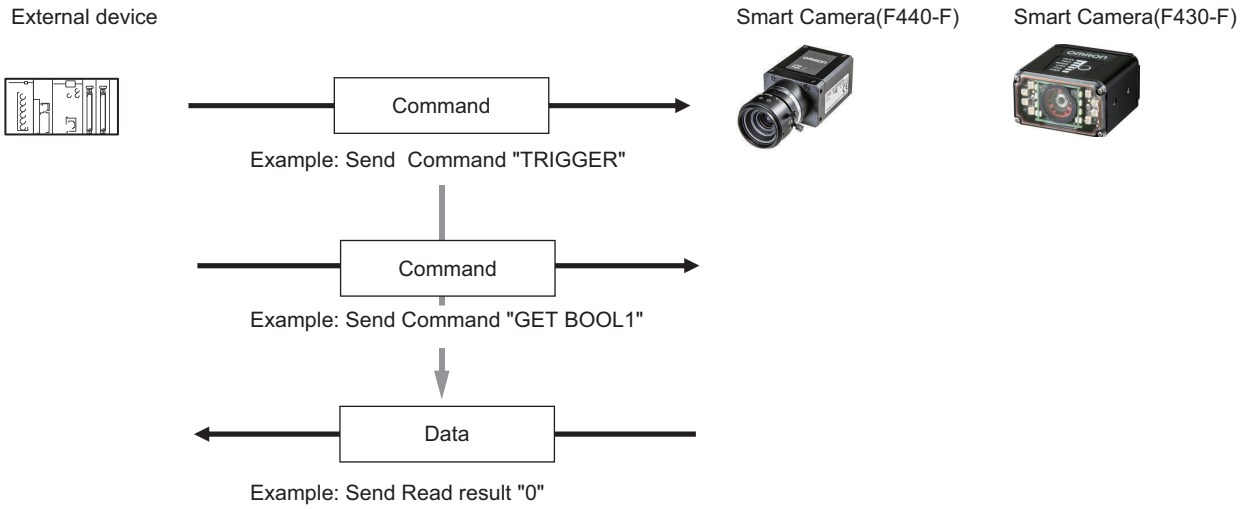
Controlling Operation and Data Output with RS-232C

4-1 Controlling Operation and Data Output with RS-232C

This section explains how to connect the smart camera to an external device (such as PLC) using RS-232C communications and the methods that you can use to control the smart camera and its output.

4-1-1 Communications Processing Flow

In a system configuration in which it is connected by Serial (RS-232C) communications to an external device (such as PLC), serial commands can be received and reading results can be output to the external device.
Below is the basic flow for establishing the Serial (RS-232C) communications, executing a TRIGGER command and outputting the Read result.



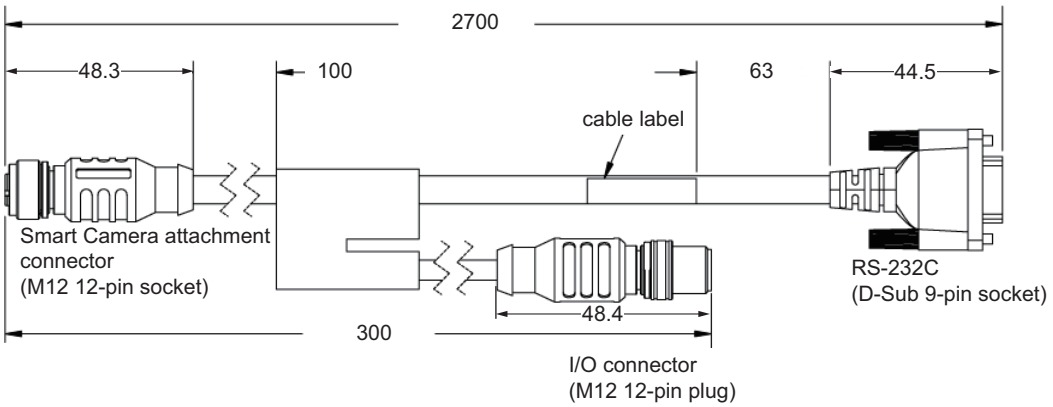
4-1-2 RS-232C Wiring

There are two ways of wiring the F440/F430 for RS-232C connection.

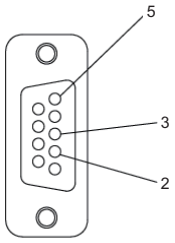
Using the RS-232C-I/O Y cable (V430-WQR-3M)

The D-Sub 9 Pin connector can be connected directly to an IBM PC compatible Serial Port.
V430-WQR-3M

(Unit: mm)



Please connect V430-W8□ to the I/O connector (M12 plug) and connect it to power supply etc.
RS-232C (D-sub 9 Pin Female Connector)

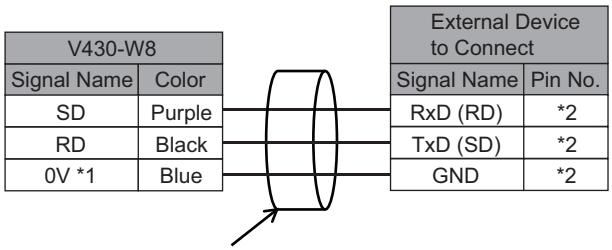
Pin No.	Signal Name	Pin Layout Diagram
1	-	
2	HOST_RxD(SD)	
3	HOST_TxD(RD)	
4	-	
5	0V	
6	-	
7	-	
8	-	
9	-	

Using the RS-232C Signal on I/O cable (V430-W8☐)

RS-232C communication is possible by combining the signal for RS-232C communication (SD, RD) coming from the I/O cable (V430-W8☐) with the RS-232C signal of the device it is connected to.
(If the V430-W8☐ is connected to the M12 plug of the V430-WQR-3M, the RS-232C signal on the V430-W8☐ cannot be used.)

- I/O Cable Connection Diagram (All V430-W8)

Wire color	Pin No.	Signal Name	Function
Brown	2	24V	Power supply
Blue	7	0V	GND
Red	8	COM_IN	Common Input Signals (Input Common)
Red Striped	12	COM_OUT	Common Output Signals (Output Common)
White	1	TRIG	Read Trigger Input (Trigger)
Black	9	RD	Receive Data (RD)
Violet	10	SD	Send Data (SD)
Gray	5	OUTPUT 1	(Output 1)
Gray Striped	11	OUTPUT 2	(Output 2)
Pink	6	OUTPUT 3	(Output 3)
Green	3	DEFAULT	(Default)
Yellow	4	NEW MASTER	(New Master)
None	-	-	(Shield)



V430-W8	
Signal Name	Color
SD	Purple
RD	Black
0V *1	Blue

External Device to Connect	
Signal Name	Pin No.
RxD (RD)	*2
TxD (SD)	*2
GND	*2

Use a shielded cable. Up to 15m cable length.

*1. 0V is shared with the 0V for the power supply of this product, so please branch it.
*2. Please connect according to your device specifications.

