MITSUBISHI ELECTRIC

FA Sensor

MELSENSOR

Vision Sensor VS20
User's Manual

-VS20M-11F310
-VS20M-12F410
-VS20M-13F410
-VS20C-12F410
-VS20C-13F410

Powered by

COGNEX

This product is designed and manufactured by Cognex Corporation.
*Note that the warranty and general specifications of this product
differ from that of programmable controller products.

COGNEX

PRECAUTIONS REGARDING WARRANTY AND SPECIFICATIONS

This product is designed and manufactured by Cognex Corporation. Note that the warranty and general specifications of this product differ from that of programmable controller products.

• Warranty

Item	Description
Free warranty period	18 months after delivery or 24 months after manufacture
Repair period after discontinuation of manufacture	7 years

• General specifications

Item	Specifications
Ambient operating temperature	0 to 40℃
Ambient storage temperature	-10 to 60℃
Maximum humidity	Less than 95% RH, non-condensing
Vibration resistance	IEC 60068-2-6: A vibration of 10 G (10 to 500 Hz at 100 m/s² with 15 mm width) was applied to each X, Y, and Z direction for 2 hours.
Shock resistance	IEC 60068-2-27: 1000 half sinusoidal shocks with 11 G in 10 ms were applied.
Operating atmosphere	There is no danger of corrosive gases, flammable gases, and strong alkaline substances to adhere.
Protective structure	IP65 (when all connectors are attached to cables or shielded by a sealing cap)
Installation location	Outside a control panel

CE

This section describes a summary of precautions when bringing into CE conformance the machinery formed by using the vision sensor.

Note that the descriptive content is material created based on regulation requirements and standards obtained by Mitsubishi Electric Corporation. However, machinery manufactured in accordance with this content is not necessarily guaranteed to conform with the above commands.

Final judgment regarding CE conformance or the method of conformance must be the judgment of the machinery manufacturer itself.

To meet the CE compliant conditions, implement the following items.

• Significant amount of noise on the power source may cause malfunction. Use a regulated DC power supply with an isolating transformer for the power supply. Additionally, install a noise filter (SNR-10-223 by COSEL or an equivalent product) between the vision sensor and the regulated DC power supply.

Precautions

Ground the FG terminal with the ground cable as short as possible (with the length of 30 cm or shorter).

• EMC application

Item	Description
EMC applicable standard	EN61131-2

SAFETY PRECAUTIONS

(Read these precautions before using this product.)

Before using this product, please read this manual and the relevant manuals carefully and pay full attention to safety to handle the product correctly.

The precautions given in this manual are concerned with this product only. For the safety precautions for other modules, refer to their respective user's manuals.

In this manual, the safety precautions are classified into two levels: "⚠ WARNING" and "⚠ CAUTION".

⚠ **WARNING**	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.

⚠ **CAUTION**	Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage.

Under some circumstances, failure to observe the precautions given under "⚠ CAUTION" may lead to serious consequences.

Observe the precautions of both levels because they are important for personal and system safety.

Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

[Installation Precautions]

⚠WARNING

- ● Before touching the vision sensor, be sure to touch an electric conductor such as grounded metal to discharge the static electricity from your body. Otherwise, damage or faulty operation of the vision sensor may occur.
- ● Be sure to install an I/O connector module to the main module. If not installed, dust or water-proof performance may not be obtained.

[Installation Precautions]

⚠CAUTION

- ● IP protection rating is guaranteed only when all the connectors are connected with cables or sealed with sealing caps.
- ● The cable is designed to connect with its key aligned with the keyway of the connector on the Vision Sensor. Do not force the connections or damage may occur.

[Wiring Precautions]

⚠CAUTION

- ● Use only 24 VDC and observe the indicated polarity. Otherwise, fire or damage may result.
- ● The frame ground terminal of the I/O module and the shield ground of each connector (RS232 OUT port and SENSOR port) are internally conducting. The system ground is designed on the condition that a ground connection is provided. The ground potential may affect the vision sensor and peripheral devices such as programmable controllers via cables. For safe operation, it is recommended to connect all the ground connections securely.

[Security Precautions]

⚠ WARNING

● To maintain the security (confidentiality, integrity, and availability) of the programmable controller and the system against unauthorized access, denial-of-service (DoS) attacks, computer viruses, and other cyberattacks from external devices via the network, take appropriate measures such as firewalls, virtual private networks (VPNs), and antivirus solutions.

[Startup and Maintenance Precautions]

⚠ CAUTION

● Do not clean the vision sensor with highly irritating or corrosive solvent such as caustic alkali solution, methyl ethyl ketone (MEK), and gasoline. Doing so may cause a fault.

[Disposal Precautions]

⚠ CAUTION

● When disposing of this product, treat it as industrial waste.

PRECAUTIONS FOR USE

Observe the following precautions when installing and operating the vision sensor, to reduce the risk of injury or equipment damage:

- This device requires the use of an LPS or NEC class 2 power supply.
- To reduce the risk of damage or malfunction due to over-voltage, line noise, electrostatic discharge (ESD), power surges, or other irregularities in the power supply, route all cables away from high-voltage power sources.
- Do not install the vision sensor where they are directly exposed to environmental hazards such as excessive heat, dust, moisture, humidity, impact, vibration, corrosive substances, flammable substances, or static electricity.
- Do not expose an image sensor to laser light; image sensors can be damaged by direct or reflected laser light.
  If your application requires the use of laser light that may strike the image sensor, a lens filter at the corresponding laser's wavelength is recommended.
  Consult your local system integrator or application engineer for suggestions.
- A vision sensor does not contain user-serviceable parts. Do not make electrical or mechanical modifications to a vision sensor.
  Any modification may void your warranty.
- Changes or modifications not expressly approved by the party responsible for regulatory compliance could void the user's authority to operate the equipment.
- Service loops (extra wire length) should be included with all cable connections.
- If the bend radius or service loop is smaller than 10 times of the cable diameter, the cable may cause cable shielding degradation, cable damage, or wear out in a short period.
  The bend radius must begin at least 152.4 mm from the connector.
- This equipment is a Class A device. Using this equipment in a domestic environment may cause radio disturbance. In this case, the user may be required to take appropriate measures.
- If there is concern about noise, set a noise filter (SNR-10-223, COSEL or an equivalent) between the vision sensor and the stabilized DC power supply.
- When using the vision sensor for the first time, update its firmware to the latest by using the latest In-Sight Explorer (vision sensor setup tool).

CONDITIONS OF USE FOR THE PRODUCT

(1)This vision sensor shall be used in conditions;

  i) where any problem, fault or failure occurring in the vision sensor, if any, shall not lead to any major or serious accident; and

  ii) where the backup and fail-safe function are systematically or automatically provided outside of the vision sensor for the case of any problem, fault or failure occurring in the vision sensor.

(2)This vision sensor has been designed and manufactured for the purpose of being used in general industries.

  MITSUBISHI ELECTRIC SHALL HAVE NO RESPONSIBILITY OR LIABILITY (INCLUDING, BUT NOT LIMITED TO ANY AND ALL RESPONSIBILITY OR LIABILITY BASED ON CONTRACT, WARRANTY, TORT, PRODUCT LIABILITY) FOR ANY INJURY OR DEATH TO PERSONS OR LOSS OR DAMAGE TO PROPERTY CAUSED BY THIS VISION SENSOR THAT ARE OPERATED OR USED IN APPLICATION NOT INTENDED OR EXCLUDED BY INSTRUCTIONS, PRECAUTIONS, OR WARNING CONTAINED IN MITSUBISHI ELECTRIC USER'S, INSTRUCTION AND/OR SAFETY MANUALS, TECHNICAL BULLETINS AND GUIDELINES FOR the VISION SENSOR.

  ("Prohibited Application")

  Prohibited Applications include, but not limited to, the use of the vision sensor in;

   Nuclear Power Plants and any other power plants operated by Power companies, and/or any other cases in which the public could be affected if any problem or fault occurs in the vision sensor.

   Railway companies or Public service purposes, and/or any other cases in which establishment of a special quality assurance system is required by the Purchaser or End User.

   Aircraft or Aerospace, Medical applications, Train equipment, transport equipment such as Elevator and Escalator, Incineration and Fuel devices, Vehicles, Manned transportation, Equipment for Recreation and Amusement, and Safety devices, handling of Nuclear or Hazardous Materials or Chemicals, Mining and Drilling, and/or other applications where there is a significant risk of injury to the public or property.

  Notwithstanding the above restrictions, Mitsubishi Electric may in its sole discretion, authorize use of the vision sensor in one or more of the Prohibited Applications, provided that the usage of the vision sensor is limited only for the specific applications agreed to by Mitsubishi Electric and provided further that no special quality assurance or fail-safe, redundant or other safety features which exceed the general specifications of the vision sensors are required. For details, please contact the Mitsubishi Electric representative in your region.

(3)Mitsubishi Electric shall have no responsibility or liability for any problems involving programmable controller trouble and system trouble caused by DoS attacks, unauthorized access, computer viruses, and other cyberattacks.

INTRODUCTION

Thank you for purchasing the Mitsubishi Electric FA sensor, MELSENSOR.

This manual describes the specifications, functions, system configuration, system construction, installation, maintenance and inspection, and troubleshooting to use the vision sensors listed below.

Before using the product, please read this manual and relevant manuals carefully, and develop familiarity with the functions and performance of the MELSENSOR vision sensor to handle the product correctly.

Please make sure that the end users read this manual.

Available vision sensors

Product name	Model
VS20	VS20M-11F310, VS20M-12F410, VS20M-13F410, VS20C-12F410, VS20C-13F410

CONTENTS

RELEVANT MANUALS

Manual name [manual number]	Description	Available form
Vision Sensor VS20 User's Manual [SH-081769ENG] (this manual)	Functions, installation methods, system configuration, and required hardware components, etc. of the vision sensor VS20	Print book e-Manual PDF
Vision Sensor Connection Guide [BCN-P5999-0861]	Procedures for connecting a vision sensor to a MELSEC programmable controller to control a vision system through a CC-Link IE Field Network Basic connection, an SLMP connection, an I/O connection, or an EtherNet/IP connection	e-Manual PDF

Point

e-Manual refers to the Mitsubishi Electric FA electronic book manuals that can be browsed using a dedicated tool.

e-Manual has the following features:

• Required information can be cross-searched in multiple manuals.

• Other manuals can be accessed from the links in the manual.

• Hardware specifications of each part can be found from the product figures.

• Pages that users often browse can be bookmarked.

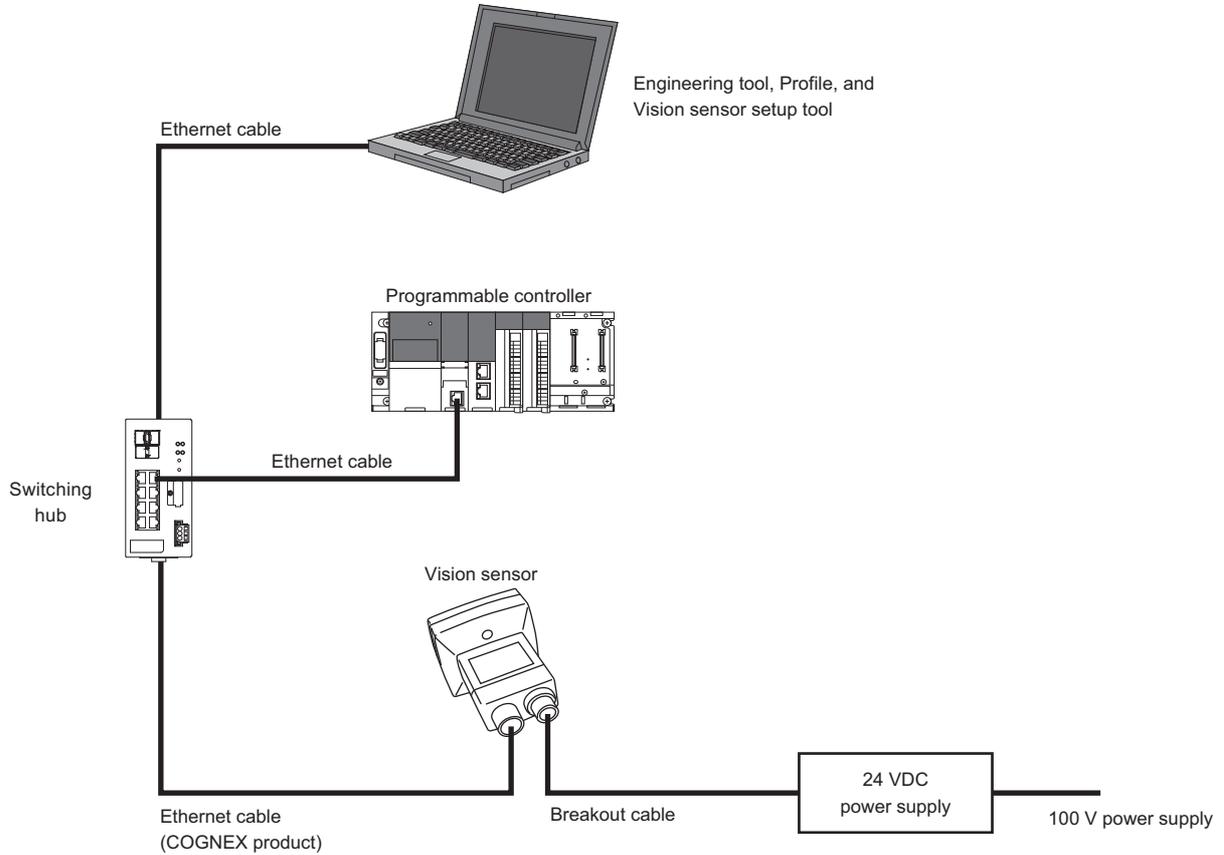• Sample programs can be copied to an engineering tool.

TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
Built-in Ethernet port LCPU	A generic term for L02CPU, L02CPU-P, L06CPU, L06CPU-P, L26CPU, L26CPU-P, L26CPU-BT, and L26CPU-PBT
Engineering tool	A tool used for setting up programmable controllers, programming, debugging, and maintenance. A generic term for GX Works2, GX Works3, and MELSOFT Navigator.
Ethernet interface module	A generic term for RJ71EN71, QJ71E71-100, and LJ71E71-100
EtherNet/IP network interface module	A generic term for RJ71EIP91
Exposure time	In photographing by a camera, the time that imager type being exposed to the light through the lens after the shutter is opened
Feature (target object)	A target object in an image
FTP	An abbreviation for File Transfer Protocol. The communication protocol to transfer files on the network.
FX3UCPU	A generic term for FX3UCPU and FX3UCCPU
FX5 intelligent Ethernet function module	A generic term for FX5-ENET
FX5 intelligent EtherNet/IP function module	A generic term for FX5-ENET/IP
FX5CPU	A generic term for FX5UJCPU, FX5UCPU, and FX5UCCPU
GX Works2	A generic product name for SWnDND-GXW2 and SWnDNC-GXW2. ('n' indicates its version.) GX Works2 corresponding to MELSOFT Navigator is the product later than GX Works2 Version 1.11M.
GX Works3	A generic product name for SWnDND-GXW3 ('n' indicates its version.)
High-speed Universal model QCPU	A generic term for Q03UDVCPU, Q04UDVCPU, Q06UDVCPU, Q13UDVCPU, and Q26UDVCPU
In-Sight Explorer	Setup tool for a vision sensor manufactured by Cognex Corporation
Job	The vision controlling program created with the setup tool for the vision sensor
Machine vision	A system that recognizes images instead of human eye, and performs locating, classification, measuring, and inspection
MELSOFT Navigator	The product name of the IDE (integrated development environment) in SWnDND-IQWK model (MELSOFT iQ Works) ('n' indicates its version.)
QnUDE(H)CPU	A generic term for Q03UDECPU, Q04UDEHCPU, Q06UDEHCPU, Q10UDEHCPU, Q13UDEHCPU, Q20UDEHCPU, Q26UDEHCPU, Q50UDEHCPU, and Q100UDEHCPU
RnCPU	A generic term for R04CPU, R04ENCPU, R08CPU, R08ENCPU, R16CPU, R16ENCPU, R32CPU, R32ENCPU, R120CPU, and R120ENCPU
RnENCPU	A generic term for R04ENCPU, R08ENCPU, R16ENCPU, R32ENCPU, and R120ENCPU
Serial communication module	A generic term for RJ71C24, RJ71C24-R2, QJ71C24N, QJ71C24N-R2, LJ71C24, LJ71C24-R2, FX5-232ADP, FX5-232-BD, FX3U-232-BD, FX3U-232ADP-MB, and FX3G-232-BD
SLMP	An abbreviation for SeamLess Message Protocol. The protocol to access the programmable controller connected from the external device to the SLMP corresponding device, or connected to the SLMP corresponding device.
Universal model process CPU	A generic term for Q04UDPVCPU, Q06UDPVCPU, Q13UDPVCPU, and Q26UDPVCPU
Vision sensor VS20	A generic term for VS20M-11F310, VS20M-12F410, VS20M-13F410, VS20C-12F410, and VS20C-13F410

1 **PRODUCT OVERVIEW**

Vision sensor VS20s are developed for automated inspection, measurement, and identification applications on the factory floor, and can be used in network connections as well as for standalone applications.
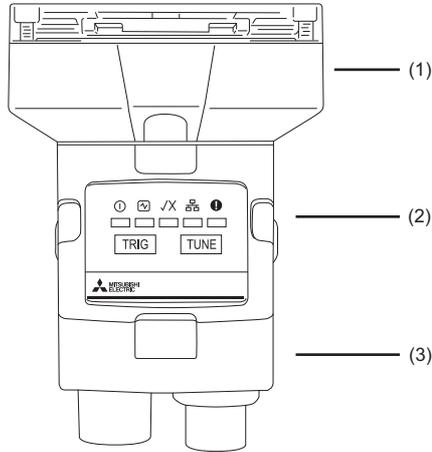Vision sensor VS20 can be configured remotely over a network.

Engineering tool, Profile, and
Vision sensor setup tool

Ethernet cable

Programmable controller

Ethernet cable

Switching
hub

Vision sensor

Ethernet cable
(COGNEX product)

Breakout cable

24 VDC
power supply

100 V power supply

MEMO

2 PART NAMES

Standard components

The three main parts of a vision sensor VS20 are shown below.

Item	Part name
(1)	Optics module, featuring high brightness white LED ring light and 8 mm lens
(2)	Main module, including image sensor and CPU
(3)	I/O connector module

Connectors and indicators

The built-in lighting system and other features of a vision sensor VS20 are shown below.
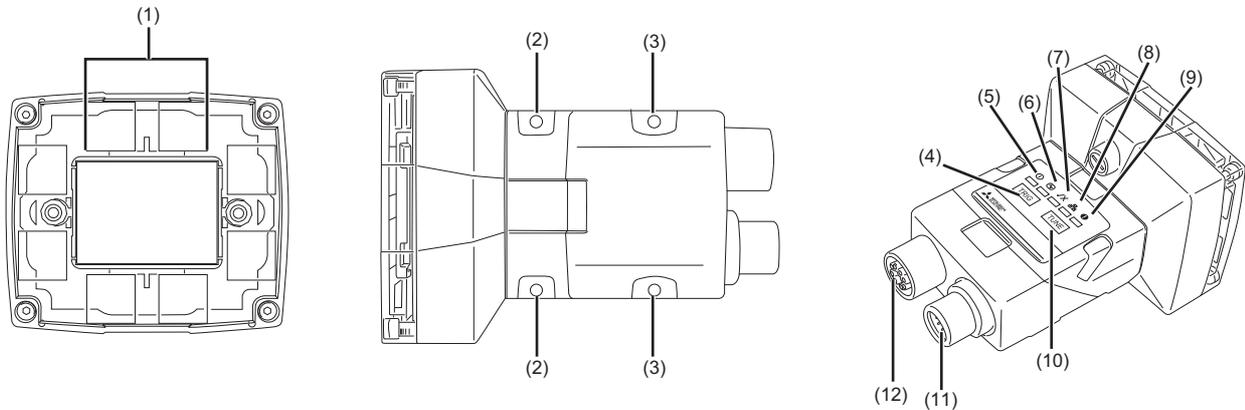
| Item	Name
(1)	Illumination LEDs
(2)	Mounting hole (M3 × 3.5 mm)
(3)	Mounting hole (M3 × 3.5 mm)
(4)	TRIG button
(5)	Power indicator
(6)	Trigger status indicator (LED5 (Yellow))
(7)	Pass/Fail indicator (LED4 (Green)/LED4 (Red))
(8)	Network status indicator
(9)	Error indicator
(10)	TUNE button (unsupported)
(11)	Power, I/O and RS-232 connector
(12)	Ethernet connector

Indicator display specifications

The display specifications for each indicator are as follows.

Item	Color	Meaning
Power indicator	Green	Power ON
Status indicator	Yellow	Active[*1]
Pass/Fail indicator	Green	Pass (default[*1])
	Red	Fail (default[*1])
Network status indicator	Yellow	Link up
	Orange (blink)	Data transfer
Error indicator	Red	Error

*1 The status can be changed by setting "Inputs/Outputs" in In-Sight Explorer. (☞ 4 FUNCTION LIST)

TRIG button

An image capture can be started manually by pressing the TRIG button.

TRIG button
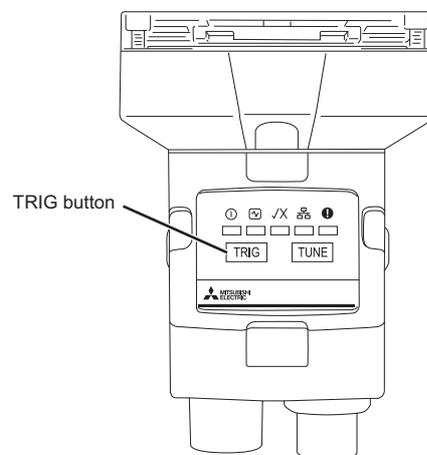
3 SPECIFICATIONS

This chapter shows the specifications of vision sensor VS20s.

3.1 General Specifications

The following shows the general specifications of vision sensor VS20s.

Item	Specifications
Ambient operating temperature	0 to 40℃
Ambient storage temperature	-10 to 60℃
Maximum humidity	Less than 95% RH, non-condensing
Vibration resistance	IEC 60068-2-6: A vibration of 10 G (10 to 500 Hz at 100 m/s² with 15 mm width) was applied to each X, Y, and Z direction for 2 hours.
Shock resistance	IEC 60068-2-27: 1000 half sinusoidal shocks with 11 G in 10 ms were applied.
Operating atmosphere	There is no danger of corrosive gases, flammable gases, and strong alkaline substances to adhere.
Protective structure	IP65 (when all connectors are attached to cables or shielded by a sealing cap)
Installation location[*1]	Outside a control panel

*1 Do not install it in the following places:
· Where the ambient temperature or humidity exceed the applicable ranges
· Where condensation occurs due to sudden temperature changes
· Where there is corrosive or flammable gas
· Where there are a lot of conductible dust, iron filings, or salt
· Where in danger of organic solvents, such as benzene, thinner, and alcohol or strong alkaline substances such as caustic soda to adhere
· Where subject to much vibration or shock
· Where in danger of liquid such as water, oil, or chemicals to adhere

3.2 Performance Specifications

The following shows the performance specifications of vision sensor VS20s.

Specifications		VS20M-11F310	VS20M-12F410	VS20C-12F410	VS20M-13F410	VS20C-13F410
Memory		32 MB flash memory Unlimited storage when storing in the remote network device Image processing: 128 MB SDRAM				
Imager type		1/3-inch CMOS, 4.80 mm × 3.60 mm (W × H), 3.75 µm sq. pixels				
Lens		S-mount/M12, 8 mm (standard), Options: 3.6 mm, 6 mm, 12 mm, 16 mm, 25 mm				
Image resolution (pixels)		640 × 480 (standard)	640 × 480 (standard)		640 × 480 (standard)	
			640 × 480 (2 × image magnification mode)		640 × 480 (2 × image magnification mode)	
					800 × 600 (2 × image magnification mode)[*1]	
Bit depth		256 gray levels (8 bits/pixel).		24-bit color	256 gray levels (8 bits/pixel).	24-bit color
Electronic shutter speed		1 µs to 1000 ms				
Maximum image acquisition speed[*2]		40 full frames per second	75 full frames per second	55 full frames per second	75 full frames per second	55 full frames per second
Power consumption		24 VDC ± 10%, 48 W (2.0 A) maximum when the illumination is ON.				
Trigger	—	• Opto-isolated image acquisition trigger input × 1 • Remote software commands via Ethernet				
	Voltage	• ON: 15 to 24 VDC (standard 24 VDC) • OFF: 0 to 5 VDC (standard 0 VDC)				
	Current	• 3.6 mA/12 VDC • 7.5 mA/24 VDC • Resistance: Max. 5.48 kΩ				
Discrete inputs	—	• Opto-isolated general-purpose input × 1 • General-purpose input × 7: Available when connecting a CIO-1400 I/O module[*3]				
	Voltage	• ON: 15 to 24 VDC (standard 24 VDC) • OFF: 0 to 5 VDC (standard 0 VDC)				
	Current	• 3.6 mA/12 VDC • 7.5 mA/24 VDC • Resistance: Max. 5.48 kΩ				
Discrete outputs	—	• Opto-isolated high-speed output × 4 • High-speed output × 2, general-purpose output × 6: Available when connecting a CIO-1400 I/O module[*3]				
	Voltage	28 VDC maximum through external load				
	Current[*4]	• ON status: Max. 50 mA (sink or source) • Leakage current in OFF status: Max. 100 µA • External load resistance: 240 Ω to 10 kΩ Each line is rated at a maximum 50 mA and protected against over-current, short circuits, and transients from switching inductive loads. A protection diode is required for a high inductive load.				
Network communication		CC-Link IE Field Network Basic, SLMP scanners, SLMP, MODBUS/TCP, EtherNet/IP, TCP/IP, UDP, FTP, Telnet (native mode), DHCP (default at shipment from the factory), fixed and link local IP address setting				
Other communications		RS-232 (RxD, TxD (TIA/EIA-232-F reference))				
Material		Aluminum housing				
Mounting		M3 screw holes × 4				
Dimensions		Straight configuration: 92 mm × 60 mm × 52 mm, right angle configuration: 62 mm × 60 mm × 67 mm				
Weight		200g				

*1 The resolutions of VS20M-13F410 and VS20C-13F410 are 640 × 480 pixels. The resolutions can be set as 800 × 600 pixels in In-Sight Explorer.
For details, refer to the help of In-Sight Explorer.

*2 The maximum frame rate when all of the following conditions are applied.
· Minimum exposure
· No connection with In-Sight Explorer
· Image resolution: 640 × 480 (2 × image magnification mode for VS20M-12F410 and VS20M-13F410 models).

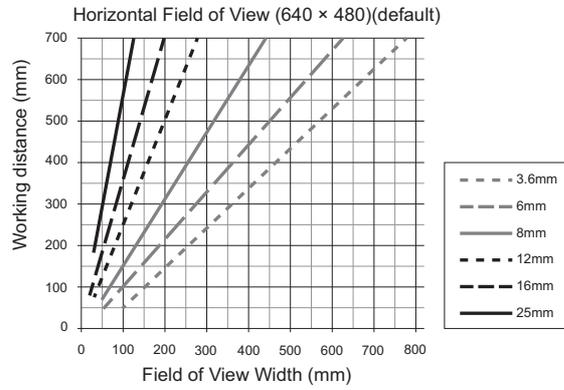*3 For details on an I/O module, refer to the following:
☞ Page 32 I/O module

*4 When an I/O module is connected, the high speed output is only sink type up to 50 mA, and the general-purpose output is sink type or source type up to 100 mA which can be set by users.

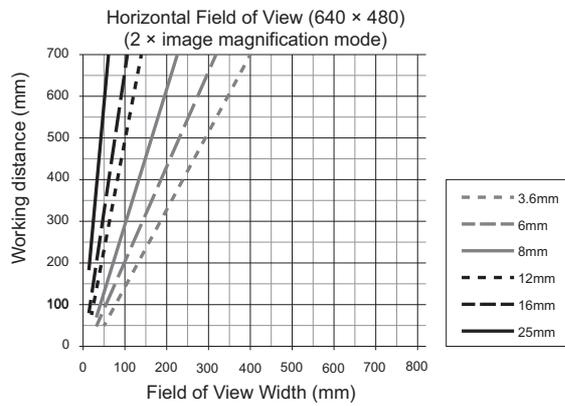# Working distance and field of view

The distance from a lens to an inspection target is referred to as 'working distance', and an area where a vision sensor can see at that distance is referred to as 'field of view.'

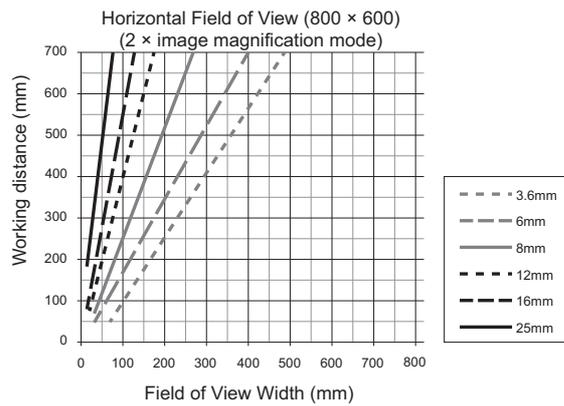As the working distance increases, so does the field of view.

- VS20M-11F310, VS20M-12F410, VS20C-12F410, VS20M-13F410, VS20C-13F410

Horizontal Field of View (640 × 480)(default)

- VS20M-12F410, VS20C-12F410, VS20M-13F410, VS20C-13F410

Horizontal Field of View (640 × 480)
(2 × image magnification mode)

- VS20M-13F410, VS20C-13F410

Horizontal Field of View (800 × 600)
(2 × image magnification mode)

3.3 I/O Specifications

This section shows the connection example of the image acquisition trigger input and high-speed outputs, and specifications for cables and connectors.

> **Point**
>
> For details of breakout cables, refer to the following:
> ☞ Page 21 Breakout cable specifications

Image acquisition trigger input

An opto-isolated image acquisition trigger input (×1) is integrated into a vision sensor.

