

Vision Sensor FH Series Vision System

Hardware Setup Manual

FH-2□□□/ FH-2□□□-□□

FH-5□□□/ FH-5□□□-□□

FH-L□□□/ FH-L□□□-□□



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Introduction

Thank you for purchasing the FH series.

This manual contains information that is necessary to use the FH series.

Please read this manual and make sure you understand the functionality and performance of the FH series before you attempt to use it in a control system.

Keep this manual in a safe place where it will be available for reference during operation.

Intended Audience

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

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

Applicable Products

This manual covers the following products.

- FH-2□□□
- FH-2□□□-□□
- FH-5□□□
- FH-5□□□-□□
- FH-L□□□
- FH-L□□□-□□

Part of the specifications and restrictions are given in other manuals. Refer to *Relevant Manuals* on page 2 and *Related Manuals* on page 25.

Relevant Manuals

The following table provides the relevant manuals for the FH series.

Read all of the manuals that are relevant to your system configuration and application before you use the FH series.

| Purpose of use | Manual | | | | | | | |
|--|---|---|---|-------------------------------------|---|--|---|--|
| | Basic information | | | FH Series Smart Camera Setup Manual | FH/FHV Series Vision System Processing Item Function Reference Manual | FH Series Vision System Macro Customize Functions Programming Manual | FH Series Vision System User's Manual for Communications Settings | FH Series Vision System Operation Manual for Systemac Studio |
| | FH Series Vision System Hardware Setup Manual | FH/FHV Series Vision System User's Manual | | | | | | |
| Overview of FH series | ● | ● | | | | | | |
| Setup and Wiring | | | | | | | | |
| EtherCAT | | | | | | | | |
| EtherNet/IP | | | | | | | | |
| PROFINET | | ● | ● | | | | | |
| Ethernet | | | | | | | | |
| RS-232C | | | | | | | | |
| Parallel interface | | | | | | | | |
| Setup the communication setting of sensor controller | | | | | | | | ● |
| EtherCAT | | | | | | | | |
| EtherNet/IP | | | | | | | | |
| PROFINET | ● | ● | ● | | | ● | | |
| Ethernet | | | | | | | | |
| RS-232C | | | | | | | | |
| Parallel interface | | | | | | | | |
| Setup the sensor controller | | | | | | | | ● |
| EtherCAT | | | | | | | | |
| EtherNet/IP | | | | | | | | |
| PROFINET | ● | | | | | ● | | |
| Ethernet | | | | | | | | |
| RS-232C | | | | | | | | |
| Parallel interface | | | | | | | | |

| Purpose of use | Manual | | | | | | |
|-------------------------------------|--|--|---|---|--|--|---|
| | Basic information | | | FH Series Vision System Processing Item Function Reference Manual | FH Series Vision System Macro Customize Functions Programming Manual | FH Series Vision System User's Manual for Communications Settings | FH Series Vision System Operation Manual for Sysmac Studio |
| | FH Series Vision System Hardware Setup Manual | FH Series Vision System User's Manual | FHV Series Smart Camera Setup Manual | | | | |
| Create and Set the Scene | | | | | | | • |
| EtherCAT | | | | | | | |
| EtherNet/IP | | | | | | | |
| PROFINET | • | | | • | | | |
| Ethernet | | | | | | | |
| RS-232C | | | | | | | |
| Parallel interface | | | | | | | |
| Optimizing the Scene Flow | | | | | | | |
| EtherCAT | | | | | | | |
| EtherNet/IP | | | | | | | |
| PROFINET | | | | • | • | | |
| Ethernet | | | | | | | |
| RS-232C | | | | | | | |
| Parallel interface | | | | | | | |
| Connecting the Controller | | | | | | | • |
| EtherCAT | | | | | | | |
| EtherNet/IP | | | | | | | |
| PROFINET | • | • | • | | | • | |
| Ethernet | | | | | | | |
| RS-232C | | | | | | | |
| Parallel interface | | | | | | | |
| Using Helpful Functions | | | | | | | • |
| EtherCAT | | | | | | | |
| EtherNet/IP | | | | | | | |
| PROFINET | • | | | | | | |
| Ethernet | | | | | | | |
| RS-232C | | | | | | | |
| Parallel interface | | | | | | | |
| Troubleshooting and Problem Solving | • | | | | | | |

Manual Structure

Page Structure

The following page structure is used in this manual.

The diagram illustrates the structure of a manual page. It shows a page with a grey header bar containing the text "4 Installation and Wiring". Below this is a section header "4-3 Mounting Units". Underneath is a sub-section header "4-3-1 Connecting Controller Components". The main body of the page contains a procedure with two numbered steps. Step 1 includes a diagram of units with labels for "Hook", "Connector", and "Hook holes". Step 2 includes a diagram of a slider with labels for "Release", "Lock", and "Slider". Below the procedure is a "Precautions for Correct Use" section with a warning icon and text. At the bottom of the page, there is a footer with the text "NJ-series CPU Unit Hardware User's Manual (W500)" and the page number "4-9".

Annotations on the left side of the diagram:

- Level 2 heading:** Points to the "4-3 Mounting Units" header.
- Level 3 heading:** Points to the "4-3-1 Connecting Controller Components" header.
- A step in a procedure:** Points to the number "1" in the first step.
- Indicates a procedure:** Points to the number "1" in the first step.
- Special information:** Points to the "Precautions for Correct Use" section.
- Manual name:** Points to the footer text "NJ-series CPU Unit Hardware User's Manual (W500)".

Annotations on the right side of the diagram:

- Level 1 heading:** Points to the "4 Installation and Wiring" header.
- Level 2 heading:** Points to the "4-3 Mounting Units" header.
- Level 3 heading:** Points to the "4-3-1 Connecting Controller Components" header.
- Gives the current headings:** Points to the "4-3-1 Connecting Controller Components" header.
- Page tab:** Points to the "4" in the grey header bar.
- Gives the number of the main section:** Points to the "4" in the grey header bar.

Note This illustration is provided only as a sample. It may not literally appear in this manual.

Special Information

Special information in this manual is classified as follows:



Precautions for Safe Use

Precautions on what to do and what not to do to ensure safe usage of the product.



Precautions for Correct Use

Precautions on what to do and what not to do to ensure proper operation and performance.



Additional Information

Additional information to read as required.

This information is provided to increase understanding or make operation easier.

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Section 1 Confirm the Package

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Warranty, Limitations of Liability

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Safety Precautions

Symbols and the Meanings for Safety Precautions Described in This Manual








The following notation is used in this manual to provide precautions required to ensure safe usage of a sensor controller. The safety precautions that are provided are extremely important to safety.

Always read and heed the information provided in all safety precautions.

The following notation is used.

| | |
|--|--|
|  WARNING | <p>Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may result in serious injury or death.</p> <p>Additionally there may be significant property damage.</p> |
|  Caution | <p>Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.</p> |

Meanings of Alert Symbols

| | |
|---|---|
|  | <p>General Prohibition Indicates general prohibitions, including warnings, for which there is no specific symbol</p> |
|  | <p>General Caution Indicates general cautions, including warnings, for which there is no specific symbol.</p> |
|  | <p>The filled circle symbol indicates operations that you must do. The specific operation is shown in the circle and explained in text. This example shows a general precaution for something that you must do.</p> |
|  | <p>Electrical Hazard Indicates the possible danger of electric shock under specific conditions.</p> |
|  | <p>Explosion Hazard Indicates the possible danger of explosion under specific conditions.</p> |
|  | <p>LED light Hazard Indicates the possible danger of LED radiation or light.</p> |
|  | <p>High Temperature Caution Indicates the possible danger of injury by high temperature under specific conditions.</p> |

Warning

⚠ WARNING

This product must be used according to this manual and Instruction Sheet. Failure to observe this may result in the impairment of functions and performance of the product.



This product is not designed or rated for ensuring the safety of persons. Do not use it for such purposes.



Never connect the AC power supply with this product. When the AC power supply is connected, it causes the electric shock and a fire.



A lithium battery is built into the Controller and may occasionally combust, explode, or burn if not treated properly. Dispose of the Controller as industrial waste, and never disassemble, apply pressure that would deform, heat to 100°C or higher, or incinerate the Controller.



If you keep watching the LED light, it may have an adverse effect on the eyes, do not stare directly into the light emitted from the LED. If a specular object is used, take care not to allow reflected light to enter your eyes.



Do not touch the terminals while the power supply is ON. Doing so may result in electrical shock.



Please take external safety measures so that the system as a whole should be on the safe side even if a failure of a sensor controller or an error due to an external factor occurred. An abnormal operation may result in serious accident.



Please take fail-safe measures on your side in preparation for an abnormal signal due to signal conductor disconnection and/or momentary power interruption. An abnormal operation may result in a serious accident.



Anti-virus protection

Install the latest commercial-quality antivirus software on the computer connected to the control system and maintain to keep the software up-to-date.



Security measures to prevent unauthorized access

Take the following measures to prevent unauthorized access to our products.

- Install physical controls so that only authorized personnel can access control systems and equipment.
- Reduce connections to control systems and equipment via networks to prevent access from untrusted devices.
- Set strong passwords and change them frequently.
- Scan virus to ensure safety of USB drives or other external storages before connecting them to control systems and equipment.



Data input and output protection

Validate backups and ranges to cope with unintentional modification of input/output data to control systems and equipment.

- Checking the scope of data
- Checking validity of backups and preparing data for restore in case of falsification and abnormalities
- Safety design, such as emergency shutdown and fail-soft operation in case of data tampering and abnormalities



Data recovery

Backup data and keep the data up-to-date periodically to prepare for data loss.



When using an intranet environment through a global address, connecting to an unauthorized terminal such as a SCADA, HMI or to an unauthorized server may result in network security issues such as spoofing and tampering. You must take sufficient measures such as restricting access to the terminal, using a terminal equipped with a secure function, and locking the installation area by yourself.



When constructing an intranet, communication failure may occur due to cable disconnection or the influence of unauthorized network equipment. Take adequate measures, such as restricting physical access to network devices, by means such as locking the installation area.



When using a device equipped with the USB flash drive or SD Memory Card function, there is a security risk that a third party may acquire, alter, or replace the files and data in the removable media by removing the removable media or unmounting the removable media. Please take sufficient measures, such as restricting physical access to the sensor controller or taking appropriate management measures for removable media, by means of locking the installation area, entrance management, etc., by yourself.



 **Caution**

Please take fail-safe measures on your side in preparation for an abnormal signal due to signal conductor disconnection and/or momentary power interruption. An abnormal operation may result in a serious accident.



Precautions for Safe Use

Condition of the Fitness of OMRON Products

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 - b) Applications that require high reliability, including but not limited to supply systems for gas, water and electricity, etc., 24 hour continuous operating systems, financial settlement systems and other applications that handle rights and property.
 - c) Applications under severe condition or in severe environment, including but not limited to outdoor equipment, equipment exposed to chemical contamination, equipment exposed to electromagnetic interference and equipment exposed to vibration and shocks.
 - d) Applications under conditions and environment not described in specifications.
- 1. In addition to the applications listed from (a) to (d) above, *Omron products* (see definition) are not intended for use in vehicles designed human transport (including two wheel vehicles). Please do NOT use Omron products for vehicles designed human transport. Please contact the Omron sales staff for information on our automotive line of products.
- 2. The above is part of the Terms and Conditions Agreement. Please use carefully read the contents of the guarantee and disclaimers described in our latest version of the catalog, data sheets and manuals.

Installation Environment (FH-2000/FH-5000 Series)

- Do not use the product in the environment with flammable or explosive gases.
- Regularly clean the vent holes or fan outlet to prevent dust or particles blocking them. Internal temperature increases when those are blocked, it causes malfunction.
- To secure safety for operation and maintenance, install the product apart from high-voltage devices and power devices.
- Make sure to tighten all screws in mounting.

Installation Environment (FH-L Series)

- Do not use the product in the environment with flammable or explosive gases.
- Install the product so that the air can flow freely through its cooling vents.
- Regularly clean the vent holes or fan outlet to prevent dust or particles blocking them. Internal temperature increases when those are blocked, it causes malfunction.
- To secure safety for operation and maintenance, install the product apart from high-voltage devices and power devices.
- Make sure to tighten all screws in mounting.

- When mounting the product using DIN rail mounting brackets, be sure to tighten all screws.
- Make sure to mount the product on DIN-rail securely.

Power Supply and Wiring

- Make sure to use the product within the power voltage specified by catalog, this manual, or instruction sheet.
- Never connect the product to AC power. If connected, it causes malfunction.
- The recommended power supply for FH-2000/FH-5000 series is the S8VS-□□□24 (manufactured by OMRON) or S8VK-G-□□□24 (manufactured by OMRON).
The recommended power supply for FH-L series is the S8VK-G□□□24 (manufactured by OMRON) or S8VS-□□□24 (manufactured by OMRON).
- Select and use the appropriate wire size based on consumption current. (FH-2000/FH-5000 series: AWG10 to 16, FH-L series: AWG12 to 16)
- Keep the power supply wires as short as possible (Max 2m).
- Provide the power from a DC power supply (safety extra-low voltage circuits) that has been taken measures not to generate high-voltage.
- Check the following again before turning on the power.
 - Are the voltage and polarity of the power source set correctly? (24 VDC for positive terminal. 0 VDC for negative terminal.)
 - Is the functional grounding terminal connected to the ground (FG)?
 - Is the load of the output signal not short-circuited?
 - Is the load current for the output signal within the specified range?
 - Are there no wrong wirings?
 - Are the voltage value and polarity of the power supply that is provided to the encoder cable (ENC0 VDD/GND, ENC1 VDD/GND) correct? (5 VDC)

Grounding

- Since the power supply circuit for the sensor controller is described in the manual and instruction sheet, please check it.
- When a base is packed in a camera that will be connected to the sensor controller, make sure to mount the camera using the base. Since the enclosure of the camera body is connected to the internal circuits, mounting the camera without using the base allows the internal circuits to be directly connected to the ground, which may cause malfunction or failure.
- Apply Class D grounding (grounding resistance: 100 [Ω] or less) Wire the grounding wire for the sensor controller independently. If the grounding wire is shared with other devices or connected to a building beam, the sensor controller may be adversely affected.
- Do not ground the plus (+) terminal when the sensor controller is connected to the FH-SC12/FH-SM12. The internal circuits may cause a short-circuit and result in malfunction.
- Do not ground the plus (+) terminal of the 24 VDC power source when the sensor controller is connected to the FH-MT12 with a USB cable. The internal circuits may cause a short-circuit and result in malfunction.
- When using the sensor controller and the peripheral devices such as a monitor, USB connection devices, RS-232C connection devices, there should be no potential difference in ground level. If not, it may cause malfunction. Take measures that the potential difference does not occur between the grounds for the sensor controller and the peripheral devices.

Communications with Upper Device

- After confirming that the product is started up, communicate with the high-order device. During start-up, an indefinite signal may be output to the high-order interface. To avoid this problem, clear the receiving buffer of your device at initial operations.

Failsafe Measures

- Be sure to take fail-safe measures externally when controlling stages and robots by using the measurement results of the sensor controller (axis movement output by calibration and alignment measurement).
- On a sensor controller side, supplementary use operations and branches of the sensor controller to configure a check flow such as “data should not be externally provide if the data is in a range from -XXXXX to XXXXX” based on the stage/robots range of movement.

Others

- Use only the camera and cables designed specifically for the product. Use of other products may result in malfunction or damage of the product.
- Using an USB extension cable may cause malfunction or damage. Do not use commercially available extension cables.
- Please insert monitor connector perpendicularly so that the connector resin part and pin are not rubbing against each other. Damaged pin may cause contact failure due to generation and invasion of resin powder.
- Always turn OFF the power of the sensor controller and peripheral devices before connecting or disconnecting a camera or cable. Connecting the cable with power supplied may result in damage of the camera or peripheral devices.
- For the cable that is flexed repeatedly, use the robotic cable type (Bend resistant camera cable) to prevent damages.
- Do not apply torsion stress to the cable. It may damage the cable.
- Secure the minimum bending radius of the cable. Otherwise the cable may be damaged.
- Do not apply stress to the connector by pulling or bending the cable. It may damage the connector.
- Do not attempt to dismantle, repair, or modify the product.
- Should you notice any abnormalities, immediately stop use, turn OFF the power supply, and contact your OMRON representative.
- Do not drop the product nor apply excessive vibration or shock to the product. Doing so may cause malfunction or burning.
- This product is heavy. Be careful not to drop it while handling.
- Do not insert an SD memory card in the reverse orientation, at an angle, or in a twisting manner.
- Illumination is normal immediately after the power supply is turned ON. Do not look directly into the illumination light.

Precautions for Correct Use

Installation and Storage Sites (FH-2000/FH-5000 series)

Install and store the product in a location that meets the following conditions:

- Surrounding temperature of 0 to +50°C*1 (-20 to +65°C in storage)
*1. FH-5000 Series: Surrounding temperature of 0 to 45°C
- No rapid changes in temperature (place where dew does not form)
- Relative humidity of between 35% to 85%
- No presence of corrosive or flammable gases
- Place free of dust, salts and iron particles
- Place free of vibration and shock
- Place out of direct sunlight
- Place where it will not come into contact with water, oils or chemicals
- Place not affected by strong electro-magnetic waves
- Place not near to high-voltage, or high-power equipment

Installation and Storage Sites (FH-L series)

Install and store the product in a location that meets the following conditions:

- Surrounding temperature of 0 to +55°C (-25 to +70°C in storage)
- No rapid changes in temperature (place where dew does not form)
- Relative humidity of between 10 to 90%
- No presence of corrosive or flammable gases
- Place free of dust, salts and iron particles
- Place free of vibration and shock
- Place out of direct sunlight
- Place where it will not come into contact with water, oils or chemicals
- Place not affected by strong electro-magnetic waves
- Place not near to high-voltage, or high-power equipment

Orientation of Product

- For efficient heat dissipation, install the product only with the orientation written in this manual or the Instruction Sheet. Install the product so that the air can flow freely through its cooling vents.

Ambient Temperature

- To secure good ventilation, install the product with clearance written in this manual or the Instruction Sheet.
- Do not install the product immediately above significant heat sources, such as heaters, transformers, or large-capacity resistors.
- Use the product within the operating temperature range based on the specifications of it.
- Install a forced cooling fan or air conditioner not to exceed the operating temperature range when the ambient temperature is close to the upper limit of its range.

Component Installation and Handling

- When touching a terminal part or a signal wire in a connector, take anti-static measures using a wrist strap or another device to prevent damage from static electricity.
- Be sure to execute Device Information Storage Tool described in the *Vision System FH/FHV Series User's Manual (Cat. No. Z365)* when connecting USB memory device or SD memory card.
- When removing USB memory device or SD memory card, select **Function** menu - **System information - Drive information** on the main screen, then press the **Eject** button and confirm it is safe to remove.
- When using remote operation, before removing a USB memory device or SD memory card, make sure that data is not being read or written to them.
For a USB flash drive, the memory device's LED flashes or lights while data is being read or written, so make sure that it is turned OFF before removing the memory.
For SD memory card, the SD BUSY LED flashes or lights while data is being read or written, so make sure that it is turned OFF before removing the memory.
- Turning OFF the Power:
When a message is displayed indicating that a task is in progress, do not turn OFF the power. Doing so causes the data in the memory to be corrupted, resulting in the product not operating properly upon the next start-up.
Do not turn OFF during saving data to sensor controller.
When turns OFF, conform the followings proceedings have completed. and then operate again.
 - When saves using sensor controller: Confirm the save processing is completed and next operation is possible.
 - When saves using communication command: Intended command is completed. BUSY signal is turned OFF.
- After turning off the power, wait at least 1 second before restarting.

Maintenance

- Turn OFF the power and ensure the safety before maintenance.
- Clean the lens with a lens-cleaning cloth or air brush.
- Lightly wipe off dirt with a soft cloth.
- Dirt on the image element must be removed using an air brush.
- Do not use thinners or benzine.

Connecting the Sensor Controller and Monitor with a Switcher and Splitter

- Do not use devices that may require re-recognition of the monitor by the sensor controller when a switching operation was performed. If such re-recognition processing happens at switching operation, it may cause measurement time to be longer.

Regulations and Standards

Using Product Outside Japan

If you export (or provide a non-resident with) this product or a part of this product that falls under the category of goods (or technologies) specified by the Foreign Exchange and Foreign Trade Control Law as those which require permission or approval for export, you must obtain permission or approval or service transaction permission) pursuant to the law.

U.S. California Notice:

- The following information must be displayed for all products that contain primary lithium batteries with a perchlorate content of 6 ppb or higher when shipped to or transported through the State of California, USA.
Perchlorate Material - special handling may apply.
See www.dtsc.ca.gov/hazardouswaste/perchlorate
- The product contains a lithium battery with a perchlorate content of 6 ppb or higher. When exporting an end product containing the product to or shipping through California, USA, label all packing and shipping containers appropriately.

Conformance to KC Standards

Observe the following precaution if you use this product in Korea.

사 용 자 안 내 문

이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

- Guidance for users
This product meets the electromagnetic compatibility requirements for business use. There is a risk of radio interference when this product is used in home.

Conformance to EC/EU Directives and UK Legislation

The product is compliant with the standards below:

- EC Directive 2004/108/EC (Until April 19 2016) / EU Directive 2014/30/EU (After April 20 2016) / UK legislation 2016 No 1091 Electromagnetic Compatibility Regulations 2016 EN61326-1 Electromagnetic environment: Industrial electromagnetic environment (EN/IEC 61326-1 Table 2)
- Also, the following condition is applied to the immunity test of this product.
 - If the level of disturbance of the video is such that characters on the monitor are readable, the test is a pass.
- EMC-related performance of the OMRON devices will vary depending on the configuration, wiring, and other conditions of the equipment or control panel on which the OMRON devices are installed.
- The customer must, therefore, perform the final check to confirm that devices and the overall machine conform to EMC standards.
- If there is a need to respond to the EC / EU directive and UK legislation, please use by an analog RGB output.

Conformance to UL Standards

This product complies with UL Standards.

- UL61010-2-201

WEEE Directive



Dispose of in accordance with WEEE Directive

Related Manuals

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

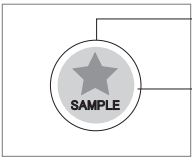
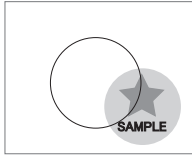
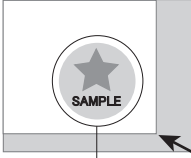
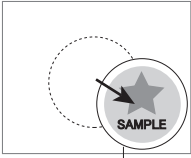
| Name of Manual | Cat. No. | Model | Purpose | Contents |
|--|-----------|---|---|--|
| Vision System FH Instruction Sheet | 3648743-1 | FH-2□□2 FH-2□□2-□□ FH-5□□2 FH-5□□2-□□ | To confirm the safety and usage precautions of the Vision System FH series sensor controller. | Describes the definitions of basic terms, meaning of signal words, and precautions for correct use of FH series in the manual. |
| Vision System FH Instruction Sheet | 3102269-4 | FH-2□□□ FH-2□□□-□□ FH-5□□□ FH-5□□□-□□ | To confirm the safety and usage precautions of the Vision System FH series sensor controller. | Describes the definitions of basic terms, meaning of signal words, and precautions for correct use of FH series in the manual. |
| Vision System FH-L Instruction Sheet | 3615792-0 | FH-L□□□ FH-L□□□-□□ | To confirm the safety and usage precautions of the Vision System FH-Lite series sensor controller. | Describes the definitions of basic terms, meaning of signal words, and precautions for correct use of FH-L series in the manual. |
| Vision System FH/FHV Series User's Manual | Z365 | FH-2□□□ FH-2□□□-□□ FH-5□□□ | When user want to know about the FH/FHV series. | Describes the soft functions, setup, and operations to use FH/FHV series. |
| Vision System FH/FHV series Processing Item Function Reference Manual | Z341 | FH-5□□□-□□ FH-L□□□ FH-L□□□-□□ | When user confirm the details of each processing items at the create the measurement flow or operate it. | Describes the software functions, settings, and operations for using FH/FHV series. |
| Vision System FH/FHV Series User's manual for Commu- nications Settings | Z342 | | When user confirm the setting of communication functions. | Describes the functions, settings, and communications methods for communication between FH/FHV series and PLCs. The following communications protocol are described. Parallel, PLC Link, EtherNet/IP, EtherCAT, and Non-procedure. |
| Vision System FH series Hardware Setup Manual | Z366 | FH-2□□□ FH-2□□□-□□ FH-5□□□ FH-5□□□-□□ FH-L□□□ FH-L□□□-□□ | When user want to know about the Hard-ware specifications or to setup the sensor controller of the Vision System FH series. | Describes FH series specifications, dimensions, part names, I/O information, installation information, and wiring information. |
| Vision System FH series Macro Customize Func- tions Programming Manual | Z367 | | When user operate or programming using Macro Customize functions. | Describes the functions, settings, and operations for using Macro Customize function of the FH series. |
| Vision System FH Series Operation Manual for Sysmac Studio | Z343 | FH-2□□□ FH-2□□□-□□ FH-5□□□ FH-5□□□-□□ | When user connect to NJ/NX series via EtherCAT communication. | Describes the operating procedures for setting up and operating FH series Vision Sensors from the Sysmac Studio FH Tools. |

| Name of Manual | Cat. No. | Model | Purpose | Contents |
|--|----------|---|---|--|
| FH-UMAI□ FH Application Software Processing Item Function Reference Manual | Z437 | FH-UMAI1 FH-5□□□ FH-5□□□-□□ | When user confirm the details of each processing items at the create the meas- urement flow or op- erate it. | Describes the software functions, settings, and operations. |
| FH-UMAI□ FH Application Software Version Update Tool Oper- ating Manual | Z438 | FH-UMAI1 | When using FH- UMAI. | Describes the software upgrade pro- cedure. |
| FH-UMLIC-08 FH Application Software Processing Item Function Reference Manual | Z510 | FH-UMLIC-08 FH-5552 FH-5552-□□ FH-5551 FH-5551-□□ | When user confirm the details of each processing items at the create the meas- urement flow or op- erate it. | Describes the software functions, settings, and operations. |
| FH-UMLIC-08 FH Application Software Installation Manual | Z511 | FH-UMLIC-08 | When using FH- UMLIC-08. | Describes the installation procedure. |

Terminology

| Term | Definition |
|--|---|
| FH Series | All FH series model names as follows: FH-2□□□, FH-2□□□-□□, FH-5□□□, FH-5□□□-□□, FH-L□□□, FH-L□□□-□□ |
| FH-2000 series | All FH-2□□□ series model names as follows: FH-2□□□, FH-2□□□-□□ |
| FH-5000 series | All FH-5□□□ series model names as follows: FH-5□□□, FH-5□□□-□□ |
| FH-L series | All FH-L□□□ series model names as follows: FH-L□□□, FH-L□□□-□□ |
| FHV Series | All FHV series model names. |
| FZ5 series | All FZ series name shows the following: FZ5-6□□, FZ5-6□□-□□, FZ5-8□□, FZ5-8□□-□□, FZ5-11□□, FZ5-11□□-□□, FZ5-12□□, FZ5-12□□-□□, FZ5-L35□, FZ5-L35□-□□ |
| FZ5-600 series | All FZ5-6□□ series name the following: FZ5-6□□, FZ5-6□□-□□ |
| FZ5-800 series | All FZ5-8□□ series name the following: FZ5-8□□, FZ5-8□□-□□ |
| FZ5-1100 series | All FZ5-11□□ series name the following: FZ5-11□□, FZ5-11□□-□□ |
| FZ5-1200 series | All FZ5-12□□ series name the following: FZ5-12□□, FZ5-12□□-□□ |
| FZ5-L series | All FZ5-L35□ series name the following: FZ5-L35□, FZ5-L35□-□□ |
| Sensor controller | It is a generic name of FH/FZ5 series. For FHV series, it has the same meaning as <i>Smart Camera</i> . |
| Measurement flow (abbreviated as <i>flow</i>) | A continuous flow of measurement processing. A measurement flow consists of a scene created from a combination of processing items. |
| Measurement processing | Executing processing items for inspections and measurements. |
| Measurement ID | Information of time when the sensor controller receives the measurement trigger and the line no. Format of measurement ID: YYYY-MM-DD_HH-MM-SS-XXXN (YYYY: Year, MM: Month, DD: Date, HH: Hour, MM: Minute, SS: Second, XXX: Millisecond, N: Line number) • Example: Measurement time: 11:10:25.500 AM, December 24, 2007 and Line 0, the measurement ID is "2007-12-24_11-10-25-5000". |
| Processing item | Any of the individual items for vision inspections that are partitioned and packaged so that they can be flexibly combined. These include the Search, Position Compensation, and Fine Matching items. Processing items can be classified for image input ([Input image]), inspection/measurement ([Measurement]), image correction ([Compensate image]), inspection/measurement support ([Support measurement]), process branching ([Branch]), results external output ([Output result]), resulting image display ([Display result]), etc. You can freely classify processing items to handle a wide range of applications. A scene (i.e., a unit for changing the measurement flow) is created by registering the processing items as units. |

| Term | Definition |
|---|---|
| Scene | <p>A unit for changing the measurement flow that consists of a combination of processing items.</p> <p>Scene is used because of the correspondence to the scene (i.e., type of measurement object and inspection contents) where measurements are performed.</p> <p>A scene is created for each measurement or measurement contents.</p> <p>You can easily achieve a changeover simply by changing the scene when the measurement object or inspection content changes.</p> <p>Normally you can set up to 128 scenes. If you need more than 128 scenes, you can separate them into different groups or use the Conversion Scene Group Data Tool to create a scene group that contains over 128 scenes.</p> |
| Processing unit (abbreviated as <i>unit</i>) | <p>A processing item that is registered in a scene.</p> <p>Numbers are assigned to processing units in order from the top and they are executed in that order.</p> <p>Processing items are registered for the processing units to create a scene (i.e., a unit for changing the measurement flow).</p> |
| Measurement trigger | <p>A trigger for executing measurements.</p> <p>With a parallel interface, the STEP signal is used. With a serial interface, an Execute One Measurement or a Start Continuous Measurement command is used.</p> |
| Test measurement | <p>A measurement that is performed to manually test (check) measurements under the conditions that are set in the currently displayed scene.</p> <p>Test measurements can be executed on an Adjustment Window. Processing is completed inside the sensor controller and the measurement results are not normally output on an external interface.</p> <p>However, if you checked Output in test measurement to output the measurement results after executing measurements.</p> |
| Single measurement | <p>A measurement that is executed only once in synchronization with the trigger input.</p> |
| Continuous measurement | <p>Measurements are executed repeatedly and automatically without a trigger input.</p> |
| Operation mode | <ul style="list-style-type: none"> • Double Speed Multi-input: A mode that processes the measurement flow for the first trigger and then processes the measurement flow in parallel for the second trigger to achieve a high-speed trigger input interval. It is used together with the multi-input function. • Multi-line Random-trigger: A trigger mode that allows you to independently processing multiple measurement flows. With traditional image processing, two or more triggers cannot be acknowledged at the same time. In Multi-line Random-trigger Mode, you can randomly input multiple triggers into one sensor controller to independently process multiple scenes in parallel. • Non-stop adjustment mode: A mode that allows you to adjust the flow and set parameters while performing measurements. The enables adjustments without stopping the line or stopping inspections. • Standard: A logging mode that allows complete parallel processing of measurements and logging. Traditionally, logging was not possible while processing measurements. Either measurements or logging had to be given priority and the other one had to wait. With this mode, you can save the measurement images in external storage without affecting the transaction time. |

| Term | Definition |
|--|--|
| Parallel processing (an option for any of the above operation modes) | <p>Parallel processing splits part of the measurement flow into two or more tasks, and processes each task in parallel to shorten the transaction time.</p> <p>Processing items for parallel processing are used so that the user can specify the required parallel processing.</p> |
| Multi-input function | <p>A function that is used to consecutively and quickly input images.</p> <p>It allows the next STEP signal to be acknowledged as soon as the image input processing is completed. There is no need to wait for measurement processing to be completed.</p> <p>You can check whether image input processing has been completed with the status of the READY signal. Even if the READY signal is ON when measurement processing is being executed, the next STEP signal can be acknowledged.</p> |
| Position compensation | <p>When the location and direction of measured objects are not fixed, the positional deviation between reference position and current position is calculated and measurement is performed after correcting.</p> <p>Please select processing items that are appropriate to the measurement object from processing items that are related to position compensation.</p> <ul style="list-style-type: none"> ● Reference position Measurement area and objects to be measured are correctly aligned.  <ul style="list-style-type: none"> ● When position of object to be measured is deflected  <p>Object to be measured overflows Measurement area.</p> <p>When position deflection correction is set in advance:</p> <div style="display: flex; justify-content: space-around;"> <div style="width: 45%;"> <p>Measurement will be carried out after moving the image for a corresponding deflection and returning to the reference position.</p>  <p>Measurement will be carried out after measured object enters into Measurement area.</p> </div> <div style="width: 45%;"> <p>Measurement will be carried out after moving the Measurement area for a corresponding deflection.</p>  </div> </div> |
| Reference position | <p>The point that is always the reference. If the location of the registered model is different from the reference position, the setting should be changed in Ref. setting.</p> |
| Model | <p>The image pattern that serves as the inspection target. Characteristics portions are extracted from images of the object and registered as model registration.</p> |

| Term | Definition |
|----------------|--|
| 2's complement | <p>Binary numbers are generally used to represent negative numbers. Negative numbers are expressed by <i>Inverting all bits of a positive number and adding 1 to the result.</i> Ex. -1 is expressed as 2's complement. -1 can be calculated by 0-1.</p> $\begin{array}{r} \downarrow \text{(In the case of 1, minus 1)} \\ \square 00000000 (= 0) \\ -) 00000001 (= 1) \\ \hline 11111111 (= -1) \end{array} \leftarrow \text{"1" expresses with 2's Complement (for 8 bits)}$ <p>There are methods for simple calculation without performing this kind of computation. For instance, <i>Negative number = inverting all bits of a positive number and then adding 1 to the result.</i></p> $\begin{array}{r} 00000001 (= 1) \\ \downarrow \text{Invert all bits} \\ 11111110 \\ \downarrow \text{Plus 1} \\ \boxed{11111111} (= -1) \end{array}$ <p>The <i>first digit</i> is used to judge whether the number is positive or negative.</p> <ul style="list-style-type: none"> • When 0: Positive number (or 0) • When 1: Negative number <p>The advantage of two's complement numbers is that positive and negative numbers can be used as is in calculations. Ex. When $-1+10=9$</p> $\begin{array}{r} 11111111 (= -1) \\ +) 00001010 (= 10) \\ \hline 00001001 (= 9) \end{array}$ |

Revision History

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



| Rev. Code | Rev. Date | Revision Contents |
|-----------|-----------|--|
| 01 | Apr. 2016 | Original product |
| 02 | Aug. 2016 | Corrected mistakes |
| 03 | Apr. 2017 | Corrected mistakes and revisions for the support of NY series |
| 04 | Apr. 2017 | Corrected mistakes |
| 05 | Jun. 2017 | Revisions for the support of FZ5-800 Series, FZ5-1200 Series, and FZ-S□5M3 |
| 06 | Jul. 2018 | Added FH-2000 series, FH-5000 series, and FH-S□21R / FH-S□X12 |
| 07 | Jul. 2019 | Removed FZ5 series, adjusted the layout, and corrected mistakes |
| 08 | Nov. 2019 | Corrected mistakes |
| 09 | Jul. 2020 | Added FH-5550, FH-5550-10, and FH-5550-20 Added FH-UMA11 |
| 10 | Nov. 2020 | Added SysmacStudio Ver.1.43 |
| 11 | Mar. 2021 | Touch panel monitor specification change |
| 12 | Apr. 2021 | Corrected mistakes |
| 14 | Oct. 2021 | Corrected mistakes |
| 15 | Jan. 2022 | Removed FAE-5002 and FAE-5004 Adjusted the layout |
| 16 | May 2022 | Deleted the product information of FH-1000 / FH-3000 series Removed HMC-SD491 and HMC-SD291 Added HMC-SD492 and HMC-SD292 Corrected mistakes |
| 17 | Sep. 2022 | Revisions for adding safety precautions regarding security Corrected mistakes |
| 18 | Oct. 2022 | Corrected mistakes |
| 19 | Dec. 2022 | Added FH-L551 and FH-L551-10. Added FZ-VSBX □M, VS-HVA series, FZ-MEM16G, and 3Z4S-LT IDGB series. Added SysmacStudio Ver.1.53. Revisions for update <i>Precautions for Safe Use, Precautions for Correct Use, Regulations and Standards, Related Manuals.</i> Added <i>3-8 Available List of FH Software Versions.</i> Corrected mistakes. |

| Rev. Code | Rev. Date | Revision Contents |
|-----------|-----------|--|
| 20 | Mar. 2023 | Added FH-SCX01/FH-SMX01 and FH-SCX03/FH-SMX03. Removed FZ-SC5M2 / FZ-S5M2 and VS-MCH series. Revisions for update <i>3-4 Lens</i> . Revisions for recommended operational environment of the FH-AP1 and FH-AP1L. |
| 21 | Sep. 2023 | Revisions for update <i>6-1 Parallel Interface - Internal Specifications for Parallel Interface</i> . |
| 22 | Nov. 2023 | Added HMC-SD293, HMC-SD493 and HMC-SD1A3. Removed HMC-SD292, HMC-SD492, NSD6-002GS(P11SE and NSD6-004GS(P11SEI). Revisions for update <i>3-5 Touch Panel Monitor and Cable</i> . Corrected mistakes. |
| 23 | Mar. 2024 | Added FH-2052, FH-2052-10, and FH-2052-20. Added FH-5052, FH-5052-10, and FH-5052-20. Added FH-5552, FH-5552-10, and FH-5552-20. Added FH-2051, FH-2051-10, and FH-2051-20. Added FH-5051, FH-5055-10, and FH-5051-20. Added FH-5551, FH-5551-10, and FH-5551-20. Added FH-SMX-SWIR and FH-SMX01-SWIR. Removed FZ-VM and FH-VMRGB. FH-VMDA specification changed. Corrected mistakes. |
| 24 | Jun. 2024 | Revisions for recommended operational environment of the FH-AP1 and FH-AP1L. Corrected mistakes. |
| 25 | Aug. 2024 | Revisions for update <i>Regulations and Standards</i> . FH-2052 / FH-2052-10 / FH-2052-20 / FH-5052 / FH-5052-10 / FH-5052-20 / FH-5552 / FH-5552-10 / FH-5552-20 acquired UL certification. Revisions for update <i>Recommended EtherCAT and EtherNet/IP Communications Cables</i> . Added XW2K-34G-T. |
| 26 | Feb. 2025 | The specifications of the FH-SMX-SWIR / FH-SMX01-SWIR camera base have changed. Corrected mistakes. |
| 27 | Jun. 2025 | Revisions for update <i>U.S. California Notice</i> . Revisions for update <i>1-2-4 Lighting and Lighting Controller and 3-7 Sysmac Studio</i> . Corrected mistakes |
| 28 | Sep. 2025 | Added FH-UMLIC-08 and FH-UDLIC-SIM. |

1

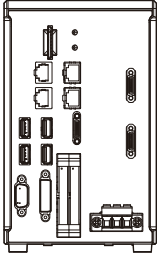
Confirm the Package

| | | |
|------------|--|------------|
| 1-1 | Sensor Controller | 1-2 |
| 1-1-1 | FH-2□□□ / FH-5□□□ | 1-2 |
| 1-1-2 | FH-2□□□-10 / FH-5□□□-10 | 1-2 |
| 1-1-3 | FH-2□□□-20 / FH-5□□□-20 | 1-3 |
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| 1-2-1 | FH Application Software | 1-4 |
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1-1 Sensor Controller

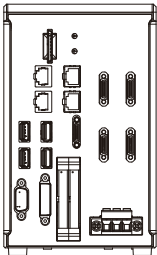
First, please check to see whether the package has all the necessary Sensor controller parts.

1-1-1 FH-2□□□ / FH-5□□□

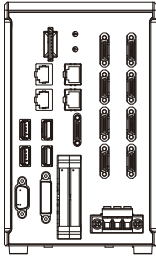


- Sensor controller: 1
FH-2□□□ / FH-5□□□: 1
- Instruction sheet: 1
- Instruction Installation Manual for FH series: 1
- General Compliance Information and Instructions for EU: 1
- Membership registration: 1
- Power source: 1 (male)
FH-XCN: 1
- Ferrite core for camera cable: 2

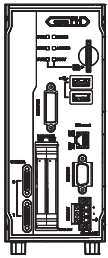
1-1-2 FH-2□□□-10 / FH-5□□□-10



- Sensor controller: 1
FH-2□□□-10 / FH-5□□□-10: 1
- Instruction sheet: 1
- Instruction Installation Manual for FH series: 1
- General Compliance Information and Instructions for EU: 1
- Membership registration: 1
- Power source: 1 (male)
FH-XCN: 1
- Ferrite core for camera cable: 4

1-1-3 FH-2□□□-20 / FH-5□□□-20

- Sensor controller: 1
FH-2□□□-20 / FH-5□□□-20: 1
- Instruction sheet: 1
- Instruction Installation Manual for FH series: 1
- General Compliance Information and Instructions for EU: 1
- Membership registration: 1
- Power source: 1 (male)
FH-XCN: 1
- Ferrite core for camera cable: 8

1-1-4 FH-L□□□ / FH-L□□□-□□

- Sensor controller: 1
FH-L□□□ / FH-L□□□-□□: 1
- Instruction sheet: 1
- Instruction Installation Manual for FH-L series: 1
- General Compliance Information and Instructions for EU: 1
- Membership registration: 1
- Power source: 1 (male)
FH-XCN-L: 1

1-2 Sold Separately

1-2-1 FH Application Software







| Appearance | Description | Model |
|------------|---|--------------|
| - | AI Defect Inspection Software Installer ^{*1} | FH-UMLIC-08 |
| - | License for AI Defect Inspection Simulator | FH-UDLIC-SIM |
| - | Scratch Detect AI Software Installer ^{*2} | FH-UMAI1 |

*1. This product can be installed on the FH-5552/FH5552-□□/□□/□□/□□/□□/□□.

*2. This product can be installed on the FH-5□□□/□□/□□/□□-□□ sensor controller (version 6.40 or later).

1-2-2 Cameras and Related

Camera

| Appearance | Type | Description | Color/ Mono- chrome | Image Ac- quisition Time ^{*1} | Model |
|---|---|--|---------------------------|--|----------|
|  | High-speed Digital CMOS Cameras (Lens required) | 12 megapixels (Up to four cam- eras can be con- nected to one sensor controller. <i>Camera on page 1-4)</i> | Color | 24.9 ms ^{*2} | FH-SCX12 |
| | | | Mono- chrome | | FH-SMX12 |
|  | High-speed Digital CMOS Cameras (Lens required) | 5 megapixels | Color | 10.3 ms ^{*2} | FH-SCX05 |
| | | | Mono- chrome | | FH-SMX05 |
|  | High-speed Digital CMOS Cameras (Lens required) | 3.2 megapixels | Color | 6.6 ms ^{*2} | FH-SCX03 |
| | | | Mono- chrome | | FH-SMX03 |
|  | High-speed Digital CMOS Cameras (Lens required) | 0.4 megapixels | Color | 6.5 ms ^{*3} | FH-SCX01 |
| | | | Mono- chrome | | FH-SMX01 |
|  | High-speed Digital CMOS Cameras (Lens required) | 1.6 megapixels | Color | 1.9 ms ^{*3} | FH-SCX |
| | | | Mono- chrome | | FH-SMX |
|  | High-speed Digital CMOS Cameras (Lens required) | 12 megapixels (Up to four cam- eras can be con- nected to one sensor controller. ^{*4}) | Color | 25.7 ms ^{*2} | FH-SC12 |
| | | | Mono- chrome | | FH-SM12 |

| Appearance | Type | Description | Color/ Mono- chrome | Image Ac- quisition Time *1 | Model |
|---|--|--|---------------------------|-----------------------------------|---------------|
|  | High-speed Digital CMOS Cameras (Lens required) | 4 megapixels | Color | 8.5 ms *2 | FH-SC04 |
| | | | Mono- chrome | | FH-SM04 |
|  | High-speed Digital CMOS Cameras (Lens required) | 2 megapixels | Color | 4.6 ms *2 | FH-SC02 |
| | | | Mono- chrome | | FH-SM02 |
|  | High-speed Digital CMOS Cameras (Lens required) | 0.3 megapixe | Color | 3.3 ms | FH-SC |
| | | | Mono- chrome | | FH-SM |
|  | Digital CMOS Cameras (Lens required) | 20.4 megapixels (Up to four cam- eras can be con- nected to one sensor controller. <i>Camera on page 1-4)</i> | Color | 42.6 ms *2 | FH-SC21R |
| | | | Mono- chrome | | FH-SM21R |
|  | Digital CMOS Cameras (Lens required) | 5 megapixels | Color | 71.7 ms | FH-SC05R |
| | | | Mono- chrome | | FH-SM05R |
|  | Digital CMOS Cameras (Lens required) | 5 megapixels | Color | 38.2 ms | FZ-SC5M3 |
| | | | Mono- chrome | | FZ-S5M3 |
|  | Shortwave Infrared (SWIR) Cameras (Lens required) *5 | 1.31 megapixels | Mono- chrome | 8.3 ms | FH-SMX01-SWIR |
| | | 0.33 megapixels | Mono- chrome | 4.2 ms | FH-SMX-SWIR |
|  | Digital CCD Cameras (Lens required) | 2 megapixels | Color | 33.3 ms | FZ-SC2M |
| | | | Mono- chrome | | FZ-S2M |
|  | Digital CCD Cameras (Lens required) | 0.3 megapixels | Color | 12.5 ms | FZ-SC |
| | | | Mono- chrome | | FZ-S |
|  | High-speed Digital CCD Cam- eras (Lens required) | 0.3 megapixels | Color | 4.9 ms | FZ-SHC |
| | | | Mono- chrome | | FZ-SH |
|  | Small Digital CCD Cameras (Lenses for small camera re- quired) | 0.3 megapixels flat type | Color | 12.5 ms | FZ-SFC |
| | | | Mono- chrome | | FZ-SF |
|  | Small Digital CCD Cameras (Lenses for small camera re- quired) | 0.3 megapixels pen type | Color | 12.5 ms | FZ-SPC |
| | | | Mono- chrome | | FZ-SP |

1-2 Sold Separately

1

1-2-2 Cameras and Related

| Appearance | Type | Description | Color/ Mono- chrome | Image Ac- quisition Time *1 | Model |
|----------------------------|---|---------------|---------------------------|-----------------------------------|-----------|
| | Intelligent Compact Digital CMOS Cameras (Camera + Manual Focus Lens + High power Lighting) *6 | Narrow view | Color | 16.7 ms | FZ-SQ010F |
| | | Standard view | Color | | FZ-SQ050F |
| Wide View (long-distance) | | Color | FZ-SQ100F | | |
| Wide View (short-distance) | | Color | FZ-SQ100N | | |

*1. The image acquisition time does not include image conversion processing time by the sensor controller.

*2. Frame rate in high speed mode when the camera is connected using two camera cables. For other conditions, please refer to 3-2-1 *High-speed digital CMOS Camera (FH-S camera series)* on page 3-19.

*3. The value in high speed mode. For other information, refer to 3-2-1 *High-speed digital CMOS Camera (FH-S camera series)* on page 3-19.

*4. Up to eight cameras other than 12 megapixels cameras can be connected to a FH-5□□□-20, and FH-2□□□-20.

*5. Export and Trade Control Laws

This product is classed as a commodity (or technology) requiring acquisition of export permission in accordance with foreign exchange and overseas trade control laws.

When this product is to be taken outside of Japan, adopt the required procedures such as application for export permission by the Japanese government.

When this product is to be taken outside of countries after imported from Japan, please confirm export and trade control laws of country and adopt the required procedures.

*6. When the built-in lighting of an FZ-SQ□□□□ is used, it may not be possible to shorten the processing time due to restrictions on the light emission time.











Precautions for Correct Use

Some cameras cannot be used with FH sensor controllers with older software versions. Refer to 3-8 *Available List of FH Software Versions* on page 3-100.

Camera Mounting Bracket

| Appearance | Description | | Model |
|------------|---|--|---------------|
| | For Intelligent Compact Digital Camera | Mounting Bracket | FQ-XL |
| | | Precise Mounting Brackets | FQ-XL2 |
| | | Polarizing Filter Attachment (Packaged item) | FQ-XF1 |
| | | Cover Attachment (for replacement) | FQ-XF2 |
| - | Mounting Base for FZ-S□, FH-S□05R, FH-S□X, FH-S□X01 | | FZ-S-XLC |
| | Mounting Base for FZ-S□2M | | FZ-S2M-XLC |
| | Mounting Base for FZ-SH□ | | FZ-SH-XLC |
| | Mounting Base for FH-S□, FZ-S□5M□, FH-S□X05, FH-S□02, FH-S□04, FH-S□X03, FH-S□X12, FH-S□21R | | FH-SM-XLC |
| | Mounting Base for FH-S□12 | | FH-SM12-XLC |
| | M42 - F Mount Conversion Adapter | | FH-ADF/M42-10 |

Camera Cable

| Appearance | Description | Model |
|---|--|---|
|  | Camera Cable Cable length: 2 m, 3 m, 5 m, or 10 m ^{*1} | FZ-VS3 2M FZ-VS3 3M FZ-VS3 5M FZ-VS3 10M |
|  | Bend resistant Camera Cable Cable length: 2 m, 3 m, 5 m, or 10 m ^{*1} | FZ-VSB3 2M FZ-VSB3 3M FZ-VSB3 5M FZ-VSB3 10M |
|  | Super bend resistant Camera Cable 5 m or 10 m ^{*1} | FZ-VSBX 5M FZ-VSBX 10M |
|  | Right-angle Camera Cable ^{*2} Cable length: 2 m, 3 m, 5 m, or 10 m ^{*1} | FZ-VSL3 2M FZ-VSL3 3M FZ-VSL3 5M FZ-VSL3 10M |
|  | Bend resistant Right-angle Camera Cable ^{*2} Cable length: 2 m, 3 m, 5 m, or 10 m ^{*1} | FZ-VSLB3 2M FZ-VSLB3 3M FZ-VSLB3 5M FZ-VSLB3 10M |
|  | Long-distance Camera Cable Cable length: 15 m ^{*1} | FZ-VS4 15M |
|  | Long-distance Right-angle Camera Cable ^{*2} Cable length: 15 m ^{*1} | FZ-VSL4 15M |
|  | Cable Extension Unit Up to two Extension Units and three Cables can be connected (Maximum cable length: 45 m ^{*1}) | FZ-VSJ |



*1. The maximum cable length depends on the Camera being connected, and the model and length of the Cable being used. For further information, please refer to 3-3-5 *Cable Connection Table* on page 3-47 and 3-3-6 *Cable Extension Units* on page 3-52.

When a high-speed digital CMOS camera FH-S□02/-S□04/-S□12/-S□X03/-S□X05/-S□X12/-S□21R is used in the high speed digital mode of transmission speed, two camera cables are required.

*2. This Cable has an L-shaped connector on the Camera end.




1-2-3 Monitor

Monitor

| Appearance | Description | Model |
|---|---|---------|
|  | Touch Panel Monitor 12.1 inches (for FH sensor controllers) ^{*1} | FH-MT12 |
|  | LCD Monitor 8.4 inches | FZ-M08 |

*1. FH Series sensor controllers version 5.32 or higher is required.

Monitor Cables





| Appearance | Description | Model |
|---|---|---|
|  | DVI-Analog Conversion Cable for Touch Panel Monitor / LCD Monitor Cable length: 2 m, 5 m or 10 m | FH-VMDA 2M FH-VMDA 5M FH-VMDA 10M |
|  | RS-232C Cable for Touch Panel Monitor Cable length: 2 m, 5 m or 10 m | XW2Z-□□ □PP-1 *1 |
|  | USB Cable for Touch Panel Monitor Cable length: 2 m or 5 m | FH-VUAB 2M FH-VUAB 5M |

*1. Insert the cables length into □□□ in the model number as follows. 2 m = 200, 5 m = 500, 10 m = 010.

A video signal cable and an operation signal cable are required to connect the Touch Panel Monitor.







| Signal | Cable | 2 m | 5 m | 10 m |
|------------------------------|-----------------------------|-----|-----|------|
| Video signal | DVI-Analog Conversion Cable | Yes | Yes | Yes |
| Touch panel operation signal | USB Cable | Yes | Yes | No |
| | RS-232C Cable | Yes | Yes | Yes |

1-2-4 Lighting and Lighting Controller

| Appearance | Description | | Model |
|---|--|----------------|----------------------------------|
| - | External Lighting | - | FLV Series |
| - | | - | FL Series |
|  | Lighting Controller (Required to control external lighting from a sensor controller) | For FLV-Series | Camera Mount Lighting Controller |
|  | | | Analog Lighting Controller |
|  | | For FL-Series | Camera Mount Lighting Controller |
|  | | | Digital Lighting Controller |





For the method of setting the lighting controller, please refer to the respective instruction manual.

