MITSUBISHI ELECTRIC

FA Sensor

MELSENSOR

Vision Sensor VS80
User's Manual

-VS80M-100-E
-VS80M-100
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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
Case temperature	0 to 50℃*1
Ambient storage temperature	-20 to 80℃
Maximum humidity	Less than 80% RH, non-condensing
Vibration resistance	IEC 60068-2-6: A vibration of 10 G (10 to 500 Hz at 100 m/s^2 with 15 mm width) was applied to each X, Y, and Z direction for 2 hours.
Shock resistance	IEC 60068-2-27: 18 half sinusoidal shocks (3 shocks for each X, Y, and Z direction) with 80 G (800 m/s^2 at 11 ms) were applied.
Operating atmosphere	There is no danger of corrosive gases, flammable gases, and strong alkaline substances to adhere.
Protective structure	IP40 (with cables connected and appropriate lens attached)
Installation location	Outside a control panel

*1 A vision sensor should be used in the environment where the temperature around the vision sensor is about 0 to 35℃ because the case temperature is easily influenced by the environment the vision sensor is installed in.

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 for the input/output, 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 (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.
- When connecting a device to a CPU module (Ethernet port), turn the power of the CPU module OFF first, then connect the device.

[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 avoid the risk of injury or equipment damage:

- The power for a vision sensor is intended to be supplied by IEEE802.3af, UL, or NRTL approved PoE power supply with class 0, 2, 3, or 4.
  Apply a PoE power supply that suits the system environment.
  Any other voltage creates a risk of fire or shock and can damage the components.
  Applicable national and local wiring standards and rules must be followed.
- If there is concern about noise when using an AC type PoE power supply, set a noise filter (EAP-03-472 by COSEL, or an equivalent product) to the PoE 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.
- 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
VS80	VS80M-100-E, VS80M-100, VS80M-200-E, VS80M-200-ER, VS80M-200, VS80M-200-R, VS80M-400-E, VS80M-400-ER, VS80M-400, VS80M-400-R, VS80M-202-E, VS80M-202-ER, VS80M-202, VS80M-202-R, VS80M-402-E, VS80M-402-ER, VS80M-402, VS80M-402-R, VS80C-100, VS80C-200-R, VS80C-400-R , VS80C-202-R, VS80C-402-R

CONTENTS

RELEVANT MANUALS

Manual name [manual number]	Description	Available form
Vision Sensor VS80 User's Manual [SH-081891ENG] (this manual)	Functions, installation methods, system configuration, and required hardware components, etc. of the vision sensor VS80	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

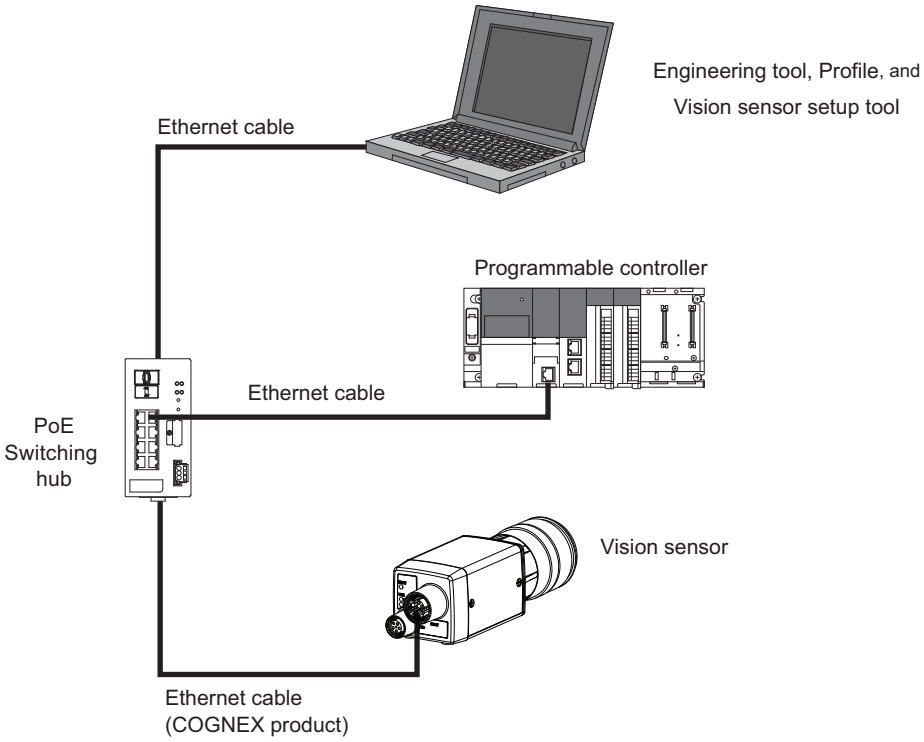
Unless otherwise specified, this manual uses the following terms.

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.)
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 locationing, 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.)
OCRMax™	A high performance OCR (Optical Character Recognition) tool which provides high text-reading ability and high-speed processing capability. OCRMax overcomes the limitations of other OCR technologies, and it handles character variations, text skew, and proportional fonts.
PatMax RedLine™	A location tool for high-speed pattern matching, which has been improved based on PatMax technology, to locate parts and features. PatMax RedLine is designed to detect a target object in runs 10 times faster than PatMax, with no loss of search accuracy on high-resolution images.
PatMax®	A feature location tool (patented technology authorized by the United States) which Cognex Corporation developed by utilizing advanced geometric pattern matching technology. Objects can be found reliably and accurately despite changes in angle, size, and shading.
PoE	An abbreviation for Power over Ethernet. A technology that supplies electric power through an Ethernet cable. This allows a hub and cables that support PoE to supply electric power to devices.
QnUDE(H)CPU	A generic term for Q03UDECPU, Q04UDEHCPU, Q06UDEHCPU, Q10UDEHCPU, Q13UDEHCPU, Q20UDEHCPU, Q26UDEHCPU, Q50UDEHCPU, and Q100UDEHCPU
ReadIDMax	A tool to read barcodes with high-accuracy. By using 1DMax™ and 2DMax™, up to 128 barcodes can be read at one time regardless of the position of the barcodes in the screen. • 1DMax: A 1-D barcode reading algorithm optimized for omnidirectional barcode reading. • 2DMax: A 2-D code reading algorithm that provides reliable code reading despite code quality, printing method, or the surface that the codes are marked on.
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.
Trigger debounce	The time from when a trigger is input to a connector of a camera to when the camera detects the trigger.
Universal model High-speed Type QCPU	A generic term for Q03UDVCPU, Q04UDVCPU, Q06UDVCPU, Q13UDVCPU, and Q26UDVCPU

Term	Description
Universal model process CPU	A generic term for Q04UDPVCPU, Q06UDPVCPU, Q13UDPVCPU, and Q26UDPVCPU
Vision sensor VS80	A generic term for VS80M-100-E, VS80M-100, VS80M-200-E, VS80M-200-ER, VS80M-200, VS80M-200-R, VS80M-400-E, VS80M-400-ER, VS80M-400, VS80M-400-R, VS80M-202-E, VS80M-202-ER, VS80M-202, VS80M-202-R, VS80M-402-E, VS80M-402-ER, VS80M-402, VS80M-402-R, VS80C-100, VS80C-200-R, VS80C-400-R, VS80C-202-R, and VS80C-402-R

1 PRODUCT OVERVIEW

Vision sensor VS80s 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 VS80 can be configured remotely over a network.

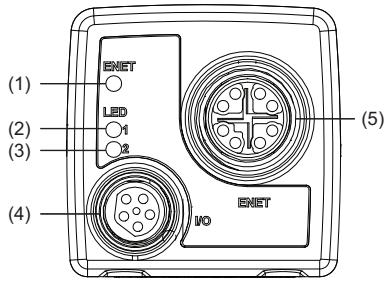


MEMO

2 PART NAMES

Connectors and indicators

The part names and functions of a vision sensor VS80 are shown below.



Item	Name	Function
(1)	ENET LED	Indicates the link status. • Flashing (green): Linking-up (1 Gbps) • Flashing (orange and green): Linking-up (100 Mbps) • Flashing (red): Linking-up (10 Mbps) • OFF: Linking-down
(2)	LED1	Turns ON in green when the vision sensor is active (editing a job). (The status is not set by default.) *1
(3)	LED2	Turns ON in red when the vision sensor is active (editing a job). (The status is not set by default.) *1
(4)	I/O connector	An M8 connector that provides access to a trigger input and high-speed output through a breakout cable or an I/O module cable. (☞ Page 22 Breakout cable specifications, Page 23 I/O module cable specifications)
(5)	ENET connector	A 10Base-T/100Base-T/1000Base-T connector that provides Ethernet connection and PoE through an Ethernet cable. (☞ Page 22 Ethernet cable specifications)

*1 The status can be changed by setting "Inputs/Outputs" in In-Sight Explorer. (☞ Page 24 Function List)

Point

- When the power is turned ON, the ENET LED turns ON in orange.
  Then, LED1 turns ON in green and LED2 turns ON in red.
  After that, both LED1 and LED2 turn OFF.
- If both LED1 and LED2 are turned ON in red, the firmware update of the vision sensor was interrupted.

MEMO

3 SPECIFICATIONS

This chapter shows the specifications of vision sensor VS80s.

3.1 General Specifications

The following shows the general specifications of vision sensor VS80s.

Item	Specifications
Case temperature	0 to 50℃[*1,*2,*3]
Ambient storage temperature	-20 to 80℃
Maximum humidity	Less than 80% RH, non-condensing
Vibration resistance	IEC 60068-2-6: A vibration of 10 G (10 to 500 Hz at 100 m/s^2 with 15 mm width) was applied to each X, Y, and Z direction for 2 hours.
Shock resistance	IEC 60068-2-27: 18 half sinusoidal shocks (3 shocks for each X, Y, and Z direction) with 80 G (800 m/s^2 at 11 ms) were applied.
Operating atmosphere	There is no danger of corrosive gases, flammable gases, and strong alkaline substances to adhere.
Protective structure	IP40 (with cables connected and appropriate lens attached)
Installation location[*4]	Outside a control panel

*1 Case temperature can be confirmed using EV GetSystemConfig ("Internal.Temperature") Extended Native Mode command.
When the command is issued, it will return the internal temperature of a vision sensor in degrees Celsius.
The returned temperature will be ±5 degrees of the case temperature of a vision sensor.
For details on the command, refer to the help of In-Sight Explorer.

