KEYENCE

Ultra Compact Vision Sensor

IV-G Series

Vision Sensor

IV Series

User's Manual
(Field Network)

Read this manual before use.
After you read this manual, keep it in a safe place for future reference.

1	Getting Started
2	EtherNet/IP
3	Cyclic communication
4	PROFINET
5	Data I/O communication
A	Reference program

EtherNet/IP™

PROFI®NET

Introduction

Read this manual before using the product in order to achieve maximum performance.
Keep this manual in a safe place after reading it so that it can be used at any time.

Symbols

The following symbols alert you to important messages.
Be sure to read these messages carefully.

⚠ DANGER
It indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING
It indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION
It indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE
It indicates a situation which, if not avoided, could result in product damage as well as property damage.

▶ Important
It indicates cautions and limitations that must be followed during operation.

✎ Point
It indicates additional information on proper operation.

Reference
It indicates tips for better understanding or useful information.

📖 It indicates the reference pages in this manual or the reference pages in separate manuals.

Ethernet/IP is a trademark of ODVA, inc.

Cautions

(1) Unauthorized reproduction of this manual in whole or part is prohibited.
(2) The contents of this manual may be changed for improvements without prior notice.
(3) An utmost effort has been made to ensure the contents of this manual are as complete as possible. If there are any mistakes or questions, please contact a KEYENCE office listed in the back of the manual.
(4) Regardless of item (3), KEYENCE will not be liable for any effect resulting from the use of this unit.
(5) Any manuals with missing pages or other paging faults will be replaced.

The company names and product names used in this manual are registered trademarks or the trademarks of their respective companies.

Safety Information for IV/IV-G Series

General Precautions

> **⚠ DANGER**
>
> - Do not use this product for the purpose to protect a human body or a part of human body.
> - This product is not intended for use as an explosion-proof product. Do not use this product in hazardous location and/or potentially explosive atmosphere.

> **⚠ CAUTION**
>
> - You must verify that the IV/IV-G Series are operating correctly in terms of functionality and performance before the start and the operation of the IV/IV-G Series.
> - We recommend that you take substantial safety measures to avoid any damage in the event of a problem occurring.

> **NOTICE**
>
> - KEYENCE never warrants the function or performance of the IV/IV-G Series if it is used in manner that differs from the IV/IV-G Series specifications contained in this instruction manual or if the IV/IV-G Series are modified by yourself.
> - When the IV/IV-G Series is used in combination with other instruments, functions and performance may be degraded, depending on operating conditions and the surrounding environment.
> - Do not place the instruments, including peripherals, under the rapid temperature change. It may cause condensation and may damage instruments or peripherals.
> - Remove the power cable from the power supply if you do not use this product for a long time.

Important Instructions

Observe the following precautions to prevent malfunction of the IV/IV-G Series and to ensure that it is used properly.

Precautions on use

> ⚠ **CAUTION**
>
> - **The power of this product and instruments connected to this product must be turned off when the cable is to be installed or removed. Failure to do so may cause an electric shock or a product damage.**
> - **Use this product in the correct supply voltage. Failure to do so may cause a product damage.**

> *NOTICE*
>
> - **For instructions**
>   - **Do not turn OFF the power while setting the items or saving the settings. Otherwise, all or part of the setting data may be lost.**
>   - **Do not let water, dust or oil stick to the camera/light of the sensor. Failure to do so may cause a malfunction.**
>   - **When this product becomes dirty, do not rub it with a wet cloth, benzene, thinner, or alcohol. Doing so may change the color or shape of the unit.**
>   - **If the unit is heavily contaminated, disconnect all the cables including the power supply cable, wipe off the dirt with a cloth soaked with mild detergent, and then wipe with a soft dry cloth.**
> - **For external master image registration**
>   **If the external master image registration is to be performed frequently, set [Write ROM when using Ext. Master Save] of the input option to [No] for nonvolatile memory protection of the internal sensor. When the option is set to [Yes], the nonvolatile memory is guaranteed to write for 100,000 times.**
> - **For automatic focus function**
>   - **Automatic focus function is used for adjusting the focusing position at the time of installation. This will not activate during the operation.**
>   - **Focusing position can be registered in each program. The program configurations are guaranteed to switch for 100,000 times. If the focusing position does not need to change for each program, set [Auto Focus Adjustment Position] to [Common] for extending the life-span.**
>   - **Do not apply shock or vibration during the focusing position adjustment. Failure to do so may cause a product damage.**

Measures to be taken when an abnormality occurs

> *NOTICE*
>
> **In the following cases, turn the power OFF immediately. Using the IV/IV-G Series in an abnormal condition could cause fire, electric shock, or malfunction.**
> **Contact our office for repair.**
> - **If water or debris enters the IV/IV-G Series.**
> - **If the IV/IV-G Series is dropped or the case is damaged.**
> - **If abnormal smoke or odor emanates from the IV/IV-G Series.**

Precautions on installation

NOTICE

- **To use this product correctly and safely, avoid installing it in the following locations. Failure to do so may cause fire, electric shock, or malfunction.**
  - **Outdoors**
  - **Altitude above 2000 m**
  - **Locations that are humid, dusty or poorly ventilated**
  - **Locations where the temperature is high such as those exposed to direct sunlight**
  - **Locations where there are flammable or corrosive gases**
  - **Locations where the unit may be directly subjected to vibration or impact**
  - **Locations where water, oil, or chemicals may splash onto the unit**
- **To improve the anti-noise feature, install the unit following the precautions below. Otherwise, a malfunction may occur.**
  - **Ground the FG cable of the sensor.**
  - **Do not mount the unit in a cabinet where high-voltage equipment is already installed.**
  - **Mount the unit as far from power lines as possible.**
  - **Separate the unit as far as possible from the devices that emit strong electric or magnetic field (such as solenoid or chopper).**
  - **Separate the I/O signal line from the power line or high-voltage line.**
- **For power supply**
  - **Noise superimposed on the power supply could cause malfunction. Use a stabilized DC power supply configured with an isolation transformer.**
  - **When using a commercially available switching regulator, be sure to ground the frame ground terminal.**
- **Devices including this unit are precision components. Do not apply shock or vibration.**
- **When connecting to a network, let engineers who are knowledgeable about networks handle it.**

Precautions on Regulations and Standards

UL Certification

For IV-G500CA/IV-G500MA/IV-G150MA/IV-G300CA/IV-G600MA/IV-G10/IV-G15

This product is a UL/C-UL Listed product.
• UL File No. E301717
• Category NRKH2, NRKH8

Be sure to consider the following specifications when using this product as a UL/C-UL Listed Product.
• Use a power supply with Class 2 output defined in NFPA70 (NEC: National Electrical Code).
• Power supply/External input/Control output shall be connected to a single Class 2 source only.
• Use copper wire of AWG 16 to 18 (stranded wire) whose temperature rating is 60 ºC or higher for the power terminal block.
• Enclosure Type 1 (Based on UL50)
• Use under pollution level 2.

For IV-500C/IV-500CA/IV-500M/IV-500MA/IV-150M/IV-150MA/IV-2000M/IV-2000MA

This product is a UL/C-UL Listed product.
• UL File No. E301717
• Category NRKH, NRKH7

Be sure to consider the following specifications when using this product as a UL/C-UL Listed Product.
• Use a power supply with Class 2 output defined in NFPA70 (NEC: National Electrical Code).
• Power supply/External input/Control output shall be connected to a single Class 2 source only.
• Use with an over current protection device which is rated 24 V or more and not more than 1A.
• Enclosure Type 1 (Based on UL50)
• Use under pollution level 2.

CE Marking

For IV-G500CA/IV-G500MA/IV-G150MA/IV-G300CA/IV-G600MA/IV-G10/IV-G15/ IV-500C/IV-500CA/IV-500M/IV-500MA/IV-150M/IV-150MA/IV-2000M/IV-2000MA

Keyence Corporation has confirmed that this product complies with the essential requirements of the applicable EC Directive, based on the following specifications. Be sure to consider the following specifications when using this product in the Member State of European Union.

● **EMC Directive**

• Applicable Standard   EN60947-5-2, Class A

• The length of power I/O cable, Ethernet cable and Monitor cable must be less than or equal to 30m.

Remarks:

These specifications do not give any guarantee that the end-product with this product incorporated complies with the essential requirements of EMC Directive. The manufacturer of the end-product is solely responsible for the compliance on the end-product itself according to EMC Directive.

Version of the IV/IV-G Series

You can download the most recent operation software for the sensor (IV-150/500/2000, IV-G150/500/300/600) and IV-Navigator (IV-H1) from the KEYENCE web site.
Please refer to the description on the homepage for the introduction method.
URL : http://www.keyence.com/

Supported models and versions

■ IV-150/500/2000

Version 2.00.00 or later is the version of this document.

■ IV-G150/500/300/600

No limitation on version.

Structure of This Manual

1	Getting Started	This chapter explains the system configurations and overview of IV/IV-G Series.
2	EtherNet/IP	This chapter describes the overview of EtherNet/IP and the communication specifications and functions of the EtherNet/IP communication in the IV/IV-G series.
3	Cyclic communication	This chapter describes the overview, setting method, data allocation, and operating procedure of the cyclic communication in the EtherNet/IP communication.
4	PROFINET	This chapter describes the overview of PROFINET and the communication specifications and functions of the PROFINET communication in the IV/IV-G series.
5	Data I/O communication	This chapter describes the overview, setting method, data allocation, and operating procedure of the data I/O communication in the PROFINET communication.
A	Reference program	This chapter explains Reference program, etc.

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A

Contents

Chapter 3 Cyclic communication

Chapter 1 Getting Started

Chapter 2 EtherNet/IP

Chapter 4 PROFINET

Chapter 5 Data I/O communication

Appendices

MEMO

1

Getting Started

This chapter explains the system configurations and overview of IV/IV-G Series.

System Configuration

Basic configurations of IV/IV-G Series

Connecting the host device and single sensor (IV series)

Host device such as PLC
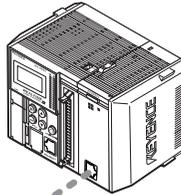
In addition to the status result import, the trigger control and switching of the set program number can be performed with the control output.

IV Series
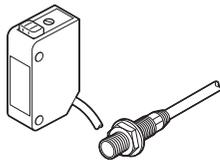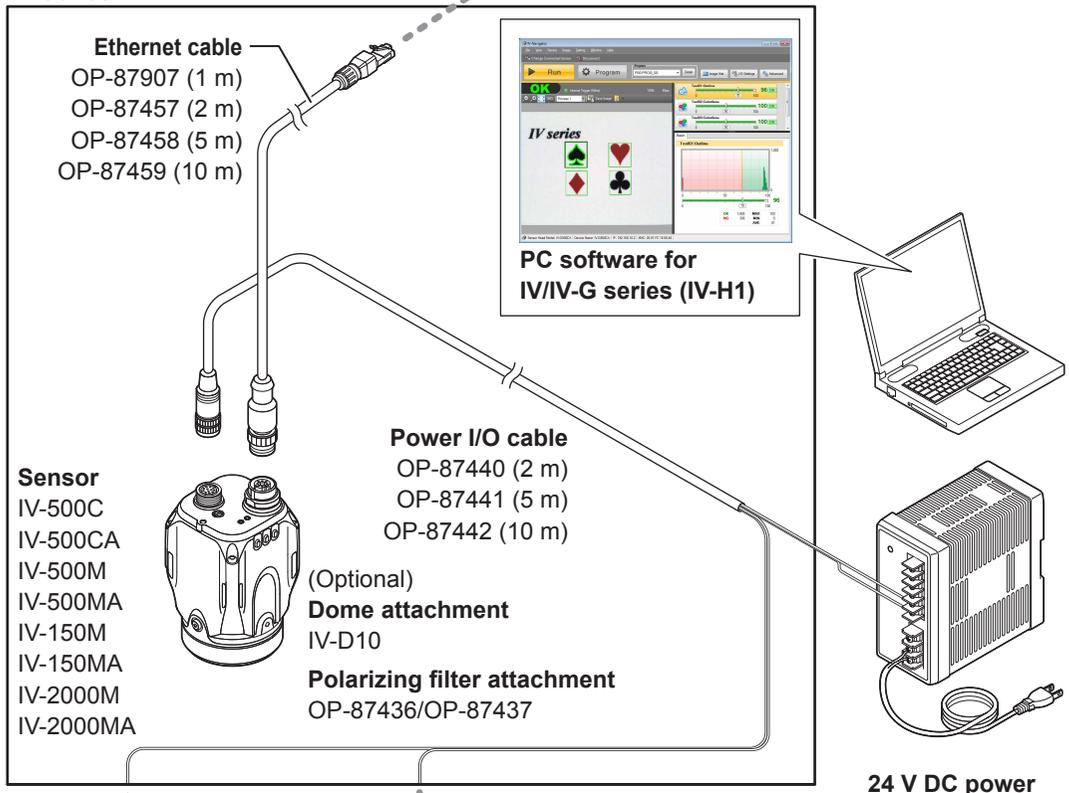
Ethernet cable
OP-87907 (1 m)
OP-87457 (2 m)
OP-87458 (5 m)
OP-87459 (10 m)

IV series

PC software for IV/IV-G series (IV-H1)

Sensor
IV-500C
IV-500CA
IV-500M
IV-500MA
IV-150M
IV-150MA
IV-2000M
IV-2000MA

Power I/O cable
OP-87440 (2 m)
OP-87441 (5 m)
OP-87442 (10 m)

(Optional)
Dome attachment
IV-D10

Polarizing filter attachment
OP-87436/OP-87437

24 V DC power

Photoelectric/ proximity sensor etc.
Sends the signal to the trigger input when the target is detected.
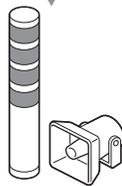
Indicator light/buzzer etc.
Alarm can be output by the status output function.

Connecting the host device and single sensor (IV-G series)

Host device such as PLC

In addition to the status result import, the trigger control and switching of the set program number can be performed with the control output.

IV-G Series

Ethernet cable
OP-87907 (1 m)
OP-87457 (2 m)
OP-87458 (5 m)
OP-87459 (10 m)

PC software for IV/IV-G series (IV-H1)

Sensor amplifier (Main)
IV-G10

Sensor Head
IV-G500CA
IV-G500MA
IV-G150MA
IV-G300CA
IV-G600MA

IV-G Series

I/O cable for IV-G series
OP-87906

24 V DC power

Photoelectric/ proximity sensor etc.
Sends the signal to the trigger input when the target is detected.

Indicator light/buzzer etc.
Alarm can be output by the status output function.

1

Connecting the host device and multiple sensors

Ethernet switch
(Example) NE-Q05

Host device such as PLC
In addition to the status
result import, the trigger
control and switching of the
set program number can be
performed with the control
output.

Ethernet cable
OP-87907 (1 m)
OP-87457 (2 m)
OP-87458 (5 m)
OP-87459 (10 m)
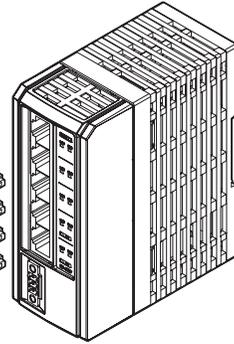
LAN cable
OP-87950 (1 m)
OP-87951 (3 m)
OP-87952 (5 m)
OP-87953 (10 m)
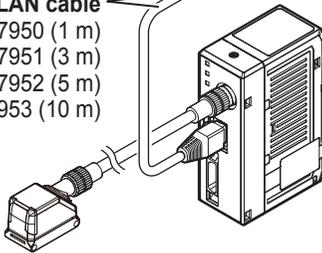
IV-G Series
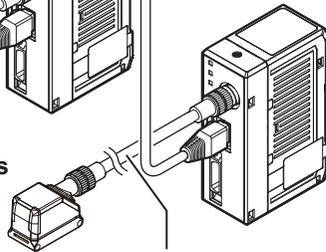
**Sensor head/
amplifier cable for
IV-G series**
OP-87903 (2 m)
OP-87904 (5 m)
OP-87905 (10 m)
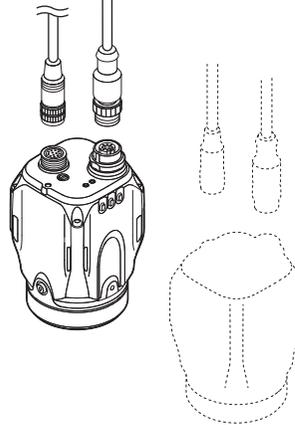
IV Series

**PC software for
IV/IV-G series (IV-H1)**

Overview of IV/IV-G Series

IV/IV-G Series

The IV/IV-G series is a "Vision Sensor". This sensor can be attached easily so complicated detection operations such as detecting the shapes of parts with a photoelectric switch can be achieved easily. Operation conditions settings require the PC software for IV/IV-G series, IV-Navigator (IV-H1) or the intelligent monitor (IV-M30). After setting is completed, the sensor can be operated independently. The IV/IV-G Series operates as an EtherNet/IP communication adaptor or a PROFINET communication I/O device.

With EtherNet/IP communication or PROFINET communication, the control output signal and status result, etc., can be input to the PLC as communication data.

System configuration example

Host device such as PLC
(EtherNet/IP communication scanner,
PROFINET communication I/O controller)

EtherNet/IP communication
adapter, PROFINET
communication I/O device

Sensor Head

Sensor

Sensor Amplifier

IV-G Series
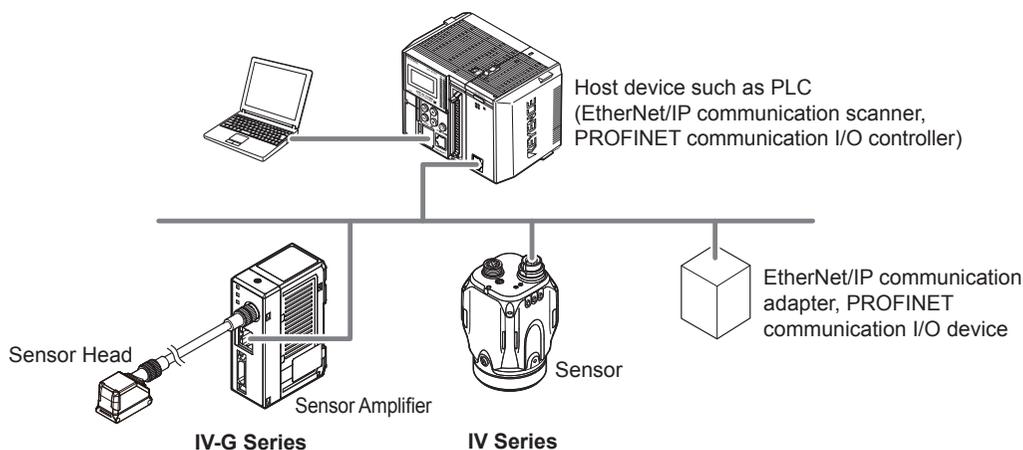
IV Series

Reference

• EtherNet/IP communication and PROFINET communication cannot be used simultaneously.
• For the details of installation, connection, and operation methods of the IV/IV-G Series, refer to "IV/IV-G Series User's Manual (Monitor/PC Software)".

Operation of the indicator light

■ IV series: Operation of the sensor indicator light

Details on operations of the indicator light are shown below.
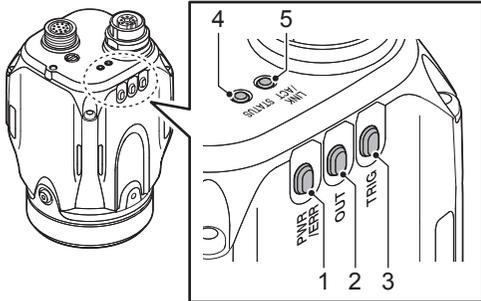
1 PWR/ERR

Indicates the power supplying status to the sensor and the error status of the sensor.

- Green (ON) ......Operating.
- Green (Blink)....Setting processing. Operation is stopped. Blinks once a second.
- Red (ON).........Unrecoverable error has occurred.
- Red (Blink) ....Recoverable error has occurred.
- Orange (Blink)...Flash LED has been required on the PROFINET communication I/O controller. Blinks 4 times with a period of about a second.
- (OFF) ....Power is not supplied. Adjusting the focusing position (manual focus only).

2 OUT

Indicates the comprehensive result.

- Green ....Comprehensive result is "OK".
- Red ....Comprehensive result is "NG".
- (OFF) ....Setting processing. Standby status until the first judge finishes after starting the operation or after switching the program number.
- Orange (Blink) ...Indicates the focusing status while adjusting the focusing position with the blinking speed (manual focus type only). Flash LED has been required on the PROFINET communication I/O controller. Blinks 4 times with a period of about a second.

3 TRIG

Green light lights up (one-shot) according to input of the internal or external trigger.

- Orange (Blink)...Flash LED has been required on the PROFINET communication I/O controller. Blinks 4 times with a period of about a second.

4 STATUS

Indicates the connecting status to the PC.