1-2-5 Accessories

| Appearance | Description | | | | Model |
|---|--|---------------------------|---|--------------------------------|----------------|
|  | USB flash drive | | 2 GB | | FZ-MEM2G |
| | | | 8 GB | | FZ-MEM8G |
| | | | 16 GB | | FZ-MEM16G |
|  | SD card | | 2 GB | | HMC-SD293 |
| | | | 4 GB | | HMC-SD493 |
| | | | 16 GB | | HMC-SD1A3 |
|  | USB/Monitor Switcher | | | | FZ-DU |
| - | Mouse - Driverless wired mouse (A mouse that requires the mouse driver to be installed is not supported.) | | | | - |
|  | EtherCAT junction slaves | 3 ports | Power supply voltage: 20.4 VDC to 28.8 VDC (24 VDC -15 % to +20 %) | Current consumption: 0.22 A | GX-JC03 |
| | | 6 ports | | | GX-JC06 |
|  | Industrial Switching Hubs for EtherNet/IP and Ethernet | 5 ports | | Current consumption: 0.07 A | W4S1-05D |
| - | Calibration Plate | | | | FZD-CAL |
|  | Common items related to DIN rail (for FH-L55□/FH-L55□-□□) | DIN rail mounting bracket | | | FH-XDM-L |
| | | DIN 35 mm rail | <ul style="list-style-type: none"> Length: 75.5/95.5/115.5/200 cm Height: 7.5 mm Material: Iron Surface: Conductive | PHOENIX CONTACT | NS 35/7.5 PERF |
| | | | <ul style="list-style-type: none"> Length: 75.5/95.5/115.5/200 cm Height: 15 mm Material: Iron Surface: Conductive | | NS 35/15 PERF |
| - | | End plate | Need 2 pieces each sensor controller | PHOENIX CONTACT | CLIPFIX 35 |

1-2-6 Cable

Parallel I/O Cables and Encoder Cable

| Appearance | Description | Model |
|---|--|-------------------------------------|
|  | Parallel I/O Cable *1 Cable length: 2 m, 5 m or 15 m | XW2Z-S013-□ *2 |
|  | Parallel I/O Cable for Connector-terminal Conversion Unit *1 Cable length: 0.5 m, 1 m, 1.5 m, 2 m, 3 m, 5 m | XW2Z-□□□EE *3 |
|  | Ultra-Compact Interface Wiring System (General-Purpose) | XW2K-34G-T *4 XW2R-□34GD-T *5 |
|  | Encoder Cable for line-driver Cable length: 1.5 m | FH-VR 1.5M |

*1. 2 Cables are required for all I/O signals.

*2. Insert the cables length into □ in the model number as follows. 2 m = 2, 5 m = 5, 15 m = 15

*3. Insert the cables length into □□□ in the model number as follows. 0.5 m = 050, 1 m = 100, 1.5 m = 150, 2 m = 200, 3 m = 300, 5 m = 500

*4. Refer to the *XW2K Series Datasheet (Cat. No. G152)* for details.



*5. Insert the wiring method into □ in the model number as follows. Phillips screw = J, Slotted screw (rise up) = E, Push-in spring = P



Refer to the *XW2R (General-purpose devices) Data Sheet* for details.

Recommended EtherCAT and EtherNet/IP Communications Cables

Use Straight STP (shielded twisted-pair) cable of category 5 or higher with double shielding (braiding and aluminum foil tape) for EtherCAT.

Use Straight or cross STP (shielded twisted-pair) cable of category 5 or higher for EtherNet/IP.

| Item | Appearance | Recommended manufacturer | Cable length (m) | Model |
|--|---|--------------------------|------------------|----------------------|
| Cable with Connectors on Both Ends (RJ45/RJ45) Standard RJ45 plugs type *1 Wire Gauge and Number of Pairs: AWG26, 4-pair Cable Cable Sheath material: PUR Cable color: Yellow *2 |  | OMRON | 0.3 | XS6W-6PUR8SS30CM-YF |
| | | | 0.5 | XS6W-6PUR8SS50CM-YF |
| | | | 1 | XS6W-6PUR8SS100CM-YF |
| | | | 2 | XS6W-6PUR8SS200CM-YF |
| | | | 3 | XS6W-6PUR8SS300CM-YF |
| | | | 5 | XS6W-6PUR8SS500CM-YF |
| Cable with Connectors on Both Ends (RJ45/RJ45) Rugged RJ45 plugs type *1 Wire Gauge and Number of Pairs: AWG22, 2-pair Cable Cable color: Light blue |  | OMRON | 0.3 | XS5W-T421-AMD-K |
| | | | 0.5 | XS5W-T421-BMD-K |
| | | | 1 | XS5W-T421-CMD-K |
| | | | 2 | XS5W-T421-DMD-K |
| | | | 3 | XS5W-T421-GMD-K |
| | | | 5 | XS5W-T421-JMD-K |

| Item | Appearance | Recommended manufacturer | Cable length (m) | Model |
|--|---|--------------------------|------------------|------------------|
| Cable with Connectors on Both Ends (M12 Straight/M12 Straight) Shield Strengthening Connector cable *3 M12/Smartclick Connectors Wire Gauge and Number of Pairs: AWG22, 2-pair Cable Cable color: Black |  | OMRON | 0.5 | XS5W-T421-BM2-SS |
| | | | 1 | XS5W-T421-CM2-SS |
| | | | 2 | XS5W-T421-DM2-SS |
| | | | 3 | XS5W-T421-EM2-SS |
| | | | 5 | XS5W-T421-GM2-SS |
| | | | 10 | XS5W-T421-JM2-SS |
| Cable with Connectors on Both Ends (M12 Straight/RJ45) Shield Strengthening Connector cable *3 M12/Smartclick Connectors Wire Gauge and Number of Pairs: AWG22, 2-pair Cable Cable color: Black |  | OMRON | 0.5 | XS5W-T421-BMC-SS |
| | | | 1 | XS5W-T421-CMC-SS |
| | | | 2 | XS5W-T421-DMC-SS |
| | | | 3 | XS5W-T421-EMC-SS |
| | | | 5 | XS5W-T421-GMC-SS |
| | | | 10 | XS5W-T421-JMC-SS |

*1. Cables with standard RJ45 plugs are available in the following lengths: 0.2 m, 0.3 m, 0.5 m, 1 m, 1.5 m, 2 m, 3 m, 5 m, 7.5 m, 10 m, 15 m, 20 m.


Cables with rugged RJ45 plugs are available in the following lengths: 0.3 m, 0.5 m, 1 m, 2 m, 3 m, 5 m, 10 m, 15 m.

For details, refer to the Industrial Ethernet Connectors Catalog (Cat. No. G019).

*2. Cables colors are available in yellow, green, and blue.

*3. For details, contact your OMRON representative.

Cables / Connectors

| Item | | Recommended manufacturer | Model |
|--|--|--------------------------|-----------------|
| Products for EtherCAT or EtherNet/IP (1000BASE-T/100BASE-TX) Wire gauge and number of pairs: AWG24, 4-pair cable | Cable | Kuramo Electric Co. | KETH-SB *1 |
| | RJ45 Connector | Panduit Corporation | MPS588-C *1 |
| Products for EtherCAT or EtherNet/IP (1000BASE-TX/100BASE-T) Wire gauge and number of pairs: AWG22, 2-pair cable | Cable | Kuramo Electric Co. | KETH-PSB-OMR *2 |
| | | JMACS Japan Co., Ltd. | PNET/B *2 |
| | RJ45 Assembly Connector  | OMRON | XS6G-T421-1 *2 |

*1. We recommend you to use the above Cable and RJ45 Connector together.

*2. We recommend you to use the above Cable and RJ45 Assembly Connector together.

1-2-7 Software

Automation Software Sysmac Studio

The Sysmac Studio is the software that provides an integrated environment for setting, programming, debugging and maintenance of machine automation controllers including the NJ/NX-series CPU Units, NY-series Industrial PC, EtherCAT Slave, and the HMI.

For details, refer to your local OMRON website and *Sysmac Studio Catalog* (Cat. No. P138).

Development Environment

| Product | Specifications | Specifications | | Model |
|----------------------|--|--------------------|--------|---------|
| | | Number of licenses | Media | |
| Application Producer | Software components that provide a development environment to further customize the standard controller features of the FH Series. System requirements: <ul style="list-style-type: none"> • CPU: Intel Pentium Processor (SSE2 or higher) • Windows 10 Pro (32/64bit) or Enterprise (32/64bit), Windows 11 Pro (64bit) or Enterprise (64bit) • .NET Framework: .NET Framework 3.5 SP1 • Memory: At least 2 GB RAM Available disk space: At least 2 GB • Browser: Microsoft® Internet Explorer 6.0 or later • Display: XGA (1024 x 768), True Color (32-bit) or higher • Optical drive: CD/DVD drive • The following software is required to customize the software: Microsoft® Visual Studio® 2008 Professional or Microsoft® Visual Studio® 2010 Professional or Microsoft® Visual Studio® 2012 Professional or Microsoft® Visual Studio® 2013 Professional | - (Media only) | CD-ROM | FH-AP1 |
| | | 1 license | - | FH-AP1L |

2

Overview of FH series

| | | |
|------------|------------------------------------|------------|
| 2-1 | Overview of System | 2-2 |
| 2-1-1 | Basic System of Measurement | 2-2 |
| 2-1-2 | FH-2000/FH-5000 Series | 2-3 |
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2-1 Overview of System

2-1-1 Basic System of Measurement

An FH series sensor controller uses pre-built packages that contain all the processing tasks (for image input, measurement processing, displays, outputs, etc.) that are required for vision inspections.

You arrange these packaged processes in order of execution of the vision inspection.

An FH series sensor controller executes vision inspections according to user-created flows.

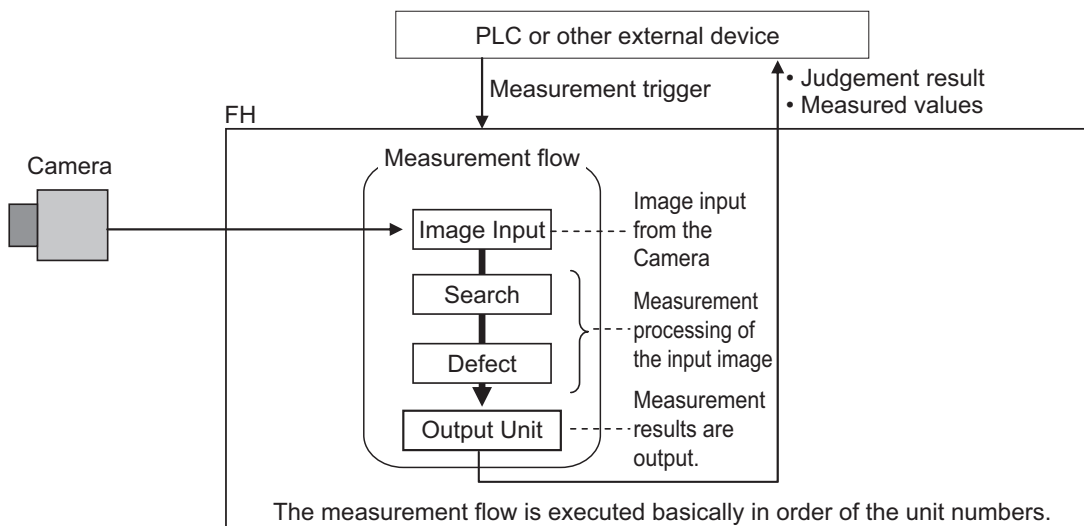


Additional Information

In the FH series sensor controller, a flow that contains packaged processes that are arranged in order of execution of processing items and image processing is called a measurement flow. Processing items and measurement flows can have more than one setting. You can switch the setting based on the scene to inspect. (Refer to the *Vision System FH/FHV series User's Manual (Cat. No. Z365)*.)

Concept of Measurement Processing

When the FH receives a measurement trigger from the PLC or other external device, the image input from a Camera, measurement processing, and output of measurement results (e.g., OK/NG judgement results) are executed in the order that those processing items are registered in the measurement flow.



In the measurement flow, you can change the processing to execute based on the inspection results or input conditions of the vision inspection.

You can use macro processing to execute pre-packaged processing items and functions in the FH to create original programs. This allows you to create original measurement processes, display processing, input and output processing, and settings dialog boxes that are custom-tailored to your application.

2-1-2 FH-2000/FH-5000 Series

Vision System FH-2000/FH-5000 series is the BOX type sensor controller having functions and high-speed needed to incorporate with a machine, and safety, reliability, and maintainability as an industrial controller.

This series includes the conventional image processing functions and added functions needed to incorporate with a machine. As sensor controller supporting high-speed communications, with EtherCAT, it enables synchronous control with connecting to input and output devices such and a programmable controller.

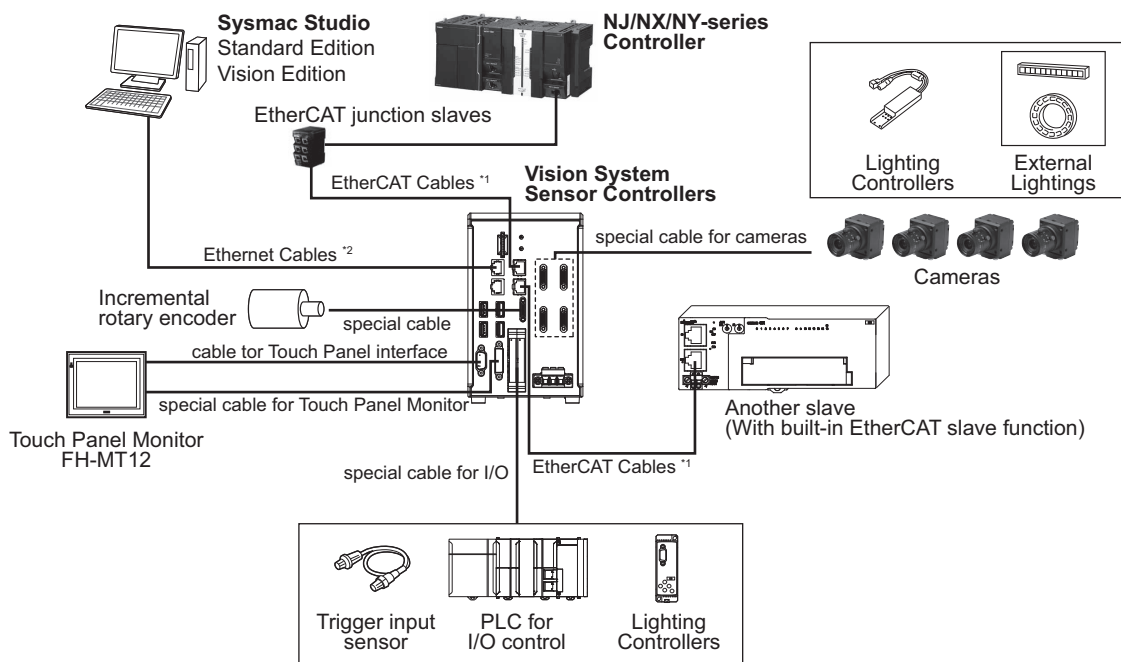
This series can connect with up to eight cameras and transmits images faster than that in the conventional models.

OMRON provides Sysmac device designed by unified communication specifications and User Interface Specifications. Vision System FH-2000/FH-5000 series can be easily connected with NJ/NX/NY-series Controller and Sysmac devices such as EtherCAT slaves by using the automation software Sysmac Studio and which are designed to meet the optimum functions and operations.

The example of a system configuration is shown below.

EtherCAT Connection for FH Series

Example of the FH sensor controllers (4-camera type)



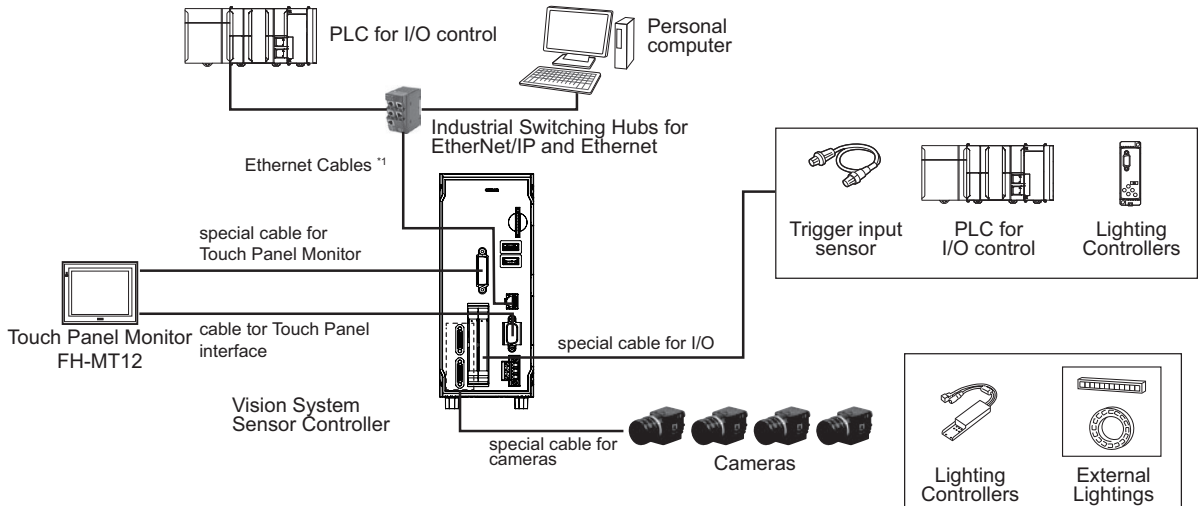
*1. To use STP (shielded twisted-pair) cable of category 5 or higher with double shielding (braiding and aluminum foil tape) for EtherCAT and RJ45 connector.

*2. To use STP (shielded twisted-pair) cable of category 5 or higher for Ethernet and RJ45 connector.

2-1-3 FH-L Series

Vision System FH-L series is the small and low-cost BOX type sensor controller having functions and high-speed needed to built into a machine, and safety, reliability, and maintainability as an industrial controller.

This series can connect with up to four cameras and transmits images faster than that in the conventional models.

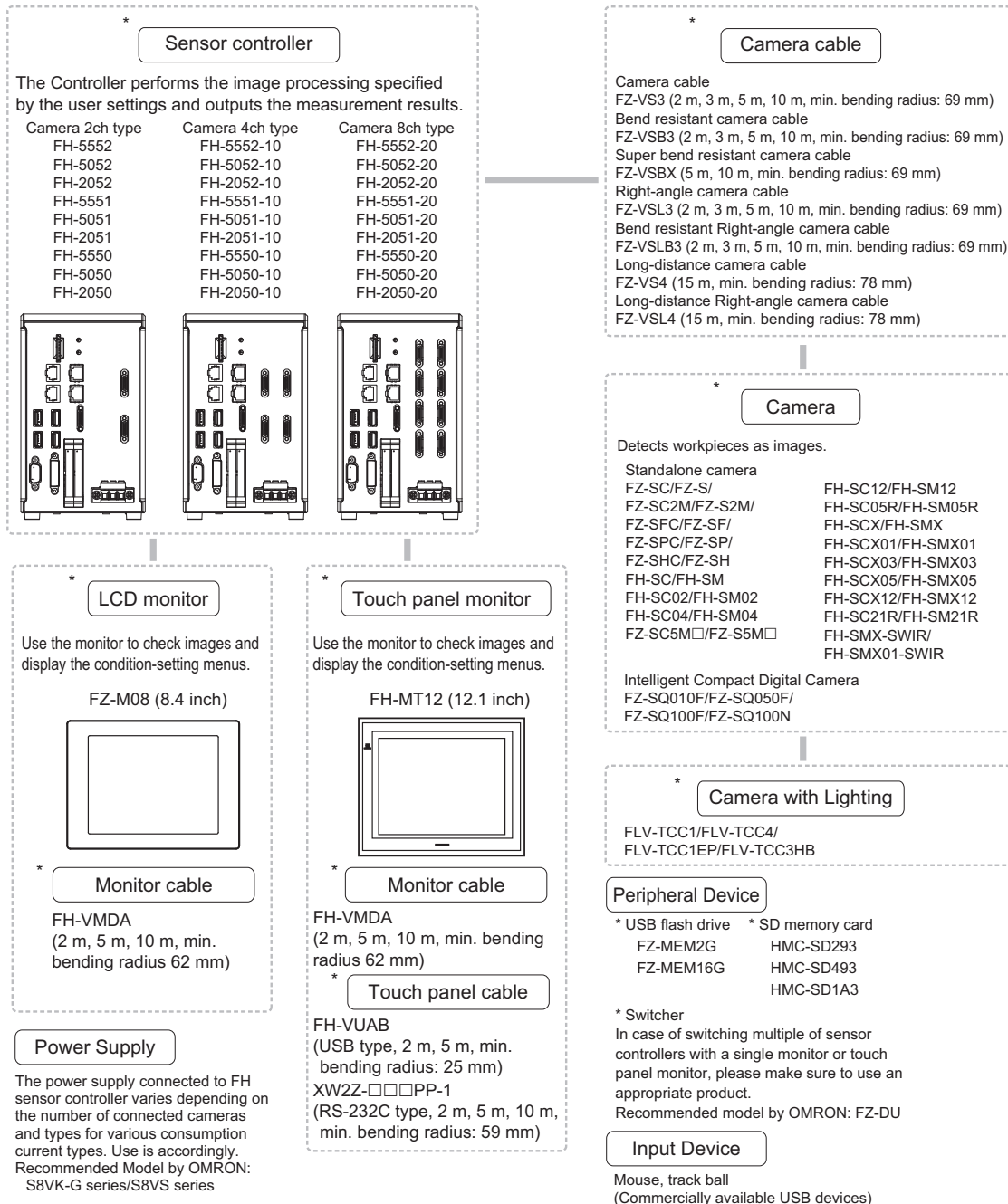


*1. To use STP (shielded twisted-pair) cable of category 5 or higher for Ethernet and RJ45 connector.

2-2 System Configuration

2-2-1 FH-2000/FH-5000 Series

* Items indicated with an asterisk are dedicated items, and cannot be substituted.

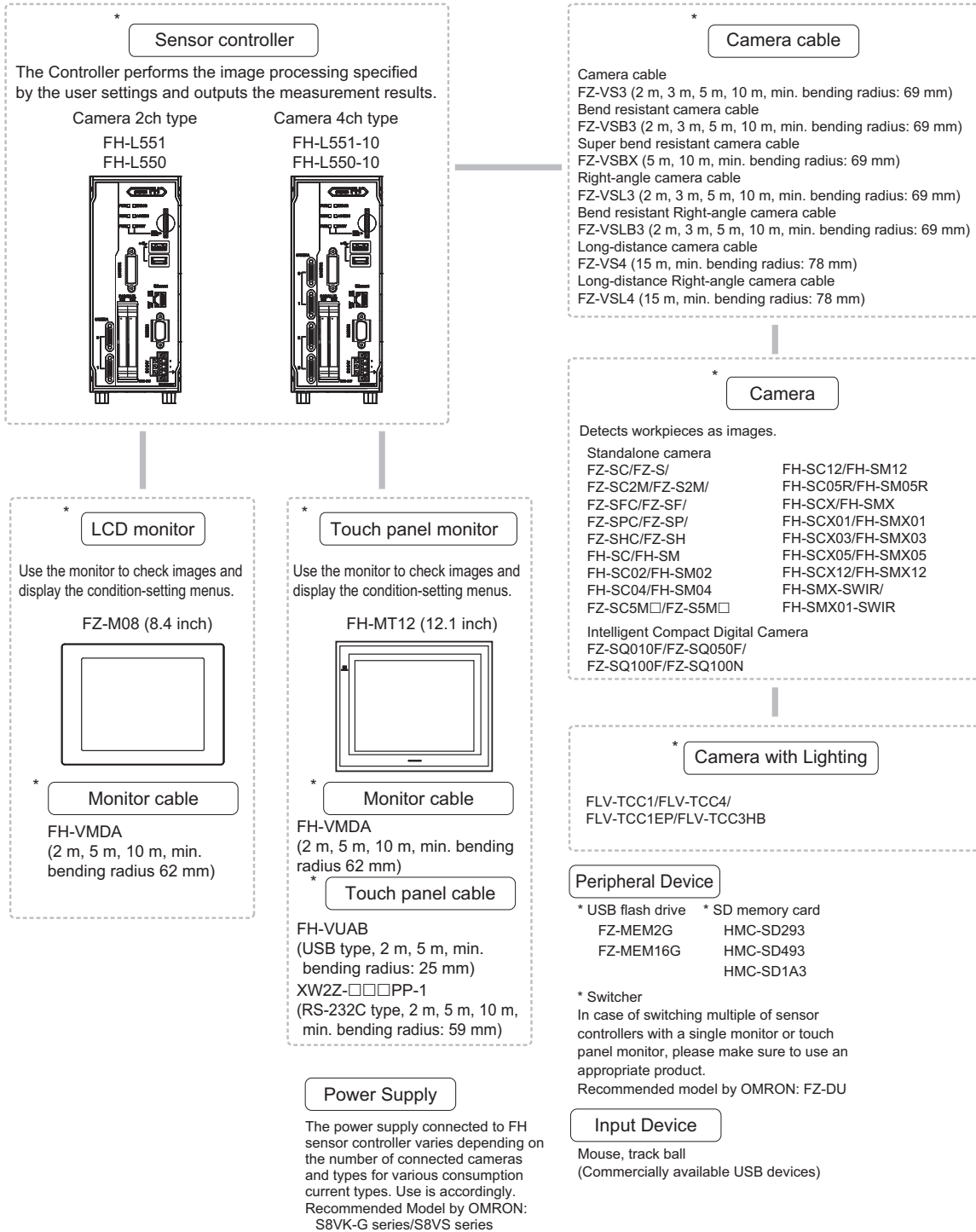


Precautions for Correct Use

Some cameras cannot be used with FH sensor controllers with older software versions. Refer to *3-8 Available List of FH Software Versions* on page 3-100.

2-2-2 FH-L Series

* Items indicated with an asterisk are dedicated items, and cannot be substituted.



Precautions for Correct Use

Some cameras cannot be used with FH sensor controllers with older software versions. Refer to *3-8 Available List of FH Software Versions* on page 3-100.

2-3 Flow of Use Procedure

The following table shows the flow for using the FH.

| Procedure | Description | Reference |
|---|--|---|
| Preparations | Installation and Wiring | <i>Section 4 Handling and Installation Environment</i> on page 4-1 <i>Section 5 Setup and Wiring</i> on page 5-1 |
| | ↓ | |
| | Turning ON Power | <i>5-1 When turning ON and OFF</i> on page 5-2 |
| | ↓ | |
| | Language Selection in Dialog Box (only when the sensor controller is started for the first time) | <i>Vision System FH/FHV series User's Manual (Cat.No. Z365)</i> |
| | ↓ | |
| | Main Window (Layout 0) Display | <i>Vision System FH/FHV series User's Manual (Cat.No. Z365)</i> |
| | ↓ | |
| | Camera Adjustments (Display the settings dialog box for a Camera Image Input processing item.) | <i>Vision System FH/FHV series User's Manual (Cat.No. Z365)</i> |
| | ↓ | |
| | Select Tool - System settings , and then under Startup setting , set the settings for <i>Basic, Communication, and Operation mode</i> . | <i>Vision System FH/FHV series User's Manual (Cat.No. Z365)</i> |
| | ↓ | |
| | Click the Data save button, and then select Function - System restart . | <i>Vision System FH/FHV series User's Manual (Cat.No. Z365)</i> |
| ↓ | | |
| Select Tool - System settings , and then set the settings for <i>Camera, Communication and Other</i> . | <i>Vision System FH/FHV series User's Manual (Cat.No. Z365)</i> | |
| ↓ | | |
| Click the Data save button. | <i>Vision System FH/FHV series User's Manual (Cat.No. Z365)</i> | |
| ↓ | | |
| Scene Editing | In the Main Window (layout 0), edit the measurement flow. <ul style="list-style-type: none"> • Register processing items. • Set the properties for each processing item. | <i>Vision System FH/FHV series User's Manual (Cat.No. Z365)</i> |
| | ↓ | |
| | Click the Data save button. | <i>Vision System FH/FHV series User's Manual (Cat.No. Z365)</i> |
| ↓↑ | | |

| Procedure | Description | Reference |
|-------------------------|---|--|
| Testing | Execute test measurements. (In the Main Window (layout 0), click the Measure button.) | <i>Vision System FH/FHV series User's Manual (Cat.No. Z365)</i> |
| | ↓ | |
| | Adjust the parameters for each processing item. | <i>Vision System FH/FHV series Processing Item Function Reference Manual (Cat. No. Z341)</i> |
| | ↓ | |
| | Click the Data save button. | <i>Vision System FH/FHV series User's Manual (Cat.No. Z365)</i> |
| ↓ | | |
| Measuring (Operation) | In the Main Window (layout 0), click the Switch layout button, and then select <i>Main Window (Layout 1)</i> . | <i>Vision System FH/FHV series User's Manual (Cat.No. Z365)</i> |
| | ↓ | |
| | In the Main Window (layout 1), check the communications with the PLC. | <i>Vision System FH/FHV series User's Manual for Communications Settings (Cat. No. Z342)</i> |
| | ↓ | |
| | In the Main Window (layout 1), execute commands from the PLC, such as measurement trigger commands. | <i>Vision System FH/FHV series User's Manual for Communications Settings (Cat. No. Z342)</i> |
| ↓ | | |
| Management and Analysis | Save and analyze measurement data and images. | <i>Vision System FH/FHV series User's Manual for Communications Settings (Cat. No. Z342)</i> |

3

Configuration

| | | |
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3-1 Sensor Controller

3-1-1 High-speed, Large-capacity Controller / Standard Controller (FH-5000/FH-2000 Series)

Specification

| Series | FH-5000 Series | | | FH-2000 Series | | |
|----------------------|--|--|--|---|--|--|
| Model | | FH-5552-10/ FH-5052-10/ FH-5551-10/ FH-5051-10/ FH-5550-10/ FH-5050 | FH-5552-20/ FH-5052-20/ FH-5551-20/ FH-5051-20/ FH-5550-20/ FH-5550-10/ FH-5050-20 | | FH-2052-10/ FH-2051-10/ FH-2050-10 | FH-2052-20/ FH-2051-20/ FH-2050-20 |
| Controller Type | Box type | | | | | |
| Parallel IO polarity | NPN/PNP (common) | | | | | |
| Memory, Storage | <ul style="list-style-type: none"> FH-5552/FH-5552-10/ FH-5552-20: 32GB RAM, 128GB ROM FH-5052/FH-5052-10/ FH-5052-20: 8GB RAM, 64GB ROM FH-5551/FH-5551-10/ FH-5551-20: 32GB RAM, 64GB ROM FH-5051/FH-5051-10/ FH-5051-20: 8GB RAM, 64GB ROM FH-5550/FH-5550-10/ FH-5550-20: 32GB RAM, 64GB ROM FH-5050/FH-5050-10/ FH-5050-20: 8GB RAM, 32GB ROM | | | <ul style="list-style-type: none"> FH-2052/FH-2052-10/ FH-2052-20: 8GB RAM, 64GB ROM FH-2051/FH-2051-10/ FH-2051-20: 8GB RAM, 64GB ROM FH-2050/FH-2050-10/ FH-2050-20: 8GB RAM, 32GB ROM | | |

| Series | | FH-5000 Series | | | FH-2000 Series | | |
|------------------------------|-----------------------------|--|-----------------------|-------------|---------------------------------|---|-------------|
| Model | | | FH-5552-10/ | FH-5552-20/ | | | |
| | | | FH-5052-10/ | FH-5052-20/ | | | |
| | | FH-5552/ | FH-5551-10/ | FH-5551-20/ | FH-2052/ FH-2051/ FH-2050 | FH-2052-10/ | FH-2052-20/ |
| | | FH-5052/ | FH-5051-10/ | FH-5051-20/ | | FH-2051-10/ | FH-2051-20/ |
| | | FH-5551/ | FH-5051-10/ | FH-5051-20/ | | FH-2050-10 | FH-2050-20 |
| | | FH-5051/ | FH-5550-10/ | FH-5550-20/ | | | |
| | | FH-5550/ | FH-5050-10/ | FH-5050-20/ | | | |
| | FH-5050 | FH-5550-10/ | FH-5550-20/ | | | | |
| | | FH-5050-10 | FH-5050-20 | | | | |
| Number of cores | | <ul style="list-style-type: none"> FH-5052/FH-5052-10/ FH-5052-20/FH-5552/ FH-5552-10/FH-5552-20: 8 cores FH-5051/FH-5051-10/ FH-5051-20/FH-5551/ FH-5551-10/FH-5551-20: 4 cores FH-5050/FH-5050-10/ FH-5050-20/FH-5550/ FH-5550-10/FH-5550-20: 4 cores | | | 2 cores | | |
| AI Processing Items | AI Defect Inspection *1 | <ul style="list-style-type: none"> FH-5552/FH-5552-10/ FH-5552-20/FH-5551/ FH-5551-10/FH-5551-20: Yes Other than the above: No | | | No | | |
| | AI Scratch Detect Filter *2 | Yes | | | No | | |
| | AI Fine Matching | Yes | | | Yes | | |
| Main Functions | Operation Mode | Standard | Yes | | | | |
| | | Double Speed Multi-input | Yes | | | | |
| | | Non-stop adjustment mode | Yes | | | | |
| | | Multi-line random-trigger mode | Yes (Maximum 8 lines) | | | Yes (Maximum 8 lines) According to the CPU performance, FH-2000 series is recommended to use up to two lines in this mode. | |
| | Parallel Processing | Yes | | | | | |
| Number of Connectable Camera | | 2 | 4 | 8 | 2 | 4 | 8 |

| Series | | FH-5000 Series | | | FH-2000 Series | | |
|--|---------------------------|--|---|---|---|--|--|
| Model | | | FH-5552-10/ FH-5052-10/ FH-5551-10/ FH-5051-10/ FH-5550-10/ FH-5050-10/ FH-5550-20/ FH-5050-20 | FH-5552-20/ FH-5052-20/ FH-5551-20/ FH-5051-20/ FH-5550-20/ FH-5050-20 | | FH-2052-10/ FH-2051-10/ FH-2050-10 | FH-2052-20/ FH-2051-20/ FH-2050-20 |
| Supported Camera | FH-S series camera | <ul style="list-style-type: none"> FH-5052/FH-5052-10/ FH-5052-20/FH-5552/ FH-5552-10/FH-5552-20/ FH-5051/FH-5051-10/ FH-5051-20/FH-5551/ FH-5551-10/FH-5551-20: All of the FH-S series cameras are connectable. FH-5050/FH-5050-10/ FH-5050-20/FH-5550/ FH-5550-10/FH-5550-20: FH-S series cameras except FH-SMX-SWIR/FH-SMX01-SWIR are connectable. <p>*3 *4</p> | | | <ul style="list-style-type: none"> FH-2052/FH-2052-10/ FH-2052-20/FH-2051/ FH-2051-10/FH-2051-20: All of the FH-S series cameras are connectable. FH-2050/ FH-2050-10/ FH-2050-20: FH-S series cameras except FH-SMX-SWIR/FH-SMX01-SWIR are connectable. <p>*3 *4</p> | | |
| | FZ-S series camera | All of the FZ-S series cameras are connectable. | | | | | |
| Camera I/F | | OMRON I/F | | | | | |
| Possible Number of Captured Images | | Refer to <i>About Number of Logging Images</i> or <i>About Max. Number of Loading Images during Multi-input</i> in the <i>Vision System FH/FHV series User's Manual (Cat.No. Z365)</i> . | | | | | |
| Possible Number of Logging Images to Sensor Controller | | | | | | | |
| Possible Number of Scenes | | 128 | | | | | |
| Operating on UI | USB Mouse | Yes (wired USB and driver is unnecessary type) | | | | | |
| | Touch Panel | Yes (RS-232C/USB connection: FH-MT12) | | | | | |
| Setup | | Create the processing flow using Flow editing. | | | | | |
| Language | | English, Japanese, Simplified Chinese, Traditional Chinese, Korean, German, French, Spanish, Italian, Vietnamese, Polish | | | | | |
| External Interface | Serial Communication | RS-232C x 1 | | | | | |
| | Ethernet Communication | Protocol: Non-procedure (TCP/UDP) Physical layer: 1000BASE-T x 2 | | | | | |
| | EtherNet/IP Communication | Yes (Target/Ethernet port) (Refer to <i>Component Names and Functions</i> on page 3-9 and use a port that supports Ethernet/IP communication.) | | | | | |

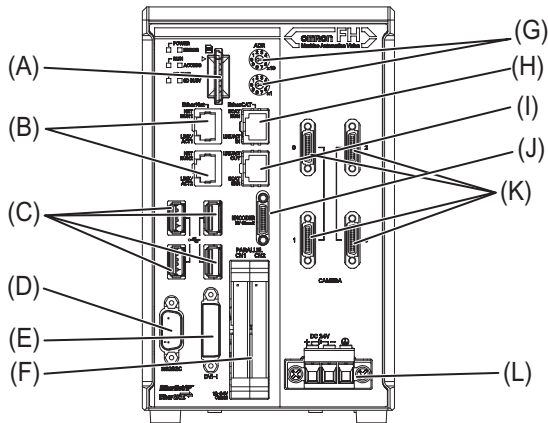
| Series | FH-5000 Series | | | FH-2000 Series | | |
|------------------------|---|---|---|---------------------------------|--|--|
| Model | FH-5552/ FH-5052/ FH-5551/ FH-5051/ FH-5550/ FH-5050 | FH-5552- 10/ FH-5052- 10/ FH-5551- 10/ FH-5051- 10/ FH-5550- 10/ FH-5050- 10 | FH-5552- 20/ FH-5052- 20/ FH-5551- 20/ FH-5051- 20/ FH-5550- 20/ FH-5050- 20 | FH-2052/ FH-2051/ FH-2050 | FH-2052- 10/ FH-2051- 10/ FH-2050- 10 | FH-2052- 20/ FH-2051- 20/ FH-2050- 20 |
| PROFINET Communication | Yes (Slave/Ethernet port) Conformance class A | | | | | |
| EtherCAT Communication | Yes (slave) Physical layer: 100BASE-TX | | | | | |
| Parallel I/O | 12 inputs/31 outputs: Use 1 Line. Operation mode: Except Multi-line random-trigger mode. 17 inputs/37 outputs: Use 2 Line. Operation mode: Multi-line random-trigger mode. 14 inputs/29 outputs: Use 3 to 4 Line. Operation mode: Multi-line random-trigger mode. 19 inputs/34 outputs: Use 5 to 8 Line. Operation mode: Multi-line random-trigger mode. | | | | | |
| Encoder Interface | Input voltage: 5 V \pm 5% Signal: RS-422A Line Driver Level Phase A/B/Z: 1 MHz | | | | | |
| Monitor Interface | DVI-I output (Analog RGB & DVI-D single link) x 1 • DVI connection (Recognize the recommended resolution automatically) • RGB connection (Resolution XGA 1024x768 dot) | | | | | |
| USB I/F | USB2.0 host x 2 (BUS Power: 5 V/0.5 A per port) USB3.0 host x 2 (BUS Power: 5 V/0.9 A per port) | | | | | |
| SD Card I/F | SDHC x 1 | | | | | |
| Indicator Lamps | Main | POWER: Green ERROR: Red RUN: Green ACCESS: Yellow | | | | |
| | Ethernet | NET RUN1: Green LINK/ACT1: Yellow NET RUN2: Green LINK/ACT2: Yellow | | | | |
| | SD Card | SD POWER: Green SD BUSY: Yellow | | | | |
| | EtherCAT | ECAT RUN: Green LINK/ACT IN: Green LINK/ACT OUT: Green ECAT ERR: Red | | | | |
| Supply Voltage | 20.4 VDC to 26.4 VDC | | | | | |

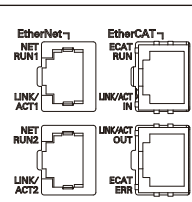
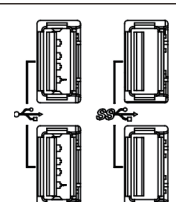
| Series | | FH-5000 Series | | | FH-2000 Series | | |
|---------------------|---|---|---|---|--|--|--|
| Model | | | FH-5552-10/ FH-5052-10/ FH-5551-10/ FH-5051-10/ FH-5550/ FH-5050 | FH-5552-20/ FH-5052-20/ FH-5551-20/ FH-5051-20/ FH-5550-10/ FH-5050-10 | | FH-2052-10/ FH-2051-10/ FH-2050-10 | FH-2052-20/ FH-2051-20/ FH-2050-20 |
| Current consumption | <ul style="list-style-type: none"> When connecting the following cameras <ul style="list-style-type: none"> - Intelligent compact digital CMOS camera - Shortwave Infrared (SWIR) Camera When connecting the following lighting or lighting controllers without an external power supply <ul style="list-style-type: none"> - FLV-TCC1 - FLV-TCC4 - FLV-TCC3HB - FLV-TCC1EP - FL-TCC1 When connecting the following lighting or lighting controllers <ul style="list-style-type: none"> - FL-TCC1PS - FL-MD□MC | 5.6A max. | 7.7A max. | 12.2A max. | 4.6A max. | 6.6A max. | 11.2A max. |
| | Other than above | 4.5A max. | 5.5A max. | 7.3A max. | 3.5A max. | 4.3A max. | 6.3A max. |
| Built-in FAN | | Yes | | | | | |
| Usage Environment | Ambient temperature range | Operating: 0°C to +45°C Storage: -20 to +65°C (with no icing or condensation) | | | Operating: 0°C to +50°C Storage: -20 to +65°C (with no icing or condensation) | | |
| | Ambient humidity range | Operating and storage: 35 to 85% (with no condensation) | | | | | |
| | Ambient atmosphere | No corrosive gases | | | | | |
| | Vibration tolerance | Oscillation frequency: 10 to 150 Hz, Half amplitude: 0.1 mm, Acceleration: 15 m/s ² Sweep time: 8 minute/count, Sweep count: 10, Vibration direction: up and down/front and behind/left and right | | | | | |
| | Shock resistance | Impact force: 150 m/s ² Test direction: up and down/front and behind/left and right | | | | | |

| Series | | FH-5000 Series | | | FH-2000 Series | | | |
|--------|-------------------|----------------------|--|---|----------------|--|---|--|
| Model | | | FH-5552-10/ FH-5052-10/ FH-5551-10/ FH-5051-10/ FH-5550-10/ FH-5050 | FH-5552-20/ FH-5052-20/ FH-5551-20/ FH-5051-20/ FH-5550-20/ FH-5050-20 | | FH-2052-10/ FH-2051-10/ FH-2050-10 | FH-2052-20/ FH-2051-20/ FH-2050-20 | |
| | Noise immunity | Fast Transient Burst | <ul style="list-style-type: none"> DC power: Direct infusion: 2 kV, Pulse rising: 5 ns, Pulse width: 50 ns, Burst continuation time: 15 ms/0.75 ms, Period: 300 ms, Application time: 1 min. I/O line: Direct infusion: 1 kV, Pulse rising: 5 ns, Pulse width: 50 ns, Burst continuation time: 15 ms/0.75 ms, Period: 300 ms, Application time: 1 min. | | | | | |
| | Grounding | | Class D grounding (100 Ω or less grounding resistance) *5 | | | | | |
| | External Features | Dimensions | | 190 mm x 115 mm x 182.5 mm Note Height: Including the rubber at the base. | | | | |
| | | Weight | | Approx. 3.4kg | Approx. 3.6kg | Approx. 3.6kg | <ul style="list-style-type: none"> FH-2052: Approx. 3.4kg FH-2052-10/FH-2052-20: Approx. 3.6kg FH-2051/FH-2050: Approx. 3.0kg FH-2051-10/FH-2050-10/ FH-2051-20/FH-2050-20: Approx. 3.2kg | |
| | | Degree of protection | | IEC60529 IP20 | | | | |
| | | Case material | | Cover: zinc-plated steel plate, Side plate: aluminum (A6063) | | | | |

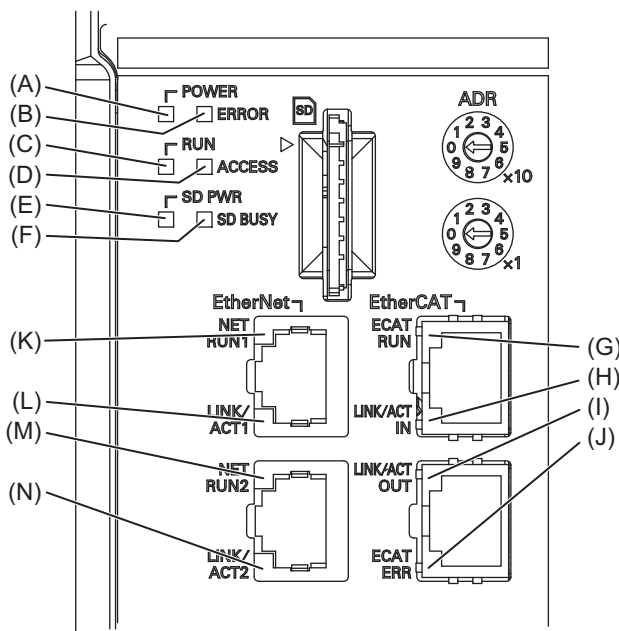
- *1. Optional FH Application Software (FH-UMLIC-08 AI Defect Inspection Software Installer) is required.
- *2. Optional FH Application Software (FH-UMAI1 Scratch Detect AI Software Installer) is required.
- *3. When 12 megapixels/20.4 megapixels cameras with FH-2□□□-20 / FH-5□□□-20: Max. 4 cameras are connectable.
When use except 12 megapixels/20.4 megapixels cameras with FH-2□□□-20 / FH-5□□□-20: Max. 8 cameras are connectable.
- *4. Some cameras cannot be used with FH sensor controllers with older software versions.
Refer to 3-8 Available List of FH Software Versions on page 3-100.
- *5. Existing the third class grounding

Component Names and Functions



| Connector name | Description |
|--|--|
| (A) SD memory card installation connector | Install the SD memory card. Do not plug or unplug the SD memory card during measurement operation. Otherwise measurement time may be affected or data may be destroyed. |
| (B) Ethernet connector | <p>Connect an Ethernet device.</p> <div style="border: 1px solid black; padding: 5px;"> <p>Upper port : Ethernet port</p> <p>Lower port : Ethernet port, EtherNet/IP port, and PROFINET port are sharing use.</p>  </div> |
| (C) USB connector | <p>Connect a USB device.</p> <p>Do not plug or unplug it during measurement. Otherwise measurement time may be affected or data may be destroyed.</p> <div style="border: 1px solid black; padding: 5px;"> <p>Left ports: USB2.0</p> <p>Right ports: USB3.0</p> <p>The USB3.0 interface has a higher bus power supply capability than the USB2.0 interface, and you can expect more stable operation with it.</p> <p>Also, when used in combination with a USB3.0 device, you can expect higher transfer speed than USB2.0.</p>  </div> |
| (D) RS-232C connector | Connect an external device such as a PLC. |
| (E) DVI-I connector | Connect a monitor. |
| (F) I/O (Parallel) connector (control lines, data lines) | Connect the controller to external devices such as a sync sensor and PLC. |
| (G) EtherCAT address setup volume | Used to set a station address (00 to 99) as an EtherCAT communication device. |
| (H) EtherCAT communication connector (IN) | Connect the opposed EtherCAT device. |

| | Connector name | Description |
|-----|--|---|
| (I) | EtherCAT communication connector (OUT) | Connect the opposed EtherCAT device. |
| (J) | Encoder connector | Connect an encoder. |
| (K) | Camera connector | Connect cameras. |
| (L) | Power supply terminal connector | Connect a DC power supply. Wire the FH sensor controller independently on other devices. Wire the ground line. Be sure to ground the FH sensor controller alone. Use an attachment power terminal (male) for installation. For details, refer to <i>5-3 Sensor Controller Installation</i> on page 5-5. |



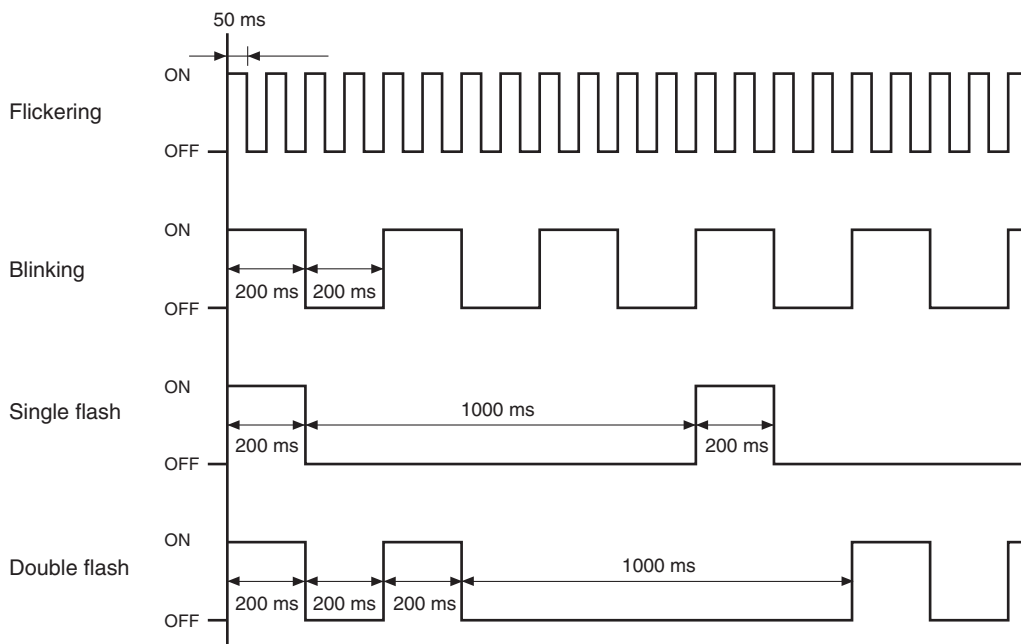
| | LED name | Description |
|-----|---------------------------|---|
| (A) | POWER LED | Lights up while power is ON. |
| (B) | ERROR LED | Lights up when an error has occurred. |
| (C) | RUN LED | Lights up while the layout turned on output setting is displayed. |
| (D) | ACCESS LED | Blinks while the internal nonvolatile memory is accessed. |
| (E) | SD POWER LED | Lights up while power is supplied to the SD memory card and the card is usable. |
| (F) | SD BUSY LED | Blinks while the SD memory card is accessed. |
| (G) | EtherCAT RUN LED | Lights up while EtherCAT communications are usable. |
| (H) | EtherCAT LINK/ACT IN LED | Lights up when connected with an EtherCAT device, and blinks while performing communications. |
| (I) | EtherCAT LINK/ACT OUT LED | Lights up when connected with an EtherCAT device, and blinks while performing communications. |
| (J) | EtherCAT ERR LED | Lights up when EtherCAT communications have become abnormal. |
| (K) | Ethernet NET RUN1 LED | Lights up while Ethernet communications are usable. |
| (L) | Ethernet LINK/ACT1 LED | Lights up when connected with an Ethernet device, and blinks while performing communications. |

| | LED name | Description |
|-----|------------------------|---|
| (M) | Ethernet NET RUN2 LED | Lights up while Ethernet communications are usable. |
| (N) | Ethernet LINK/ACT2 LED | Lights up when connected with an Ethernet device, and blinks while performing communications. |

EtherCAT status indicator LED

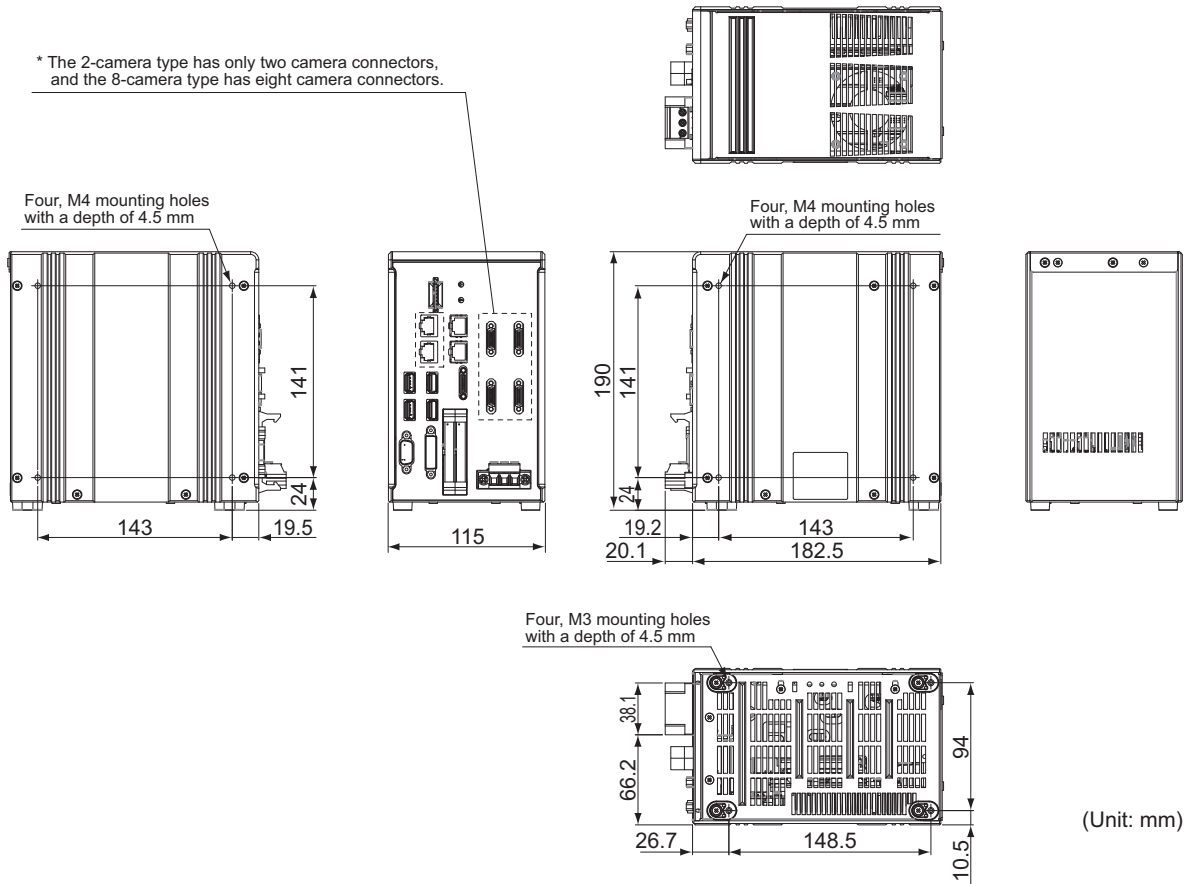
Detailed LED specifications are given below.

| LED name | Color | Status | Contents |
|------------|-------|--------------|--|
| ECAT RUN | Green | OFF | Initialization status |
| | | Blinking | Pre-Operational status |
| | | Single flash | Safe-Operational status |
| | | ON | Operational status |
| ECAT ERROR | Red | OFF | No error |
| | | Blinking | Communication setting error or PDO mapping error |
| | | Single flash | Synchronization error or communications data error |
| | | Double flash | Application WDT timeout |
| | | ON | PDI WDT timeout |
| L/A IN | Green | OFF | Link not established in physical layer |
| | | Flickering | In operation after establishing link |
| | | ON | Link established in physical layer |
| L/A OUT | Green | OFF | Link not established in physical layer |
| | | Flickering | In operation after establishing link |
| | | ON | Link established in physical layer |



Dimensions

* The 2-camera type has only two camera connectors, and the 8-camera type has eight camera connectors.