*2 Additional cooling measures are required if the case temperature exceeds 50℃.
Examples of such measures include:
· Attach an extra heat sink to a vision sensor using M3 screws.
· Lower the ambient temperature so that air can pass through a vision sensor.

*3 A vision sensor should be used in the environment where the temperature around the vision sensor is about 0 to 35℃ because the case temperature is easily influenced by the environment the vision sensor is installed in.

*4 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 VS80s.

Specifications	VS80M-100-E VS80M-100	VS80M-200-E VS80M-200-ER VS80M-200 VS80M-200-R	VS80M-400-E VS80M-400-ER VS80M-400 VS80M-400-R	VS80M-202-E VS80M-202-ER VS80M-202 VS80M-202-R	VS80M-402-E VS80M-402-ER VS80M-402 VS80M-402-R
Processor performance	1 time	1.5 times	2 times	1.5 times	2 times
Memory	512 MB flash memory Unlimited storage when storing in the remote network device Image processing: 512 MB SDRAM				
Imager type	1/1.8 inch CMOS, global shutter				
	3.6 mm diagonal, 4.5 × 4.5 μm square pixels			9 mm diagonal, 4.5 × 4.5 μm square pixels	
Lens	C-mount				
Image resolution (pixels)	640 × 480			1600 × 1200	
Bit depth	256 gray levels (8 bits/pixel).				
Electronic shutter speed	14μs to 520ms			20μs to 940ms	
Maximum image acquisition speed[*1,*2]	217 full frames per second			53 full frames per second	
Power consumption	Max. 6.49 W (supplied with PoE (class 2))				
Trigger	• Opto-isolated image acquisition trigger input × 1 • Remote software commands via Ethernet				
Discrete inputs	• N/A • General-purpose input × 8: Available when connecting a CIO-MICRO I/O module[*3]				
Discrete outputs	• Opto-isolated NPN/PNP high-speed output × 2 • General-purpose output × 8: Available when connecting a CIO-MICRO I/O module[*3]				
Network communication	CC-Link IE Field Network Basic, SLMP scanners, SLMP, MODBUS/TCP, TCP/IP, UDP, FTP, Telnet (native mode), DHCP (default at shipment from the factory), fixed and link local IP address setting				
Material	Zinc die-cast housing				
Mounting	M3 screw hole × 4				
Dimensions	31.0 mm × 31.2 mm × 75.1 mm				
Weight	132.2 g				

Specifications	VS80C-100	VS80C-200-R	VS80C-400-R	VS80C-202-R	VS80C-402-R
Processor performance	1 time	1.5 times	2 times	1.5 times	2 times
Memory	512 MB flash memory Unlimited storage when storing in the remote network device Image processing: 512 MB SDRAM				
Imager type	1/1.8 inch CMOS, global shutter				
	3.6 mm diagonal, 4.5 × 4.5 μm square pixels			9 mm diagonal, 4.5 × 4.5 μm square pixels	
Lens	C-mount				
Image resolution (pixels)	640 × 480			1600 × 1200	
Bit depth	24-bit color				
Electronic shutter speed	14μs to 520ms			20μs to 940ms	
Maximum image acquisition speed[*1,*2]	135 full frames per second			33 full frames per second	
Power consumption	Max. 6.49 W (supplied with PoE (class 2))				
Trigger	• Opto-isolated image acquisition trigger input × 1 • Remote software commands via Ethernet				
Discrete inputs	• N/A • General-purpose input × 8: Available when connecting a CIO-MICRO I/O module[*3]				
Discrete outputs	• Opto-isolated NPN/PNP high-speed output × 2 • General-purpose output × 8: Available when connecting a CIO-MICRO I/O module[*3]				
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				
Material	Zinc die-cast housing				
Mounting	M3 screw hole × 4				
Dimensions	31.0 mm × 31.2 mm × 75.1 mm				

Specifications	VS80C-100	VS80C-200-R	VS80C-400-R	VS80C-202-R	VS80C-402-R
Weight	132.2 g				

*1 The number of image sensor rows can be set in In-Sight Explorer.
Decreasing the number of rows will increase the number of frames per second acquired by a vision sensor.
For details, refer to the help of In-Sight Explorer.

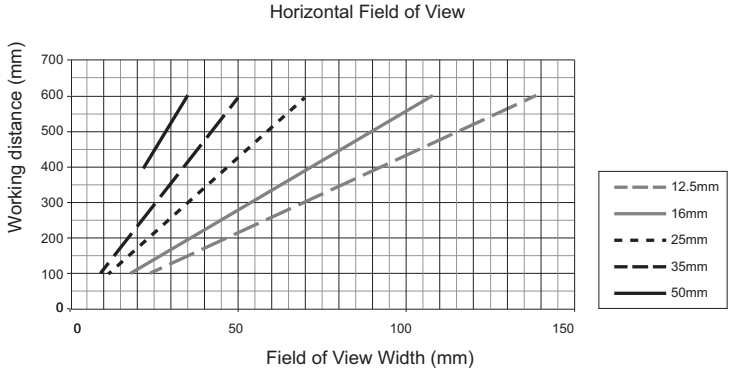
*2 The maximum frame rate of full image frame capture when all of the following conditions are applied.
· Minimum exposure
· No connection with In-Sight Explorer
· Images are captured with an image acquisition trigger input

*3 For details on an I/O module, refer to the following section.
☞ Page 43 Connection of an I/O Module

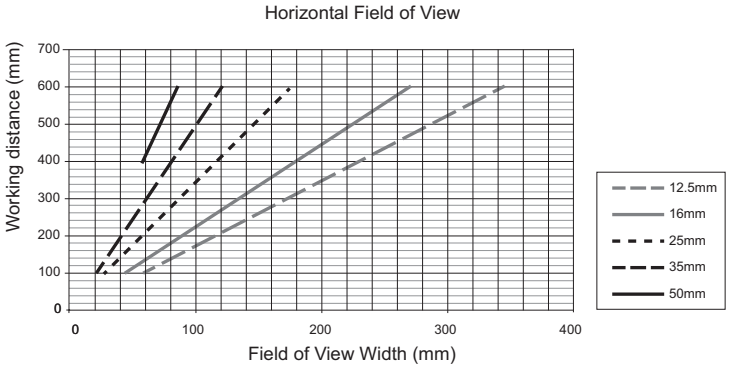
Working distance and field of view

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.

- VS80M-100-E, VS80M-100, VS80M-200-E, VS80M-200-ER, VS80M-200, VS80M-200-R, VS80M-400-E, VS80M-400-ER, VS80M-400, VS80M-400-R, VS80C-100, VS80C-200-R, VS80C-400-R



- VS80M-202-E, VS80M-202-ER, VS80M-202, VS80M-202-R, VS80M-402-E, VS80M-402-ER, VS80M-402, VS80M-402-R, VS80C-202-R, VS80C-402-R



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 section.

☞ Page 22 Breakout cable specifications

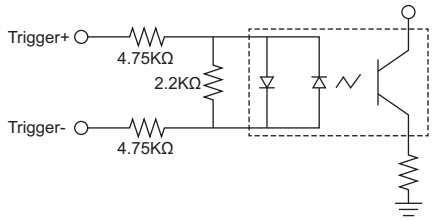
Image acquisition trigger input

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: 20 to 28 VDC (standard 24 VDC) • OFF: 0 to 3 VDC (standard threshold: 8 VDC)
Current	• ON: 1.9 to 3.0 mA (20 to 28 VDC input) • OFF: less than 300μA (less than 3 VDC input)
Delay*1	Maximum 7.2 μs delay from when a vision sensor receives a trigger to when an image acquisition starts. Input pulse should be a minimum of 1 ms wide.

*1 The maximum delay is obtained based on 1μs trigger debounce time.

To trigger from the output of a sink type photodetector or programmable controller, connect 'Trigger-' of a breakout cable to 24 VDC, and connect 'Trigger+' to the output of a photoelectric sensor or an output module.
When the output turns ON, 'Trigger+' is pulled down to 0 VDC, and then the opto-coupler of the sensor turns 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 photoelectric sensor or an output module, and connect 'Trigger-' to 0 VDC.
When the output turns ON, 'Trigger+' is pulled up to 24 VDC, and then the opto-coupler of the sensor turns ON.



Maximum voltage between input pins: 28 V, standard voltage transition: 8 V

High-speed outputs

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

Specifications	Description
Voltage	28 VDC maximum through external load
Current	• Sink current: Max. 100 mA • Leakage current in OFF status: Max. 100 μA • External load resistance: 240 Ω to 10 kΩ Each line is rated at a maximum 100 mA and protected against over-current, short circuits, and transients from switching inductive loads. A protection diode is required for a high inductive load.
Delay*1	Maximum delay to opto-isolators turning ON: 30 μs

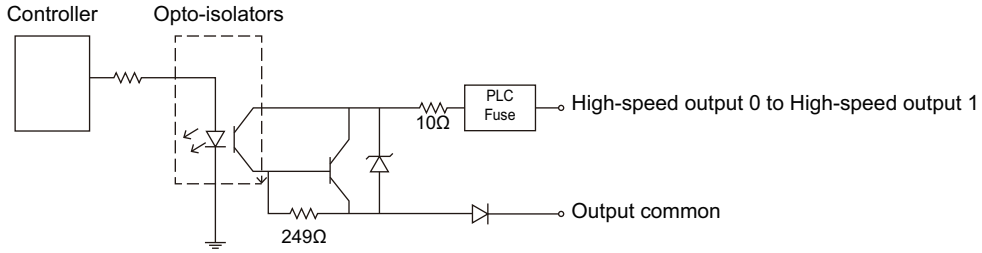
*1 The delay due to the turning OFF of optical isolators depends on which output is connected to the load.
With a 240 Ω load, the maximum delay will be 30 μs.

For a sink type device, connect an external load between 'High-speed output 0' to 'High-speed output 1' of a breakout cable and the positive side (standard 24 VDC).

'Output common' needs to be connected to the negative side (0 VDC).

When 'High-speed output 0' and 'High-speed output 1' are turned ON, the outputs are pulled down to 3 VDC or less, then a current flows to the external load.