Example: When using OMRON Serial Communication Unit

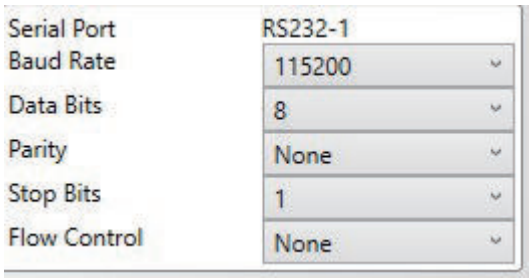
CJ1W-SCU22	
Signal Name	Pin No.
RxD (RD)	3
TxD (SD)	2
GND	9

4-1-3 Communication Settings (Serial (RS-232C))

RS-232C Communication Settings on the Smart Camera

Set the RS-232C communications settings on the smart Camera according to the settings on the PLC or other external device.

1 Set the Baud Rate, Parity, Stop Bit, and Data Length according to the RS-232C communication settings of the external device to connect to.



Setting Item	Setting Value	Description
Baud Rate	110, 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 (Default: 115200)	Set the transmission speed for RS-232C communications. (Unit:bps) Set it to match the communications specifications of the external device.
Data Bits	• 5 • 6 • 7 • 8 (default)	Length of the data bits. Select eight or seven. Set it to match the communications specifications of the external device.

Setting Item	Setting Value	Description
Parity	• None(default) • Odd • Even	An error detection routine that sets 1 data bit per character to 1 or 0 so that the total number of bits in the data field is even or odd. Set it to match the communications specifications of the external device.
Stop Bit	• 1 (default) • 2	1 or 2 bits appended to the end of the data per each character to indicate End of the data. Set it to match the communications specifications of the external device.
Flow Control	• None • Xon/Xoff • Hardware	Set the parameters for the flow control to use. Set it to match the communications specifications of the external device.

4-1-4 Output Settings

Example: Output a string that you read using the Decode Tool.

• Register the read string in the Decode Tool.

• Open the **TCP/IP and Serial Out** settings in the Test Outputs Tool.

• Select the port to use for string output.

• Click the **+** icon in the Build Output String area and then select the **Tool Output Value** option.

• Click **<Not Connected>** in the Build Output String area and then select the **Decode Text** option of the Decode Tool.

• Use any serial communication tool to configure the IP address, port, and other settings and then connect to the F440/F430.

• Input the measurement trigger to the F440/F430.

• The F440/F430 outputs the read string (decoded text) to the serial communication tool.

4-1-5 Serial Command List (RS-232C)

See *A-3 Serial Command* on page A-4 for serial command.

A

Appendices

A-1 EtherNet/IP Information

A-1-1 EtherNet/IP Device Identity

Item	Setting Value
Device Type	Device type:100, Vendor Specific, Machine Vision Smart Camera
Vendor ID	Omron Microscan's ODVA Vendor ID is 1095.
Product Code	F430-F: 6903 F440-F: 6905
Interface Revision	Major.Minor = 2.1
Connection Property	Class 1 Implicit Messaging
Input Assembly Instance	(to PLC/client): 102
Output Assembly Instance	(to camera): 114
Size	Fixed, 320 bytes in both directions
Input Trigger/Trigger Mode	Cyclic
RPI(Requested Packet Interval)	Greater than 20 ms recommended. 10 ms to 3.2 s allowed.
Input Type/Connection Type	• Point-to-Point (PLC OUT, O >T) • Point-to-Point (PLC IN, T >O)
Connection Priority	Scheduled

A-1-2 EDS File

Contact your Omron representative for the EDS file.

A-2 PROFINET Information

A-2-1 PROFINET IO Identity

The table below shows the PROFINET device ID information for the F440-F/F430-F.

- **Vendor ID**
  Omron Microscan's Systems, Inc. Vendor ID is 0x0257.
- **Device ID**
  F430: 0x7000
  F440: 0x7005
- **Vendor name**
  Vender name is OMRON MICROSCAN SYSTEMS, INC.
- **Device function**
  Device function is as follows:
  - MainFamily = General
  - ProductFamily = SmartCamera

A-2-2 GSDML File

Contact your Omron representative for the GSDML file.

A-2-3 Connection Properties: RT Cyclic Messaging

Odd slot numbers are input to the PLC, even slot numbers are output from the PLC.
Maximum data size in either direction is 518 bytes. The data size can be reduced by removing slots that are not used.
Cycle update time for MicroHAWK F430-F: 16 ms
Cycle update time for F440-F: 16 ms

Additional Information

The GSD file contains element MinDeviceInterval, which is 512. Multiply this by 31.25 µs. This is the cycle time. See the PROFINET GSDML specification for more information.

A-3 Serial Command

Serial commands can be sent via TCP port, AutoVISION terminal, or HyperTerminal.

Precautions for Correct Use

The MicroHAWK MV-4000 does not support focus commands.

Serial Command Syntax

- Command parameters include required parameters that must be always specified and option parameters that may be specified as needed.
- Insert a space between the command and the parameters.
- Insert a space between each parameter.
- Add a delimiter <CR> to the end of the command or parameter.
- No space is required between the parameter and the delimiter.
- Option parameters may be omitted.
- <CR> indicates a Carriage Return.
- <LF> indicates a Line Feed.
- <ETX> indicates the End of Text.

AUTOCAL

Initiates camera calibration of gain, exposure, and focus. Each parameter is independent. Ranges are device-dependent.

Precautions for Correct Use

AUTOCAL only functions when the camera is OFFLINE.

● Command Format

AUTOCAL -exp=SettingValue -expval=SettingValue -gain=SettingValue -gainval=SettingValue -focus=SettingValue -focval=SettingValue<CR>

- Insert a space between the command and the parameters.
- Insert a space between each parameter.
- Add a delimiter <CR> to the end of the command or parameter.
- No space is required between the parameter and the delimiter.
- Refer to the table below for the setting values.

Required Parameter

None

Option parameter

Parameter	Setting value	Description
-exp	• 1 • 0	Automatic calibration of exposure time • 1: Enables automatic calibration of exposure time. • 0: Disables automatic calibration of exposure time. When -exp=0, set the exposure time with -expval.
-expval	60-100000 (µs)	Exposure time Sets the exposure time.
-gain	• 1 • 0	Automatic calibration of gain • 1: Enables automatic calibration of gain. • 0: Disables automatic calibration of gain. When -gain=0, set the gain with -gainval.
-gainval	0-100 (%)	Gain Sets the gain.
-focus	• 1 • 0	Automatic calibration of focus • 1: Enables automatic calibration of focus. • 0: Disables automatic calibration of focus. When -focus=0, set the focus with -focval.
-focval	0-9999 (mm)	Focus Sets the focus.

● Response Format

If processed normally:

Gain;Exposure time;Focus;Lower limit of focus;Upper limit of focus<CR><LF><ETX>

- The lower and upper limits of focus vary depending on the model.