Additional Information

We have the 2D CAD data or 3D CAD data.
You can download CAD data from www.fa.omron.co.jp.

3-1-2 Lite Controller (FH-L Series)

Specification

| Series | | FH-L Series | | | | |
|--|------------------------------------|--|---|------------------|-------------------|--|
| Model | | FH-L550 | FH-L551 | FH-L550-10 | FH-L551-10 | |
| Controller Type | | Box type | | | | |
| Parallel IO polarity | | NPN/PNP (common) | | | | |
| Memory, Storage | | 4GB RAM, 4GB ROM | 4GB RAM, 32GB ROM | 4GB RAM, 4GB ROM | 4GB RAM, 32GB ROM | |
| AI Processing Items | AI Defect Inspection | No | | | | |
| | AI Scratch Detect Filter | No | | | | |
| | AI Fine Matching | No | Yes*1 | No | Yes*1 | |
| Main Functions | Operation Mode | Standard | Yes | | | |
| | | Double Speed Multi-input | Yes | | | |
| | | Non-stop adjustment mode | Yes | | | |
| | | Multi-line random-trigger mode | No | | | |
| | Parallel Processing | | Yes | | | |
| | Number of Connectable Camera | | 2 | | 4 | |
| | Supported Camera | FH-S series camera | <ul style="list-style-type: none"> FH-L551/FH-L551-10: FH-S series cameras except FH-SM21R/FH-SC21R are connectable. FH-L550/FH-L550-10: FH-S series cameras except FH-SM21R/FH-SC21R/FH-SMX-SWIR/FH-SMX01-SWIR are connectable. *2 | | | |
| | | FZ-S series camera | All of the FZ-S series cameras are connectable. | | | |
| | Camera I/F | | OMRON I/F | | | |
| | Possible Number of Captured Images | | Refer to <i>About Number of Logging Images</i> or <i>About Max. Number of Loading Images during Multi-input</i> in the <i>Vision System FH/FHV series User's Manual (Cat.No. Z365)</i> . | | | |
| Possible Number of Logging Images to Sensor Controller | | | | | | |
| Possible Number of Scenes | | 128 | | | | |
| Operating on UI | USB Mouse | Yes (wired USB and driver is unnecessary type) | | | | |
| | Touch Panel | Yes (RS-232C/USB connection: FH-MT12) | | | | |

| Series | | FH-L Series | | | |
|--------------------|---------------------------|---|---------|------------|------------|
| Model | | FH-L550 | FH-L551 | FH-L550-10 | FH-L551-10 |
| | Setup | Create the processing flow using Flow editing. | | | |
| | Language | English, Japanese, Simplified Chinese, Traditional Chinese, Korean, German, French, Spanish, Italian, Vietnamese, Polish | | | |
| External Interface | Serial Communication | RS-232C x 1 | | | |
| | Ethernet Communication | Protocol: Non-procedure (TCP/UDP) Physical layer: 1000BASE-T x 1 | | | |
| | EtherNet/IP Communication | Yes (Target/Ethernet port) (Refer to <i>Component Names and Functions</i> on page 3-16 and use a port that supports Ethernet/IP communication.) | | | |
| | PROFINET Communication | Yes (Slave/Ethernet port) Conformance class A | | | |
| | EtherCAT Communication | None | | | |
| | Parallel I/O | High-speed input: 1 Normal speed: 9 High-speed output: 4 Normal speed: 23 | | | |
| | Encoder Interface | None | | | |
| | Monitor Interface | DVI-I output (Analog RGB & DVI-D single link) x 1 <ul style="list-style-type: none"> DVI connection (Recognize the recommended resolution automatically) RGB connection (Resolution XGA 1024×768 dot) | | | |
| | USB I/F | USB2.0 host x 1 (BUS Power: Port 5 V/0.5 A) USB3.0 host x 1 (BUS Power: Port 5 V/0.5 A) | | | |
| | SD Card I/F | SDHC x 1 | | | |
| Indicator Lamps | Main | POWER: Green ERROR: Red RUN: Green ACCESS: Yellow | | | |
| | Ethernet | NET RUN: Green LINK/ACT: Yellow | | | |
| | SD Card | SD POWER: Green SD BUSY: Yellow | | | |
| | EtherCAT | None | | | |
| Supply Voltage | | 20.4 VDC to 26.4 VDC | | | |

| Series | | FH-L Series | | | |
|---------------------|---|----------------------|--|---------------|------------|
| Model | | FH-L550 | FH-L551 | FH-L550-10 | FH-L551-10 |
| Current consumption | <ul style="list-style-type: none"> When connecting the following cameras <ul style="list-style-type: none"> - Intelligent compact digital CMOS camera - Shortwave Infrared (SWIR) Camera When connecting the following lighting or lighting controllers without an external power supply <ul style="list-style-type: none"> - FLV-TCC1 - FLV-TCC4 - FLV-TCC3HB - FLV-TCC1EP - FL-TCC1 When connecting the following lighting or lighting controllers <ul style="list-style-type: none"> - FL-TCC1PS - FL-MD□MC | 2.7A max. | | 4.4A max. | |
| | Other than above | 1.5A max. | | 2.0A max. | |
| Built-in FAN | | None | | | |
| Usage Environment | Ambient temperature range | | Operating: 0°C to +55°C Storage: -25 to +70°C (with no icing or condensation) | | |
| | Ambient humidity range | | Operating and Storage: 10 to 90% (with no condensation) | | |
| | Ambient atmosphere | | No corrosive gases | | |
| | Vibration tolerance | | 5 to 8.4 Hz with 3.5 mm amplitude, 8.4 to 150 Hz, acceleration of 9.8 m/s ² 100 min each in X, Y, and Z directions (10 sweeps of 10 min each = 100 min total) | | |
| | Shock resistance | | Impact force: 150 m/s ² Test direction: up and down/front and behind/left and right | | |
| | Noise immunity | Fast Transient Burst | <ul style="list-style-type: none"> DC power: <ul style="list-style-type: none"> Direct infusion: 2 kV, Pulse rising: 5 ns, Pulse width: 50 ns, Burst continuation time: 15 ms/0.75 ms, Period: 300 ms, Application time: 1 min. I/O line: <ul style="list-style-type: none"> Direct infusion: 1 kV, Pulse rising: 5 ns, Pulse width: 50 ns, Burst continuation time: 15 ms/0.75 ms, Period: 300 ms, Application time: 1 min. | | |
| | Grounding | | Class D grounding (100 Ω or less grounding resistance) ^{*3} | | |
| External Features | Dimensions | | 200 mm x 80 mm x 130 mm | | |
| | Weight | | Approx. 1.5kg | Approx. 1.5kg | |
| | Degree of protection | | IEC60529 IP20 | | |
| | Case material | | PC | | |

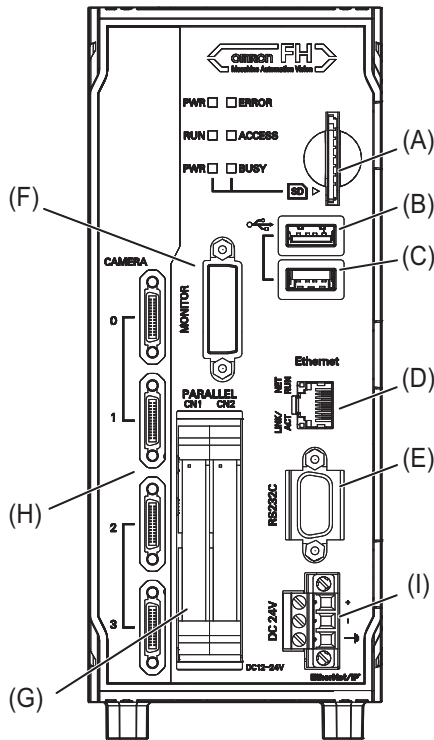
*1. Be sure to use the 0.3 megapixels camera or the 0.4 megapixels camera.

*2. Some cameras cannot be used with FH sensor controllers with older software versions.

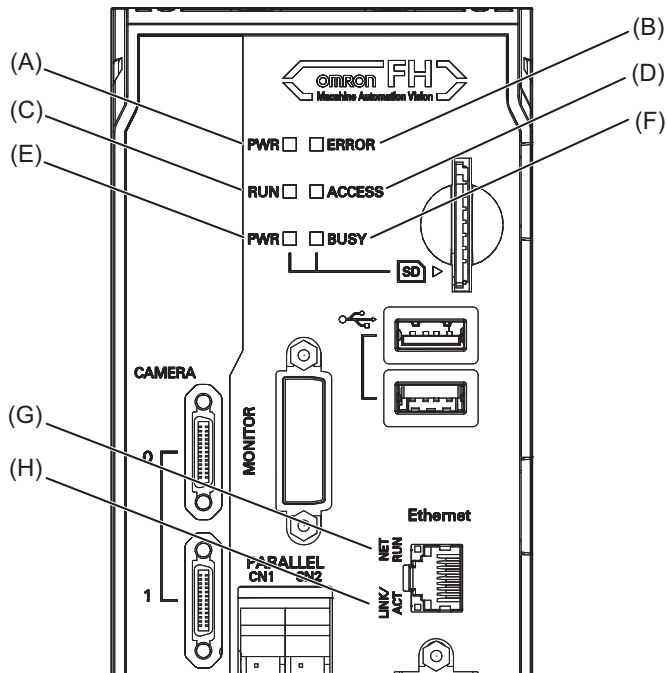
Refer to 3-8 Available List of FH Software Versions on page 3-100.

- *3. Existing the third class grounding

Component Names and Functions

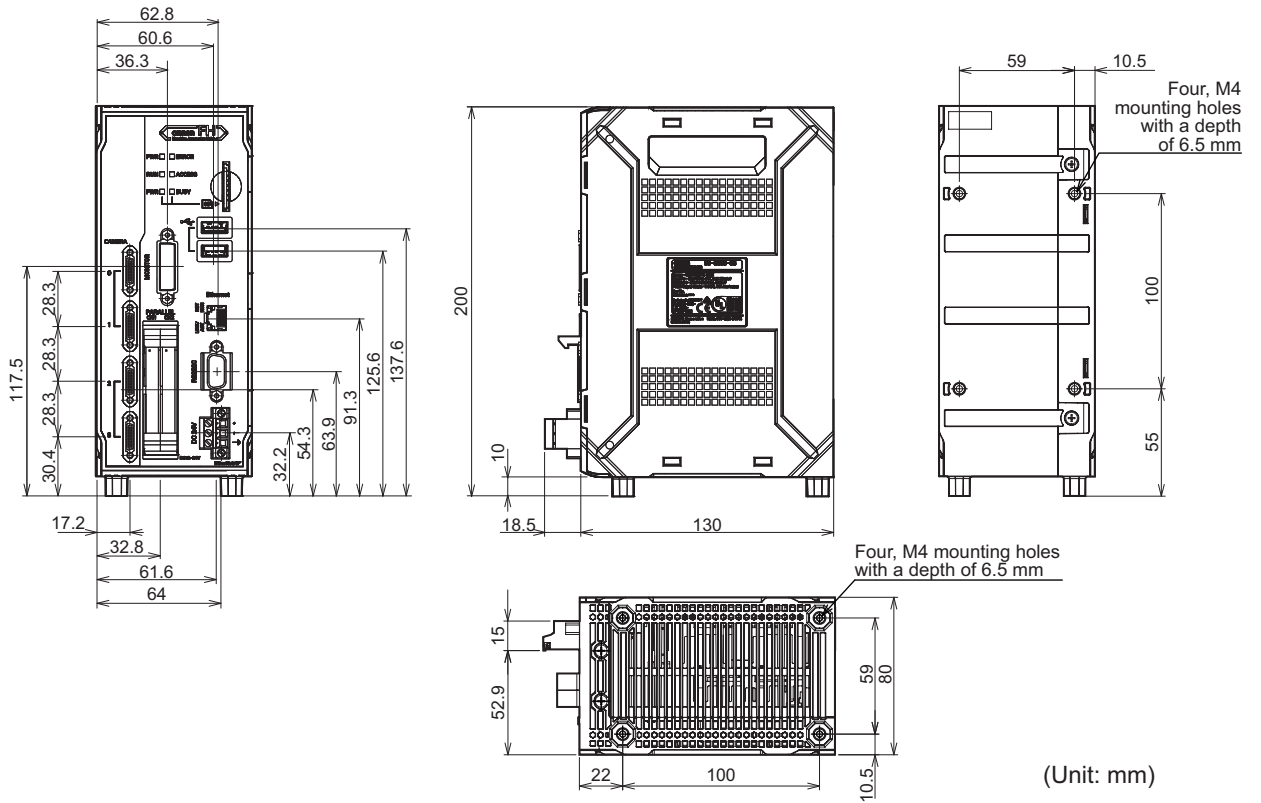


| | Connector name | Description |
|-----|--|---|
| (A) | SD memory card installation connector | Install the SD memory card. Do not plug or unplug the SD memory card during measurement operation. Otherwise measurement time may be affected or data may be destroyed. |
| (B) | USB2.0 connector | Connects to USB 2.0. Do not plug or unplug it during measurement. Otherwise measurement time may be affected or data may be destroyed. |
| (C) | USB3.0 connector | Connects to USB 3.0. Do not plug or unplug it during measurement. Otherwise measurement time may be affected or data may be destroyed. USB 3.0 has a high ability to supply the bus power. Use the sensor controller by combining USB 3.0, faster transport can be realized. |
| (D) | Ethernet connector | Connect an Ethernet device. Ethernet port, EtherNet/IP port, and PROFINET port are sharing use. |
| (E) | RS-232C connector | Connect an external device such as a PLC. |
| (F) | Monitor connector | Connect a monitor. |
| (G) | I/O (Parallel) connector (control lines, data lines) | Connect the controller to external devices such as a sync sensor and PLC. |
| (H) | Camera connector | Connect cameras. |
| (I) | Power supply terminal connector | Connect a DC power supply. Wire the FH sensor controller independently on other devices. Wire the ground line. Be sure to ground the FH sensor controller alone. Use an attachment power terminal (male) for installation. For details, refer to 5-3 <i>Sensor Controller Installation</i> on page 5-5. |



| | LED name | Description |
|-----|-----------------------|---|
| (A) | PWR LED | Lights up while power is ON. |
| (B) | ERROR LED | Lights up when an error has occurred. |
| (C) | RUN LED | Lights up while the layout turned on output setting is displayed. |
| (D) | ACCESS LED | Blinks while the internal nonvolatile memory is accessed. |
| (E) | SD PWR LED | Lights up while power is supplied to the SD memory card and the card is usable. |
| (F) | SD BUSY LED | Blinks while the SD memory card is accessed. |
| (G) | Ethernet NET RUN LED | Lights up while Ethernet communications are usable. |
| (H) | Ethernet LINK/ACT LED | Lights up when connected with an Ethernet device, and blinks while performing communications. |

Dimensions



Additional Information

We have the 2D CAD data or 3D CAD data.
 You can download CAD data from www.fa.omron.co.jp.

3-2 Camera

3-2-1 High-speed digital CMOS Camera (FH-S camera series)



Precautions for Safe Use

About connection of sensor controller and FH-SC12/FH-SM12 (12 megapixels camera).

- When you connect the sensor controller to the FH-SC12/FH-SM12, do not ground the positive terminal of 24 VDC power source. The internal circuit is possible to be given damage, it can be cause the failure.



Precautions for Correct Use

Some cameras cannot be used with FH sensor controllers with older software versions. Refer to 3-8 Available List of FH Software Versions on page 3-100.

Specification

| Model | FH-SM | FH-SC | FH-SM02 | FH-SC02 |
|--|--|----------------|--|-----------------|
| Image elements | CMOS image elements (1/3-inch equivalent) | | CMOS image elements (2/3-inch equivalent) ^{*1} | |
| Color/Monochrome | Monochrome | Color | Monochrome | Color |
| Effective pixels | 640 (H) x 480 (V) | | 2040 (H) x 1088 (V) | |
| Pixel size | 7.4 (μm) x 7.4 (μm) | | 5.5 (μm) x 5.5 (μm) | |
| Shutter function | Electronic shutter: Shutter speeds can be set from 20 μs to 100 ms. | | Electronic shutter: Shutter speeds can be set from 25 μs to 100 ms. | |
| Partial function | 1 to 480 lines | 2 to 480 lines | 1 to 1088 lines | 2 to 2088 lines |
| Frame rate (Image Acquisition Time ^{*2}) | 308 fps (3.3 ms) | | 219 fps (4.6 ms) ^{*3} | |
| Lens mounting | C mount | | | |
| Field of vision, installation distance | Selecting a lens according to the field of vision and installation distance | | | |
| Ambient temperature range | Operating: 0 to +40°C, Storage: -25 to +65°C (with no icing or condensation) | | | |
| Ambient humidity range | Operating and Storage: 35 to 85% (with no condensation) | | | |
| Weight | Approx. 105g | | Approx. 110g | |
| Accessories | • Instruction Sheet | | | |

*1. The element size is equivalent to 2/3 inch, however the recommended lens is a 1 inch compatible lens. Vignetting may occur with the 2/3 inch lens.

*2. This image acquisition time does not include the image conversion processing time of the sensor controller.

*3. Frame rate in high speed mode when the camera is connected using two camera cables.

| Model | FH-SM04 | FH-SC04 | FH-SM12 | FH-SC12 |
|--|--|-----------------|--|---------|
| Image elements | CMOS image elements (1-inch equivalent) | | CMOS image elements (1.76-inch equivalent) | |
| Color/Monochrome | Monochrome | Color | Monochrome | Color |
| Effective pixels | 2040 (H) x 2048 (V) | | 4084 (H) x 3072 (V) | |
| Pixel size | 5.5 (μm) x 5.5 (μm) | | 5.5 (μm) x 5.5 (μm) | |
| Shutter function | Electronic shutter: Shutter speeds can be set from 25 μs to 100 ms. | | Electronic shutter: Shutter speeds can be set from 60 μs to 100 ms. | |
| Partial function | 1 to 2048 lines | 2 to 2048 lines | 4 to 3072 lines (4-line increments) | |
| Frame rate (Image Acquisition Time *1) | 118 fps (8.5 ms) *2 | | 38.9 fps (25.7 ms) *2 | |
| Lens mounting | C mount | | M42 mount | |
| Field of vision, installation distance | Selecting a lens according to the field of vision and installation distance | | | |
| Ambient temperature range | Operating: 0 to +40°C, Storage: -25 to +65°C (with no icing or condensation) | | | |
| Ambient humidity range | Operating and Storage: 35 to 85% (with no condensation) | | | |
| Weight | Approx. 110g | | Approx. 320g | |
| Accessories | • Instruction Sheet | | | |

*1. This image acquisition time does not include the image conversion processing time of the sensor controller.

*2. Frame rate in high speed mode when the camera is connected using two camera cables.

| Model | FH-SMX | FH-SCX | FH-SMX01 | FH-SCX01 | FH-SMX03 | FH-SCX03 |
|--|--|--------|--|----------|--|----------|
| Image elements | CMOS image elements (1/2.9-inch equivalent) | | CMOS image elements (1/2.9-inch equivalent) | | CMOS image elements (1/1.8-inch equivalent) | |
| Color/Monochrome | Mono-chrome | Color | Mono-chrome | Color | Mono-chrome | Color |
| Effective pixels | 720 (H) x 540 (V) | | 1440 (H) x 1080 (V) | | 2046 (H) x 1536 (V) | |
| Pixel size | 6.9 (μm) x 6.9 (μm) | | 3.45 (μm) x 3.45 (μm) | | 3.45 (μm) x 3.45 (μm) | |
| Shutter function | Electronic shutter: Shutter speeds can be set from 1 μs to 100 ms. | | Electronic shutter: Shutter speeds can be set from 1 μs to 100 ms. | | | |
| Partial function | 4 to 540 lines (4-line increments) | | 4 to 1,080 lines (4-line increments) | | 4 to 1,536 lines (4-line increments) | |
| Frame rate (Image Acquisition Time *1) | 523.6 fps (1.9 ms) *2 | | 154.6 fps (6.5 ms) *2 | | 151.4 fps (6.6 ms) *3 | |
| Lens mounting | C mount (Recommend 3Z4S-LE SV-V series) | | C mount (Recommend 3Z4S-LE SV-H series) | | | |
| Field of vision, installation distance | Selecting a lens according to the field of vision and installation distance | | | | | |
| Ambient temperature range | Operating: 0 to +50°C, Storage: -25 to +65°C (with no icing or condensation) | | Operating: 0 to +45°C, Storage: -20 to +65°C (with no icing or condensation) | | Operating: 0 to +40°C, Storage: -20 to +65°C (with no icing or condensation) | |
| Ambient humidity range | Operating and Storage: 35 to 85% (with no condensation) | | | | | |
| Weight | Approx. 48g | | Approx. 48g | | Approx. 85g | |

| Model | FH-SMX | FH-SCX | FH-SMX01 | FH-SCX01 | FH-SMX03 | FH-SCX03 |
|-------------|---|--------|----------|----------|----------|----------|
| Accessories | <ul style="list-style-type: none"> • Instruction Sheet • General Compliance Information and Instructions for EU | | | | | |

*1. This image acquisition time does not include the image conversion processing time of the sensor controller.

*2. Frame rate in high speed mode.

*3. Frame rate in high speed mode when the camera is connected using two camera cables.

| Model | FH-SMX05 | FH-SCX05 | FH-SMX12 | FH-SCX12 |
|--|---|----------|---|----------|
| Image elements | CMOS image elements (2/3-inch equivalent) | | CMOS image elements (1.1-inch equivalent) | |
| Color/Monochrome | Monochrome | Color | Monochrome | Color |
| Effective pixels | 2448 (H) x 2048 (V) | | 4092 (H) x 3000 (V) | |
| Pixel size | 3.45 (μm) x 3.45 (μm) | | 3.45 (μm) x 3.45 (μm) | |
| Shutter function | Electronic shutter: Shutter speeds can be set from 1 μs to 100 ms. | | Electronic shutter: Shutter speeds can be set from 1.5 μs to 100 ms. | |
| Partial function | 4 to 2048 lines (4-line increments) | | 4 to 3,000 lines (4-line increments) | |
| Frame rate (Image Acquisition Time *1) | 97.2 fps (10.3 ms) *3 | | 40.1 fps (24.9 ms) *3 | |
| Lens mounting | C mount (Recommend 3Z4S-LE SV-H series) | | C mount (Recommend 3Z4S-LE SV-LLD series) | |
| Field of vision, installation distance | Selecting a lens according to the field of vision and installation distance | | | |
| Ambient temperature range | Operating: 0 to +40°C, Storage: -25 to +65°C (with no icing or condensation) | | | |
| Ambient humidity range | Operating and Storage: 35 to 85% (with no condensation) | | | |
| Weight | Approx. 85g | | Approx. 85g | |
| Accessories | <ul style="list-style-type: none"> • Instruction Sheet • General Compliance Information and Instructions for EU | | | |

*1. This image acquisition time does not include the image conversion processing time of the sensor controller.

*2. Frame rate in high speed mode.

*3. Frame rate in high speed mode when the camera is connected using two camera cables.



Additional Information

The imaging area of a camera can be calculated by multiplying the effective pixels by the pixel size.

Image-Acquisition Time*1

| Model | FH-SM02/F H-SC02 | FH-SM04/F H-SC04 | FH-SM12/F H-SC12 | FH-SMX/F H-SCX | FH-SMX01/ FH-SCX01 | FH-SMX03/ FH-SCX03 | FH-SMX05/ FH-SCX05 | FH-SMX12/ FH-SCX12 | FH-SM21R/ FH-SC21R |
|-------|---------------------|---------------------|---------------------|-------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|-------|---------------------|---------------------|---------------------|-------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|

2 Cables*2

| | | | | | | | | | |
|-------------------|--------|---------|---------|---|---|---------|---------|---------|---------|
| High Speed Mode*3 | 4.6 ms | 8.5 ms | 25.7 ms | - | - | 6.6 ms | 10.3 ms | 24.9 ms | 42.6 ms |
| Standard Mode | 9.7 ms | 17.9 ms | 51.3 ms | - | - | 14.1 ms | 22.1 ms | 53.5 ms | 90.1 ms |

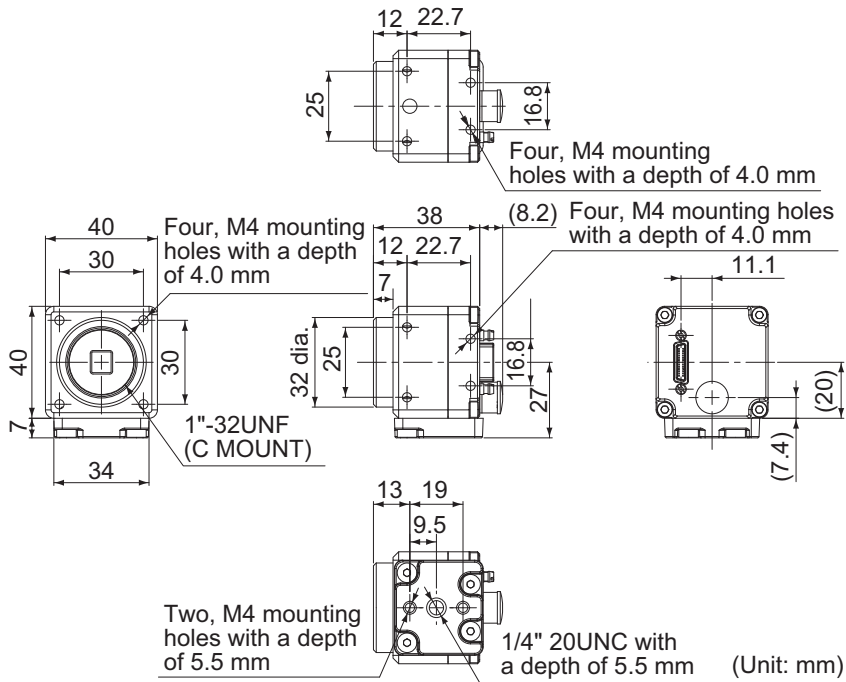
1 Cable

| Model | FH-SM02/F H-SC02 | FH-SM04/F H-SC04 | FH-SM12/F H-SC12 | FH-SMX/F H-SCX | FH-SMX01/FH-SCX01 | FH-SMX03/FH-SCX03 | FH-SMX05/FH-SCX05 | FH-SMX12/FH-SCX12 | FH-SM21R/FH-SC21R |
|-------------------|------------------|------------------|------------------|----------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| High Speed Mode*3 | 9.2 ms | 17.0 ms | 51.3 ms | 1.9 ms | 6.5 ms | 13.2 ms | 20.6 ms | 50.0 ms | 83.3 ms |
| Standard Mode | 19.3 ms | 35.8 ms | 102.0 ms | 3.8 ms | 14.7 ms | 28.2 ms | 44.1 ms | 106.4 ms | 175.4 ms |

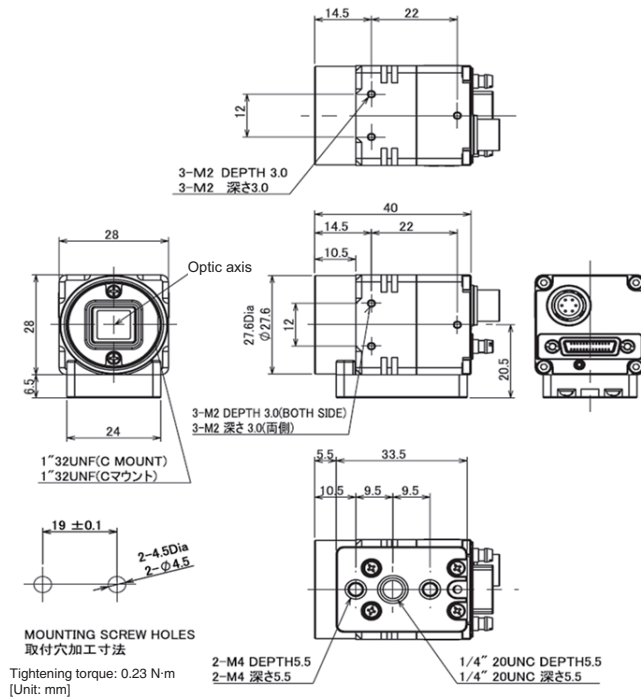
- *1. This image acquisition time does not include the image conversion processing time of the sensor controller.
- *2. Two Camera ports of the controller are used per one camera.
- *3. Up to 5 m Camera Cable length.

Dimensions

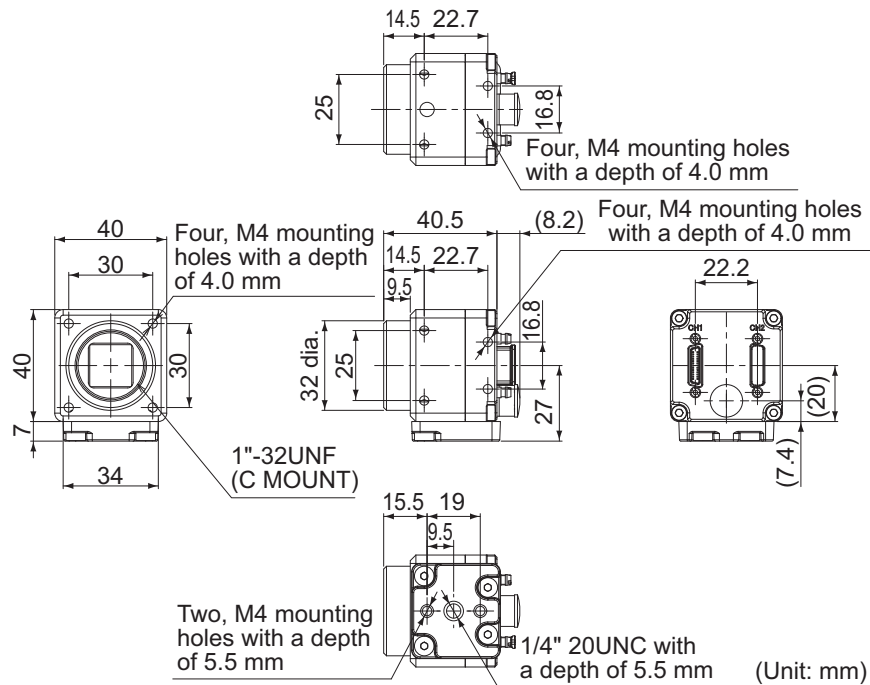
● 0.3 Megapixels Camera: FH-SC/FH-SM



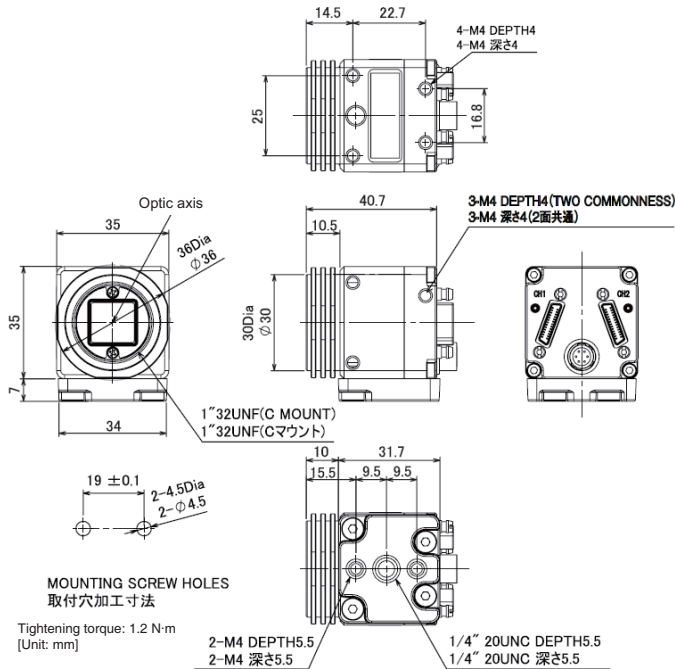
● 0.4 Megapixels Camera: FH-SCX/FH-SMX and 1.6 Megapixels Camera: FH-SCX01/FH-SMX01



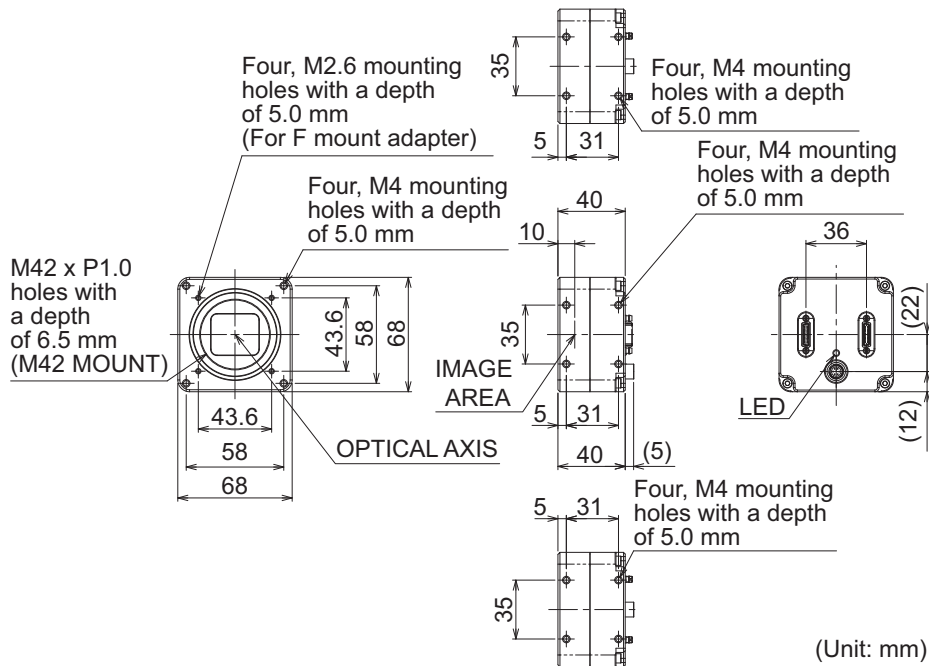
● 2 Megapixels Camera: FH-SC02/FH-SM02 and 4 Megapixels Camera: FH-SC04/FH-SM04



● **3.2 Megapixels Camera: FH-SCX03/FH-SMX03, 5 Megapixels Camera: FH-SCX05/FH-SMX05 and 12 Megapixels Camera: FH-SCX12/FH-SMX12**



● **12 Megapixels Camera: FH-SC12/FH-SM12**



Additional Information

We have the 2D CAD data or 3D CAD data.
You can download CAD data from www.fa.omron.co.jp.

3-2-2 Digital CMOS Camera (FH-S camera series)



Precautions for Correct Use

Some cameras cannot be used with FH sensor controllers with older software versions. Refer to 3-8 Available List of FH Software Versions on page 3-100.

Specification

| Model | FH-SM05R | FH-SC05R | FH-SM21R | FH-SC21R | FZ-S5M3 | FZ-SC5M3 |
|--|---|----------|---|----------|--|----------|
| Image elements | CMOS image elements (1/2.5-inch equivalent) | | CMOS image elements (1-inch equivalent) | | CMOS image elements (2/3-inch equivalent) | |
| Color/Monochrome | Mono-chrome | Color | Mono-chrome | Color | Mono-chrome | Color |
| Effective pixels | 2592 (H) x 1944 (V) | | 5544 (H) x 3692 (V) | | 2448 (H) x 2048 (V) | |
| Pixel size | 2.2 (μm) x 2.2 (μm) | | 2.4 (μm) x 2.4 (μm) | | 3.45 (μm) x 3.45 (μm) | |
| Scan Type | Progressive | | | | | |
| Shutter Method | Rolling shutter | | | | Global shutter | |
| Shutter function | Electronic shutter: Electronic shutter; Shutter speeds can be set from 500 μs to 100 ms in multiples of 50 μs. | | Electronic shutter: Shutter speeds can be set from 50 μs to 100 ms. *1 | | Electronic shutter: Shutter speeds can be set from 20 μs to 100 ms. | |
| Partial function | 4 to 1944 lines (2-line increments) | | 1848 to 3692 lines | | 4 to 2048 lines | |
| Frame rate (Image Acquisition Time*2) | 14 fps (71.7 ms) | | 23.5 fps (42.6 ms) | | 25.6 fps (38.2 ms) | |
| Lens mounting | C mount | | C mount(Recommend 3Z4S-LE SV-LLD series) | | C mount (Recommend 3Z4S-LE SV-H series) | |
| Field of vision, installation distance | Selecting a lens according to the field of vision and installation distance | | | | | |
| Ambient temperature range | Operating: 0 to +40°C, Storage: -30 to +65°C (with no icing or condensation) | | Operating: 0 to +40°C, Storage: -20 to +65°C (with no icing or condensation) | | Operating: 0 to +40°C, Storage: -25 to +65°C (with no icing or condensation) | |
| Ambient humidity range | Operating and Storage: 35 to 85% (with no condensation) | | | | | |
| Weight | Approx. 52g | | Approx. 85g (w/base) | | Approx. 85g (w/base) | |
| Accessories | • Instruction Sheet | | • Instruction Sheet • General Compliance Information and Instructions for EU | | | |

*1. When using FH-S□21R in the reset mode and rolling shutter, the actual shutter speed is rounded to the following values for the screen set values and reflected to the real operation.

Note that the reflecting method depends on the number of cables and communication speed setting.

Camera cable: 1, Communication speed: Standard: A multiple of 46.9 μs

Camera cable: 1, Communication speed: High-speed: A multiple of 22.3 μs

Camera cable: 2, Communication speed: Standard: A multiple of 23.5 μs

Camera cable: 2, Communication speed: High-speed: A multiple of 11.2 μs

For example, the actual shutter speed is below when the shutter speed is set to 2,000 μs.

Camera cable: 1, Communication speed: Standard: 1,969.8 μs (42 times of 46.9 μs)

Camera cable: 1, Communication speed: High-speed: 1,984.7 μs (89 times of 22.3 μs)

Camera cable: 2, Communication speed: Standard: 1,997.5 μs (85 times of 23.5 μs)

Camera cable: 2, Communication speed: High-speed: 1,993.6 μs (178 times of 11.2 μs)

*2. This image acquisition time does not include the image conversion processing time of the sensor controller.

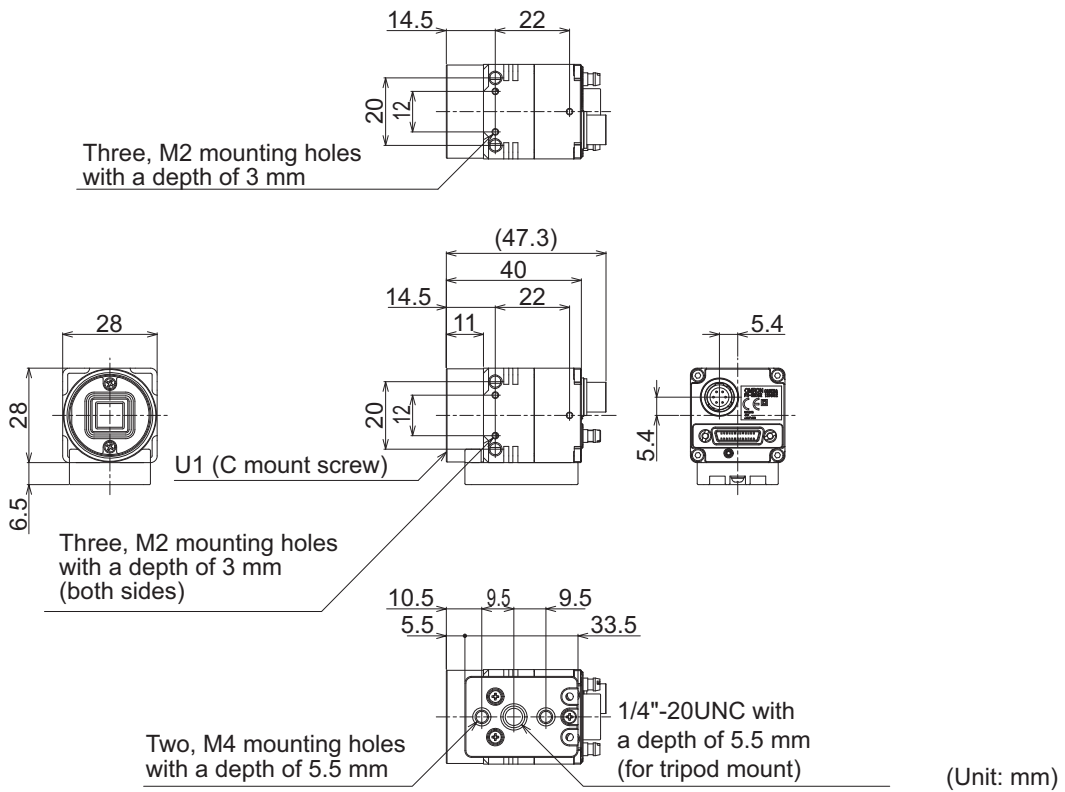


Additional Information

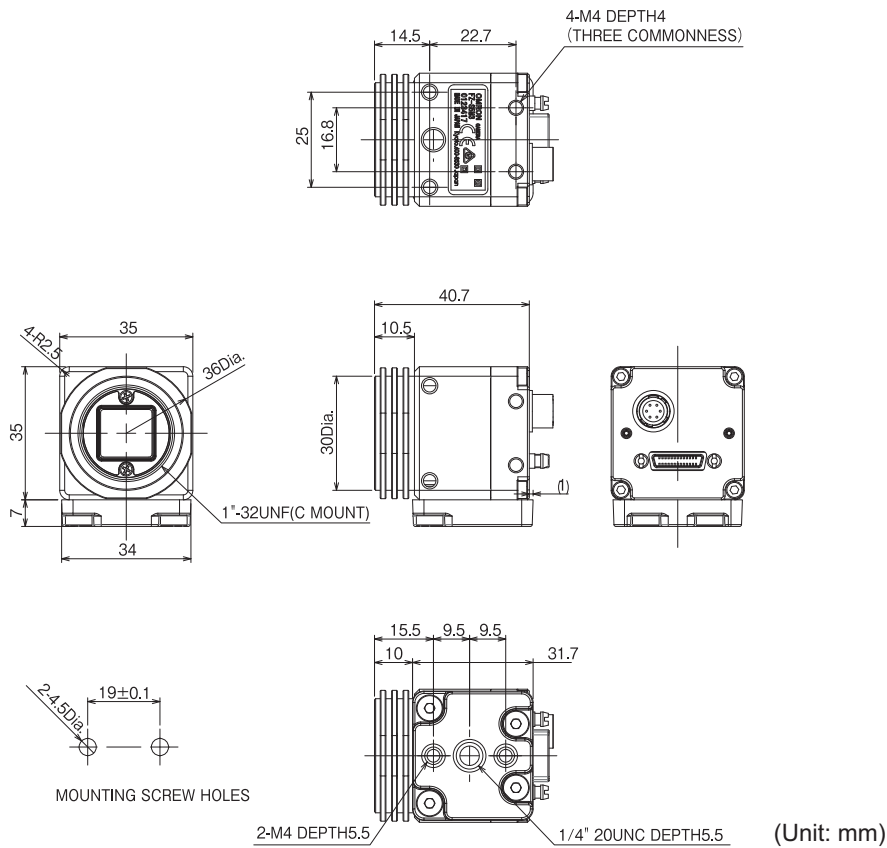
The imaging area of a camera can be calculated by multiplying the effective pixels by the pixel size.

Dimensions

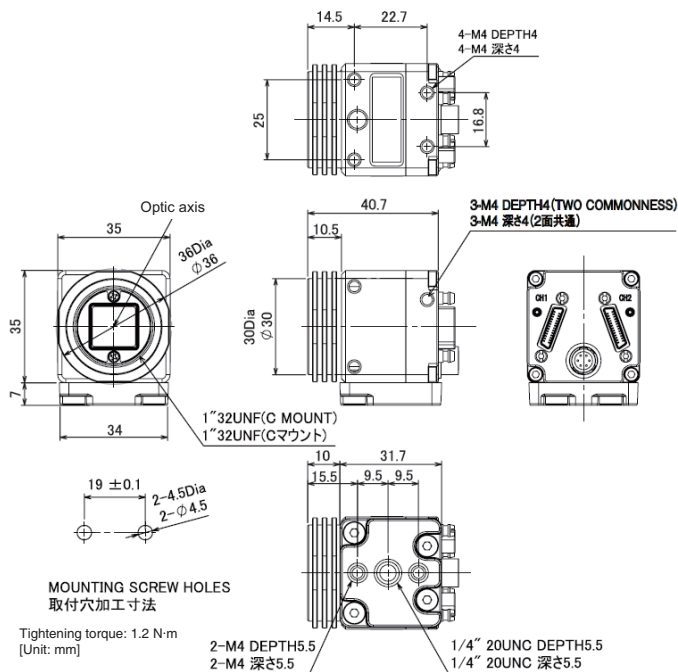
● **5 Megapixels Camera: FH-SM05R/FH-SC05R**



● 5 Megapixels Camera: FZ-S5M3/FZ-SC5M3



● 20.4 Megapixels Camera: FH-SM21R/FH-SC21R



(Unit: mm)



Additional Information

We have the 2D CAD data or 3D CAD data.
You can download CAD data from www.fa.omron.co.jp.

3-2-3 Shortwave Infrared (SWIR) Camera (FH-S camera series)



Precautions for Correct Use

Some cameras cannot be used with FH sensor controllers with older software versions. Refer to *3-8 Available List of FH Software Versions* on page 3-100.

Specification

| Model | FH-SMX-SWIR | FH-SMX01-SWIR |
|--|---|--|
| Image elements | CMOS image elements (1/4-inch equivalent) *1 | CMOS image elements (1/2-inch equivalent) *1 |
| Color/Monochrome | Monochrome | |
| Effective pixels | 640 (H) x 512 (V) | 1280 (H) x 1024 (V) |
| Pixel size | 5.0 (μm) x 5.0 (μm) | |
| Shutter function | Electronic shutter: Shutter speeds can be set from 8 μs to 100 ms. | |
| Partial function | 8 to 512 lines (8-line increments) | 8 to 1024 lines (8-line increments) |
| Frame rate (Image Acquisition Time *2) | 240 fps (4.2 ms) | 120 fps (8.3 ms) |
| Lens mounting | C mount | |
| Field of vision, installation distance | Selecting a lens according to the field of vision and installation distance | |
| Ambient temperature range | Operating: 0 to +40°C*3, Storage: -20 to +65°C (with no icing or condensation) | |
| Ambient humidity range | Operating and Storage: 35 to 85% (with no condensation) | |
| Weight | Approx. 505g (w/base) | |
| Accessories | <ul style="list-style-type: none"> • Instruction Sheet • General Compliance Information and Instructions for EU | |

*1. If the interval between capturing images is more than 1 minute, the camera brightness value may decrease by more than 1 %.

*2. This image acquisition time does not include the image conversion processing time of the sensor controller.

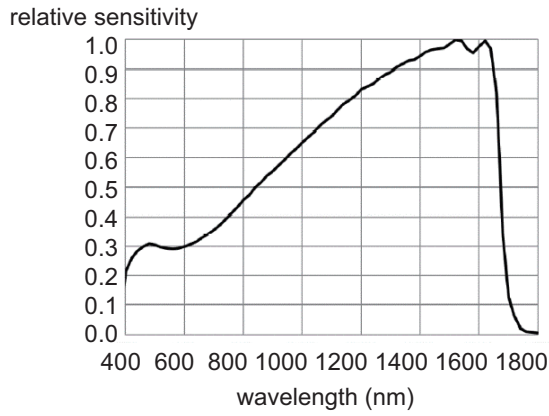
*3. This camera controls the temperature of the image elements at 15°C to improve image quality. If the temperature of the image elements (value of the camera's built-in temperature sensor) rises above 15°C, white spots and noise will increase.

We recommend that the ambient temperature during operation be below +34°C, or the upper part of the case temperature below +46°C.

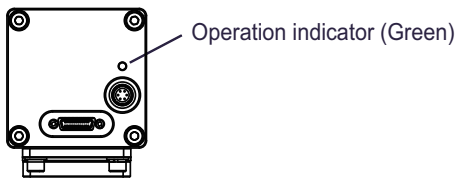


Additional Information

- The imaging area of a camera can be calculated by multiplying the effective pixels by the pixel size.
- Spectral sensitivity characteristics: wavelength range 400 to 1700 nm



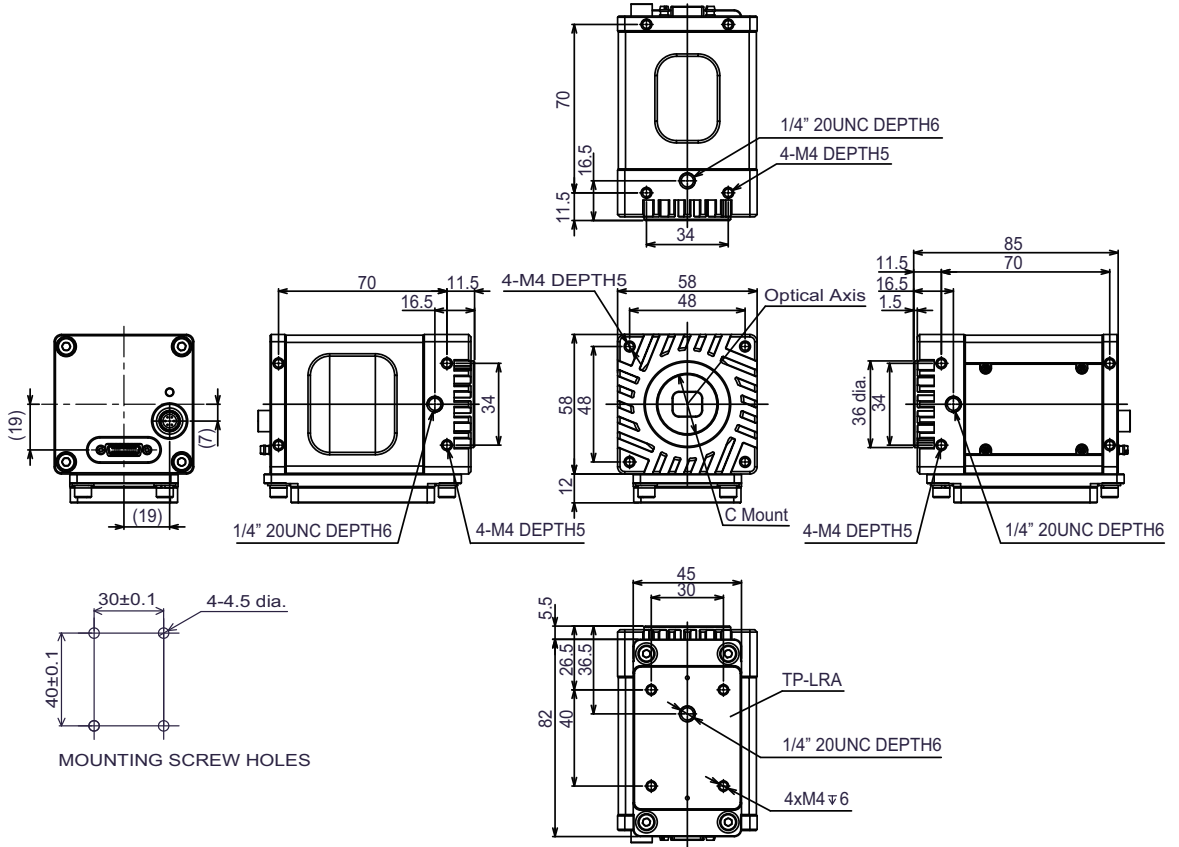
- State and indicator lamp



| State | indicator lamp |
|--|----------------|
| Power OFF | OFF |
| The camera's built-in temperature sensor value is 15°C | Solid ON |
| The camera's built-in temperature sensor value is not 15°C | Flashing |

Dimensions

- 0.33 Megapixels SWIR Camera: FH-SMX-SWIR, 1.31 Megapixels SWIR Camera: FH-SMX01-SWIR



(Unit: mm)



Additional Information

We have the 2D CAD data or 3D CAD data.
You can download CAD data from www.fa.omron.co.jp.