- Green (ON) ......Normally connected with monitor, PC, EtherNet/IP communication scanner, or PROFINET communication I/O controller.
- Green (Blink)....IP address has been retrieved but the sensor is not correctly connected with monitor, PC, EtherNet/IP communication scanner, or PROFINET communication I/O controller.
- Red (Blink) ....Timeout has occurred at the communication with EtherNet/IP communication scanner.
- Red (ON).........IP address coincides with another device.
- (OFF) ....IP address is not assigned. Not correctly connecting with PC.
- Orange (Blink)..Indicates the focusing status while adjusting the focusing position with the blinking speed (manual focus type only).

5 LINK/ACT

Indicates the linking status within PC or Ethernet switch.

- Green (ON) ......Normally linked.
- Green (Blink)....Normally linked, and the data is sending/receiving.
- (OFF) ....Sensor is not normally linked.

■ IV-G series: Operation of the sensor head indicator light

Indicator light

- Green (ON) ......Comprehensive result is "OK".
- Green (Blink)....Under startup or setting in progress. Operation is stopped.
  Blinks once a second.
- Red (ON).........Comprehensive result is "NG".
- Red (Blink) ....An error has occurred.
- (OFF) ....Standby status until the first judgment finishes after starting the operation or after switching the program number.
  Version of the sensor head and sensor amplifier does not match.
- Green and red are ...Flash LED has been
  blinking alternately   required on the PROFINET communication I/O controller. Or LED Blinking has been required.

■ IV-G series: Operation of the sensor amplifier indicator light

1 PWR/ERR

Indicates the power supplying status to the sensor and the error status of the sensor.

- Green (ON) ......Operating.
- Green (Blink)....Under startup or setting in progress. Operation is stopped. Blinks once a second.
- Red (ON).........Unrecoverable error has occurred.
- Red (Blink) ....Recoverable error has occurred.
- Orange (Blink)..Flash LED has been required on the PROFINET communication I/O controller. Or LED Blinking has been required. Blinks 4 times with a period of about a second.
- (OFF) ....Power is not supplied.

2 OUT

Indicates the comprehensive result.

- Green ....Comprehensive result is "OK".
- Red ....Comprehensive result is "NG".
- (OFF) ....Setting processing.
  Standby status until the first judge finishes after starting the operation or after switching the program number.
- Orange (Blink)..Flash LED has been required on the PROFINET communication I/O controller. Or LED Blinking has been required. Blinks 4 times with a period of about a second.

3 TRIG

Green light lights up (one-shot) according to input of the internal or external trigger.

- Orange (Blink)..Flash LED has been required on the PROFINET communication I/O controller. Or LED Blinking has been required. Blinks 4 times with a period of about a second.

4 STATUS

Indicates the connecting status to the PC.
- Green (ON) ......Normally connected with monitor, PC, EtherNet/IP communication scanner, or PROFINET communication I/O controller.
- Green (Blink)....IP address has been retrieved but the sensor is not correctly connected with monitor, PC, EtherNet/IP communication scanner, or PROFINET communication I/O controller.
- Red (Blink) ....Timeout has occurred at the communication with EtherNet/IP communication scanner.
- Red (ON)..........The IP address coincides with other device or a network loop is detected.
- (OFF) ....IP address is not assigned. Not correctly connecting with PC.

5 LINK/ACT

Indicates the linking status within PC or Ethernet switch.
- Green (ON) ......Normally linked.
- Green (Blink)....Normally linked, and the data is sending/receiving.
- (OFF) ....Sensor is not normally linked.

2

EtherNet/IP

This chapter describes the overview of EtherNet/IP and the communication specifications and functions of the EtherNet/IP communication in the IV/IV-G series.

2

EtherNet/IP

Overview of EtherNet/IP

What is EtherNet/IP?

EtherNet/IP is an open industrial networking standard developed and maintained by the ODVA (Open DeviceNet Vendor Association, Inc.). All supported devices can use the communication network regardless of the vendor.

Ethernet and an industrial protocol have been combined and standardized as EtherNet/IP (Industrial Protocol). Communication is achieved by combining a protocol called CIP (Common Industrial Protocol) and the TCP/IP and Ethernet. This allows the network to be shared and used with standard Ethernet.

To start the Ethernet/IP communication, one device needs to open a communication line called a "connection" for the other device. The device that will open a connection is referred to as the "scanner", and the device whose connection will be opened is referred to as the "adapter" (IV/IV-G series is an adapter device).

The EtherNet/IP communication offers the following two types of communications: Cyclic communication for sending and receiving data periodically (Implicit communication), and message communication for sending and receiving commands/responses at arbitrary timings.

In the cyclic communication, you can set the RPI (Request Packet Interval: communication cycle) based on the priority of the data to be sent/received, enabling sending/receiving of data with adjusted overall communication load. Various data including the control output, status result import, trigger control and switching to the set program No. can be communicated without a ladder program.

In the message communication, you can send/receive the required commands and responses at the required timings. The message communication is used for applications requiring no punctuality unlike the cyclic communication, such as for reading and writing the adapter device settings.

The IV/IV-G series supports cyclic communication (Implicit communication).
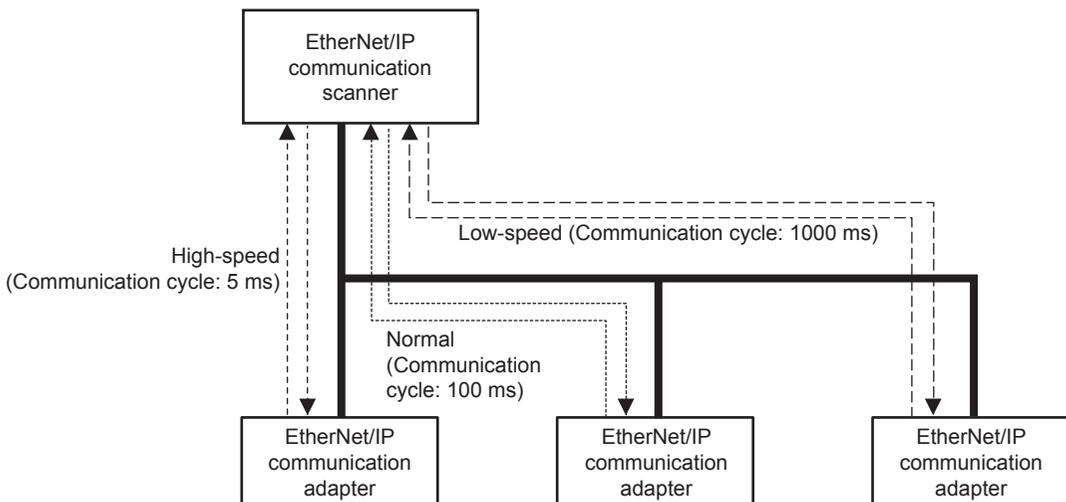
EtherNet/IP communication specifications and functions in the IV/IV-G series

This section describes the overview of the EtherNet/IP communication functions supported in the IV/IV-G series.

EtherNet/IP communication specifications in the IV/IV-G series

Cyclic communication (Implicit messages)	Number of connections	16

Overview of the EtherNet/IP communications functions in the IV/IV-G series

The following shows the list of functions that can be used to control the IV/IV-G series using the EtherNet/IP communication.

Function	Content
Trigger input	Executes a trigger input for the sensor.
Program switching	Executes a program switching for the sensor.
External master registration	Executes an external master registration for the sensor.
Error clear input	Executes an error clear.
Read out status	Allows you to check the unit status (Imaging, RUN, BUSY, Error).
Read overall status result	Reads out the overall status result.
Read judgment processing time	Reads out the judgment processing time.
Read each tool's status result	Read each tool's status result
Read statistics information	Reads out the number of triggers issued that generated a trigger error and the number of trigger errors.

✎ **Point**

• If you are switching programs using the EtherNet/IP communication, set the [Switching method] option to [Monitor/PC]. For details of the setting, refer to the "IV/IV-G Series User's Manual (Monitor / PC Software)".

• If the master registration will be executed using the EtherNet/IP communication, set the [Write to ROM at external master reg.] option to [No]. For details of the setting,refer to the "IV/IV-G Series User's Manual (Monitor / PC Software)".

List of supported PLCs

Check the instruction manual of each PLC for details of the setting methods.

Keyence PLC

■ KV series

PLC model	EtherNet/IP communication unit	Firmware version	Software used	Version of the software used
KV-3000	KV-EP21V	Ver.2 or later	KV STUDIO	Ver.6.0 or later
KV-5000	KV-EP21V	Ver.2 or later		
KV-5500	- (Built-in port or KV-EP21V)	Ver.2 or later		

Rockwell Automation PLC

PLC model	EtherNet/IP communication unit	Firmware version	Software used	Version of the software used
1756 ControlLogix	1756-ENBT 1756-EN2T	Ver.13 or later	RSLogix5000	Ver.13 or later
1769 CompactLogix	- (Built in the unit)	Ver.13 or later		

OMRON PLC

PLC model	EtherNet/IP communication unit	Firmware version	Software used	Version of the software used
SYSMAC CJ2	- (Built-in port or CJ1W-EIP21)	V1.0 or later	CX-One	Ver.3.0 or later
SYSMAC CJ1	CJ1W-EIP21	V1.0 or later		
SYSMAC CS1	CJ1W-EIP21	V1.0 or later		

3

Cyclic communication

This chapter describes the overview, setting method, data allocation, and operating procedure of the cyclic communication in the EtherNet/IP communication.

3

Cyclic communication

Overview of the cyclic communication

What is cyclic communication?

This function enables cyclic (i.e. in fixed intervals) data communications with the EtherNet/IP devices.

This function provides high-speed control with several to several tens of milliseconds.

The communication can be controlled by referencing and updating the variables in the PLC, making it easy to control the programs on the PLC side.

Input Area

- Status result
- Control/status/error result
- Statistics information
- Tool information

Output data

- Status result
- Control/status/error result
- Statistics information
- Tool information

RPI
(Communication cycle)

Output Area

- Trigger control
- External master image registration control
- Program switching control
- Handshake control

Input data

- Trigger control
- External master image registration control
- Program switching control
- Handshake control
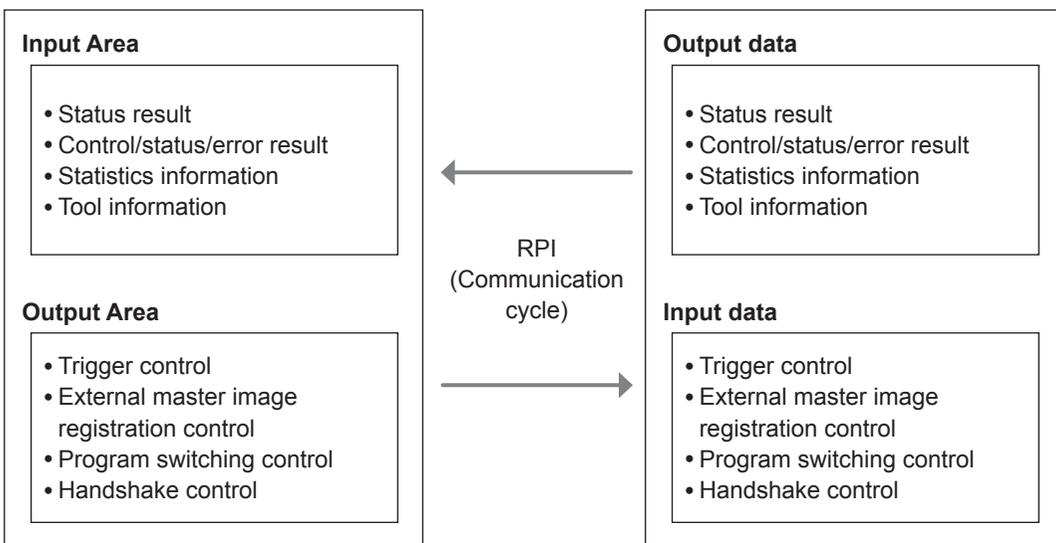
Point

- Communication settings for the cyclic communication, such as the RPI (communication cycle) and the data size, will be configured on the PLC side.
- In a network with many connected devices (including the EtherNet/IP devices), a network delay and/or packet loss may occur when there is a heavy load on the network. Conduct a thorough verification before the operation.

Cyclic communication setting method

This following explains the setting method when using the cyclic communication.

Point

- To control the IV/IV-G series using the EtherNet/IP communication, select [Network connection] for the sensor connection setting. When connected directly, the field network settings will be greyed out and disabled.
- If you have modified the protocol settings, the connection with the sensor will be terminated and then restarted.

Setting the IV/IV-G series

You can configure the following settings for the IV/IV-G series using the monitor (IV-M30) or IV-Navigator (IV-H1).

When settings on the monitor (IV-M30)

Set the field network settings of the sensor to [EtherNet/IP].

1 **Tap the [Sensor Advanced] button on the [Sensor Setup Menu] screen.**
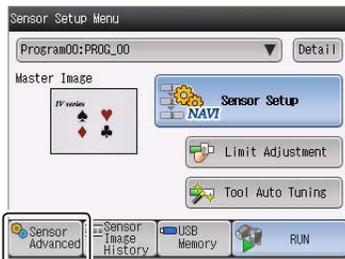
2 **Tap the [Environmental] button, and then the [Adv. Network Settings] button.**
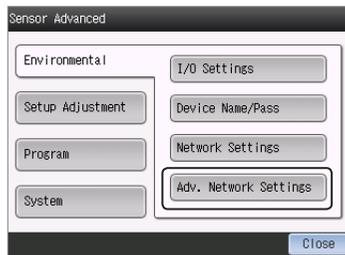
3 **Tap the [Settings] button in the "Field Network".**

4 **Select [Ethernet/IP] for the protocol.**
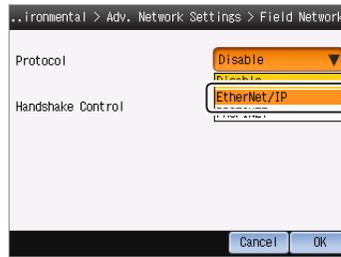
5 **To enable the handshake control, select [Enable].**
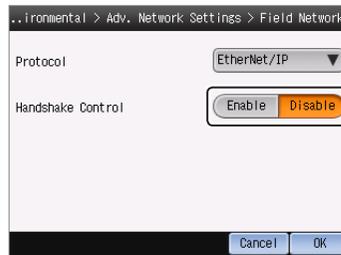
Point

- When the protocol is set as [Disable], this setting item is shaded and cannot be selected.
- When the data handshake control is set as [Enabled], the status result will not be updated until [Result acquisition complete notice] ("Address2, Bit0" of Output Assembly) is input.
  □ "Operating procedure of the cyclic communication" (Page 3-26)

6 **After the setting is completed, tap the [OK] button.**

3

Cyclic communication

When setting by IV-Navigator (IV-H1)

Set the field network settings of the sensor to [EtherNet/IP].

1 **Display the Advanced Sensor Settings screen.**

2 **Select the [Environmental] tab, and then click the [Setting] button under [Field network].**
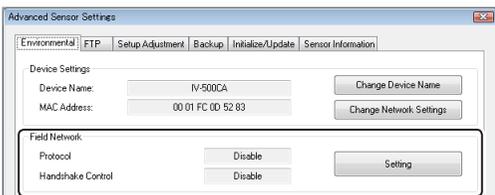
3 **Select [EtherNet/IP] in [Protocol] for the field network.**
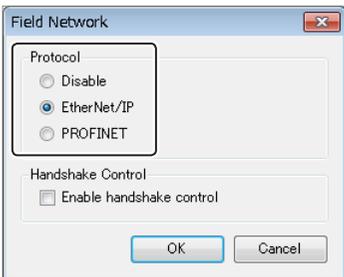
To enable the handshake control, check this check box ☑ .

> **⚓ Point**
>
> • When the protocol is set as [Disable], this setting item is shaded and cannot be selected.
> • When the data handshake control is set as [Enabled], the status result will not be updated until [Result acquisition complete notice] ("Address2, Bit0" Output Assembly) is input.
> 📖 "Operating procedure of the cyclic communication" (Page 3-26)

4 **After the setting is completed, click the [OK] button.**

The system returns to the Advanced Sensor Settings screen.

5 **Click the [OK] button.**

PLC settings

You can set the following settings for the PLC:

(1) Set the connection to be used for the cyclic communication.

(2) Set the device to be used for the cyclic communication.

For details of the setting, refer to the instruction manual of each PLC.

Reference

If you are using the Keyence KV series, (1) and (2) can be set automatically simply by making a selection in KV STUDIO.

Establishing the connection

In the cyclic communication, one device opens a logical communication circuit called a "connection" for the other device; and data communication will become possible if the open is successful.

The device that will open a connection is referred to as the "scanner", and the device whose connection will be opened is referred to as the "adapter".

(IV/IV-G series is an adapter device)

In the EtherNet/IP communication, a connection must be opened from the scanner when the cyclic communication is started.

The communication is started in the following procedure:

(1) The scanner requests a connection open request to the adapter.

(2) Compatibility will be checked on the adapter side.

(3) A connection will open if no error is encountered in the compatibility check.

(1) Connection open request

(2) Compatibility check

(3) Connection open

Scanner   Adapter device
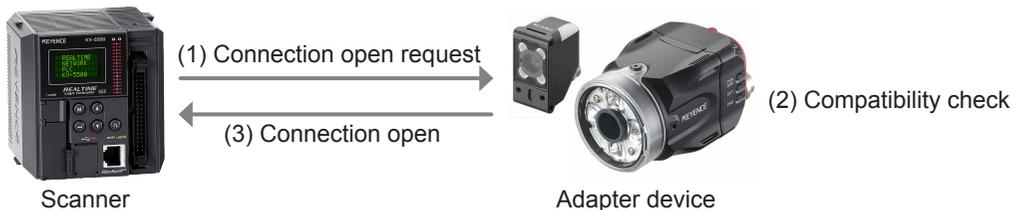
Reference

- A compatibility check is used to check whether the device set by the scanner and the IV/IV-G series are in match with one another, in order to prevent the scanner from communicating with a wrong device when it communicates with the IV/IV-G series.
- Communication settings for the cyclic communication, such as the communication cycle (RPI) and the data size, will be configured on the scanner side.
  In a network with many connected devices (including the EtherNet/IP devices), a network delay and/or packet loss may occur when there is a heavy load on the network. Conduct a thorough verification before the operation.

3

Cyclic communication

There are many types of connections, and the connection available for each device are defined in the EDS file. The EDS file can be downloaded from the KEYENCE web site. The EDS file is also included in the folder in which the PC software for IV/IV-G series IV-Navigator (IV-H1) has been installed.

✎ **Point**

Note that the EDS file for the IV series is different from that for the IV-G series.

The following shows the list of connections that are available in the IV/IV-G series.

No	Connection name	Application type	I/O	Assembly Instance	Size (bytes)	RPI
1	Monitor Data And External Input (Monitor/External input)	Exclusive Owner	This unit → Scanner	64H (100)	2 to 392	5 to 10000ms
			Scanner → This unit	65H (101)	2 to 12	
2	Monitor Data (Input Only) (Monitor data)	Input Only	This unit → Scanner	64H (100)	2 to 392	5 to 10000ms
			Scanner → This unit	FEH (254)	0	

When using the Keyence KV series (EtherNet/IP communication scanner), the names of the connections with the IV/IV-G series will be "Monitor/External Input" and "Monitor Data". The relationship of each connection name is as described below.

1: Monitor Data And External Input → Monitor/External input
2: Monitor Data (Input Only) → Monitor data

Reference

- The trigger timings of each connection are controlled by the cyclic communications; and both the point-to-point and Multicast connection types are supported.
- If you wish to open "Exclusive Owner" and "Input Only" connections simultaneously, set the connection type to "Multicast" and match the RPI and the size.
- The details of each application type are as described below.
  [Exclusive Owner]
  - This connection allows you to configure the data transmission from the scanner to the IV/IV-G series, and vice versa.
  - This connection type is used when the scanner will not only monitor the data of the IV/IV-G series but also provide external input to the IV/IV-G series.
  - It is not possible for multiple scanners to open "Exclusive Owner" connections for a single IV/IV-G series unit.
  [Input Only]
  - This connection only allows you to configure the data transmission from the IV/IV-G series to the scanner.
  - This connection is used when the scanner will only monitor the data of the IV/IV-G series.
  - Multiple scanners can simultaneously open "Input Only" connections for a single IV/IV-G series unit.
  - If connections will be opened simultaneously from multiple scanners, set the connection type to "Multicast" and match the RPI and the size.

Keyence KV series settings

This following explains the setting method when using KV-5500.
For details of the required setting, such as the unit configuration for the PLC and the KV STUDIO settings for connecting with the PC, refer to the "KV STUDIO User's Manual" and the "KV-EP21V User's Manual".