If not processed normally:

!ERROR<CR><LF><ETX>

● Command Example

Example 1:
Initiate camera calibration of gain, exposure time, and focus.
Command: AUTOCAL
Response: 0;4632;134;50;300
The calibration results are: Gain = 0, Exposure time = 4632 µs, Focus = 134, Lower limit of focus = 50, and Upper limit of focus = 300.

Example 2:
Go offline, get the photometry settings (gain, exposure time, focus) from QUERYAUTOCAL, change the gain to 18%, and execute the calibration.
Command: OFFLINE
Response: !OK
Command: QUERYAUTOCAL
Response: 0;4632;134;50;300
The gain is 0.
Command: AUTOCAL -gain=0 -gainval=18
Execute the calibration with the gain fixed to 18%.
Response: 18;3308;128;50;300
The exposure time has been changed from 4632 to 3308 µs without change to the gain.

Example 3:
Go offline, get the photometry settings (gain, exposure time, focus) from QUERYAUTOCAL, change the exposure time to 1000 µs, and execute the calibration.
Command: OFFLINE
Response: !OK
Command: QUERYAUTOCAL
Response: 0;3478;226;50;300
The exposure time is 3478 µs.
Command: AUTOCAL -exp=0 -expval=1000
The exposure time is fixed to 1000 µs.
Response: 31;1000;98;50;300
The gain has been changed from 0% to 31% with the exposure time remaining at 1000 µs.

GET

Gets the value of a tag (bool1-200, int1-200, etc.) used in the device.

Precautions for Correct Use

This command only functions when the camera is ONLINE.

● Command Format

GET tagname<CR>
or
GET service<CR>
or
GET service.tagname<CR>

- Insert a space between the command and the parameters.
- Add a delimiter <CR> to the end of the command or parameter.
- No space is required between the parameter and the delimiter.
- Specify tagname, service, or service.tagname.
  Use the INFO command to get a full list of tags and services, as well as attributes of the tag and list of subtags.
  tagname specifies the tag from which you want to get information. It must correspond to one of the tags supported by the device.
  To get a single value from an array (such as int), add an index to the array name such as GET int1 (where 1 is the index). If the index is omitted, the full array of values will be returned in a comma-separated list of values.
  service specifies the service for which you want to get information.
  The AVP service allows retrieval of step and datum information from the job tree using forward slash '/' in the symbolic name path. GET avp/insp1/snapshot1/status paths are not case-sensitive and do not need to be fully qualified if unique. GET avp/snapshot1/status will return the same result if there is only one inspection.
  When issued against a step, GET avp/snapshot1 will return the values for all datums. Success Return: On success will return the value stored in the tag.

service.tagname gets the value of the tag in a service. For example, for the EIP input assembly, specify the command as GET eip.input.

Required Parameter
None

Option Parameter
None

● Response Format

If processed normally:
data<CR><LF><ETX>

- Returns the value of the tag used in the device, etc. Refer to Command Example.

If not processed normally:
!ERROR<ETX>

● Command Example

Example 1:
Set 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10 in the int1 to int10 tags and get the data of all the int tags.
Command: SET int1 1,2,3,4,5,6,7,8,9,10
Response: !OK SET int1
Command: GET int
Response: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,

Example 2:
Set 1 in the int1 tag and get the value of the int1 tag.
Command: SET int1 1
Response: !OK SET int1
Command: GET int1
Response: 1

Example 3:
Set a string in the string4 tag and get Input assembly information.
Command: SET string4 abcdefghijklmnopqrstuvwxyz
Response: !OK SET string4
Command:GET eip.input
Response:
0x0000 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0010 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0020 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0030 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0040 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

0x0050 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0060 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0070 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0080 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0090 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x00a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x00b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x00c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x00d0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x00e0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x00f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0100 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0110 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0120 1a 00 00 00 61 62 63 64 65 66 67 68 69 6a 6b 6c
0x0130 6d 6e 6f 70 71 72 73 74 75 76 77 78 79 7a 00 00

GETIMAGE

Serial transfer the inspection image in binary data format.

Precautions for Correct Use

- Ymodem transfer option is not supported on the MicroHAWK MV-4000.
- This command only functions when the camera is ONLINE.
- To receive the image data, you need to create a user program.
- To save the received image data to a file, you need to create a user program.

Additional Information

- This command always returns the last (most recent) image.

● Command Format

GETIMAGE -transfer=SettingValue -format=SettingValue -quality=SettingValue -woi=SettingValue -inspection=SettingValue<CR>

- Insert a space between the command and the parameters.
- Insert a space between each parameter.
- Add a delimiter <CR> to the end of the command or parameter.
- No space is required between the parameter and the delimiter.
- Refer to the table below for the setting values.
- If the -transfer option is omitted completely, the transfer mode is over the TCP and Ethernet port.

Required Parameter

None

Option Parameter

Parameter	Setting value	Description
-transfer	• ymodem	Uses Ymodem protocol over the serial port. If the -transfer option is omitted completely, the transfer mode is over the TCP and Ethernet port.
-format	• jpg • png • tif • raw	Specifies the format of the image. RAW and TIF are not supported for UART connection. If omitted, the image format is JPG.*1
-quality	0-100	specifies a JPG compression quality of n less than or equal to 100. The default quality is 80 if not specified. This setting is only supported for the JPG file type.*2
-woi	• Upper left coordinate x, upper left coordinate y, lower right coordinate x, lower right coordinate y	Specifies a rectangular area of the image to be included in the output image. Specify the upper-left and lower-right coordinates. Specify the values in the order of left, top, right, and bottom. If omitted, the full image buffer is returned.*3
-inspection	1-n	Specifies the inspection from which to retrieve an image. The image will be the latest image within that inspection. If not specified, it will look for the inspection that has the image and will be the latest image of the first inspection that has the image.

*1. All image file types return complete file information that can be saved directly to disk except the RAW file type, which requires explicit conversion.

*2. PNG, RAW, TIF formats provide lossless image compression. If format is set to PNG, RAW, TIF, the quality setting does not apply.

*3. -woi option is valid only when the image format is TIFF or JPG.

	Color Full-image	Color woi	Monochrome Full-image	Monochrome woi
PNG	OK	NA	OK	NA
RAW	OK	NA	OK	NA
TIF	OK	OK	OK	OK
JPG	OK	OK	OK	OK

The full image size depends on the camera type.
For details, refer to *F440-F Data Sheet (Q352), MicroHAWK F430-F Data Sheet (Q278) and MicroHAWK F420-F Data Sheet (Q279)*. Check the camera type and see its resolution.

● Response Format

• When -transfer=ymodem

If processed normally:

!OK<CR><LF><ETX>

Image data

If not processed normally:

!ERROR<CR><LF><ETX>

• When -transfer option is omitted

If processed normally:

Image data

If not processed normally:

None

Additional Information

Image data is output in binary with the configuration shown in the table below.