3-2-4 Digital CCD Camera: FZ-S Camera Series

Specification

| Model | FZ-S | FZ-SC | FZ-S2M | FZ-SC2M |
|--|---|-------|---|---------|
| Image elements | Interline transfer reading all pixels, CCD image elements (1/3-inch equivalent) | | Interline transfer reading all pixels, CCD image elements (1/1.8-inch equivalent) | |
| Color/Monochrome | Monochrome | Color | Monochrome | Color |
| Effective pixels | 640 (H) x 480 (V) | | 1600 (H) x 1200 (V) | |
| Pixel size | 7.4 (μm) x 7.4 (μm) | | 4.4 (μm) x 4.4 (μm) | |
| Shutter function | Electronic shutter: Shutter speeds can be set from 20 μs to 100 ms. | | | |
| Partial function | 12 to 480 lines | | 12 to 1200 lines | |
| Frame rate (Image Acquisition Time ^{*1}) | 80 fps (12.5 ms) | | 30 fps (33.3 ms) | |
| Lens mounting | C mount | | | |
| Field of vision, installation distance | Selecting a lens according to the field of vision and installation distance | | | |
| Ambient temperature range | Operating: 0 to +50°C, Storage: -25 to +65°C (with no icing or condensation) | | Operating: 0 to +40°C, Storage: -25 to +65°C (with no icing or condensation) | |
| Ambient humidity range | Operating and Storage: 35 to 85% (with no condensation) | | | |
| Weight | Approx. 55g | | Approx. 76g | |
| Accessories | • Instruction Sheet | | | |

*1. This image acquisition time does not include the image conversion processing time of the sensor controller.

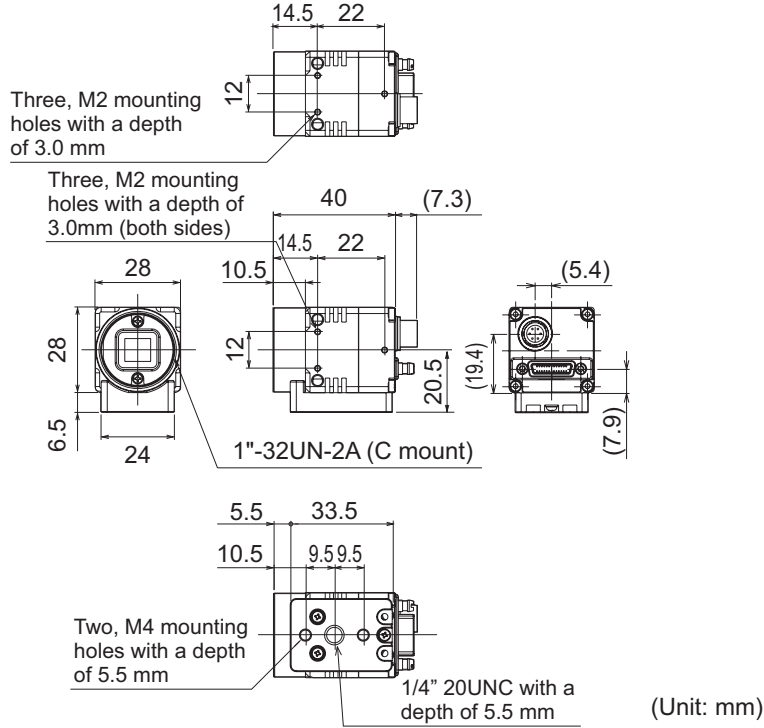


Additional Information

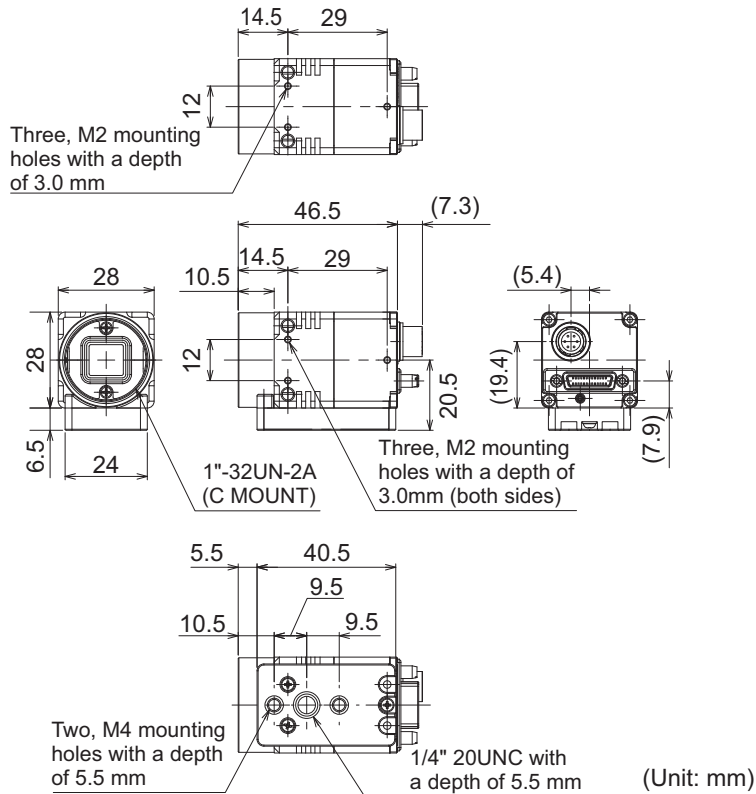
The imaging area of a camera can be calculated by multiplying the effective pixels by the pixel size.

Dimensions

● 0.3 Megapixels Camera: FZ-S/FZ-SC



● 2 Megapixels Camera: FZ-S2M/FZ-SC2M



3-2-5 High-speed Digital CCD Camera: FZ-SH Camera Series

Specification

| Model | FZ-SH | FZ-SHC |
|--|---|--------|
| Image elements | Interline transfer reading all pixels, CCD image elements (1/3-inch equivalent) | |
| Color/Monochrome | Monochrome | Color |
| Effective pixels | 640 (H) x 480 (V) | |
| Pixel size | 7.4 (μm) x 7.4 (μm) | |
| Shutter function | Electronic shutter: Electronic shutter: select shutter speeds from 1/10 to 1/50,000 s. | |
| Partial function | 12 to 480 lines | |
| Frame rate (Image Acquisition Time *1) | 204 fps (4.9 ms) | |
| Field of vision, installation distance | Selecting a lens according to the field of vision and installation distance | |
| Ambient temperature range | Operating: 0 to +40°C, Storage: -25 to +65°C (with no icing or condensation) | |
| Ambient humidity range | Operating and Storage: 35 to 85% (with no condensation) | |
| Weight | Approx. 105g | |
| Accessories | <ul style="list-style-type: none"> • Instruction Sheet • General Compliance Information and Instructions for EU | |

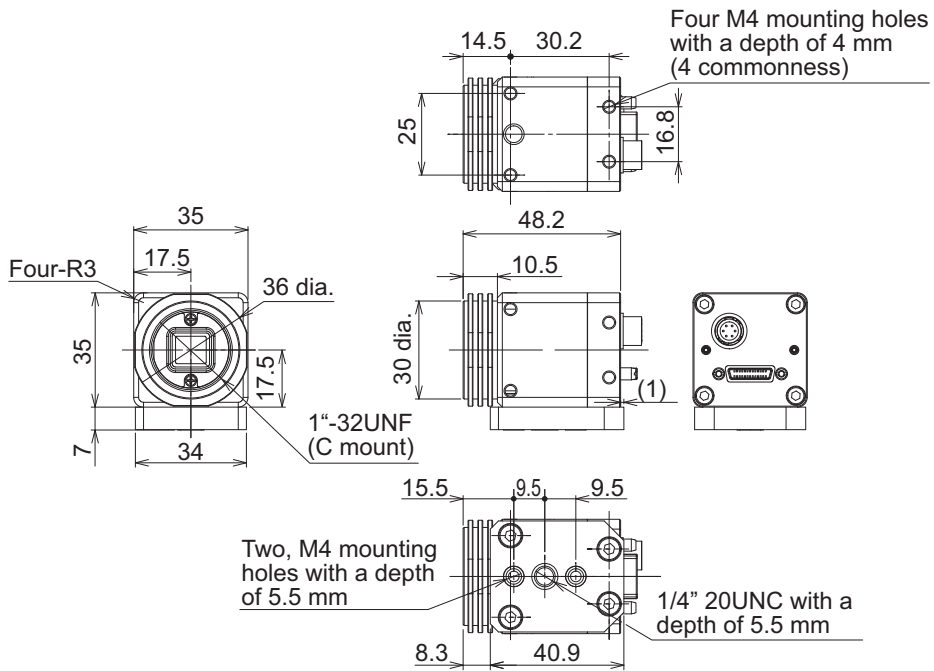
*1. This image acquisition time does not include the image conversion processing time of the sensor controller.



Additional Information

The imaging area of a camera can be calculated by multiplying the effective pixels by the pixel size.

Dimensions



Additional Information

We have the 2D CAD data or 3D CAD data.
You can download CAD data from www.fa.omron.co.jp.

3-2-6 Small Digital CCD Cameras: FZ-S Camera Series

Specification

| Model | FZ-SF | FZ-SFC | FZ-SP | FZ-SPC |
|---|--|--------|---|--------|
| Image elements | Interline transfer reading all pixels, CCD image elements (1/3-inch equivalent) | | | |
| Color/Monochrome | Monochrome | Color | Monochrome | Color |
| Effective pixels | 640 (H) x 480 (V) | | | |
| Pixel size | 7.4 (μm) x 7.4 (μm) | | | |
| Shutter function | Electronic shutter: Shutter speeds can be set from 20 μs to 100 ms. | | | |
| Partial function | 12 to 480 lines | | | |
| Frame rate (Image Acquisition Time ^{*1}) | 80 fps (12.5 ms) | | | |
| Lens mounting | Special mount (M10.5 P0.5) | | | |
| Field of vision, installation distance | Selecting a lens according to the field of vision and installation distance | | | |
| Ambient temperature range | Operating of camera amp: 0 to +50°C, Operating of camera head: 0 to +45°C Storage: -25 to +65°C (with no icing or condensation) | | | |
| Ambient humidity range | Operating and Storage: 35 to 85% (with no condensation) | | | |
| Minimum bending radius between camera head and camera amplifier | 12.7 mm | | | |
| Weight | Approx. 150g | | | |
| Accessories | <ul style="list-style-type: none"> • Instruction Sheet • installation bracket • Four mounting screws (M2 x 4) | | <ul style="list-style-type: none"> • Instruction Sheet | |

*1. This image acquisition time does not include the image conversion processing time of the sensor controller.

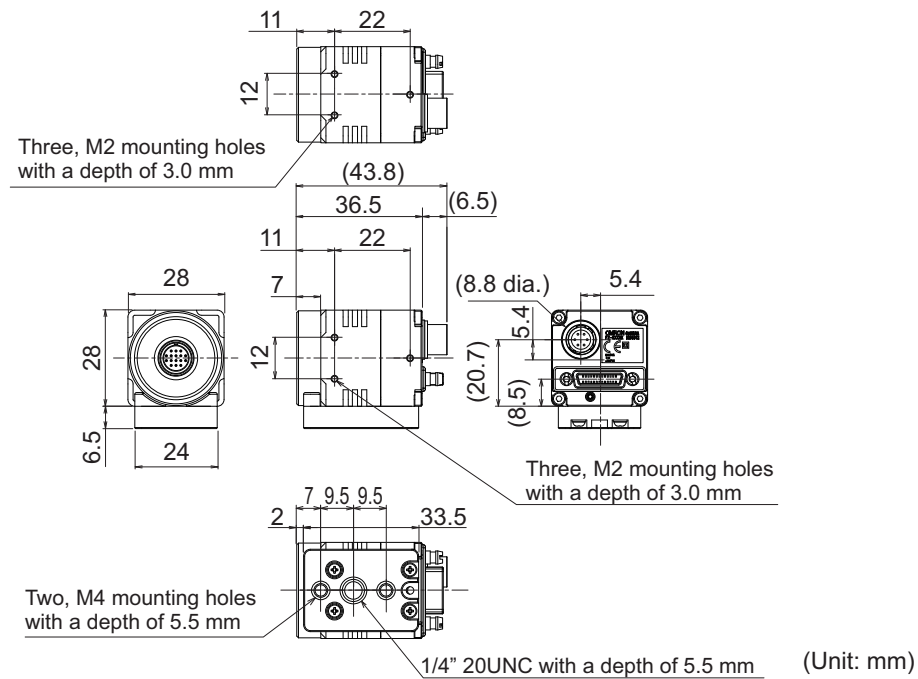


Additional Information

The imaging area of a camera can be calculated by multiplying the effective pixels by the pixel size.

● Camera Amplifier

Flat Camera, Pen-shaped Camera



Additional Information

We have the 2D CAD data or 3D CAD data.
You can download CAD data from www.fa.omron.co.jp.

3-2-7 Intelligent Compact Digital CMOS Camera: FZ-S camera Series

Specification

| Model | FZ-SQ010F | FZ-SQ050F | FZ-SQ100F | FZ-SQ100N |
|--|---|------------------------|-------------------------|-------------------------|
| Image elements | CMOS color image elements (1/3-inch equivalent) | | | |
| Color/Monochrome | Color | | | |
| Effective pixels | 752 (H) x 480 (V) | | | |
| Pixel size | 6.0 (μm) x 6.0 (μm) | | | |
| Shutter function | 1/250 to 1/32258 | | | |
| Partial function | 8 to 480 lines | | | |
| Frame rate (Image Acquisition Time *1) | 60 fps (16.7 ms) | | | |
| Field of vision | 7.5 x 4.7 to 13 x 8.2 mm | 13 x 8.2 to 53 x 33 mm | 53 x 33 to 240 x 153 mm | 29 x 18 to 300 x 191 mm |
| Installation distance | 38 to 60 mm | 56 to 215 mm | 220 to 970 mm | 32 to 380 mm |
| LED class *2 | Risk Group2 | | | |
| Ambient temperature range | Operating: 0 to +50°C, Storage: -25 to +65°C | | | |
| Ambient humidity range | Operating and Storage: 35 to 85% (with no condensation) | | | |
| Weight | Approx. 150g | | Approx. 140g | |
| Accessories | Mounting bracket (FQ-XL), Polarizing filter attachment (FQ-XF1), Instruction Sheet, Warning label | | | |

*1. This image acquisition time does not include the image conversion processing time of the sensor controller.

*2. Applicable standards: IEC62471-2

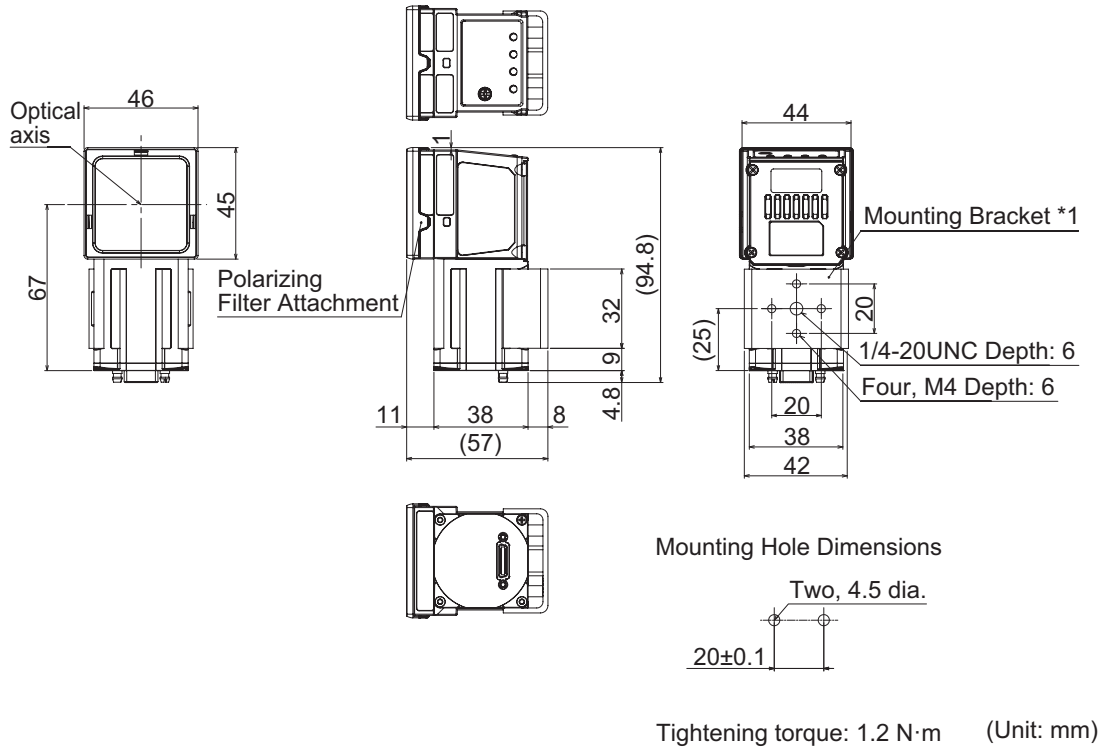


Additional Information

The imaging area of a camera can be calculated by multiplying the effective pixels by the pixel size.

Dimensions

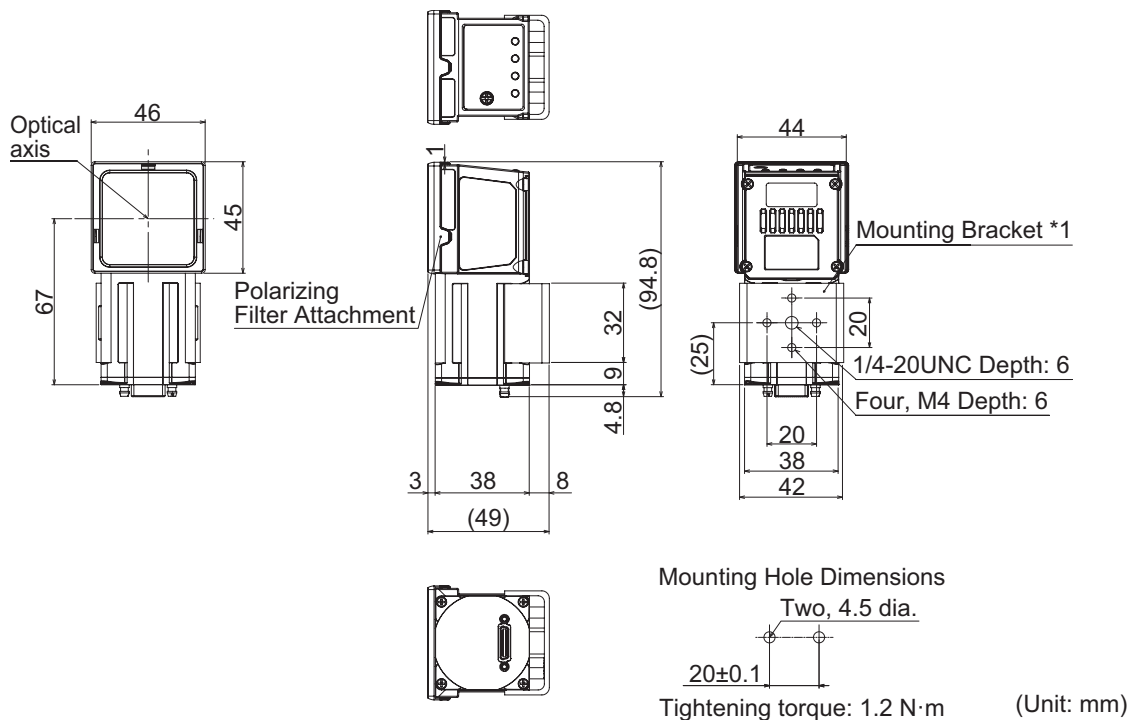
● Narrow view: FZ-SQ010F and Standard view: FZ-SQ050F



*1. The mounting brackets can be connected to either side.

● Wide View

- Long-distance: FZ-SQ100F
- Short-distance: FZ-SQ100N



*1. The mounting brackets can be connected to either side.



Additional Information

We have the 2D CAD data or 3D CAD data.
You can download CAD data from www.fa.omron.co.jp.

3-3 Camera Cable

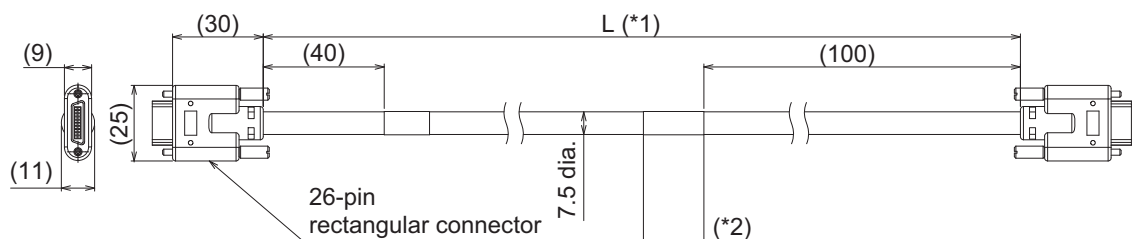
3-3-1 Camera Cable and Right-angle Camera Cable

Specification

| Model | FZ-VS3 2M FZ-VSL3 2M | FZ-VS3 3M FZ-VSL3 3M | FZ-VS3 5M FZ-VSL3 5M | FZ-VS3 10M FZ-VSL3 10M |
|---------------------------|--|-------------------------|-------------------------|---------------------------|
| Vibration (resistance) | 10 to 150 Hz, Single amplitude 0.15 mm, 3 directions, 8 strokes, 4 times | | | |
| Ambient temperature range | Operation and storage: 0 to +65°C (with no icing or condensation) | | | |
| Ambient humidity range | Operation and storage: 40 to 70% (with no condensation) | | | |
| Ambient atmosphere | No corrosive gases | | | |
| Material | Cable sheath, connector: PVC | | | |
| Minimum bending radius | 69 mm | | | |
| Weight | Approx. 170g | Approx. 250g | Approx. 390g | Approx. 740g |

Dimensions

● Camera Cable: FZ-VS3

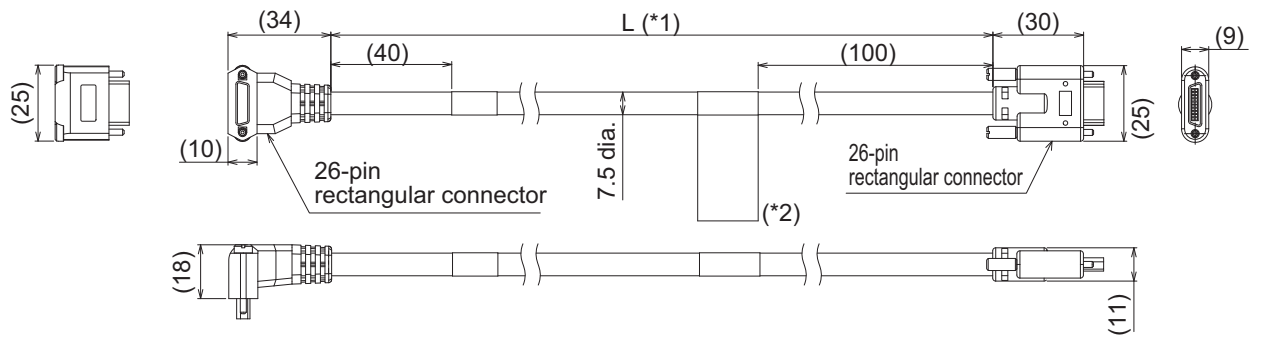


*1. Cable is available in 2 m/3 m/5 m/10 m.

*2. Each camera cables has polarity. Please ensure that the name plate side of the cable is connected to the controller.

(Unit: mm)

● Right-angle Camera Cable: FZ-VSL3



*1. Cable is available in 2 m/3 m/5 m/10 m.

*2. Each camera cables has polarity. Please ensure that the name plate side of the cable is connected to the controller.

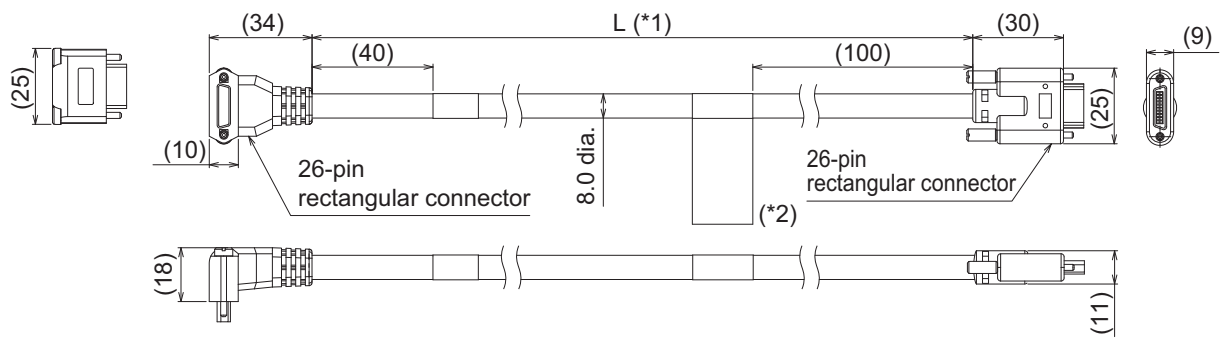
(Unit: mm)



Additional Information

We have the 2D CAD data or 3D CAD data.
You can download CAD data from www.fa.omron.co.jp.

● Bend resistant Right-angle Camera Cable: FZ-VSLB3



*1. Cable is available in 2 m/3 m/5 m/10 m.

*2. Each camera cables has polarity. Please ensure that the name plate side of the cable is connected to the controller.

(Unit: mm)



Additional Information

We have the 2D CAD data or 3D CAD data.
You can download CAD data from www.fa.omron.co.jp.

3-3-3 Super bend resistant Camera Cable

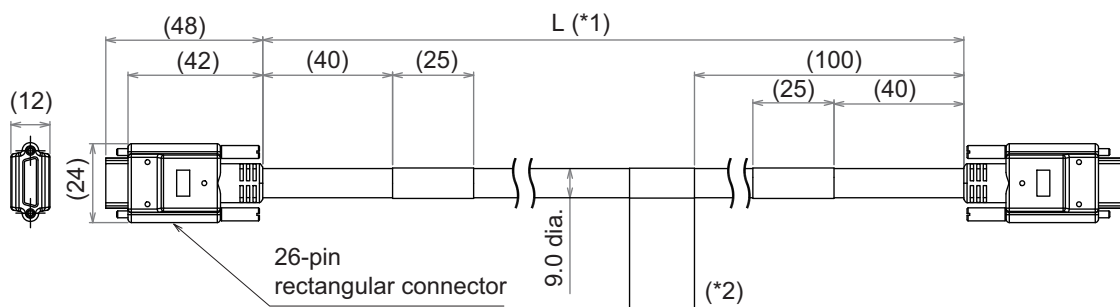
Specification

| Model | FZ-VSBX 5M | FZ-VSBX 10M |
|---------------------------|--|--------------|
| Vibration (resistance) | 10 to 150 Hz, Single amplitude 0.15 mm, 3 directions, 8 strokes, 4 times | |
| Ambient temperature range | Operation and storage: 0 to +65°C (with no icing or condensation) | |
| Ambient humidity range | Operation and storage: 40 to 70% (with no condensation) | |
| Ambient atmosphere | No corrosive gases | |
| Material | Cable sheath, connector: PVC | |
| Minimum bending radius | 69 mm | |
| Bend performance *1 | U-bend flexing: 6.5 million times or more, Bending radius: 50 mm, Stroke: 300 mm, Speed: 30/minute | |
| Weight | Approx. 460g | Approx. 880g |

*1. This data values are for reference only and not guaranteed values.

Dimensions

● Super bend resistant Camera Cable: FZ-VSBX



*1. Cable is available in 5 m/10 m.

*2. Each camera cables has polarity. Please ensure that the name plate side of the cable is connected to the controller.



Additional Information

We have the 2D CAD data or 3D CAD data.
You can download CAD data from www.fa.omron.co.jp.

3-3-4 Long-distance Camera Cable and Long-distance Right-angle Camera Cable

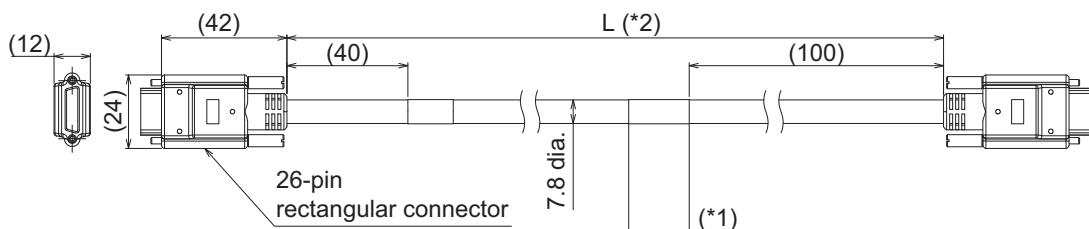
Specification

| Model | FZ-VS4 15M | FZ-VSL4 15M |
|---------------------------|--|-------------|
| Vibration (resistance) | 10 to 150 Hz, Single amplitude 0.15 mm, 3 directions, 8 strokes, 4 times | |
| Ambient temperature range | Operation and storage: 0 to +65°C (with no icing or condensation) | |
| Ambient humidity range | Operation and storage: 40 to 70% (with no condensation) | |
| Ambient atmosphere | No corrosive gases | |
| Material | Cable sheath, connector: PVC | |
| Minimum bending radius | 78 mm | |
| Weight | Approx. 1400g | |

*1. This data values are for reference only and not guaranteed values.

Dimensions

● Long-distance Camera Cable: FZ-VS4

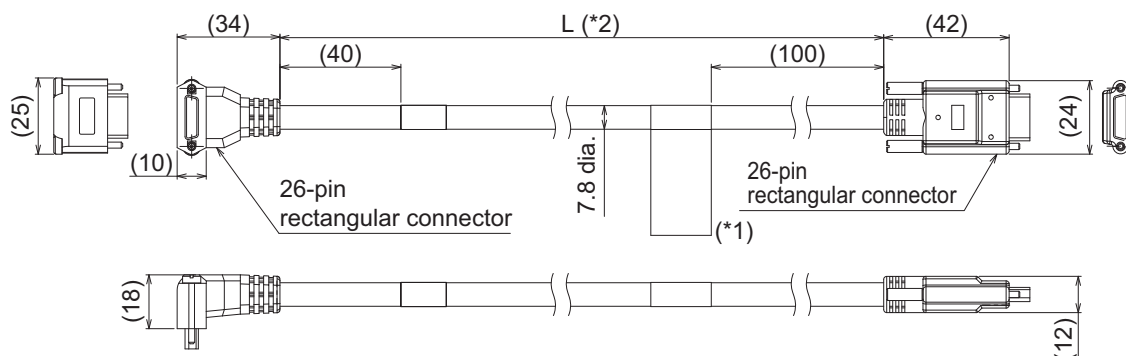


*1. Each camera cables has polarity. Please ensure that the name plate side of the cable is connected to the controller.

*2. Cable is available in 15 m.

(Unit: mm)

● Long-distance Right-angle Camera Cable: FZ-VSL4



*1. Each camera cables has polarity. Please ensure that the name plate side of the cable is connected to the controller.

*2. Cable is available in 15 m.

(Unit: mm)



Additional Information

We have the 2D CAD data or 3D CAD data.
You can download CAD data from www.fa.omron.co.jp.

3-3-5 Cable Connection Table

For connection of camera cables, refer to the following table.

Camera Cable for FH-S Camera Series

| Name | Model | Length | High-speed digital CMOS Camera (Standalone) | | | | |
|--|-------------------|--------|---|--------------------|----------|--------------------|----------|
| | | | 0.3 mega-pixel camera | 2 megapixel camera | | 4 megapixel camera | |
| | | | FH-SM/FH-SC | FH-SM02/FH-SC02 | | FH-SM04/FH-SC04 | |
| | | | - | High speed | Standard | High speed | Standard |
| Camera cable Right-angle Camera cable | FZ-VS3 | 2 m | OK | OK | OK | OK | OK |
| | FZ-VSL3 | 3 m | OK | OK | OK | OK | OK |
| | | 5 m | OK | OK | OK | OK | OK |
| | | 10 m | OK | - | OK | - | OK |
| Bend resistant Camera cable Bend resistant Right-angle Camera cable | FZ-VSB3 | 2 m | OK | OK | OK | OK | OK |
| | | 3 m | OK | OK | OK | OK | OK |
| | FZ-VSLB3 | 5 m | OK | OK | OK | OK | OK |
| | | 10 m | OK | - | OK | - | OK |
| Super bend resistant Camera cable | FZ-VSBX | 5 m | OK | OK | OK | OK | OK |
| | | 10 m | OK | - | OK | - | OK |
| Long-distance Camera cable Long-distance Right-angle Camera cable | FZ-VS4 FZ-VSL4 | 15 m | OK | - | OK | - | OK |

| Name | Model | Length | High-speed digital CMOS Camera (Standalone) | | Digital CMOS Camera |
|--|-------------------|--------|---|----------|---------------------|
| | | | 12 megapixel camera | | 5 megapixel camera |
| | | | FH-SM12/FH-SC12 | | FH-SM05R/FH-SC05R |
| | | | High speed | Standard | - |
| Camera cable Right-angle Camera cable | FZ-VS3 | 2 m | OK | OK | OK |
| | FZ-VSL3 | 3 m | OK | OK | OK |
| | | 5 m | OK | OK | OK |
| | | 10 m | - | OK | OK |
| Bend resistant Camera cable Bend resistant Right-angle Camera cable | FZ-VSB3 | 2 m | OK | OK | OK |
| | FZ-VSLB3 | 3 m | OK | OK | OK |
| | | 5 m | OK | OK | OK |
| | | 10 m | - | OK | OK |
| Super bend resistant Camera cable | FZ-VSBX | 5 m | OK | OK | OK |
| | | 10 m | - | OK | OK |
| Long-distance Camera cable Long-distance Right-angle Camera cable | FZ-VS4 FZ-VSL4 | 15 m | - | OK | OK |

| Name | Model | Length | High-speed digital CMOS Camera (Standalone) | | | |
|--|-------------------|--------|---|----------|----------------------|----------|
| | | | 0.4 megapixel camera | | 1.6 megapixel camera | |
| | | | FH-SMX/FH-SCX | | FH-SMX01/FH-SCX01 | |
| | | | High speed | Standard | High speed | Standard |
| Camera cable Right-angle Camera cable | FZ-VS3 | 2 m | OK | OK | OK | OK |
| | FZ-VSL3 | 3 m | OK | OK | OK | OK |
| | | 5 m | OK | OK | OK | OK |
| | | 10 m | - | OK | - | OK |
| Bend resistant Camera cable Bend resistant Right-angle Camera cable | FZ-VSB3 | 2 m | OK | OK | OK | OK |
| | FZ-VSLB3 | 3 m | OK | OK | OK | OK |
| | | 5 m | OK | OK | OK | OK |
| | | 10 m | - | OK | - | OK |
| Super bend resistant Camera cable | FZ-VSBX | 5 m | OK | OK | OK | OK |
| | | 10 m | - | OK | - | OK |
| Long-distance Camera cable Long-distance Right-angle Camera cable | FZ-VS4 FZ-VSL4 | 15 m | - | OK | - | OK |

| Name | Model | Length | High-speed digital CMOS Camera (Standalone) | | | |
|--|-------------------|--------|---|----------|--------------------|----------|
| | | | 3.2 megapixel camera | | 5 megapixel camera | |
| | | | FH-SMX03/FH-SCX03 | | FH-SMX05/FH-SCX05 | |
| | | | High speed | Standard | High speed | Standard |
| Camera cable Right-angle Camera cable | FZ-VS3 | 2 m | OK | OK | OK | OK |
| | FZ-VSL3 | 3 m | OK | OK | OK | OK |
| | | 5 m | OK | OK | OK | OK |
| | | 10 m | - | OK | - | OK |
| Bend resistant Camera cable Bend resistant Right-angle Camera cable | FZ-VSB3 | 2 m | OK | OK | OK | OK |
| | FZ-VSLB3 | 3 m | OK | OK | OK | OK |
| | | 5 m | OK | OK | OK | OK |
| | | 10 m | - | OK | - | OK |
| Super bend resistant Camera cable | FZ-VSBX | 5 m | OK | OK | OK | OK |
| | | 10 m | - | OK | - | OK |
| Long-distance Camera cable Long-distance Right-angle Camera cable | FZ-VS4 FZ-VSL4 | 15 m | - | OK | - | OK |

| Name | Model | Length | High-speed digital CMOS Camera (Standalone) | | Digital CMOS Camera (Standalone) | |
|--|-------------------|--------|---|----------|----------------------------------|----------|
| | | | 12 megapixel camera | | 20.4 megapixel camera | |
| | | | FH-SMX12/FH-SCX12 | | FH-SM21R/FH-SC21R | |
| | | | High speed | Standard | High speed | Standard |
| Camera cable Right-angle Camera cable | FZ-VS3 | 2 m | OK | OK | OK | OK |
| | FZ-VSL3 | 3 m | OK | OK | OK | OK |
| | | 5 m | OK | OK | OK | OK |
| | | 10 m | - | OK | - | OK |
| Bend resistant Camera cable Bend resistant Right-angle Camera cable | FZ-VSB3 | 2 m | OK | OK | OK | OK |
| | FZ-VSLB3 | 3 m | OK | OK | OK | OK |
| | | 5 m | OK | OK | OK | OK |
| | | 10 m | - | OK | - | OK |
| Super bend resistant Camera cable | FZ-VSBX | 5 m | OK | OK | OK | OK |
| | | 10 m | - | OK | - | OK |
| Long-distance Camera cable Long-distance Right-angle Camera cable | FZ-VS4 FZ-VSL4 | 15 m | - | OK | - | OK |

| Name | Model | Length | Shortwave Infrared (SWIR) Camera (Standalone) | |
|---|----------|--------|---|-----------------------|
| | | | 0.33 megapixel camera | 1.31 megapixel camera |
| | | | FH-SMX-SWIR | FH-SMX01-SWIR |
| | | | - | - |
| Camera cable | FZ-VS3 | 2m | OK | OK |
| Right-angle Camera cable | FZ-VSL3 | 3m | OK | OK |
| | | 5m | OK | OK |
| | | 10m | - | - |
| Bend resistant Camera cable | FZ-VSB3 | 2m | OK | OK |
| Bend resistant Right-angle Camera cable | FZ-VSLB3 | 3m | OK | OK |
| | | 5m | OK | OK |
| Super bend resistant Camera cable | FZ-VSBX | 10m | - | - |
| | | 5m | OK | OK |
| Long-distance Camera cable | FZ-VS4 | 15m | - | - |
| Long-distance Right-angle Camera cable | FZ-VSL4 | | | |

Camera Cable for FZ-S Camera Series

| Name | Model | Length | Digital CCD Camera (Standalone) | | |
|--|-------------------|--------|---------------------------------|--------------------|--------------------|
| | | | 0.3 megapixel camera | 2 megapixel camera | 5 megapixel camera |
| | | | FZ-S/FZ-SC | FZ-S2M/FZ-SC2M | FZ-S5M3/FZ-SC5M3 |
| Camera cable Right-angle Camera cable | FZ-VS3 | 2 m | OK | OK | OK |
| | FZ-VSL3 | 3 m | OK | OK | OK |
| | | 5 m | OK | OK | OK |
| | | 10 m | OK | OK | - |
| Bend resistant Camera cable Bend resistant Right-angle Camera cable | FZ-VSB3 | 2 m | OK | OK | OK |
| | | 3 m | OK | OK | OK |
| | FZ-VSLB3 | 5 m | OK | OK | OK |
| | | 10 m | OK | OK | - |
| Super bend resistant Camera cable | FZ-VSBX | 5 m | OK | OK | OK |
| | | 10 m | OK | OK | - |
| Long-distance Camera cable Long-distance Right-angle Camera cable | FZ-VS4 FZ-VSL4 | 15 m | OK | OK | - |

| Name | Model | Length | Small Digital CCD Camera (Standalone) Flat type/pen type | High-speed digital CCD Camera (Standalone) | Intelligent Compact Digital CMOS Camera |
|--|-------------------|--------|---|--|---|
| | | | FZ-SF/FZ-SFC FZ-SP/FZ-SPC | FZ-SH/FZ-SHC | FZ-SQ□ |
| | | | Camera cable Right-angle Camera cable | FZ-VS3 | 2 m |
| FZ-VSL3 | 3 m | OK | | OK | OK |
| | 5 m | OK | | OK | OK |
| | 10 m | OK | | OK | OK |
| Bend resistant Camera cable Bend resistant Right-angle Camera cable | FZ-VSB3 | 2 m | OK | OK | OK |
| | | 3 m | OK | OK | OK |
| | FZ-VSLB3 | 5 m | OK | OK | OK |
| | | 10 m | OK | OK | OK |
| Super bend resistant Camera cable | FZ-VSBX | 5 m | OK | OK | OK |
| | | 10 m | OK | OK | OK |
| Long-distance Camera cable Long-distance Right-angle Camera cable | FZ-VS4 FZ-VSL4 | 15 m | OK | OK | OK |

3-3-6 Cable Extension Units

You can extend the distance between the sensor controller and Camera by using cable extension units.

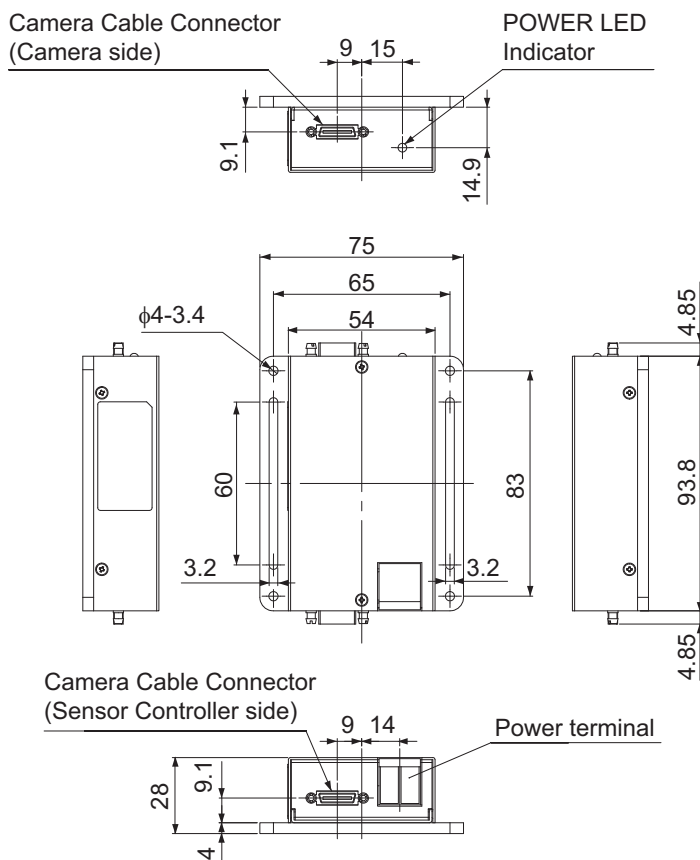
Specification

| Model | FZ-VSJ |
|---------------------------|--|
| Supply Voltage *1 | 11.5 to 13.5 VDC |
| Current consumption *2 | 1.5 A max. |
| Ambient temperature range | Operating: 0 to +50°C; Storage: -25 to +65°C (with no icing or condensation) |
| Ambient humidity range | Operating and Storage: 35 to 85% (with no condensation) |
| Weight | Approx. 240g |
| Accessories | Instruction Sheet and 4 mounting screws |

*1. A 12-VDC power supply must be provided to the Cable Extension Unit when connecting the Intelligent Compact Digital Camera, or the Lighting Controller.

*2. The current consumption shows when connecting the Cable Extension Unit to an external power supply.

Dimensions



(Unit: mm)



Additional Information

We have the 2D CAD data or 3D CAD data.
You can download CAD data from www.fa.omron.co.jp.

Maximum Extension Length Using Cable Extension Units FZ-VSJ

| Model | Transmission speed *1 | No. of CH used for connection *2 | Maximum cable length using 1 Camera Cable *1 | Max. number of connectable Extension Units | Using Cable Extension Units FZ-VSJ | |
|--|-----------------------|----------------------------------|--|--|------------------------------------|--|
| | | | | | Max. cable length | Connection configuration |
| High-speed digital CMOS Cameras | | | | | | |
| FH-SM/FH-SC | - | - | 15 m (Using FZ-VS4/VSL4) | 2 | 45 m | [Configuration 1] Camera cable: 15 m x 3 Extension Unit: 2 |
| FH-SMX/FH-SCX FH-SMX01/FH-SCX01 | Standard | - | 15 m (Using FZ-VS4/VSL4) | 2 | 45 m | [Configuration 1] Camera cable: 15 m x 3 Extension Unit: 2 |
| | High speed | - | 5 m (Using FZ-VS□/VSL□) | 2 | 15 m | [Configuration 3] Camera cable: 15 m x 3 Extension unit: 2 |
| FH-SM02/FH-SC02 FH-SM04/FH-SC04 FH-SM12/FH-SC12 FH-SMX03/FH-SCX03 FH-SMX05/FH-SCX05 FH-SMX12/FH-SCX12 | Standard | 1CH | 15 m (Using FZ-VS4/VSL4) | 2 | 45 m | [Configuration 1] Camera cable: 15 m x 3 Extension Unit: 2 |
| | | 2CH | 15 m (Using FZ-VS4/VSL4) | 4 *3 | 45 m | [Configuration 2] Camera cable: 15 m x 6 Extension Unit: 4 |
| | High speed | 1CH | 5 m (Using FZ-VS□/VSL□) | 2 | 15 m | [Configuration 3] Camera cable: 15 m x 3 Extension unit: 2 |
| | | 2CH | 5 m (Using FZ-VS□/VSL□) | 4 *3 | 15 m | [Configuration 4] Camera cable: 5 m x 6 Extension Unit: 4 |
| Digital CMOS Cameras | | | | | | |
| FH-SM21R/FH-SC21R | Standard | 1CH | 5 m (Using FZ-VS4/VSL4) | 2 | 45 m | [Configuration 1] Camera cable: 15 m x 3 Extension Unit: 2 |
| | | 2CH | 15 m (Using FZ-VS4/VSL4) | 4 *3 | 45 m | [Configuration 2] Camera cable: 15 m x 6 Extension Unit: 4 |
| | High speed | 1CH | 5 m (Using FZ-VS□/VSL□) | 2 | 15 m | [Configuration 3] Camera cable: 15 m x 3 Extension unit: 2 |
| | | 2CH | 5 m (Using FZ-VS□/VSL□) | 4 *3 | 15 m | [Configuration 4] Camera cable: 5 m x 6 Extension Unit: 4 |

| Model | Transmission speed *1 | No. of CH used for connection *2 | Maximum cable length using 1 Camera Cable *1 | Max. number of connectable Extension Units | Using Cable Extension Units FZ-VSJ | |
|--|-----------------------|----------------------------------|--|--|------------------------------------|--|
| | | | | | Max. cable length | Connection configuration |
| FH-SM05R/FH-SC05R | - | - | 15 m (Using FZ-VS4/VSL4) | 2 | 45 m | [Configuration 1] Camera cable: 15 m x 3 Extension Unit: 2 |
| FZ-S5M3/FZ-SC5M3 | - | - | 5 m (Using FZ-VS□/VSL□) | 2 | 15 m | [Configuration 3] Camera cable: 15 m x 3 Extension unit: 2 |
| Shortwave Infrared (SWIR) Cameras | | | | | | |
| FH-SMX-SWIR/FH-SMX01-SWIR | - | - | 5 m (Using FZ-VS□/VSL□) | 2 | 15 m | [Configuration 3] Camera cable: 15 m x 3 Extension unit: 2 |
| Digital CCD Cameras | | | | | | |
| FZ-S/FZ-SC FZ-S2M/FZ-SC2M | - | - | 15 m (Using FZ-VS4/VSL4) | 2 | 45 m | [Configuration 1] Camera cable: 15 m x 3 Extension Unit: 2 |
| Small Digital CCD Cameras Flat type/pen type | | | | | | |
| FZ-SF/FZ-SFC FZ-SP/FZ-SPC | - | - | 15 m (Using FZ-VS4/VSL4) | 2 | 45 m | [Configuration 1] Camera cable: 15 m x 3 Extension Unit: 2 |
| High-speed digital CCD Cameras | | | | | | |
| FZ-SH/FZ-SHC | - | - | 15 m (Using FZ-VS4/VSL4) | 2 | 45 m | [Configuration 1] Camera cable: 15 m x 3 Extension Unit: 2 |
| Intelligent Compact Digital CMOS Cameras | | | | | | |
| FZ-SQ□ | - | - | 15 m (Using FZ-VS4/VSL4) | 2 | 45 m | [Configuration 1] Camera cable: 15 m x 3 Extension Unit: 2 |

- *1. The FH-S□□□ enables switching between standard and high speed modes. In high speed mode, images can be transferred approximately two times faster than in standard mode, but the connectable cable length will be shorter.
- *2. The FH-S□□□ has two channels to connect Camera Cables. Connection to two channels makes image transfer two times faster than connection to one channel: high speed mode using two channels can transfer approximately four times as many images as standard mode using one channel.
- *3. Each channel can be used to connect up to two Cable Extension Units: up to four extension units, two units per one channel, can be connected by using two channels.

Connection Configuration

Connection configuration of FH-2000/FH-5000 sensor controller and Camera are the bellows.

| Con-figuration | Connection configuration using the maximum length of Camera Cables | Remarks |
|----------------|--|--|
| 1 | | - |
| 2 | | Camera cable connector CH2 Camera cable connector CH1 |
| 3 | | - |
| 4 | | Camera cable connector CH2 Camera cable connector CH1 |

- *1. Select the Camera Cables between the sensor controller and Extension Unit, between the Extension Units, and between the Extension Unit and Camera according to the connected Camera. Different types or lengths of Camera Cables can be used for (1), (2), and (3) as well as for (4), (5), and (6). However, the type and length of Camera Cable (1) must be the same as those of Camera Cable (4), (2) must be the same as (5), and (3) must be the same as (6).