1 **Right-click KV-5500 in the unit editor of KV STUDIO, and then select [EtherNet/IP setting].**
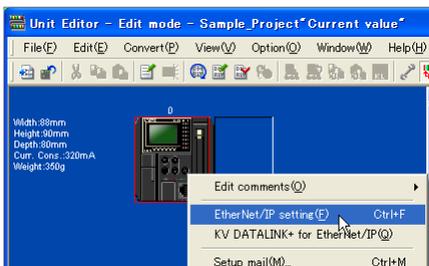
2 **Drag [IV Series] from the Unit list and add it to the scan list.**

If the IV-G series is used, drag [IV-G series] and add it to the scan list.
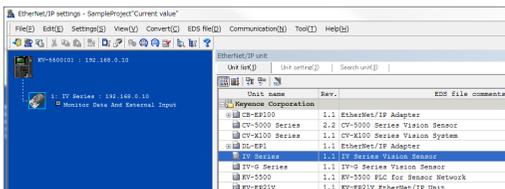
3 **Set the Node address and IP address for the IV/IV-G series on the [Initial adapter settings] screen.**
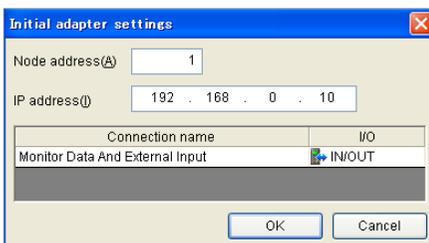
4 **Modify the settings as necessary.**

Click the connection name in the scan list.
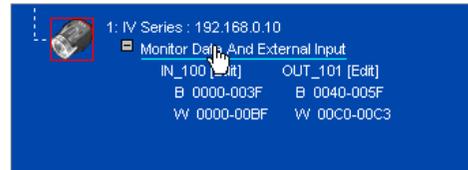
The [Connection settings] screen will appear.
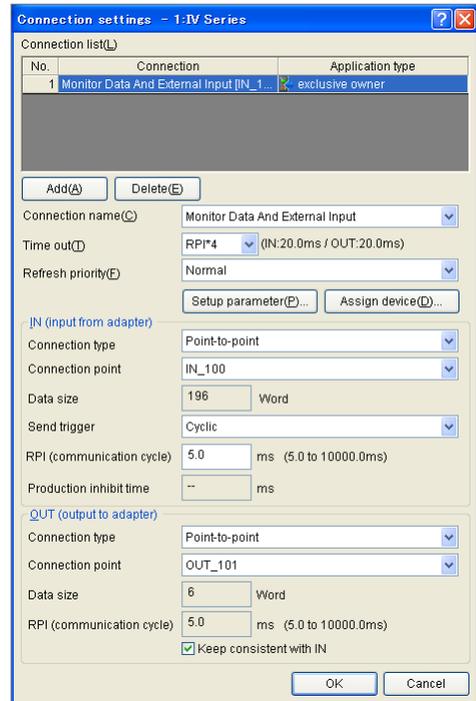
● **Connection name**

Select [Monitor Data and External Input] or [Monitor data].

● **RPI (communication cycle)**

You can set the cyclic communication cycle.

● **Connection type**

Select [Point-to-point] or [Multicast].

5 **Save the settings and close [EtherNet/IP settings] and the unit editor.**

6 **Select [Device comment edit window] from the [Edit] menu in KV STUDIO.**

The [Device comment edit] screen will appear.
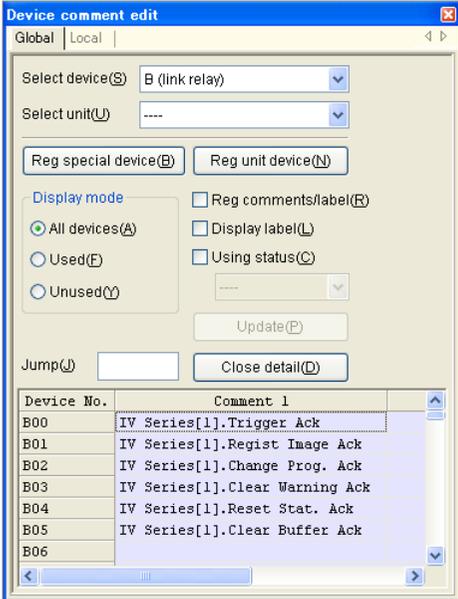
Click [Details].

The [Register unit device] screen will appear.

7 **Make sure that the [IV Series] checkbox is ON ☑ in the [Select unit] field, and then click the [Reg] button.**
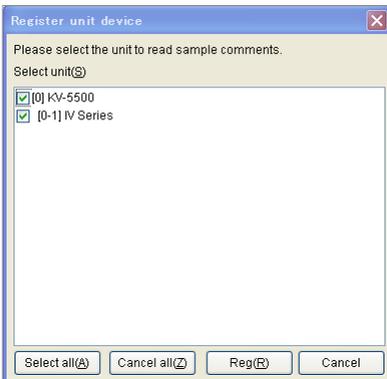
8 **Select [PLC Transfer] from the [Monitor/ Simulator] menu of KV STUDIO.**

Rockwell Automation Control Logix series settings

This following explains the setting method when using a Control Logix PLC.

1 **Select the EtherNet/IP communication unit to be connected with the IV/IV-G series in the I/O configuration of RsLogix5000, and then right-click to select [New Module].**
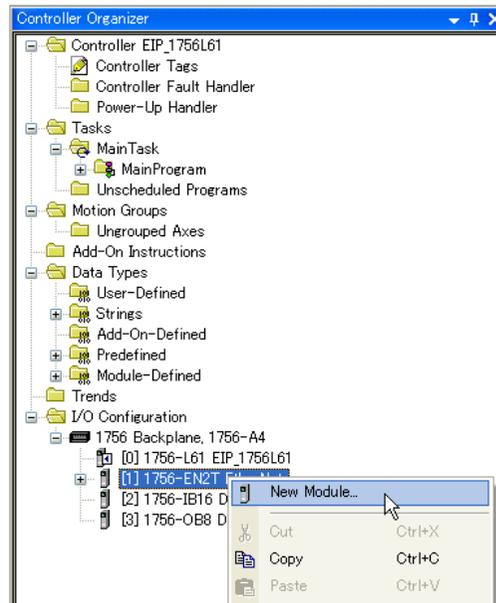
The [Select Module] screen will appear.

2 **Click the [+] button next to Communications, and then select EtherNET-MODULE (Generic Ethernet Module) and click the [OK] button.**
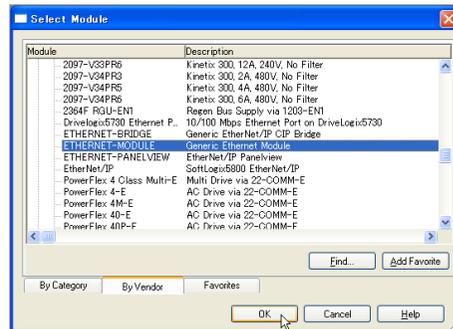
The [New Module] screen will appear.

3 **Modify the settings as necessary.**
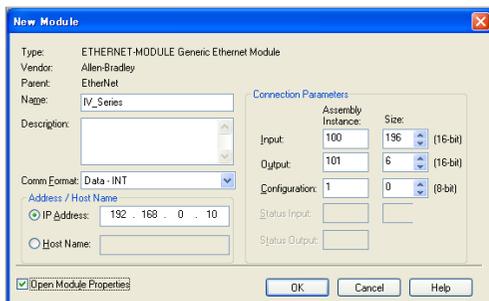
● **Name (Device name)**

You can assign a desired name. The following tags will be generated based on the entered names and used for the data sent and received in the cyclic communication.

　• (Device name): I..... Information received from the IV/IV-G series

　• (Device name): O... Information to be sent to the IV/IV-G series

　• (Device name): C ... Not used.

● **Comm Format**

You can enter a desired format. Due to the structure of the assembly object, programming will be easier with a format that supports a 2-byte alignment.

● **IP Address**

You can enter the IP address of the IV/IV-G series.

● **Input (Assembly Instance)**

Enter "100".

● **Input (Size)**

You can enter the Input Assembly size of the IV/IV-G series.

● **Output (Assembly Instance)**

Enter "101".

● **Output (Size)**

You can enter the Output Assembly size for the IV/IV-G series.

● **Configuration (Assembly Instance)**

Enter "1".

● **Configuration (Size)**

Enter "0".

Reference

• Setting the Comm Format option to [Input Data] will enable you to establish cyclic communication with multiple PLCs using the "Input only" connection.

To set the Comm Format to [Input Data], perform the following settings on each PLC.

Item	Setting contents
Comm Format	Input Data-INT
Input (Assembly Instance)	100
Input (Size)	Input Assembly size of the IV/IV-G series
Output (Assembly Instance)	254
Output (Size)	Output Assembly size for the IV/IV-G series

If communications with multiple PLCs will be established using the "Input Only" connection, set the connection type to "Multicast".

• For details of the Input Assembly and Output Assembly sizes for the IV/IV-G series, refer to ▯ "EtherNet/IP communication specifications in the IV/IV-G series" (Page 2-3) .

4 **Set the RPI (communication cycle) for the cyclic communication.**

Make sure to set a value longer than or equal to 5 ms.
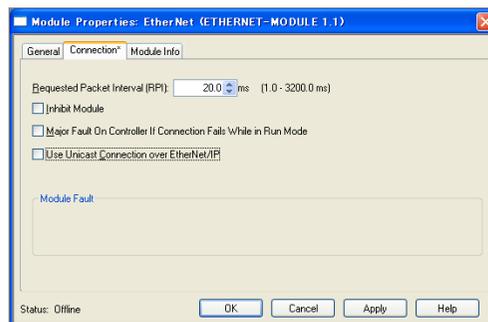
5 **Download the settings to the PLC.**

The EtherNet/IP communication will be enabled when you switch to online after downloading the settings.

3

Cyclic communication

Data allocation in the cyclic communication

Input Assembly (IV/IV-G series → PLC)

Input Assembly are devices that write responses from the IV/IV-G series to the PLC.

The device map of the data allocated for the Input Assembly is as shown below.

These parameters output the statuses, status results and statistics information of the IV/IV-G series.

For details of each parameter, refer to 📖 "Input Assembly parameter details" (Page 3-12).

Address	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	Reserved by system		Buffer clear response	Statistics reset response	Warning clear response	Program switching response	Master registration response	Trigger response
1	Reserved by system					Program switching failed	Master registration failed	Trigger failed
2	Reserved by system		Ready	RUN	Imaging status	BUSY	Result update complete	Result available
3	Error	Warning	Buffer overrun	Reserved by system				
4	Reserved by system	Overall judgment NG	LOGIC4	LOGIC3	LOGIC2	LOGIC1	Position correction	Overall judgment
5	Reserved by system							
6	Tool 8	Tool 7	Tool 6	Tool 5	Tool 4	Tool 3	Tool 2	Tool 1
7	Tool 16	Tool 15	Tool 14	Tool 13	Tool 12	Tool 11	Tool 10	Tool 9
8 - 9	Error NO. (Unsigned 16-bit integer)							
10 - 11	Warning No. (Unsigned 16-bit integer)							
12 - 13	Number of remaining buffers (Unsigned 16-bit integer)							
14 - 15	Checksum (Unsigned 16-bit integer)							
16 - 17	Current program No. (Unsigned 16-bit integer)							
18 - 19	Program No. during judgment (Unsigned 16-bit integer)							
20 - 21	Result NO. (Unsigned 16-bit integer)							
22 - 23	Processing time (Unsigned 16-bit integer)							
24 - 25	Processing time MAX (16-bit unsigned integer)							
26 - 27	Processing time MIN (Unsigned 16-bit integer)							
28 - 29	Processing time AVE (Unsigned 16-bit integer)							
30 - 31	Reserved by system							
32 - 35	Number of triggers (Unsigned 32-bit integer)							
36 - 39	Number of OKs (Unsigned 32-bit integer)							
40 - 43	Number of NGs (Unsigned 32-bit integer)							
44 - 47	Number of trigger errors (Unsigned 32-bit integer)							
48 - 51	Reserved by system							

Address	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
52 - 53	Position correction score (Unsigned 16-bit integer)							
54 - 55	Position correction score MAX (Unsigned 16-bit integer)							
56 - 57	Position correction score MIN (Unsigned 16-bit integer)							
58 - 59	Position correction score Lower threshold (Unsigned 16-bit integer)							
60 - 71	Reserved by system							
72 - 73	Tool 1 score (Unsigned 16-bit integer)							
74 - 75	Tool 1 score MAX (Unsigned 16-bit integer)							
76 - 77	Tool 1 score MIN (Unsigned 16-bit integer)							
78 - 79	Tool 1 lower threshold (Unsigned 16-bit integer)							
80 - 81	Tool 1 upper threshold (Unsigned 16-bit integer)							
82 - 91	Reserved by system							
92 - 391	Tool 2 to 16 (Same as Tool 1) The start address of tool number "n" is 72 + (n-1) x 20							

3

Cyclic communication

Input Assembly parameter details

■ Input Assembly Address 0: Control result (response)

The Bits at Address 0 of the Input Assembly have the following functions:

Address	Bit	Item	Content	Data content
0	0	Trigger response	Stores the external trigger response.	0 : OFF 1 : ON
	1	Master image registration response	Stores the master image registration response.	0 : OFF 1 : ON
	2	Program switching response	Stores the program switching response.	0 : OFF 1 : ON
	3	Warning clear response	Stores the warning clear response.	0 : OFF 1 : ON
	4	Statistics reset response	Stores the statistics reset response.	0 : OFF 1 : ON
	5	Buffer clear response	Stores the buffer clear response.	0 : OFF 1 : ON
	6 to 7	Reserved by system	---	---

■ Input Assembly Address 1: Control error result

The Bits at Address 1 of the Input Assembly have the following functions:

Address	Bit	Item	Content	Data content
1	0	Trigger failed	This bit is output when the external trigger is unsuccessful.	0 : - 1 : The external trigger has failed.
	1	Master image registration failed	This bit is output when the master image registration is unsuccessful.	0 : - 1 : Master image registration has failed.
	2	Program switching failed	This bit is output when the program switching is unsuccessful.	0 : - 1 : Program switching has failed.
	3 to 7	Reserved by system	---	---

■ Input Assembly Address 2 to 3: Handshake control/status/error result

The Bits at Address 2 to 3 of the Input Assembly have the following functions:

Address	Bit	Item	Content	Data content
2	0	Result available	This bit is output when the status result can be acquired.	0 : The status result cannot be acquired. 1 : The status result can be acquired.
	1	Result update complete	This bit switches the ON/OFF statuses when the status result is updated.	0 <=> 1: The statuses will be switched when the status result is updated.
	2	BUSY	This bit is output when the unit is unable to accept new trigger inputs, such as while performing imaging, processing a judgment, registering an external master image, switching programs, etc.	0 : The unit is not in busy status. 1 : The unit is in busy status.
	3	Imaging	This bit is output while the unit is performing imaging operation.	0 : The unit is not performing imaging operation. 1 : The unit is performing imaging.
	4	RUN	This bit is output when the unit is "RUN" and no system errors have occurred.	0 : The unit is not in operation. 1 : The unit is operating normally.
	5	Ready	This bit is output when the start-up sequence of this unit completes after power-on.	0 : The start-up has not completed yet. 1 : The start-up has completed.
	6 to 7	Reserved by system	---	---
3	0 to 4	Reserved by system	---	---
	5	Buffer overrun status	If handshake control is [Enabled], this bit is output when an overrun of the status result has occurred.	0 : No buffer overrun has occurred. 1 : The buffer is in overrun status.
	6	Warning status	This bit outputs the warning status of the unit.	0 : The unit is not in warning status. 1 : The unit is in warning status.
	7	Error status	This bit outputs the error status of the unit.	0 : The unit is not in error status. 1 : The unit is in error status.

3

Cyclic communication

Reference

- By monitoring whether the unit is in "Imaging" status, you can determine whether the target object or the unit can be moved before completion of the image processing.
- "BUSY" and "Imaging" statuses may be skipped in some cyclic frequency settings. It is therefore necessary to take the imaging condition into consideration when setting the cyclic frequency.
- Warning statuses can be cleared from the EtherNet/IP communication. For the warning details, refer to the warning code. The first occurred warning code will be displayed.
- When two or more warnings are issued, all subsequent warnings after the first warning will be saved in the history. If you clear the warnings, the warning code of the highest priority warning will be displayed.

Warning			
Warning clear			
Warning No.	0	Warning code 1	0	Warning code 2

- Error statuses cannot be cleared from the EtherNet/IP communication. For the error details, refer to the error code. The error code of the highest priority error will be displayed.
- The buffer overrun status can be cleared using a warning clear.

■ Input Assembly Address 4 to 7: Status result

The Bits at Address 4 to 7 of the Input Assembly have the following functions:

Address	Bit	Item	Content	Data content
4	0	Overall judgment	Displays the overall status result.	0 : NG 1 : OK
	1	Position correction	Displays the position correction result.	0 : NG 1 : OK
	2	Logic 1	Displays the result of Logic 1.	0 : NG 1 : OK
	3	Logic 2	Displays the result of Logic 2.	0 : NG 1 : OK
	4	Logic 3	Displays the result of Logic 3.	0 : NG 1 : OK
	5	Logic 4	Displays the result of Logic 4.	0 : NG 1 : OK
	6	Overall judgment NG*	Displays the "total status result is NG".	0 : NG 1 : OK
	7	Reserved by system	---	---
5	0 to 7	Reserved by system	---	---
6	0	Tool 1	Displays the result of Tool 1.	0 : NG 1 : OK
	1	Tool 2	Displays the result of Tool 2.	0 : NG 1 : OK
	2	Tool 3	Displays the result of Tool 3.	0 : NG 1 : OK
	3	Tool 4	Displays the result of Tool 4.	0 : NG 1 : OK
	4	Tool 5	Displays the result of Tool 5.	0 : NG 1 : OK
	5	Tool 6	Displays the result of Tool 6.	0 : NG 1 : OK
	6	Tool 7	Displays the result of Tool 7.	0 : NG 1 : OK
	7	Tool 8	Displays the result of Tool 8.	0 : NG 1 : OK
7	0	Tool 9	Displays the result of Tool 9.	0 : NG 1 : OK
	1	Tool 10	Displays the result of Tool 10.	0 : NG 1 : OK
	2	Tool 11	Displays the result of Tool 11.	0 : NG 1 : OK
	3	Tool 12	Displays the result of Tool 12.	0 : NG 1 : OK
	4	Tool 13	Displays the result of Tool 13.	0 : NG 1 : OK
	5	Tool 14	Displays the result of Tool 14.	0 : NG 1 : OK
	6	Tool 15	Displays the result of Tool 15.	0 : NG 1 : OK
	7	Tool 16	Displays the result of Tool 16.	0 : NG 1 : OK

*
• When the IV-150/IV-500/IV-2000 sensor is used:
  The sensor of version 3.00.00 or later can be used.
• When the IV-G150/IV-G300/IV-G500/IV-G600 sensor is used:
  Any sensor can be used regardless of the version of the sensor.

Reference
• If the position correction/logic/tool is not set, the data content will be "0".
• If the status result of the tool is either "trigger standby" (no judgment) or "judgment not possible", the data content will be OFF (0).

■ Input Assembly Address 8 to 23: Error/status/status result information

The Bits at Address 8 to 23 of the Input Assembly have the following functions:

Address	Data type*	Item	Content	Data content
8 to 9	UINT	Error code	Displays the currently occurring error code.	0 to 128
10 to 11	UINT	Warning code	Displays the currently occurring warning code.	0 to 128
12 to 13	UINT	Number of remaining buffers	Displays the number of status results that can be buffered, if handshake control is [Enabled].	0 to 10
14 to 15	UINT	Checksum	Displays the current sensor setting status using an arbitrary 5-digit integer.	0 to 65535
16 to 17	UINT	Current program No.	Displays the current program No.	0 to 31
18 to 19	UINT	Program No. during judgment	Displays the program No. of the latest judgment process.	0 to 31
20 to 21	UINT	Result No.	Displays the judgment process counts.	0 to 32767
22 to 23	UINT	Processing time	Displays the processing time of the latest judgment process.	0 to 10000

* UINT : Unsigned 16-bit integer
  UDINT : Unsigned 32-bit integer

Reference

• The unit of processing time is msec.
• If two or more errors are occurring at the same time, the error code of the highest priority error will be displayed.
   📖 "Error code list" (Page 3-22)
• The first occurred warning code will be displayed.
   📖 "Warning code list" (Page 3-23)
• A checksum can be used to monitor whether the sensor settings have been modified by a third party.
• The checksum will remain unchanged even if you switch programs.
• The checksum will remain unchanged even if you change the IP address, subnet mask, default gateway or port number of the IV/IV-G series.
• For the number of remaining buffers, refer to 📖 "Reading out the overall status result of the IV/IV-G series (Handshake control [Enabled])" (Page 3-28).
• The upper limit value of the result No. is 32767. If the maximum value is exceeded, it will go back to 0 and start counting up again.
• The result No. will also count the judgment process counts that were skipped due to the cyclic frequency setting.