No.	Name	Description
1	Image header	It consists of the following four pieces of data. The size of each data is 4 bytes, for a total of 16 bytes. • Image width [pix] • Image height [pix] • Rowbytes, Image width rounded up to the next multiple of 4 [pix] • Pixel format Pixel format takes the following values. MONOCHROME: 0 COLOR_RGB: 1 COLOR_BGR: 2 COLOR_BAYERGR8: 3 COLOR_BAYERRG8: 4 COLOR_BAYERGB8: 5 COLOR_BAYERBG8: 6 COLOR_HSI: 7 For 5MP color F320-F/F330-F/F420-F/F430-F cameras, you will only see COLOR_BAYERGR8 and COLOR_BAYERBG8.
2	Image data	The number of bytes varies depending on the image size.
3	delimiter	1 byte <ETX>

Configuration example of the image header part:
(F430-F□□□□12M-□□□ (Camera resolution: 1280 x 960 pix))
- Image width = 1280
- Image height = 960
- Rowbytes = 1280
- Pixel format = 0 (MONOCHROME)

Each of these 4 values is sent as type Int32 in bytes as follows.
- 1280 = 0x00000500
- 960 = 0x000003C0
- 1280 = 0x00000500
- 0 = 0x00000000

Therefore, the image header part is as follows in hexadecimal.
00 00 05 00
00 00 03 C0
00 00 05 00
00 00 00 00

● Command Example

Example 1:

Get an image from the camera with the following settings.

Protocol: ymodem, Format: png, Inspection: Inspection 1

Command: GETIMAGE -transfer=ymodem -format=png -inspection=1

Response: !OK

The image data is output in binary on the same port used to send the GETIMAGE command.

Example 2:
Get an image from the camera with the following settings.
Protocol: ymodem, Format: jpg (default), Quality: 50, Inspection: Inspection 1 (default)
GETIMAGE –transfer=ymodem –quality=50 -inspection=1
Response: !OK
The image data is output in binary on the same port used to send the GETIMAGE command.

Example 3:
Get an image from the camera with the following settings.
Protocol: ymodem, Format: jpg (default), Quality: 50, Inspection: Inspection 1 (default), Image area to be acquired: Area specified by the upper left coordinates (320, 240) and the lower right coordinates (960, 720).
Command: GETIMAGE –transfer=ymodem –quality=50 -inspection=1 –woi=320,240,960,720
Response: !OK
The image data is output in binary on the same port used to send the GETIMAGE command.

Example 4:
Get image from camera with TCP connection, format: tif
When the GETIMAGE command is sent from a TCP connection, it does not send !OK response and starts sending image data immediately.
Protocol: TCP connection, Format: tif, Inspection: Inspection 1 (default)
Command: GETIMAGE –format = tif -inspection=1
Response:
The image data is output in binary on the same port used to send the GETIMAGE command.

HELP

Gets the command format and function description of serial commands.

● Command Format

HELP<CR>

- Add a delimiter <CR> to the end of the command or parameter.

Required Parameter
None

Option Parameter
None

● Response Format

If processed normally:
Command format of serial commands<CR><LF><CR><LF>Function description of serial commands<CR><LF>...Command format of serial commands<CR><LF><CR><LF>Function description of serial commands<CR><LF><ETX>

If not processed normally:
!ERROR<CR><LF><ETX>

● Command Example

Example 1:
Gets the command format and function description of serial commands.
Command: HELP
Response:
:
SET <tagname> <value>

Sets value of a global tag
GET {tagname¦service.tagname¦service}

Gets value of a global tag
:

INFO

Gets information about a tag or service.

● Command Format

INFO<CR>
or
INFO service<CR>
or
INFO service.tagname<CR>

- Insert a space between the command and the parameters.
- Add a delimiter <CR> to the end of the command or parameter.
- No space is required between the parameter and the delimiter.
- Specify only the command. Or, specify service or service.tagname with the command.
  When only the command is specified, it gets a list of services.
  service gets a list of tags in the specified service.
  The AVP service allows retrieval of step and datum information from the job tree using forward slash '/' in the symbolic name path. INFO avp/insp1/snapshot1/status paths are not case-sensitive and do not need to be fully qualified if unique.
  INFO avp/snapshot1/status will return the same result if there is only one inspection.
  service.tagname gets the attributes of the tag in the service as well as a list of subtags. For example, for the EIP input assembly, specify the command as INFO eip.input.

Required Parameter
None

Option Parameter
None

● Response Format

If processed normally:

data<CR><LF><ETX>

- Returns information about a tag or service. Refer to Command Example.

If not processed normally:

None

● Command Example

Example 1:
Get a list of services.
Command: INFO
Response:
avp
data
eip
file
gateway
io
record
system
tcp
tcpcmd
uart

Example 2:
Get a list of tags in the eip service.
Command: INFO eip
Response:
control
status
echo
cmdcode
cmdarg
cmdcoderslt
cmdret
cmdstr
cmdstrrslt
execmd
trigcmd
trigtag
rstcounttag
input
output
bool
int

long
float
string

Example 3:
Get information about the input tag in the eip service.
Command: INFO eip.input
Response:
type = buffer
assembly = 102
dir = out
endian = little
label = Input Assembly
size = 320
online
expbusy
acqbusy
triggerready
error
resetcountack
resetstatsack
execmdack
triggerack
inspbusy
inspstat
datavalid
echo
cmdcoderslt
cmdret
state
vio
bool
int
long
float
stringlong
stringshort

JOBBOOT

Sets the job slot that boots up when the device's power is turned ON.

● Command Format

JOBBOOT -slot=SettingValue<CR>

- Insert a space between the command and the parameters.
- Add a delimiter <CR> to the end of the command or parameter.

- No space is required between the parameter and the delimiter.
- Refer to the table below for the setting values.

Required Parameter

Parameter	Setting value	Description
-slot	1 to (Maximum job slot number to store the job)	Sets the job slot number.*1

*1. Set the job slot number although -slot= is optional. Refer to Command Example.

Option Parameter

None

● Response Format

If processed normally:

!OK<CR><LF><ETX>

If not processed normally:

!ERROR<CR><LF><ETX>

● Command Example

Example 1:

Set the job slot that boots up when the device's power is turned ON to slot number 2.

Command: JOBBOOT -slot=2

or

Command: JOBBOOT 2

Response: !OK

JOBDELETE

Deletes the job in slot n, or deletes jobs in all slots.

Precautions for Correct Use

Does not delete the current job loaded in camera memory.

● Command Format

JOBDELETE -slot=SettingValue<CR>

or

JOBDELETE -all<CR>

- Specify -slot or -all.
- Insert a space between the command and the parameters.
- Add a delimiter <CR> to the end of the command or parameter.
- No space is required between the parameter and the delimiter.
- Refer to the table below for the setting values.

Required Parameter

None

Option Parameter

Parameter	Setting value	Description
-slot	1 to (Maximum job slot number to store the job)	Deletes the job specified by the setting value.*1
-all	None	Deletes all jobs.

*1. Set the job slot number although -slot= is optional. Refer to Command Example.