Image acquisition can be started using a sink type device or source type device.

To start the image acquisition with these devices, "Camera" needs to be selected from the pull-down list of "Trigger" under "Edit Acquisition Settings" in In-Sight Explorer.
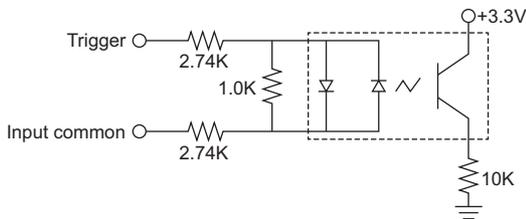
Specifications	Description
Voltage	• ON: 15 to 24 VDC (standard: 24 VDC) • OFF: 0 to 5 VDC (standard 0 VDC)
Current	• 3.6 mA/12 VDC • 7.5 mA/24 VDC • Resistance: Max. 5.48 kΩ
Delay	Maximum 1.45 ms delay from when a vision sensor receives a trigger to when an image acquisition starts Minimum 1ms wide for an input pulse

To trigger from the output of a sink type photodetector or programmable controller, connect 'Trigger' of a breakout cable to the output of a photoelectric sensor or an output module, and connect 'Input common' to 24 VDC.

When the output is turned ON, 'Trigger' is pulled down to 0 VDC and the opto-coupler of the sensor is turned ON.

To trigger from the output of a source type photodetector or programmable controller, connect 'Trigger' of a breakout cable to the output of a detector or an output module, and connect 'Input common' to 0 VDC.

When the output is turned ON, 'Trigger' is pulled up to 24 VDC and the opto-coupler of the sensor is turned ON.

Maximum voltage between input pins: 28 VDC, minimum voltage transition: 12 VDC

High-speed outputs

High-speed outputs can be set as either a sink line or source line.

Specifications	Description
Voltage	28 VDC maximum through external load
Current[*1]	• Sink type or source type: Max. 50 mA • Leakage current in OFF status: 100 μA • External load resistance: 240 Ω to 10 kΩ Each line is rated at a maximum 50 mA and protected against over-current, short circuits, and transients from switching inductive loads. A protection diode is required for a high inductive load.

*1   When an I/O module is connected, the high speed output is only sink type up to 50 mA, and the general-purpose output is sink type or source type up to 100 mA which can be set by users.

For a sink type device, connect an external load between 'High-speed output 0' to 'High-speed output 3' of a breakout cable and the positive side (28 VDC or less).

When 'High-speed output 0' to 'High-speed output 3' are turned ON, the outputs are pulled down to 3 VDC or less, then a current flows to the external load.
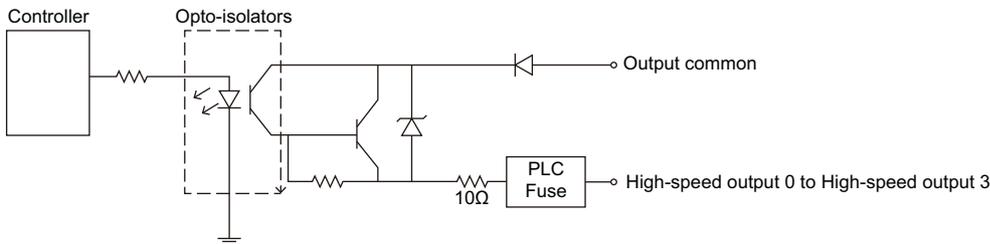
When 'High-speed output 0' to 'High-speed output 3' are turned OFF, a current does not flow to the external load.
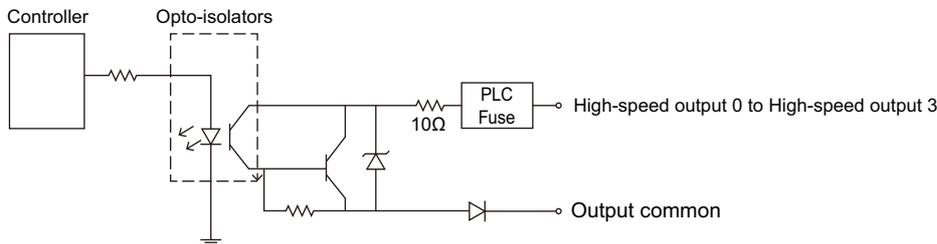
For a source type device, connect an external load between 'High-speed output 0' to 'High-speed output 3' of a breakout cable and the negative side (0 VDC).

For a connection to which a 24 VDC power supply is connected, when 'High-speed output 0' to 'High-speed output 3' are turned ON, the outputs are pulled up to 21 VDC or more, then a current flows to the external load.
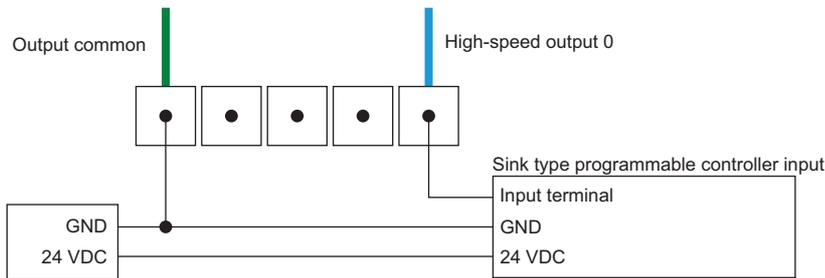
When 'High-speed output 0' to 'High-speed output 3' are turned OFF, a current does not flow to the external load.
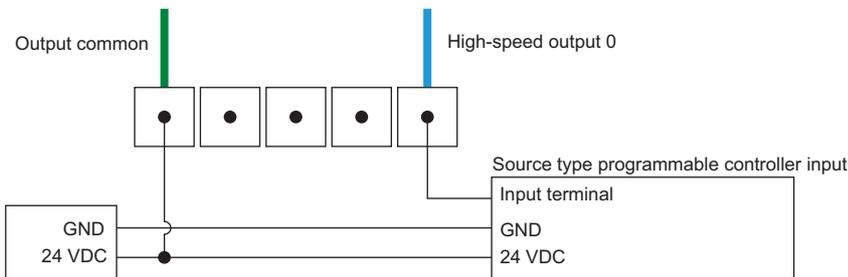
High-speed output wiring

To connect to the inputs of a sink type programmable controller, connect 'High-speed output 0' to 'High-speed output 3' of a breakout cable directly to the input terminals of the controller inputs.

When 'High-speed output 0' to 'High-speed output 3' are turned ON, the input terminals are pulled down to 3 VDC or less.

To connect to the inputs of a source type programmable controller, connect 'High-speed output 0' to 'High-speed output 3' of a breakout cable directly to the input terminals of the controller inputs.

When 'High-speed output 0' to 'High-speed output 3' are turned ON, the input terminals are pulled up to 21 VDC or more.

To connect 'High-speed output 0' to 'High-speed output 3" of a breakout cable to a relay, LED, or similar load, connect the negative side of the load to 'High-speed output 0' to 'High-speed output 3" and connect the positive side to 24 VDC.

When 'High-speed output 0' to 'High-speed output 3' are turned ON, the negative side of the load is pulled down to 3 VDC or less, then 24 VDC is applied to the load.

Use a protection diode for a high inductive load. Connect the anode to a output and connect the cathode to '24 VDC'.
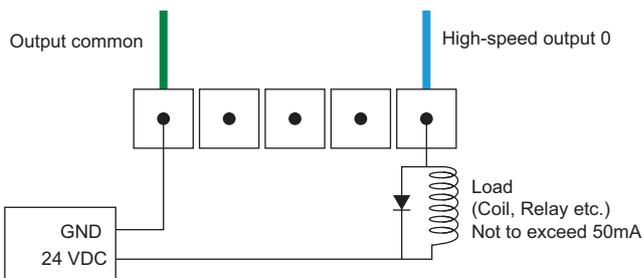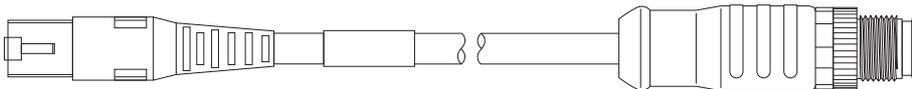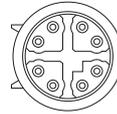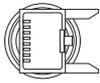
Ethernet cable specifications

Ethernet cables are used for the network communication by Ethernet connection.

By using an Ethernet cable, a vision sensor can directly be connected to a single device, and also can be connected to multiple devices via a switching hub or a router.

M12X-code, RJ-45 cable

P1

P1: To a vision sensor

Point

- If the bend radius or service loop is smaller than 10 times of the cable diameter, the Ethernet cable (COGNEX product) may cause cable shielding degradation, cable damage, or wear out in a short period. The bend radius must be at least 152.4 mm from the connector.
- Cables are sold separately.

Breakout cable specifications

Breakout cables provide power supply input, image acquisition trigger input, general-purpose input, high-speed output, and RS-232 serial communication.

Breakout cables are not terminated.
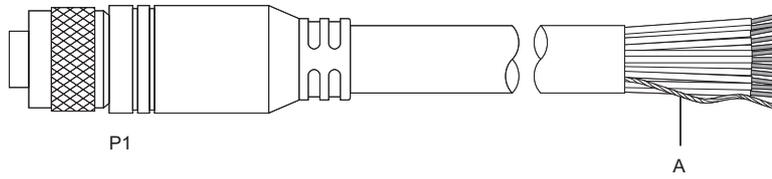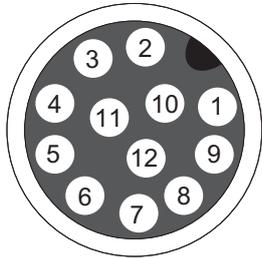
P1: To a vision sensor

A: Power supply return pass

Pin Number	Signal name	Wire color
1	High-speed output 2 (Direct 2)[*1]	Yellow
2	RS-232 Tx	White/Yellow
3	RS-232 Rx	Brown
4	High-speed output 3 (Direct 3)[*1]	White/Brown
5	General-purpose input 0 (Direct 0)[*1]	Violet
6	Input common	White/Violet
7	24 VDC	Red
8	GND	Black
9	Output common	Green
10	Trigger	Orange
11	High-speed output 0 (Direct 0)[*1]	Blue
12	High-speed output 1 (Direct 1)[*1]	Gray

*1 () represents notations on In-Sight Explorer.

Precautions

Cut unused wires or protect them with insulating materials.

Be careful not to short-circuit with 24 VDC wires.

Point

For RS-232 connection, use the power supply return path for the ground.

Cables are sold separately.

I/O module cable specifications

I/O module cables are used for connecting vision sensors to I/O modules directly.

When an I/O module is used, all power supplies and communication lines used for vision sensors are connected via a I/O module cable.

P1

P1: To a vision sensor

Point
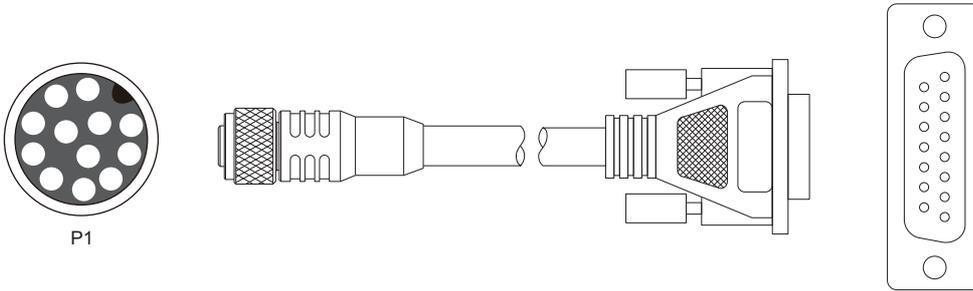
Cables are sold separately.

4 FUNCTION LIST

The main functions of In-Sight Explorer are listed below.

For details, refer to the help of In-Sight Explorer.

Function name			Description
Application Steps			The settings, which are necessary to use a vision sensor, are displayed in the order so that the settings can be made easily.
	1. Start		To select a vision sensor to set. An image to set determination conditions can be specified as well.
		Get Connected	To select a vision sensor to set, and establish a connection.
		Set Up Image	To specify an image to be used for setting determination conditions. The image is specified by importing an image reflected to a vision sensor, or specifying an image file saved in a personal computer.
	2. Set Up Tools		To set conditions to determine the image captured with a vision sensor.
		Locate Part	To make settings to determine whether there is a location that matches the set feature.
		Location Tools	To set the features (pattern, edge, edge intersection, circle)[*1].
		Inspect Part	To make settings to determine whether the feature that has been set is satisfied. The shape and quantity of products can be inspected.
		Presence/Absence Tools	To make settings for judging the presence/absence of features (brightness, contrast, pattern, color pixel count, edge, circle)[*2].
		Measurement Tools	To make settings for measuring the distance and angle of a specific location and the diameter[*3] of a circle.
		Counting Tools	To make settings used to count features (edge, pattern)[*4].
		Math & Logic Tools	To make settings for calculation processing or processing based on a logic by combining results set with multiple tools.
	3. Configure Results		To set an output method for the determination results of the images that were acquired.
		Inputs/Outputs	To set the data input toward 'general-purpose input 0' and the data output toward 'High-speed input 0' to 'High-speed input 3' of the breakout cable.
		Communication	To make settings for communication between a vision sensor and an external device such as a programmable controller according to the specified method.
	4. Finish		To save settings and check operations.
		Filmstrip	To check the images saved in the vision sensor and the results of capture, or check the images saved in the personal computer.
		Save Job	To save settings to a vision sensor.
		Run Job	To operate a vision sensor based on the settings made in prior steps. The operation can also be checked.
iQ Sensor Solution functions			The functions of iQ Sensor Solution can be performed using an engineering tool. For details on the iQ Sensor Solution functions, refer to the following: 📖iQ Sensor Solution Reference Manual
	Automatic detection of connected devices		To detect connected vision sensors.
	Linkage with dedicated tools (association with properties)		To make In-Sight Explorer to start from an engineering tool.

*1   For the features that can be set with the location tool for each model, refer to the following:
  ☞ Page 23 Features that can be set with the location tool for each model
*2   For the features that can be set with the presence/absence judgment tool for each model, refer to the following:
  ☞ Page 24 Features that can be set with the presence/absence judgment tool for each model
*3   For the measurements that can be performed with the size measurement tool for each model, refer to the following:
  ☞ Page 24 Measurements that can be performed with the size measurement tool for each model
*4   For the features that can be set with the counting tool for each model, refer to the following:
  ☞ Page 24 Features that can be set with the counting tool for each model

Features that can be set with the location tool for each model

○: Supported, ─: Not supported

Feature	VS20M-11F310	VS20M-12F410	VS20C-12F410	VS20M-13F410	VS20C-13F410
Pattern	○	○	○	○	○
Edge	─	─	─	○	○
Edge intersection	─	─	─	○	○
Circle	─	─	─	○	○

Features that can be set with the presence/absence judgment tool for each model

○: Supported, ─: Not supported

Feature	VS20M-11F310	VS20M-12F410	VS20C-12F410	VS20M-13F410	VS20C-13F410
Pattern	○	○	○	○	○
Pixel counting	─	○ (gray scale)	○ (color)	○ (gray scale)	○ (color)
Brightness	─	○	○	○	○
Contrast	─	○	○	○	○
Edge	─	─	─	○	○
Circle	─	─	─	○	○

Measurements that can be performed with the size measurement tool for each model

○: Supported, ─: Not supported

Measurement	VS20M-11F310	VS20M-12F410	VS20C-12F410	VS20M-13F410	VS20C-13F410
Distance	─	─	─	○	○
Angle	─	─	─	○	○
Circle diameter	─	─	─	○	○

Features that can be set with the counting tool for each model

○: Supported, ─: Not supported

Feature	VS20M-11F310	VS20M-12F410	VS20C-12F410	VS20M-13F410	VS20C-13F410
Pattern	─	─	─	○	○
Edge	─	─	─	○	○

5 SYSTEM CONFIGURATION

5.1 Ethernet Connection

The following figure shows the system configuration for Ethernet connection.