■ Input Assembly Address 24 to 51: Statistics information

The Bits at Address 24 to 51 of the Input Assembly have the following functions:

Address	Data type*	Item	Content	Data content
24 to 25	UINT	Processing time MAX	Displays the maximum processing time value.	0 to 10000
26 to 27	UINT	Processing time MIN	Displays the minimum processing time value.	0 to 10000
28 to 29	UINT	Processing time AVE	Displays the average processing time value.	0 to 10000
30 to 31	---	Reserved by system	---	---
32 to 35	UDINT	Number of triggers	Displays the total number of triggers issued.	0-999999999
36 to 39	UDINT	Number of OKs	Displays the total number of triggers issued whose overall status result was "OK".	0-999999999
40 to 43	UDINT	Number of NGs	Displays the total number of triggers issued whose overall status result was "NG".	0-999999999
44 to 47	UDINT	Number of trigger errors	Number of triggers issued that generated a trigger error	0-999999999
48 to 51	---	Reserved by system	---	---

* UINT : Unsigned 16-bit integer
  UDINT : Unsigned 32-bit integer

Reference

- The unit of processing time is msec.
- The maximum number of triggers is 999999999. If the maximum value is exceeded, it will go back to 0 and start counting up again.
- The maximum value for the number of OK triggers, number of NG triggers, and the number of trigger errors is 999999999. The value will stop updating when the upper limit value is reached.
- A reset will occur in the following conditions:
  - When [Statistics reset] is input
  - When a tool is added/deleted/copied
  - When the enable/disable status of the upper threshold value for the color area/area tool or the setting scale has been changed via user operation or tool auto-tuning
  - When a tool auto-tuning is started with two or more tools other than the position correction tool set
  - When the sensor is switched OFF
  - When the program is switched
  - When a correction for the sensor is started
  - When the sensor is initialized

■ Input Assembly Address 52 to 71: Position correction information

The Bits at Address 52 to 71 of the Input Assembly have the following functions:

Address	Data type*	Item	Content	Data content
52 to 53	UINT	Position correction tool matching rate	Stores the matching rate of the position correction tool.	0 to 100
54 to 55	UINT	Position correction tool matching rate MAX	Stores the maximum matching rate value of the position correction tool.	0 to 100
56 to 57	UINT	Position correction tool matching rate MIN	Stores the minimum matching rate value of the position correction tool.	0 to 100
58 to 59	UINT	Position correction tool threshold	Stores the threshold value of the position correction tool.	0 to 100
60 to 71	---	Reserved by system	---	---

* UINT : Unsigned 16-bit integer
  UDINT : Unsigned 32-bit integer

Reference

Maximum and minimum matching rate values of the position correction tool will be reset in the same manner as the statistics information.
If the position correction tool is not set, the data content will be "0".

■ Input Assembly Address 72 to 391: Tool information

The Bits at Address 72 to 391 of the Input Assembly have the following functions:

Address	Data type*	Item	Content	Data content
72 to 73	UINT	Tool 1 matching rate	Stores the matching rate of Tool 1.	0 to 999
74 to 75	UINT	Tool 1 matching rate MAX	Stores the maximum matching rate value of Tool 1.	0 to 999
76 to 77	UINT	Tool 1 matching rate MIN	Stores the minimum matching rate value of Tool 1.	0 to 999
78 to 79	UINT	Tool 1 lower limit value	Stores the lower threshold value of Tool 1.	0 to 999
80 to 81	UINT	Tool 1 upper limit value	Stores the upper threshold value of Tool 1.	0 to 999
82 to 91	---	Reserved by system	---	---

Thereafter, the information of tool 2, 3, ... 16 will be assigned for each 20-byte Address of Input Assembly.
* UINT : Unsigned 16-bit integer
  UDINT : Unsigned 32-bit integer

Reference

• Maximum and minimum matching rate values of the tool will be reset in the same manner as the statistics information.
• If the tool is not set, the data content will be "0".
• If the upper threshold value of the tool is not set, the data content of the tool's upper limit value will be "65535".

Output Assembly (PLC → IV/IV-G series)

Output Assembly are devices that write instructions from the PLC to the IV/IV-G series.

The device map of the data allocated for the Output Assembly is as shown below.

These parameters are responsible for the control instructions for the IV/IV-G series, clearing of warnings and handshake control.

For details of each parameter, refer to 📖 "Output Assembly parameter details" (Page 3-20).

Address	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	Reserved by system		Buffer clear request	Statistics reset request	Warning clear request	Program switching request	Master registration request	Trigger request
1	Reserved by system							
2	Reserved by system							Result acquisition complete notification
3	Reserved by system							
4 - 5	Program No.							
6 - 7	Reserved by system							
8-11	Reserved by system							

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Cyclic communication

Output Assembly parameter details

■ Output Assembly Address 0 to 1: Control request

The Bits at Address 0 to 1 of the Output Assembly have the following functions:

Address	Bit	Item	Content	Data content
0	0	Trigger request	Requests the external trigger.	0 : OFF 1 : ON
	1	Master image registration request	Requests a master image registration.	0 : OFF 1 : ON
	2	Program switching request	Requests a program switching.	0 : OFF 1 : ON
	3	Warning clear request	Requests a warning clear.	0 : OFF 1 : ON
	4	Statistics reset request	Requests a statistics reset.	0 : OFF 1 : ON
	5	Buffer clear request	Requests a buffer clear.	0 : OFF 1 : ON
	6 to 7	Reserved by system	---	---
1	0 to 7	Reserved by system	---	---

Reference

The following will occur when a buffer clear is requested:

- If handshake control is [Enabled]
  - The current status result will be cleared.
  - The status result in the buffer will be cleared.
  - The result available bit will become OFF (0).
  - The number of remaining buffers will become "10".
- If the handshake control is [Disabled]
  - The current status result will be cleared.
  - The result available bit will become OFF (0).
- If you are switching programs using the EtherNet/IP communication, set the [Switching method] option to [Monitor/PC]. For details of the setting, refer to the "IV/IV-G Series User's Manual (Monitor / PC Software)".
- Buffer overrun and warning statuses will not be cleared even if you execute a buffer clear request.

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Cyclic communication

■ **Output Assembly Address 2 to 3: Handshake control**

The Bits at Address 2 to 3 of the Output Assembly have the following functions:

Address	Bit	Item	Content	Data content
2	0	Result acquisition complete notification	Permits the updating of the status result.	0: OFF 1: ON
	1 to 7	Reserved by system	---	---
3	0 to 7	Reserved by system	---	---

Reference

A result acquisition completion notice is used when handshake control is [Enabled].

Updating of the status result will be permitted when you request a result acquisition completion notice.

For details, refer to 📖 "Reading out the overall status result of the IV/IV-G series (Handshake control [Enabled])" (Page 3-28).

■ **Output Assembly Address 4 to 11: Program No.**

The Bits at Address 4 to 11 of the Output Assembly have the following functions:

Address	Data type	Item	Content	Data content
4 to 5	UINT	Program No.	Stores the program No. when a program switching is requested.	0 to 31
6 to 11	---	Reserved by system	---	---

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Cyclic communication

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Cyclic communication

Error code list

The following shows the list of error codes that are generated in the IV/IV-G series.

Error code	Content	Cause	Countermeasure
0	No error	---	---
1 - 32	Program No. xx corruption error	• A data error has occurred in program No. xx. • The data corruption may have occurred due to a power-off while writing settings data and/or due to noise.	• Initialize the program No. xx. • Switch on the power back ON. • Do not switch off the unit while the settings are being saved. • If the error persists, contact your nearest KEYENCE office.
75	Non-volatile memory error (EEPROM)	• A data error has occurred. • The data corruption may have occurred due to a power-off while writing settings data and/or due to noise.	• Initialize the settings of this unit. • Switch on the power back ON. • Do not switch off the unit while the settings are being saved. • If the error persists, contact your nearest KEYENCE office.
76	Non-volatile memory error (FLASHROM)		
81-128	System error	An error may have occurred in the sensor.	• Switch on the power back ON. • If the error persists, contact your nearest KEYENCE office.

*   When the IV-G series sensor is used, error code 124 will be displayed if the sensor head is not connected to the sensor amplifier.

Reference

If two or more errors are occurring at the same time, the error code of the highest priority error will be displayed.
Greater the error code, higher the priority of the error will be.

Warning code list

The following shows the list of warning codes that are generated in the IV/IV-G series.

Warning code	Content	Cause	Countermeasure
0	No error	---	---
62	Field network overrun error	An overrun of the status result has occurred.	Request a result acquisition completion notice to permit the updating of the status result.
63	Field network bad request error (Master registration)	External master registration has been requested from EtherNet/IP while the unit is in "Setting" status.	Do not request an external master registration while the unit is in "Setting" status.
64	Field network bad request error (Program switching)	• Program switching has been requested from EtherNet/IP while the unit is in "Setting" status. • A program switching request to a non-existent program No. was made from EtherNet/IP. • A program switching requested was made from EtherNet/IP while the program switching method was set to [External input].	• Do not request a program switching while the unit is in "Setting" status. • The program No. should be set in the range between 0 and 31. • If you are switching programs from EtherNet/IP, set the program switching via external input to [Disabled].
65	Trigger error	A trigger has been input while the unit was in busy status. (If you have set the trigger error option to [Enabled])	Do not input triggers while the unit is in busy status.
66	External master registration error (Insufficient outline)	The outline tool is unable to extract the outline of the new master image.	• Check if there are any problems with the registered image and the detection tool or the position correction setting. • Adjust the brightness of the image to be registered.
67	External master registration error (Insufficient area)	The color area/area tool is unable to extract the area of the new master image.	
68	External master registration error (Brightness correction failed)	The brightness of the new master image cannot be corrected appropriately.	

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Cyclic communication

Warning code	Content	Cause	Countermeasure
70	FTP Transfer Error (Insufficient Data Buffer)	The transfer has failed because a volume of data exceeding the remaining FTP buffer capacity has been generated.	• Modify the trigger cycle of this unit. • Check the load status of the network.
71	FTP Transfer Error (Transfer Failed)	The data transfer to the destination folder has failed.	Check the access permissions of the destination folder.
72	FTP connection error	Connection to the FTP server has failed.	• Check the IP address of the FTP server. • Check the port number of the FTP server. • Check the user name for logging into the FTP server. • Check the password for logging into the FTP server.
73	External master registration error (Insufficient work memory)	There is insufficient work memory.	Delete one or more detection tools.
74	External master registration error (No images)	There are no registered images for master registration.	Perform the master image registration after having captured the image to be used for the registration.

Reference

• When two or more warnings are issued, all subsequent warnings after the first warning will be saved in the history.
  If you clear the warnings, the warning code of the highest priority warning will be displayed.

• Greater the warning code, higher the priority of the warning will be.

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Cyclic communication

Operating procedure of the cyclic communication

This section explains the method for communicating from the PLC to the IV/IV-G series using cyclic communication.

Reading out the overall status result of the IV/IV-G series (Handshake control [Disabled])

■ When a trigger is successful

(1) Execute a [Trigger request]. ($0 \rightarrow 1$)

(2) If the trigger is valid, [Trigger response] will change from 0 to 1.

(3) [BUSY] will change from 0 to 1 when a trigger is input.

(4) [BUSY] will change from 1 to 0 when the judgment process ends.

The [Result update complete] Bit will be switched at this time; and [Overall judgment] will be updated.

Reference

- [Result update complete] will switch to "1" if its value was "0" after the previous judgment update (or from "0" to "1" if the previous value was "1").
- [Result available] will switch from 0 to 1 at the timing when the first judgment process has been confirmed; and the new value will be retained thereafter.
- [Result available] will be reset in the following conditions:
  - If handshake control is set to [Disabled]
    - When the program is switched
    - When the unit's status is switched from "Setting" to "RUN"
    - When a buffer clear request is issued
  - If handshake control is set to [Enabled]
    - When a buffer clear request is issued
- [Result No.] will be counted up each time the status result is updated. The upper limit value is 32767. If the maximum value is exceeded, it will go back to 0 and start counting up again.
- [Result No.] will also count the judgment process counts that were skipped due to the cyclic frequency setting.
- [Busy] and [Imaging] may be skipped in some cyclic frequency settings. It is therefore necessary to take the imaging condition into consideration when setting the cyclic frequency.

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Cyclic communication

■ **When a trigger is unsuccessful**

(1) Execute a [Trigger request]. (0 → 1)

(2) If the trigger is valid, [Trigger response] will change from 0 to 1.

(3) [BUSY] will change from 0 to 1 when a trigger is input.

(4) [BUSY] will change from 1 to 0 when the judgment process ends.
    The [Result update complete] BIT will be switched at this time; and [Overall judgment] will be updated.

(5) If you wish to output trigger errors, set the trigger error option to [Enabled].
    If a trigger has been input while the trigger error option is set to [Enabled] and the unit is in "BUSY" status, [Trigger failed] will change from 0 to 1 ignoring the trigger input. No judgment process will be performed for trigger B.

(6) If the trigger input is unsuccessful, [Warning] will switch from "0" to "1" and [Warning No.] will be updated to "65". For details, refer to 📖 "Warning code list" (Page 3-23).

| Reference |

- [Result update complete] will switch to "1" if its value was "0" after the previous judgment update (or from "0" to "1" if the previous value was "1").
- [Result available] will switch from 0 to 1 at the timing when the first judgment process has been confirmed; and the new value will be retained thereafter.
- [Result No.] will be counted up each time the status result is updated. The upper limit value is 32767. If the maximum value is exceeded, it will go back to 0 and start counting up again.
- [Result No.] will also count the judgment process counts that were skipped due to the cyclic frequency setting.
- [Busy] and [Imaging] may be skipped in some cyclic frequency settings. It is therefore necessary to take the imaging condition into consideration when setting the cyclic frequency.
- [Number of trigger errors] will be counted up at the timing when the [Result updated] BIT is switched.

Reading out the overall status result of the IV/IV-G series (Handshake control [Enabled])

The following describes the operating procedure when the data handshake control is set to [Enabled].
You can acquire all status results without fail by setting the data handshake control to [Enabled].

(1) Execute a [Trigger request]. (0 → 1)
(2) If the trigger is valid, [Trigger response] will change from 0 to 1.
(3) [BUSY] will change from 0 to 1 when a trigger is input.
(4) [BUSY] will change from 1 to 0 when the judgment process ends.
     At this time, the [Result update complete] BIT will be switched, [Result available] will change from 0 to 1, and [Overall judgment] will be updated.
(5) [Number of remaining buffers] will be decremented by 1 when the status result is updated.
(6) Executes [Result acquisition complete notice] (0 → 1). [Number of remaining buffers] will be incremented by 1.

Reference

- [Result update complete] will switch to "1" if its value was "0" after the previous judgment update (or from "0" to "1" if the previous value was "1").
- [Result No.] will be counted up each time the status result is updated. The upper limit value is 32767. If the maximum value is exceeded, it will go back to 0 and start counting up again.
- [Result No.] will also count the judgment process counts that were skipped due to the cyclic frequency setting.
- [Busy] and [Imaging] may be skipped in some cyclic frequency settings. It is therefore necessary to take the imaging condition into consideration when setting the cyclic frequency.
- [Number of trigger errors] will be counted up at the timing when the [Result updated] BIT is switched.
- If handshake control has been set to [Enabled], the status result will not be updated until [Result acquisition complete notice] is set ON/OFF (0 → 1 → 0), even if the next trigger has been input and a judgment process has been executed.
- If a new trigger is input when [Number of remaining buffers] is "0", [Buffer overrun] will switch from "0" to "1". The status result from the new trigger will be ignored.
- [Buffer overrun] can be cleared using [Warning clear].

Switching the programs in the IV/IV-G series

```
Program No.            | Program No.
Program switching request
Program switching response
BUSY
```
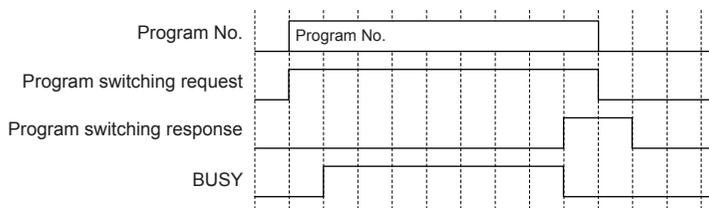
(1) Write the program No. to be set to [Program No.].
     For the write range setting, refer to 📖 "Output Assembly parameter details" (Page 3-20).

(2) Execute [Program switching request]. (0 → 1)

(3)   You can check the input status in [Program switching response].

Reference

• [BUSY] will change from 0 to 1 while the program switching is in progress.

• If the program switching fails, [Program switching failed] will change from "0" to "1".

• If the program switching is unsuccessful, [Warning] will switch from "0" to "1" and [Warning No.] will be updated to "64". For details, refer to 📖 "Warning code list" (Page 3-23).

• You cannot switch programs from the EtherNet/IP communication while the unit is in "Setting" status.

• If you are switching programs using the EtherNet/IP communication, set the [Switching method] option to [Monitor/PC]. For details of the setting, refer to the "IV/IV-G Series User's Manual (Monitor / PC Software)".

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Cyclic communication

Registering a master image for the IV/IV-G series externally

Master registration request
Master registration response
BUSY

(1) Execute a [Master registration request]. (0 → 1)

(2) You can check the input status in [Master registration response].

Reference

- [BUSY] will change from 0 to 1 while the master image registration is in progress.
- If the master image registration is unsuccessful, [Master registration failed] will change from 0 to 1.
- If the master image registration is unsuccessful, [Warning] will switch from "0" to "1" and [Warning No.] will be updated according to the failure details. For details, refer to 📖 "Warning code list" (Page 3-23).
- You cannot register a master image from the EtherNet/IP communication while the unit is in [Setting] status.
- If you wish to write the master registration data to the sensor ROM, set the [Write to ROM at external master reg.] option to [Yes]. For details of the setting, refer to the "IV/IV-G Series User's Manual (Monitor / PC Software)".

3

Cyclic communication

4

PROFINET

This chapter describes the overview of PROFINET and the communication specifications and functions of the PROFINET communication in the IV/IV-G series.

4

PROFINET

Overview of PROFINET

What is PROFINET?

PROFINET is an open industrial networking standard developed and maintained by the PI (PROFINET International).
All supported devices can use the communication network regardless of the vendor.
PROFINET allows easy integration with the currently used field bus (such as PROFIBUS), enabling you to protect the existing assets without modifying the legacy system.

The following two types of communication standards exist for the PROFINET communication: PROFINET CBA communication for data communications between processes and between I/O controllers, and PROFINET I/O communication for data communications between the I/O controller and I/O device.

The PROFINET communication for the IV/IV-G series supports the PROFINET I/O communication and complies with Conformance Class A.

The PROFINET I/O communication offers the following two types of communication methods for cyclic data: Real-time communication (RT) and isochronous real-time communication (IRT).
Real-time communication provides similar communication performance as the existing field bus, such as the device control in normal factory automation, using Ethernet. The isochronous real-time communication is capable of meeting stringent real-time requirements, including synchronized motion control.

The real-time communications offer the following two types of communications: Data I/O communication for sending and receiving data periodically, and record data communication for sending and receiving commands/responses at arbitrary timings. In the data I/O communication, you can set the SendCycle (Communication cycle) based on the priority of the data to be sent/received, enabling sending/receiving of data with adjusted overall communication load. The record data communication is used for communication applications that require little punctuality (unlike the data I/O communication).

The IV/IV-G series supports the data I/O communication provided by the real-time communications (RT).
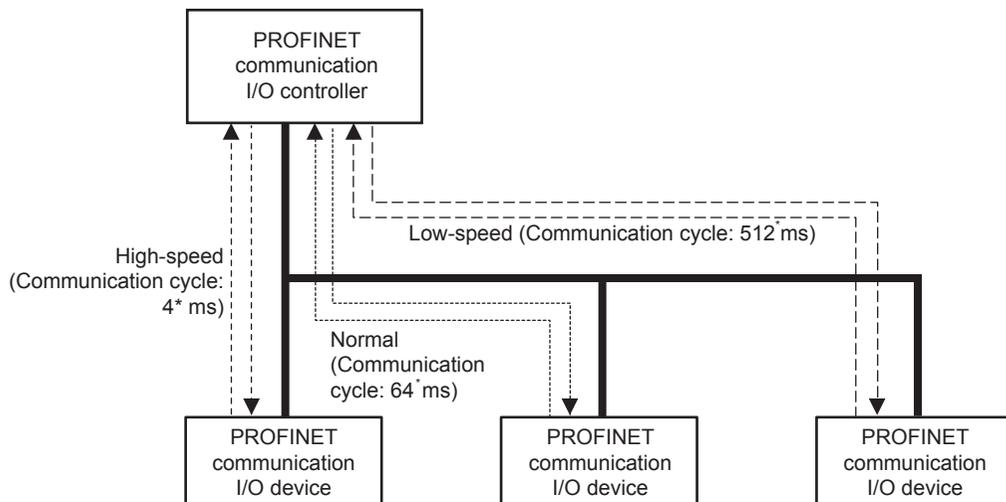
* If you configure the setting to "auto", the overall communication load will be adjusted and the SendCycle (Communication cycle) will be set automatically.

PROFINET communication specifications and functions in the IV/IV-G series

IV/IV-G series PROFINET communication specifications

Data I/O communication	Communication size	to 408 byte

Specifying the IP address using the DCP protocol

In the PROFINET communication, you can specify the IP address of I/O devices using the DCP protocol (Discovery and Configuration Protocol).