● Response Format

If processed normally:

!OK<CR><LF><ETX>

If not processed normally:

!ERROR<CR><LF><ETX>

● Command Example

Example 1:
Delete the job in slot 1.
Command: JOBDELETE 1
or
Command: JOBDELETE -slot=1
Response: !OK

Example 2:
Delete all jobs in all slots.
Command: JOBDELETE -all
Response: !OK

JOBDOWNLOAD

Downloads a .avz job file via the specified transfer method.
Ymodem supported only over RS-232; FTP supported only over network connection.

Precautions for Correct Use

JOBDOWNLOAD only supports FTP on the MicroHAWK MV-4000.

● Command Format

JOBDOWNLOAD -transfer=SettingValue -size=SettingValue -c<CR>

- Insert a space between the command and the parameters.
- Insert a space between each parameter.
- Add a delimiter <CR> to the end of the command or parameter.
- No space is required between the parameter and the delimiter.

- Refer to the table below for the setting values.

Required Parameter

Parameter	Setting value	Description
-transfer	• ftp • ymodem	Specifies the transfer method. Ymodem supported only over RS-232; FTP supported only over network connection.

Option Parameter

Parameter	Setting value	Description
-size	-	When a job is downloaded to the camera via FTP, this command creates a RAM disk to hold the .avz file until the JOBLOAD –mem –r command is executed. This RAM disk must be larger than the .avz that is to be transferred. If manually setting the size use this equation to determine the maximum size that can be used: (available contiguous RAM – 15 MB) / 2 The available contiguous RAM, is the second value reported by the serial command MEMINFO. The default RAM disk size is 10 MB.
-c	None	Cancels a previous JOBDOWNLOAD request that is either complete or in progress. If the previous JOBDOWNLOAD is a transfer executed via FTP, delete /streamd0 on the RAM disk.

● Response Format

- When -transfer=ftp

  If processed normally:

  - Without the -c option, the response will be as follows.
    FTP job load initialized. Please ftp avz file to /streamd0 and issue jobload -mem<CR><LF>!OK<CR><LF><ETX>
  - If the command is canceled with the -c option, the response will be as follows.
    FTP load cancelled.<CR><LF>!OK<CR><LF><ETX>

  If not processed normally:

  - If the command fails to create a drive via FTP
    Failed to create ram drive for FTP load. Requested size: [size] MemContig: [mem]<CR><LF>!ERROR<CR><LF><ETX>
  - If data is already loaded via FTP
    FTP load already in progress.<CR><LF>!ERROR<CR><LF><ETX>
  - If the AVZ file size is too large to load the data
    Specified avz size too large. Not enough ram to load a [integer] byte AVZ job<CR><LF>!ERROR<CR><LF><ETX>

- When -transfer=ymodem

  If processed normally:

  !OK<CR><LF><ETX>

If not processed normally:
!ERROR<CR><LF><ETX>

● Command Example

Example 1:
Load a .avz job file via the FTP transfer method and start the job.

- Create a fixed size RAM disk /streamd0 in advance.
  Command: JOBDOWNLOAD -transfer=ftp
  Response:
  FTP job load initialized. Please ftp avz file to /streamd0 and issue jobload -mem
  !OK
- The user transfers the .avz job file to /streamd0 via FTP.
- Load the .avz job file from /streamd0 into RAM, delete the RAM disk /streamd0, and start the inspection.
  Command: JOBLOAD -mem -r
  Response: !OK

Example 2:
Load a .avz job file via the RS-232 ymodem transfer method.

- Specify the RS-232 ymodem transfer method.
  Command: JOBDOWNLOAD -transfer=ymodem
  Response: !OK
- The user transfers the .avz job file via RS-232. When the transfer is complete, the job will be loaded automatically.

JOBINFO

Gets job summary or info about slot n.

● Command Format

JOBINFO -slot=SettingValue -v<CR>

- Insert a space between the command and the parameters.
- Insert a space between each parameter.
- Add a delimiter <CR> to the end of the command or parameter.
- No space is required between the parameter and the delimiter.
- JOBINFO (without parameters) gets a list of all jobs on the device.
- Refer to the table below for the setting values.

Required Parameter
None

Option Parameter

Parameter	Setting value	Description
-slot	1 to (Maximum job slot number to store the job)	Sets the job slot number for which you want to get information.*1

Parameter	Setting value	Description
-v	None	Returns the disk space (in bytes) used by the job. It also returns a list of total disk space and free disk space (in bytes).

*1. Set the job slot number although -slot= is optional. Refer to Command Example.

● Response Format

If processed normally:

- Without the -v option
  slot1=Job name<CR><LF>slot1=Job name<CR><LF>...Job name<CR><LF><ETX>

- With the -v option
  slot1=Job name, Disk space<CR><LF>...slot2=Job name, Disk space<CR><LF>...freeflash=Total disk space<CR><LF>totalflash=Free disk space<CR><LF><ETX>

If not processed normally:
!ERROR<CR><LF><ETX>

● Command Example

Example 1:
Get a list of all jobs on the device.
Command: JOBINFO
Response:
slot1=Test1.avp
slot2=Test2.avp

Example 2:
Get a list of all jobs on the device and the disk space used by the jobs.
Command: JOBINFO -v
Response:
slot1=Test1.avp,192729
slot2=Test2.avp,192729
freeflash=1760952320
totalflash=1920991232

Example 3:
Get information about job slot number 1.
Command: JOBINFO -slot=1
or
Command: JOBINFO 1
Response:
slot1=Test1.avp

JOBLOAD

Loads a job from slot n or from memory when used with the JOBDOWNLOAD command via FTP.

● Command Format

JOBLOAD -slot=SettingValue -r<CR>
or
JOBLOAD -mem -r<CR>

- Specify -slot or -mem.
- Insert a space between the command and the parameters.
- Insert a space between each parameter.
- Add a delimiter <CR> to the end of the command or parameter.
- No space is required between the parameter and the delimiter.
- Refer to the table below for the setting values.

Required Parameter

None

Option Parameter

Parameter	Setting value	Description
-slot	1 to (Maximum job slot number to store the job)	Sets the job slot number.*1
-mem	None	Loads a job from memory.
-r	None	Start inspections.

*1. Set the job slot number although -slot= is optional. Refer to Command Example.

● Response Format

If processed normally:

!OK<CR><LF><ETX>

If not processed normally:

!ERROR<CR><LF><ETX>

● Command Example

Example 1:
Load the job from slot 1.
Command: JOBLOAD 1
or
Command: JOBLOAD -slot=1
Response: !OK

Example 2:
Load a .avz job file via the FTP transfer method and start the job.

- Create a fixed size RAM disk /streamd0 in advance.
  Command: JOBDOWNLOAD -transfer=ftp
  Response:
  FTP job load initialized. Please ftp avz file to /streamd0 and issue jobload -mem
  !OK
- The user transfers the .avz job file to /streamd0 via FTP.