3-4 Lens





Use the lens selector (www.fa.omron.co.jp/product/tool/lens_selector/en/index.html) for lens selection and field of view/installation.





| Camera | | Recommended lens | | |
|--------------------|----------------------------------|--|---|---|
| Resolution | Model | Standard Lens (Lens for general inspection. Ideal for when a wide field of view, a long working distance, or cost effectiveness is required.) | Telecentric Lens (Lens ideal for high-precision inspection and alignment. Images can be captured at high magnification, and distortion at edges of images is low.) | Vibrations and Shocks Resistant Lens (Robust lens with improved resistance to vibrations and shocks is ideal for industrial use. Design without lock screws enables installation in narrow positions.) |
| 0.3 million pixels | FZ-SF/SFC | 3-4-7 Lenses for Small Camera (FZ-LES Series) on page 3-64 | - | - |
| | FZ-SP/SPC | | 3-4-8 High-resolution Telecentric Lens for C-mount Lens for 2/3-inch Image Sensor (VS-TCH Series) on page 3-65 | 3-4-10 Vibration and Shock Resistant C-mount Lens for 2/3-inch Image Sensor (VS-MCA Series) on page 3-67 |
| | FZ-S/SC FH-SM/SC FZ-SH/SHC | | | |
| 0.4 million pixels | FH-SMX/SCX | 3-4-1 C-mount Lens for 1/3-inch Image Sensor (SV-V Series) on page 3-59 | | 3-4-13 Non-telecentric Macro Lens for C-mount CamerasC (VS-MC Series) on page 3-75 |
| 1.6 million pixels | FH-SMX01/SCX01 | 3-4-2 C-mount Lens for 2/3-inch Image Sensor (SV-H Series) on page 3-60 | 3-4-9 High-resolution Telecentric Lens for C-mount Lens for 1.1-inch Image Sensor (VS-TEV Series) on page 3-66 | 3-4-11 Vibration and Shock Resistant C-mount Lens for 1-inch Image Sensor (VS-MCH1 Series) on page 3-70 |
| 2 million pixels | FZ-S2M/SC2M | | | |
| | FH-SM02/SC02 | 3-4-3 C-mount Lens for 1-inch Image Sensor (VS-H1 Series) on page 3-61 | | |
| 3.2 million pixels | FH-SMX03/SCX03 | | | 3-4-10 Vibration and Shock Resistant C-mount Lens for 2/3-inch Image Sensor (VS-MCA Series) on page 3-67 3-4-13 Non-telecentric Macro Lens for C-mount CamerasC (VS-MC Series) on page 3-75 |
| 4 million pixels | FH-SM04/SC04 | | | 3-4-11 Vibration and Shock Resistant C-mount Lens for 1-inch Image Sensor (VS-MCH1 Series) on page 3-70 |




| Camera | | Recommended lens | | |
|---------------------|---|--|---|---|
| Resolution | Model | Standard Lens (Lens for general inspection. Ideal for when a wide field of view, a long working distance, or cost effectiveness is required.) | Telecentric Lens (Lens ideal for high-precision inspection and alignment. Images can be captured at high magnification, and distortion at edges of images is low.) | Vibrations and Shocks Resistant Lens (Robust lens with improved resistance to vibrations and shocks is ideal for industrial use. Design without lock screws enables installation in narrow positions.) |
| 5 million pixels | FH-SM05R/SC05R FZ-S5M3/SC5M3 FH-SMX05/SCX05 | 3-4-2 C-mount Lens for 2/3-inch Image Sensor (SV-H Series) on page 3-60 | 3-4-8 High-resolution Telecentric Lens for C-mount Lens for 2/3-inch Image Sensor (VS-TCH Series) on page 3-65 | 3-4-10 Vibration and Shock Resistant C-mount Lens for 2/3-inch Image Sensor (VS-MCA Series) on page 3-67 3-4-13 Non-telecentric Macro Lens for C-mount CamerasC (VS-MC Series) on page 3-75 |
| 12 million pixels | FH-SMX12/SCX12 | 3-4-6 C-mount Lens for 4/3-inch Image Sensor (VS-LLD Series) on page 3-64 3-4-5 C-mount Lens for 1.1-inch Image Sensor (VS-HVA Series) on page 3-63 | 3-4-9 High-resolution Telecentric Lens for C-mount Lens for 1.1-inch Image Sensor (VS-TEV Series) on page 3-66 | - |
| | FH-SM12/SC12 | 3-4-4 M42-mount Lens for Large Image Sensor (VS-L/M42-10 Series) on page 3-62 | - | 3-4-12 Vibration and Shock Resistant M42-mount Lens for 1.8-inch Image Sensor (VS-MCL/M42-10 Series) on page 3-72 |
| 20.4 million pixels | FH-SM21R/SC21R | 3-4-6 C-mount Lens for 4/3-inch Image Sensor (VS-LLD Series) on page 3-64 3-4-5 C-mount Lens for 1.1-inch Image Sensor (VS-HVA Series) on page 3-63 | 3-4-9 High-resolution Telecentric Lens for C-mount Lens for 1.1-inch Image Sensor (VS-TEV Series) on page 3-66 | 3-4-11 Vibration and Shock Resistant C-mount Lens for 1-inch Image Sensor (VS-MCH1 Series) on page 3-70 |
| 0.33 million pixels | FH-SMX-SWIR | VS Technology CO., LTD | VS Technology CO., LTD | - |
| 1.31 million pixels | FH-SMX01-SWIR | VS-H1-SWIR Series | VS-THV Sderies | - |

3-4-1 C-mount Lens for 1/3-inch Image Sensor (SV-V Series)

Specification




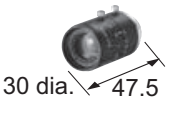
| Model | 3Z4S-LE SV-03514V | 3Z4S-LE SV-04514V | 3Z4S-LE SV-0614V | 3Z4S-LE SV-0813V |
|---|---|---|---|---|
| Appearance/ Dimensions (Unit: mm) |  |  |  |  |
| Focal length (mm) | 3.5 | 4.5 | 6 | 8 |
| Aperture (F No.) | 1.4 to Close | 1.4 to Close | 1.4 to Close | 1.3 to Close |
| Filter size | - | - | M27.0 P0.5 | M25.5 P0.5 |
| Maximum sensor size | 1/3 inch | | | |
| Mount | C mount | | | |


| Model | 3Z4S-LE SV-1214V | 3Z4S-LE SV-1614V | 3Z4S-LE SV-2514V | 3Z4S-LE SV-3518V |
|---|--|--|--|--|
| Appearance/ Dimensions (Unit: mm) |  |  |  |  |
| Focal length (mm) | 12 | 16 | 25 | 35 |
| Aperture (F No.) | 1.4 to Close | 1.4 to Close | 1.4 to Close | 1.8 to Close |
| Filter size | M27.0 P0.5 | M27.0 P0.5 | M27.0 P0.5 | M27.0 P0.5 |
| Maximum sensor size | 1/3 inch | | | |
| Mount | C mount | | | |


| Model | 3Z4S-LE SV-5018V | 3Z4S-LE SV-7527V | 3Z4S-LE SV-10035V |
|---|---|---|--|
| Appearance/ Dimensions (Unit: mm) |  |  |  |
| Focal length (mm) | 50 | 75 | 100 |
| Aperture (F No.) | 1.8 to Close | 2.7 to Close | 3.5 to Close |
| Filter size | M30.5 P0.5 | M30.5 P0.5 | M30.5 P0.5 |
| Maximum sensor size | 1/3 inch | | |
| Mount | C mount | | |

3-4-2 C-mount Lens for 2/3-inch Image Sensor (SV-H Series)

Specification





| Model | 3Z4S-LE SV-0614H | 3Z4S-LE SV-0814H | 3Z4S-LE SV-1214H | 3Z4S-LE SV-1614H |
|---|---|---|--|---|
| Appearance/ Dimensions (Unit: mm) |  |  |  |  |
| Focal length (mm) | 6 | 8 | 12 | 16 |
| Aperture (F No.) | 1.4 to 16 | 1.4 to 16 | 1.4 to 16 | 1.4 to 16 |
| Filter size | M40.5 P0.5 | M35.5 P0.5 | M27.0 P0.5 | M27.0 P0.5 |
| Maximum sensor size | 2/3 inch | | | |
| Mount | C mount | | | |




| Model | 3Z4S-LE SV-2514H | 3Z4S-LE SV-3514H | 3Z4S-LE SV-5014H | 3Z4S-LE SV-7525H |
|---|---|---|--|---|
| Appearance/ Dimensions (Unit: mm) |  |  |  |  |
| Focal length (mm) | 25 | 35 | 50 | 75 |
| Aperture (F No.) | 1.4 to 16 | 1.4 to 16 | 1.4 to 16 | 2.5 to Close |
| Filter size | M27.0 P0.5 | M35.5 P0.5 | M40.5 P0.5 | M34.0 P0.5 |
| Maximum sensor size | 2/3 inch | | | 1 inch |
| Mount | C mount | | | |

| Model | 3Z4S-LE SV-10028H |
|---|---|
| Appearance/ Dimensions (Unit: mm) |  |
| Focal length (mm) | 100 |
| Aperture (F No.) | 2.8 to Close |
| Filter size | M37.5 P0.5 |
| Maximum sensor size | 1 inch |
| Mount | C mount |

3-4-3 C-mount Lens for 1-inch Image Sensor (VS-H1 Series)





Specification



| Model | 3Z4S-LE VS-0618H1 | 3Z4S-LE VS-0814H1 | 3Z4S-LE VS-1214H1 | 3Z4S-LE VS-1614H1N |
|---|--|--|---|--|
| Appearance/ Dimensions (Unit: mm) |  64.5 dia. 57.2 |  57 dia. 59 |  38 dia. 48.0[WD:∞] to 48.5[WD:300] |  38 dia. 45.0[WD:∞] to 45.9[WD:300] |
| Focal length (mm) | 6 | 8 | 12 | 16 |
| Aperture (F No.) | 1.8 to 16 | 1.4 to 16 | 1.4 to 16 | 1.4 to 16 |
| Filter size | Can not be used a filter. | M55.0 P0.75 | M35.5 P0.5 | M30.5 P0.5 |
| Maximum sensor size | 1 inch | | | |
| Mount | C mount | | | |

| Model | 3Z4S-LE VS-2514H1 | 3Z4S-LE VS-3514H1 | 3Z4S-LE VS-5018H1 |
|---|--|---|--|
| Appearance/ Dimensions (Unit: mm) |  38 dia. 33.5[WD:∞] to 35.6[WD:300] |  38 dia. 35.0[WD:∞] to 39.1[WD:300] |  44 dia. 44.5[WD:∞] to 49.5[WD:500] |
| Focal length (mm) | 25 | 35 | 50 |
| Aperture (F No.) | 1.4 to 16 | 1.4 to 16 | 1.8 to 16 |
| Filter size | M30.5 P0.5 | M30.5 P0.5 | M40.5 P0.5 |
| Maximum sensor size | 1 inch | | |
| Mount | C mount | | |

3-4-4 M42-mount Lens for Large Image Sensor (VS-L/M42-10 Series)





Specification


| Model | 3Z4S-LE VS-L1828/M42-10 | 3Z4S-LE VS-L2526/M42-10 | 3Z4S-LE VS-L3528/M42-10 | 3Z4S-LE VS-L5028/M42-10 |
|---|--|--|--|--|
| Appearance/ Dimensions (Unit: mm) |  58.5 dia. 94 |  58.5 dia. 80 |  64.5 dia. 108 |  66 dia. 94.5 |
| Focal length (mm) | 18 | 25 | 35 | 50 |
| Aperture (F No.) | 2.8 to 16 | 2.6 to 16 | 2.8 to 16 | 2.8 to 16 |
| Filter size | M55.0 P0.75 | M55.0 P0.75 | M62.0 P0.75 | M62.0 P0.75 |
| Maximum sensor size | 1.8 inch | | | |
| Mount | M42 mount | | | |

| Model | 3Z4S-LE VS-L1828/M42-10 | 3Z4S-LE VS-L2526/M42-10 |
|---|---|---|
| Appearance/ Dimensions (Unit: mm) |  55.5 dia. 129.5 |  54 dia. 134.5 |
| Focal length (mm) | 85 | 100 |
| Aperture (F No.) | 4.0 to 16 | 2.8 to 16 |
| Filter size | M52.0 P0.75 | M52.0 P0.75 |
| Maximum sensor size | 1.8 inch | |
| Mount | M42 mount | |

3-4-5 C-mount Lens for 1.1-inch Image Sensor (VS-HVA Series)


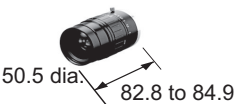
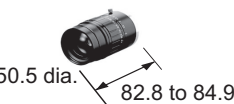
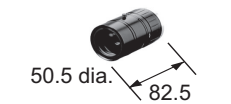
Specification


| Model | 3Z4S-LE VS-HVA1226 | 3Z4S-LE VS-HVA1626 | 3Z4S-LE VS-HVA2524 | 3Z4S-LE VS-HVA3522 |
|---|---|---|---|---|
| Appearance/ Dimensions (Unit: mm) | 36.5 dia.  | 37.5 dia.  | 37.0 dia.  | 39.5 dia.  |
| Focal length (mm) | 12 | 16 | 25 | 35 |
| Aperture (F No.) | F2.6 to Close | F2.6 to Close | F2.4 to Close | F2.2 to Close |
| Filter size | M34.0 P0.5 | M30.0 P0.5 | M35.5 P0.5 | M34.0 P0.5 |
| Maximum sensor size | 1.1 inch | | | |
| Mount | C mount | | | |

| Model | 3Z4S-LE VS-HVA5024 |
|---|--|
| Appearance/ Dimensions (Unit: mm) | 40.0 dia.  |
| Focal length (mm) | 50 |
| Aperture (F No.) | F2.4 to Close |
| Filter size | M30.5 P0.5 |
| Maximum sensor size | 1.1 inch |
| Mount | C mount |

3-4-6 C-mount Lens for 4/3-inch Image Sensor (VS-LLD Series)




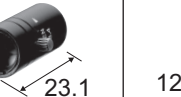
Specification

| Model | 3Z4S-LE VS-LLD12.5 | 3Z4S-LE VS-LLD18 | 3Z4S-LE VS-LLD25 | 3Z4S-LE VS-LLD50 |
|---|---|---|--|---|
| Appearance/ Dimensions (Unit: mm) |  |  |  |  |
| Focal length (mm) | 12.5 | 18 | 25 | 35 |
| Aperture (F No.) | 2.5 to 16 | 2.1 to 16 | 2.1 to 16 | 2.2 to 16 |
| Filter size | M62.0 P0.75 | M43.0 P0.75 | M43.0 P0.75 | M46.0 P0.75 |
| Maximum sensor size | 4/3 inch | | | |
| Mount | C mount | | | |

| Model | 3Z4S-LE VS-LLD50 |
|---|---|
| Appearance/ Dimensions (Unit: mm) |  |
| Focal length (mm) | 50 |
| Aperture (F No.) | 2.2 to 16 |
| Filter size | M46 P0.75 |
| Maximum sensor size | 4/3 inch |
| Mount | C mount |

3-4-7 Lenses for Small Camera (FZ-LES Series)

Specification

| Model | FZ-LES3 | FZ-LES6 | FZ-LES16 | FZ-LES50 |
|---|---|---|--|---|
| Appearance/ Dimensions (Unit: mm) |  |  |  |  |
| Focal length (mm) | 3 | 6 | 16 | 30 |
| Aperture (F No.) | 2.0 to 16 | 2.0 to 16 | 3.4 to 16 | 3.4 to 16 |

3-4-8 High-resolution Telecentric Lens for C-mount Lens for 2/3-inch Image Sensor (VS-TCH Series)

Specification

| Model*1 | | | 3Z4S-LE VS-TCH05 -65□□□□ | 3Z4S-LE VS-TCH05 -110□□□□ | 3Z4S-LE VS-TCH1 -65□□□□ | 3Z4S-LE VS-TCH1 -110□□□□ |
|----------------------------------|---------------|-----------------------|--------------------------------|---------------------------------|-------------------------------|--------------------------------|
| Optical magnification (±5 %) | | | 0.5x | | 1.0x | |
| Field of view (±5%) (V x H) (mm) | FH-SC/SM | 1/3 inch equivalent | 9.6 x 7.2 | | 4.8 x 3.6 | |
| | FH-S□05R | 1/2.5 inch equivalent | 11.4 x 8.56 | | 5.7 x 4.28 | |
| | FZ-SC/S | 1/3 inch equivalent | 9.6 x 7.2 | | 4.8 x 3.6 | |
| | FZ-SC2M/S2M | 1/1.8 inch equivalent | 14.0 x 10.6 | | 7.0 x 5.3 | |
| | FZ-SC5M□/S5M□ | 2/3 inch equivalent | 16.8 x 14.2 | | 8.4 x 7.1 | |
| WD (mm)*2 | | | 75.3 | 110.8 | 68.8 | 110.3 |
| Effective FNO | | | 9.42 | 9.49 | 9.94 | 10.49 |
| Depth of field (mm) *3 | | | 3 | 3.04 | 0.8 | 0.84 |
| Resolution (μm) *4 | | | 12.43 | 12.9 | 6.71 | 6.99 |
| TV distortion | | | 0.02 % | 0.02 % | 0.01 % | 0.02 % |
| Maximum sensor size | | | 2/3 inch | | | |

| Model*1 | | | 3Z4S-LE VS-TCH1.5 -65□□□□ | 3Z4S-LE VS-TCH1.5 -110□□□□ | 3Z4S-LE VS-TCH2 -65□□□□ | 3Z4S-LE VS-TCH2 -110□□□□ |
|----------------------------------|---------------|-----------------------|---------------------------------|----------------------------------|-------------------------------|--------------------------------|
| Optical magnification (±5 %) | | | 1.5x | | 2.0x | |
| Field of view (±5%) (V x H) (mm) | FH-SC/SM | 1/3 inch equivalent | 3.2 x 2.4 | | 2.4 x 1.8 | |
| | FH-S□05R | 1/2.5 inch equivalent | 3.8 x 2.85 | | 2.85 x 2.14 | |
| | FZ-SC/S | 1/3 inch equivalent | 3.2 x 2.4 | | 2.4 x 1.8 | |
| | FZ-SC2M/S2M | 1/1.8 inch equivalent | 4.7 x 3.5 | | 3.5 x 2.7 | |
| | FZ-SC5M□/S5M□ | 2/3 inch equivalent | 5.6 x 4.7 | | 4.2 x 3.6 | |
| WD (mm)*2 | | | 65 | 110.8 | 65 | 110.8 |
| Effective FNO | | | 11.8 | 11.97 | 13.6 | 13.5 |
| Depth of field (mm) *3 | | | 0.4 | 0.43 | 0.3 | 0.27 |
| Resolution (μm) *4 | | | 5.24 | 5.33 | 4.53 | 4.53 |
| TV distortion | | | 0.01 % | 0.02 % | 0.03 % | 0.03 % |
| Maximum sensor size | | | 2/3 inch | | | |

| Model*1 | | 3Z4S-LE VS-TCH4 -65□□□□ | 3Z4S-LE VS-TCH4 -110□□□□ |
|------------------------------|--|-------------------------------|--------------------------------|
| Optical magnification (±5 %) | | 4.0x | |

| Model*1 | | | 3Z4S-LE VS-TCH4 -65□□□□ | 3Z4S-LE VS-TCH4 -110□□□□ |
|--|---------------|-----------------------|-------------------------------|--------------------------------|
| Field of view (±5%) (V x H) (mm) | FH-SC/SM | 1/3 inch equivalent | 1.2 x 0.9 | |
| | FH-S□05R | 1/2.5 inch equivalent | 1.43 x 1.07 | |
| | FZ-SC/S | 1/3 inch equivalent | 1.2 x 0.9 | |
| | FZ-SC2M/S2M | 1/1.8 inch equivalent | 1.8 x 1.3 | |
| | FZ-SC5M□/S5M□ | 2/3 inch equivalent | 2.1 x 1.8 | |
| WD (mm)*2 | | | 65 | 110.8 |
| Effective FNO | | | 17.91 | 22.2 |
| Depth of field (mm) *3 | | | 0.09 | 0.11 |
| Resolution (μm) *4 | | | 3 | 3.73 |
| TV distortion | | | 0.02 % | 0.03 % |
| Maximum sensor size | | | 2/3 inch | |

*1. Insert the shape into □□□□ in the model number as follows.

Straight: -O

Coaxial: CO-O

*2. The working distance is the distance from the end of the lens to the sensor.

*3. The depth of field is calculated using a permissible circle of confusion diameter of 0.04 mm.

*4. The resolution is calculated using a wavelength of 550 nm.



Precautions for Correct Use

1. Fixing the lens or other reinforcement may be required depending on the installation angle or operating environment (vibration/shock). When fixing the lens, insulate the lens from the fixture.
2. The above specifications are values calculated from the optical design and can vary depending on installation conditions.

3-4-9 High-resolution Telecentric Lens for C-mount Lens for 1.1-inch Image Sensor (VS-TEV Series)

Specification

| Model | | | 3Z4S-LE VS-TEV0305 | | 3Z4S-LE VS-TEV05075 | | 3Z4S-LE VS-TEV07510 | |
|-------------------------------------|---------|------------------------|-----------------------|--------|------------------------|------------|------------------------|-------------|
| Optical magnification | | | 0.3x | 0.5x | 0.5x | 0.75x | 0.75xx | 1.0x |
| Field of view (V x H) (mm) | FH-S | 1.1 inch equivalent | 47.1 x | 28.2 x | 28.2 x | 18.8 x | 18.8 x | 14.1 x |
| | □X12 | | 34.5 | 20.7 | 20.7 | 13.8 | 13.8 | 10.4 |
| | FH-S | 1 inch equivalent | 44.4 x | 26.6 x | 26.6 x | 17.7 x | 17.7 x | 13.3 x 8.9 |
| | □21R | | 29.6 | 17.7 | 17.7 | 11.8 | 11.8 | |
| | FH-S□04 | 1 inch equivalent | 37.5 x | 22.5 x | 22.5 x | 15.0 x | 15.0 x | 11.3 x 11.3 |
| | □02 | | 37.5 | 22.5 | 22.5 | 15.0 | 15.0 | |
| | FH-S□02 | 2/3 inch equivalent | 37.5 x | 22.5 x | 22.5 x | 15.0 x 8.0 | 15.0 x 8.0 | 11.3 x 6.0 |
| | | | 19.9 | 12.0 | 12.0 | | | |
| WD (mm)*1 | | | 221.5 | 125.8 | 173.2 | 133.9 | 133.9 | 114.0 |
| Effective FNO | | | 4.3 | 6.2 | 5.0 | 6.8 | 6.8 | 8.5 |

| Model | 3Z4S-LE VS-TEV0305 | | 3Z4S-LE VS-TEV05075 | | 3Z4S-LE VS-TEV07510 | |
|---------------------|------------------------|---------|------------------------|--------|------------------------|--------|
| | Depth of field (mm) *2 | 3.8 | 2.0 | 1.6 | 1.0 | 1.0 |
| Resolution (μm) *3 | 9.59 | 8.39 | 6.71 | 6.10 | 6.10 | 5.69 |
| TV distortion | 0.03 % | -0.04 % | 0.06 % | 0.04 % | 0.04 % | 0.02 % |
| Maximum sensor size | 1.1 inch | | | | | |

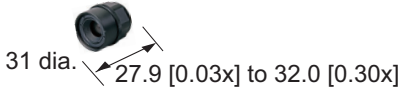
*1. The working distance is the distance from the end of the lens to the sensor.

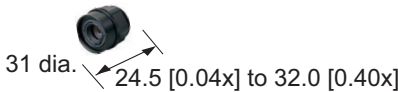
*2. The depth of field is calculated using a permissible circle of confusion diameter of 0.04 mm.


*3. The resolution is calculated using a wavelength of 550 nm.


3-4-10 Vibration and Shock Resistant C-mount Lens for 2/3-inch Image Sensor (VS-MCA Series)


Specification


| Model | 3Z4S-LE VS-MCA15-□□□□*1 | | | | | | | | |
|---|--|-------|-------|-------|------|------|-------|-----|-----|
| Appearance/ Dimensions (Unit: mm) |  | | | | | | | | |
| Focal length (mm) | 15 | | | | | | | | |
| Filter size | M27.0 P0.5 | | | | | | | | |
| Optical magnification | 0.03x | | | 0.20x | | | 0.30x | | |
| Aperture (fixed F No.) | 2 | 5.6 | 8 | 2 | 5.6 | 8 | 2 | 5.6 | 8 |
| Depth of field (mm) *2 | 186.7 | 515.6 | 728.9 | 4.8 | 13.4 | 19.2 | 2.3 | 6.5 | 9.2 |
| Maximum sensor size | 2/3 inch | | | | | | | | |
| Mount | C mount | | | | | | | | |


| Model | 3Z4S-LE VS-MCA20-□□□□*1 | | | | | | | | |
|---|---|-------|-------|-------|-----|------|-------|-----|-----|
| Appearance/ Dimensions (Unit: mm) |  | | | | | | | | |
| Focal length (mm) | 20 | | | | | | | | |
| Filter size | M27.0 P0.5 | | | | | | | | |
| Optical magnification | 0.04x | | | 0.25x | | | 0.40x | | |
| Aperture (fixed F No.) | 2 | 5.6 | 8 | 2 | 5.6 | 8 | 2 | 5.6 | 8 |
| Depth of field (mm) *2 | 105.0 | 290.0 | 415.0 | 3.2 | 9.0 | 12.8 | 1.5 | 3.9 | 5.6 |
| Maximum sensor size | 2/3 inch | | | | | | | | |
| Mount | C mount | | | | | | | | |

| Model | 3Z4S-LE VS-MCA25-□□□□*1 | | | | | | | | |
|---|---|-------|-------|-------|-----|------|-------|-----|-----|
| Appearance/ Dimensions (Unit: mm) |  31 dia. 27.0 [0.05x] to 38.5 [0.50x] | | | | | | | | |
| Focal length (mm) | 25 | | | | | | | | |
| Filter size | M27.0 P0.5 | | | | | | | | |
| Optical magnification | 0.05x | | | 0.25x | | | 0.50x | | |
| Aperture (fixed F No.) | 2 | 5.6 | 8 | 2 | 5.6 | 8 | 2 | 5.6 | 8 |
| Depth of field (mm) ^{*2} | 67.2 | 188.8 | 268.8 | 3.2 | 9.0 | 12.8 | 1.0 | 2.7 | 3.8 |
| Maximum sensor size | 2/3 inch | | | | | | | | |
| Mount | C mount | | | | | | | | |

| Model | 3Z4S-LE VS-MCA30-□□□□*1 | | | | | | | | |
|---|--|-------|-------|-------|------|------|-------|-----|-----|
| Appearance/ Dimensions (Unit: mm) |  31 dia. 24.5 [0.06x] to 36.2 [0.45x] | | | | | | | | |
| Focal length (mm) | 30 | | | | | | | | |
| Filter size | M27.0 P0.5 | | | | | | | | |
| Optical magnification | 0.06x | | | 0.15x | | | 0.45x | | |
| Aperture (fixed F No.) | 2 | 5.6 | 8 | 2 | 5.6 | 8 | 2 | 5.6 | 8 |
| Depth of field (mm) ^{*2} | 53.3 | 131.1 | 188.9 | 8.2 | 22.8 | 32.7 | 1.3 | 3.2 | 4.6 |
| Maximum sensor size | 2/3 inch | | | | | | | | |
| Mount | C mount | | | | | | | | |

| Model | 3Z4S-LE VS-MCA35-□□□□*1 | | | | | | | | |
|---|---|-----|------|-------|-----|-----|-------|-----|-----|
| Appearance/ Dimensions (Unit: mm) |  31 dia. 32.0 [0.26x] to 45.7 [0.65x] | | | | | | | | |
| Focal length (mm) | 35 | | | | | | | | |
| Filter size | M27.0 P0.5 | | | | | | | | |
| Optical magnification | 0.26x | | | 0.30x | | | 0.65x | | |
| Aperture (fixed F No.) | 2 | 5.6 | 8 | 2 | 5.6 | 8 | 2 | 5.6 | 8 |
| Depth of field (mm) ^{*2} | 3.0 | 8.4 | 12.0 | 2.2 | 6.5 | 9.2 | 0.7 | 1.7 | 2.5 |
| Maximum sensor size | 2/3 inch | | | | | | | | |
| Mount | C mount | | | | | | | | |

| Model | 3Z4S-LE VS-MCA50-□□□□*1 | | | | | | | | |
|---|---|------|-------|-------|------|------|-------|-----|-----|
| Appearance/ Dimensions (Unit: mm) |  31 dia. 44.0 [0.08x] to 63.4 [0.48x] | | | | | | | | |
| Focal length (mm) | 50 | | | | | | | | |
| Filter size | M27.0 P0.5 | | | | | | | | |
| Optical magnification | 0.08x | | | 0.20x | | | 0.48x | | |
| Aperture (fixed F No.) | 2 | 5.6 | 8 | 2 | 5.6 | 8 | 2 | 5.6 | 8 |
| Depth of field (mm) *2 | 32.5 | 75.0 | 107.5 | 6.0 | 13.4 | 19.2 | 1.3 | 2.9 | 4.1 |
| Maximum sensor size | 2/3 inch | | | | | | | | |
| Mount | C mount | | | | | | | | |

| Model | 3Z4S-LE VS-MCA75-□□□□*1 | | | | | | | | |
|---|---|------|------|-------|------|------|-------|-----|-----|
| Appearance/ Dimensions (Unit: mm) |  31 dia. 70.0 [0.14x] to 105.5 [0.62x] | | | | | | | | |
| Focal length (mm) | 75 | | | | | | | | |
| Filter size | M27.0 P0.5 | | | | | | | | |
| Optical magnification | 0.14x | | | 0.20x | | | 0.62x | | |
| Aperture (fixed F No.) | 2 | 5.6 | 8 | 2 | 5.6 | 8 | 2 | 5.6 | 8 |
| Depth of field (mm) *2 | 16.7 | 28.6 | 41.2 | 9.2 | 13.4 | 19.2 | 1.3 | 2.5 | 3.6 |
| Maximum sensor size | 2/3 inch | | | | | | | | |
| Mount | C mount | | | | | | | | |

*1. Insert the aperture into □□□□ in the model number as follows.

F=2.0: blank

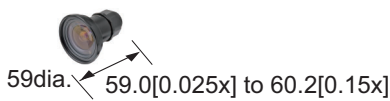
F=5: F5.6

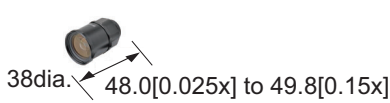
F=8: F8

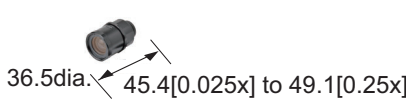
*2. When circle of least confusion is 0.04mm.

3-4-11 Vibration and Shock Resistant C-mount Lens for 1-inch Image Sensor (VS-MCH1 Series)

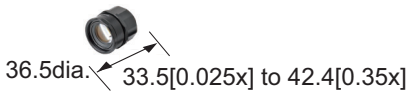
Specification

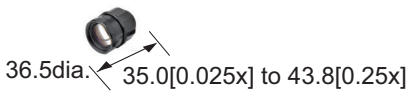
| Model | 3Z4S-LE VS-MC08H1-□□□□□*1 | | | | | | | | |
|---|---|-------|--------|-------|------|------|-------|------|------|
| Appearance/ Dimensions (Unit: mm) |  59dia. 59.0[0.025x] to 60.2[0.15x] | | | | | | | | |
| Focal length (mm) | 8 | | | | | | | | |
| Filter size | M55.0 P0.75 | | | | | | | | |
| Optical magnification | 0.025x | | | 0.10x | | | 0.15x | | |
| Aperture (fixed F No.) ^{*2} | 1.4 | 5.6 | 8 | 1.4 | 5.6 | 8 | 1.4 | 5.6 | 8 |
| Depth of field (mm) ^{*3} | 179.0 | 735.0 | 1050.0 | 12.0 | 49.3 | 70.4 | 5.7 | 22.9 | 32.7 |
| Maximum sensor size | 1 inch | | | | | | | | |
| Mount | C mount | | | | | | | | |

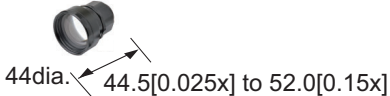
| Model | 3Z4S-LE VS-MC12H1-□□□□□*1 | | | | | | | | |
|---|---|-------|--------|-------|------|------|-------|------|------|
| Appearance/ Dimensions (Unit: mm) |  38dia. 48.0[0.025x] to 49.8[0.15x] | | | | | | | | |
| Focal length (mm) | 12 | | | | | | | | |
| Filter size | M35.5 P0.5 | | | | | | | | |
| Optical magnification | 0.025x | | | 0.10x | | | 0.15x | | |
| Aperture (fixed F No.) ^{*2} | 1.4 | 5.6 | 8 | 1.4 | 5.6 | 8 | 1.4 | 5.6 | 8 |
| Depth of field (mm) ^{*3} | 179.0 | 735.0 | 1050.0 | 12.0 | 49.3 | 70.4 | 5.7 | 22.9 | 32.7 |
| Maximum sensor size | 1 inch | | | | | | | | |
| Mount | C mount | | | | | | | | |

| Model | 3Z4S-LE VS-MC16H1-□□□□□*1 | | | | | | | | |
|---|---|--|--|-------|--|--|-------|--|--|
| Appearance/ Dimensions (Unit: mm) |  36.5dia. 45.4[0.025x] to 49.1[0.25x] | | | | | | | | |
| Focal length (mm) | 16 | | | | | | | | |
| Filter size | M30.5 P0.5 | | | | | | | | |
| Optical magnification | 0.025x | | | 0.10x | | | 0.25x | | |

| Model | 3Z4S-LE VS-MC16H1-□□□□□*1 | | | | | | | | |
|--------------------------|---------------------------|-------|--------|------|------|------|-----|-----|------|
| Aperture (fixed F No.)*2 | 1.4 | 5.6 | 8 | 1.4 | 5.6 | 8 | 1.4 | 5.6 | 8 |
| Depth of field (mm) *3 | 179.0 | 735.0 | 1050.0 | 12.0 | 49.3 | 70.4 | 2.3 | 9.0 | 12.8 |
| Maximum sensor size | 1 inch | | | | | | | | |
| Mount | C mount | | | | | | | | |

| Model | 3Z4S-LE VS-MC25H1-□□□□□*1 | | | | | | | | |
|---|---|-------|--------|-------|------|------|-------|-----|-----|
| Appearance/ Dimensions (Unit: mm) |  | | | | | | | | |
| Focal length (mm) | 25 | | | | | | | | |
| Filter size | M30.5 P0.5 | | | | | | | | |
| Optical magnification | 0.025x | | | 0.10x | | | 0.35x | | |
| Aperture (fixed F No.)*2 | 1.4 | 5.6 | 8 | 1.4 | 5.6 | 8 | 1.4 | 5.6 | 8 |
| Depth of field (mm) *3 | 179.0 | 735.0 | 1050.0 | 12.0 | 49.3 | 70.4 | 1.2 | 4.9 | 7.1 |
| Maximum sensor size | 1 inch | | | | | | | | |
| Mount | C mount | | | | | | | | |

| Model | 3Z4S-LE VS-MC35H1-□□□□□*1 | | | | | | | | |
|---|---|-------|--------|-------|------|------|-------|-----|------|
| Appearance/ Dimensions (Unit: mm) |  | | | | | | | | |
| Focal length (mm) | 35 | | | | | | | | |
| Filter size | M30.5 P0.5 | | | | | | | | |
| Optical magnification | 0.025x | | | 0.10x | | | 0.25x | | |
| Aperture (fixed F No.)*2 | 1.4 | 5.6 | 8 | 1.4 | 5.6 | 8 | 1.4 | 5.6 | 8 |
| Depth of field (mm) *3 | 179.0 | 735.0 | 1050.0 | 12.0 | 49.3 | 70.4 | 2.3 | 9.0 | 12.8 |
| Maximum sensor size | 1 inch | | | | | | | | |
| Mount | C mount | | | | | | | | |

| Model | 3Z4S-LE VS-MC50H1-□□□□□*1 | | | | | | | | |
|---|---|--|--|--|--|--|--|--|--|
| Appearance/ Dimensions (Unit: mm) |  | | | | | | | | |
| Focal length (mm) | 50 | | | | | | | | |

| Model | 3Z4S-LE VS-MC50H1-□□□□□*1 | | | | | | | | |
|--------------------------------------|---------------------------|-------|--------|-------|------|------|-------|------|------|
| Filter size | M40.5 P0.5 | | | | | | | | |
| Optical magnification | 0.025x | | | 0.10x | | | 0.15x | | |
| Aperture (fixed F No.) ^{*2} | 1.4 | 5.6 | 8 | 1.4 | 5.6 | 8 | 1.4 | 5.6 | 8 |
| Depth of field (mm) ^{*3} | 179.0 | 735.0 | 1050.0 | 12.0 | 49.3 | 70.4 | 5.7 | 22.9 | 32.7 |
| Maximum sensor size | 1 inch | | | | | | | | |
| Mount | C mount | | | | | | | | |

*1. Insert the aperture into □□□□□ in the model number as follows.

F = 1.4: blank

F = 5.6: FN056


F = 8: FN080


*2. F-number can be selected from maximum aperture, 5.6, and 8.0.

*3. When circle of least confusion is 40 μm.


3-4-12 Vibration and Shock Resistant M42-mount Lens for 1.8-inch Image Sensor (VS-MCL/M42-10 Series)


Specification


| Model | 3Z4S-LE VS-MCL18-□□□□□/M42-10*1 | | | | | | | | |
|--------------------------------------|--|-------|--------|-------|------|------|-------|-----|------|
| Appearance/Dimensions (Unit: mm) |  52dia 91.5 [0.025x] to 96.1 [0.25x] | | | | | | | | |
| Focal length (mm) | 18 | | | | | | | | |
| Filter size | M46.0 P0.75 | | | | | | | | |
| Optical magnification | 0.025x | | | 0.10x | | | 0.25x | | |
| Aperture (fixed F No.) ^{*2} | 2.8 | 5.6 | 8 | 2.8 | 5.6 | 8 | 2.8 | 5.6 | 8 |
| Depth of field (mm) ^{*3} | 367.0 | 735.0 | 1050.0 | 24.6 | 49.3 | 70.4 | 4.5 | 9.0 | 12.8 |
| Maximum sensor size | 1.8 inch | | | | | | | | |
| Mount | M42 mount | | | | | | | | |


| Model | 3Z4S-LE VS-MCL25-□□□□□/M42-10*1 | | | | | | | | |
|----------------------------------|---|--|--|--|--|--|--|--|--|
| Appearance/Dimensions (Unit: mm) |  52dia. 72.0 [0.025x] to 82.3 [0.40x] | | | | | | | | |
| Focal length (mm) | 25 | | | | | | | | |
| Filter size | M46.0 P0.75 | | | | | | | | |

| Model | 3Z4S-LE VS-MCL25-□□□□□/M42-10*1 | | | | | | | | |
|--------------------------|---------------------------------|-------|--------|-------|------|------|-------|-----|-----|
| Optical magnification | 0.025x | | | 0.10x | | | 0.40x | | |
| Aperture (fixed F No.)*2 | 2.6 | 5.6 | 8 | 2.6 | 5.6 | 8 | 2.6 | 5.6 | 8 |
| Depth of field (mm) *3 | 367.0 | 735.0 | 1050.0 | 24.6 | 49.3 | 70.4 | 1.8 | 3.9 | 5.6 |
| Maximum sensor size | 1.8 inch | | | | | | | | |
| Mount | M42 mount | | | | | | | | |

| Model | 3Z4S-LE VS-MCL35-□□□□□/M42-10*1 | | | | | | | | |
|-----------------------------------|---|-------|--------|-------|------|------|-------|-----|-----|
| Appearance/ Dimensions (Unit: mm) |  55dia. 99.5 [0.025x] to 117.6 [0.35x] | | | | | | | | |
| Focal length (mm) | 35 | | | | | | | | |
| Filter size | M52.0 P0.75 | | | | | | | | |
| Optical magnification | 0.025x | | | 0.20x | | | 0.50x | | |
| Aperture (fixed F No.)*2 | 2.8 | 5.6 | 8 | 2.8 | 5.6 | 8 | 2.8 | 5.6 | 8 |
| Depth of field (mm) *3 | 367.0 | 735.0 | 1050.0 | 6.5 | 13.4 | 19.2 | 2.0 | 3.9 | 5.6 |
| Maximum sensor size | 1.8 inch | | | | | | | | |
| Mount | M42 mount | | | | | | | | |

| Model | 3Z4S-LE VS-MCL50-□□□□□/M42-10*1 | | | | | | | | |
|-----------------------------------|---|-------|-------|-------|------|------|-------|-----|-----|
| Appearance/ Dimensions (Unit: mm) |  52dia. 64.0 [0.05x] to 82.0 [0.40x] | | | | | | | | |
| Focal length (mm) | 50 | | | | | | | | |
| Filter size | M46.0 P0.75 | | | | | | | | |
| Optical magnification | 0.05x | | | 0.20x | | | 0.40x | | |
| Aperture (fixed F No.)*2 | 2.8 | 5.6 | 8 | 2.8 | 5.6 | 8 | 2.8 | 5.6 | 8 |
| Depth of field (mm) *3 | 97.6 | 188.0 | 269.0 | 6.5 | 13.4 | 19.2 | 2.0 | 3.9 | 5.6 |
| Maximum sensor size | 1.8 inch | | | | | | | | |
| Mount | M42 mount | | | | | | | | |

| Model | 3Z4S-LE VS-MCL85-□□□□□/M42-10*1 | | | | | | | | |
|---|---|-------|-------|-------|-----|-----|-------|-----|-----|
| Appearance/ Dimensions (Unit: mm) |  52dia. 105.0 [0.05×] to 130.2 [0.35×] | | | | | | | | |
| Focal length (mm) | 85 | | | | | | | | |
| Filter size | M46.0 P0.75 | | | | | | | | |
| Optical magnification | 0.05x | | | 0.30x | | | 0.35x | | |
| Aperture (fixed F No.) ^{*2} | 4 | 5.6 | 8 | 4 | 5.6 | 8 | 4 | 5.6 | 8 |
| Depth of field (mm) ^{*3} | 134.0 | 188.0 | 269.0 | 4.6 | 6.5 | 9.2 | 3.5 | 4.9 | 7.1 |
| Maximum sensor size | 1.8 inch | | | | | | | | |
| Mount | M42 mount | | | | | | | | |

| Model | 3Z4S-LE VS-MCL100-□□□□□/M42-10*1 | | | | | | | | |
|---|--|-------|-------|-------|------|------|-------|-----|-----|
| Appearance/ Dimensions (Unit: mm) |  52dia. 110.0 [0.05×] to 135.0 [0.30×] | | | | | | | | |
| Focal length (mm) | 100 | | | | | | | | |
| Filter size | M46.0 P0.75 | | | | | | | | |
| Optical magnification | 0.05x | | | 0.20x | | | 0.30x | | |
| Aperture (fixed F No.) ^{*2} | 2.8 | 5.6 | 8 | 2.8 | 5.6 | 8 | 2.8 | 5.6 | 8 |
| Depth of field (mm) ^{*3} | 94.1 | 188.0 | 269.0 | 6.5 | 13.4 | 19.2 | 3.2 | 6.5 | 9.2 |
| Maximum sensor size | 1.8 inch | | | | | | | | |
| Mount | M42 mount | | | | | | | | |

*1. Insert the aperture into □□□□□ in the model number as follows.

F = 2.6 to 4.0: blank

F = 5.6: FN056

F = 8: FN080

*2. F-number can be selected from maximum aperture, 5.6, and 8.0.

*3. When circle of least confusion is 40 μm.

3-4-13 Non-telecentric Macro Lens for C-mount CamerasC (VS-MC Series)

Specification

| Model | | | 3Z4S-LE VS-MC01-330 | 3Z4S-LE VS-MC03-180 | 3Z4S-LE VS-MC05-130 | 3Z4S-LE VS-MC1-80 |
|--|---------------------------------|-----------------------|---------------------|---------------------|---------------------|-------------------|
| Optical magnification ($\pm 5\%$) | | | 0.1x | 0.3x | 0.5x | 1.0x |
| Field of view ($\pm 5\%$) (V x H) (mm) | FZ-S/SC | 1/3 inch equivalent | 48.0 x 36.0 | 16.0 x 12.0 | 9.6 x 7.2 | 4.8 x 3.6 |
| | FH-SM/SC FZ-SH/SHC | | | | | |
| | FH-SMX/SCX | 1/2.9 inch equivalent | 50.0 x 38.0 | 16.7 x 12.7 | 10.0 x 7.6 | 5.0 x 3.8 |
| | FH-SM05R/SC05R | 1/2.5 inch equivalent | 57.0 x 43.0 | 19.0 x 14.3 | 11.4 x 8.6 | 5.7 x 4.3 |
| | FZ-S2M/SC2M | 1/1.8 inch equivalent | 70.0 x 53.0 | 23.3 x 17.7 | 14.0 x 10.6 | 7.0 x 5.3 |
| | FH-SMX05/SCX05 FZ-S5M3/SC5M3 | 2/3 inch equivalent | 84.0 x 71.0 | 28.0 x 23.7 | 16.8 x 14.2 | 8.4 x 7.1 |
| WD (mm) | | | 325.5 | 184.8 | 126.3 | 82.4 |
| Effective FNO | | | 4.43 | 5.29 | 6.10 | 8.14 |
| Depth of field (mm) *1 | | | 35.4 | 4.7 | 2.0 | 0.7 |
| Resolution (μm) *2 | | | 30.5 | 11.6 | 8.2 | 5.5 |
| TV distortion | | | 0.01% max. | 0.00% max. | 0.00% max. | 0.00% max. |

*1. The depth of field is calculated using a permissible circle of confusion diameter of 0.04 mm.

*2. The resolution is calculated using a wavelength of 550 nm.

3-4-14 Extension Tubes

Specification

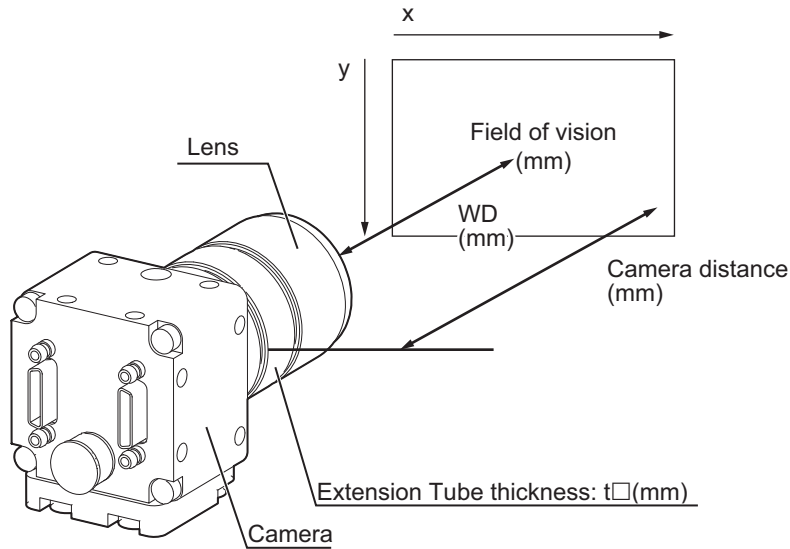
| Lenses | For M42 mount Lenses *1 | For C mount Lenses *1 | For Small Digital CCD Cameras |
|----------|---|--|---|
| Model | 3Z4S-LE VS-EXR/M42 | 3Z4S-LE SV-EXR | FZ-LESR |
| Contents | Set of 5 tubes (20 mm, 10 mm, 8 mm, 2 mm, and 1 mm) Maximum outer diameter: 47.5 mm dia. | Set of 7 tubes (40 mm, 20 mm, 10 mm, 5 mm, 2.0 mm, 1.0 mm, and 0.5 mm) Maximum outer diameter: 30 mm dia. | Set of 3 tubes (15 mm, 10 mm, 5 mm) Maximum outer diameter: 12 mm dia. |

*1. Do not use the 0.5-mm, 1.0-mm, and 2.0-mm Extension Tubes attached to each other. Since these Extension Tubes are placed over the threaded section of the Lens or other Extension Tube, the connection may loosen when more than one 0.5-mm, 1.0-mm or 2.0-mm Extension Tube are used together. Reinforcement is required to protect against vibration when Extension Tubes exceeding 30 mm are used. When using the Extension Tube, check it on the actual device before using it.

3-4-15 Meaning of Optical Chart

How-to View the Optical Chart

The X axis of the optical chart shows the field of vision (mm)^{*1}, The Y axis of the optical chart shows the camera installation distance (mm) or WD^{*2}.



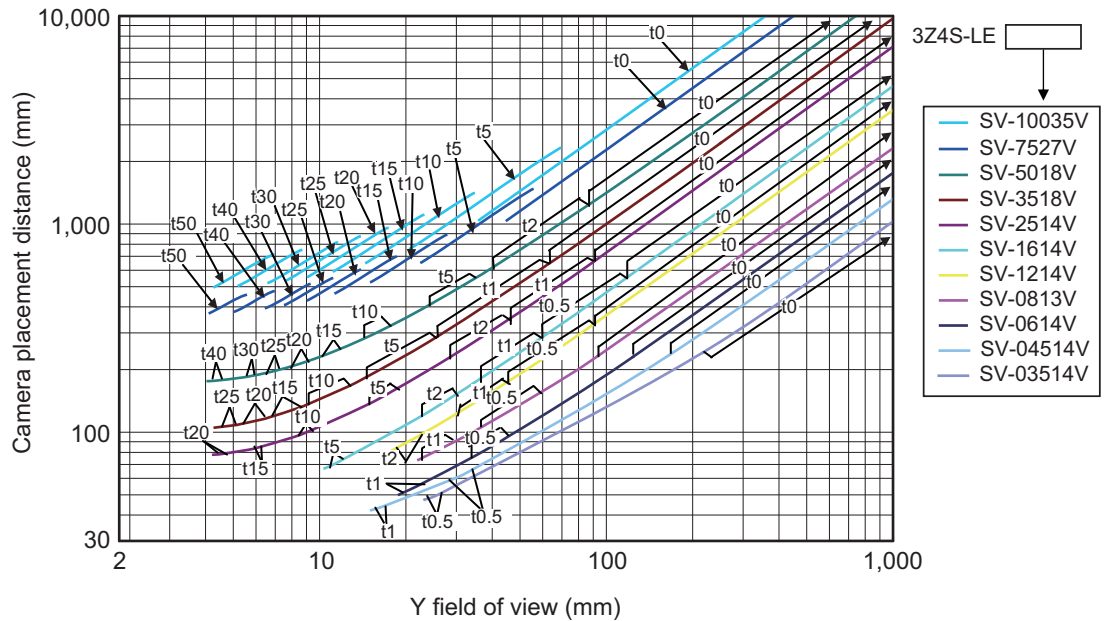
*1. The lengths of the fields of vision given in the optical charts are the lengths of the Y axis.

*2. The vertical axis represents WD for small cameras.