The DCP protocol offers two methods for setting the IP address.

(1)　The IP address can be set by the I/O controller based on the device name information of the I/O device.

(2)　The IP address and device name of the I/O device can be set by the I/O supervisor (PC, etc.).

PROFINET communication I/O Controller

(1) Check the presence of an I/O device

(2) Response

(3) Set the IP address

(4) Response
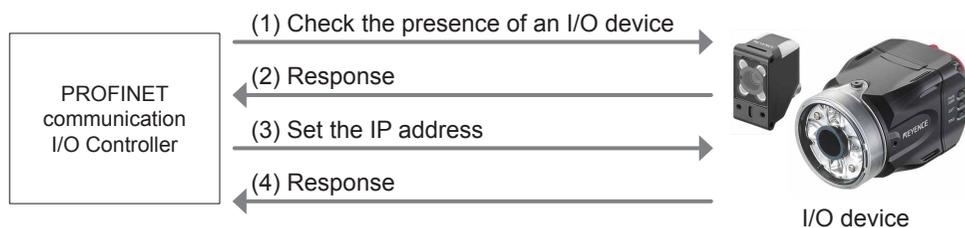
I/O device

Reference

- If the IP address of the I/O device will be set by the I/O controller, the I/O device name must match the name in the config of the I/O controller.
- If the IP address will be set by the DCP protocol, the IP address of the sensor will be initialized.
- The IP address set by the DCP protocol will be stored in the volatile memory. When you restart the sensor, the sensor will start up with its IP address in "----" (unregistered) status.

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PROFINET

Overview of the PROFINET communication functions in the IV/IV-G series

The following shows the list of functions that can be used to control the IV/IV-G series in the PROFINET communication.

Function	Content
Trigger input	Executes a trigger input for the sensor.
Program switching	Executes a program switching for the sensor.
External master registration	Executes an external master registration for the sensor.
Error clear input	Executes an error clear.
Read out status	Allows you to check the unit status (Imaging, RUN, BUSY, Error).
Read overall status result	Reads out the overall status result.
Read judgment processing time	Reads out the processing time of the judgment.
Read each tool's status result	Read each tool's status result
Read statistics information	"Reads out the number of triggers issued that generated a trigger error and the number of trigger errors.

Point

- If you are switching programs using the EtherNet/IP communication, set the [Switching method] option to [Monitor/PC]. For details of the setting, refer to the "IV/IV-G Series User's Manual (Monitor / Software)".
- If the external master registration will be executed using the PROFINET communication, set the [Write to ROM at external master reg.] option to [No]. For details of the setting, refer to the "IV/IV-G Series User's Manual (Monitor / Software)".

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PROFINET

List of supported PLCs

Check the instruction manual of each PLC for details of the setting methods.

Siemens PLC

PLC model	PROFINET communication unit	Firmware version	Software used	Version of the software used
S7 300 series Example: CPU315-2 PN/DP	- (Built in the unit)	V2.6 or later	STEP 7	V5.5.0.0 or later
S7 400 series Example: CPU414-3 PN/DP	- (Built in the unit)	V5.3 or later	STEP 7	V5.5.0.0 or later
S7 1200 series Example: CPU1212C	- (Built in the unit)	V2.0 or later	STEP 7 Basic	Version V11 Update 1

Phoenix Contact PLC

PLC model	PROFINET communication unit	Firmware version	Software used	Version of the software used
ILC 350 PN	- (Built in the unit)	V 3.53F.13	PC WORX	6.10.56

OMRON PLC

PLC model	PROFINET communication unit	Firmware version	Software used	Version of the software used
SYSMAC CJ2/CJ1	CJ1W-PNT21	V1.04 or later	CX-One	Ver.4.04 or later

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Data I/O communication

This chapter describes the overview, setting method, data allocation, and operating procedure of the data I/O communication in the PROFINET communication.

5

Data I/O communication

Overview of the data I/O communication

What is data I/O communication?

This function enables cyclic (i.e. in fixed intervals) data communications with the PROFINET devices. This function provides high-speed control with several to several tens of milliseconds.

The communication can be controlled by referencing and updating the variables in the PLC, making it easy to control the programs on the PLC side.

PROFINET communication I/O Controller

Input Area

• Status result
• Control/status/error result
• Statistics information
• Tool information

Output Area

• Trigger control
• External master image registration control
• Program switching control
• Handshake control

SendCycle (Communication cycle)

Output data

• Status result
• Control/status/error result
• Statistics information
• Tool information

Input data

• Trigger control
• External master image registration control
• Program switching control
• Handshake control

Point

• Communication settings for the data I/O communication, such as SendCycle (communication cycle) and the data size, will be configured on the PLC side.
• In a network with many connected devices (including the PROFINET devices), a network delay and/ or packet loss may occur when there is a heavy load on the network. Conduct a thorough verification before the operation.

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Data I/O communication

Data I/O communication setting method

This following explains the setting method when using the data I/O communication.

Setting the IV/IV-G series

You can configure the following settings for the IV/IV-G series using the monitor (IV-M30) or IV-Navigator (IV-H1).

When settings on the monitor (IV-M30)

Set the field network settings of the sensor to [PROFINET].

1 **Touch the [Sensor Advanced] button on the [Sensor Setup Menu] screen.**

2 **Touch the [Environmental] button, followed by the [Adv. Network Settings] button.**

3 **Touch the [Settings] button for the field network.**

4 **Select [PROFINET] for the protocol.**

5 **Select [Enabled] if you wish to enable the data handshake control.**

6 **Once you have finished configuring the settings, touch the [OK] button.**

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Data I/O communication

When setting by IV-Navigator (IV-H1)

Set the field network settings of the sensor to [PROFINET].

1 **Open the Advanced Sensor Settings screen.**

2 **Select the [Environmental] tab, and then click the [Setting] button under [Field network].**
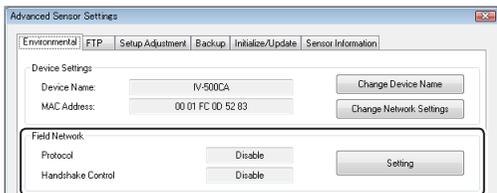
3 **Select [PROFINET] in [Protocol] for the field network.**
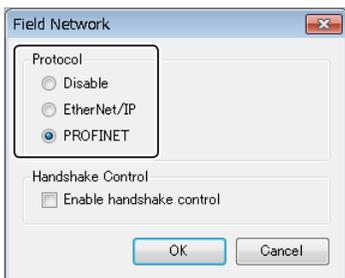
Tick the checkbox ☑ if you wish to enable the data handshake control.

> **⚠ Point**
>
> • If the protocol is set to [Disabled], the settings will be greyed out and disabled.
> • If data handshake control has been set to [Enabled], the status result will not be updated until [Result acquisition complete notice] ("Address2 Bit0" of Command Control) is input.
> 📖 "Operating procedure of the data I/O communication" (Page 5-32)

4 **When you have finished configuring the settings, click the [OK] button.**
The system returns to the Advanced Sensor Settings screen.

5 **Click the [OK] button.**
You will return to the main screen of [Setting].

Setting the device name

> **✎ Point**
>
> • Device naming rules for when the PROFINET communication is used
>   • Do not use characters other than "a-z", "0-9", "-", and ".".
>   • "-" (Half-width hyphen) cannot be used at the beginning and end of the name.
>   • "port-x (x: 0-999)" cannot be used.
>   • "n.n.n.n (n: 0-999)" cannot be used.
> • The sensor will be restarted if the device name or network setting is modified while the PROFINET function is in use.

When settings on the monitor (IV-M30)

1 **Touch the [Sensor Advanced] button on the sensor settings menu screen.**

2 **Touch the [Environmental] button, followed by the [Device Name/Pass] button.**
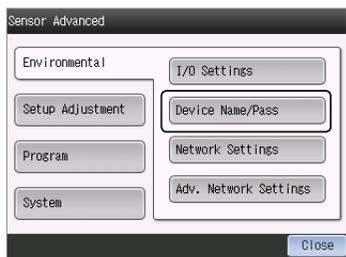
3 **Set the device settings of the sensor.**
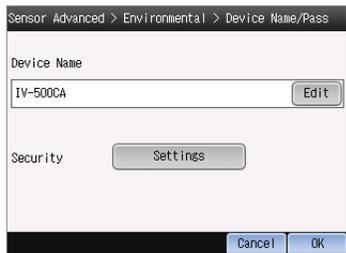
4 **Touching the [Edit] button under [Device name] will bring up the screen for entering the device name.**

Enter a desired name, and then touch the [OK] button.

5 **Once you have finished configuring the settings, touch the [OK] button.**

You will return to the sensor expansion screen.

When setting by IV-Navigator (IV-H1)

1 **Open Advanced Sensor Settings screen.**

2 **Select the [Device settings] tab.**

3 **Set the environment settings of the sensor.**
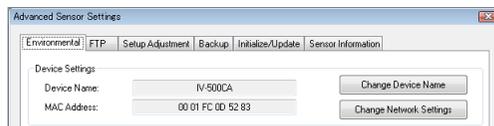
● **Device name**

Displays the name of the sensor.

To rename a sensor, click the [Rename device] button and enter a desired name on the device name screen.

You can assign a desired name to and manage the sensor.

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Data I/O communication

PLC settings

You can set the following settings for the PLC:

(1) Establish a real-time communication for setting up the data I/O communication.

(2) Se the I/O device to be used for the data I/O communication.

For details of the setting, Refer to the instruction manual of each PLC.

Establishing the data I/O communication

To start a data I/O communication, you need to create a communication path called AR (Application Relation) and establish a real-time communication between the I/O controller and the I/O device . When you create the AR, separate communication channels for data I/O and record data communications will be set up. These communication channels are called CR (Communication Relation).

The communication is started in the following procedure:
(1) The I/O controller requests an AR connection to the I/O device.
(2) A response is returned from the I/O device, establishing a real-time communication.
(3) A connection will open if no error is encountered in the compatibility check.

PROFINET communication I/O Controller

(1) Requesting an AR connection

(2) Establishing a real-time communication
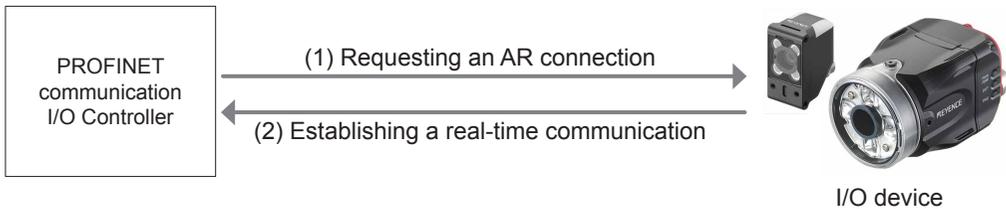
I/O device

Reference

Communication settings for the data I/O communication, such as SendCycle (communication cycle) and the data size, will be configured on the I/O controller side.
In a network with many connected devices (including the PROFINET devices), a network delay and/or packet loss may occur when there is a heavy load on the network. Conduct a thorough verification before the operation.

Setting the Siemens TIA Portal

This following explains the setting method when using TIA Portal.

1 **Launch [TIA Portal V11] with the PC and CPU connected.**
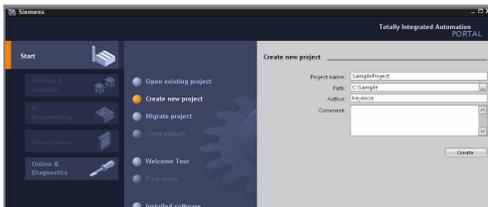
2 **Select the [Device & Networks] tab, and then click [Add new device].**

The [Add new device] screen will appear.

3 **Select the CPU to be connected.**
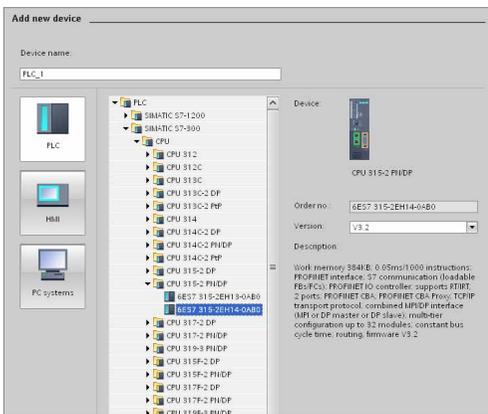
4 **Right-click the selected CPU in [Project tree], and then click [Open].**
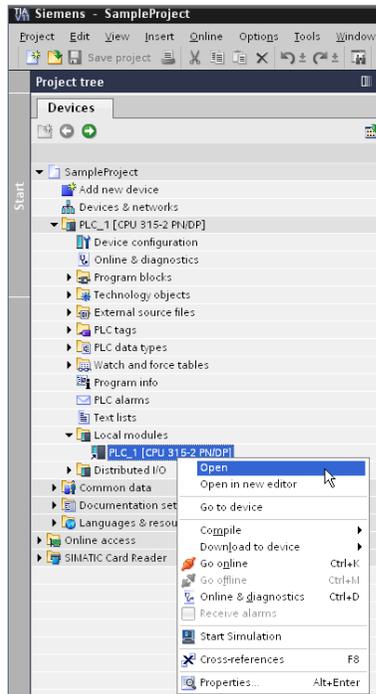
The [(Set device name [Selected CPU])] screen will appear.

5 **Set the IP address and subnet mask of the CPU from [General] - [PROFINET interface] - [Ethernet addresses], and then click the [Add new subnet] button.**

5

Data I/O communication
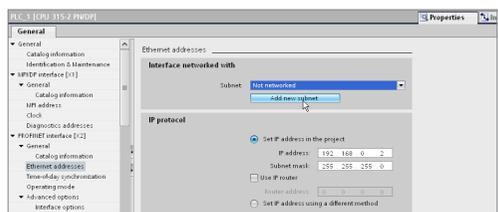
6 **Install the GSDML file if you are configuring the IV/IV-G series for the first time.**
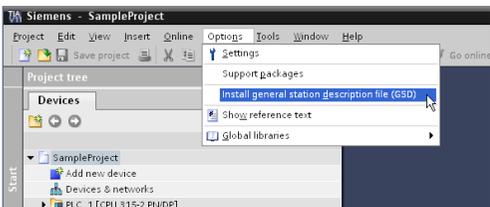
- Select [Install general station description file (GSD)] from the [OptIOns] menu.
- Select the GSDML file for the IV/IV-G series you wish to install, and then click the [Install] button.
- Restart TIA Portal V11 after the installation.

Reference

The GSDML file for the IV/IV-G series can be downloaded from the KEYENCE web site.
http: //www.keyence.co.jp

7 **Open [Other field devices] - [PROFINET I/O] - [Sensors] - [KEYENCE CORPORATION] - [Keyence Vision Sensors] from [Hardware catalog] on the [Devices] - [Device & networks] screen, and then drag & drop [IV-xxxx].**

If the IV-G series is used, drag and drop;
- IV-G Main unit for [IV-G10]
- IV-G Expansion unit for [IV-G15]
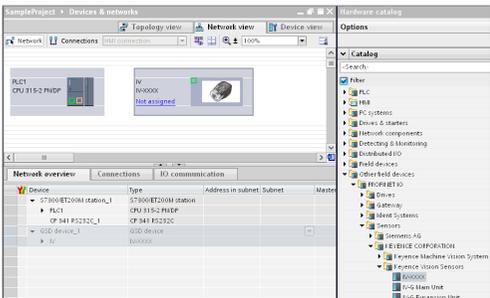
8 **Connect the PLC with the IV/IV-G series by mouse operation.**
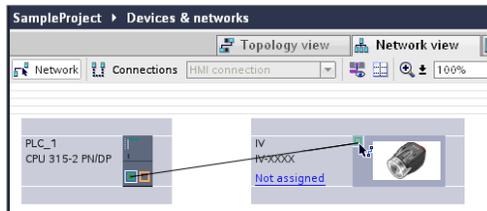
If the connection is successful, the following information will appear.
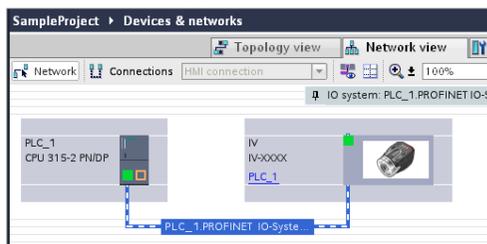
9 **Double-click the IV/IV-G series' icon on the [Device & networks] screen.**

The [IV] screen will appear.

10 **Enter the same character string as the PROFINET device name of the IV/IV-G series to be connected.**
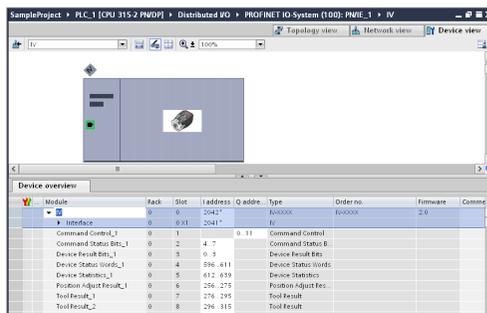
11 **Click the [Properties] tab. Select [PROFINET interface [x1]] - [Ethernet addresses] under [General], and then select the IP address setting method for the IV/IV-G series.**

● **To set a new IP address for the IV/IV-G series using the DCP protocol**
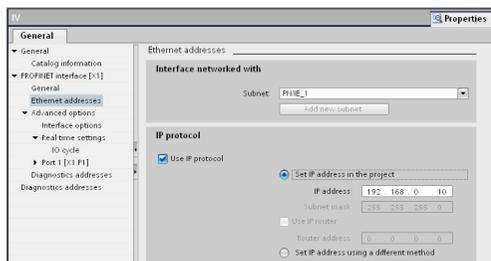
● **To use the IP address that is already registered for the IV/IV-G series**
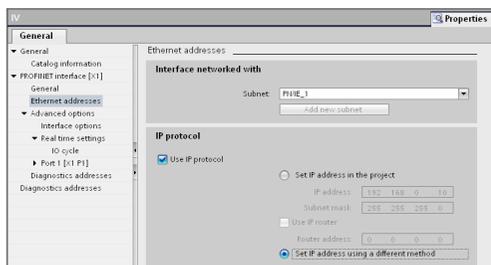
Reference

• If the IP address will be set by the DCP protocol, the IP address of the sensor will be initialized.
• The IP address set by the DCP protocol will be stored in the volatile memory.
When you restart the sensor, the sensor will start up with its IP address in "----" (unregistered) status.

12 **Click the [Properties] tab. Select [PROFINET interface [x1]] - [Advanced options] - [Real time settings] in [General], and then set the SendCycle (communication cycle) for the data I/O communication in [Update time].**
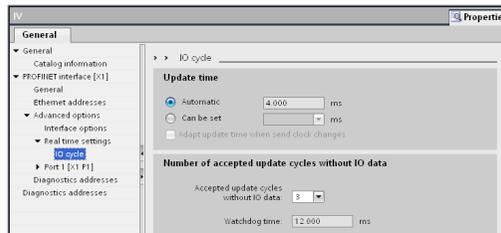
13 **Click the CPU in the [Devices] tab. Select [Compile] - [All] and save the settings.**

5

Data I/O communication
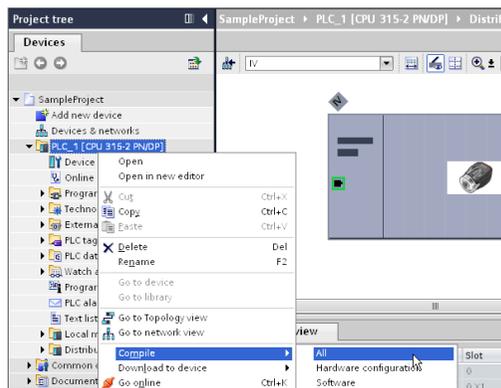
14 **Click the CPU in the [Devices] tab. Select [Download to device] - [All] to download the setting to the CPU.**
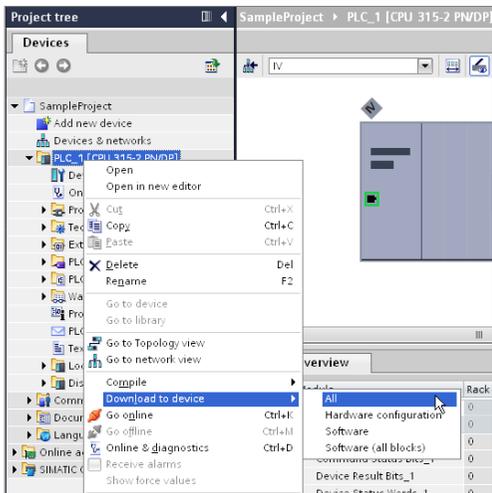
The [Extended download to device] screen will appear.