Diagram labels:
(3) Engineering tool, Profile
(4) Vision sensor setup tool
(8) Ethernet cable
(2) Programmable controller
(8) Ethernet cable
(7) Switching hub
(1) Vision sensor
(5) Ethernet cable (COGNEX product)
(6) Breakout cable
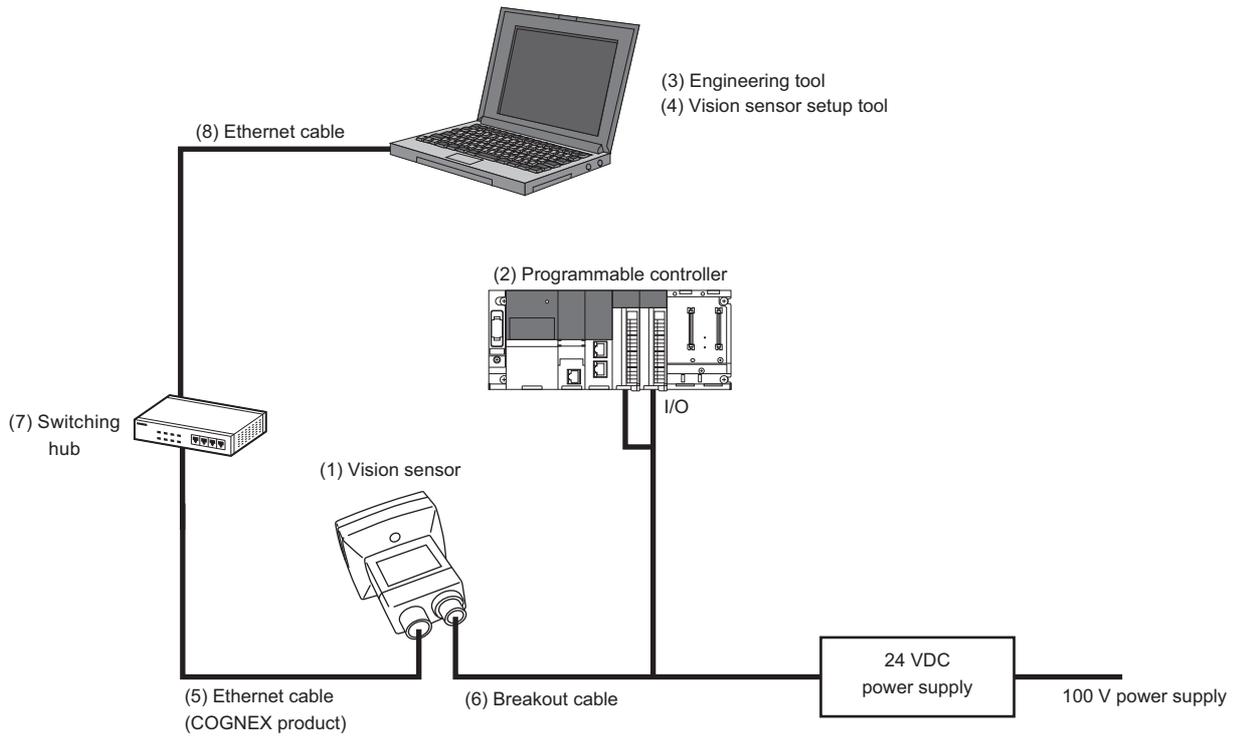24 VDC power supply
100 V power supply
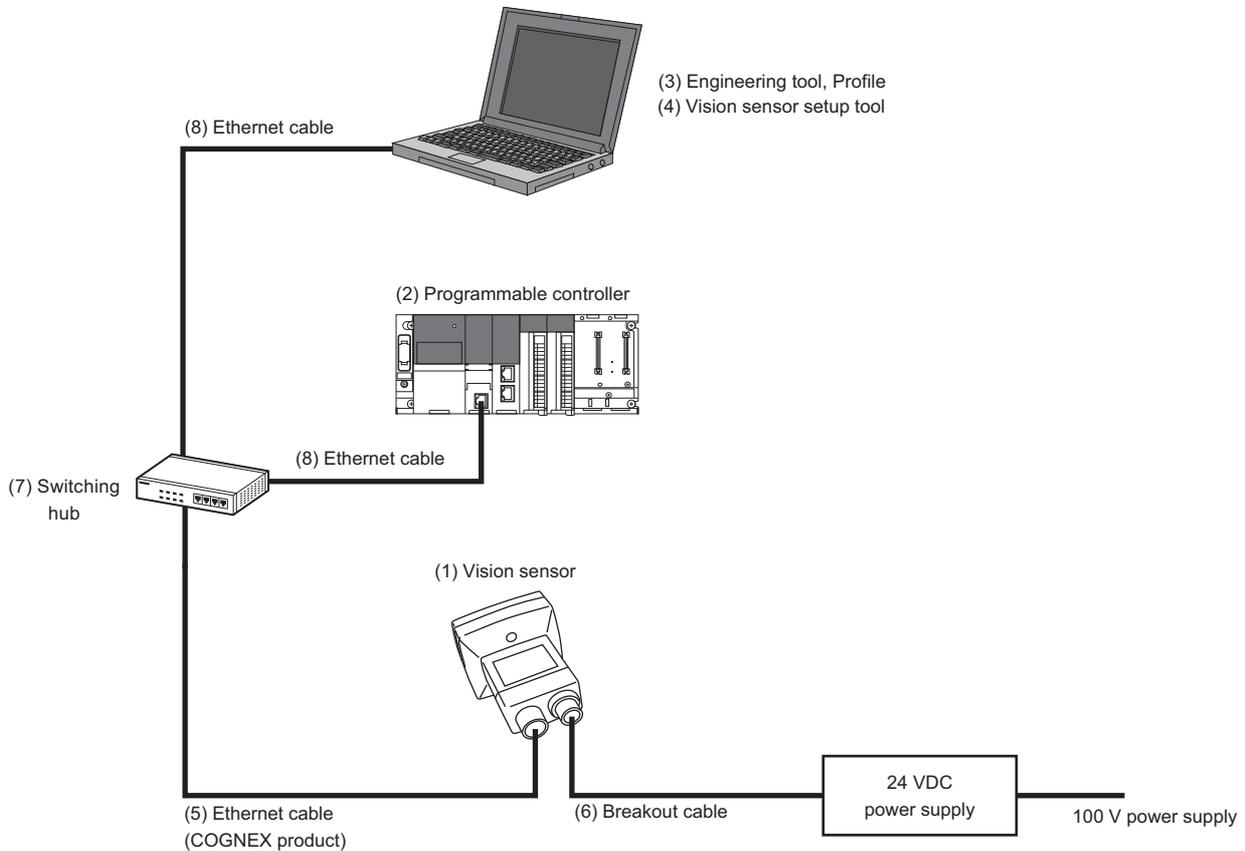
> **Point**
>
> The same system configuration as above can be applied when configuring settings for CC-Link IE Field Network Basic connection, EtherNet/IP connection, and SLMP scanner connection in In-Sight Explorer.
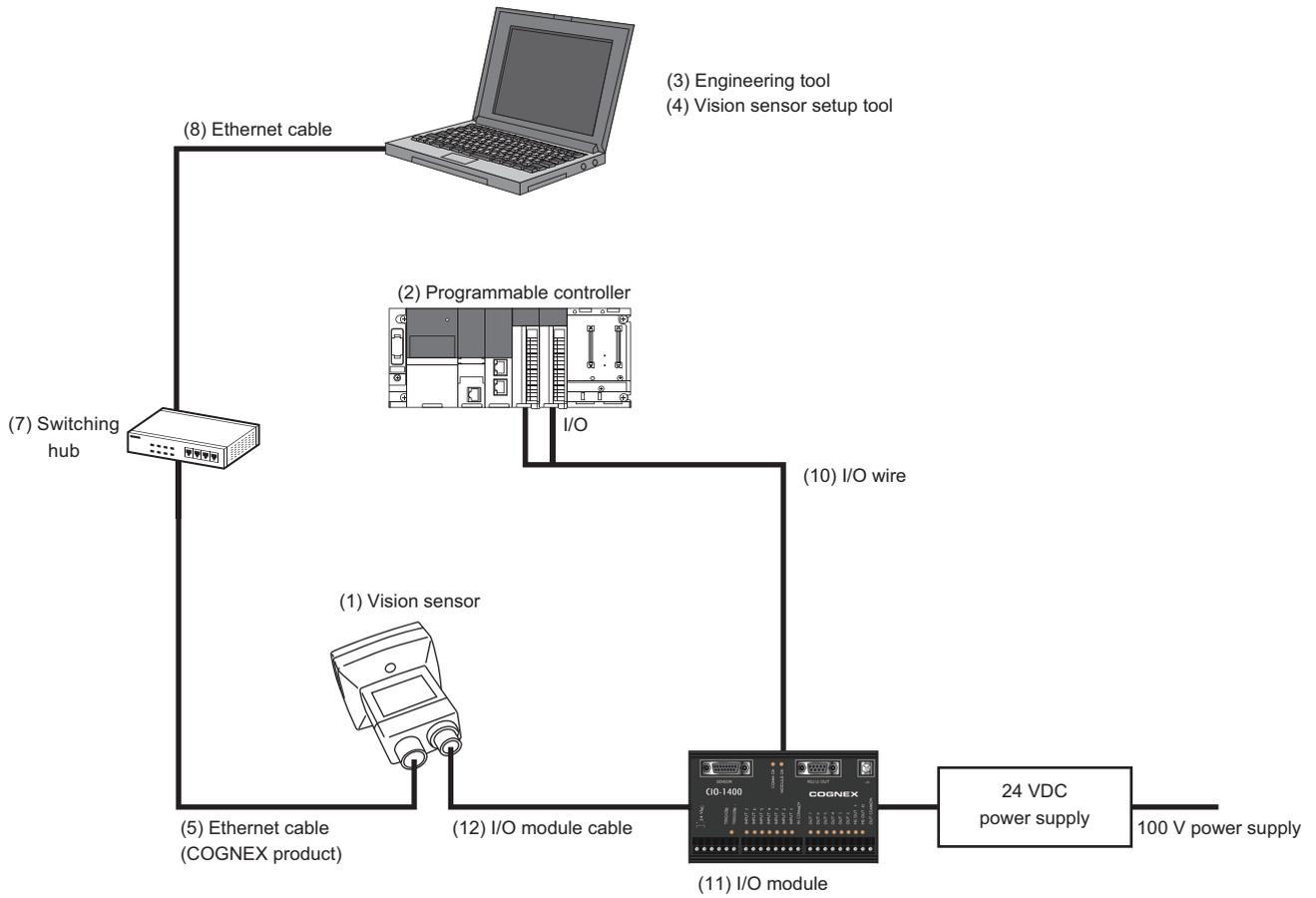
5.2 I/O Connection

The following figure shows the system configuration for I/O connection.

(3) Engineering tool
(4) Vision sensor setup tool

(8) Ethernet cable

(2) Programmable controller

I/O

(7) Switching hub

(1) Vision sensor

24 VDC power supply

100 V power supply

(5) Ethernet cable (COGNEX product)

(6) Breakout cable

5.3   I/O Connection Using an I/O Module

The following figure shows the system configuration for I/O connection using an I/O module.

(3) Engineering tool
(4) Vision sensor setup tool

(8) Ethernet cable

(2) Programmable controller

I/O

(7) Switching hub

(10) I/O wire

(1) Vision sensor

24 VDC power supply

100 V power supply

(5) Ethernet cable (COGNEX product)

(12) I/O module cable

(11) I/O module

5.4　Hardware Components

The hardware components of the system configuration are as follows.

No.	Component name	Remarks	Reference
(1)	Vision sensor	Vision sensor VS20	—
(2)	Programmable controller	Required for using vision sensors.	Page 29 Modules
(3)	Engineering tool	Required for setting a programmable controller	Page 30 Software
(4)	Vision sensor setup tool	Required for setting a vision sensor	
(5)	Ethernet cable (COGNEX product)	Required for setting a vision sensor from a personal computer	Page 31 Cables
(6)	Breakout cable	Required for supplying power.	
(7)	Switching hub	Commercial product	—
(8)	Ethernet cable	Commercial product	
(9)	USB cable	Commercial product	
(10)	I/O wire	Commercial product	
(11)	I/O module	Optional item	Page 32 I/O module
(12)	I/O module cable	Optional item	Page 32 I/O module cable

5.5 Applicable System

The modules and software that are available for a vision sensor VS20 are as follows.

Modules

The modules and versions that are available for a vision sensor VS20 are as follows.

For specifications and model names of modules that can be used for each of the connection methods, refer to the manual for each module.

○: Supported, —: Not supported

Module		Version	Connection method				
			SLMP	CC-Link IE Field Network Basic	MODBUS /TCP	EtherNet/ IP	Serial communi cation (RS-232)
RnCPU, RnENCPU		No restrictions[*1]	○	○	○	—	—
FX5CPU		No restrictions[*2]	○	○	○	—	—
High-speed Universal model QCPU, Universal model process CPU		No restrictions[*3]	○	—	—	—	—
QnUDE(H)CPU		No restrictions[*3]	○	—	—	—	—
Built-in Ethernet port LCPU		No restrictions[*4]	○	—	—	—	—
FX3UCPU (FX3U-ENET-L)[*5]		The firmware version is 3.10 or later.	○	—	—	—	—
EtherNet/IP net interface module	iQ-R series EtherNet/IP network interface module	• The firmware version is 04 or later. • RnCPU, RnENCPU (all versions)	—	—	—	○	—
	iQ-F series FX5 intelligent EtherNet/IP function module	• FX5UJCPU module (all versions) • FX5UCPU module (Ver.1.110 or later) • FX5UCCPU module[*6] (Ver.1.110 or later)	—	—	—	○	—
Serial communication module		No restrictions	—	—	—	—	○

*1　The firmware version of a module must be 28 or later for the automatic detection function of connected devices in an engineering tool.

*2　The firmware version of a module must be 1.040 or later for the automatic detection function of connected devices in an engineering tool.

*3　The first five digits of the serial number of a module must be 19042 or higher for the automatic detection function of connected devices in an engineering tool.

*4　The first five digits of the serial number of a module must be 18112 or higher for the automatic detection function of connected devices in an engineering tool.

*5　SLMP connection is not available for a CPU module itself. Use the CPU module and an FX3U-ENET-L for the Ethernet communication together.