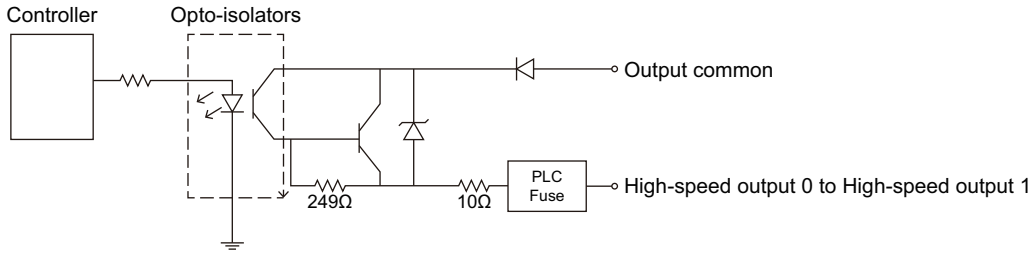
When 'High-speed output 0' and 'High-speed output 1' are turned OFF, a current does not flow to the external load.



For a source type device, connect an external load between 'High-speed output 0' to 'High-speed output 1' of a breakout cable and the negative side (0 VDC).

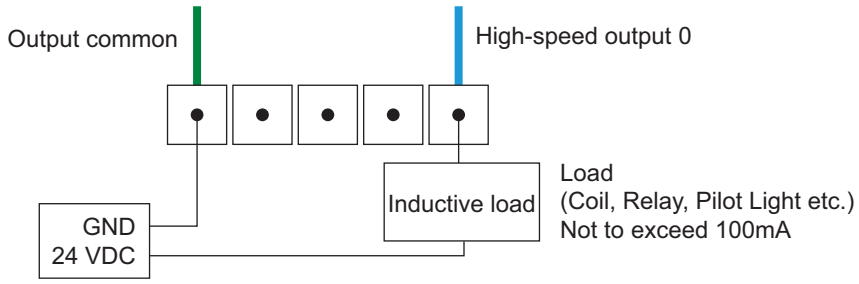
For a connection to which 'Output common' is connected to the positive side (standard 24 VDC), when 'High-speed output 0' and 'High-speed output 1' are turned ON, the outputs are pulled up to 21 VDC or more, then a current flows to the external load.

When 'High-speed output 0' and 'High-speed output 1' are turned OFF, a current does not flow to the external load.

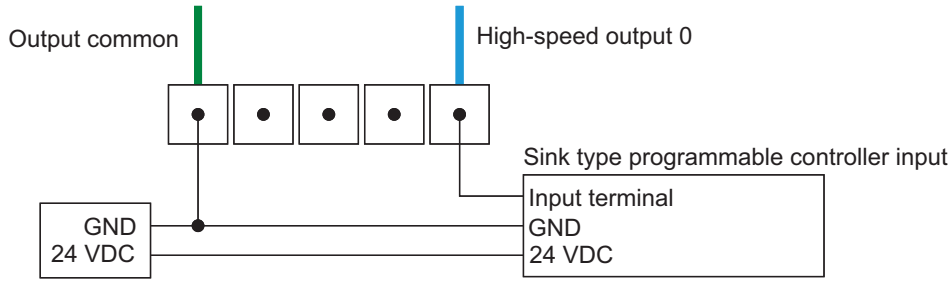


High-speed output wiring

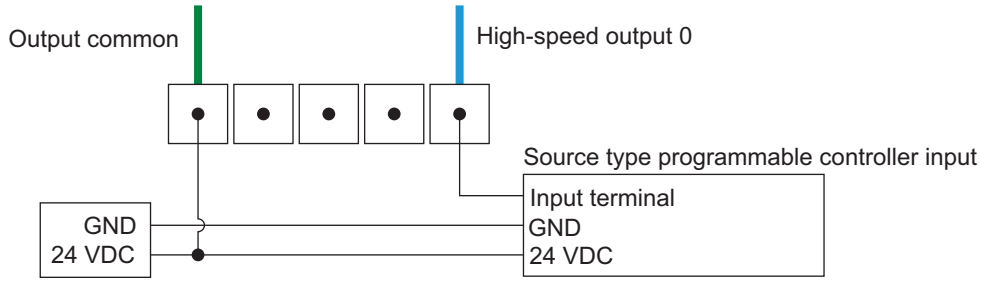
To connect a high-speed output to the same load with a relay or an LED using a breakout cable, connect the negative side of the load to the output, and the positive side to 24 VDC.
When 'High-speed output 0' and 'High-speed output 1' are turned ON, the output is pulled down to 3 VDC or less and which causes 21 VDC or more load.
Use a protective diode for a high inductive load. Connect anodes to 'High-speed output 0' and 'High-speed output 1' and the cathode to 24 VDC.



To connect to a sink type programmable controller input, connect 'High-speed output 0' and 'High-speed output 1' of the breakout cable to the programmable controller input terminal.
When 'High-speed output 0' and 'High-speed output 1' turn ON, the input terminal is pulled down to 3 VDC or less.



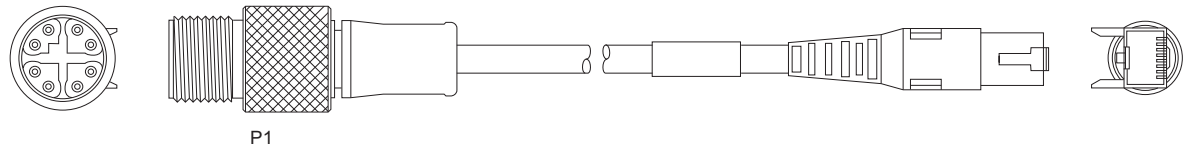
To connect to a source type programmable controller input, connect 'High-speed output 0' and 'High-speed output 1' of the breakout cable to the programmable controller input terminal.
When 'High-speed output 0' and 'High-speed output 1' are turned ON, the input terminal is pulled up to 21 VDC or more.



Ethernet cable specifications

Ethernet cables are used for the network communications by Ethernet connection and power supply.
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



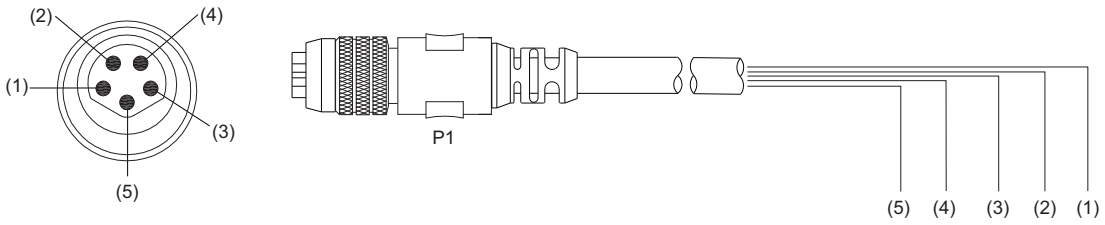
P1: To a vision sensor

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

A breakout cable is used for connecting a trigger and a high-speed output on a vision sensor.
Breakout cables are not terminated.



P1: To a vision sensor

Pin Number	Signal name	Wire color
(1)	High-speed output 0 (Direct 0)*1	Brown
(2)	High-speed output 1 (Direct 1)*1	White
(3)	Trigger+	Blue
(4)	Trigger-	Black
(5)	Output common	Gray

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

Precautions

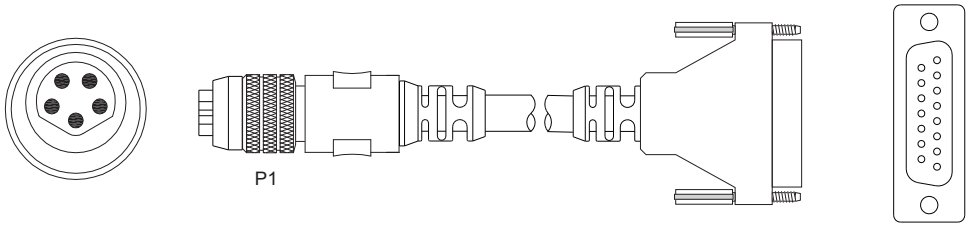
Cut unused wires or protect them with insulating materials.
Be careful not to short-circuit with 24 VDC wires.

Point

Cables are sold separately.

I/O module cable specifications

I/O module cables are used for connecting vision sensors to I/O modules directly.
Connect a cable to a trigger and high-speed output on a vision sensor.
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: To a vision sensor

Point

Cables are sold separately.

4 FUNCTIONS

This chapter explains the functions and setting methods for tools, which can be used for a vision sensor VS80.
For details, refer to the help of In-Sight Explorer.

4.1 Function List

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

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 a feature.
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.
Measurement Tools	To make settings for measuring the distance, diameter, angle, and dimension of a feature.
Counting Tools	To make settings for counting features.
Identification Tools	To make settings for identifying and verifying a feature and color.
Geometry Tools	To make settings for creating a geometrical figure.
Math & Logic Tools	To make settings for calculation processing and processing based on a logic by combining results set with multiple tools.
Plot Tools	To make settings for creating a conditionally enabled graphics that can be placed onto an image.
Image Filter Tools	To make settings for enhances an image or region of an image for image analysis.
Defect Detection Tools	To make settings for detecting a defect in an inspection target.
Calibration Tools	To make settings for creating a calibration that can be shared among jobs.
3. Configure Results	To set an output method for the determination results of the images that were acquired.
Inputs/Outputs	To set input and output data.
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 manual. 📖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.
Spreadsheet	To perform programming using spreadsheet in In-Sight Explorer. Spreadsheet is suitable for creating a complex vision application because spreadsheet has higher flexibility in setting than EasyBuilder.

Function name			Description
	Functions		To control a vision sensor and perform an inspection.
		Vision Tools	To locate parts or inspect products with functions such as Pattern Match, ID, Blob, Edge, InspectEdge, Image, Flaw Detection, or OCV/OCR.
		Geometry	To create a geometrical figure with dots and lines, and calculate the distance and angle between dots, circles, and lines.
		Graphics	To create an operator interface by editing contents displayed when operating a vision sensor.
		Mathematics	To create a formula with arithmetical functions, logical functions, statistical functions, and trigonometric functions equipped by default.
		Text	To format alphanumeric data character strings that are displayed in the spreadsheet and are used for the communication between a vision sensor and a remote device.
		Coordinate Transforms	To convert the location and distance of the feature between image, fixture, and world coordinate system.
		Input/Output	To control the method for a vision sensor to communicate with a remote device via Ethernet connection or serial port connection.
		Clocked Data Storage	To acquire one data from consecutive data every time an event occurs and the spreadsheet is updated.
		Vision Data Access	To extract values from data structures, functions, and references of other cells.
		Structures	To create graphics, fixture, mask, and region that can be used for other functions.
		Scripting	To provide the functions to perform a script by JavaScript. JavaScript source code can be created and edited on the spreadsheet.
	Snippets		A group of functions or parameters combined according to their faculty.