15 **Click the [Load] button to perform the download.**
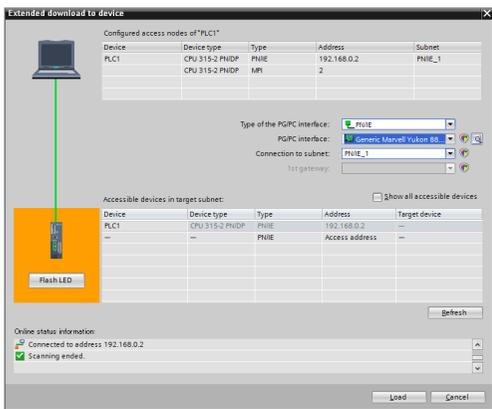
16 **Set the CPU mode switch to "RUN".**

If the connection is successful, the RUN LED of the CPU will light in green and the data I/O communication will become enabled.

⚠ Point

• By default, [Size of the process-image input area] is set to "128".
To be able to access the addresses after address 128, expand the setting as shown below.
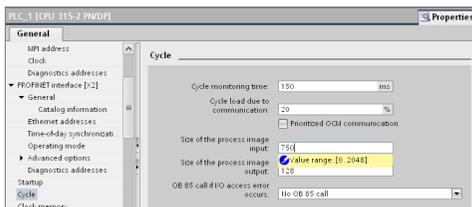
• Modifying [Size of the process image input] may affect the scan time of the PLC. Conduct a thorough verification before the operation.

Setting the Siemens SIMATIC Manager

This following explains the setting method when using SIMATIC Manager.

1 **Launch [SIMATIC Manager] with the PC and CPU connected, and then select [New] from the [File] menu.**

2 **Enter the project name into the [Name] field, and then click the [OK] button.**
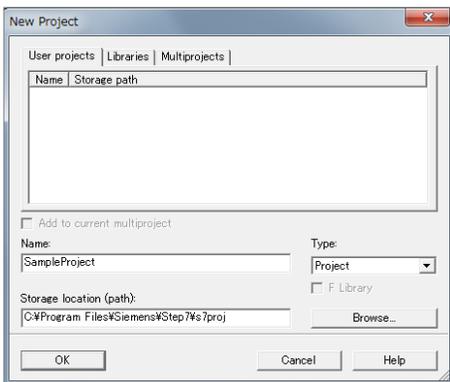
3 **Right click the project name in the Object Hierarchy in [SIMATIC Manager], and then select [Insert New Object] - [SIMATIC 300 Station].**
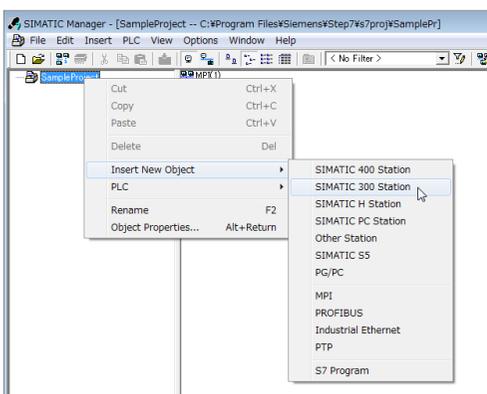
[SIMATIC 300] will be added.

4 **Expand [Object Hierarchy] and select [SIMATIC 300], and then double-click [Hardware].**
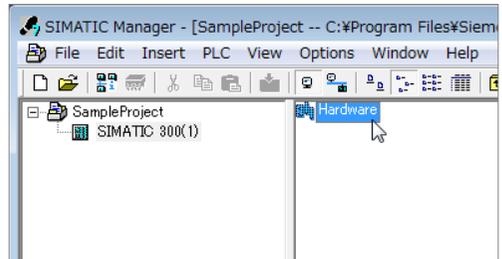
The [HW Config] window will appear.

5 **Expand [SIMATIC] - [RACK-300] from [Hardware Catalog], and then drag & drop [Rail] onto the Station Window.**
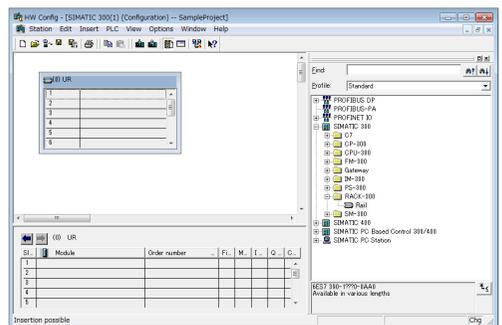
"Rail" will be added to the Station window.

6 **Drag & drop the CPU to be connected from [Hardware Catalog] and add it to the hardware configuration diagram.**
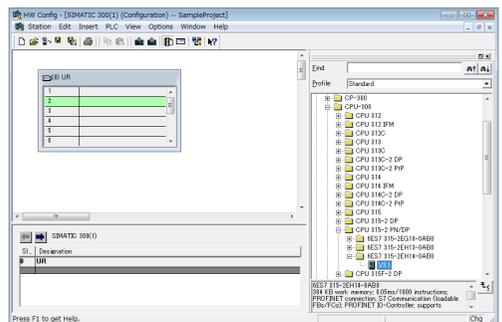
The [Properties-Ethernet interface PN-IO] window will appear.

5

Data I/O communication

7 **Set the IP address and subnet mask of the CPU, and then click the [New] button.**
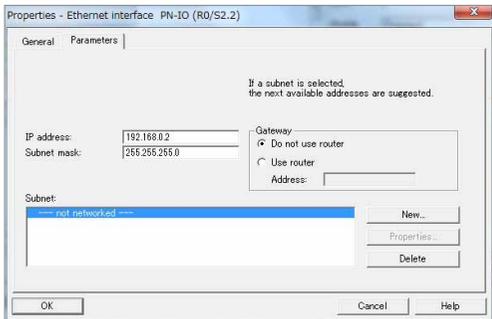
The [Properties-New subnet Industrial Ethernet] window will appear.

8 **Click the [OK] button to return to the [Properties-Ethernet interface PN-IO] window.**
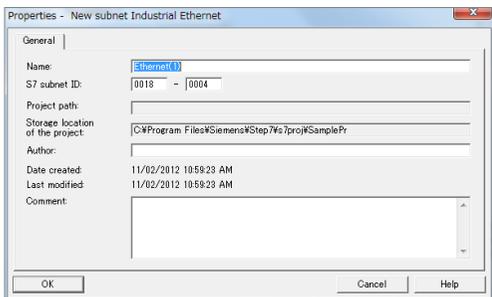
9 **Click the [OK] button.**

10 **Install the GSDML file if you are configuring the IV/IV-G series for the first time.**
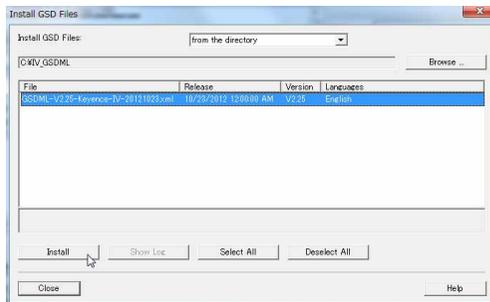
- Select [Options] - [Install GSD File] in the [HW Config] window.
- Click the [Browse] button in the [Install GSD File] window and specify the folder containing the GSDML file.
- Select the GSDML file for the IV/IV-G series you wish to install, and then click the [Install] button.

Reference

The GSDML file for the IV/IV-G series can be downloaded from the KEYENCE web site.
http: //www.keyence.co.jp

11 **Open [PROFINET IO] - [Additional Field Devices] - [Sensors] - [Keyence Vision Sensors] from [Hardware Catalog] in the [HW Config] window, and then drag & drop [IV-xxxx] onto [PROFINET-IO-System] in the Station Window.**

If the IV-G series is used, drag and drop;
• IV-G Main Unit for [IV-G10]
• IV-G Expansion Unit for [IV-G15]
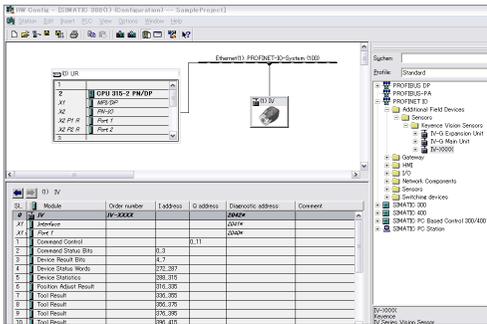
The IV/IV-G series will be added to the Station Window; and all modules available for the IV/IV-G series will be added automatically.

Reference

If [PROFINET-IO-System] is not displayed on the Station Window, right-click [PN-IO] of the CPU and select [Insert PROFINET IO System].
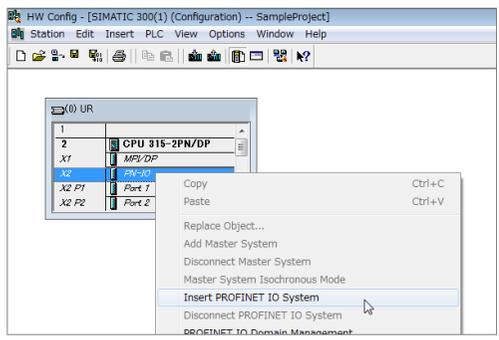
12 **Double-click the IV/IV-G series icon in the [HW Config] window.**

The [Properties - IV/IV-G series] window will appear.

13 **Enter the same character string as the PROFINET device name of the IV/IV-G series to be connected into the [Device name] field.**
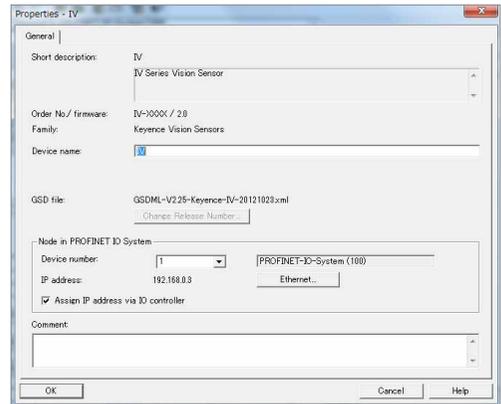
14 **Click the [Ethernet] button.**

The [Properties - Ethernet interface IV/IV-G series] window will appear.

15 **Enter the IP address for the IV/IV-G series to be connected into the [IP address] field.**
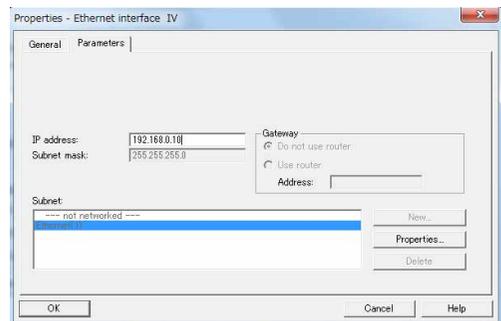
16 **Click the [OK] button to return to the [HW config] window.**

5

Data I/O communication

17 **Select [Station] - [Save and Compile] in the [HW Config] window, and save the settings.**

18 **Select [PLC] - [Download] in the [HW Config] window to download the settings to the CPU.**

19 **Set the CPU mode switch to "RUN".**
If the connection is successful, the RUN LED of the CPU will light in green and the data I/O communication will become enabled.

> ✎ **Point**
>
> • By default, [Size of the process-image input area] is set to "128".
> To be able to access the addresses after address 128, expand the setting as shown below.
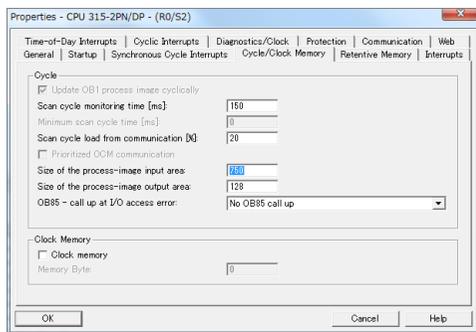
> • Modifying [Size of the process-image input area] may affect the scan time of the PLC. Make sure to conduct a thorough verification before the operation.

MEMO

Data allocations in the data I/O communication

The PROFINET communication for the IV/IV-G series is defined using the following modules:

- Command Control Module
- Command Status Bits Module
- Device Result Bits Module
- Device Status Words Module
- Device Statistics Module
- Position Adjust Result Module
- Tool Result Module

Control Modules (PLC → IV/IV-G series)

Control Modules are modules that write instructions from the PLC to the IV/IV-G series.

The device map of the data allocated for the Control Modules is as shown below.

These parameters are responsible for the control instructions for the IV/IV-G series, clearing of warnings and handshake control.

For details of each parameter, refer to ☐ "Control Modules parameter details" (Page 5-20).

■ Command Control

Slot No.: 1

Module size: 12 bytes

Address	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	Reserved by system		Buffer clear request	Statistics reset request	Warning clear request	Program switching request	Master registration request	Trigger request
1	Reserved by system							
2	Reserved by system							Result acquisition complete notification
3	Reserved by system							
4 - 5	Program No.							
6 - 11	Reserved by system							

Status Modules (IV/IV-G series → PLC)

Status Modules are modules that write responses from the IV/IV-G series to the PLC.

The device map of the data allocated for the Status Modules is as shown below.

These parameters output the statuses, status results and statistics information of the IV/IV-G series.

For details of each parameter, refer to 📖 "Status Modules parameter details" (Page 5-22).

■ Command Status Bits

Slot No.: 2
Module size: 4 bytes

Address	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	Reserved by system		Buffer clear response	Statistics reset response	Warning clear response	Program switching response	Master registration response	Trigger response
1	Reserved by system					Program switching failed	Master registration failed	Trigger failed
2	Reserved by system		Ready	RUN	Imaging status	BUSY	Result update complete	Result available
3	Error	Warning	Buffer overrun	Reserved by system				

■ Device Result Bits

Slot No.: 3
Module size: 4 bytes

Address	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	Reserved by system	Overall judgment NG	LOGIC4	LOGIC3	LOGIC2	LOGIC1	Position correction	Overall judgment
1	Reserved by system							
2	Tool 8	Tool 7	Tool 6	Tool 5	Tool 4	Tool 3	Tool 2	Tool 1
3	Tool 16	Tool 15	Tool 14	Tool 13	Tool 12	Tool 11	Tool 10	Tool 9

■ Device Status Words

Slot No.: 4

Module size: 16 bytes

Address	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0 - 1	Error No. (Unsigned 16-bit data)							
2 - 3	Warning No. (Unsigned 16-bit data)							
4 - 5	Number of remaining buffers (Unsigned 16-bit data)							
6 - 7	Checksum (Unsigned 16-bit data)							
8 - 9	Current program No. (Unsigned 16-bit data)							
10 - 11	Program No. during judgment (Unsigned 16-bit data)							
12 - 13	Result No. (Unsigned 16-bit data)							
14 - 15	Processing time (Unsigned 16-bit data)							

■ Device Statistics

Slot No.: 5

Module size: 28 bytes

Address	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0 - 1	Processing time MAX (Unsigned 16-bit data)							
2 - 3	Processing time MIN (Unsigned 16-bit data)							
4 - 5	Processing time AVE (Unsigned 16-bit data)							
6 - 7	Reserved by system							
8 - 11	Number of triggers (Unsigned 32-bit data)							
12 - 15	Number of OKs (Unsigned 32-bit data)							
16 - 19	Number of NGs (Unsigned 32-bit data)							
20 - 23	Number of trigger errors (Unsigned 32-bit data)							
24 - 27	Reserved by system							

5

Data I/O communication

Tool Result Modules (IV/IV-G series→ PLC)

Tool Result Modules are modules that write responses from the IV/IV-G series to the PLC.

The device map of the data allocated for the Tool Result Modules is as shown below.

Stores the matching rate and threshold information of the position correction and other tools.

For details of each parameter, refer to 📖 "Tool Result Modules parameter details" (Page 5-28).

■ Position Adjust Result

Slot No.: 6

Module size: 20 bytes

Address	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0 - 1	Position correction score (Unsigned 16-bit data)							
2 - 3	Position correction score MAX (Unsigned 16-bit data)							
4 - 5	Position correction score MIN (Unsigned 16-bit data)							
6 - 7	Position correction score Lower threshold (Unsigned 16-bit data)							
8 - 19	Reserved by system							

■ Tool Result

Slot No.: 7 to 22

Module size: 20 bytes

Address	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0 - 1	Tool score (Unsigned 16-bit data)							
2 - 3	Tool score MAX (Unsigned 16-bit data)							
4 - 5	Tool score MIN (Unsigned 16-bit data)							
6 - 7	Tool lower threshold (Unsigned 16-bit data)							
8 - 9	Tool upper threshold (Unsigned 16-bit data)							
10 - 19	Reserved by system							

Control Modules parameter details

■ Command Control Address 0 to 1: Control request

The Bits at Address 0 to 1 of the Command Control have the following functions:

Address	Bit	Item	Content	Data content
0	0	Trigger request	Requests the external trigger.	0 : OFF 1 : ON
	1	Master image registration request	Requests a master image registration.	0 : OFF 1 : ON
	2	Program switching request	Requests a program switching.	0 : OFF 1 : ON
	3	Warning clear request	Requests a warning clear.	0 : OFF 1 : ON
	4	Statistics reset request	Requests a statistics reset.	0 : OFF 1 : ON
	5	Buffer clear request	Requests a buffer clear.	0 : OFF 1 : ON
	6 to 7	Reserved by system	---	---
1	0 to 7	Reserved by system	---	---

Reference

The following will occur when a buffer clear is requested:

- If handshake control is [Enabled]
  - The current status result will be cleared.
  - The status result in the buffer will be cleared.
  - The result available bit will become OFF (0).
  - The number of remaining buffers will become "10".
- If handshake control is [Disabled]
  - The current status result will be cleared.
  - The result available bit will become OFF (0).
- If you are switching programs using the PROFINET communication, set the [Switching method] option to [Monitor/PC]. For details of the setting, Refer to the "IV/IV-G Series User's Manual (Monitor / PC Software)".
- Buffer overrun and warning statuses will not be cleared even if you execute a buffer clear request.

■ Command Control Address 2 to 3: Handshake control

The Bits at Address 2 to 3 of the Command Control have the following functions:

Address	Bit	Item	Content	Data content
2	0	Result acquisition complete notification	Permits the updating of the status result.	0 : OFF 1 : ON
	1 to 7	Reserved by system	---	---
3	0 to 7	Reserved by system	---	---

Reference

A result acquisition completion notice is used when handshake control is [Enabled].
Updating of the status result will be permitted when you request a result acquisition completion notice.
For details, refer to 📖 "Reading out the overall status result of the IV/IV-G series (Handshake control [Enabled])" (Page 5-34).

■ Command Control Address 4 to 11: Program No.

The Bits at Address 4 to 11 of the Command Control have the following functions:

Address	Bit	Item	Content	Data content
4 to 5	UINT	Program No.	Stores the program No. when a program switching is requested.	0 to 31
6 to 11	---	Reserved by system	---	---

5

Data I/O communication

Status Modules parameter details

■ Command Status Bits Address 0: Control result (response)

The Bits at Address 0 of the Command Status Bits have the following functions:

Address	Bit	Item	Content	Data content
0	0	Trigger response	Stores the external trigger response.	0 : OFF 1 : ON
	1	Master image registration response	Stores the master image registration response.	0 : OFF 1 : ON
	2	Program switching response	Stores the program switching response.	0 : OFF 1 : ON
	3	Warning clear response	Stores the warning clear response.	0 : OFF 1 : ON
	4	Statistics reset response	Stores the statistics reset response.	0 : OFF 1 : ON
	5	Buffer clear response	Stores the buffer clear response.	0 : OFF 1 : ON
	6 to 7	Reserved by system	---	---

■ Command Status Bits Address 1: Control error result

The Bits at Address 1 of the Command Status Bits have the following functions:

Address	Bit	Item	Content	Data content
1	0	Trigger failed	This bit is output when the external trigger is unsuccessful.	0 : - 1 : The external trigger has failed.
	1	Master image registration failed	This bit is output when the master image registration is unsuccessful.	0 : - 1 : Master image registration has failed.
	2	Program switching failed	This bit is output when the program switching is unsuccessful.	0 : - 1 : Program switching has failed.
	3 to 7	Reserved by system	---	---

■ Command Status Bits Address 2 to 3: Handshake control/status/error result

The Bits at Address 2 to 3 of the Command Status Bits have the following functions:

Address	Bit	Item	Content	Data content
2	0	Result available	This bit is output when the status result can be acquired.	0 : The status result cannot be acquired. 1 : The status result can be acquired.
	1	Result update complete	This bit switches the ON/OFF statuses when the status result is updated.	0 <=> 1: The statuses will be switched when the status result is updated.
	2	BUSY	This bit is output when the unit is unable to accept new trigger inputs, such as while performing imaging, processing a judgment, registering an external master image, switching programs, etc.	0 : The unit is not in busy status. 1 : The unit is in busy status.
	3	Imaging	This bit is output while the unit is performing imaging operation.	0 : The unit is not performing imaging operation. 1 : The unit is performing imaging.
	4	RUN	This bit is output when the unit is "RUN" and no system errors have occurred.	0 : The unit is not in operation. 1 : The unit is operating normally.
	5	Ready	This bit is output when the start-up sequence of this unit completes after power-on.	0 : The start-up has not completed yet. 1 : The start-up has completed.
	6 to 7	Reserved by system	---	---
3	0 to 4	Reserved by system	---	---
	5	Buffer overrun status	If handshake control is [Enabled], this bit is output when an overrun of the status result has occurred.	0 : No buffer overrun has occurred. 1 : The buffer is in overrun status.
	6	Warning status	This bit outputs the warning status of the unit.	0 : The unit is not in warning status. 1 : The unit is in warning status.
	7	Error status	This bit outputs the error status of the unit.	0 : The unit is not in error status. 1 : The unit is in error status.