- Load the .avz job file from /streamd0 into RAM, delete the RAM disk /streamd0, and start the inspection.
  Command: JOBLOAD -mem -r
  Response: !OK

JOBSAVE

Saves the current job to slot n.

● Command Format

JOBSAVE -slot=SettingValue<CR>

- Insert a space between the command and the parameters.
- Add a delimiter <CR> to the end of the command or parameter.
- No space is required between the parameter and the delimiter.
- Refer to the table below for the setting values.

Required Parameter

Parameter	Setting value	Description
-slot	1 to (Maximum job slot number to store the job)	Sets the job slot number.*1

*1. Set the job slot number although -slot= is optional. Refer to Command Example.

Option Parameter

None

● Response Format

If processed normally:

!OK<CR><LF><ETX>

If not processed normally:

!ERROR<CR><LF><ETX>

● Command Example

Example 1:
Save the current job to slot 1.
Command: JOBSAVE -slot=1
or
Command: JOBSAVE 1
Response: !OK

JOBSAVEAS

Saves the current job in the specified slot with the specified name.

● Command Format

JOBSAVEAS -slot=SettingValue -name=SettingValue<CR>

- Insert a space between the command and the parameters.
- Add a delimiter <CR> to the end of the command or parameter.
- No space is required between the parameter and the delimiter.
- Refer to the table below for the setting values.

Required Parameter

Parameter	Setting value	Description
-slot	1 to (Maximum job slot number to store the job)	Sets the job slot number.*1
-name	Filename	Sets the filename.

*1. Set the job slot number although -slot= is optional. Refer to Command Example.

Option Parameter

None

● Response Format

If processed normally:

!OK<CR><LF><ETX>

If not processed normally:

!ERROR<CR><LF><ETX>

● Command Example

Example 1:

Save the current job in slot 1 with the file name JOB1.

Command: JOBSAVEAS -slot=1 -name=JOB1

Response: !OK

MEMAVAIL

Returns available memory (bytes) for device.

● Command Format

MEMAVAIL -cp<CR>

- Insert a space between the command and the parameters.
- Insert a space between each parameter.
- Add a delimiter <CR> to the end of the command or parameter.
- No space is required between the parameter and the delimiter.

Required Parameter

None

Option Parameter

Parameter	Setting value	Description
-cp	None	This option parameter is not supported by the F420-F/F430-F/F440-F.

● Response Format

If processed normally:

Available memory for the device (in bytes)<CR><LF><ETX>

If not processed normally:

None

● Command Example

Example 1:

Get the available memory for the device.

Command: MEMAVAIL

Response: 147370208

MEMCONTIG

Returns maximum memory block for device.

● Command Format

MEMCONTIG -cp<CR>

- Insert a space between the command and the parameters.
- Add a delimiter <CR> to the end of the command or parameter.
- No space is required between the parameter and the delimiter.

Required Parameter

None

Option Parameter

Parameter	Setting value	Description
-cp	None	This option parameter is not supported by the F420-F/F430-F/F440-F.

● Response Format

If processed normally:

Maximum contiguous memory block size (in bytes) available for the device<CR><LF><ETX>

If not processed normally:

None

● Command Example

Example 1:

Get the maximum contiguous memory block size (in bytes) available for the device.
Command: MEMCONTIG
Response: 143581132

MEMFRAGS

Returns memory fragments for device.

Precautions for Correct Use

MEMFRAGS is not supported by the MicroHAWK MV-4000. It will return !ERROR.

● Command Format

MEMFRAGS -cp<CR>

- Insert a space between the command and the parameters.
- Add a delimiter <CR> to the end of the command or parameter.
- No space is required between the parameter and the delimiter.

Required Parameter

None

Option Parameter

Parameter	Setting value	Description
-cp	None	This option parameter is not supported by the F420-F/F430-F/F440-F.

● Response Format

If processed normally:

Number of memory fragments for the device<CR><LF><ETX>

If not processed normally:

!ERROR<CR><LF><ETX>

● Command Example

Example 1:
Get the number of memory fragments for the device.
Command:MEMFRAGS
Response:
63

MEMINFO

Returns memory summary “avail/contig/frags” for device.

- avail: available memory (bytes) for device
- contig: maximum memory block for device
- frags: memory fragments for device

- used: used memory (bytes) for device

● Command Format

MEMINFO -cp -v<CR>

- Insert a space between the command and the parameters.
- Insert a space between each parameter.
- Add a delimiter <CR> to the end of the command or parameter.
- No space is required between the parameter and the delimiter.

Required Parameter

None

Option Parameter

Parameter	Setting value	Description
-cp	None	This option parameter is not supported by the F420-F/F430-F/F440-F.
-v	None	Displays the name of the memory summary together.

● Response Format

If processed normally:

- Without the -v option
  Available memory for the device;Maximum contiguous memory block size available for the device;Number of memory fragments for the device;Memory currently used for the device<CR><LF><ETX>

- With the -v option
  avail=Available memory for the device<CR><LF>contig=Maximum contiguous memory block size available for the device<CR><LF>frags=Number of memory fragments for the device<CR><LF>used=Memory currently used for the device<CR><LF><ETX>

If not processed normally:

None

● Command Example

Example 1:
Command: MEMINFO
Response:
166933980;164594212;46;101501476

Example 2:
Command:MEMINFO -v
Response:
avail=166933696
contig=164594212
frags=43
used=101501760

OFFLINE

Sets the device offline.

● Command Format

OFFLINE<CR>

- Add a delimiter <CR> to the end of the command or parameter.

Required Parameter
None

Option Parameter
None

● Response Format

If processed normally:
!OK<ETX>

If not processed normally:
!ERROR<ETX>

● Command Example

Example 1:
Set the device offline.
Command: OFFLINE
Response: !OK

ONLINE

Sets the device online.

● Command Format

ONLINE<CR>

- Add a delimiter <CR> to the end of the command or parameter.

Required Parameter
None

Option Parameter
None

● Response Format

If processed normally:
!OK<ETX>

If not processed normally:
!ERROR<ETX>

● Command Example

Example 1:
Set the device online.
Command: ONLINE
Response: !OK

ONLINE?

Queries if each inspection on the camera is online.

● Command Format

ONLINE? -insp=SettingValue<CR>

- Insert a space between the command and the parameters.
- Add a delimiter <CR> to the end of the command or parameter.
- No space is required between the parameter and the delimiter.

Required Parameter
None

Option Parameter

Parameter	Setting value	Description
-insp	1-n	Specifies inspection n for which you want to query if it is online. If no inspection is specified, all inspections will be queried.

● Response Format

If processed normally:
Status of inspection<CR><LF><ETX>

- For the status of inspection, the command will return !1 if all inspections are online and !0 otherwise.
  If the camera is running a multi-inspection job, this command will return !1 if all inspections are online and !0 otherwise.

If not processed normally:
None

● Command Example

Example 1:
Get the status of inspection.
Command: ONLINE?
Response: !1
Inspections are online.