4.2 Tool List

The following table shows the details of tools that can be set in In-Sight Explorer.

Tool	Settings	Description
Location Tools	PatMax RedLine Pattern[*1]	To locate a single pattern, using the PatMax RedLine algorithms, and display the XY coordinates, angle, and score of the pattern.
	PatMax Pattern	To locate a single pattern feature, using the PatMax algorithm, and display the XY coordinates, angle, and score of the pattern.
	Pattern	To locate a single pattern feature, and display the XY coordinates, angle, and score of the pattern.
	PatMax RedLine Patterns (1-10)[*1]	To locate up to 10 patterns, using the PatMax RedLine algorithm, and display the XY coordinates, angle, and score of the patterns.
	PatMax Patterns (1-10)	To locate up to 10 patterns, using the PatMax algorithm, and display the XY coordinates, angle, and score of the patterns.
	Patterns (1-10)	To locate up to 10 patterns, and display the XY coordinates, angle, and score of the patterns.
	Edge	To locate linear edges. The XY coordinates of the mid-point of the edge, and its angular orientation are reported.
	Edge Intersection	To create a fixture from the intersection point of two edges, and report the XY coordinates of the crossing point and the bisect angle.
	Blob	To locate a blob (a single group of dark or light-colored connected pixels), and report the XY coordinates of the centroid of the found blob.
	Blobs (1-10)	To locate up to 10 blobs (groups of dark or light-colored connected pixels), and report the XY coordinates of the centroid of the found blobs.
	Color Blob	To locate a color blob (a single group of colored connected pixels), and report the XY coordinates of the centroid of the found blobs.
	Color Blobs (1-10)	To locate up to 10 blobs (groups of colored connected pixels), and report the XY coordinates of the centroid of the found blobs.
	Circle	To locate a circular edge feature, and report the diameter and XY coordinates of the circle's center.
	Compute Fixture	To calculate a fixture location based on mathematical expressions, and report the XY coordinates and the angle of the fixture. It is required for location tools or inspection tools as inputs.
Presence/Absence Tools	Brightness	To determine whether or not a feature is present or absent, based upon an average greyscale (brightness) value.
	Contrast	To determine whether or not a feature is present or absent, based upon the contrast between features.
	PatMax RedLine Pattern[*1]	To determine whether or not a pattern is present or absent, using the PatMax RedLine algorithm.
	PatMax Pattern	To determine whether or not a pattern is present or absent, using the PatMax algorithm.
	Pattern	To determine whether or not a pattern is present or absent.
	Pixel Count	To determine whether or not a feature is present or absent, based upon the number of dark or light-colored pixels in a region.
	Color Pixel Count	To determine whether or not a feature is present or absent, based upon the number of pixels that matches the selected Color Model(s) in a region.
	Blob	To determine whether or not blobs (groups of dark or light-colored connected pixels) are present.
	Color Blob	To determine whether or not color blobs (groups of colored connected pixels) are present.
	Edge	To determines whether or not a liner edge is present or absent.
	Circle	To determine whether or not a circular feature is present or absent.
	Sharpness	To determine the relative focus of images acquired by In-Sight Explorer by measuring the degree to which the region includes the smallest resolvable features in a 'scene'.

Tool	Settings	Description
Measurement Tools	Distance	To measure the distance between any two features (edges, circles, patterns, and/or blobs), and report the distance in pixels.
	Angle	To measure the distance between two linear edge features, and report the angle between the two edges.
	Blob Area	To measure the area of a blob (a single group of dark or light-colored connected pixels), and display the area in pixels.
	Blob Areas (1-10)	To measure the area of up to 10 blobs (groups of dark or light-colored connected pixels), and display the area in pixels.
	Color Blob Area	To measure the area of a color blob (a single group of colored connected pixels), and display the area in pixels.
	Color Blob Areas (1-10)	To measure the area of up to 10 color blobs (groups of colored connected pixels), and display the area in pixels.
	Circle Diameter	To detect a circular feature, and report the diameter in pixels.
	Circle Concentricity	To detect two circular features, and report the distance between the centers of two circles in pixels.
	Measure Radius	To define a curved edge feature, and report the radius of the curve.
	Min/Max Points	To measure the position of edges, and determines the edge points that are closest and furthest from either the edge or the region. To create a best-fit line or circle of the edge feature, and report the edge points that are closest and furthest from the best-fit line or circle.
Counting Tools	Blob	To count the number of blobs (groups of dark or light-colored connected pixels), and report the number of the blobs.
	Color Blobs	To count the number of color blobs (groups of colored connected pixels), and report the number of the color blobs.
	Edge	To count the number of liner edges, and report the number of the edges.
	Edge Pairs	To count the number of liner edge pairs, and report the number of the edge pairs.
	PatMax RedLine Pattern[*1]	To count the number of registered patterns in the image, using the PatMax RedLine algorithm, and report the number of the patterns.
	PatMax Pattern	To count the number of registered patterns, using the PatMax algorithm, and report the number of the patterns.
	Pattern	To count the number of registered patterns, and report the number of the patterns.
Identification Tools	Read 1D Code	To read and/or verify information contained in a single 1D code, using ReadIDMax, and display the decoded information.
	Read 1D Codes (1-20)	To read and verify information contained in up to 20 bar codes, using ReadIDMax, and display the decoded information.
	Read 2D Code	To read and/or verify information contained in a single 2D code, using ReadIDMax, and display the decoded information.
	Read 2D Codes (1-20)	To read and/or verify information contained in up to 20 2D codes, using ReadIDMax, and display the decoded information.
	Read Postal Code	To read and/or verify information contained in a single postal code, using ReadIDMax, and display the decoded information.
	Read Text (OCRMAX)	To read and verify the text within a region, after registering and creating user-defined character fonts. Using the OCRMax algorithm, optical character recognition (OCR) is performed through a process of segmentation and classification against a registered font database tool.
	PatMax RedLine Patterns (1-10)[*1]	To determine from a library of registered patterns which pattern best matches the pattern in the image, using the PatMax RedLine algorithm, and report the name of the pattern and its score.
	PatMax Patterns (1-10)	To determine from a library of registered patterns which pattern best matches the pattern in the image, using the PatMax algorithm, and report the name of the pattern and its score.
	Patterns (1-10)	To determine from a library of registered patterns which pattern best matches the pattern in the image, and report the name of the pattern and its score.
	Color	To determine which colors in a trained Color Library match the colors in the image, and display the name of the found colors.
	Color Model	To determine which colors in a trained Color Library match the colors in the image, and display the name of the found Color Model(s).

Tool	Settings	Description
Geometry Tools	Point-to-Point: Line	To create a reference line between any two input features, and report the XY coordinates of the end-points of the created line.
	Point-to-Point: Mid-Point	To create a reference line between two input features, and calculate the mid-point between the features. The XY coordinates of the mid-point and its angular orientation is reported.
	Point-to-Point: Dimension	To create two reference lines between two input features and a reference edge or line, and report the distance between the mid-points of the two created reference lines.
	Perpendicular Line	To create a reference line perpendicular to another line or edge, and report the XY coordinates of the end-points of the perpendicular line.
	Line Intersection	To create a point where two lines or edges or intersects, and report the XY coordinates of the intersection point.
	Bisect Angle	To create a reference line that defines the bisection angle between two edges or lines, and report the XY coordinates of the end-points of the line and the bisection angle.
	Line From N Points	To create a best fit reference line using three to ten input features, and report the XY coordinates of the end-points of the line.
	Circle From N Points	To create a best fit circle using three to ten input features, and report the diameter of the circle.
	Circle-Line Intersection	To create two points where a line intersects a circle, and report the XY coordinates of the two points.
	User-Defined Point	To position a reference point within an image, and report the XY coordinates of the point.
	User-Defined Line	To create a reference line within an image, and report the XY coordinates of the end-points of the line.
	Circle Fit	To create a best fit circle, and report the radius of the circle and its center point.
	Line Fit	To create a best fit line, and report the start and end points of the line segment.
Math & Logic Tools	Math	To create a mathematical formula to process tool and job data, using standard mathematical functions, operations, logic, statistics, and trigonometry, using the [Expression] editor.
	Logic	To create a logical formula of tool PASS and FAIL signals, using the [Expression] editor.
	Trend	To report maximum, minimum, average, sample, and standard deviation statistics for location tools or inspection tools, over a defined number of samples.
	Statistics	To report maximum, minimum, average, sample, and standard deviation statistics for location tools or inspection tools.
	Group	To combine a location tool and an inspection tool into a group.
	Sequence	To define the number of steps for a job requiring multiple image acquisitions or stages in the assembly process.
	Compute Point	To calculate the position of a point on an image based on mathematical expressions.
	Variables	To define integer, floating point, or string values that can be input to a job from an external device.
Plot Tools	Arc	To plot an arc graphic on an image based on mathematical expressions.
	Circle	To plot a circle graphic on an image based on mathematical expressions.
	Cross	To plot a cross graphic on an image based on mathematical expressions.
	Line	To plot a line graphic on an image based on mathematical expressions.
	Point	To plot a point graphic on an image based on mathematical expressions.
	Region	To plot a region graphic on an image based on mathematical expressions.
	String	To plot a text graphic on an image based on mathematical expressions.
Image Filter Tools	Filter	To filter a region of an image with a pixel-by-pixel image-enhancement technique (such as thresholding, inverting, equalization, shrinking, expanding, filling, smoothing, or edge enhancement), and output a tool image.
	Color to Greyscale	To filter a region of an image by converting each pixel in a color image to a greyscale value.
	Color to Binary	To filter a region of an image by applying white pixels to an active Color Model(s) and black pixels to all the others.
	Transform	To filter liner, non-liner, and/or lens distortion from a region of an image, and apply the transformation from a grid calibration to the image.
	Compare	To filter a region of an image against a template to represent the normalized difference between the two.

Tool	Settings	Description
Defect Detection Tools	Surface Flaw	To detect whether or not small flaws based upon pixel intensity variations.
	Edge	To create a best fit line or circle, and determines whether or not there are deviations, such as defects or gaps.
	Edge Pairs	To create a pair of best-fit line or circle, and determines whether or not there are deviations, such as defects or gaps.
	Edge Width	To measure and verify that the thickness of a pair of edge is within tolerance.
	Bead Finder	To detect a bead feature (defined by a pair of edges), regardless of shape, by detecting the center of the bead and creating a region that can be used to inspect the width of the bead.
	Bead Tracker	To inspect the location, shape, and width of a beard feature, and determine if the bead is in the correct position, based on a use-defined edge model of a bead feature (defined by a pair of edges).
Calibration Tools	N Point	To create a calibration that can be exported to share among jobs, using 2 to 16 point pairs.
	Sequential N Point	To create a calibration that can be exported to share among jobs, using 2 to 16 point pairs and images that are sequentially captured.