Reference

- By monitoring whether the unit is in "Imaging" status, you can determine whether the target object or the unit can be moved before completion of the image processing.
- "BUSY" and "Imaging" statuses may be skipped in some data I/O cycle settings. It is therefore necessary to take the imaging condition into consideration when setting the cyclic frequency.
- Warning statuses can be cleared from the PROFINET communication. For the warning details, refer to the warning code. The first occurred warning code will be displayed.
- When two or more warnings are issued, all subsequent warnings after the first warning will be saved in the history. If you clear the warnings, the warning code of the highest priority warning will be displayed.

- Error statuses cannot be cleared from the PROFINET communication. For the error details, refer to the error code. The error code of the highest priority error will be displayed.
- The buffer overrun status can be cleared using a warning clear.

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Data I/O communication

■ Device Results Bits Address 0 to 3: Status result

The Bits at Address 0 to 3 of the Device Results Bits have the following functions:

Address	Bit	Item	Content	Data content
0	0	Overall judgment	Displays the overall status result.	0 : NG 1 : OK
	1	Position correction	Displays the position correction result.	0 : NG 1 : OK
	2	Logic 1	Displays the result of Logic 1.	0 : NG 1 : OK
	3	Logic 2	Displays the result of Logic 2.	0 : NG 1 : OK
	4	Logic 3	Displays the result of Logic 3.	0 : NG 1 : OK
	5	Logic 4	Displays the result of Logic 4.	0 : NG 1 : OK
	6	Overall judgment NG*	Displays the "total status result is NG".	0 : NG 1 : OK
	7	Reserved by system	---	---
1	0 to 7	Reserved by system	---	---
2	0	Tool 1	Displays the result of Tool 1.	0 : NG 1 : OK
	1	Tool 2	Displays the result of Tool 2.	0 : NG 1 : OK
	2	Tool 3	Displays the result of Tool 3.	0 : NG 1 : OK
	3	Tool 4	Displays the result of Tool 4.	0 : NG 1 : OK
	4	Tool 5	Displays the result of Tool 5.	0 : NG 1 : OK
	5	Tool 6	Displays the result of Tool 6.	0 : NG 1 : OK
	6	Tool 7	Displays the result of Tool 7.	0 : NG 1 : OK
	7	Tool 8	Displays the result of Tool 8.	0 : NG 1 : OK
3	0	Tool 9	Displays the result of Tool 9.	0 : NG 1 : OK
	1	Tool 10	Displays the result of Tool 10.	0 : NG 1 : OK
	2	Tool 11	Displays the result of Tool 11.	0 : NG 1 : OK
	3	Tool 12	Displays the result of Tool 12.	0 : NG 1 : OK
	4	Tool 13	Displays the result of Tool 13.	0 : NG 1 : OK
	5	Tool 14	Displays the result of Tool 14.	0 : NG 1 : OK
	6	Tool 15	Displays the result of Tool 15.	0 : NG 1 : OK
	7	Tool 16	Displays the result of Tool 16.	0 : NG 1 : OK

*
• When the IV-150/IV-500/IV-2000 sensor is used:
  The sensor of version 3.00.00 or later can be used.
• When the IV-G150/IV-G300/IV-G500/IV-G600 sensor is used:
  Any sensor can be used regardless of the version of the sensor.

Reference

• If the position correction/logic/tool is not set, the data content will be "0".

• If the status result of the tool is either "trigger standby" (no judgment) or "judgment not possible", the data content will be OFF (0).

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Data I/O communication

■ Device Status Words Address 0 to 15: Error/status/status result information

The Bits at Address 0 to 15 of the Device Status Words have the following functions:

Address	Data type*	Item	Content	Data content
0 to 1	WORD	Error code	Displays the currently occurring error code.	0 to 128
2 to 3	WORD	Warning code	Displays the currently occurring warning code.	0 to 128
4 to 5	WORD	Number of remaining buffers	Displays the number of status results that can be buffered, if handshake control is [Enabled].	0 to 10
6 to 7	WORD	Checksum	Displays the current sensor setting status using an arbitrary 5-digit integer.	0 to 65535
8 to 9	WORD	Current program No.	Displays the current program No.	0 to 31
10 to 11	WORD	Program No. during judgment	Displays the program No. of the latest judgment process.	0 to 31
12 to 13	WORD	Result No.	Displays the judgment process counts.	0 to 32767
14 to 15	WORD	Processing time	Displays the processing time of the latest judgment process.	0 to 10000

*   WORD :   Unsigned 16-bit integer
     DWORD :   Unsigned 32-bit integer

Reference

- The unit of processing time is msec.
- If two or more errors are occurring at the same time, the error code of the highest priority error will be displayed.
  ☐ "Error code list" (Page 5-29)
- The first occurred warning code will be displayed.
  ☐ "Warning code list" (Page 5-30)
- A checksum can be used to monitor whether the sensor settings have been modified by a third party.
- The checksum will remain unchanged even if you switch programs.
- The checksum will remain unchanged even if you change the IP address, subnet mask, default gateway or port number of the IV/IV-G series.
- For the number of remaining buffers, refer to ☐ "Reading out the overall status result of the IV/IV-G series (Handshake control [Enabled])" (Page 5-34).
- The upper limit value of the result No. is 32767. If the maximum value is exceeded, it will go back to 0 and start counting up again.
- The result No. will also count the judgment process counts that were skipped due to the real-time communication cycle setting.

■ Device Statistics Address 0 to 27 (Statistics information)

The Bits at Address 0 to 27 of the Device Statistics have the following functions:

Address	Data type*	Item	Content	Data content
0 to 1	WORD	Processing time MAX	Displays the maximum processing time value.	0 to 10000
2 to 3	WORD	Processing time MIN	Displays the minimum processing time value.	0 to 10000
4 to 5	WORD	Processing time AVE	Displays the average processing time value.	0 to 10000
6 to 7	---	Reserved by system	---	---
8 to 11	DWORD	Number of triggers	Displays the total number of triggers issued.	0-999999999
12 to 15	DWORD	Number of OKs	Displays the total number of triggers issued whose overall status result was "OK".	0-999999999
16 to 19	DWORD	Number of NGs	Displays the total number of triggers issued whose overall status result was "NG".	0-999999999
20 to 23	DWORD	Number of trigger errors	Number of triggers issued that generated a trigger error	0-999999999
24 to 27	---	Reserved by system	---	---

*   WORD :   Unsigned 16-bit integer
    DWORD :   Unsigned 32-bit integer

Reference
- The unit of processing time is msec.
- The maximum number of triggers is 999999999. If the maximum value is exceeded, it will go back to 0 and start counting up again.
- The maximum value for the number of OK triggers, number of NG triggers, and the number of trigger errors is 999999999. The value will stop updating when the upper limit value is reached.
- A reset will occur in the following conditions:
    - When [Statistics reset] is input
    - When a tool is added/deleted/copied
    - When the enable/disable status of the upper threshold value for the color area/area tool or the setting scale has been changed via user operation or tool auto-tuning
    - When a tool auto-tuning is started with two or more tools other than the position correction tool set
    - When the sensor is switched OFF
    - When the program is switched
    - When a correction for the sensor is started
    - When the sensor is initialized

Tool Result Modules parameter details

■ Position Adjust Result Address 0 to 19 (Position correction information)

The Bits at Address 0 to 19 of the Position Adjust Result have the following functions:

Address	Data type*	Item	Content	Data content
0 to 1	WORD	Position correction tool matching rate	Stores the matching rate of the position correction tool.	0 to 100
2 to 3	WORD	Position correction tool Matching rate MAX	Stores the maximum matching rate value of the position correction tool.	0 to 100
4 to 5	WORD	Position correction tool Matching rate MIN	Stores the minimum matching rate value of the position correction tool.	0 to 100
6 to 7	WORD	Position correction tool Threshold value	Stores the threshold value of the position correction tool.	0 to 100
8 to 19	---	Reserved by system	---	---

*   WORD :   Unsigned 16-bit integer
    DWORD :   Unsigned 32-bit integer

Reference

Maximum and minimum matching rate values of the position correction tool will be reset in the same manner as the statistics information.

■ Tool Result Address 0 to 19 (Tool information)

The Bits at Address 0 to 19 of the Tool Result have the following functions:

Address	Data type*	Item	Content	Data content
0 to 1	WORD	Tool 1 matching rate	Stores the matching rate of Tool 1.	0 to 999
2 to 3	WORD	Tool 1 matching rate MAX	Stores the maximum matching rate value of Tool 1.	0 to 999
4 to 5	WORD	Tool 1 matching rate MIN	Stores the minimum matching rate value of Tool 1.	0 to 999
6 to 7	WORD	Tool 1 lower limit value	Stores the lower threshold value of Tool 1.	0 to 999
8 to 9	WORD	Tool 1 upper limit value	Stores the upper threshold value of Tool 1.	0 to 999
10 to 19	---	Reserved by system	---	---

*   WORD :   Unsigned 16-bit integer
    DWORD :   Unsigned 32-bit integer

Thereafter, the information of tool 2, 3, ... 16 will be assigned for each 20-byte Address of "Tool Result".

Reference

• Maximum and minimum matching rate values of the tool will be reset in the same manner as the statistics information.

• If the upper threshold value of the tool is not set, the data content of the tool's upper limit value will be "65535".

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Data I/O communication

Error code list

The following shows the list of error codes that are generated in the IV/IV-G series.

Error code	Content	Cause	Countermeasure
0	No error	---	---
1 - 32	Program No. xx corruption error	• A data error has occurred in program No. xx. • The data corruption may have occurred due to a power-off while writing settings data and/or due to noise.	• Initialize the program No. xx. • Switch on the power back ON. • Do not switch off the unit while the settings are being saved. • If the error persists, contact your nearest KEYENCE office.
75	Non-volatile memory error (EEPROM)	• A data error has occurred. • The data corruption may have occurred due to a power-off while writing settings data and/or due to noise.	• Initialize the settings of this unit. • Switch on the power back ON. • Do not switch off the unit while the settings are being saved. • If the error persists, contact your nearest KEYENCE office.
76	Non-volatile memory error (FLASHROM)		
81-128	System error	An error may have occurred in the sensor.	• Switch on the power back ON. • If the error persists, contact your nearest KEYENCE office.

*   When the IV-G series sensor is used, error code 124 will be displayed if the sensor head is not connected to the sensor amplifier.

Reference

• If two or more errors are occurring at the same time, the error code of the highest priority error will be displayed.
• Greater the error code, higher the priority of the error will be.

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Data I/O communication

Warning code list

The following shows the list of warning codes that are generated in the IV/IV-G series.

Warning code	Content	Cause	Countermeasure
0	No error	---	---
62	Field network overrun error	An overrun of the status result has occurred.	Request a result acquisition completion notice to permit the updating of the status result.
63	Field network bad request error (Master registration)	External master registration has been requested from PROFINET while the unit is in "Setting" status.	Do not request an external master registration while the unit is in "Setting" status.
64	Field network bad request error (Program switching)	• Program switching has been requested from PROFINET while the unit is in "Setting" status. • A program switching request to a non-existent program No. was made from PROFINET. • A program switching requested was made from PROFINET while the program switching method was set to [External input].	• Do not request a program switching while the unit is in "Setting" status. • The program No. should be set in the range between 0 and 31. • If you are switching programs from PROFINET, set the program switching via external input to [Disabled].
65	Trigger error	A trigger has been input while the unit was in busy status. (If you have set the trigger error option to [Enabled])	Do not input triggers while the unit is in busy status.
66	External master registration error (Insufficient outline)	The outline tool is unable to extract the outline of the new master image.	• Check if there are any problems with the registered image and the detection tool or the position correction setting. • Adjust the brightness of the image to be registered.
67	External master registration error (Insufficient area)	The color area/area tool is unable to extract the area of the new master image.	
68	External master registration error (Brightness correction failed)	The brightness of the new master image cannot be corrected appropriately.	

Warning code	Content	Cause	Countermeasure
70	FTP Transfer Error (Insufficient Data Buffer)	The transfer has failed because a volume of data exceeding the remaining FTP buffer capacity has been generated.	• Modify the trigger cycle of this unit. • Check the load status of the network.
71	FTP Transfer Error (Transfer Failed)	The data transfer to the destination folder has failed.	Check the access permissions of the destination folder.
72	FTP connection error	Connection to the FTP server has failed.	• Check the IP address of the FTP server. • Check the port number of the FTP server. • Check the user name for logging into the FTP server. • Check the password for logging into the FTP server.
73	External master registration error (Insufficient work memory)	There is insufficient work memory.	Delete one or more detection tools.
74	External master registration error (No images)	There are no registered images for master registration.	Perform the master image registration after having captured the image to be used for the registration.

Reference

• When two or more warnings are issued, all subsequent warnings after the first warning will be saved in the history. If you clear the warnings, the warning code of the highest priority warning will be displayed.

Warning

Warning clear

Warning No.   0   Warning code 1   0   Warning code 2

• Greater the warning code, higher the priority of the warning will be.

Operating procedure of the data I/O communication

This section explains the method for communicating from the PLC to the IV/IV-G series using data I/O communication.

Reading out the overall status result of the IV/IV-G series (Handshake control [Disabled])

■ When a trigger is successful

(1) Execute a [Trigger request]. (0 → 1)
(2) If the trigger is valid, [Trigger response] will change from 0 to 1.
(3) [BUSY] will change from 0 to 1 when a trigger is input.
(4) [BUSY] will change from 1 to 0 when the judgment process ends.
At this time, the [Result update complete] BIT will be switched and [Overall judgment] will be updated.

Reference

• [Result update complete] will switch to "1" if its value was "0" after the previous judgment update (or from "0" to "1" if the previous value was "1").
• [Result available] will switch from 0 to 1 at the timing when the first judgment process has been confirmed; and the new value will be retained thereafter.
• [Result available] will be reset in the following conditions:
  • If handshake control is set to [Disabled]
    - When the program is switched
    - When the unit's status is switched from "Setting" to "RUN"
    - When a buffer clear request is issued
  • If handshake control is set to [Enabled]
    - When a buffer clear request is issued
• [Result No.] will be counted up each time the status result is updated.
The upper limit value is 32767. If the maximum value is exceeded, it will go back to 0 and start counting up again.
• [Result No.] will also count the judgment process counts that were skipped due to the data I/O cycle setting.
• [BUSY] and [Imaging] may be skipped in some data I/O cycle settings. It is therefore necessary to take the imaging condition into consideration when setting the data I/O cycle.

■ When a trigger is unsuccessful
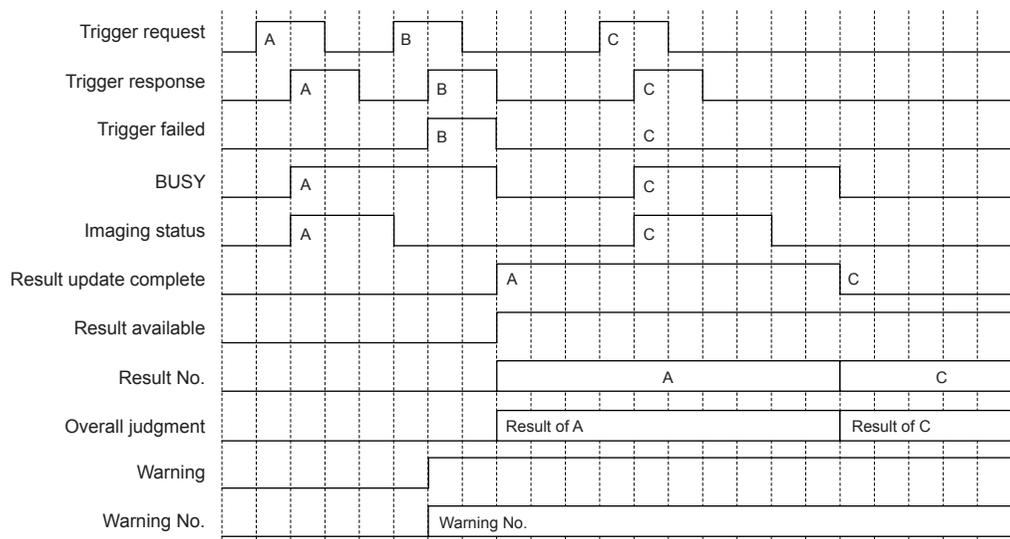
(1) Execute a [Trigger request]. (0 → 1)

(2) If the trigger is valid, the [Trigger response] will change from 0 to 1.

(3) [BUSY] will change from 0 to 1 when a trigger is input.

(4) [BUSY] will change from 1 to 0 when the judgment process ends.
     At this time, the [Result update complete] BIT will be switched and [Overall judgment] will be updated.

(5) If you wish to output trigger errors, set the trigger error option to [Enabled].
     If a trigger has been input while the trigger error option is set to [Enabled] and the unit is in "BUSY" status, [Trigger failed] will change from 0 to 1 ignoring the trigger input. No judgment process will be performed for trigger B.

(6) If the trigger input is unsuccessful, [Warning] will switch from "0" to "1" and [Warning No.] will be updated to "65". For details, refer to ▯ "Warning code list" (Page 5-30).

| Reference |

- [Result update complete] will switch to "1" if its value was "0" after the previous judgment update (or from "0" to "1" if the previous value was "1").
- [Result available] will switch from 0 to 1 at the timing when the first judgment process has been confirmed; and the new value will be retained thereafter.
- [Result No.] will be counted up each time the status result is updated.
  The upper limit value is 32767. If the maximum value is exceeded, it will go back to 0 and start counting up again.
- [Result No.] will also count the judgment process counts that were skipped due to the data I/O cycle setting.
- [BUSY] and [Imaging] may be skipped in some data I/O cycle settings. It is therefore necessary to take the imaging condition into consideration when setting the data I/O cycle.
- [Number of trigger errors] will be counted up at the timing when the [Result updated] BIT is switched.

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Data I/O communication

Reading out the overall status result of the IV/IV-G series (Handshake control [Enabled])

The following describes the operating procedure when the data handshake control is set to [Enabled].
You can acquire all status results without fail by setting the data handshake control to [Enabled].

(1) Execute a [Trigger request]. (0 → 1)
(2) If the trigger is valid, [Trigger response] will change from 0 to 1.
(3) [BUSY] will change from 0 to 1 when a trigger is input.
(4) [BUSY] will change from 1 to 0 when the judgment process ends.
   At this time, the [Result update complete] BIT will be switched, [Result available] will change from 0 to 1, and [Overall judgment] will be updated.
(5) [Number of remaining buffers] will be decremented by 1 when the status result is updated.
(6) Executes [Result acquisition complete notice] (0 → 1). [Number of remaining buffers] will be incremented by 1.

Reference

- [Result update complete] will switch to "1" if its value was "0" after the previous judgment update (or from "0" to "1" if the previous value was "1").
- [Result No.] will be counted up each time the status result is updated. The upper limit value is 32767. If the maximum value is exceeded, it will go back to 0 and start counting up again.
- [Result No.] will also count the judgment process counts that were skipped due to the data I/O cycle setting.
- [BUSY] and [Imaging] may be skipped in some data I/O cycle settings. It is therefore necessary to take the imaging condition into consideration when setting the data I/O cycle settings.
- [Number of trigger errors] will be counted up at the timing when the [Result updated] BIT is switched.
- If handshake control has been set to [Enabled], the status result will not be updated until [Result acquisition complete notice] is executed (0 → 1), even if the next trigger has been input and a judgment process has been executed.
- If a new trigger is input when [Number of remaining buffers] is "0", [Buffer overrun] will switch from "0" to "1". The status result from the new trigger will be ignored.
- [Buffer overrun] can be cleared using [Warning clear].

Switching the programs in the IV/IV-G series
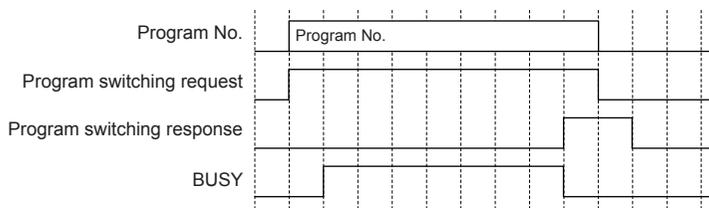
(1) Write the program No. to be set to [Program No.].
       For the write range setting, refer to 📖 "Control Modules parameter details" (Page 5-20).
(2) Execute [Program switching request]. (0 → 1)
(3) You can check the input status in [Program switching response].

Reference

- [BUSY] will change from 0 to 1 while the program switching is in progress.
- If the program switching fails, [Program switching failed] will change from "0" to "1".
- If the program switching is unsuccessful, [Warning] will switch from "0" to "1" and [Warning No.] will be updated to "64". For details, Refer to 📖 "Warning code list" (Page 5-30).
- You cannot switch programs from the PROFINET communication while the unit is in [Setting] status.
- If you are switching programs using the EtherNet/IP communication, set the [Switching method] option to [Monitor/PC]. For details of the setting, refer to the "IV/IV-G Series User's Manual (Monitor / PC Software)".