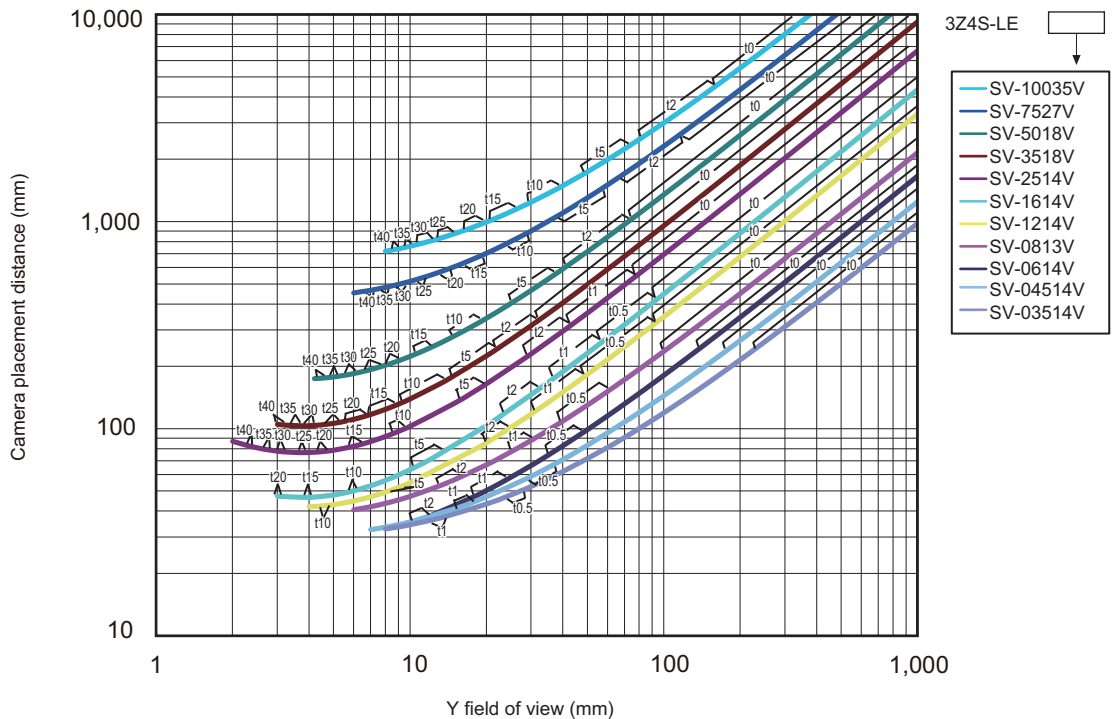
Optical Chart

● Normal Lenses

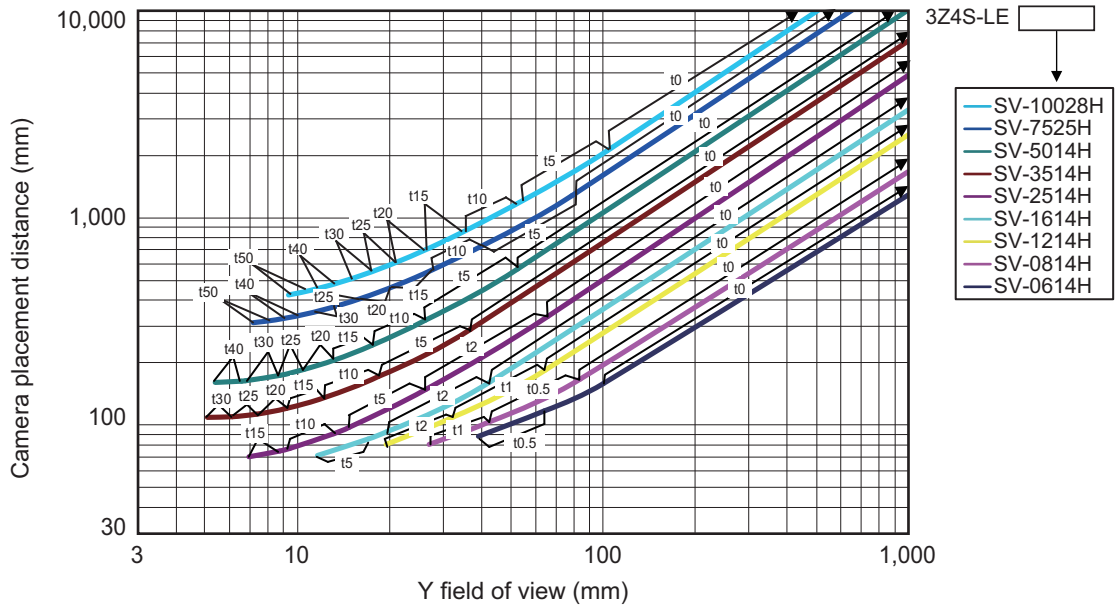
- a. Digital CCD Camera (Standalone): FZ-S□
- High-speed Digital CCD/CMOS Camera (Standalone): FZ-SH□/ FH-S□
- (Using 3Z4S-LE SV-V Series)



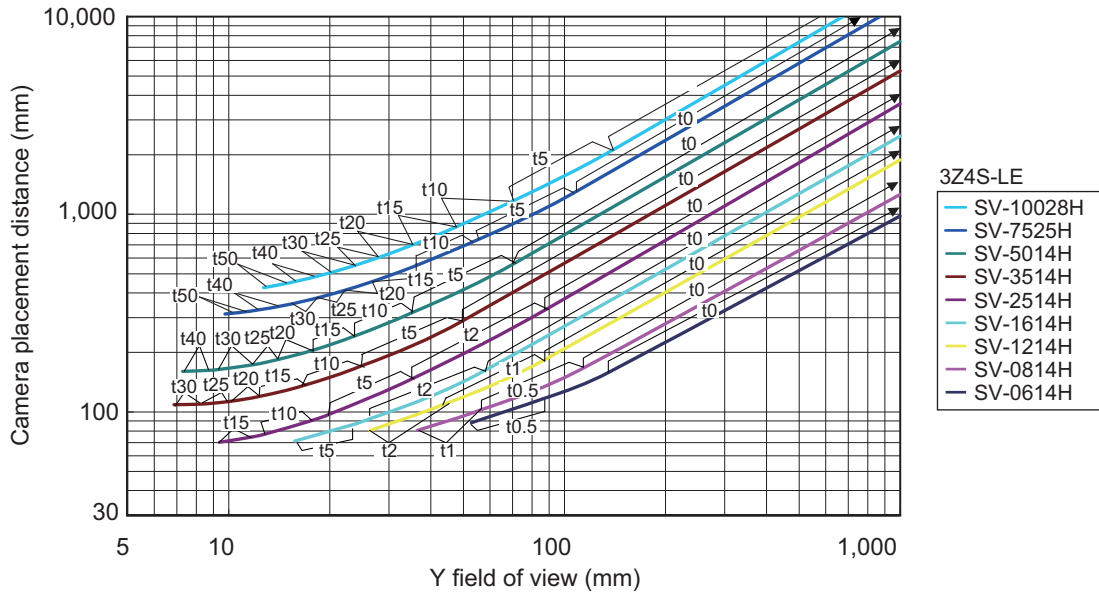
- b. High-speed Digital CMOS Camera (Standalone): FH-S□X / FH-S□X01
- (Using 3Z4S-LE SV-V Series)



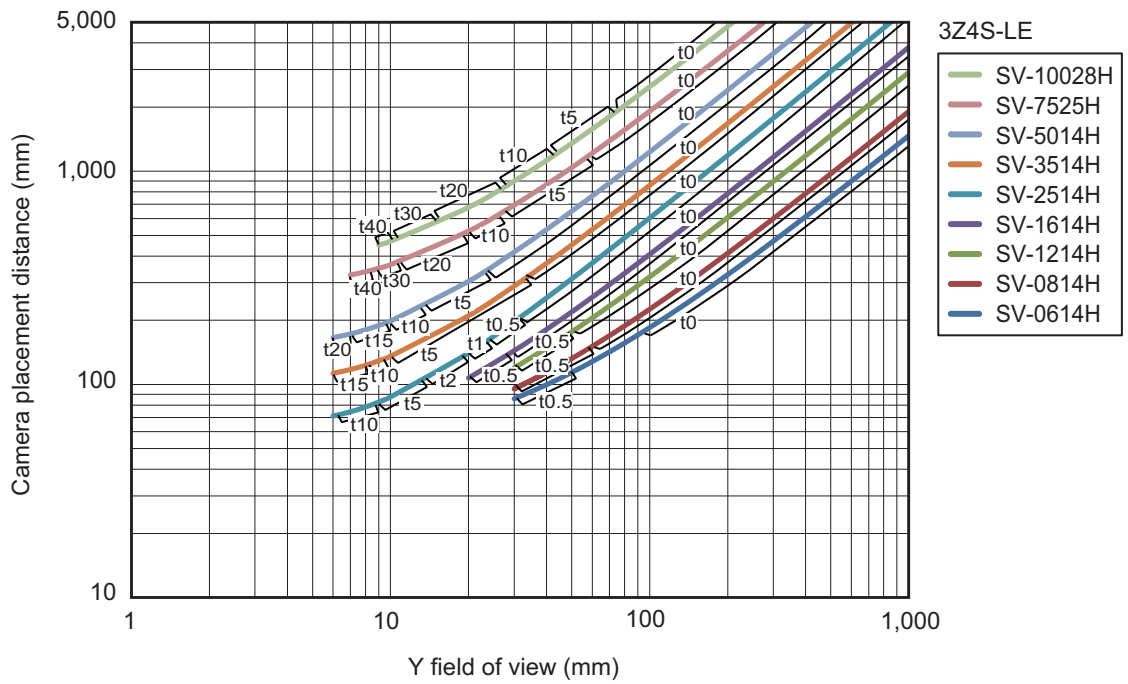
- c. Digital CCD Camera (Standalone): FZ-S□2M
 (Using 3Z4S-LE SV-H Series)



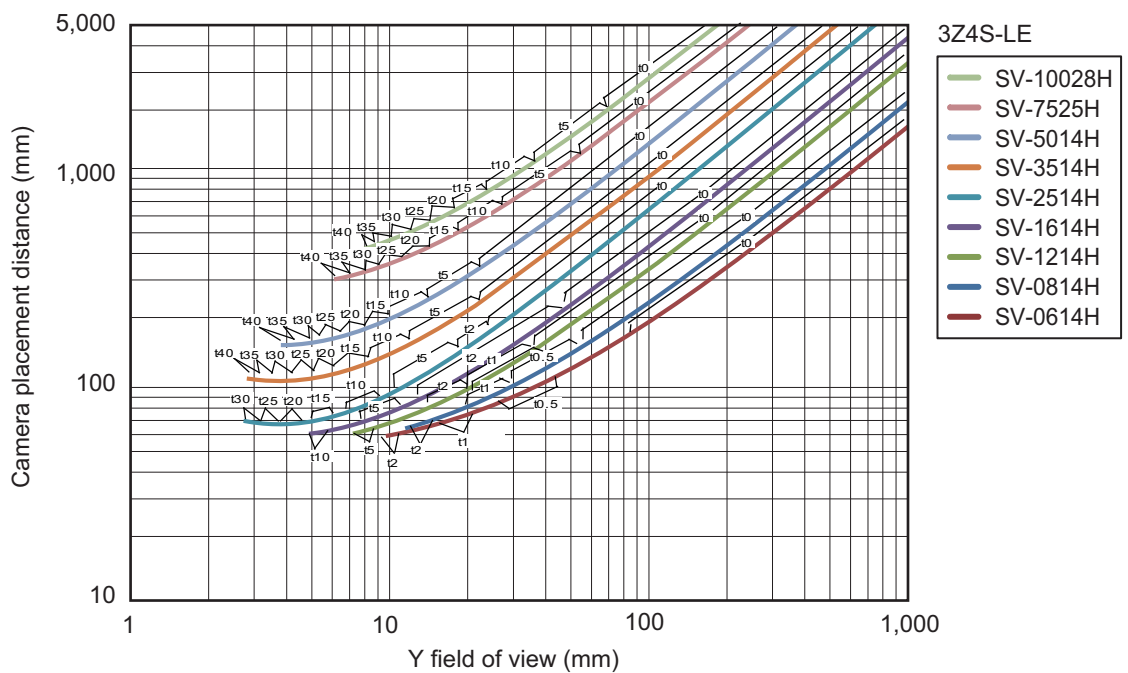
- d. Digital CCD/CMOS Camera (Standalone): FZ-S□5M3
 High-speed Digital CMOS Camera (Standalone): FH-S□X05
 (Using 3Z4S-LE SV-H Series)



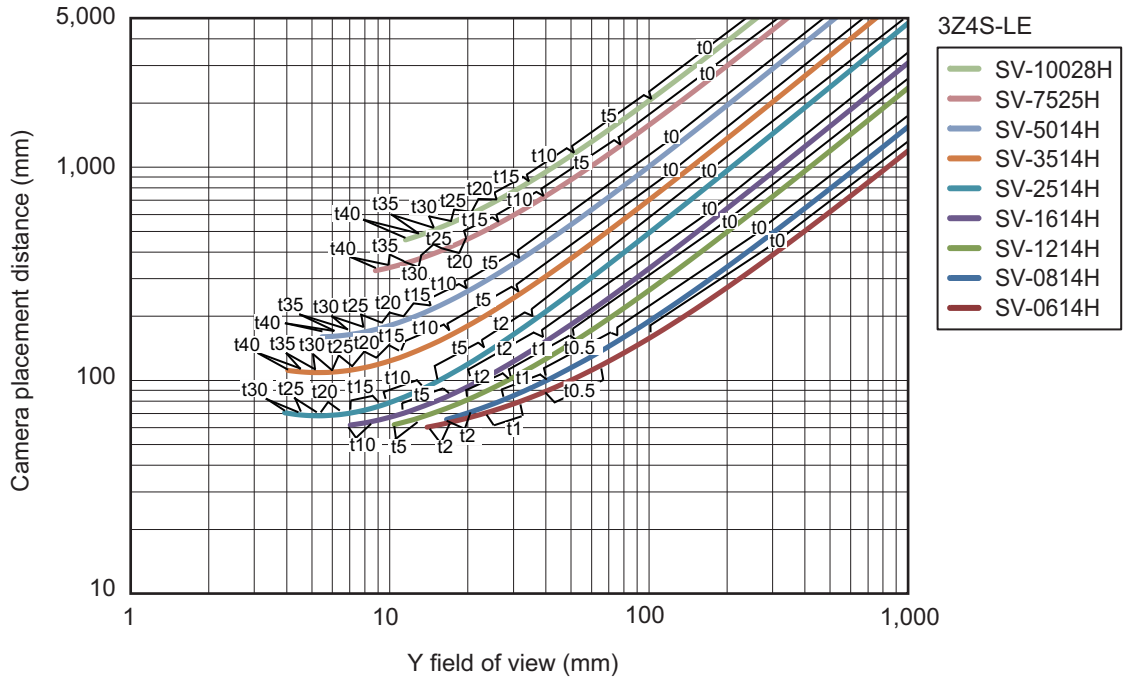
e. Digital CMOS Camera (Standalone): FH-S□05R
(Using 3Z4S-LE SV-H Series)



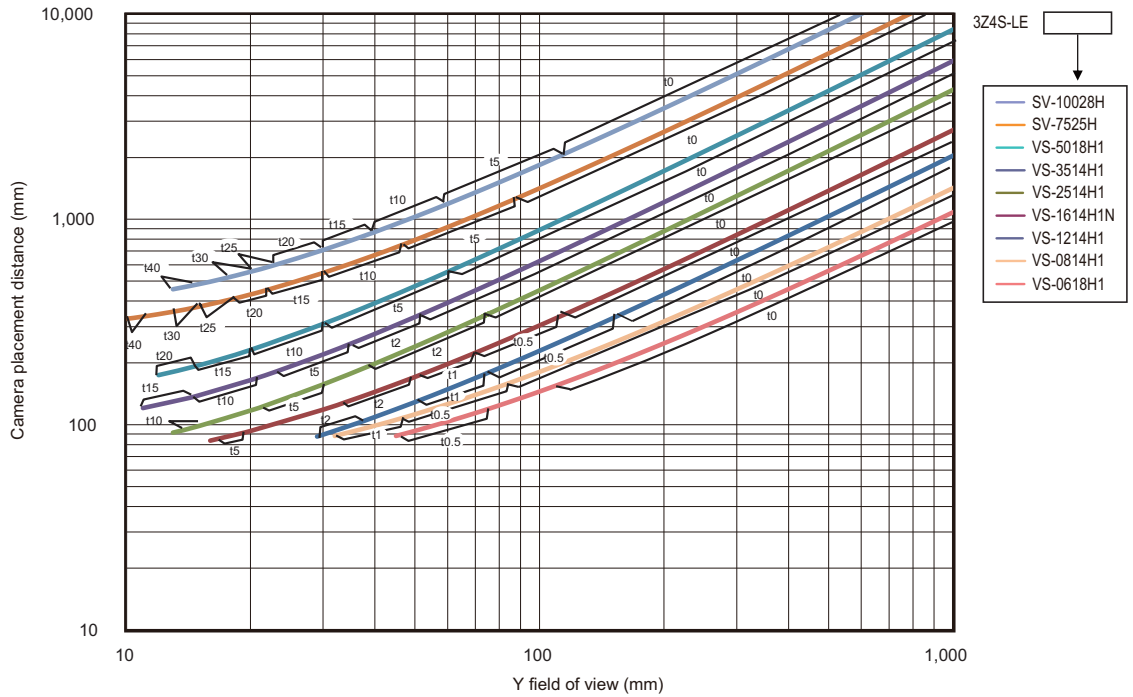
f. High-speed Digital CMOS Cameras (Standalone): FH-S□X01
(Using 3Z4S-LE SV-H Series)



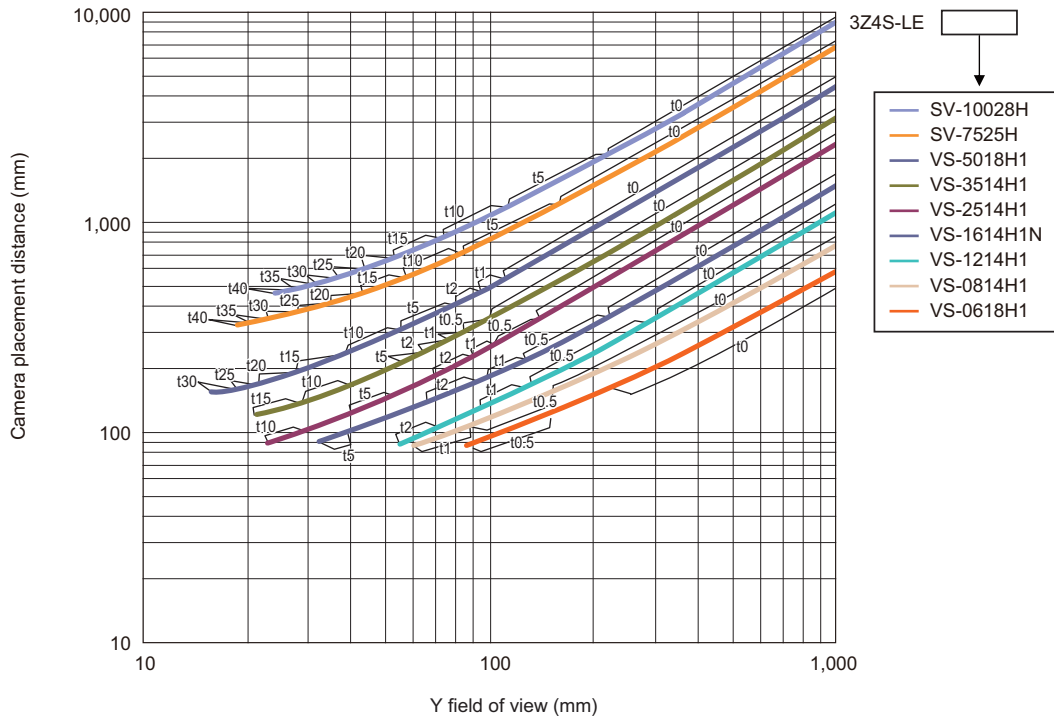
g. High-speed Digital CMOS Camera (Standalone): FH-S□X03
(Using 3Z4S-LE SV-H Series)



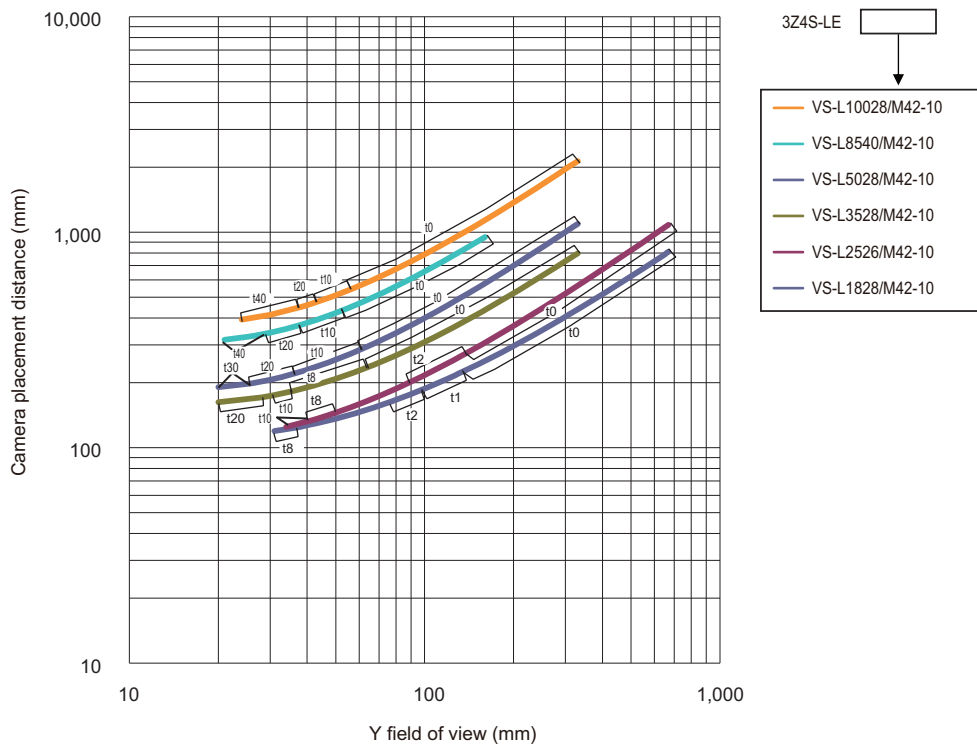
h. High-speed Digital CMOS Camera (Standalone): FH-S□02
(Using 3Z4S-LE SV-H/VS-H1 Series)



- i. High-speed Digital CMOS Camera (Standalone): FH-S□04
(Using 3Z4S-LE SV-H/VS-H1 Series)

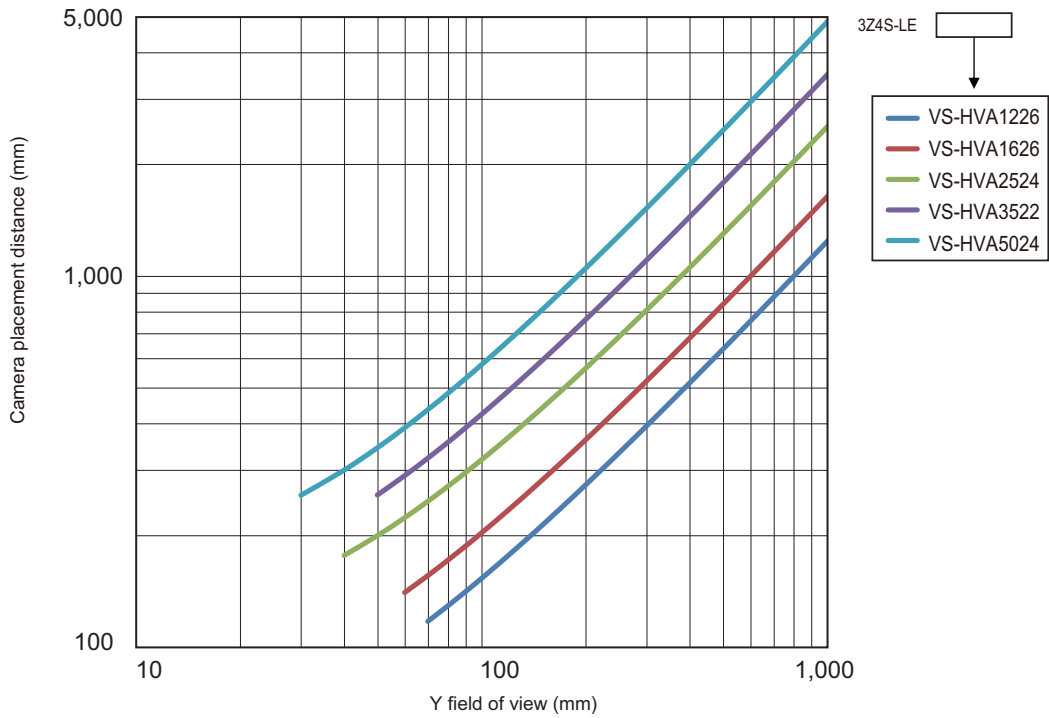


- j. High-speed Digital CMOS Camera (Standalone): FH-S□12
(Using 3Z4S-LE VS-L/M42-10 Series)



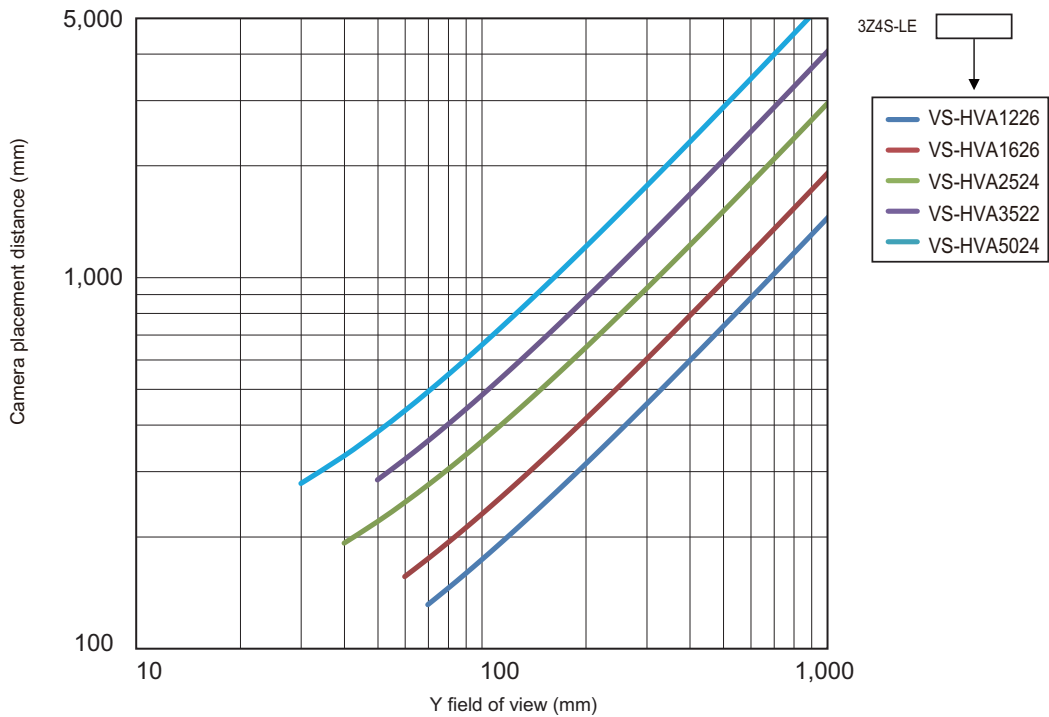
- k. High-speed Digital CMOS Camera (Standalone): FH-S□X12
(Using 3Z4S-LE VS-HVA)

Note: The 3Z4S-LE VS-HVA Series cannot be used with an extension tube.



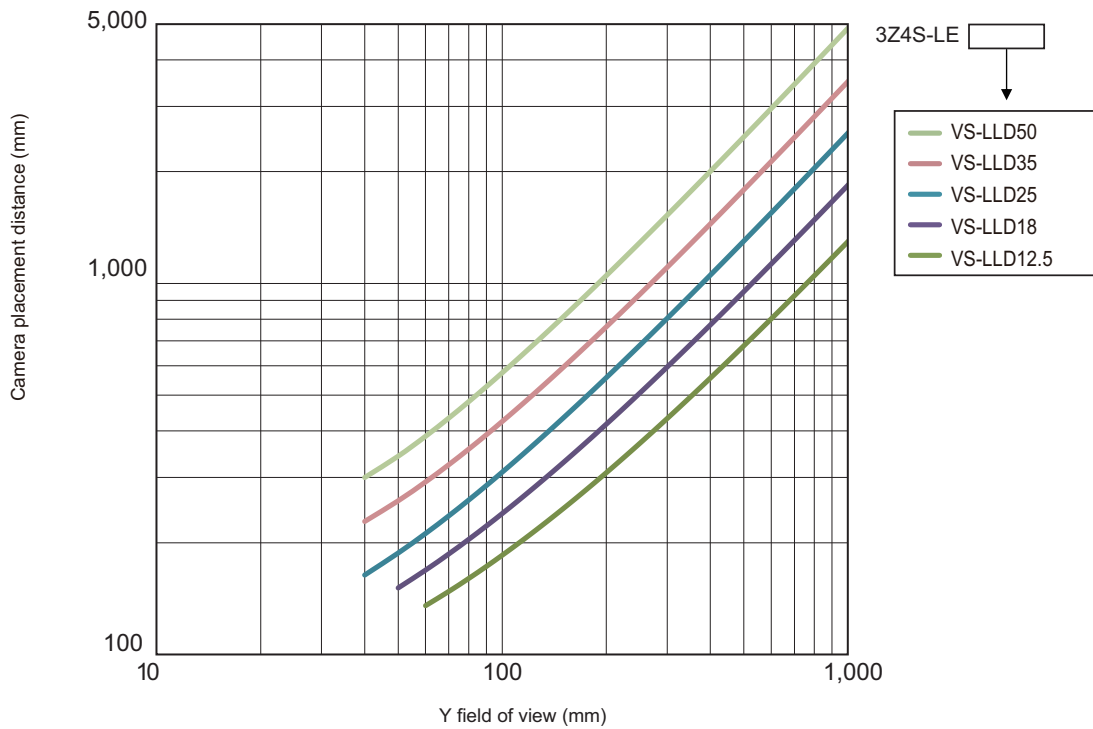
- l. Digital CMOS Camera (Standalone): FH-S□21R
(Using 3Z4S-LE VS-HVA)

Note: The 3Z4S-LE VS-HVA Series cannot be used with an extension tube.



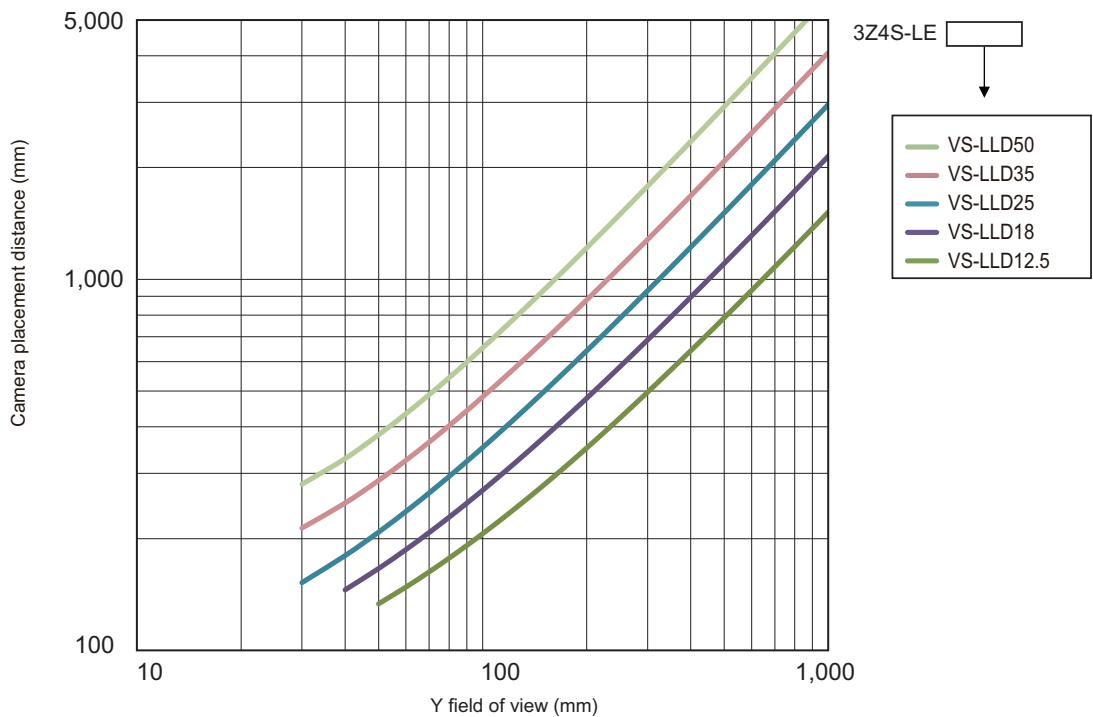
m. High-speed Digital CMOS Camera (Standalone): FH-S□X12
 (Using 3Z4S-LE VS-LLD Series)

Note: The 3Z4S-LE VS-LDD Series cannot be used with an extension tube.

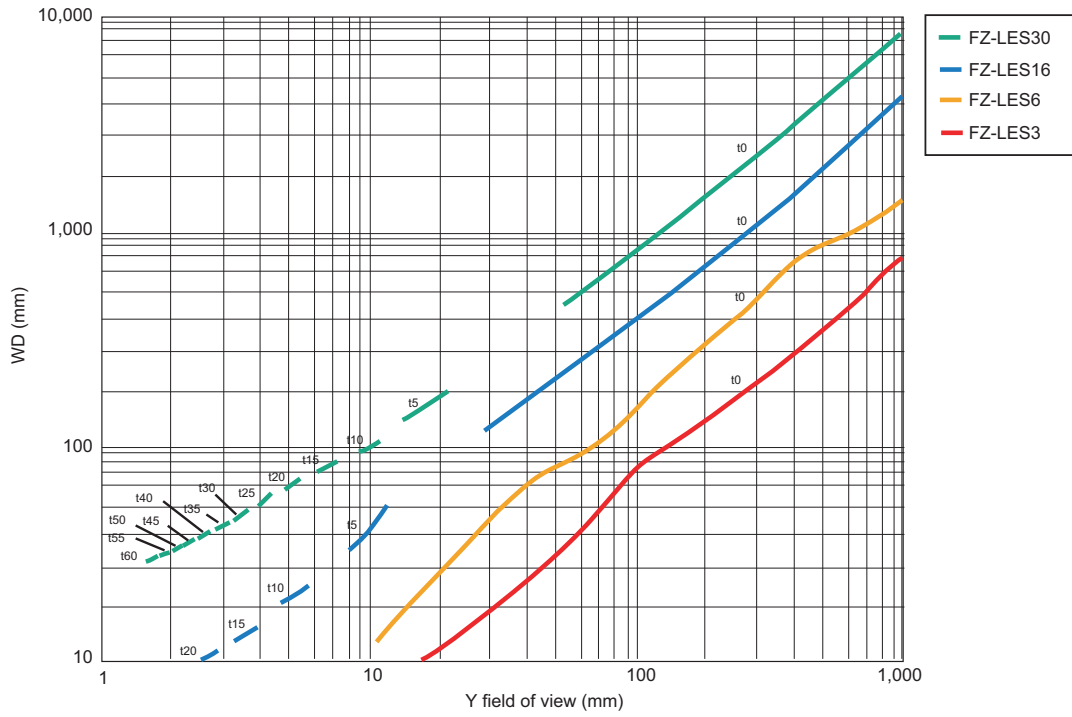


n. Digital CMOS Camera (Standalone): FH-S□21R
 (Using 3Z4S-LE VS-LLD Series)

Note: The 3Z4S-LE VS-LDD Series cannot be used with an extension tube.

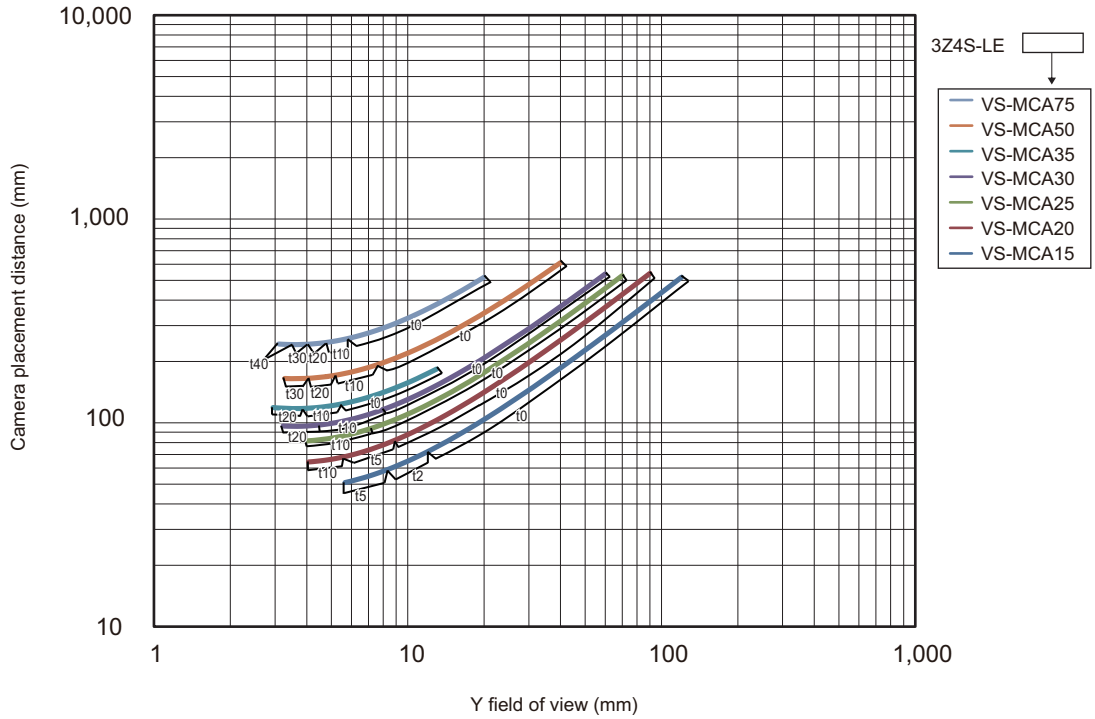


o. Small Digital CCD Cameras (Standalone): FZ-SF□ / FZ-SP□ (Using FZ-LES Series)

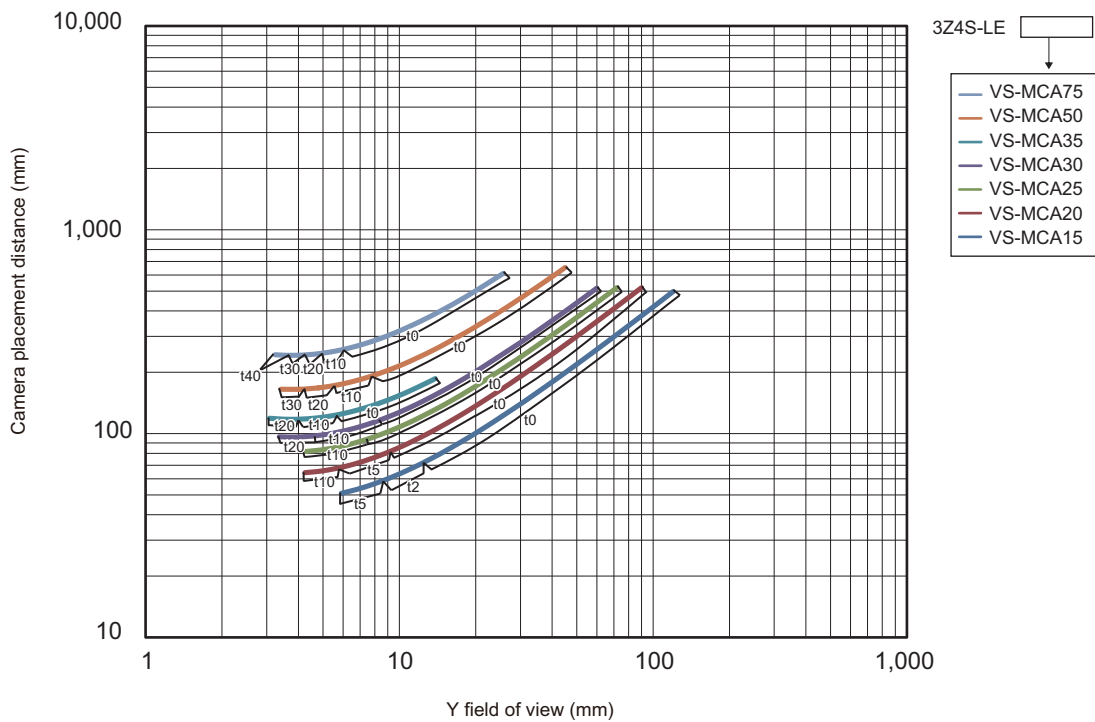


● **Vibration/Shock-resistance Lens**

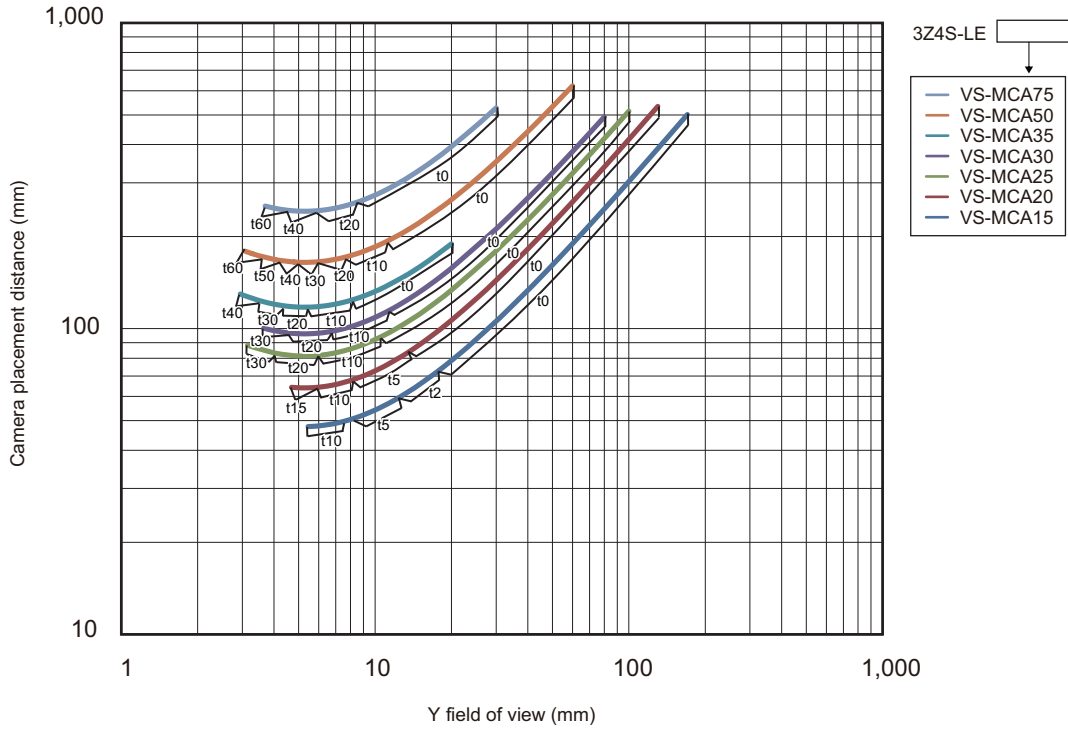
- a. Digital CCD Camera (Standalone): FZ-S□
 High-speed Digital CCD/CMOS Camera (Standalone): FZ-SH□/FH-S□
 (Using 3Z4S-LE VS-MCA Series)



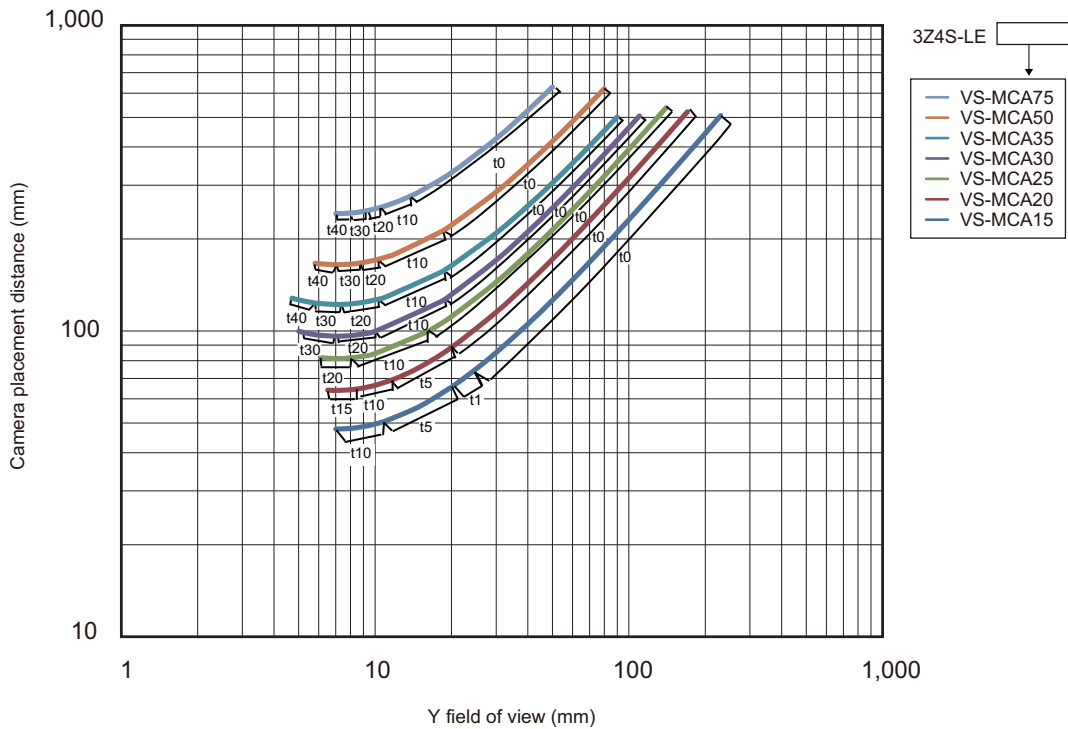
- b. High-speed Digital CMOS Camera (Standalone): FH-S□X / FH-S□X01
 (Using 3Z4S-LE VS-MCA Series)



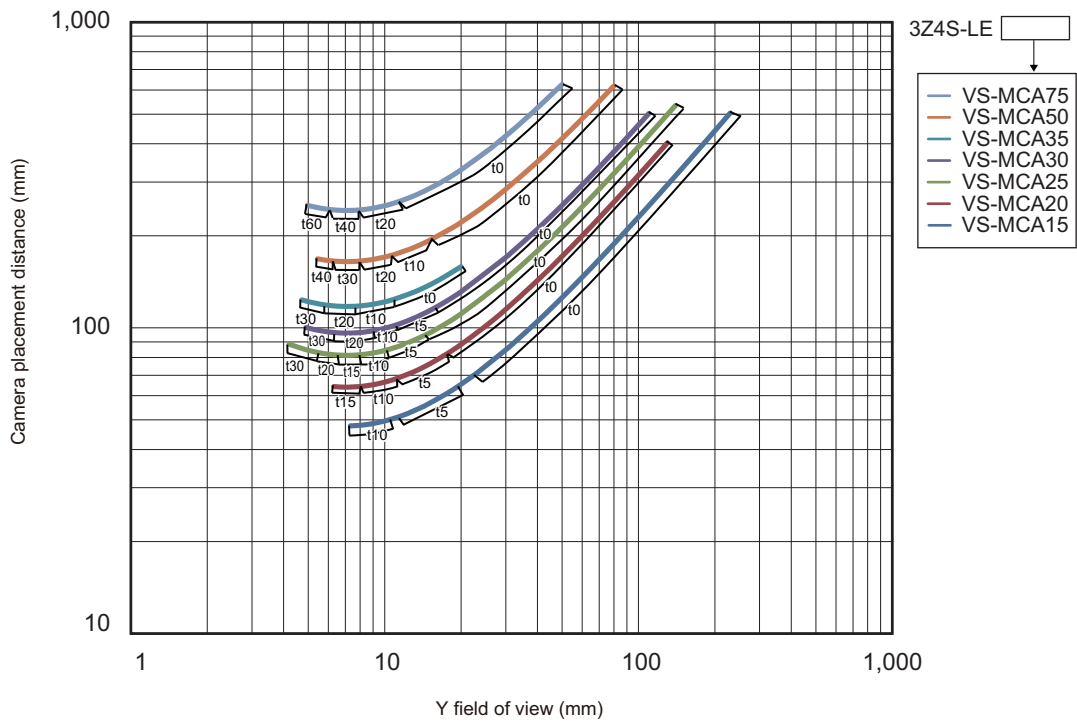
c. Digital CCD Camera (Standalone): FZ-S□2M
(Using 3Z4S-LE VS-MCA Series)



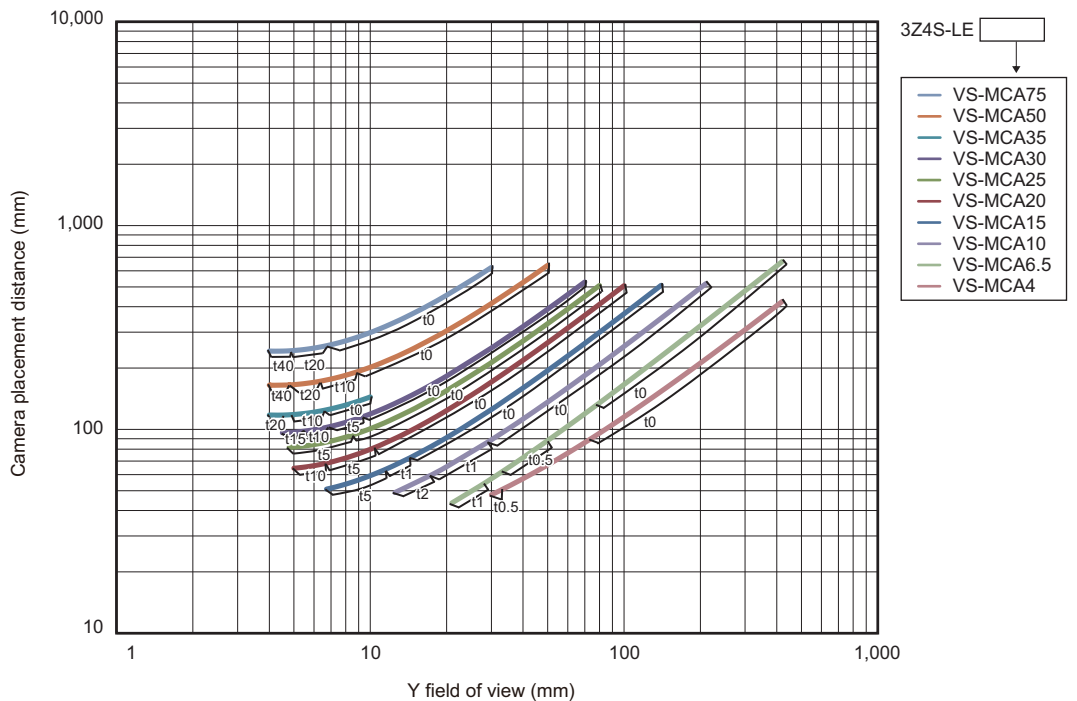
d. High-speed Digital CMOS Camera (Standalone): FH-S□X03
(Using 3Z4S-LE VS-MCA Series)



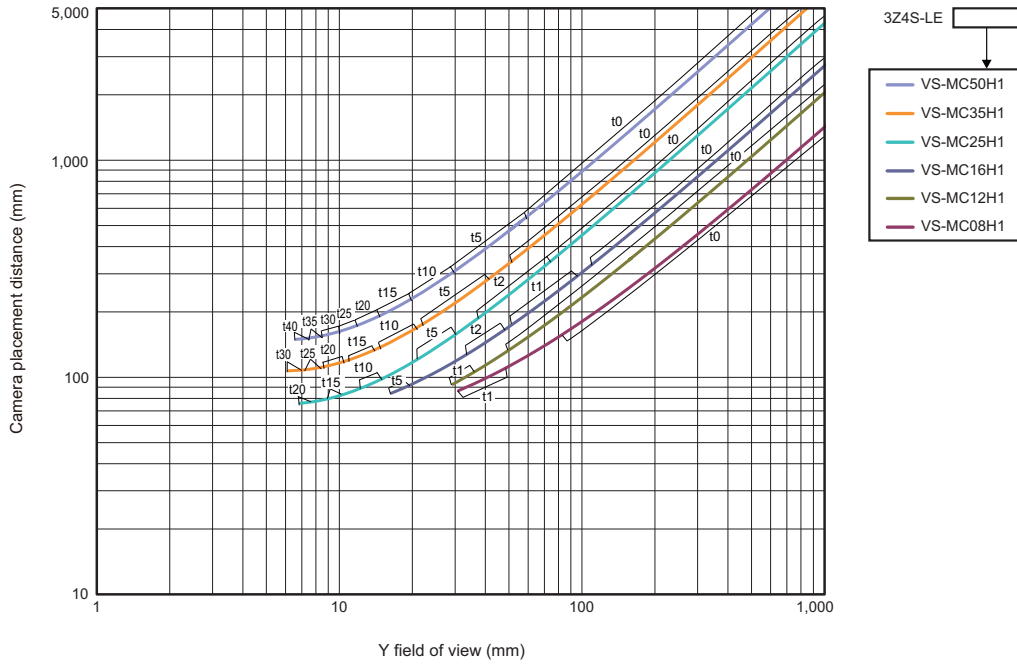
- e. Digital CCD/CMOS Camera (Standalone): FZ-S□5M3
 High-speed Digital CMOS Camera (Standalone): FH-S□X05
 (Using 3Z4S-LE VS-MCA Series)



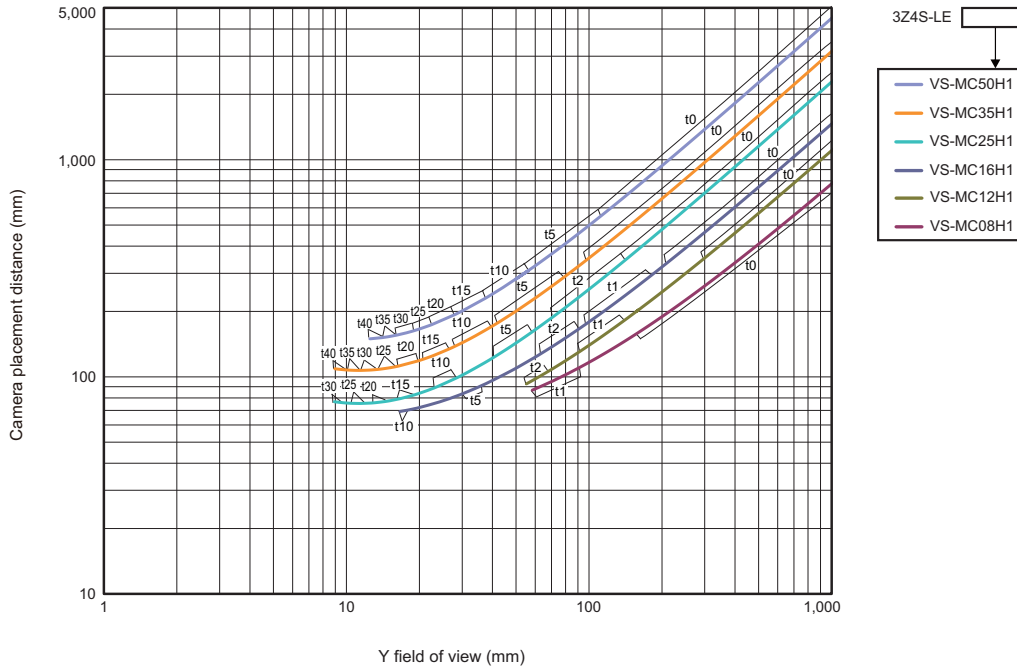
- f. Digital CMOS Camera (Standalone): FH-S□05R
 (Using 3Z4S-LE VS-MCA Series)



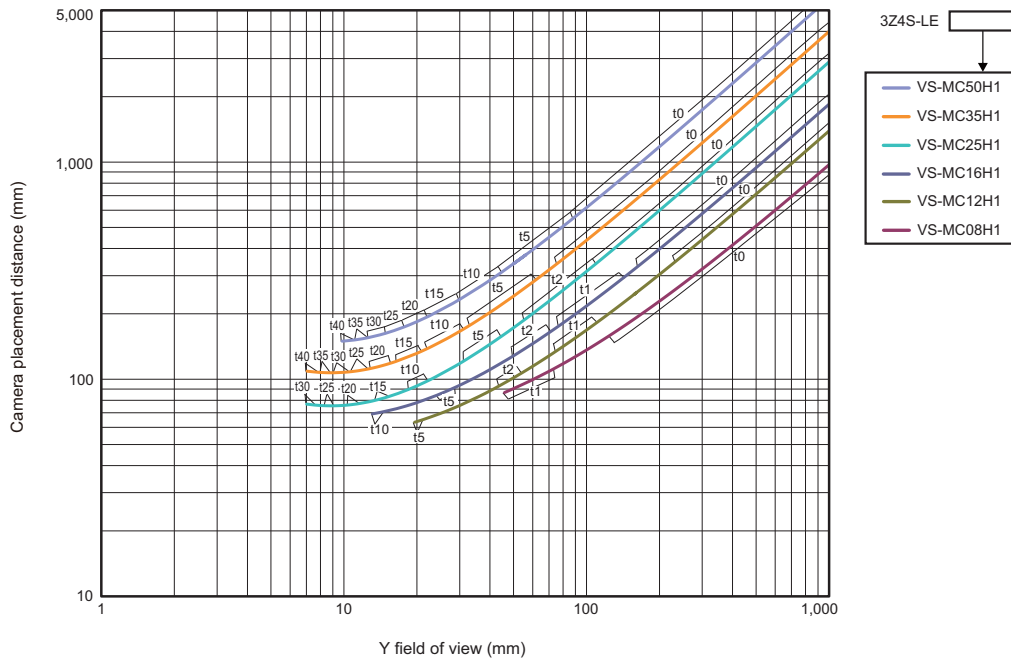
g. High-speed Digital CMOS Camera (Standalone): FH-S□02
(Using 3Z4S-LE VS-MCH1 Series)



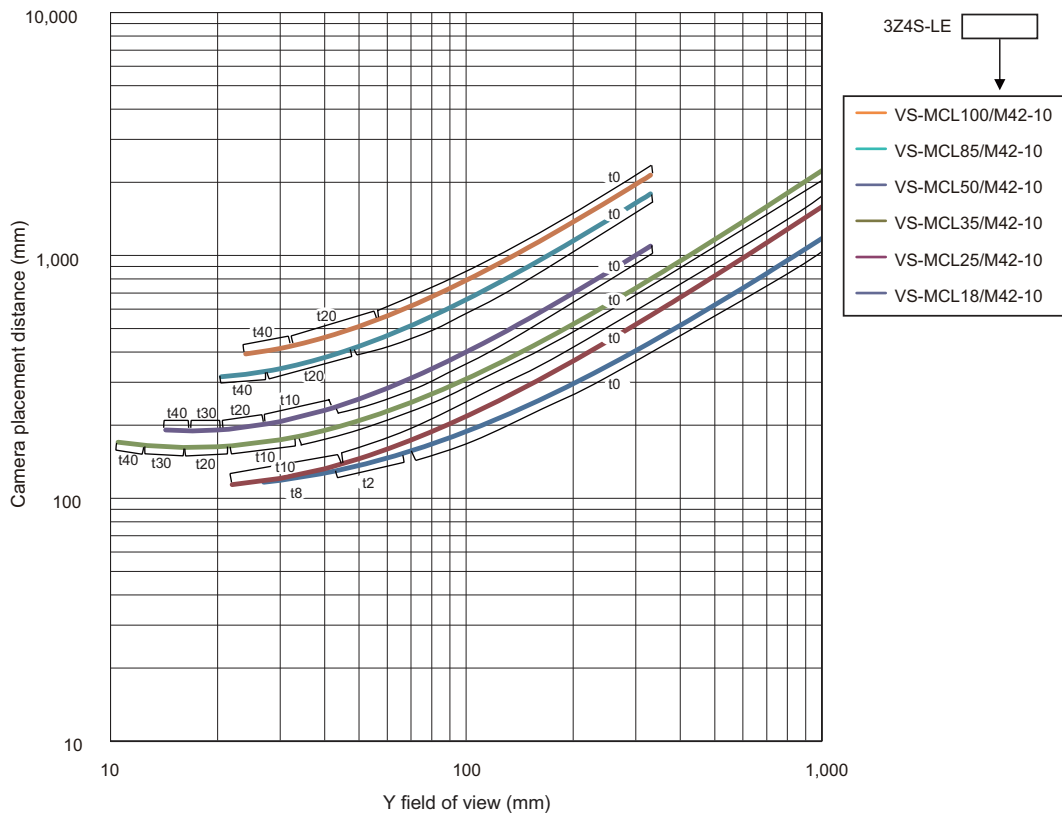
h. High-speed Digital CMOS Camera: (Standalone): FH-S□04
(Using 3Z4S-LE VS-MCH1 Series)



i. Digital CMOS Camera (Standalone): FH-S□21R
(Using 3Z4S-LE VS-MCH1 Series)



j. High-speed Digital CMOS Camera (Standalone): FH-S□12
(Using 3Z4S-LE VS-MCL/M42-10 Series)



3-5 Touch Panel Monitor and Cable

Touch Panel Monitor of FH-MT12 is connectable with FH-series sensor controller whose software is Ver. 5.32 or later.