*1 For VS80M-200-ER, VS80M-200-R, VS80M-400-ER, VS80M-400-R, VS80M-202-ER, VS80M-202-R, VS80M-402-ER, VS80M-402-R, VS80C-200-R, VS80C-400-R, VS80C-202-R, and VS80C-402-R, the following patterns can be used: PatMax RedLine Pattern and PatMax RedLine Patterns (1-10).
As for VS80M-100-E, VS80C-100, VS80M-100, VS80M-200-E, VS80M-200, VS80M-400-E, VS80M-400, VS80M-202-E, VS80M-202, VS80M-402-E, and VS80M-402, the following patterns cannot be used: PatMax RedLine Pattern and PatMax RedLine Patterns (1-10).

4.3 Interface List

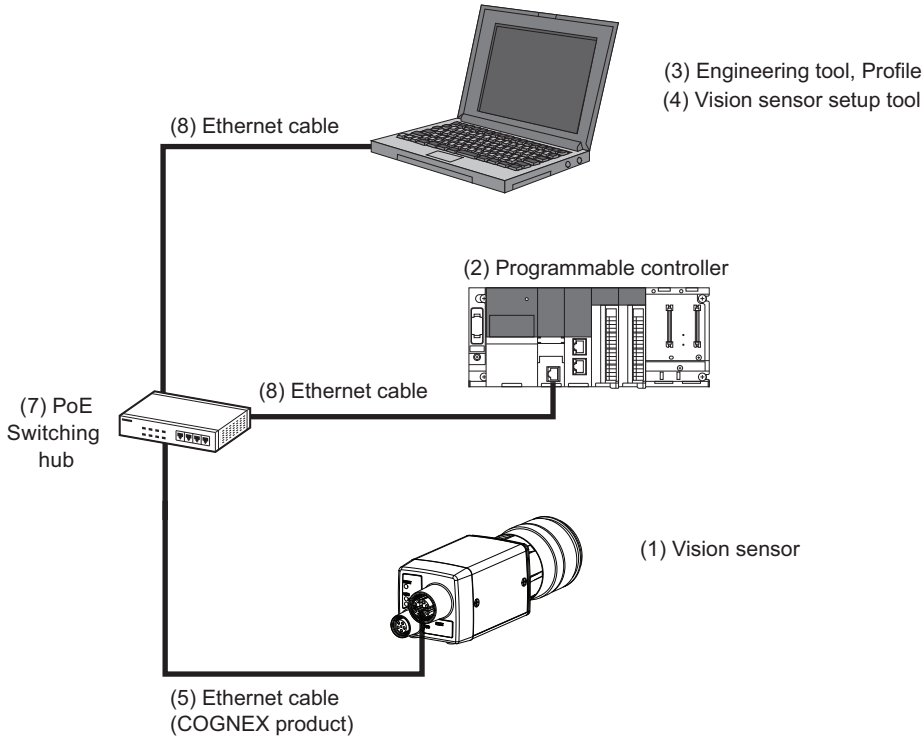
The following table shows the interfaces that can be used in In-Sight Explorer.

Interface	Description
EasyBuilder	To edit a job with an EasyBuilder interface.
Spreadsheet	To edit a job with an Spreadsheet interface.

5 SYSTEM CONFIGURATION

5.1 Ethernet Connection

The following figure shows the system configuration for Ethernet connection.

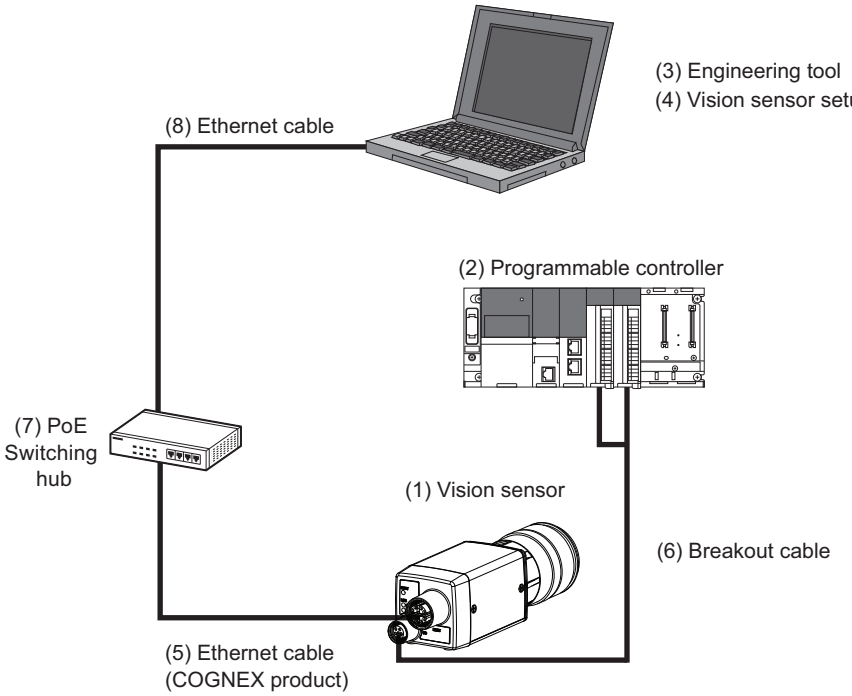


Point

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.

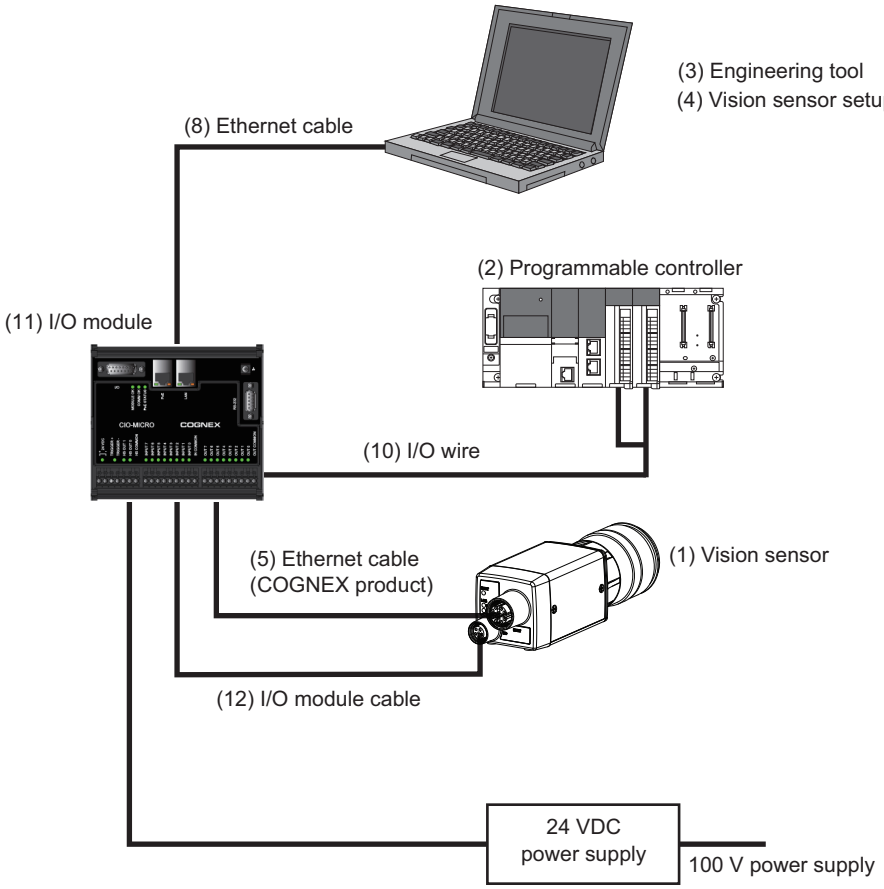
5.2 I/O Connection

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



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.



5.4 Hardware Components

The hardware components of the system configuration are as follows.

No.	Component name	Remarks	Reference
(1)	Vision sensor	Vision sensor VS80	—
(2)	Programmable controller	Required for using vision sensors.	Page 34 Modules
(3)	Engineering tool	Required for setting a programmable controller	Page 35 Software
(4)	Vision sensor setup tool	Required for setting a vision sensor	
(5)	Ethernet cable (COGNEX product)	Required for supplying power	Page 36 Cables
(6)	Breakout cable	Required for directly connecting a programmable controller and a vision sensor	
(7)	PoE switching hub	Required for supplying power to an Ethernet cable (COGNEX product)	Page 36 PoE switching hub
(8)	Ethernet cable	Commercial product	—
(9)	USB cable	Commercial product	
(10)	I/O wire	Commercial product	
(11)	I/O module	Optional item	Page 37 I/O module
(12)	I/O module cable	Optional item	Page 37 I/O module cable

5.5 Applicable System

The modules and software that are available for a vision sensor VS80 are as follows.

Modules

The modules and versions that are available for a vision sensor VS80 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
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)	—	—	—	○

*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 VS80 are as follows.

○: Supported, —: Not supported

Software	Connection method			
	SLMP	CC-Link IE Field Network Basic	MODBUS/TCP	EtherNet/IP
GX Works3	No restrictions*1	No restrictions*1	1.035M or later	1.072A or later
GX Works2	No restrictions*2	No restrictions*2	—	—
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 5.4.3 or later	Version 5.4.3 or later	Version 5.7.5PR1 or later	Version 5.7.5PR1 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 VS80 to a firmware that supports In-Sight Explorer.
For the firmware update of a vision sensor VS80, 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.

When using a VS80 color model

Configuration tool

Vision sensor setup tool	Version
In-Sight Explorer	Version 5.7.5 or later*1

*1 A vision sensor VS80 must also be updated to a firmware that supports In-Sight Explorer.
For the firmware update of a vision sensor VS80, 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."