Example 2:
Get the status of inspection.
Command: ONLINE?
Response: !0
Inspections are not offline.

Example 3:
Get the status of inspection 1.
Command: ONLINE? -insp=1
Response: !1
Inspections are online.

QUERYAUTOCAL

Gets the gain, exposure time, and focus values.

● Command Format

QUERYAUTOCAL<CR>

- Add a delimiter <CR> to the end of the command or parameter.

Required Parameter
None

Option Parameter
None

● Response Format

If processed normally:
Gain;Exposure time;Focus;Lower limit of focus;Upper limit of focus<CR><LF><ETX>

- The lower and upper limits of focus vary depending on the model.

If not processed normally:
!ERROR<CR><LF><ETX>

● Command Example

Example 1:
Gets the gain, exposure time, and focus values.
Command: QUERYAUTOCAL
Response: 18;7795;193;50;300
The values are: Gain = 18, Exposure time = 7795 µs, Focus = 193, Lower limit of focus = 50, and Upper limit of focus = 300.

QUERYFOCUSUNITS

Queries the units being used for autofocus.

● Command Format

QUERYFOCUSUNITS<CR>

- Add a delimiter <CR> to the end of the command or parameter.

Required Parameter

None

Option Parameter

None

● Response Format

If processed normally:

Unit<CR><LF><ETX>

- The command will return mm (0) or inches (1) as the unit.

If not processed normally:

!ERROR<CR><LF><ETX>

● Command Example

Example 1:
When the unit being used for autofocus is mm
Command: QUERYFOCUSUNITS
Response: 0

QUERYWHITEBAL

Get the white balance settings of a color camera.

● Command Format

QUERYWHITEBAL<CR>

- Add a delimiter <CR> to the end of the command or parameter.

Required Parameter

None

Option Parameter

None

● Response Format

If processed normally:

Color supported/unsupported;RED gain;BLUE gain;GREEN gain<CR><LF><ETX>

- For Color supported/unsupported, the command will return 1 if it is a color camera or returns 0 if it not a color camera.

If not processed normally:
!ERROR<CR><LF><ETX>

● Command Example

Example 1:
Get the white balance settings of a color camera.
Command: QUERYWHITEBAL
Response: 1;14;14;0
The white balance settings are: Color camera, RED gain 14, BLUE gain 14, and GREEN gain 0.

Example 2:
Get the white balance settings of a monochrome camera.
Command: QUERYWHITEBAL
Response: 0;0;0;0
The white balance settings are: Monochrome camera, RED gain 0, BLUE gain 0, and GREEN gain 0.

QUICKFOCUS

Initiates camera calibration of focus in the area around the point specified by x and y.

Precautions for Correct Use

This command only functions when the camera is OFFLINE.

● Command Format

QUICKFOCUS x y<CR>

- Insert a space between the command and the parameters.
- Insert a space between each parameter.
- Add a delimiter <CR> to the end of the command or parameter.
- No space is required between the parameter and the delimiter.
- Specify the coordinates (x, y) on which to autofocus.

Required Parameter
None

Option Parameter
None

● Response Format

If processed normally:
Focus;Lower limit of focus;Upper limit of focus<CR><LF><ETX>

If not processed normally:
!ERROR<CR><LF><ETX>

● Command Example

Example 1:
Initiate camera calibration of focus at the point (640,480) in the image.
Command: QUICKFOCUS 640 480
Response: 124;50;300
The focus is currently set to 124 mm and the allowable focus range of the camera is currently 50 to 300 mm.

READY?

Queries if an inspection is waiting for a trigger.

● Command Format

READY? -insp=SettingValue<CR>

- Insert a space between the command and the parameters.
- Add a delimiter <CR> to the end of the command or parameter.
- No space is required between the parameter and the delimiter.
- Refer to the table below for the setting values.

Required Parameter
None

Option Parameter

Parameter	Setting value	Description
-insp	1-n	Specifies inspection n for which you want to query if it is ready.

● Response Format

If processed normally:
Inspection trigger waiting status<CR><LF><ETX>

- The command will return 1 if the specified inspection is waiting for a trigger or !0 if not waiting for a trigger.

If not processed normally:
!ERROR<CR><LF><ETX>

● Command Example

Example 1:
Command: READY? -insp=1
Queries if inspection 1 is waiting for a trigger.
Response: !1
Inspection 1 is waiting for trigger.

REBOOT

Reboots the device.

● Command Format

REBOOT -noload<CR>

- Insert a space between the command and the parameters.
- Add a delimiter <CR> to the end of the command or parameter.
- No space is required between the parameter and the delimiter.
- Refer to the table below for the setting values.

Required Parameter

None

Option Parameter

Parameter	Setting value	Description
-noload	None	Specifies that you do not want to load the bootup job.

● Response Format

If processed normally:

None

If not processed normally:

!ERROR<CR><LF><ETX>

● Command Example

Example 1:

Command: REBOOT -noload

Reboot the device. The bootup job is not loaded.

Response:

There is no response if the command is processed normally.

RESTOREWBAL

Resets the white balance settings (Color supported/unsupported, RED gain, BLUE gain, and GREEN gain) to the factory defaults.

● Command Format

RESTOREWBAL<CR>

- Add a delimiter <CR> to the end of the command or parameter.

Required Parameter

None

Option Parameter
None

● Response Format

If processed normally:
Color supported/unsupported;RED gain;BLUE gain;GREEN gain<CR><LF><ETX>

- For Color supported/unsupported, the command will return 1 if it is a color camera or returns 0 if it not a color camera.

If not processed normally:
!ERROR<CR><LF><ETX>

● Command Example

Example 1:
Resets the white balance settings (Color supported/unsupported, RED gain, BLUE gain, and GREEN gain) to the factory defaults.
Command: RESTOREWBAL
Response: 1;15;15;0

SET

Sets the value of a tag (bool1-200, int1-200, etc.) used for the device.

● Command Format

SET tagname value<CR>

- Insert a space between the command and the parameters.
- Insert a space between each parameter.
- Add a delimiter <CR> to the end of the command or parameter.
- No space is required between the parameter and the delimiter.
- tagname must correspond to one of the tags supported by the device.
  Use the INFO command to get a full list of tags and services, as well as attributes of the tag and list of subtags.
  The AVP service allows you to set datum information from the job tree using forward slashes '/' in the symbolic name path. SET avp/insp1/snapshot1/acq1/gain 2.0 paths are not case-sensitive. When the tagname is identifiable, there is no need to specify the full path. If there is only one inspection, SET avp/acq1/gain 2.0 will set the same gain value.
  Control tags in the AVP service such as START, STOP, and TRIGGER act as switches. For example, SET avp.start 1 is equivalent to the ONLINE command. avp.start will be reset immediately and always read as 0.
- value can contain spaces. value can be a comma-separated list of items to set a sequence of tags.

Required Parameter
None

Option Parameter
None

● Response Format

If processed normally:
!OK set tagname <CR><LF><ETX>

- The command will return !OK followed by an its echo.