*6　A connector conversion module FX5-CNV-IFC or FX5-C1PS-5V is required for connecting to an FX5UCCPU module.

Software

The versions of each piece of software (engineering tool, vision sensor setup tool, vision sensor profile, and EDS file for a vision sensor) that are available for a vision sensor VS20 are as follows.

○: Supported, —: Not supported

Software	Connection method				
	SLMP	**CC-Link IE Field Network Basic**	**MODBUS/TCP**	**EtherNet/IP**	**Serial communication (RS-232)**
GX Works3	No restrictions[*1]	No restrictions[*1]	1.035M or later	1.072A or later	No restrictions
GX Works2	No restrictions[*2]	No restrictions[*2]	—	—	No restrictions
FX3U-ENET-L	GX Works2 Version 1.20W or later	—	—	—	—
EtherNet/IP Configuration Tool for RJ71EIP91	—	—	—	Ver.1.00A or later	—
EtherNet/IP Configuration Tool for FX5-ENET/IP	—	—	—	Ver.1.00A or later	—
In-Sight Explorer[*3]	Version 5.3.2 or later	Version 5.4.3 or later	Version 5.7.5PR1 or later	Version 5.7.5PR1 or later	Version 5.3.2 or later
Vision sensor profile for an engineering tool	Device Ver: 1	Device Ver: 1	—	—	—
EDS file for a vision sensor	—	—	—	Revision 1.2	—

*1 The version must be 1.035M or later for the automatic detection function of connected devices in an engineering tool.

*2 The version must be 1.565P or later for the automatic detection function of connected devices in an engineering tool.

*3 Update a vision sensor VS20 to a firmware that supports In-Sight Explorer.
For the firmware update of a vision sensor VS20, refer to "Update Firmware Dialog" in the "In-Sight Explorer Help" screen.
The procedure is as follows.
❶ Open the "In-Sight Explorer Help" screen.
Select [Help] ⇨ [In-Sight Explorer Help] in In-Sight Explorer.
❷ Open "Update Firmware Dialog."
Enter 'firmware update' in the field under "Type in the word(s) to search for" in the [Search] tab in the "In-Sight Explorer Help" screen, and click [List Topics] and select "Update Firmware Dialog" under "Select topic."

Precautions

Basically, each version of In-Sight Explorer (vision sensor setup tool) and a vision sensor has no backward compatibility.

Do not use a version older than the one used to create a JOB file. Doing so may cause an unexpected behavior.

5.6 Hardware Components and Optional Items

Items to prepare

This section shows the items required for the system configuration.

Cables

The cables that are available for a vision sensor VS20 are as follows.

Product name	Model (COGNEX model)	Remarks
Ethernet cable	CCB-84901-2001-01	Cable length 0.6 m, M12 connector⇔RJ-45 connector, straight
	CCB-84901-2001-02	Cable length 2 m, M12 connector⇔RJ-45 connector, straight
	CCB-84901-2001-05	Cable length 5 m, M12 connector⇔RJ-45 connector, straight
	CCB-84901-2001-10	Cable length 10 m, M12 connector⇔RJ-45 connector, straight
	CCB-84901-2001-15	Cable length 15 m, M12 connector⇔RJ-45 connector, straight
	CCB-84901-2001-30	Cable length 30 m, M12 connector⇔RJ-45 connector, straight
	CCB-84901-2002-02	Cable length 2 m, M12 connector⇔RJ-45 connector, right-angle
	CCB-84901-2002-05	Cable length 5 m, M12 connector⇔RJ-45 connector, right-angle
	CCB-84901-2002-10	Cable length 10 m, M12 connector⇔RJ-45 connector, right-angle
Breakout cable	CCB-PWRIO-05	Cable length 5 m, M12 connector⇔12 stranded wires, straight
	CCB-PWRIO-10	Cable length 10 m, M12 connector⇔12 stranded wires, straight
	CCB-PWRIO-15	Cable length 15 m, M12 connector⇔12 stranded wires, straight
	CCB-PWRIO-05R	Cable length 5 m, M12 connector⇔12 stranded wires, right-angle
	CCB-PWRIO-10R	Cable length 10 m, M12 connector⇔12 stranded wires, right-angle
	CCB-PWRIO-15R	Cable length 15 m, M12 connector⇔12 stranded wires, right-angle
	CCBL-05-01	Cable length 5 m, M12 connector⇔12 stranded wires, straight

Power supply

The power supply that is available for a vision sensor VS20 is as follows.

Product name	Model (COGNEX model)	Remarks
24 VDC power supply	ACC-24I	—
Power cord	CBLI-24VDUS	North America power cord
	CBLI-24VDJP	Japanese power cord
	CBLI-24VDUK	United Kingdom power cord
	CBLI-24VDEU	Europe power cord

Items to prepare as needed

This section shows the products that are available for a vision sensor VS20.

Lenses

The lenses that are available for a vision sensor VS20 are as follows.

Product name	Model (COGNEX model)	Remarks	
S-mount (M12) lens	LM12-03-01	3.6 mm F2.0, fixed aperture lens	Lenses can be changed according to the object to be inspected, working distance, and field of view. For details, refer to the following: ☞ Page 16 Working distance and field of view
	LM12-06-01	6 mm F2, fixed aperture lens	
	LM12-08-01-F25	8 mm F2.5, fixed aperture lens	
	LM12-12-01	12 mm F1.9, fixed aperture lens	
	LM12-16-01	16 mm F2.5, fixed aperture lens	
	LM12-25-01	25 mm F2, fixed aperture lens	
Lens spacer (M12)	LM12-SPACER-16-01	Used with the 16 mm lens.	—
	LM12-SPACER-25-01	Used with the 25 mm lens.	

Filter and light cover

The filters and light cover that are available for a vision sensor VS20 are as follows.

Product name	Model (COGNEX model)	Remarks
Polarizer	IMPF-2000-POLAR2	Polarization
Filter	IMBF-2000-BP470	Blue bandpass filter
	IMRF-2000-BP635	Red bandpass filter
	IMIF-2000-BP850	IR bandpass filter
Light cover	IFS-2000-HBRING-CV	Replacement ring light cover

Light

The lights that are available for a vision sensor VS20 are as follows.

Product name	Model (COGNEX model)	Remarks
LED ring light	IFS-2000-HBRING-RD	High-intensity red
	IFS-2000-HBRING-BL	High-intensity blue
	IFS-2000-HBRING-IR	High-intensity near infrared
	IFS-2000-HBRING-WH	High-intensity white

Mounting bracket

The mounting brackets that are available for a vision sensor VS20 are as follows.

Product name	Model (COGNEX model)	Remarks
Universal mounting bracket	DM100-UBRK-000	—
Pivot mounting bracket	DM100-PIVOTM-00	
Flat surface mounting plate adapter	BKT-2000-ADAPT-00	

I/O module

The I/O module that is available for a vision sensor VS20 is as follows.

Product name	Model (COGNEX model)	Remarks
I/O module	CIO-1400	—

I/O module cable

The I/O module cables that are available for a vision sensor VS20 are as follows.

Product name	Model (COGNEX model)	Remarks
I/O module cable	CCB-PWRIO-MOD-02	Cable length 2 m, M12 connector ⇔ 15 pin connector (DB15)
	CCB-PWRIO-MOD-05	Cable length 5 m, M12 connector ⇔ 15 pin connector (DB15)

6 SYSTEM CONSTRUCTION

This chapter explains how to install standard components and attach accessories to a vision sensor VS20.

6.1 Installation Environment

Before installing a vision sensor, check that the installation environment complies with the precautions for use and general specifications.

☞ PRECAUTIONS FOR USE

☞ Page 14 General Specifications

6.2 Change in Sensor Configuration (Straight to Right Angle)

Perform the following steps to change the sensor configuration from the straight to the right angle.

Precautions

- Before touching the vision sensor, be sure to touch an electric conductor such as grounded metal to discharge the static electricity from your body. Otherwise, damage or faulty operation of the vision sensor may occur.
- Be sure to install an I/O connector module to the main module. If not installed, dust or water-proof performance may not be obtained.
- Switching the vision sensor configuration to the straight or right angle should be limited up to 10 times at most.
- Disconnect the vision sensor from power before changing the orientation.

Operating procedure

1. Remove the screw covers and unscrew the cap nuts and washers with a T10 torx driver.
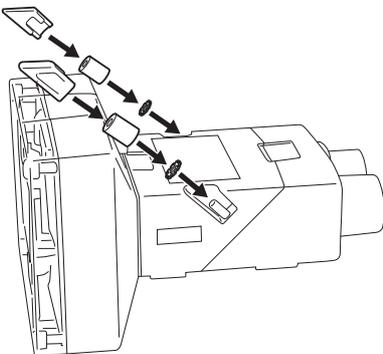
2. Detach the main module and the I/O connector module by pulling them apart.
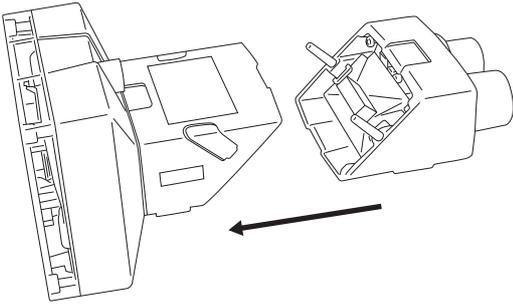
3. Change the orientation.
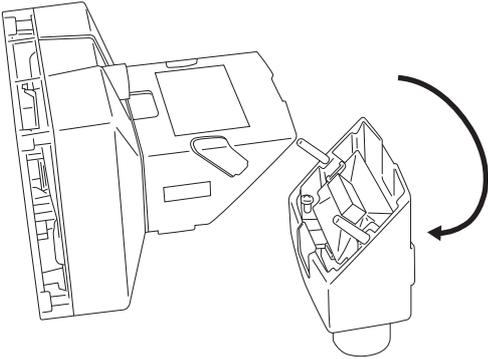
> **Point**
>
> Make sure that the gasket is properly fixed on the main module.

4. Reattach the I/O connector module to the main module.
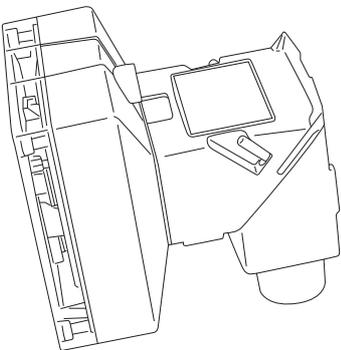
5. Attach the washers and fasten the module loosely with two cap nuts. In this case, be careful not to tighten the cap nuts firmly with a T10 torx driver.
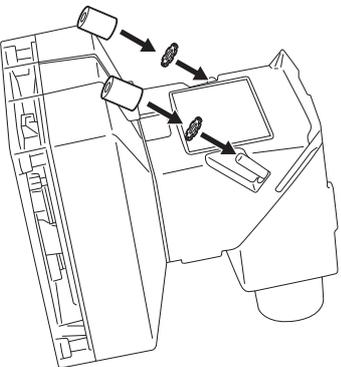
6. When fastening the cap nut, fix it with a torque of 0.12 N·m. Then install the screw cover.

Point

There are unique left and right screw covers. Take care to attach them correctly.
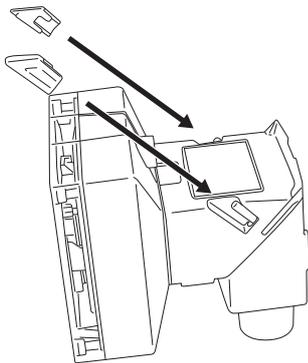
6.3 Installation of a Vision Sensor

Installation in straight configuration

Use the universal mounting bracket (DM100-UBRK-000) with the mounting holes on the I/O connector module.

M3 × 3.5
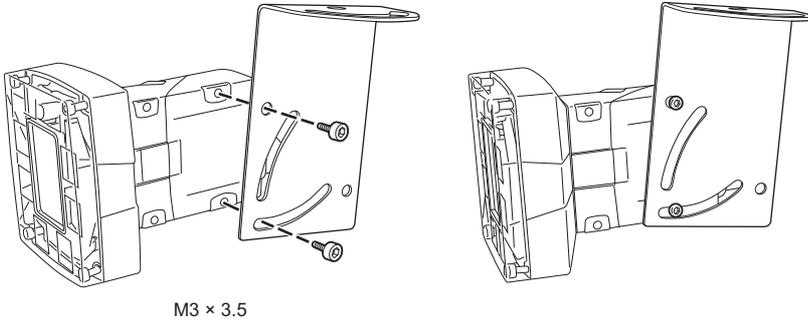
Installation in right-angle configuration

M3 × 3.5

Point
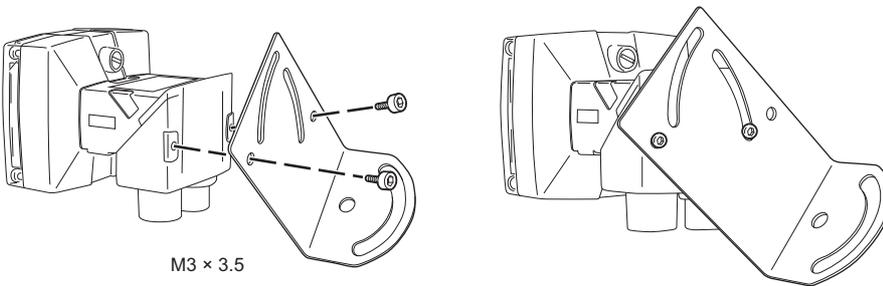
Installing a vision sensor at a slight angle (15°) can reduce reflections of light in target objections.

6.4 Connection of an Ethernet Cable

This section shows the procedure for connecting an Ethernet cable.

Operating procedure

1. Connect the Ethernet cable's M12 connector to the vision sensor's Ethernet connector.
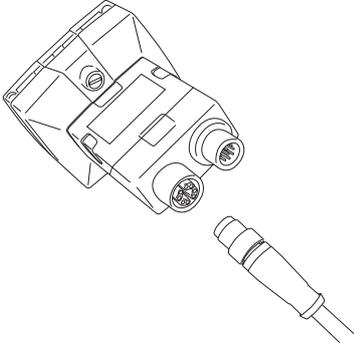
2. Connect the Ethernet cable's RJ-45 connector to the switching hub or personal computer, as applicable.

Precautions

The cable is designed to connect with its key aligned with the keyway of the connector on the Vision Sensor. Do not force the connections or damage may occur.

6.5 Connection of a Breakout Cable

This section shows the procedure for connecting a breakout cable.

> **Point**
>
> For the specifications on the breakout cable, refer to the following:
> ☞ Page 21 Breakout cable specifications

Operating procedure

1. Verify that the 24 VDC power supply being used is unplugged and not receiving power.

2. Connect an I/O wire or a serial wire to an appropriate device (such as a programmable controller).

3. Connect the 24 VDC (red wire) and GND (black wire) of a breakout cable to the corresponding terminals on the power supply.