For connection of Touch Panel Monitor and FH sensor controller, the monitor cable for video and touch panel cable are necessary.



Precautions for Safe Use

About connection of sensor controller and FH-MT12.

- Do not ground the plus (+) terminal of the 24 VDC power source when the sensor controller is connected to the FH-MT12 with a USB cable. Doing so may cause a short circuit of the internal circuit, resulting in a malfunction.

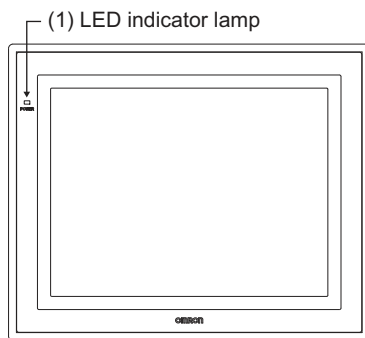
Touch Panel Monitor

● Specification

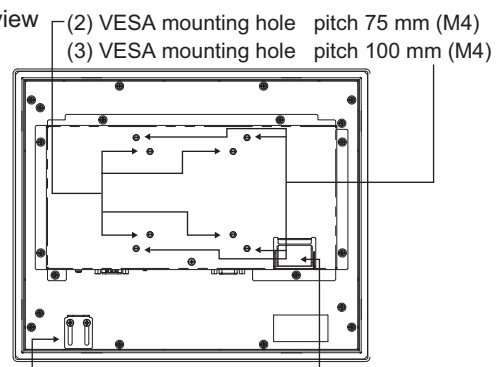
| | Model | FH-MT12 |
|--------------------|---------------------------|---|
| Major Function | Display area | 12.1 inch |
| | Resolution | 1024 (V) x 768 (H) |
| | Number of color | 16,200,000 colors (8 bit/color) |
| | Brightness | 500 cd/m ² (Typ) |
| | Contrast Ratio | 700 : 1 (Typ) |
| | Viewing angle | Horizontal (left and right): -80° to 80° (typ) Vertical (top and bottom): -70° to 70° (typ) |
| | Backlight Unit | LED, edge-light |
| | Backlight lifetime | About 80,000 hour |
| | Touch panel | 4 wire resistive touch screen |
| External interface | Video input | analog RGB |
| | Touch panel signal | USB, RS-232C |
| Ratings | Supply Voltage | 24 VDC ±10 % |
| | Current consumption | 0.5 A |
| | Insulation resistance | Between DC power supply and Touch Panel Monitor FG: 20 MΩ or higher (rated voltage 250 V) |
| Usage Environment | Ambient temperature range | Operating: 0 to +50°C, Storage: -20 to +65°C (with no icing or condensation) |
| | Ambient humidity range | Operating and Storage: 20 to 90% (with no icing or condensation) |
| | Ambient atmosphere | No corrosive gases |
| | Vibration tolerance | 10 to 150 Hz, one-side amplitude 0.1 mm (Max. acceleration 15 m/s ²), 10 times for 8 minutes for each three direction |
| | Degree of protection | Panel mounting: IP65 on the front |
| Operation | | Touch pen |
| Structure | Mounting | Panel mounting, VESA mounting |
| | Weight | Approx. 2.4 kg |
| | Case material | Front panel: PC/PBT, Front Sheet: PET, Rear case: SUS |

Component Names and Functions

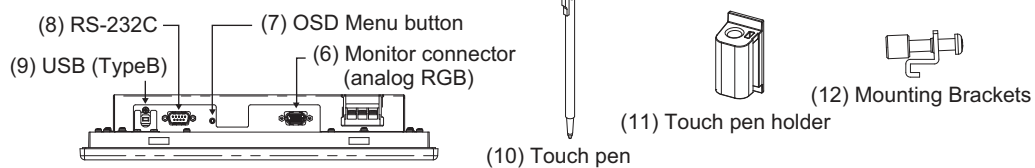
•Front view



•Rear view



•Connection terminal



| | Name | Description |
|------|--------------------------------|--|
| (1) | LED indicator lamp | Lit up green when power is ON. Lit up orange when video signal is no input. Unlit when power is OFF. |
| (2) | VESA mounting hole (M4) | Mounting hole for VESA 75 mm x 75 mm. |
| (3) | VESA mounting hole (M4) | Mounting hole for VESA 100 mm x 100 mm. |
| (4) | USB retaining bracket | Retaining bracket for USB cable. |
| (5) | Power supply terminal | Connect a 24 VDC power supply. |
| (6) | Monitor connector (analog RGB) | Connect a monitor cable for analog RGB. |
| (7) | OSD Menu button | The button to activate the OSD menu. |
| (8) | RS-232C | Connect a serial communication port for touch panel communication. |
| (9) | USB (TypeB) | Connect a USB port (Type B) for touch panel communication. |
| (10) | Touch pen | Use for operation of touch panel. |
| (11) | Touch pen holder | Put touch pen in it when not using. Paste it on the monitor by double-sided tape. |
| (12) | Mounting Brackets | Use them to mount the panel. |

For operation at launch OSD, refer to the Model FH-MT12 INSTRUCTION SHEET.

Touch Panel Monitor Cable

Normally, use the USB cable as a connection cable for Touch Panel Monitor.

Use the RS-232C cable as a connection cable for Touch Panel Monitor in the following cases.

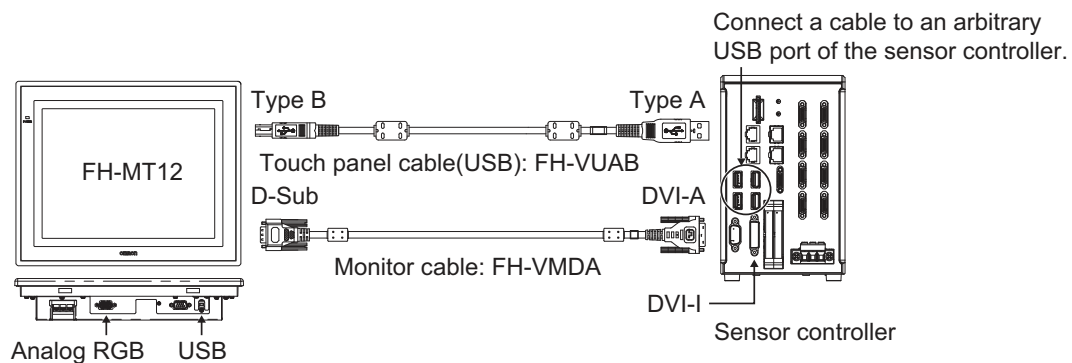
- When Touch Panel Monitor is taken apart 5 m or more from FH sensor controller.
- When the USB port of the FH sensor controller is used for other I/O connection and cannot be used for Touch Panel communications.

● Specification

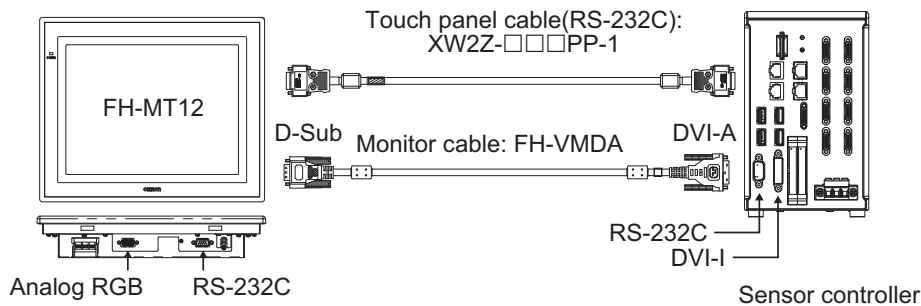
| Model | FH-VMDA (2m) | FH-VUAB (2m) | XW2Z-200PP-1 (2m) |
|---------------------------|--|--------------|--|
| Cable type | DVI-Analog Conversion Cable | USB Cable | RS-232C Cable |
| Vibration (resistance) | 10 to 150 Hz, Single amplitude 0.1 mm, 10 times for 8 minutes for each three direction | | |
| Ambient temperature range | Operating Condition: 0 to +50°C, Storage Condition: -10 to +60°C (with no icing or condensation) | | |
| Ambient humidity range | Operating and Storage: 35 to 85% (with no condensation) | | |
| Ambient atmosphere | No corrosive gases | | |
| Material | Cable outer sheath, Connector: PVC | | Cable outer sheath: PVC, Connector: ABS/Ni Plating |
| Minimum bending radius | 62 mm | 25 mm | 59 mm |
| Weight | Approx. 210g | Approx. 95g | Approx. 162g |

Connection Example

● USB Connection (Cable Length Up to 5 m)



● RS-232C Connection (Cable Length Up to 10 m)

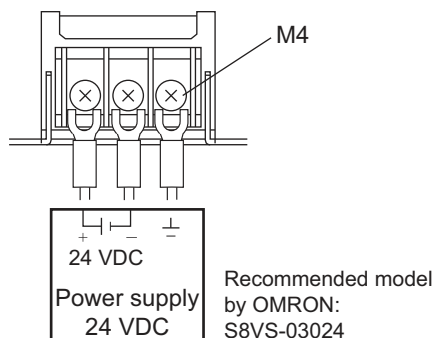


A video signal cable and an operation signal cable are required to connect the Touch Panel Monitor.

| Signal | Cable | 2 m | 5 m | 10 m |
|------------------------------|-----------------------------|-----|-----|------|
| Video signal | DVI-Analog Conversion Cable | OK | OK | OK |
| Touch panel operation signal | USB Cable | OK | OK | - |
| | RS-232C Cable | OK | OK | OK |

Wiring

The power terminal block for the Touch Panel Monitor is located on the back of it. Connect a power supply of 24 VDC there.



| Indication on the power terminal block | Name | Function |
|--|------------------------------------|--|
| + | DC input terminal (+V) | Connect to the DC output terminal (+V) of 24 VDC power. |
| - | DC input terminal (-V) | Connect to the DC output terminal (-V) of 24 VDC power. |
| | FG (Functional grounding terminal) | Connect to the earth. Functional grounding is done to protect device and system functions, including prevention of noise from external sources, or prevention of noise from devices or equipment that could have harmful effects on other devices or equipment |

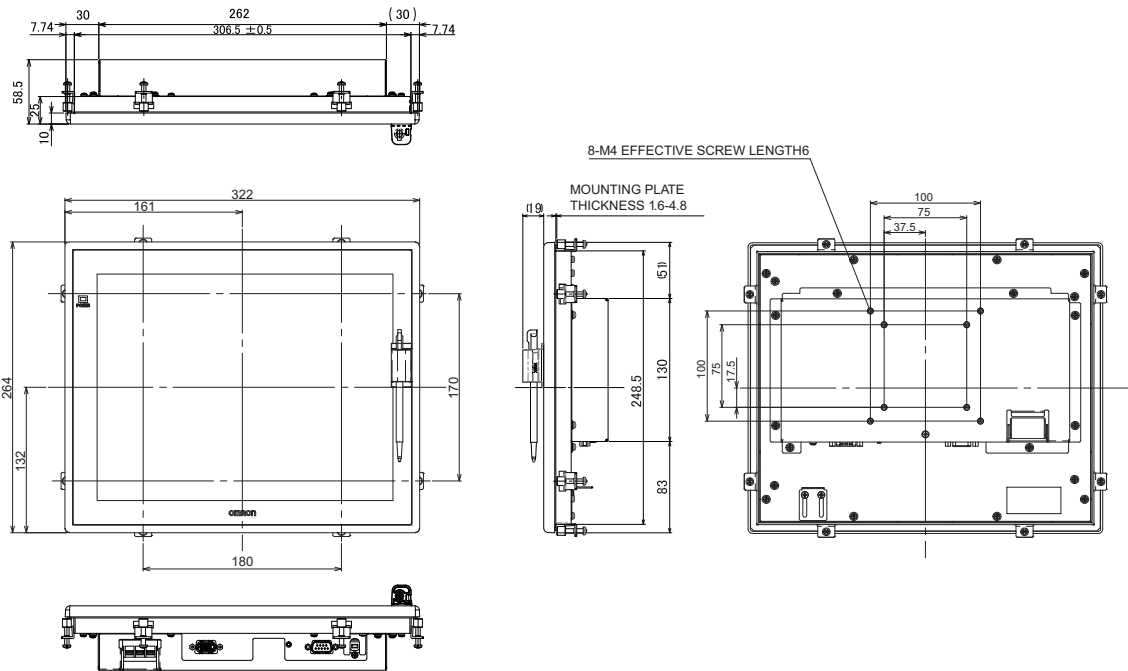
- Wire the power supply wires as short as possible. (Max.2 m)
- If UL's certification is required, use a UL class II power supply.
- Use the cables and crimping terminals with the specified dimensions.
Do not directly connect an electric wire that is simply twisted to the terminal block.

- Recommended wire size: AWG 13 to 22 (0.326 to 2.62 mm²)
- Terminal screw: M4 (Tightening torque: 1.0 N•m)
- Crimping Terminal



Dimensions

● Touch Panel Monitor

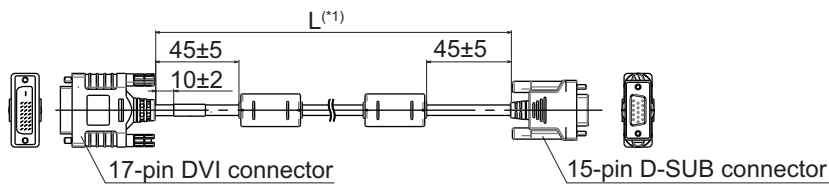


(Unit: mm)

Note:

1. Panel thickness: 1.6 to 4.8 mm
2. No burr allowed

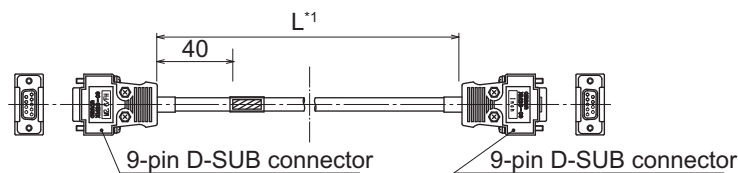
● DVI-Analog Conversion Cable for Touch Panel Monitor: FH-VMDA



*1. Cable is available in 2 m/5 m/10 m.

(Unit: mm)

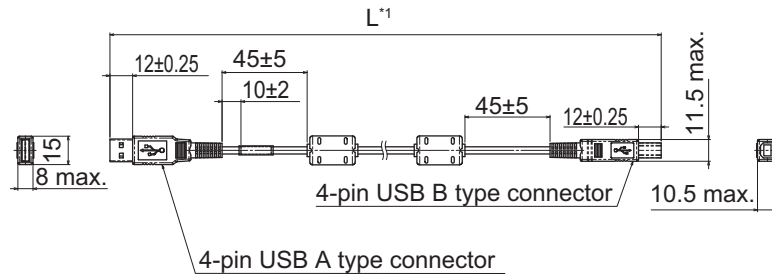
● RS-232C Cable for Touch Panel Monitor: XW2Z-□□□PP-1



*1. Cable is available in 2 m/5 m/10 m.

(Unit: mm)

● **USB Cable for Touch Panel Monitor: FH-VUAB**



*1. Cable is available in 2 m/5 m.

(Unit: mm)

3-6 LCD and Cable

Specification

● LCD Monitor

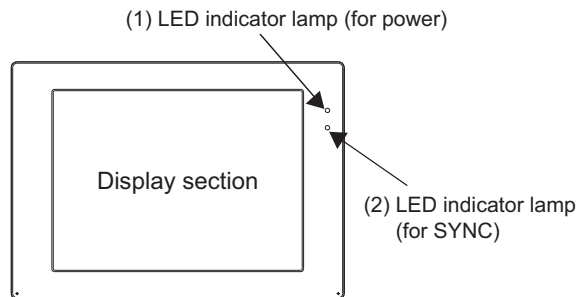
| Model | FZ-M08 |
|---------------------------|--|
| Size | 8.4 inches |
| Type | Liquid crystal color TFT |
| Resolution | 1,024 x 768 dots |
| Input signal | Analog RGB video input 1 channel |
| Supply Voltage | 21.6 to 26.4 VDC |
| Current consumption | Approx. 0.7 A max. |
| Ambient temperature range | Operating: 0 to +50°C, Storage: -25 to +65°C (with no icing or condensation) |
| Ambient humidity range | Operating and Storage: 35 to 85% (with no condensation) |
| Weight | Approx. 1.2kg |
| Accessories | Instruction Sheet and 4 mounting brackets |

● Monitor Cable

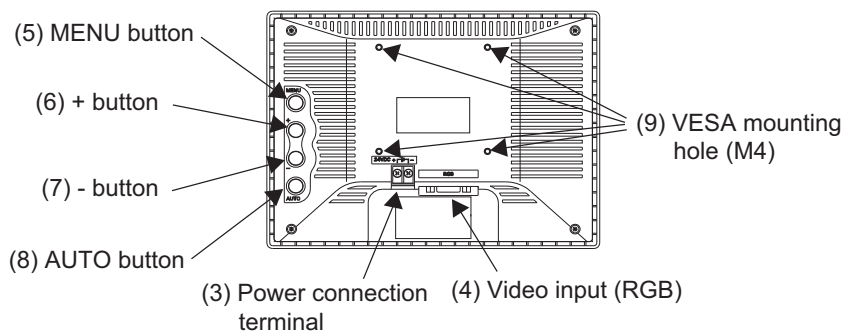
| Model | FH-VMDA |
|---------------------------|--|
| Vibration (resistance) | 10 to 150 Hz, Single amplitude 0.1 mm, 10 times for 8 minutes for each three direction |
| Ambient temperature range | Operating Condition: 0 to +50°C, Storage Condition: -10 to +60°C (with no icing or condensation) |
| Ambient humidity range | Operating and Storage: 35 to 85% (with no condensation) |
| Ambient atmosphere | No corrosive gases |
| Material | Cable outer sheath, Connector: PVC |
| Minimum bending radius | 62 mm |
| Weight | FH-VMDA 2M: Approx. 210g FH-VMDA 5M: Approx. 380g FH-VMDA 10M: Approx. 650g |

Component Names and Functions

● Front View



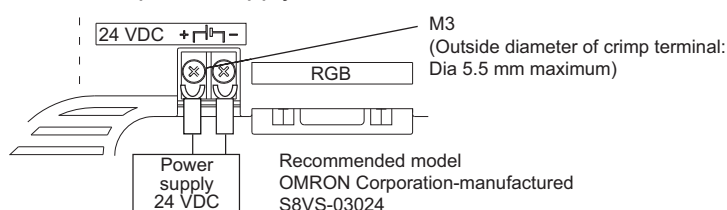
● Rear



| | Name | Description |
|-----|--------------------------------|--|
| (1) | LED indicator lamp (for power) | Lit up green when power is ON. |
| (2) | LED indicator lamp (for SYNC) | Lit up orange while the video signal is input. |
| (3) | Power supply terminal | Connect a 24 VDC power supply. |
| (4) | Video input (RGB) | Video input terminal (RGB) |
| (5) | MENU button | OSD operating button (MENU button) |
| (6) | + button | OSD operating button (+ button) |
| (7) | - button | OSD operating button (- button) |
| (8) | AUTO button | OSD operating button (AUTO button) |
| (9) | VESA mounting hole (M4) | Mounting hole for VESA 75 mm x 75 mm. |

Wire

The power terminal block for the Touch Panel Monitor is located on the back of it. Connect a power supply of 24 VDC there.

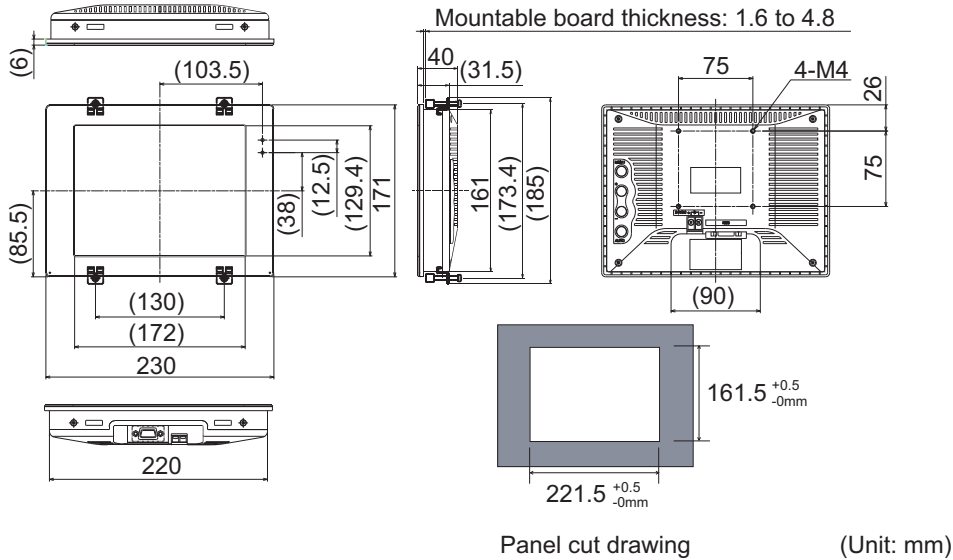


- Keep the power supply wires as short as possible (maximum 10 m).

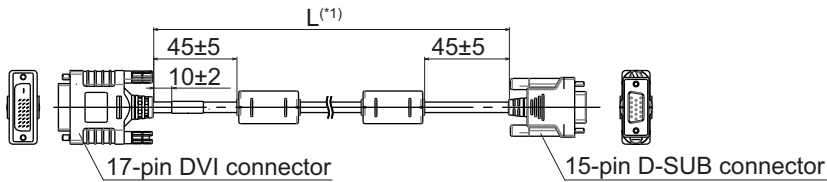
- If UL recognition is required, use a UL class II power supply.
Regarding installation, do not use the VESA mounting but fix the monitor unit using the board mounting.

Dimensions

● LCD Monitor: FZ-M08



● Monitor Cable: FH-VMDA



*1. Cable is available in 2 m/5 m/10 m.

(Unit: mm)

3-7 Sysmac Studio

When you connect the FH-2000/FH-5000 Series and Sysmac Studio, use the latest version.

| FH Series | Version of FH Series | Corresponding version of Sysmac Studio |
|----------------------|----------------------|--|
| FH-2□□□ / FH-2□□□-□□ | Ver. 6.60 or later | Ver. 1.59 or later |
| | Ver. 6.55 | Ver. 1.59 or later |
| FH-5□□□ / FH-5□□□-□□ | Ver. 6.51 | Ver. 1.53 or later |
| | Ver. 6.40 | Ver. 1.43 or later |
| | Ver. 6.31 | Ver. 1.30 or later |
| | Ver. 6.21 | Ver. 1.26 or later |
| | Ver. 6.11 | Ver. 1.25 or later |

3-8 Available List of FH Software Versions

3-8-1 Available List of Sensor Controllers and Software Versions

Below is a list of correspondence between each sensor controller and the software version of the FH sensor controller.

Some sensor controllers cannot be used depending on the software version.

| Model | Software version that can be used with FH sensor controller |
|-----------------------------------|---|
| FH-2050 / FH-2050-10 / FH-2050-20 | Ver.6.10 to Ver.6.55 |
| FH-5050 / FH-5050-10 / FH-5050-20 | |
| FH-5550 / FH-5550-10 / FH-5550-20 | |
| FH-2051 / FH-2051-10 / FH-2051-20 | Ver.6.51 or later |
| FH-5051 / FH-5051-10 / FH-5051-20 | |
| FH-5551 / FH-5551-10 / FH-5551-20 | |
| FH-2052 / FH-2052-10 / FH-2052-20 | Ver.6.60 or later |
| FH-5052 / FH-5052-10 / FH-5052-20 | |
| FH-5552 / FH-5552-10 / FH-5552-20 | |
| FH-L550 / FH-L550-10 | Ver.5.60 to Ver.6.55 |
| FH-L551 / FH-L551-10 | Ver.6.51 or later |



Precautions for Correct Use

Do not install software versions other than those supported by the each FH sensor controller. In particular, if you downgrade to software version 6.40 or earlier on the FH-2051/5051/5551/2052/5052/5552 series and FH-L551 series, the process may not be completed, and the FH sensor controller will not start properly.

3-8-2 Available List of Cameras and Software Versions

Below is a list of correspondence between each camera and the software version of the FH sensor controller.

Some cameras cannot be used with FH sensor controllers with older software versions.

| Model | FH software version that the camera can use |
|---------------------|---|
| FH-SM / FH-SC | Ver.5.00 or later |
| FH-SM02 / FH-SC02 | |
| FH-SM04 / FH-SC04 | |
| FH-SM12 / FH-SC12 | Ver.5.20 or later |
| FH-SMX / FH-SCX | Ver.6.10 or later |
| FH-SMX05 / FH-SCX05 | |
| FH-SMX12 / FH-SCX12 | |
| FH-SMX01 / FH-SCX01 | Ver.6.51 or later |
| FH-SMX03 / FH-SCX03 | |
| FH-SM05R / FH-SC05R | Ver.5.60 or later |

| Model | FH software version that the camera can use |
|---|---|
| FH-SM21R / FH-SC21R | Ver.6.10 or later (FH-2000 / FH-5000 series only) |
| FH-SMX-SWIR / FH-SMX01-SWIR | Ver.6.60 or later |
| FZ-S5M3 / FZSC5M3 | Ver.5.72 or later |
| FZ-S / FZ-SC / FZ-S2M / FZ-SC2M / FZ-S5M2 / FZSC5M2 | Ver.5.00 or later |
| FZ-SH / FZ-SHC | Ver.5.00 or later |
| FZ-SF / FZ-SFC / FZ-SP / FZ-SPC | Ver.5.00 or later |
| FZ-SQ010F / FZ-SQ050F / FZ-SQ100F / FZ-SQ100N | Ver.5.00 or later |

3-8-3 Available List of Lightings and Lighting Controllers and Software Versions

Below is a list of correspondence between each lighting / lighting controller and the software version of the FH sensor controller.

Some lightings / lighting controllers cannot be used with FH sensor controllers with older software versions.

| Model | FH software version that the camera can use |
|--|---|
| FLV-TCC1 / FLV-TCC4 | Ver.5.10 or later |
| FLV-TCC3HB / FLV-TCC1EP | Ver.5.30 or later |
| FLV-ATC series | Ver.6.10 or later |
| FL-TCC1 | Ver.5.00 or later |
| FL-TCC1PS / FL-PS90W / FL-PS140W / FL-PS260W | Ver.6.10 or later |
| FL-MD90MC / FL-MD180MC | Ver.6.10 or later |
| FL-STC series | Ver.5.00 or later |

4

Handling and Installation Environment

| | | |
|-----|------------------------------|-----|
| 4-1 | All Series | 4-2 |
| 4-2 | FH-2000/FH-5000 Series | 4-4 |
| 4-3 | FH-L Series | 4-5 |

4-1 All Series

WARNING

This product must be used according to this manual and Instruction Sheet. Failure to observe this may result in the impairment of functions and performance of the product.



This product is not designed or rated for ensuring the safety of persons. Do not use it for such purposes.



A lithium battery is built into the Controller and may occasionally combust, explode, or burn if not treated properly. Dispose of the Controller as industrial waste, and never disassemble, apply pressure that would deform, heat to 100°C or higher, or incinerate the Controller.



Precautions for Safe Use

Installation Environment

- Do not use the product in the environment with flammable or explosive gases.
- Regularly clean the vent holes or fan outlet to prevent dust or particles blocking them. Internal temperature increases when those are blocked, it causes malfunction.
- To secure safety for operation and maintenance, install the product apart from high-voltage devices and power devices.
- Make sure to tighten all screws in mounting.

Handling of sensor controller

- Do not attempt to dismantle, repair, or modify the product.
- Do not drop the product nor apply excessive vibration or shock to the product. Doing so may cause malfunction or burning.
- This product is heavy. Be careful not to drop it while handling.
- Do not insert an SD memory card in the reverse orientation, at an angle, or in a twisting manner.



Precautions for Correct Use

Installation and Storage Sites

Install and store the product in a location that meets the following conditions:

- No rapid changes in temperature (place where dew does not form)
- No presence of corrosive or flammable gases
- Place free of dust, salts and iron particles
- Place free of vibration and shock
- Place out of direct sunlight
- Place where it will not come into contact with water, oils or chemicals
- Place not affected by strong electro-magnetic waves
- Place not near to high-voltage, or high-power equipment
- Do not install the product immediately above significant heat sources, such as heaters, transformers, or large-capacity resistors.
- Do not install the sensor controller in a cabinet with high-voltage equipment installed. Mount the sensor controller at 200 [mm] or more from power cables apart.

Handling of sensor controller

- When touching a terminal part or a signal wire in a connector, take anti-static measures using a wrist strap or another device to prevent damage from static electricity.
- Be sure to execute Device Information Storage Tool described in the *Vision System FH/FHV Series User's Manual (Cat. No. Z365)* when connecting USB memory device or SD memory card.
- When removing USB memory device or SD memory card, select **Function** menu - **System information - Drive information** on the main screen, then press the **Eject** button and confirm it is safe to remove.
- When using remote operation, before removing a USB memory device or SD memory card, make sure that data is not being read or written to them.
For a USB flash drive, the memory device's LED flashes or lights while data is being read or written, so make sure that it is turned OFF before removing the memory.
For SD memory card, the SD BUSY LED flashes or lights while data is being read or written, so make sure that it is turned OFF before removing the memory.

Maintenance

- Lightly wipe off dirt with a soft cloth.
 - Do not use thinners or benzine.
 - Clean the lens with a lens-cleaning cloth or air brush.
 - Dirt on the image element must be removed using an air brush.
-

4-2 FH-2000/FH-5000 Series



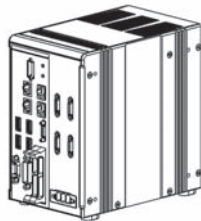
Precautions for Correct Use

Ambient Temperature

- Install and store the product in a location that meets the following conditions:
 - Surrounding temperature of 0 to +50°C^{*1} (-20 to +65°C in storage)
 - *1. FH-5000 Series: Surrounding temperature of 0 to 45°C
 - Relative humidity of between 35% to 85%
- Do not let the ambient temperature exceed 50°C (122°F)^{*2}.
- Provide a forced-air fan cooling or air conditioning if the ambient temperature is near 50°C (122°F)^{*2} so that the ambient temperature never exceeds 50°C (122°F)^{*2}.
 - *2. FH-5000 Series: 45°C (113°F)

Orientation of Product

- For good heat dissipation, install the product only in the position shown below so as not to block the ventilation holes. Install the product so that the air can flow freely through its cooling vents.



- Do not install the product in the following positions.



- For good ventilation, provide a clearance of 50 [mm] or more above the sensor controller away from other devices in the normal floor mounting. For the right and left sides, provide a clearance of 30 [mm] or more, and for the back side, 15 [mm] or more. These clearances are also required when mounting multiple sensor controllers side by side. For the back mounting, the back-side clearance of 15 [mm] is not required.

4-3 FH-L Series



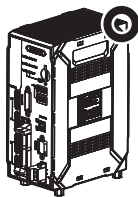
Precautions for Correct Use

Ambient Temperature

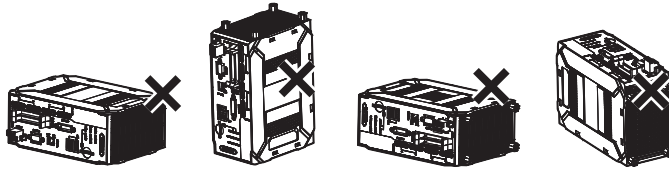
- Install and store the product in a location that meets the following conditions:
 - Surrounding temperature of 0 to +55°C (-25 to +70°C in storage)
 - Relative humidity of between 10% to 90%
- Provide a forced-air fan cooling or air conditioning if the ambient temperature is near 55°C (131°F) so that the ambient temperature never exceeds 55°C (131°F).

Orientation of Product

- For good heat dissipation, install the product only in the position shown below so as not to block the ventilation holes.



- Do not install the product in the following positions.



- For good ventilation, provide a clearance of 50 mm or more above the sensor controller away from other devices in the normal floor mounting. For the right and left sides, back side, for other devices, or sensor controller 25 mm or more.

5

Setup and Wiring

| | | |
|------------|--|-------------|
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| 5-1-2 | FH-2000/FH-5000 Series..... | 5-3 |
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| 5-8-2 | FH-2000/FH-5000 Series..... | 5-30 |
| 5-8-3 | FH-L Series..... | 5-32 |

5-1 When turning ON and OFF

5-1-1 All Series

WARNING

Never connect the AC power supply with this product. When the AC power supply is connected, it causes the electric shock and a fire.



Do not touch the terminals while the power supply is ON. Doing so may result in electrical shock.



Caution

Please take fail-safe measures on your side in preparation for an abnormal signal due to signal conductor disconnection and/or momentary power interruption. An abnormal operation may result in a serious accident.



Precautions for Safe Use

- Check the following again before turning on the power.
 - Are the voltage and polarity of the power source set correctly? (24 VDC for positive terminal. 0 VDC for negative terminal.)
 - Is the functional grounding terminal connected to the ground (FG)?
 - Is the load of the output signal not short-circuited?
 - Is the load current for the output signal within the specified range?
 - Are there no wrong wirings?
- While the power is ON or immediately after the power is turned OFF, the sensor controller and camera case are still hot. Do not touch the case.
- Make sure to turn off the power when attach or detach cameras or cables. Connecting cables while the power is supplied may cause malfunction or damage to cameras or peripheral devices.
- Illumination is normal immediately after the power supply is turned ON. Do not look directly into the illumination light.
- After confirming that the product is started up, communicate with the high-order device.
- Should you notice any abnormalities, immediately stop use, turn OFF the power supply, and contact your OMRON representative.



Precautions for Correct Use

Turning OFF the Power

When a message is displayed indicating that a task is in progress, do not turn OFF the power. Doing so causes the data in the memory to be corrupted, resulting in the product not operating properly upon the next start-up.

Do not turn OFF during saving data to sensor controller.

When turns OFF, conform the followings proceedings have completed. and then operate again.

- When saves using sensor controller: Confirm the save processing is completed and next operation is possible.

- When saves using communication command: Intended command is completed. BUSY signal is turned OFF.

After turning off the power, wait at least 1 second before restarting.

Maintenance

Turn OFF the power and ensure the safety before maintenance.

5-1-2 FH-2000/FH-5000 Series



Precautions for Safe Use

- Check the following again before turning on the power.
Are the voltage value and polarity of the power supply that is provided to the encoder cable (ENC0 VDD/GND, ENC1 VDD/GND) correct? (5 VDC)
-

5-2 Fail-Safe Measures

The fail-safe measures are the same for each series. Confirm the following instructions.

WARNING

Please take external safety measures so that the system as a whole should be on the safe side even if a failure of a sensor controller or an error due to an external factor occurred. An abnormal operation may result in serious accident.



Please take fail-safe measures on your side in preparation for an abnormal signal due to signal conductor disconnection and/or momentary power interruption.



Precautions for Safe Use

Fail-Safe Measures

- Be sure to take fail-safe measures externally when controlling stages and robots by using the measurement results of the sensor controller (axis movement output by calibration and alignment measurement).
- On a sensor controller side, supplementary use operations and branches of the sensor controller to configure a check flow such as “data should not be externally provide if the data is in a range from -XXXXX to XXXXX” based on the stage/robots range of movement.

Communication with High-order Device

- After confirming that the product is started up, communicate with the high-order device. During start-up, an indefinite signal may be output to the high-order interface. To avoid this problem, clear the receiving buffer of your device at initial operations.
-

5-3 Sensor Controller Installation

5-3-1 All Series



Precautions for Safe Use

Power Supply and Wiring

- Make sure to use the product with the power supply voltage specified by this manual.
- Provide the power from a DC power supply (safety extra-low voltage circuits) that has been taken measures not to generate high-voltage.
- Make sure to tighten all screws in mounting.

5-3-2 FH-2000/FH-5000 Series



Precautions for Safe Use

Power Supply and Wiring

- Keep the power supply wires as short as possible (Max. 2 m).
- Use the wire of a suitable size (AWG 10 to 16) according to the current consumption.

Ground

- The power supply circuit of the FH sensor controller is insulated from the internal circuit.
- When a base is packed in a camera that will be connected to the sensor controller, make sure to mount the camera using the base. Since the enclosure of the camera body is connected to the internal circuits, mounting the camera without using the base allows the internal circuits to be directly connected to the ground, which may cause malfunction or failure.
- Apply Class D grounding (grounding resistance: 100 [Ω] or less)
- Provide the grounding point as close to the product as possible to shorten the grounding wire.
- Wire the grounding wire for the sensor controller independently. If the grounding wire is shared with other devices or connected to a building beam, the sensor controller may be adversely affected.

Connect the sensor controller to FH-MT12

- Do not ground the positive terminal of the 24 VDC power supply when connecting the sensor controller and FH-MT12 using a USB cable. The internal circuits may cause a short-circuit and result in malfunction.

Connect the sensor controller to FH-SC12/FH-SM12 (12 megapixels camera)

- Do not ground the positive terminal of the 24 VDC power supply when connecting the sensor controller and a 12 megapixels camera like FH-SC12 or FH-SM12.

Other

- There are products in which the enclosure, mounting screw holes, or ground terminal are short-circuited to 0 V inside (e.g., commercially available monitor products). Connecting the enclosure, mounting screw holes, or ground terminal of such products to the sensor controller with the ground terminal connected to the ground allows the 0 V reference inside the product to be directly connected to the ground, which may cause equipment failure or malfunction.



Precautions for Correct Use

When connecting the sensor controller and monitor with a switcher and splitter

- Do not use devices that may require re-recognition of the monitor by the sensor controller when a switching operation was performed. If such re-recognition processing happens at switching operation, it may cause measurement time to be longer.

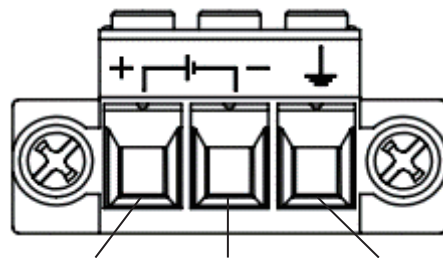
Connection of Terminal Block of FH-2000/FH-5000 Series

Connecting of sensor controller's terminal block in order to connect package the terminal block connector (male; FH-XCN).


Use the specified wire size (AWG10 to 16) and keep the power supply wires as short as possible (Max. 2 m).

The coating removal margin for the power line is 10mm.

- 1 Insert the end of the signal line (electric wire) into the terminal block connector (male), and tighten the three screws on the connector top to fix the wire. Recommended tightening torque: 0.7-0.8 N•m
- 2 Connect the wire to the terminal block connector (male) depending on the indicated terminal block connector.



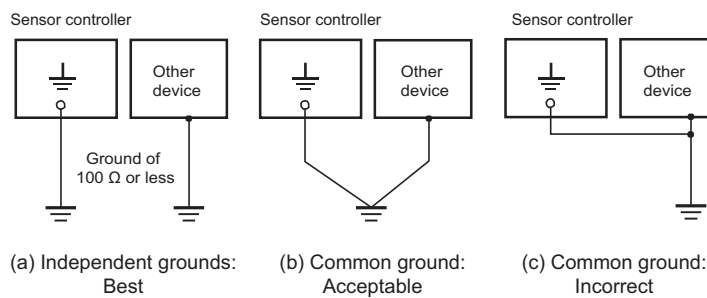
DC input terminal (+V) DC input terminal (-V) FG (functional grounding terminal)

| Indicate of terminal block connector | Name | Function |
|---|------------------------------------|---|
| + | DC input terminal (+V) | Connect to the DC output terminal (+V) of 24 VDC power. |
| - | DC input terminal (-V) | Connect to the DC output terminal (-V) of 24 VDC power. |
|  | FG (Functional grounding terminal) | Connect to the earth. Functional grounding is done to protect device and system functions, including prevention of noise from external sources, or prevention of noise from devices or equipment that could have harmful effects on other devices or equipment |

- When you ground the FG, it may cause to enter noise into devices or equipment. If an equipment malfunction or failure occurs, disconnect the FG from the ground and see if the condition improves.
- The outer shell of the sensor controller has continuity with the FG. Connecting the outer shell to the ground may allow noise to enter the device or equipment. If an equipment malfunction

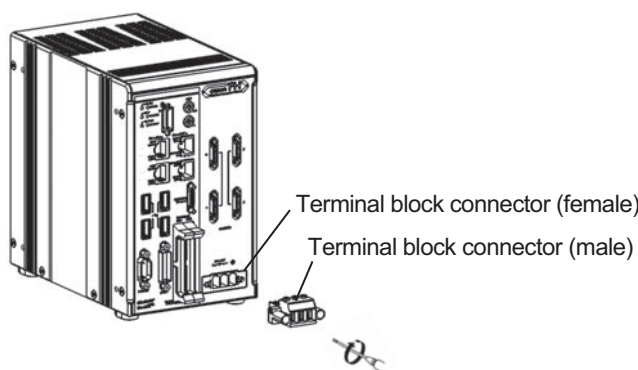
or failure occurs, remove the connection between the outer shell and the ground and see if the condition improves.

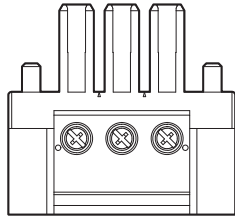
- For grounding, use a dedicated ground wire (2 mm² or larger) and apply Class D grounding (third class grounding: 100 Ω or less grounding resistance).
- Do not share the sensor controller's ground with other equipment or ground the sensor controller to the metal structure of a building. Doing so may worsen operation. Whenever possible, use an independent ground (with the ground pole separated by a minimum of 10 m from any other ground pole).
- Ground to 100 Ω or less, and if possible use a separate ground from those of other devices. (Refer to figure (a) in the diagram below.)
- If using an independent ground is not possible, then use a common ground as shown in figure (b). Connect to the ground pole of the other device.



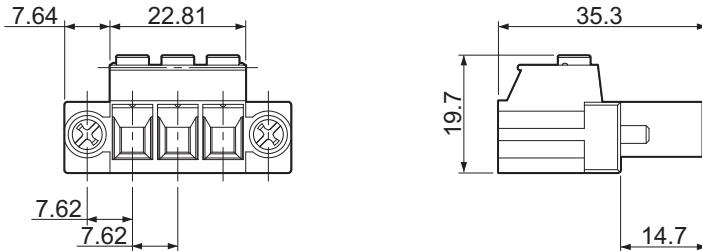
Grounding Methods

- 3** Insert the terminal block connector (male) to the terminal block connector (female) of sensor controller.
- 4** Tighten and fix the left and right screws for the terminal block connector (male). (Recommended tightening torque: 0.7 to 0.8 N•m)





(Unit: mm)



Recommended Power Source of FH-2000/FH-5000 Series

Power source types for FH series differ depending on the number of cameras due to current consumption differences. Refer to the following table to use the appropriate type.

When you connect your camera to the lighting via Light Controller, the current consumption is same as when the Intelligent Compact Digital camera is connected.

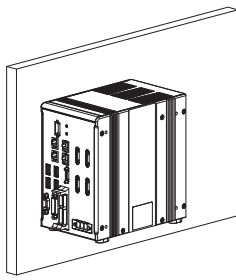
| Item | Connected camera, Lighting controller, and Lighting type | FH-5□□□ | FH-5□□□-10 | FH-5□□□-20 |
|--|---|---------------------------|---------------------------|---------------------------|
| Recommended Power Source S8VK-G S8VS | <ul style="list-style-type: none"> When connecting intelligent compact digital cameras: When connecting the following lightings or light controllers without external power supplies: <ul style="list-style-type: none"> FLV-TCC1 FLV-TCC4 FLV-TCC3HB FLV-TCC1EP FL-TCC1 When connecting the following lighting or light controllers: <ul style="list-style-type: none"> FL-TCC1PS FL-MD□MC | S8VK-G12024 S8VS-12024 | S8VK-G24024 S8VS-18024 | S8VK-G48024 S8VS-48024 |
| | Other than above case | S8VK-G12024 S8VS-12024 | S8VK-G24024 S8VS-18024 | S8VK-G24024 S8VS-18024 |

| Item | Connected camera, Lighting controller, and Lighting type | FH-2□□□ | FH-2□□□-10 | FH-2□□□-20 |
|--|---|---------------------------|---------------------------|---------------------------|
| Recommended Power Source S8VK-G S8VS | <ul style="list-style-type: none"> When connecting intelligent compact digital cameras: When connecting the following lightings or light controllers without external power supplies: <ul style="list-style-type: none"> FLV-TCC1 FLV-TCC4 FLV-TCC3HB FLV-TCC1EP FL-TCC1 When connecting the following lighting or light controllers: <ul style="list-style-type: none"> FL-TCC1PS FL-MD□MC | S8VK-G12024 S8VS-12024 | S8VK-G24024 S8VS-18024 | S8VK-G48024 S8VS-48024 |
| | Other than above case | S8VK-G12024 S8VS-09024 | S8VK-G12024 S8VS-12024 | S8VK-G24024 S8VS-18024 |

Mounting of FH-2000/FH-5000 Series

- Make sure to tighten all screws in mounting.
- For good ventilation, provide a clearance of 50 [mm] or more above the sensor controller away from other devices in the normal floor mounting. For the right and left sides, provide a clearance of 30 [mm] or more, and for the back side, 15 [mm] or more. These clearances are also required when mounting multiple sensor controllers side by side. For the back mounting, the back-side clearance of 15 [mm] is not required.
- Do not install the product immediately above significant heat sources, such as heaters, transformers, or large-capacity resistors.
- Do not install the sensor controller in a cabinet with high-voltage equipment installed.
- Mount the sensor controller at 200 [mm] or more from power cables apart.

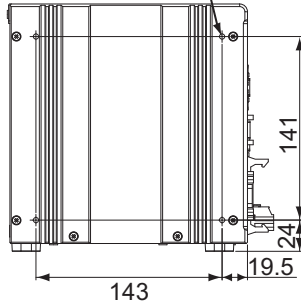
● Side Mounting



(Unit: mm)

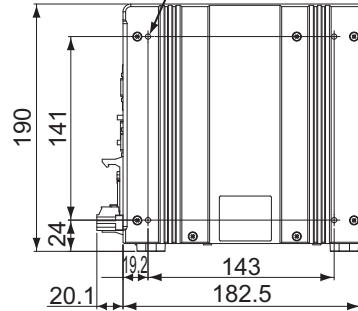
• Left side

4-M4 depth 4.5 (mounting screw hole)



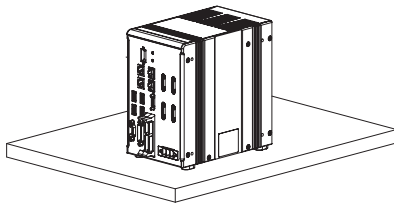
• Right side

4-M4 depth 4.5 (mounting screw hole)



- * Recommended tightening torque: 1.2 N•m to 1.3 N•m
- * The tolerance is ± 0.2 mm.

● Bottom Mounting

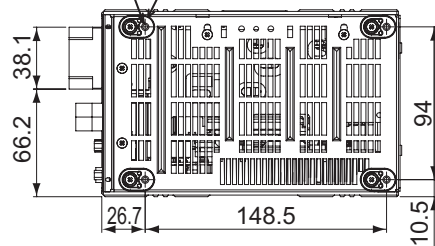


(Unit: mm)

• Bottom

4-M3 depth 4.5 (mounting screw hole)

Insulating leg: 4



- * Do not remove the Insulating leg. Fix the Insulating leg to secure the ventilation path.
- * Recommended tightening torque: 0.54 N•m to 0.6 N•m
- * The tolerance is ± 0.2 mm.

5-3-3 FH-L Series



Precautions for Safe Use

Power Supply and Wiring

- Keep the power supply wires as short as possible (Max. 2 m).
- Use the wire of a suitable size (AWG 12 to 16) according to the current consumption.
- The recommended power supply for FH-L series is the S8VK-G□□□24 (manufactured by OMRON) or S8VS-□□□24 (manufactured by OMRON).

Ground

- The power supply circuit of the sensor controller is not insulated from the internal circuit.
- When a base is packed in a camera that will be connected to the sensor controller, make sure to mount the camera using the base. Since the enclosure of the camera body is connected to the internal circuits, mounting the camera without using the base allows the internal circuits to be directly connected to the ground, which may cause malfunction or failure.
- Apply Class D grounding (grounding resistance: 100 [Ω] or less)
- Provide the grounding point as close to the product as possible to shorten the grounding wire.
- Wire the grounding wire for the sensor controller independently. If the grounding wire is shared with other devices or connected to a building beam, the sensor controller may be adversely affected.
- Check the wiring again before turning on the power.

Connect the sensor controller to the FH-MT12 Touch panel monitor.

- Do not ground the positive terminal of the 24 VDC power supply when connecting the sensor controller and FH-MT12 using a USB cable. The internal circuits may cause a short-circuit and result in malfunction.

When connect the sensor controller to the FH-SC12/FH-SM12: 12 megapixels camera

- Do not ground the positive terminal of the 24 VDC power supply when connecting the sensor controller and a 12 megapixels camera like FH-SC12 or FH-SM12.

Other

- There are products in which the enclosure, mounting screw holes, or ground terminal are short-circuited to 0 V inside (e.g., commercially available monitor products). Connecting the enclosure, mounting screw holes, or ground terminal of such products to the sensor controller with the ground terminal connected to the ground allows the 0 V reference inside the product to be directly connected to the ground, which may cause equipment failure or malfunction.