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Data I/O communication

Registering a master image for the IV/IV-G series externally

Master registration request
Master registration response
BUSY

(1) Execute a [Master registration request]. (0 → 1)

(2) You can check the input status in [Master registration response].

Reference

 • [BUSY] will change from 0 to 1 while the master image registration is in progress.

 • If the master image registration is unsuccessful, [Master registration failed] will change from 0 to 1.

 • If the master image registration is unsuccessful, [Warning] will switch from "0" to "1" and [Warning No.] will be updated according to the failure details. For details, refer to ▯ "Warning code list" (Page 5-30).

 • You cannot register a master image from the PROFINET communication while the unit is in "Setting" status.

 • If you wish to write the master registration data to the sensor ROM, set the [Write to ROM at external master reg.] option to [Yes]. For details of the setting, refer to the "IV/IV-G Series User's Manual (Monitor / PC Software)".

Appendices

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Reference program (EtherNet/IP)

This section introduces a reference program for when using EtherNet/IP communication in the IV/IV-G series.
In the actual operation, programming must be performed taking the error processing, etc. into consideration.

Handshake control [Disabled]

Keyence KV series
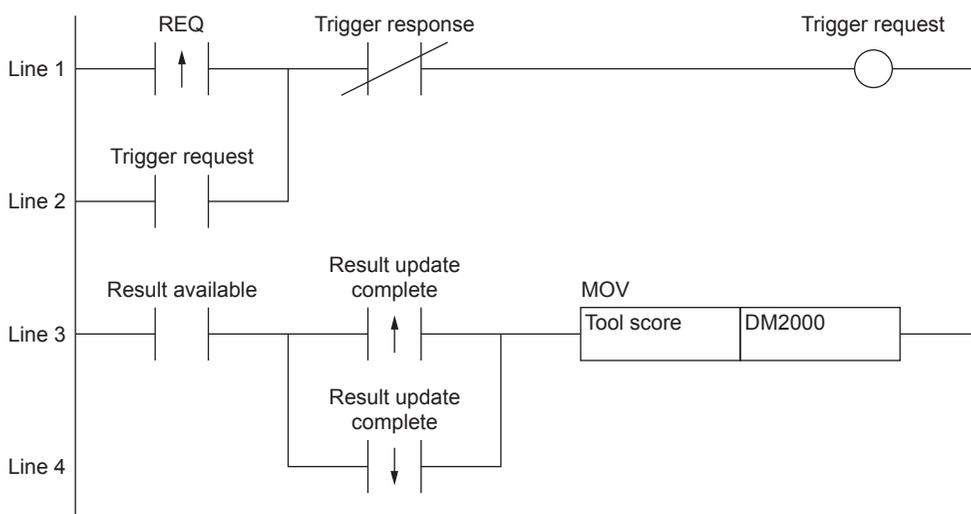
■ **Description of the reference program**

● **Line 1/Line 2**

Sets "REQ" to ON and executes a trigger request.
"Trigger response" ON will set "Trigger request" to OFF ("Trigger request" is retained until "Trigger response" is set to ON).

● **Line 3/Line 4**

"Result available" ON + Rising or falling of "Result update complete" will copy the data that have been written to the tool score to DM2000.

Rockwell Automation PLC
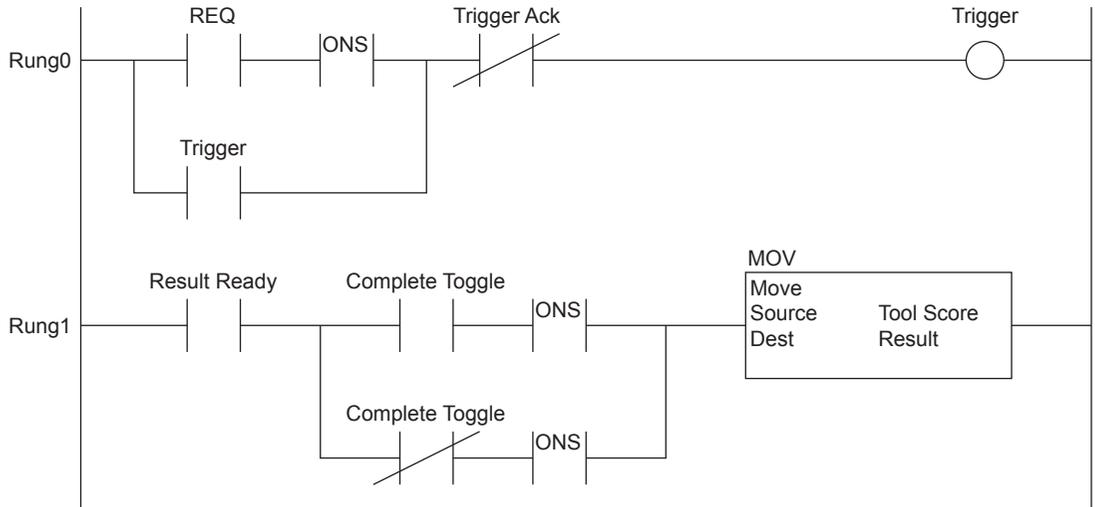
■ Description of the reference program

● Rung0

Sets "REQ" to ON and executes "Trigger".

"Trigger Ack" ON will set Trigger to OFF ("Trigger" will be retained until "Trigger Ack" becomes ON).

● Rung1

"Result Ready" ON + Rising or falling of "Complete Toggle" will copy the data that have been written to "Tool Score" to "Result".

> ✎ **Point**
>
> To ensure synchronicity between Input Data and Output Data, use the CPS instruction at the beginning of the ladder.

Handshake control [Enabled]

Keyence KV series
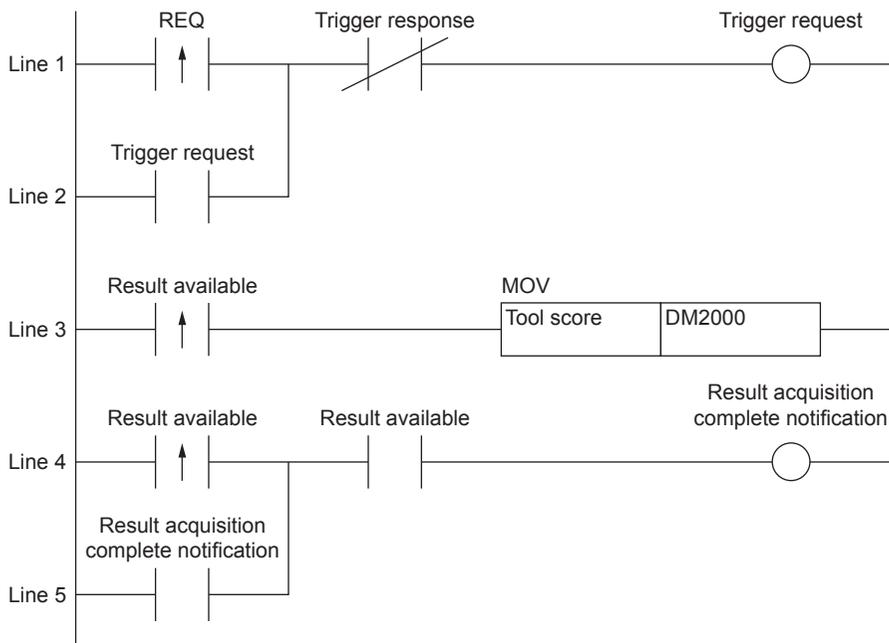
■ Description of the reference program

● Line 1/Line 2

Sets "REQ" to ON and executes a trigger request.

"Trigger response" ON will set "Trigger request" to OFF ("Trigger request" is retained until "Trigger response" is set to ON).

● Line 3

The result available bit becomes ON to copy the data written in the tool score to DM2000.

● Line 4/Line 5

"Result available" ON will execute a result acquisition completion notice.

"Result available" OFF will set "Result acquisition completion notice" to OFF ("Result acquisition completion notice" will be retained until "Result available" becomes OFF).

Rockwell Automation PLC
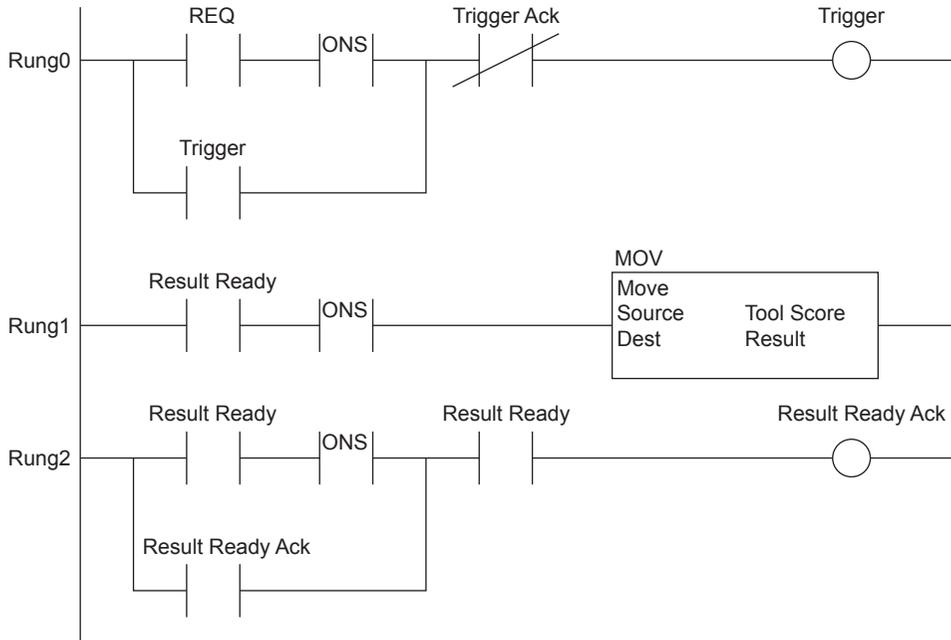
■ Description of the reference program

● Rung0

Sets "REQ" to ON and executes "Trigger".

"Trigger Ack" ON will set Trigger to OFF ("Trigger" will be retained until "Trigger Ack" becomes ON).

● Rung1

"Result Ready" ON will copy the data written in "Tool Score" to "Result".

● Rung2

"Result Ready" ON will execute "Result Ready Ack".

"Result Ready" OFF will set "Result Ready Ack" to OFF ("Result Ready Ack" will be retained until "Result Ready" becomes OFF).

✎ **Point**

To ensure synchronicity between Input Data and Output Data, use the CPS instruction at the beginning of the ladder.

Program switching

Keyence KV series
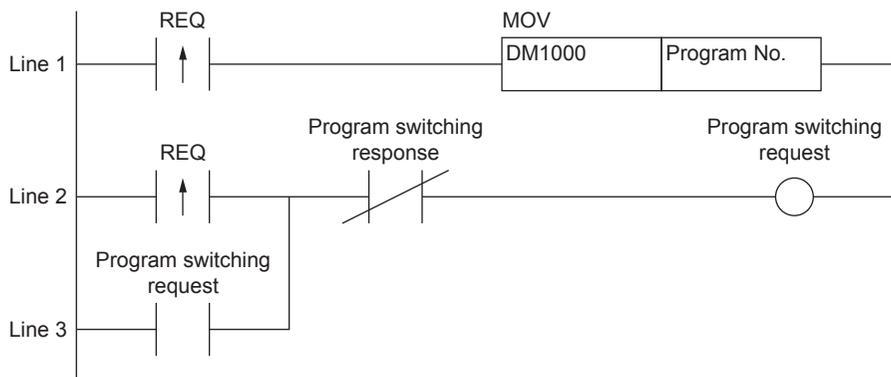
■ Description of the reference program

● Line 1

This line sets "REQ" to ON and copies the DM1000 data, which contains the program No. to be set, to the program No.

● Line 2/Line 3

Sets "REQ" to ON and executes a program switching request.
"Program switching response" ON to will set "Program switching request" to OFF ("Program switching request" will be retained until "Program switching response" becomes ON).

Rockwell Automation PLC
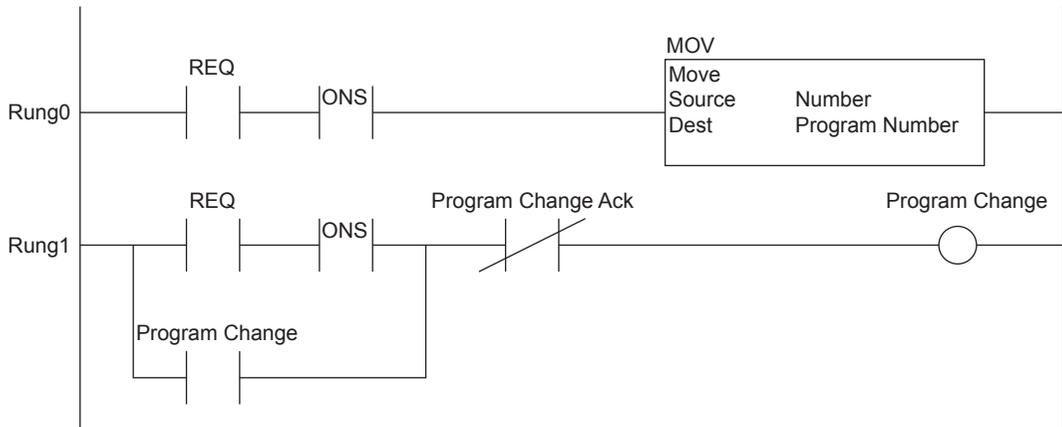
■ Description of the reference program

● Rung0

This line sets "REQ" to ON and copies the Number data, which contains the program No. to be set, to the program No.

● Rung1

Sets "REQ" to ON and executes "Program Change".
"Program Change Ack" ON will set "Program Change" to OFF ("Program Change" will be retained until "Program Change Ack" becomes ON).

Reference program (PROFINET)

This section introduces a reference program for when using the PROFINET communication in the IV/IV-G series.

In the actual operation, programming must be performed taking the error processing, etc. into consideration.

Handshake control [Disabled]

Siemens PLC
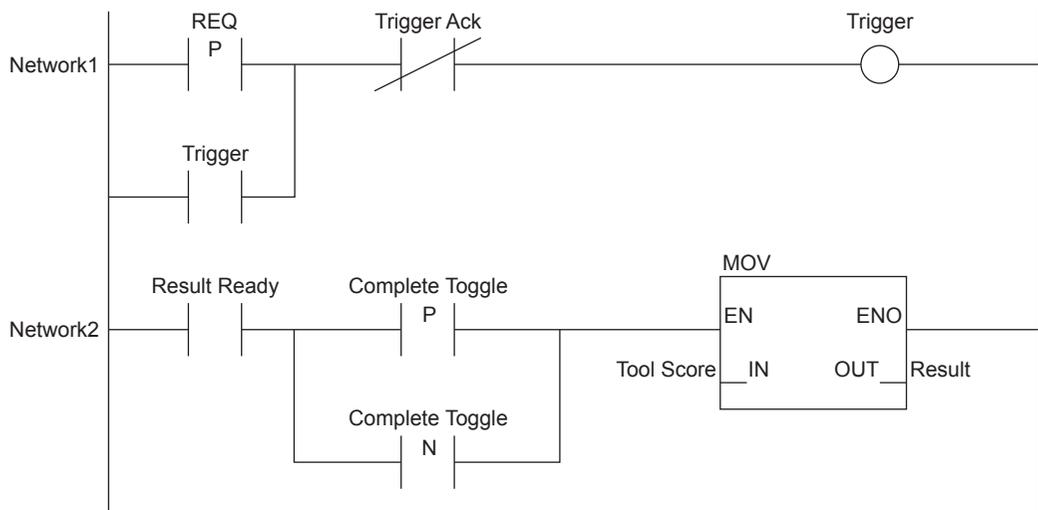
■ Description of the reference program

● Network1

Sets "REQ" to ON and executes "Trigger".

"Trigger Ack" ON will set "Trigger" to OFF ("Trigger" will be retained until "Trigger Ack" becomes ON).

● Network2

"Result Ready" ON + Rising or falling of "Complete Toggle" will copy the data that have been written to "Tool Score" to "Result".

Handshake control [Enabled]

Siemens PLC
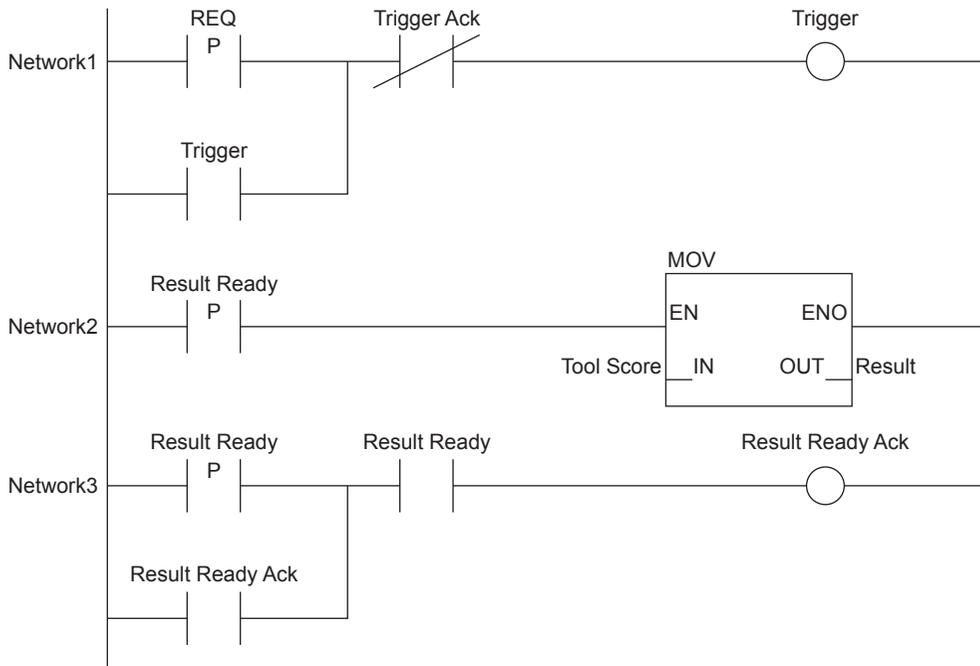
■ **Description of the reference program**

● **Network1**

Sets "REQ" to ON and executes "Trigger".

"Trigger Ack" ON will set "Trigger" to OFF ("Trigger" will be retained until "Trigger Ack" becomes ON).

● **Network2**

"Result Ready" ON will copy the data written in "Tool Score" to "Result".

● **Network3**

"Result Ready" ON will execute "Result Ready Ack".

"Result Ready" OFF will set "Result Ready Ack" to OFF ("Result Ready Ack" will be retained until "Result Ready" becomes OFF).

Program switching

Siemens PLC
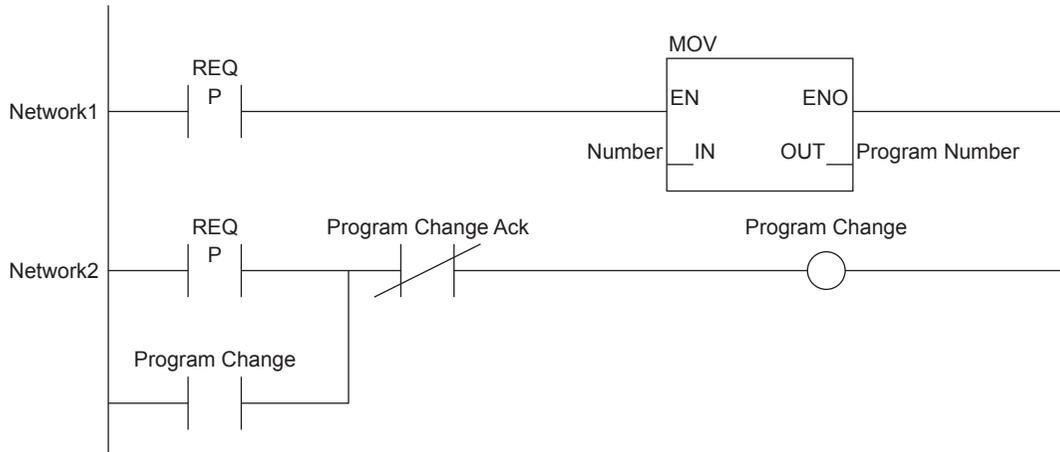
■ Description of the reference program

● Network1

This line sets "REQ" to ON and copies the Number data, which contains the program No. to be set, to the program No.

● Network2

Sets "REQ" to ON and executes "Program Change".

"Program Change Ack" ON will set "Program Change" to OFF ("Program Change" will be retained until "Program Change Ack" becomes ON).

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```
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Revision history

Revision history	Edition number	Revision details
December, 2012	1st edition	
December, 2013	2nd edition	Ethernet and Monitor cable changed
April, 2014	3rd edition	
Nobember, 2014	Revised 1st edition	Supported for IV-G Series
August, 2016	Revised 2nd edition	

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