4. Connect the M12 connector of the breakout cable to the Power, I/O and RS-232 connector of the vision sensor.
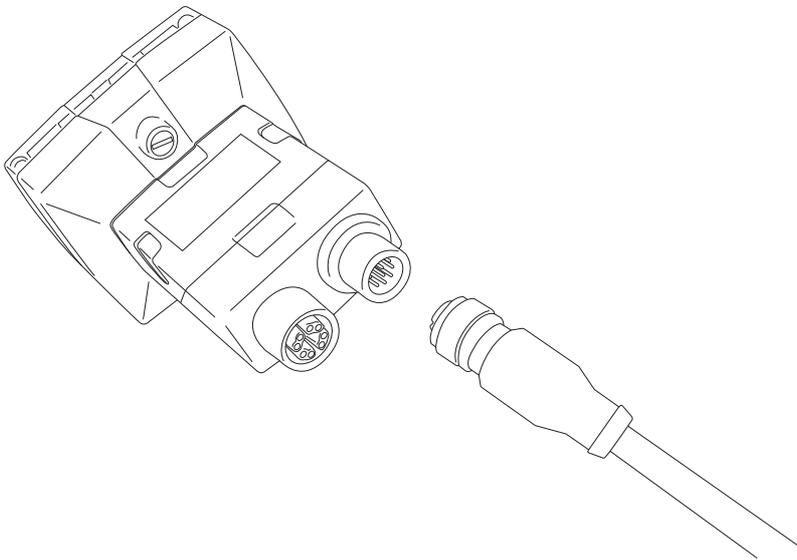
5. Turn ON the 24 VDC power supply.

Precautions

- To reduce emissions, connect the far end of the breakout cable shield to frame ground.
- Before wiring I/O wires to an I/O device or adjusting the connected wires, turn OFF the power of the vision sensor.
- Cut unused wires or protect them with insulating materials. Be careful not to short-circuit with 24 VDC wires.
- Use only 24 VDC and observe the indicated polarity. Otherwise, fire or damage may result.
- The cable is designed to connect with its key aligned with the keyway of the connector on the Vision Sensor. Do not force the connections or damage may occur.

Connection example of a breakout cable

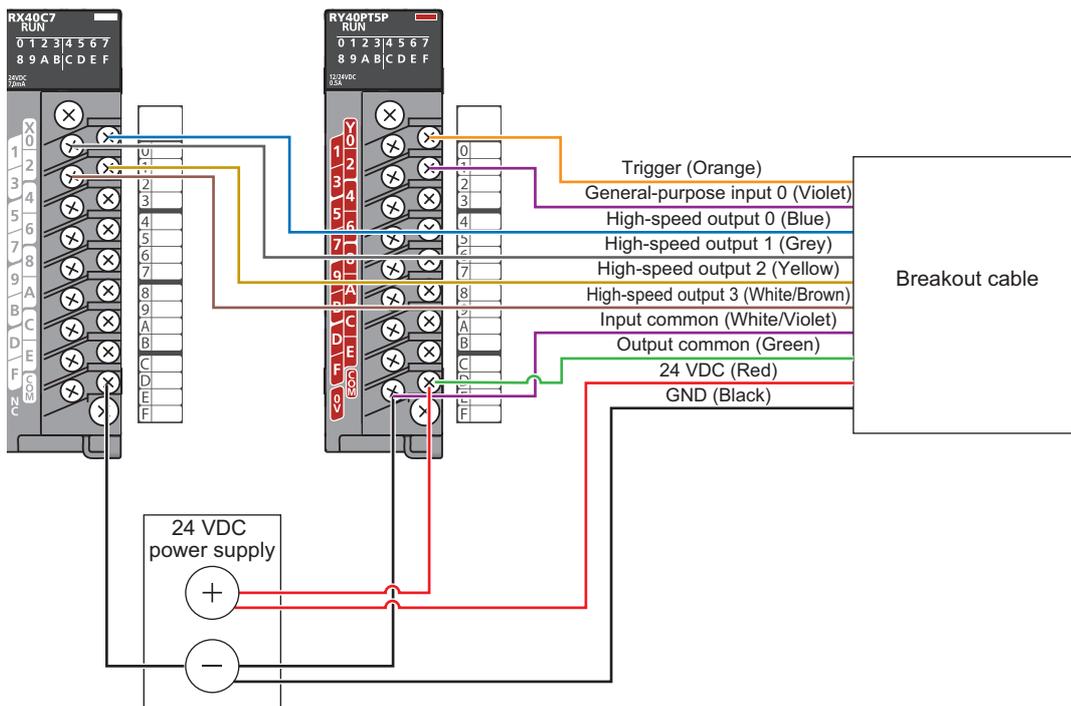This section shows an example for connecting a breakout cable.

Sink type

- Input module (positive/negative common shared type)
- Output module (sink type)
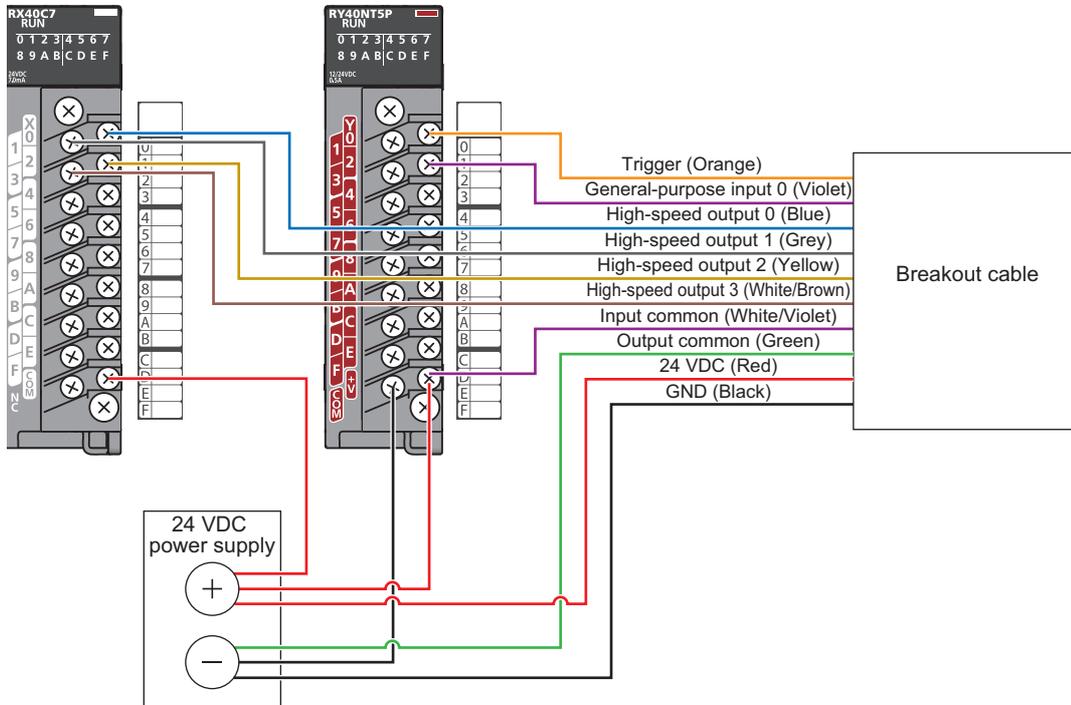
| Signal |
|--------|
| Trigger (Orange) |
| General-purpose input 0 (Violet) |
| High-speed output 0 (Blue) |
| High-speed output 1 (Grey) |
| High-speed output 2 (Yellow) |
| High-speed output 3 (White/Brown) |
| Input common (White/Violet) |
| Output common (Green) |
| 24 VDC (Red) |
| GND (Black) |

Source type

- Input module (positive/negative common shared type)
- Output module (source type)

Signal
Trigger (Orange)
General-purpose input 0 (Violet)
High-speed output 0 (Blue)
High-speed output 1 (Grey)
High-speed output 2 (Yellow)
High-speed output 3 (White/Brown)
Input common (White/Violet)
Output common (Green)
24 VDC (Red)
GND (Black)

6.6 Focus Position Setting

Focus can be adjusted using the screw on the back of a light module. Turn the screw clockwise for the shorter focal length, and counterclockwise for the longer focal length. Start the vision sensor setup tool and set up the focus while checking the effect.
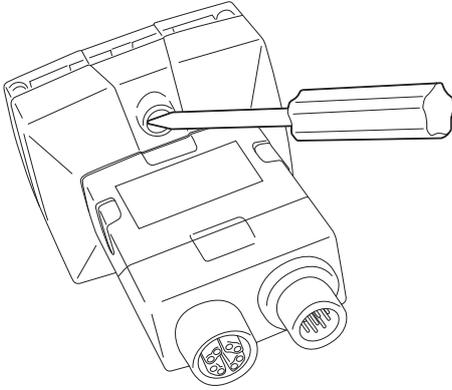
6.7   Lens Replacement

1. Verify that the 24 VDC power supply being used is unplugged and not receiving power.

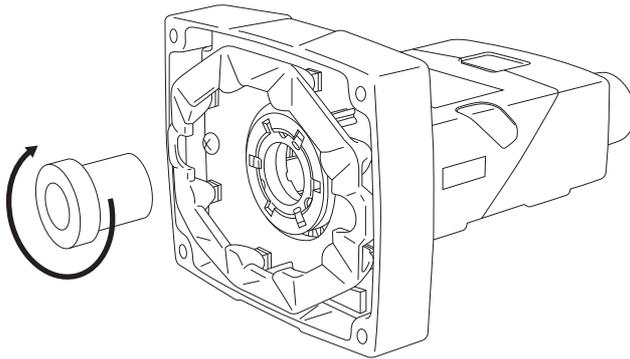*2.* Remove the four screws and the front cover from the optics module.
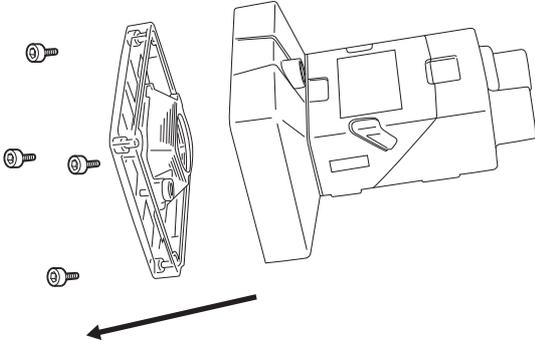
3. Move the lens to the furthest out position by turning the screw on the back of the light module clockwise.
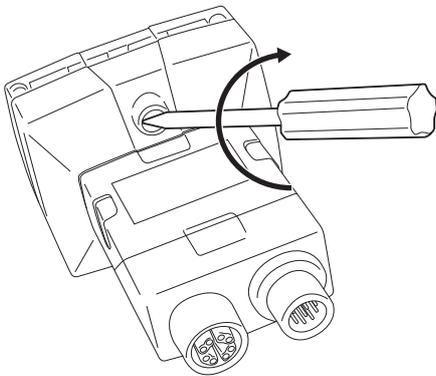
4. Turn the lens counterclockwise with your fingers to remove the lens.
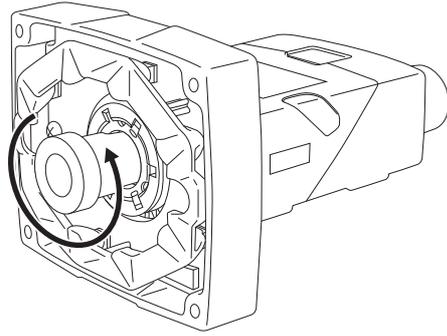
5. Insert the new lens and using your fingers, turn it clockwise to tighten the lens.

6. Reattach the front cover. Tighten four screws with a torque wrench.
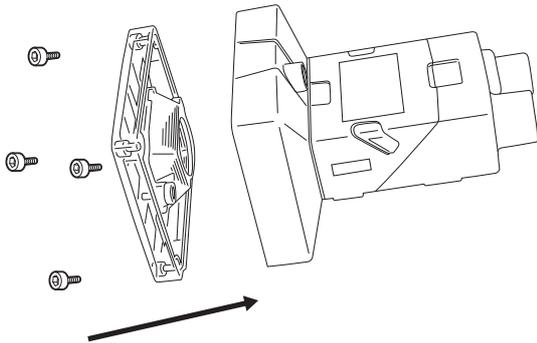
Point

The maximum tightening torque is 0.20 N·m.

7. Turn ON the 24 VDC power supply.

6.8 Installation of a Lens Filter

This section shows the procedure for installing a lens filter.

Operating procedure

1. Verify that the 24 VDC power supply being used is unplugged and not receiving power.

2. Remove the four screws and the front cover from the optics module.
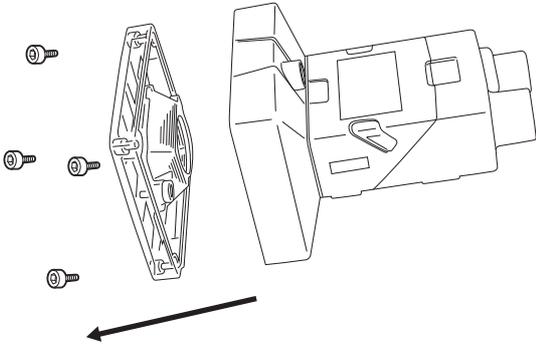
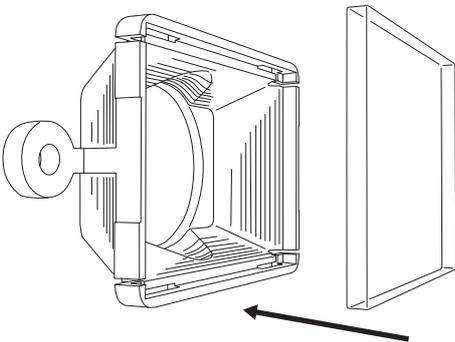*3.* Unscrew the two screws on the filter holder and remove the filter holder from the front cover.
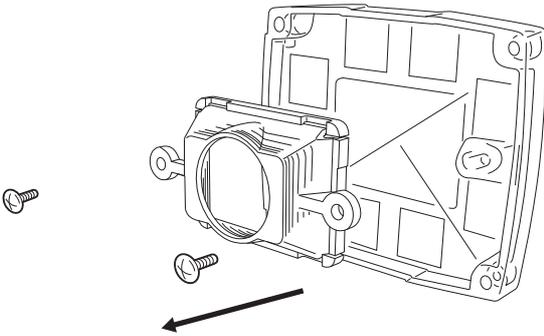
*4.* Hold the filter by the sides, then push the filter in until it is sitting firmly against the filter holder.

Point

Make sure to only touch the sides of the filter to avoid leaving fingerprints.
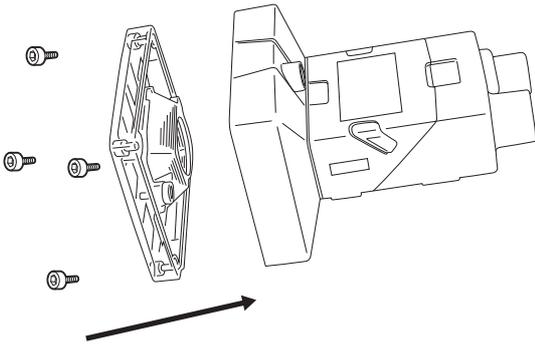Using a lens filter improves the contrast of images, so that a vision sensor can easily recognize features.