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 VS80 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-M8IO-00	Cable length 0.6 m, M8 connector⇔5 stranded wires
	CCB-M8IO-02	Cable length 2 m, M8 connector⇔5 stranded wires
	CCB-M8IO-05	Cable length 5 m, M8 connector⇔5 stranded wires
	CCB-M8IO-10	Cable length 10 m, M8 connector⇔5 stranded wires
	CCB-M8IO-15	Cable length 15 m, M8 connector⇔5 stranded wires
	CCB-M8IO-30	Cable length 30 m, M8 connector⇔5 stranded wires

PoE switching hub

The following shows the PoE switching hubs that can be used for a vision sensor VS80.

Product name	Model (COGNEX model)	Remarks
PoE injector	CPS-24V-POE1	1-port PoE hub, 24 VDC power supply
	CPS-24V-POE4	4-port PoE hub, 24 VDC power supply, class 3
PoE adapter	CPS-AC-POE1A-JP	1-port PoE adapter, AC power supply

Lens

The C-mount lenses that are available for a vision sensor VS80 are as follows.

Product name	Model (COGNEX model)	Remarks
C-mount lens	LMC-ML-M0822UR	8 mm F2.2 aperture lens
	LMC-ML-M1218UR	12 mm F1.8 aperture lens
	LMC-ML-M1616UR	16 mm F1.6 aperture lens
	LMC-ML-M2516UR	25 mm F1.6 aperture lens
	LMC-ML-M3520UR	35 mm F2.0 aperture lens

A C-mount lens other than ones in the table above can also be used.

Items to prepare as needed

This section shows the products that are available for a vision sensor VS80.

Mounting kit

The mounting kit that is available for a vision sensor VS80 is as follows.

Product name	Model (COGNEX model)	Remarks
Mounting kit	BKT-IS8K-01	Four M3 screws to fix a vision sensor VS80 to a mounting bracket, and a mounting bracket to attach a vision sensor VS80 to the mounting surface are included.

I/O module

The I/O module that is available for a vision sensor VS80 is as follows.

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

I/O module cable

The I/O module cables that are available for a vision sensor VS80 are shown below.

Product name	Model (COGNEX model)	Remarks
I/O module cable	CCB-M8DSIO-00	Cable length 0.7 m
	CCB-M8DSIO-02	Cable length 2 m
	CCB-M8DSIO-05	Cable length 5 m
	CCB-M8DSIO-10	Cable length 10 m
	CCB-M8DSIO-15	Cable length 15 m

6 SYSTEM CONSTRUCTION

This chapter explains how to attach accessories to a vision sensor VS80.

6.1 Installation Environment

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

☞ 1 PRECAUTIONS FOR USE
☞ Page 16 General Specifications

6.2 Installation of a Vision Sensor

Vision sensor can be installed with the mounting block and four M3 screws included in the optional mounting kit.
The mounting block provides mounting holes (1/4-20 and M6) for attaching a vision sensor to a mounting surface.

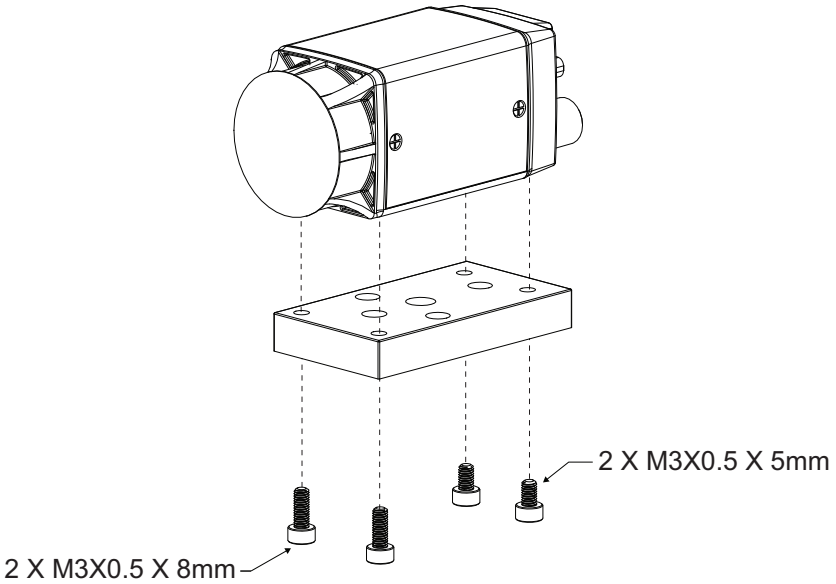
Precautions

- It is recommended the vision sensor be grounded, either by installing the vision sensor to a fixture that is electrically grounded or by connecting a wire from the vision sensor's fixture to frame ground or Earth ground.
- For the mounting holes closest to the lens opening, the insertion depth of the M3 screw should not exceed 4.5 mm.
- For the mounting holes closest to the connectors, the insertion depth of the M3 screw should not exceed 1.6 mm.

This does not include the thickness of the mounting material used.

Operating procedure

1. Align the holes on the mounting surface with the mounting holes on the vision sensor.
2. Insert the four M3 screws into the mounting holes, and tighten them using a 2.5 mm hex wrench.



Point

Screws are different in length; therefore, insert them to the correct mounting places.
The maximum tightening torque is 0.30 N·m.

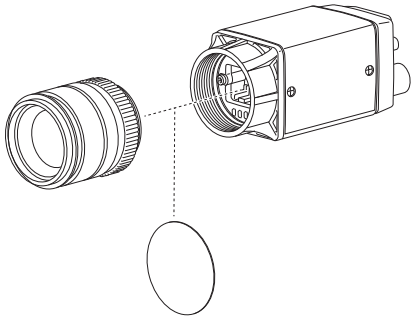
6.3 Attachment of a Lens

This section shows the attachment procedure of a lens.

Operating procedure

1. Check that the 24 VDC power supply is OFF.
2. Remove the lens protection cap and protective film from the vision sensor (if present).
3. Attach a C-mount lens to the vision sensor.

The exact lens focal length varies depending on the working distance and the field of view required for the machine vision application.

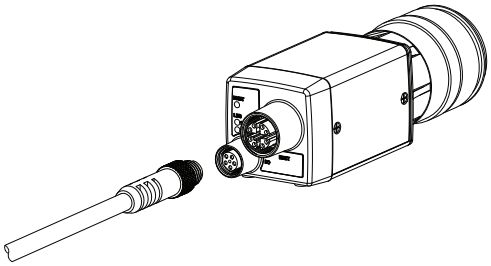


6.4 Connection of an Ethernet Cable

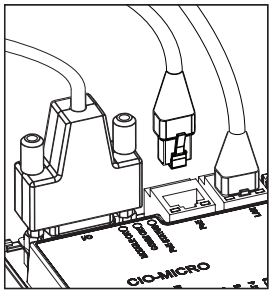
This section shows the procedure for connecting an Ethernet cable.

Operating procedure

1. Connect the Ethernet cable's M12 connector to the vision sensor's Ethernet connector.



2. Connect the RJ-45 connector of the Ethernet cable to the PoE port of an applicable device (such as an I/O module or a PoE switching hub).



Precautions

- The Ethernet cable shield must be grounded at the far end.

When using a PoE injector, a ground wire should be connected from the Ethernet shield at the PoE injector to a frame ground or an earth ground.

A digital voltmeter should be used to validate the grounding.

When using a PoE switching hub, it should have a metal case, with the case grounded to a frame ground or an earth ground.

- The PoE port of an I/O module provides power and Ethernet connectivity to a vision sensor.
  Connecting a device manufactured by other companies to this port could damage the I/O module.
- 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.
- When connecting a vision sensor and a programmable controller, simultaneously turn ON the vision sensor and the programmable controller, or first turn ON the power of the programmable controller.

6.5 Connection of a Breakout Cable

This section shows the procedure for connecting a breakout cable.

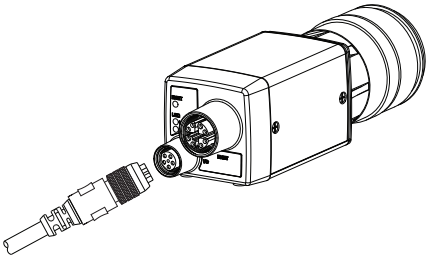
Point

For the specifications on the breakout cable, refer to the following section.

☞ Page 22 Breakout cable specifications

Operating procedure

1. Check that the 24 VDC power supply is OFF.
2. Connect the Power and I/O Breakout cable's M8 connector to the vision sensor's I/O connector.
3. Connect a trigger or a high-speed I/O wires to an appropriate device (such as a programmable controller, trigger sensor, or strobo light).



4. Turn ON the 24 VDC power supply.

Precautions

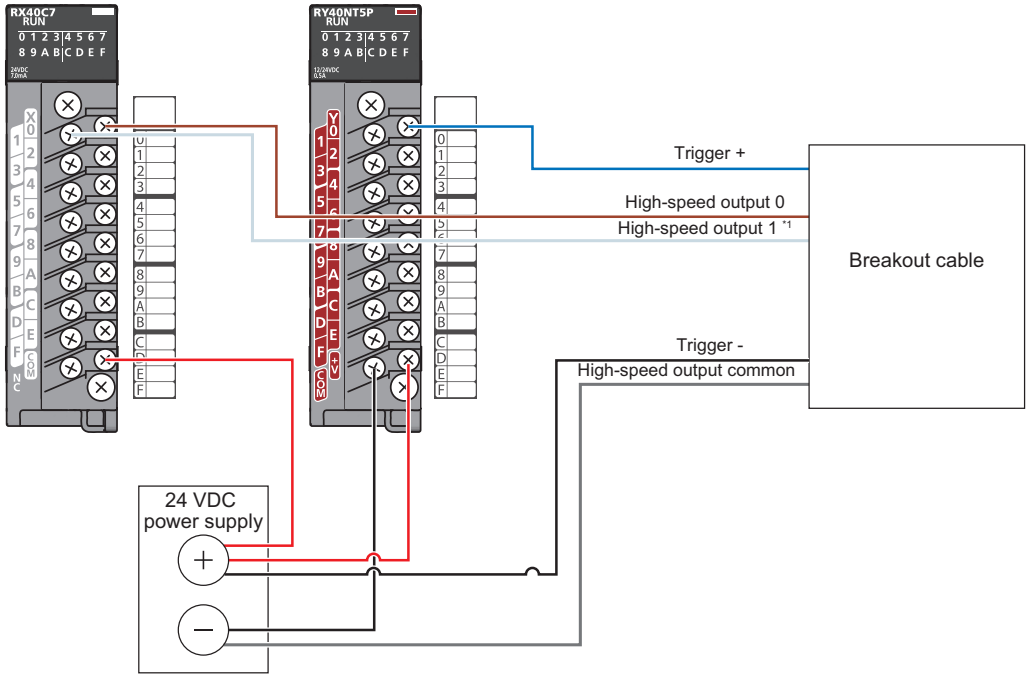
- To reduce emissions, connect the far end of the breakout cable shield to frame ground.
- Before wiring I/O wires to an I/O device or adjusting the connected wires, turn OFF the power of the vision sensor.
- Before adjusting a breakout cable, disconnect the Ethernet cable or turn OFF the PoE power supply.
- 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