If not processed normally:
!ERROR Tag tagname not found<CR><LF><ETX>

- The command will return !ERROR Tag followed by a failure reason.

● Command Example

Example 1:
Set int1 = 1, int2 = 2, and int3 = 3.
Command: SET int1 1, 2, 3
Response: !OK set int1
The command will return !OK followed by an its echo.

Example 2:
Set a string in the string4 tag and get Input assembly information.
Command: SET string4 abcdefghijklmnopqrstuvwxyz
Response: !OK SET string4
Command:GET eip.input
Response:
0x0000 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0010 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0020 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0030 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0040 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0050 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0060 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0070 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0080 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0090 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x00a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x00b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x00c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x00d0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x00e0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x00f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0100 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0110 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0120 1a 00 00 00 61 62 63 64 65 66 67 68 69 6a 6b 6c
0x0130 6d 6e 6f 70 71 72 73 74 75 76 77 78 79 7a 00 00

SETFOCUSUNITS

Sets units used for autofocus, mm (0) or inches (1).

Precautions for Correct Use

The F440-F/F430-F/F420-F only supports mm so SETFOCUSUNITS will only accept 0 and anything else will respond with !ERROR.

● Command Format

SETFOCUSUNITS 0<CR>
or
SETFOCUSUNITS 1<CR>

- Sets the unit used for autofocus. It can be set to mm (0) or inches (1).
- Insert a space between the command and the parameters.
- Add a delimiter <CR> to the end of the command or parameter.
- No space is required between the parameter and the delimiter.
- Refer to the table below for the setting values.

Required Parameter
None

Option Parameter
None

● Response Format

If processed normally:
Unit<CR><LF><ETX>

- The command will return mm (0) or inches (1).

If not processed normally:
!ERROR<CR><LF><ETX>

● Command Example

Example 1:
Set the unit used for autofocus to mm.
Command: SETFOCUSUNITS 0
Response: 0
The unit used for autofocus is set to mm (0).

TARGET

Turns ON or OFF the blue LED for the aiming light source. Use this command during installation.

Precautions for Correct Use

This command functions only when the camera is offline.

Command Format

TARGET 0<CR>
or
TARGET 1<CR>
or
TARGET off<CR>
or
TARGET on<CR>

- Insert a space between the command and the parameters.
- Add a delimiter <CR> to the end of the command or parameter.
- No space is required between the parameter and the delimiter.
- Set 1 or on to turn ON the LED.
- Set 0 or off to turn OFF the LED.

Required Parameter
None

Option Parameter
None

Response Format

If processed normally:
!OK<CR><LF><ETX>

If not processed normally:
!ERROR<CR><LF><ETX>

Command Example

Example 1:
Turn ON the blue LED for the aiming light source.
Command: TARGET 1
or
Command: TARGET on
Response: !OK
The blue LED for the aiming light source is turned ON.

Example 2:
Turn OFF the blue LED for the aiming light source.
Command: TARGET 0
or
Command: TARGET off
Response: !OK
The blue LED for the aiming light source is turned OFF.

TRIGGER

Inputs the measurement trigger.

● Command Format

TRIGGER<CR>

- Add a delimiter <CR> to the end of the command or parameter.

Required Parameter

None

Option Parameter

None

● Response Format

If processed normally:

!OK<ETX>

If not processed normally:

!ERROR Missing AVP Data Service<ETX>

● Command Example

Example 1:

Inputs the measurement trigger.

Command:TRIGGER

Response: !OK

VERSION

Returns Visionscape software version.

The Visionscape version is the same as the firmware version of the device.

● Command Format

VERSION<CR>

- Add a delimiter <CR> to the end of the command or parameter.

Required Parameter

None

Option Parameter

None

● Response Format

If processed normally:

Version<CR><LF><ETX>

If not processed normally:
None

● Command Example

Example 1:
Get the version.
Command: VERSION
Response: 9.2.2.3018
The version is 9.2.2.3018.

vt

Executes an inspection by using the virtual trigger function.

● Command Format

vt Setting value<CR>
or
vt<CR>

- Insert a space between the command and the parameters.
- Add a delimiter <CR> to the end of the command or parameter.
- No space is required between the parameter and the delimiter.
- Specify the setting value to use as a virtual trigger. The setting value must be in the range of 1 to 2048. Specify the same value as that of the virtual trigger setting. Refer to *2-1-4 Change the Type of Trigger* on page 2-6 for the virtual trigger setting. In Visionscape, the setting value must be within the range for virtual I/O points. The virtual I/O signal will turn ON and then OFF.

Required Parameter
None

Option Parameter
None

● Response Format

If processed normally:
!OK<ETX>

If not processed normally:
!ERROR<ETX>

● Command Example

Example 1:
Execute an inspection by using virtual trigger 1. An inspection will be executed when it is set to use virtual trigger 1 as a trigger.
Command: vt 1
Response: !OK

Example 2:
The command will return ERROR if the setting value of the virtual trigger is other than 1 to 2048.
Command: vt 0
Response: !ERROR

WHITEBAL

Performs automatic calibration of white balance settings: Color supported/unsupported, RED gain, BLUE gain, and GREEN gain.

Precautions for Correct Use

This command only functions when the camera is OFFLINE.

● Command Format

WHITEBAL<CR>

- Add a delimiter <CR> to the end of the command or parameter.

Required Parameter
None

Option Parameter
None

● Response Format

If processed normally:
Color supported/unsupported;RED gain;BLUE gain;GREEN gain<CR><LF><ETX>

- For Color supported/unsupported, the command will return 1 if it is a color camera or returns 0 if it not a color camera.

If not processed normally:
!ERROR<CR><LF><ETX>

● Command Example

Example 1:
Execute a white balance calibration.
Command: WHITEBAL
Response: 1;14;14;0
The calibrated settings are: Color supported/unsupported (for color cameras), RED gain 14, BLUE gain 14, and GREEN gain 0.

Example 2:
Execute a white balance calibration.
Command: WHITEBAL
Response: 0;0;0;0

The calibrated settings are Color supported/unsupported (for monochrome cameras), RED gain 0, BLUE gain 0, and GREEN gain 0. The automatic calibration of the white balance settings will not be executed for monochrome cameras.

A-4 TCP/UDP and General Port Usage

A-4-1 Ports

The following table lists the ports used by smart cameras for communication.

Port Number	Protocol	Name
49059	TCP	RPC
49049	TCP	I/O
49050	TCP	PIC/LIVE
49200	TCP	REPORT
49202	TCP	REPORTCONTROL
49201	TCP	PARTQ
49079	TCP	KEEPALIVE
49211	TCP	Serial TCP#1
49212	TCP	Serial TCP#2
49213	TCP	Serial TCP#3
49214	TCP	Serial TCP#4
49497	UDP	UDP BROADCAST
49496	UDP	UDP COMMAND
21	TCP	FTP
23	TCP	TELNET
80	TCP	HTTP

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