5. Reinstall the filter holder back to the front cover, tightening the two screws until they stop turning.
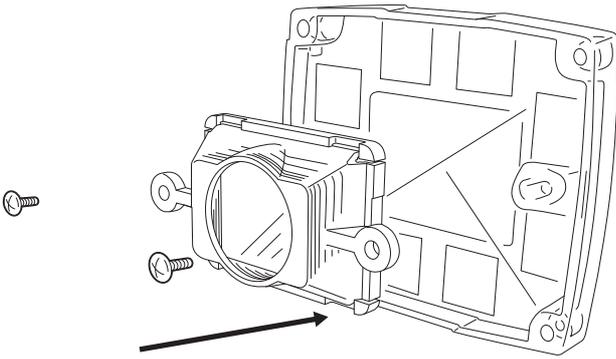
6. Reattach the front cover. Tighten four screws with a torque wrench.
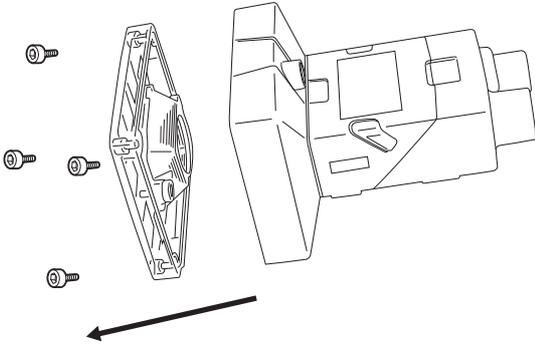

Point

The maximum tightening torque is 0.20 N·m.
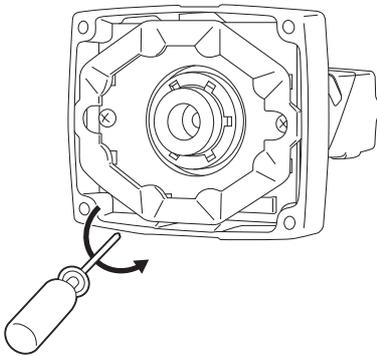
7. Turn ON the 24 VDC power supply.
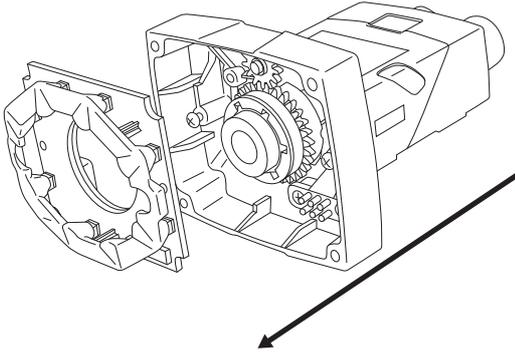
6.9　Replacement of an LED Ring Light

1. Verify that the 24 VDC power supply being used is unplugged and not receiving power.

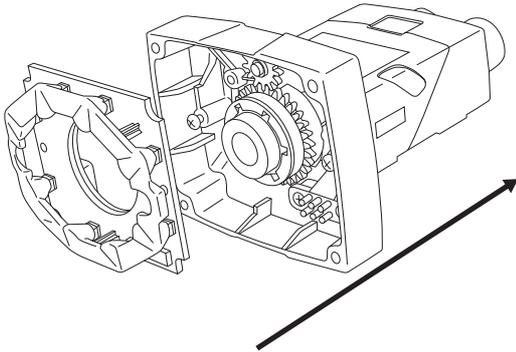*2.* Remove the four screws and the front cover from the optics module.

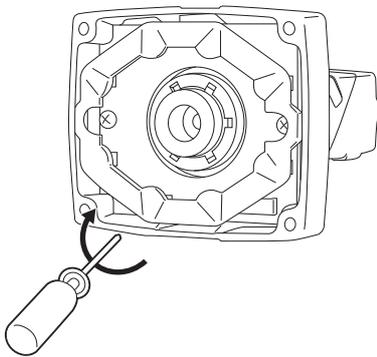*3.* Using a screwdriver, loosen the two screws on the LED ring light.

4. Remove the LED ring light.

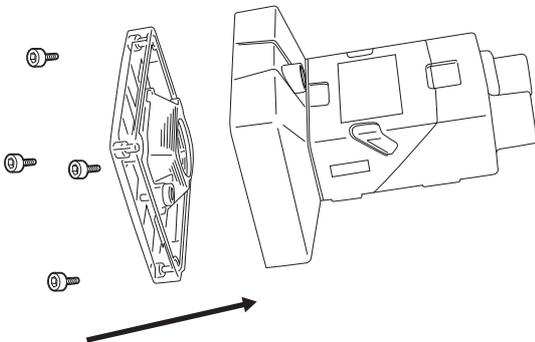*5.* Carefully align the connector on the back of the new LED ring light with the pins on the vision sensor. Gently press down the LED ring light to the optics module.

6. Using a screwdriver, tighten the screws until they stop turning.

7. Reattach the front cover. Tighten four screws with a torque wrench.

Point

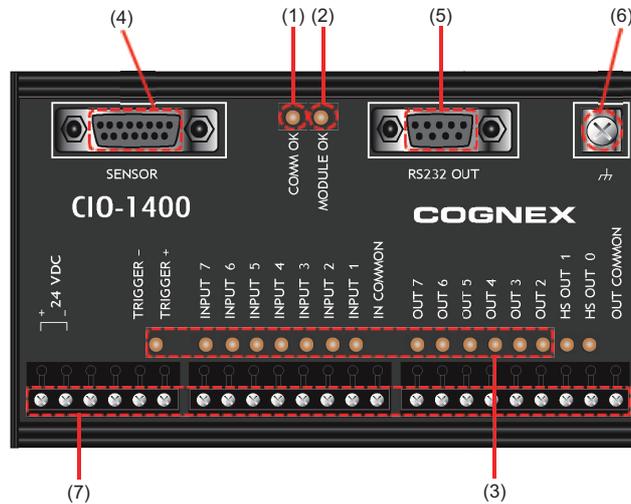The maximum tightening torque is 0.20 N·m.

8. Turn ON the 24 VDC power supply.

6.10 Connection of an I/O Module

This section shows the specifications and procedure for connecting an I/O module.

Specifications of CIO-1400 I/O modules

For the connection between an I/O module and a programmable controller, use a terminal block or an RS232 OUT port.

No.	Connector/Indicator	Description
(1)	COMM OK LED	Indicates the communication status of the I/O module. • Flashing: Flashes until the communication is established • ON (yellow): Connected successfully • OFF: Not connected
(2)	MODULE OK LED	Indicates the status of the I/O module. • ON (yellow): Communication preparation completed • OFF: Communication preparation not completed
(3)	I/Os and trigger status LEDs	Turns ON in yellow while each I/O signal is ON.
(4)	SENSOR port	Connect the I/O module cable to this port to supply the power, trigger, I/O, and RS-232 signals to the vision sensor.
(5)	RS232 OUT port (D-sub 9P, female)	Connect the RS-232 serial cable to this port to perform RS-232 communication between the I/O module and external serial device.
(6)	Frame ground terminal	Connects the common frame ground line to this terminal.
(7)	Terminal block	Connects the I/O module to a 24 VDC power, trigger, external I/Os, high-speed outputs, and common connections.

Point

• High-speed outputs can be set as sink type up to 50 mA.

• The general-purpose output can be set as sink type or source type up to 100 mA that can be set by users.

Connection procedure of a CIO-1400 I/O module

This section shows the procedure for connecting a CIO-1400 I/O module.

Operating procedure

1. Page 48 Connecting an I/O module to a power supply

2. Page 48 Connecting an I/O module to a frame ground

3. Page 49 Connecting an I/O module (terminal block) to an input/output module

4. Page 49 Connecting an I/O module (RS232 OUT port) to a serial communication module

5. Page 49 Connecting an I/O module cable to a vision sensor

Precautions

The cable is designed to connect with its key aligned with the keyway of the connector on the Vision Sensor. Do not force the connections or damage may occur.

Connecting an I/O module to a power supply

Operating procedure

1. Verify that the 24 VDC power supply being used is unplugged and not receiving power.

2. Using a screwdriver, loosen the 24 VDC positive and negative terminals on the I/O module.

3. Connect the 24 VDC power supply to the 24 VDC positive and negative terminals on the I/O module.

4. Using a screwdriver, tighten the screws and fix the lead wires on the terminal block. The maximum tightening torque is 0.40 N·m.

Precautions

Do not connect the I/O modules to a power supply other than 24 VDC. Also, do not connect the 24 VDC power supply to any terminal other than the 24 VDC positive and negative terminals. Failure to do so may result in fire or failure.

Connecting an I/O module to a frame ground

Operating procedure

1. Connect the frame ground wire to the frame ground terminal of the I/O module.

2. Connect the other end of the frame ground wire to the frame ground.

Precautions

The frame ground terminal and the shield ground of each connector (SENSOR port and RS232 OUT port) are contacted in the I/O module.
The system ground is designed on the condition that a ground connection is provided.
The ground potential may affect the vision sensor and peripheral devices such as programmable controllers via cables.
For safe operation, connect all the ground connections securely.

Connecting an I/O module (terminal block) to an input/output module

Operating procedure

1. Decide how to connect the terminal block of the I/O module to the device.

2. Using a screwdriver, loosen the applicable screw terminals.

3. Connect I/O wires to I/O terminals of the terminal block.

4. Connect the other end of the cable to the relevant I/O device.

5. Using a screwdriver, tighten the screws and fix the lead wires on the I/O terminals of the terminal block. The maximum tightening torque is 0.4 N·m.

Connecting an I/O module (RS232 OUT port) to a serial communication module

Only when using RS-232 communication, perform the following procedure.

Operating procedure

1. Connect the RS-232 serial cable (DB9 connector) to the RS232 OUT port of the I/O module.

2. Connect the other end of the RS-232 serial cable to the serial device.

3. Tighten the connector screws to fix to the I/O module.

Connecting an I/O module cable to a vision sensor

Operating procedure

1. Connect the M12 connector of the I/O module cable to the power, I/O, and RS-232 connector.

2. Connect the DB15 connector of the I/O module cable to the SENSOR connector of the I/O module.

3. Turn ON the power switch of the 24 VDC power supply connected to the I/O module.

6

Connection example of a CIO-1400 I/O module

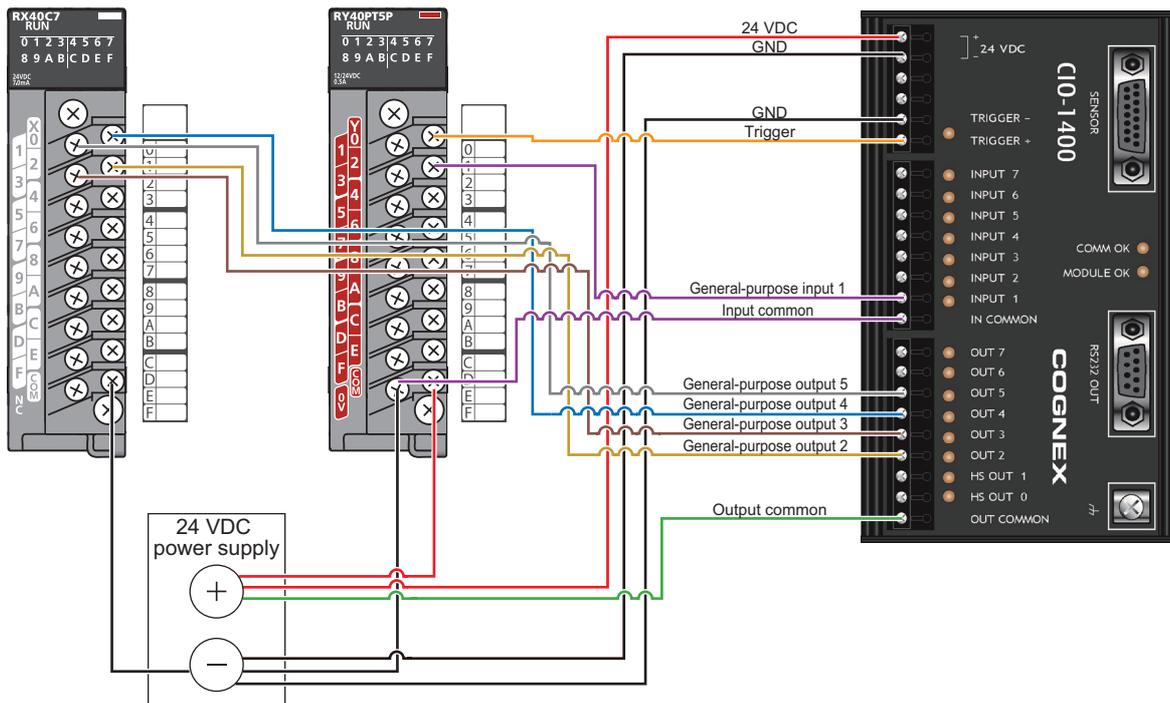This section shows an example for connecting a CIO-1400 I/O module.

Sink type

- Input module (positive/negative common shared type)
- Output module (sink type)
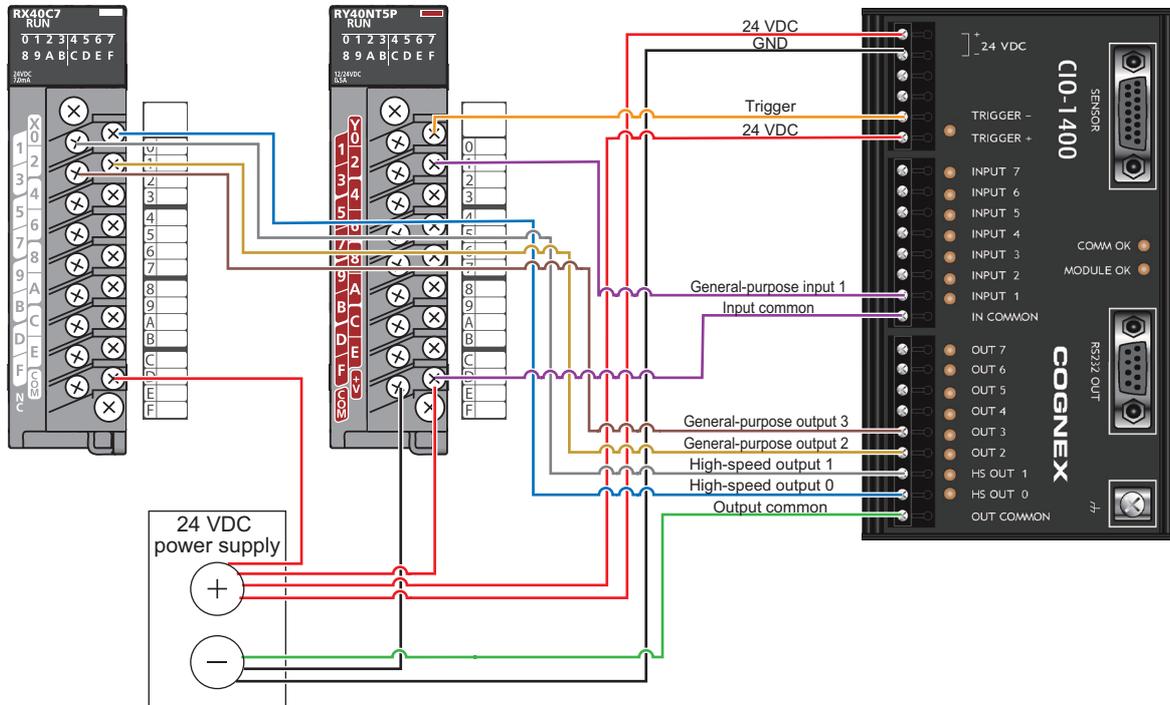
Source type

- Input module (positive/negative common shared type)
- Output module (source type)

7 INSTALLATION

7.1 Software Installation

To configure a vision sensor, In-Sight Explorer software must be installed on a networked personal computer.