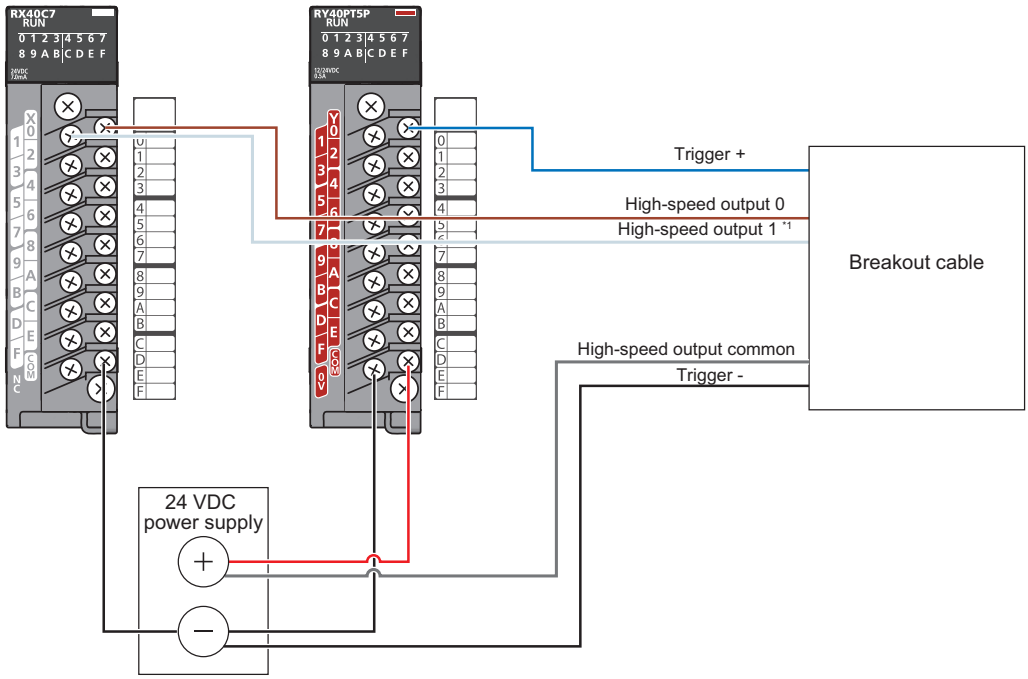
- Input module (positive/negative common shared type)
- Output module (sink type)



*1 The color of the wire is white.

Source type

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



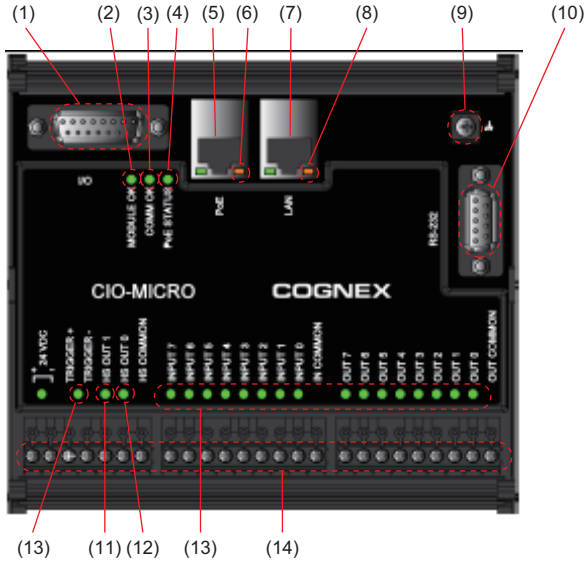
*1 The color of the wire is white.

6.6 Connection of an I/O Module

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

Specifications of CIO-MICRO I/O modules

For the connection between a CIO-MICRO I/O module and a programmable controller, use a terminal block.
If the I/O module is not used, a PoE injector or a PoE switching hub manufactured by other companies must be used to supply power to a vision sensor.



No.	Connector/Indicator	Description
(1)	I/O port (D-sub 15P, female)	Connects an I/O module to a vision sensor using an I/O module cable.
(2)	MODULE OK LED	Turns ON in green when an I/O module is initialized and the communication with a vision sensor is ready.
(3)	COMM OK LED	Turns ON in green when the communication with a vision sensor or an I/O module is successfully established.
(4)	PoE STATUS LED	Unsupported
(5)	PoE port	Connects the I/O module to a vision sensor with an Ethernet.
(6)	PoE port LED	Indicates the network connection status to a vision sensor. • Flashing (green): Linking-up • Flashing (orange): Data linking • OFF: Linking-down
(7)	LAN port	Connects the I/O module to an Ethernet network.
(8)	LAN port LED	Indicates the network connection status to a local area network. • Flashing (green): Linking-up • Flashing (orange): Data linking • OFF: Linking-down
(9)	Frame ground terminal	Connects the frame ground line to this terminal.
(10)	RS-232 port (D-sub 9P, female)	Unsupported
(11)	HS OUT0 LED	Turns ON in green when a high-speed output signal 0 is ON.
(12)	HS OUT1 LED	Turns ON in green when a high-speed output signal 1 is ON.
(13)	Each I/O and trigger status LED	Turns ON in green when each I/O signal is ON.
(14)	Terminal block	Connects the I/O module to a 24 VDC power supply, triggers, external I/Os, high-speed outputs, and commons.

Restriction

- 'General-purpose output 1', 'High-speed output 2/Input 2', and 'High-speed output 3/Input 3' are not supported.
- 1000Base-T is not supported.
- Before wiring or adjusting I/O wires, turn OFF the power of the vision sensor.

Point

- 'High-speed output 0' and 'High-speed output 1' can be set as sink or source current up to 50 mA.
- The general-purpose output can be set as sink or source current up to 100 mA that can be set by the user.

Connection procedure of a CIO-MICRO I/O module

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

Operating procedure

1. Page 44 Connecting an I/O module to a power supply
2. Page 44 Connecting an I/O module to a frame ground
3. Page 45 Connecting an I/O module (terminal block) to a programmable controller
4. Page 45 Connecting an I/O module (LAN port) to a programmable controller
5. Page 45 Connecting an Ethernet cable to a vision sensor
6. Page 45 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. Check that the 24 VDC power supply is OFF.
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 0.1921 N·m.

Precautions

Do not connect an I/O module to a power supply other than 24 VDC. Additionally, 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 (RS-232 port, LAN port, PoE port, and I/O 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 a programmable controller

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 0.1921N·m.

Connecting an I/O module (LAN port) to a programmable controller

Operating procedure

1. Connect a LAN cable (RJ-45 connector) to the LAN port of the I/O module.
2. Connect the other end of the LAN cable to a switching hub, router, or a programmable controller.

Connecting an Ethernet cable to a vision sensor

Operating procedure

1. Connect the M12 connector of an Ethernet cable to the ENET connector of the vision sensor.
2. Connect the RJ-45 connector of the Ethernet cable to the PoE port of the I/O module.

Connecting an I/O module cable to a vision sensor

Operating procedure

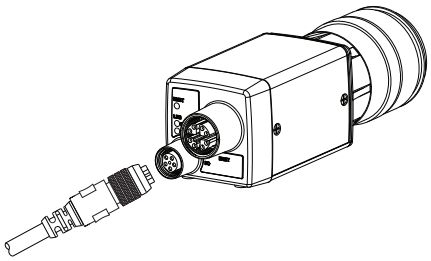
1. Connect the M8 connector of the I/O module cable to the I/O connector of the vision sensor.
2. Connect the DB15 connector of the I/O module cable to the I/O port of the I/O module.
3. Turn ON the 24 VDC power supply connected to the I/O module.

Connection of an I/O module cable

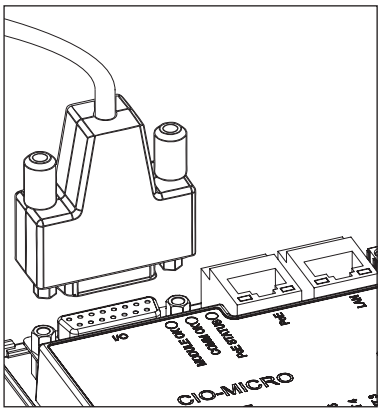
This section shows the procedure for connecting an I/O module.

Operating procedure

1. Check that the 24 VDC power supply is OFF.
2. Connect the M8 connector of the I/O module cable to the I/O connector of the vision sensor.



3. Connect the I/O module cable to the I/O port (D-sub 15P, female) of the I/O module.



4. Turn ON the 24 VDC power supply.

Precautions

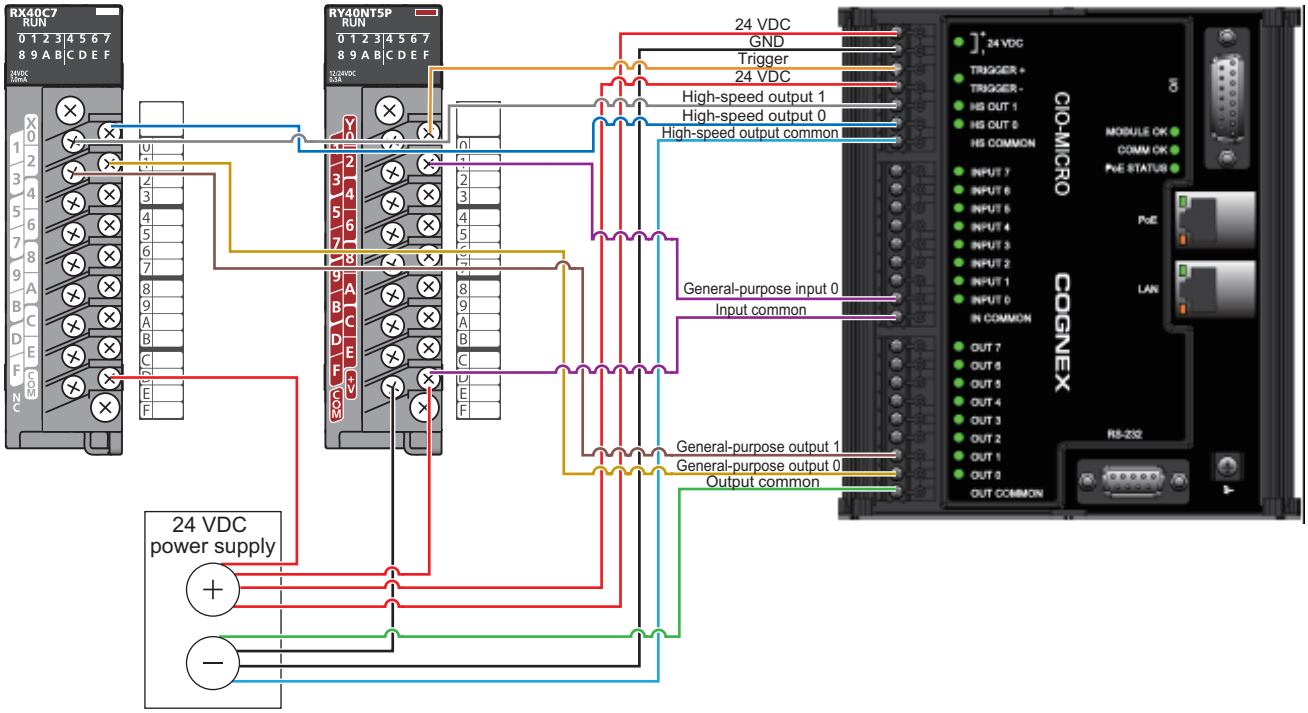
- Before wiring or adjusting I/O wires, turn OFF the power of the vision sensor.
- The cable is designed to connect with its key aligned with the keyway of the connector on the Vision Sensor. Do not force the connections or damage may occur.

Connection example of a CIO-MICRO I/O module

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

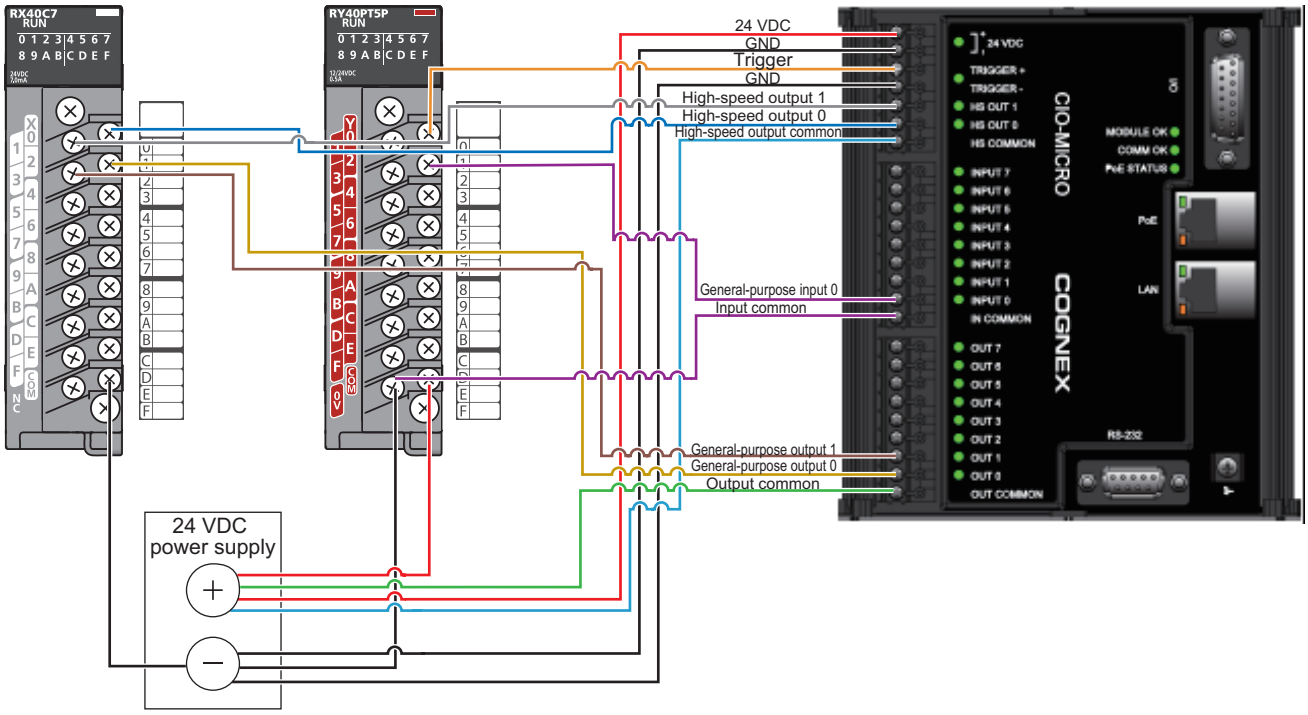
Sink type

- 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 manuals.
📖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 VS80 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).

MEMO

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

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 VS80 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: 47 dBμV/m (measured at 10 m 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.	50Hz/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 VS80 models are out of the requirement for conformance to the Low Voltage Directive.

UL/cUL

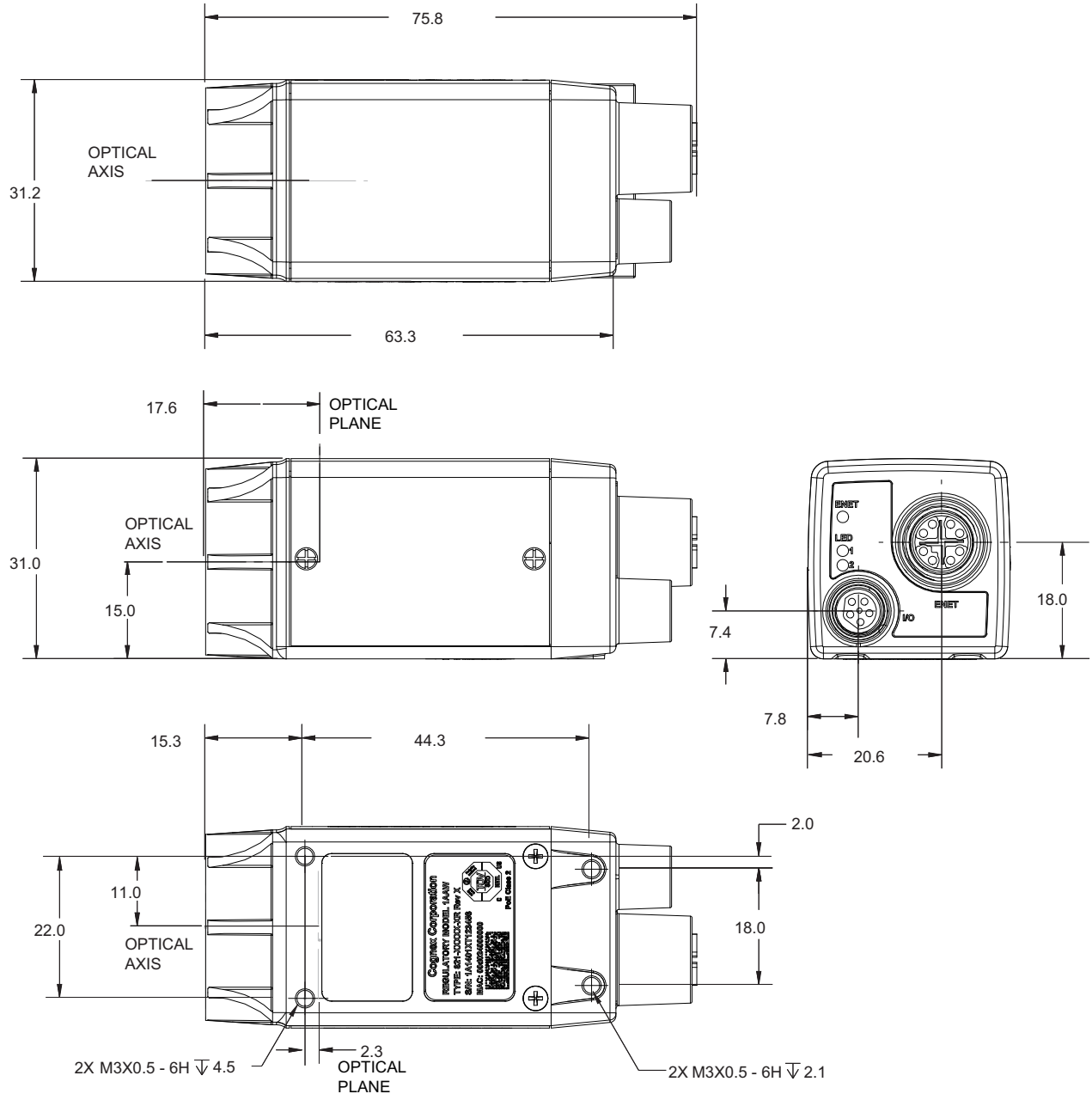
This section shows the standards that comply with UL.

• UL/cUL application

Item	Description
UL/cUL applicable standard	UL 61010-1, 3rd Edition, 2014-05-11 UL 61010-2-201, 1st Edition, 2014-01-24 CAN/CSA C22.2 No. 61010-1-12, 3rd Edition, 2012-05 CAN/CSA C22.2 No. 61010-2-201, 1st Edition, 2014-02

Appendix 2 External Dimensions

The following figures show the size of a vision sensor.



(Unit: mm)

MEMO

REVISIONS

*The manual number is given on the bottom left of the back cover.

Revision date	*Manual number	Description
February 2018	SH(NA)-081891ENG-A	First edition
June 2018	SH(NA)-081891ENG-B	■Added or modified parts Section 3.2, Section 5.5, Section 5.6
March 2019	SH(NA)-081891ENG-C	■Added or modified parts TERMS, Section 3.2, Section 4.1, Section 4.3, Appendix 1
January 2020	SH(NA)-081891ENG-D	■Added or modified parts PRECAUTIONS FOR USE, INTRODUCTION, TERMS, Section 3.2, Section 3.3, Section 4.2, Section 5.5, Section 5.6
July 2021	SH(NA)-081891ENG-E	■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

Japanese manual number: SH-081890-E

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

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SH(NA)-081891ENG-E(2107)KWIX
MODEL: VS80M/C-U-E
MODEL CODE: 13JX82

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