In-Sight Explorer can be downloaded from the Mitsubishi Electric FA website.

www.MitsubishiElectric.co.jp/fa

7.2 Registration of a Profile

To configure communication between a programmable controller and a vision sensor with an engineering tool, a profile of the vision sensor needs to be registered to the engineering tool.

A profile is data that stores information of a connected device (such as a model name.)

By registering the profile to an engineering tool, vision sensors are added to "Module List" in the "Ethernet Configuration" window and the "CC-Link IEF Basic Configuration" window.

For details on how to register profiles, refer to the following:

📖GX Works2 Version 1 Operating Manual (Common)

📖GX Works3 Operating Manual

The profile of a vision sensor can be downloaded from the Mitsubishi Electric FA website.

www.MitsubishiElectric.co.jp/fa

7.3 Registration of an EDS File

To configure communication between an RJ71EIP91 or FX5-ENET/IP and a vision sensor VS20 with EtherNet/IP Configuration Tool, registering an EDS file to EtherNet/IP Configuration Tool is required.

An EDS file is data that stores information of a connected device (such as a model name).

For details on how to register an EDS file, refer to the following:

📖MELSEC iQ-R EtherNet/IP Network Interface Module User's Manual (Application)

📖MELSEC iQ-F FX5-ENET/IP User's Manual

The EDS file for a vision sensor can be downloaded from the Mitsubishi Electric FA website.

www.MitsubishiElectric.co.jp/fa

MEMO

8 MAINTENANCE AND INSPECTION

8.1 Cleaning a Vision Sensor Housing

- To clean the outside of the vision sensor housing, apply a small amount of mild detergent cleaner or isopropyl alcohol on a cleaning cloth.
- Do not attempt to clean the vision sensor with harsh or corrosive solvents, including lye, methyl ethyl ketone (MEK) or gasoline. It may cause a failure.

8.2 Cleaning an Image Sensor Window

- To remove dust from the outside of the image sensor window, use a pressurized air duster. The air must be free of oil, moisture, or other contaminants that could remain on the lens cover. These substances could remain on the glass and possibly degrade the image.
- Do not touch the glass part of the image sensor window.
- If oil/smudges still remain, clean the window with a cotton bud soaked in alcohol (ethyl, methyl or isopropyl).

8.3 Cleaning a Lens Cover

- To remove dust from the lens cover, use a pressurized air duster. The air must be free of oil, moisture, or other contaminants that could remain on the lens cover. These substances could remain on the lens and possibly degrade the image.
- To clean the plastic window of the lens cover, apply a small amount of isopropyl alcohol on a cleaning cloth. Do not scratch the plastic window.

8

MEMO

8 MAINTENANCE AND INSPECTION
8.3 Cleaning a Lens Cover

9 TROUBLESHOOTING

If an error occurred while using a vision sensor, check the troubleshooting in the help of In-Sight Explorer and take corrective action.

MEMO

9 TROUBLESHOOTING

APPENDIX

Appendix 1   EMC and Low Voltage Directives

Compliance with the EMC Directive, which is one of the EU directives, has been mandatory for products sold within EU member states since 1996 as well as compliance with the Low Voltage Directive since 1997.

For products compliant to the EMC and Low Voltage Directives, their manufacturers are required to declare compliance and affix the CE marking.

The sales representative in EU member states is:

Company: MITSUBISHI ELECTRIC EUROPE B.V.

Address: Mitsubishi-Electric-Platz 1, 40882 Ratingen, Germany

Measures to comply with the EMC Directive

The EMC Directive sets requirements for emission (conducted and radiated electromagnetic interference emitted by a product) and immunity (the ability of a product not to be influenced by externally generated electromagnetic interference).

This section describes the precautions for machinery constructed with the MELSENSOR VS20 models to comply with the EMC Directive.

These precautions are based on the requirements of the EMC Directive and the harmonized standards. However, they do not guarantee that the entire machinery constructed according to the descriptions complies with the EMC Directive.

The manufacturer of the machinery must determine the testing method for compliance and declare conformity to the EMC Directive.

EMC Directive related standards

■ Emission requirements

Standard: EN61131-2:2007

Test item	Test description	Value specified in standard
CISPR16-2-3 Radiated emission	The electromagnetic wave emitted by the product to the external space is measured.	• 30 to 230MHzQP: 40dBμV/m (measured at 10m distance)[1] • 230 to 1000MHzQP: 47dBμV/m (measured at 10m distance)
CISPR16-2-1, CISPR16-1-2 Conducted emission	The noise level which the product emits to the power line is measured.	• 0.15 to 0.5MHzQP: 79dB, Mean: 66dB[1] • 0.5 to 30MHzQP: 73dB, Mean: 60dB

*1   QP: Quasi-Peak value, Mean: Average value

■ Immunity requirements

Standard: EN61131-2:2007

Test item	Test description	Value specified in standard
EN61000-4-2 Electrostatic discharge immunity	An electrostatic discharge is applied to the enclosure of the equipment.	• 8kV: Air discharge • 4kV: Contact discharge
EN61000-4-3 Radiated, radio-frequency, electromagnetic field immunity	An electric field is radiated to the product.	80% AM modulation @1kHz • 80 to 1000MHz: 10Vm • 1.4 to 2.0GHz: 3Vm • 2.0 to 2.7GHz: 1Vm
EN61000-4-4 Fast transient burst immunity	Burst noise is applied to power lines and signal lines.	• AC/DC power, I/O power, and AC I/O (unshielded) lines: 2kV • DC I/O, analog, and communication lines: 1kV
EN61000-4-5 Surge immunity	Lightning surge is applied to power lines and signal lines.	• AC power, AC I/O power, and AC I/O (unshielded) lines: 2kV CM, 1kV DM • DC power and DC I/O power lines: 0.5kV CM, 0.5kV DM • DC I/O, AC I/O (shielded), analog, and communication lines: 1kV CM
EN61000-4-6 Conducted RF immunity	High-frequency noise is applied to power lines and signal lines.	0.15 to 80MHz, 80% AM modulation @1kHz, 10Vrms
EN61000-4-8 Power-frequency magnetic field immunity	The product is immersed in the magnetic field of an induction coil.	50/60Hz, 30A/m
EN61000-4-11 Voltage dips and interruptions immunity	Power voltage is momentarily interrupted.	• 0%, 0.5 periods, starting at zerocrossing • 0%, 250/300 periods (50/60Hz) • 40%, 10/12 periods (50/60Hz) • 70%, 25/30 periods (50/60Hz)

Measures to comply with the Low Voltage Directive

The MELSENSOR VS20 models are out of the requirement for conformance to the Low Voltage Directive.
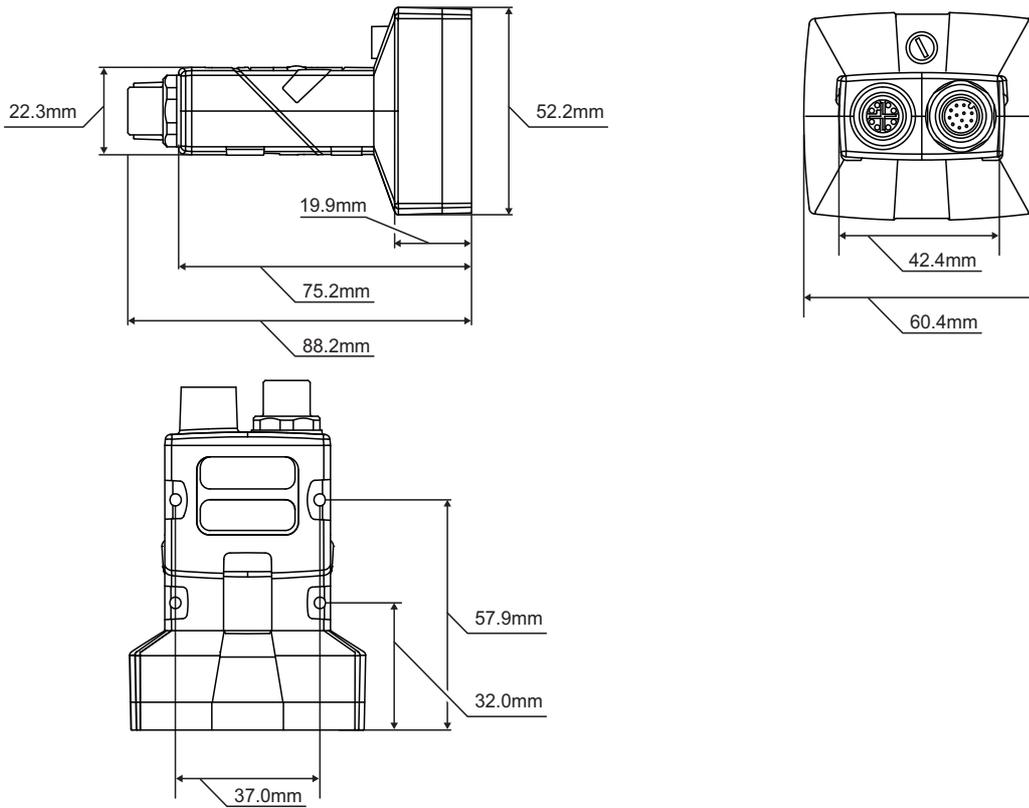
UL/cUL

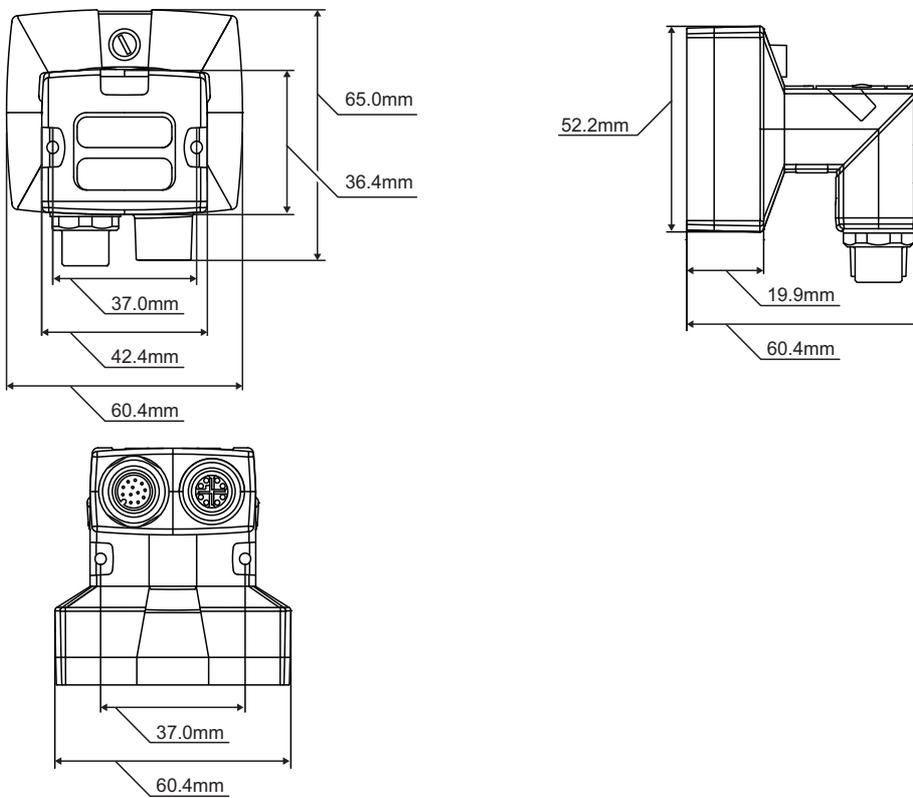This section shows the standards that comply with UL.

• UL/cUL application

Item	Description
UL/cUL applicable standard	UL 60950-1, 2nd Edition, 2014-10-14 CAN/CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-10

Appendix 2 External Dimensions

The following figures show the size of a vision sensor in the straight configuration.

The following figures show the size of a vision sensor in the right angle configuration.

A

REVISIONS

Revision date	*Manual number	Description
June 2017	SH(NA)-081769ENG-A	First edition
February 2018	SH(NA)-081769ENG-B	■Added or modified parts PRECAUTIONS FOR USE, RELEVANT MANUALS, Section 3.2, Chapter 4, Section 5.5, Section 6.5, Section 6.10, Section 7.2
June 2018	SH(NA)-081769ENG-C	■Added or modified parts Section 5.5, Section 5.6, Section 6.2, Section 7.1
March 2019	SH(NA)-081769ENG-D	■Added or modified parts Section 3.2, Section 5.1, Section 5.5, Section 7.2
January 2020	SH(NA)-081769ENG-E	■Added or modified parts PRECAUTIONS REGARDING WARRANTY AND SPECIFICATIONS, SAFETY PRECAUTIONS, PRECAUTIONS FOR USE, Section 5.6, Appendix 1
July 2021	SH(NA)-081769ENG-F	■Added or modified parts PRECAUTIONS REGARDING WARRANTY AND SPECIFICATIONS, SAFETY PRECAUTIONS, PRECAUTIONS FOR USE, CONDITIONS OF USE FOR THE PRODUCT, RELEVANT MANUALS, TERMS, Section 3.2, Section 5.1, Section 5.5, Section 7.3, Appendix 1
March 2022	SH(NA)-081769ENG-G	■Added or modified part Section 5.6

Japanese manual number: SH-081768-G

WARRANTY

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the sales representative or Mitsubishi Service Company.

However, if repairs are required onsite at domestic or overseas location, expenses to send an engineer will be solely at the customer's discretion. Mitsubishi shall not be held responsible for any re-commissioning, maintenance, or testing on-site that involves replacement of the failed module.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for eighteen (18) months after the date of purchase or delivery to a designated place.

Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be twenty-four (24) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

[Gratis Warranty Range]

(1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.

(2) Even within the gratis warranty term, repairs shall be charged for in the following cases.

1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
2. Failure caused by unapproved modifications, etc., to the product by the user.
3. When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
5. Failure caused by external irresistible forces such as fires or abnormal voltages, and Failure caused by force majeure such as earthquakes, lightning, wind and water damage.
6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
7. Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

2. Onerous repair term after discontinuation of production

(1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.

(2) Product supply (including repair parts) is not available after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:

(1) Damages caused by any cause found not to be the responsibility of Mitsubishi.

(2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.

(3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.

(4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

TRADEMARKS

Cognex and In-Sight are either registered trademarks or trademarks of Cognex Corporation.

The company names, system names and product names mentioned in this manual are either registered trademarks or trademarks of their respective companies.

In some cases, trademark symbols such as '™' or '®' are not specified in this manual.

MITSUBISHI ELECTRIC CORPORATION

When exported from Japan, this manual does not require application to the
Ministry of Economy, Trade and Industry for service transaction permission.

Specifications subject to change without notice.