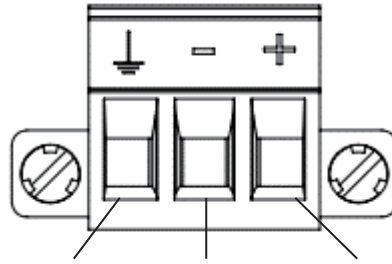
Connection of Terminal Block of FH-L Series

Connect to the terminal block by using the terminal connector, male: FH-XCN-L, which is packaged with sensor controller.


Use the wire of a suitable size (AWG 12 to 16) according to the current consumption. Keep the power supply wires as short as possible: Max. 2m.

The coating removal margin for the power line is 10mm.

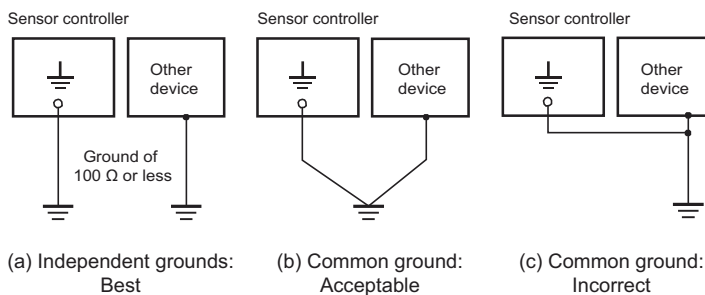
- 1** Insert the end of the signal line, electric wire, into the terminal block connector (male). Tighten the three screws on the connector top to secure the wire. Recommended tightening torque: 0.5 to 0.6 N•m
- 2** Connect the wire to the terminal block connector (male) depending on the indicated terminal block connector.



FG (functional grounding terminal) DC input terminal (-V) DC input terminal (+V)

| Indicate of terminal block connector | Name | Function |
|---|------------------------------------|---|
| + | DC input terminal (+V) | Connect to the DC output terminal (+V) of 24 VDC power. |
| - | DC input terminal (-V) | Connect to the DC output terminal (-V) of 24 VDC power. |
|  | FG (Functional grounding terminal) | Connect to the earth. Functional grounding is done to protect device and system functions, including prevention of noise from external sources, or prevention of noise from devices or equipment that could have harmful effects on other devices or equipment |

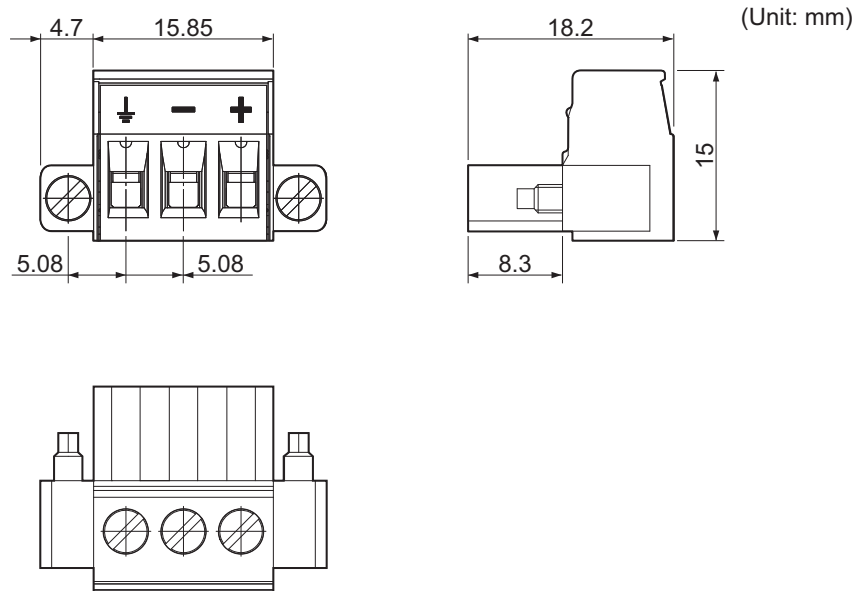
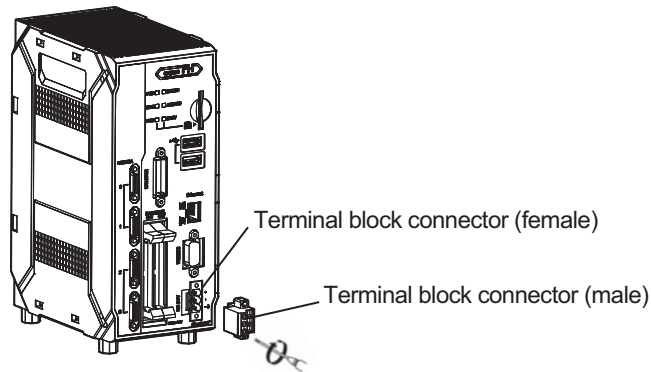
- When you ground the FG, it may cause to enter noise into devices or equipment. If an equipment malfunction or failure occurs, disconnect the FG from the ground and see if the condition improves.
- For grounding, use a dedicated ground wire (2 mm² or larger) and apply Class D grounding (third class grounding: 100 Ω or less grounding resistance).
- Do not share the sensor controller's ground with other equipment or ground the sensor controller to the metal structure of a building. Doing so may worsen operation. Whenever possible, use an independent ground (with the ground pole separated by a minimum of 10 m from any other ground pole).
- Ground to 100 Ω or less, and if possible use a separate ground from those of other devices. (Refer to figure (a) in the diagram below.)
- If using an independent ground is not possible, then use a common ground as shown in figure (b). Connect to the ground pole of the other device.



Grounding Methods

- 3 Insert the power supply terminal connector (male) into the power supply terminal connector (female) on the sensor controller side.

- 4** Secure the terminal block connector (male) by tightening the screws on the right and left sides of it with a flathead screwdriver. Recommended tightening torque: 0.5 to 0.6 N·m



Recommended Power Source for FH-L Series

The power source connected to the FH-L series sensor controller changes the power consumption depending on the number of camera. Refer to the following table.

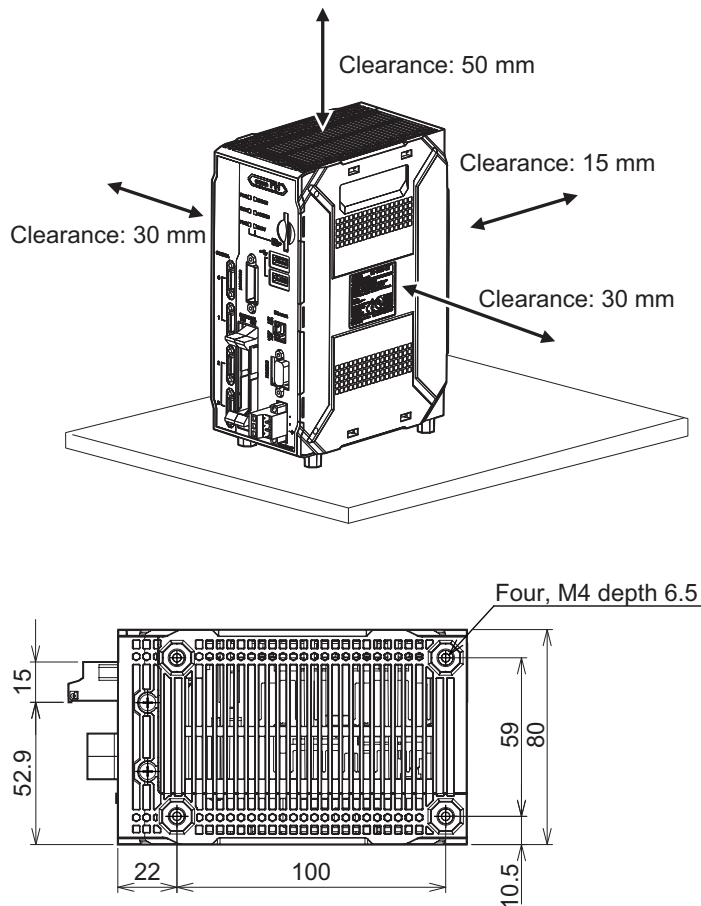
When you connect the camera using lighting Controller, the power consumption is same when connect to the Intelligent Compact Digital Camera.

| Item | Camera type | No. of camera | FH-L□□□ | FH-L□□□-□□ |
|--|---------------------------------------|---------------|---------------------------|---------------------------|
| Recommended Power Source S8VK-G S8VS | Intelligent Compact Digital Camera | 2 | S8VK-G12024 S8VS-09024 | S8VK-G12024 S8VS-09024 |
| | | 4 | - | S8VK-G12024 S8VS-12024 |
| | Camera of 0.3/2/4/5/12 million pixels | 2 | S8VK-G06024 S8VS-06024 | S8VK-G06024 S8VS-06024 |
| | | 4 | - | S8VK-G06024 S8VS-06024 |

Mounting of FH-L Series

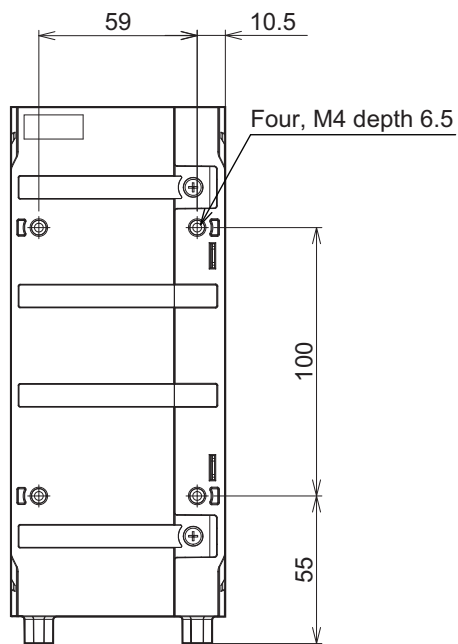
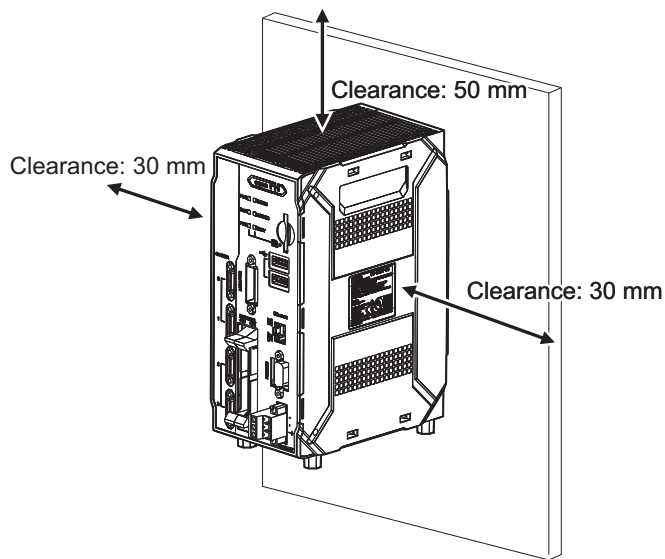
- Make sure to tighten all screws in mounting.
- For good ventilation, provide a clearance of 50 [mm] or more above the sensor controller away from other devices in the normal floor mounting. For the right and left sides, provide a clearance of 30 [mm] or more, and for the back side, 15 [mm] or more. These clearances are also required when mounting multiple sensor controllers side by side.
- Do not install the product immediately above significant heat sources, such as heaters, transformers, or large-capacity resistors.
- Do not install the sensor controller in a cabinet with high-voltage equipment installed.
- Mount the sensor controller at 200 [mm] or more from power cables apart.

● Mounting the base of the Sensor Controller (Floor mounting)



- Recommended tightening torque: 0.54 to 0.6 N•m
- The tolerance: ± 0.2 mm

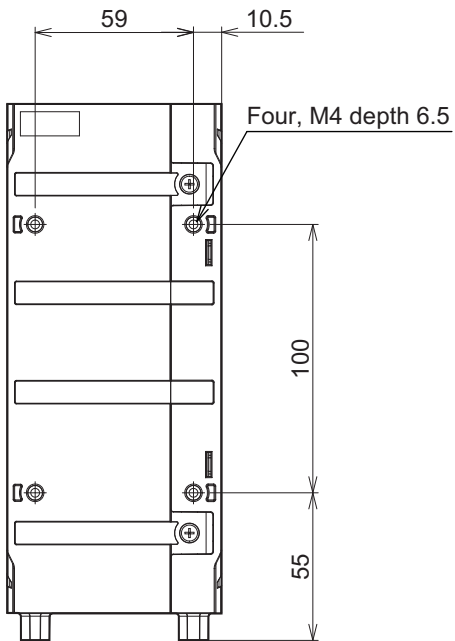
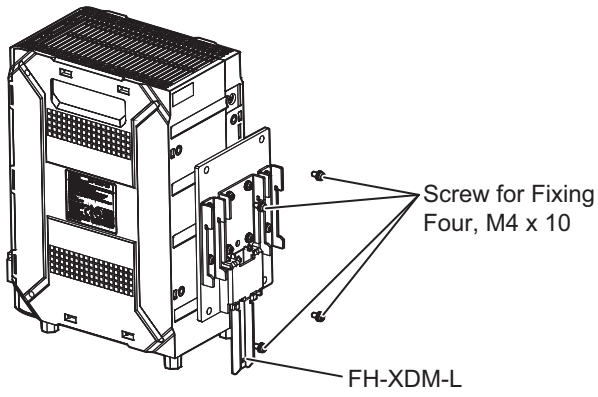
● Mounting of the Back Side



- Recommended tightening torque: 0.54 to 0.6 N•m
- The tolerance: ± 0.2 mm

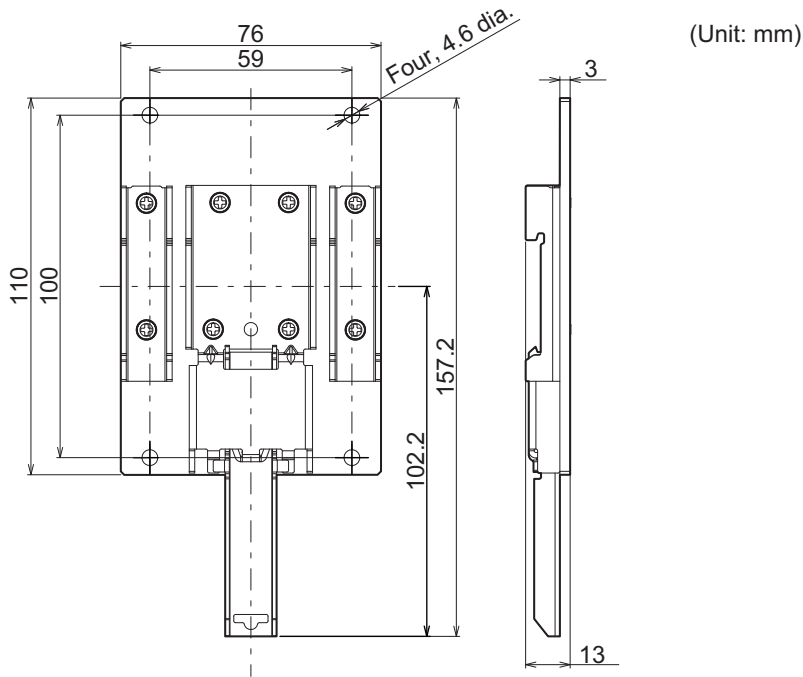
● Mounting the DIN rail

Mount DIN rail mounting bracket: FH-XDM-L, to the four mount holes on the back of the sensor controller.

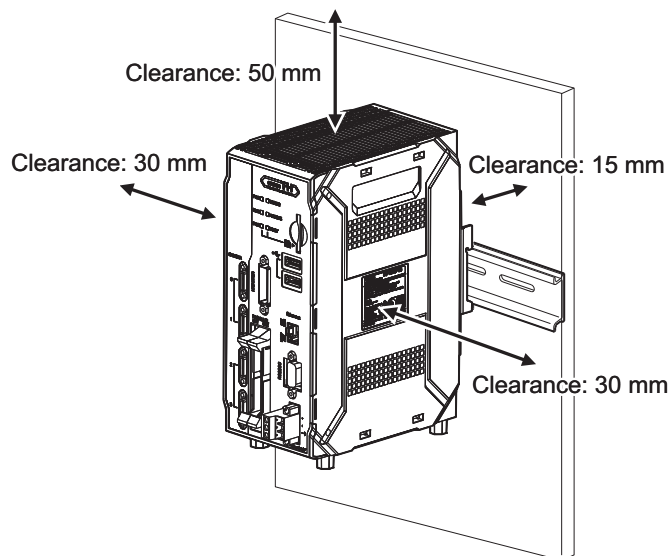


- Recommended tightening torque: 0.54 to 0.6 N•m
- The tolerance: ± 0.2 mm

- Dimensions of DIN rail mounting bracket: FH-XDM-L

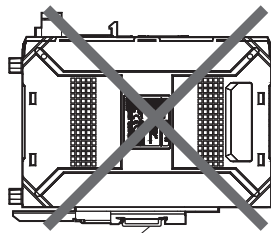


- When mounting the DIN rail, for improvement of heat dissipation, install the product in the following orientation only.



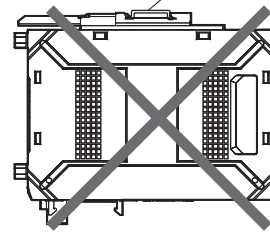
- Do not install in this orientation.

Set DIN rail to the bottom of the sensor controller.



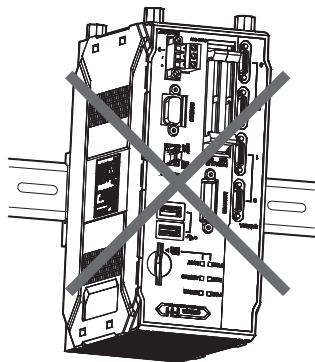
DIN Track

Set DIN rail on the top of the sensor controller.

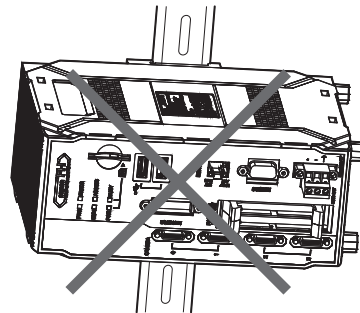


DIN Track

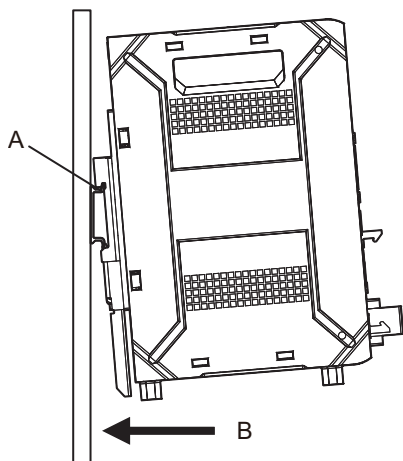
Set DIN rail vertically to the sensor controller.



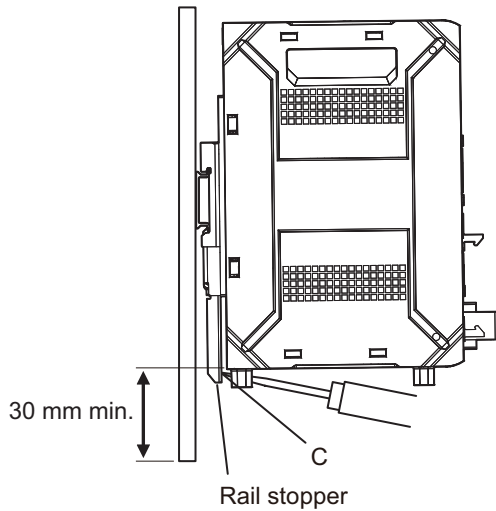
Set DIN rail horizontally to the sensor controller.



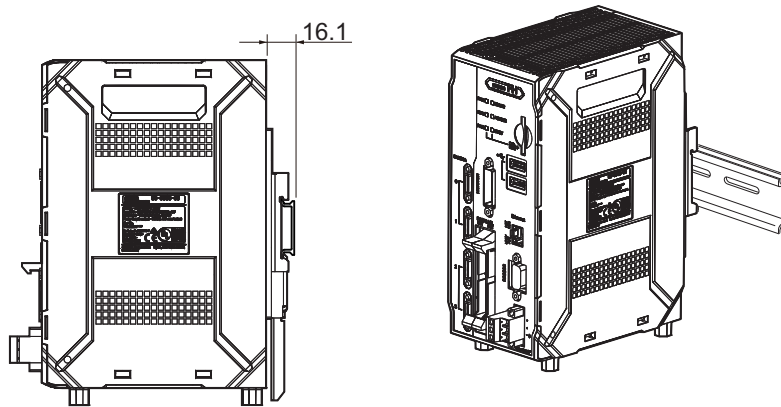
- When mounting the sensor controller to the DIN rail, click the rail stoppers, hook the part of A to rail one to the end, and then push up the rail stoppers with pushing to B direction.



- When removing, insert a flat-head screwdriver to the part of C and pull off.



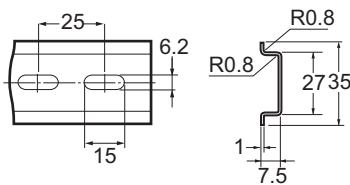
- The back clearance of DIN rail when mount the DIN rail is 16.1 mm.



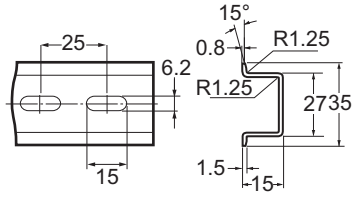
- The following items are recommended for mounting DIN rail.

| Name | Model | Manufacturer | Note |
|---------------|-----------------|-----------------|---|
| DIN35 mm rail | NS 35/ 7,5 PERF | PHOENIX CONTACT | <ul style="list-style-type: none"> • Length: 75.5/95.5/115.5/200 cm • Material: Iron • Surface: Conductive |
| | NS 35/ 15 PERF | | |
| End plate | CLIPFIX 35 | | |

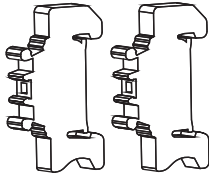
- DIN rail Dimensions:
NS 35/7.5 PERF



NS 35/165 PERF

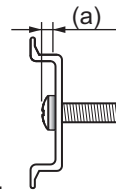


- End plate



For screw or washer, refer to the followings.

| Model | Screw Diameter | (a) |
|-----------------|----------------|-------------|
| NS 35/ 7,5 PERF | M6 | 4.6 mm max. |
| NS 35/ 15 PERF | | 10 mm max. |



(a): Length between head of screw and fastening surface.

5-4 Setup Touch Panel Monitor or Monitor

Describes the notifications of sensor controller when you setup Touch Panel Monitor or Monitor. For handling or functions of monitor, refer to each of instruction sheet.



Precautions for Safe Use

- Use specialized cameras and cables for the product. If not, it may cause malfunction or damage.
 - Make sure to turn off the power when attach or detach cameras or cables. Connecting cables while the power is supplied may cause malfunction or damage to cameras or peripheral devices.
 - Do not apply torsion stress to cables. If not, it may cause damage to cables.
 - Secure the minimum bending radius of cables. If not, it may cause damage to cables.
 - There are products in which the enclosure, mounting screw holes, or ground terminal are short-circuited to 0 V inside (e.g., commercially available monitor products). Connecting the enclosure, mounting screw holes, or ground terminal of such products to the sensor controller with the ground terminal connected to the ground allows the 0 V reference inside the product to be directly connected to the ground, which may cause equipment failure or malfunction.
 - Monitor connector: Please insert the connector perpendicularly so that the connector resin part and pin are not rubbing against each other. Damaged pin may cause contact failure due to generation and invasion of resin powder.
 - Do not ground the positive terminal of the 24 VDC power supply when connecting the sensor controller and FH-MT12 using a USB cable. The internal circuits may cause a short-circuit and result in malfunction.
-



Precautions for Correct Use

When connecting the sensor controller and monitor with a switcher and splitter

- Do not use devices that may require re-recognition of the monitor by the sensor controller when a switching operation was performed. If such re-recognition processing happens at switching operation, it may cause measurement time to be longer.

When fix the DVI connector

- If difficult to fix the bilateral screws of DVI connector, once loosen these. Then retry to fix, again.
-

5-5 Camera Installation

Guidelines and precautions for sensor controller installation when cameras are also installed.
For handling and function information for specific cameras, refer to the appropriate instruction sheet.

5-5-1 All Series

WARNING

If you keep watching the LED light, it may have an adverse effect on the eyes, do not stare directly into the light emitted from the LED. If a specular object is used, take care not to allow reflected light to enter your eyes.



Caution

Please take fail-safe measures on your side in preparation for an abnormal signal due to signal conductor disconnection and/or momentary power interruption. An abnormal operation may result in a serious accident.



Precautions for Safe Use

- Use specialized cameras and cables for the product. If not, it may cause malfunction or damage.
- Make sure to turn off the power when attach or detach cameras or cables. Connecting cables while the power is supplied may cause malfunction or damage to cameras or peripheral devices.
- Since cables to which bending is frequently applied is easily broken, use the robotic cable type (bending resistant cable) to prevent damages.
- Do not apply torsion stress to cables. If not, it may cause damage to cables.
- Secure the minimum bending radius of cables. If not, it may cause damage to cables.
- While the power is ON or immediately after the power is turned OFF, the sensor controller and camera case are still hot. Do not touch the case.



Precautions for Correct Use

- Check the following regarding the camera cable you are using.
 - Is there a disconnection?
 - Is there a short circuit?
 - Is there a problem with the connector connection?
- When connecting to the camera connector of each device, be sure to securely fix it with the fixing screw.
- Lay and route camera cables separately from high-voltage power lines.
- Do not install near equipment that generates noise.
- Do not install in hot and humid environments.
- Use in a place free from dust and oil mist.
- Do not use the camera cable exceeding the specified length.
- The camera cable FZ-VS□□ has polarity. Be sure to connect the side with the name plate on it to the sensor controller.
- Use the ferrite core equivalent to ZCAT2035-0930A (manufactured by TDK) at the controller side of the camera cable. (Excluding FH-L Series)

Maintenance

- Turn OFF the power and ensure the safety before maintenance.
- Clean the lens with a lens-cleaning cloth or air brush.
- Lightly wipe off dirt with a soft cloth.
- Dirt on the image element must be removed using an air brush.
- Do not use thinners or benzine.
- When installing / replacing the camera, reset the parameter settings of the corresponding Camera Image Input processing item.

5-5-2 FH-2000/FH-5000 Series

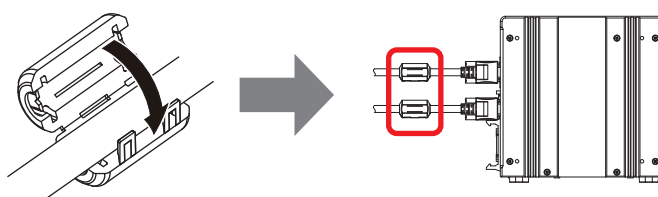


Precautions for Safe Use

- **Ground**
When a base is packed in a camera that will be connected to the sensor controller, make sure to mount the camera using the base. Since the enclosure of the camera body is connected to the internal circuits, mounting the camera without using the base allows the internal circuits to be directly connected to the ground, which may cause malfunction or failure.
- **Connect the sensor controller to FH-SC12/FH-SM12 (12 megapixels camera)**
 - Do not ground the positive terminal of the 24 VDC power supply when connecting the sensor controller and a 12 megapixels camera like FH-SC12 or FH-SM12.

Mounting of Ferrite core

Mount the ferrite core attached to the camera cable to near the sensor controller.

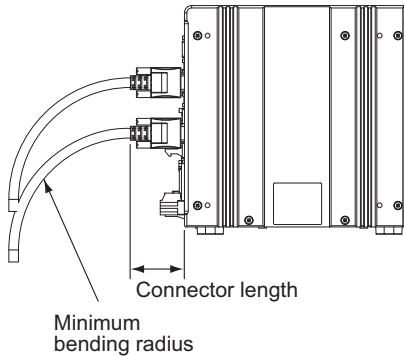


*2. Each camera cables has polarity. Please ensure that the name plate side of the cable is connected to the controller.

(Unit: mm)

Camera cable mounting

Connect the cable with securing the connector length and the minimum bending radius to the sensor controller.



*2. Each camera cables has polarity. Please ensure that the name plate side of the cable is connected to the controller.

| Name | Model | Minimum bending radius | Connector length |
|---|----------|------------------------|------------------|
| Camera Cable | FZ-VS3 | 69 [mm] | 30 [mm] |
| Right-angle Camera Cable | FZ-VSL3 | | |
| Bend resistant Camera Cable | FZ-VSB3 | | |
| Bend resistant Right-angle Camera Cable | FZ-VSLB3 | | |
| Super bend resistant Camera Cable | FZ-VSBX | 69 [mm] | 42 [mm] |
| Long-distance Camera Cable | FZ-VS4 | 78 [mm] | 42 [mm] |
| Long-distance Right-angle Camera Cable | FZ-VSL4 | | |

5-5-3 FH-L Series



Precautions for Safe Use

- **Ground**

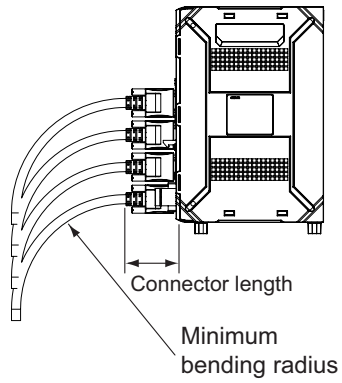
When a base is packed in a camera that will be connected to the sensor controller, make sure to mount the camera using the base. Since the enclosure of the camera body is connected to the internal circuits, mounting the camera without using the base allows the internal circuits to be directly connected to the ground, which may cause malfunction or failure.

- **When connect the sensor controller to the FH-SC12/FH-SM12: 12 megapixels camera**

Do not ground the positive terminal of the 24 VDC power supply when connecting the sensor controller and a 12 megapixels camera like FH-SC12 or FH-SM12.

Camera cable mounting

Connect the cable with securing the connector length and the minimum bending radius to the sensor controller.



*2. Each camera cables has polarity. Please ensure that the name plate side of the cable is connected to the controller.

| Name | Model | Minimum bending radius | Connector length |
|---|----------|------------------------|------------------|
| Camera Cable | FZ-VS3 | 69 [mm] | 30 [mm] |
| Right-angle Camera Cable | FZ-VSL3 | | |
| Bend resistant Camera Cable | FZ-VSB3 | | |
| Bend resistant Right-angle Camera Cable | FZ-VSLB3 | | |
| Super bend resistant Camera Cable | FZ-VSBX | 69 [mm] | 42 [mm] |
| Long-distance Camera Cable | FZ-VS4 | 78 [mm] | 42 [mm] |
| Long-distance Right-angle Camera Cable | FZ-VSL4 | | |

5-6 Insert / Remove SD Memory Card or USB Flash Drive



Precautions for Safe Use

- Do not insert an SD memory card in the reverse orientation, at an angle, or in a twisting manner.
-



Precautions for Correct Use

Handling of SD memory card

- When you touch a terminal part of SD memory card, antistatic is required by using a wrist strap or others.

When connecting USB memory device or SD memory card

- Be sure to execute Device Information Storage Tool described in the *Vision System FH/FHV Series User's Manual (Cat. No. Z365)* when connecting USB flash drive.

When removing USB memory device or SD memory card

- When removing USB memory device or SD memory card, select **Function** menu - **System information** - **Drive information** on the main screen, then press the **Eject** button and confirm it is safe to remove.
 - When using remote operation, before removing a USB memory device or SD memory card, make sure that data is not being read or written to them.
For a USB flash drive, the memory device's LED flashes or lights while data is being read or written, so make sure that it is turned OFF before removing the memory.
For SD memory card, the SD BUSY LED flashes or lights while data is being read or written, so make sure that it is turned OFF before removing the memory.
 - When a message is displayed indicating that a task is in progress, do not turn OFF the power. Doing so causes the data in the memory to be corrupted, resulting in the product not operating properly upon the next start-up.
-

Do not insert or remove USB flash drive or SD memory card during measurement, loading, and writing. There is the possibility of measurement time or damage of data.



Additional Information

For external storage device and external drive name, refer to the *Using External Storage Devices and External Drive Name* in the *Vision System FH/FHV Series User's Manual (Cat. No. Z365)*.

5-7 Use by Connecting Software

Sysmac Studio FH tool, FZ_FH Remote Operation tool, and Simulation Software are dedicated software.

5-7-1 Sysmac Studio FH Tool

Sysmac Studio FH tool is supported only FH-2000/FH-5000 series.

When you purchase these series newly, both software DVD and icons are required.



Additional Information

For Sysmac Studio FH tool, refer to the *Vision System FH Series Operation Manual for Sysmac Studio (Cat. No. Z343)*.

5-7-2 FZ_FH Remote Operation Tool

FZ_FH Remote Operation tool is supported all of the series; FH-2000/FH-5000, and FH-L series.

When you purchase these series newly, both software CD-ROM and license are required.



Additional Information

For details of FZ_FH Remote Operation tool, refer to *Remotely Operating the Controller (Remote Operation)* section in the *Vision System FH/FHV series User's Manual (Cat. No. Z365)*.

5-7-3 Simulation Software

Using the Simulation Software, you can check the operation or functions of Vision System FH series on a PC.

When you purchase these series newly, both software CD-ROM and license are required.



Additional Information

For using the Simulation Software, refer to the description of *How To Use Simulation Software*.

5-8 Installation in a Control Panel

When the sensor controller is being installed in a cabinet or control panel, be sure to provide proper ambient conditions as well as access for operation and maintenance.

5-8-1 All Series



Precautions for Safe Use

Installation Environment

- Do not use the product in the environment with flammable or explosive gases.
- Install the product so that the air can flow freely through its cooling vents.
- Regularly clean the vent holes or fan outlet to prevent dust or particles blocking them. Internal temperature increases when those are blocked, it causes malfunction.
- To secure safety for operation and maintenance, install the product apart from high-voltage devices and power devices.
- Make sure to tighten all screws in mounting.

Accessibility for Operation and Maintenance

- Do not apply torsion stress to cables. If not, it may cause damage to cables.
- Secure the minimum bending radius of cables. If not, it may cause damage to cables.



Precautions for Correct Use

Installation and Storage Sites

Install and store the product in a location that meets the following conditions:

- No rapid changes in temperature (place where dew does not form)
- No presence of corrosive or flammable gases
- Place free of dust, salts and iron particles
- Place free of vibration and shock
- Place out of direct sunlight
- Place where it will not come into contact with water, oils or chemicals
- Place not affected by strong electro-magnetic waves
- Place not near to high-voltage, or high-power equipment

Ambient Temperature

- Do not install the product immediately above significant heat sources, such as heaters, transformers, or large-capacity resistors.

Ambient temperature and humidity

- Panels have been reduced in size due to space-saving and miniaturization in devices and systems, and the temperature inside the panel may be at least 10 to 15°C higher than outside the panel. Implement the following measures against overheating at the installation site and in the panel, and allow a sufficient margin for the temperature.
- The Controller may not start normally if the temperature is below 0°C when the power is turned ON. Maintain an air temperature of at least approximately 5°C inside the panel, by implementing measures such as installing a low-capacity space heater in the panel. Alternatively, leave the Controller power ON to keep the Controller warm.
- Rapid temperature changes can cause condensation to occur, resulting in malfunctioning due to short-circuiting. When there is a possibility of this occurring, take measures against condensation,

such as leaving the Controller power ON at night or installing a heater in the control panel to keep it warmer.

Vibration and Shock

The Controller is tested for conformity with the sine wave vibration test method (IEC 60068-2-6) and the shock test method (IEC 60068-2-27) of the Environmental Testing for Electrotechnical Products. It is designed so that malfunctioning will not occur within the specifications for vibration and shock. If, however, the Controller is to be used in a location in which it will be directly subjected to regular vibration or shock, then implement the following countermeasures:

- Separate the control panel from the source of the vibration or shock. Or secure the Controller and the panel with rubber padding to prevent vibration.
- Make the building or the floor vibration-resistant.
- To prevent shock when other devices in the panel such as electromagnetic contactors operate, secure either the source of the shock or the Controller with rubber padding.

Accessibility for Operation and Maintenance

- To ensure safe access for operation and maintenance, separate the Controller as much as possible from high-voltage equipment and power machinery.
- Secure the minimum bending radius of the cable. Otherwise the cable may be damaged.
- Consider the physical size of USB flash drive, or SD memory card as these will be inserted in to the mounted sensor controller.

5-8-2 FH-2000/FH-5000 Series



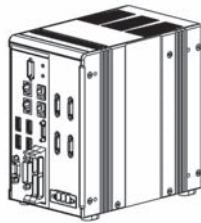
Precautions for Correct Use

Ambient Temperature

- Install and store the product in a location that meets the following conditions:
 - Surrounding temperature of 0 to +50°C*¹ (-20 to +65°C in storage)
 - *1. FH-5000 Series: Surrounding temperature of 0 to 45°C
 - Relative humidity of between 35% to 85%
- Do not let the ambient temperature exceed 50°C (122°F)*².
- Provide a forced-air fan cooling or air conditioning if the ambient temperature is near 50°C (122°F)*² so that the ambient temperature never exceeds 50°C (122°F)*².
 - *2. FH-5000 Series: 45°C (113°F)

Orientation of Product

- For good heat dissipation, install the product only in the position shown below so as not to block the ventilation holes. Install the product so that the air can flow freely through its cooling vents.



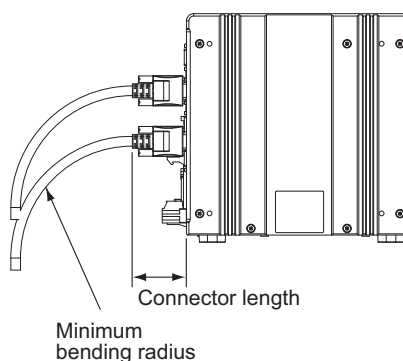
- Do not install the product in the following positions.



- For good ventilation, provide a clearance of 50 [mm] or more above the sensor controller away from other devices in the normal floor mounting. For the right and left sides, provide a clearance of 30 [mm] or more, and for the back side, 15 [mm] or more. These clearances are also required when mounting multiple sensor controllers side by side. For the back mounting, the back-side clearance of 15 [mm] is not required.

Accessibility for Operation and Maintenance

Connect the cable with securing the connector length and the minimum bending radius to the sensor controller.

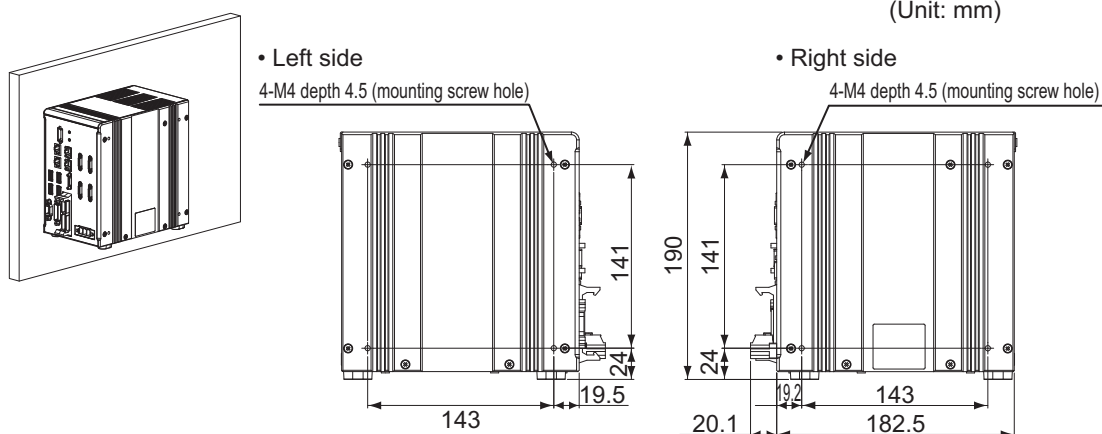


| Name | Model | Minimum bending radius | Connector length |
|---|----------|------------------------|------------------|
| Camera Cable | FZ-VS3 | 69 [mm] | 30 [mm] |
| Right-angle Camera Cable | FZ-VSL3 | | |
| Bend resistant Camera Cable | FZ-VSB3 | | |
| Bend resistant Right-angle Camera Cable | FZ-VSLB3 | | |
| Super bend resistant Camera Cable | FZ-VSBX | 69 [mm] | 42 [mm] |
| Long-distance Camera Cable | FZ-VS4 | 78 [mm] | 42 [mm] |
| Long-distance Right-angle Camera Cable | FZ-VSL4 | | |

Installation in a Control Panel

- Make sure to tighten all screws in mounting.
- For good ventilation, provide a clearance of 50 [mm] or more above the sensor controller away from other devices in the normal floor mounting. For the right and left sides, provide a clearance of 30 [mm] or more, and for the back side, 15 [mm] or more. These clearances are also required when mounting multiple sensor controllers side by side. For the back mounting, the back-side clearance of 15 [mm] is not required.

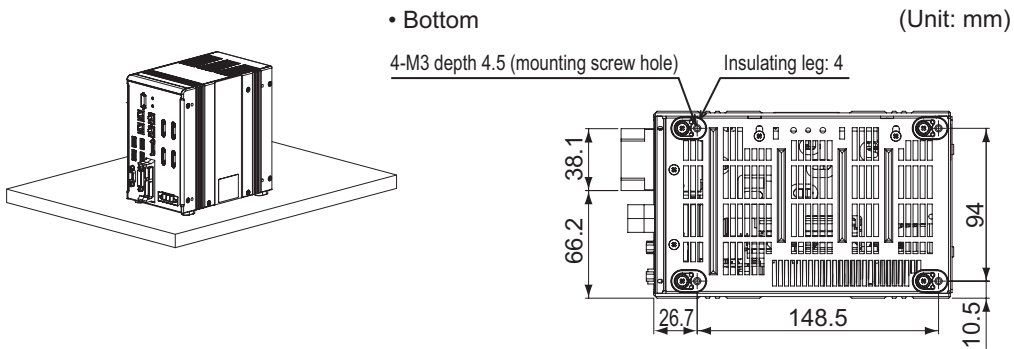
● Side Mounting



* Recommended tightening torque: 1.2 N•m to 1.3 N•m

* The tolerance is ± 0.2 mm.

● **Bottom Mounting**



- * Do not remove the Insulating leg. Fix the Insulating leg to secure the ventilation path.
- * Recommended tightening torque: 0.54 N•m to 0.6 N•m
- * The tolerance is ± 0.2 mm.

5-8-3 FH-L Series



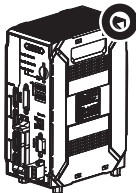
Precautions for Correct Use

Ambient Temperature

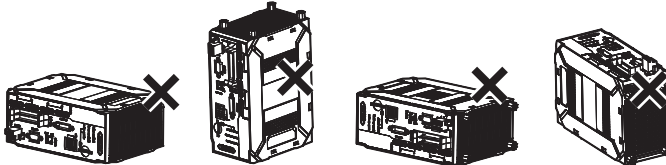
- Install and store the product in a location that meets the following conditions:
 - Surrounding temperature of 0 to +55°C (-25 to +70°C in storage)
 - Relative humidity of between 10% to 90%
- Provide a forced-air fan cooling or air conditioning if the ambient temperature is near 55°C (131°F) so that the ambient temperature never exceeds 55°C (131°F).

Orientation of Product

- For good heat dissipation, install the product only in the position shown below so as not to block the ventilation holes.



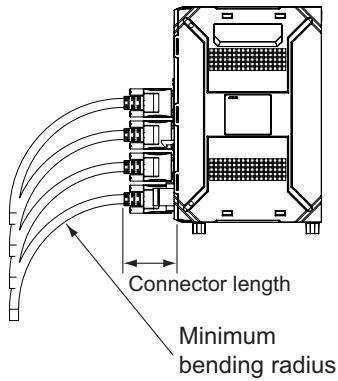
- Do not install the product in the following positions.



- For good ventilation, provide a clearance of 50 mm or more above the sensor controller away from other devices in the normal floor mounting. For the right and left sides, back side, for other devices, or sensor controller 25 mm or more.

Accessibility for Operation and Maintenance

Connect the cable with securing the connector length and the minimum bending radius to the sensor controller.

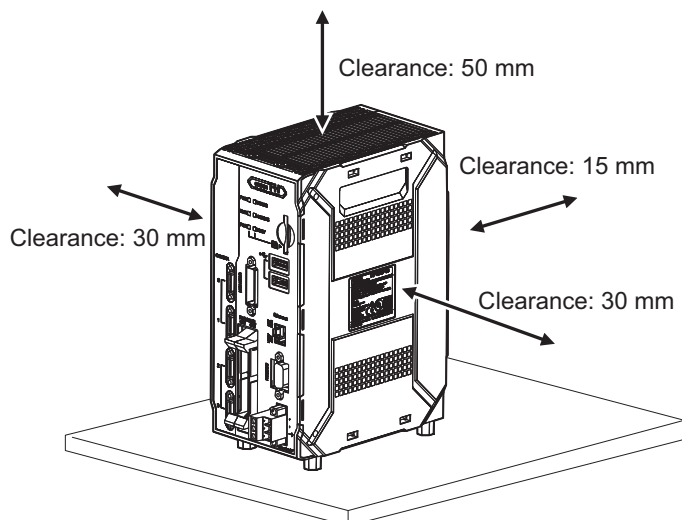


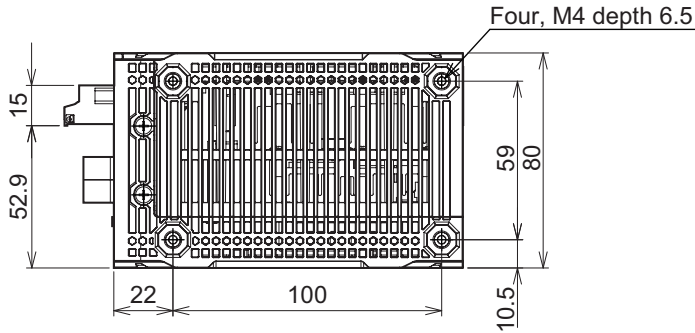
| Name | Model | Minimum bending radius | Connector length |
|---|----------|------------------------|------------------|
| Camera Cable | FZ-VS3 | 69 [mm] | 30 [mm] |
| Right-angle Camera Cable | FZ-VSL3 | | |
| Bend resistant Camera Cable | FZ-VSB3 | | |
| Bend resistant Right-angle Camera Cable | FZ-VSLB3 | | |
| Super bend resistant Camera Cable | FZ-VSBX | 69 [mm] | 42 [mm] |
| Long-distance Camera Cable | FZ-VS4 | 78 [mm] | 42 [mm] |
| Long-distance Right-angle Camera Cable | FZ-VSL4 | | |

Installation in a Control Panel

- Make sure to tighten all screws in mounting.
- For good ventilation, provide a clearance of 50 [mm] or more above the sensor controller away from other devices in the normal floor mounting. For the right and left sides, provide a clearance of 30 [mm] or more, and for the back side, 15 [mm] or more. These clearances are also required when mounting multiple sensor controllers side by side.

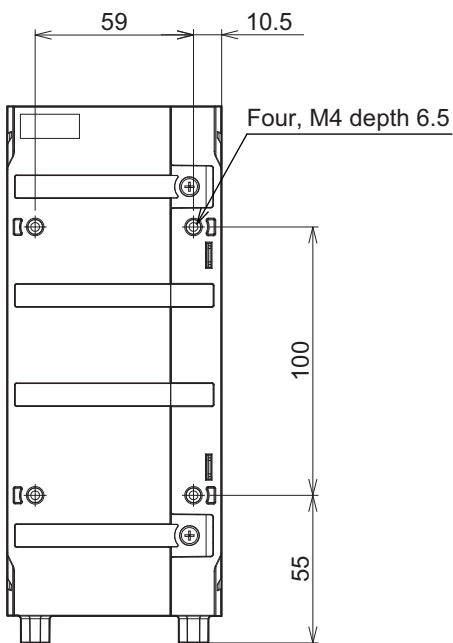
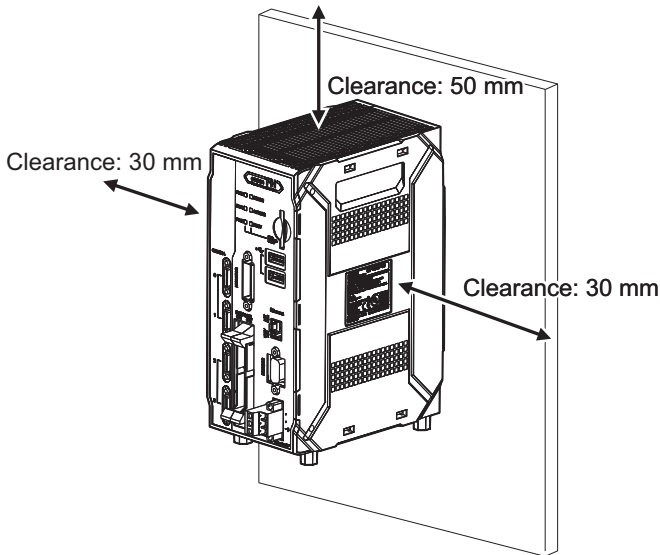
● Mounting the base of the Sensor Controller (Floor mounting)





- Recommended tightening torque: 0.54 to 0.6 N•m
- The tolerance: ± 0.2 mm

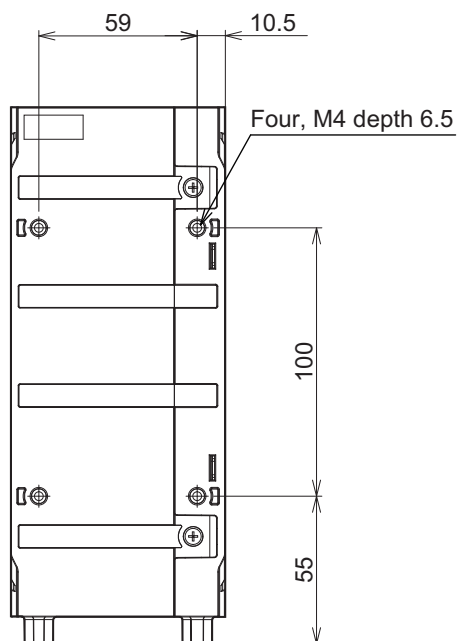
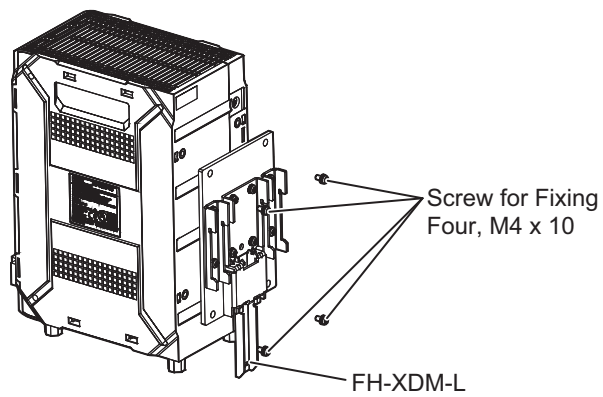
● **Mounting of the Back Side**



- Recommended tightening torque: 0.54 to 0.6 N•m
- The tolerance: ± 0.2 mm

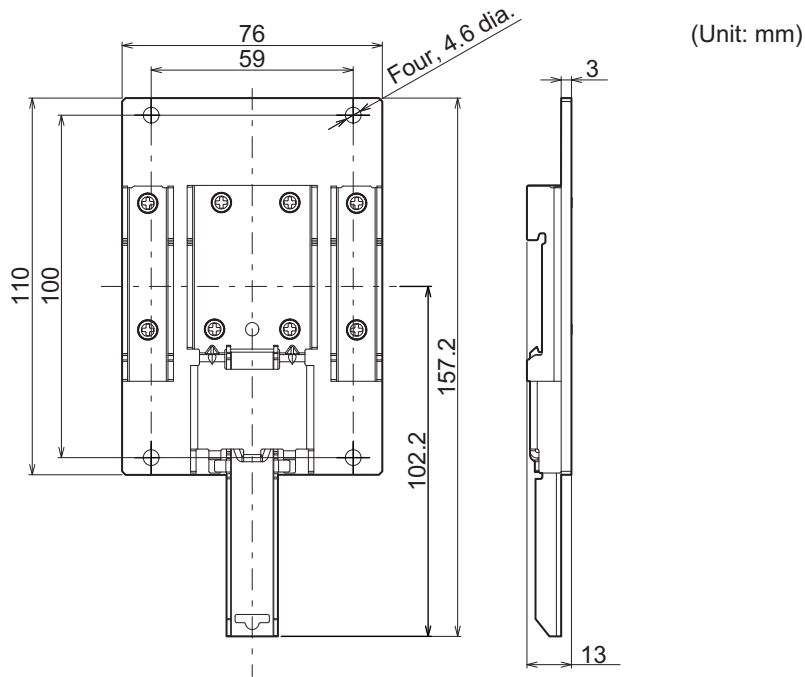
● Mounting the DIN rail

Mount DIN rail mounting bracket: FH-XDM-L, to the four mount holes on the back of the sensor controller.

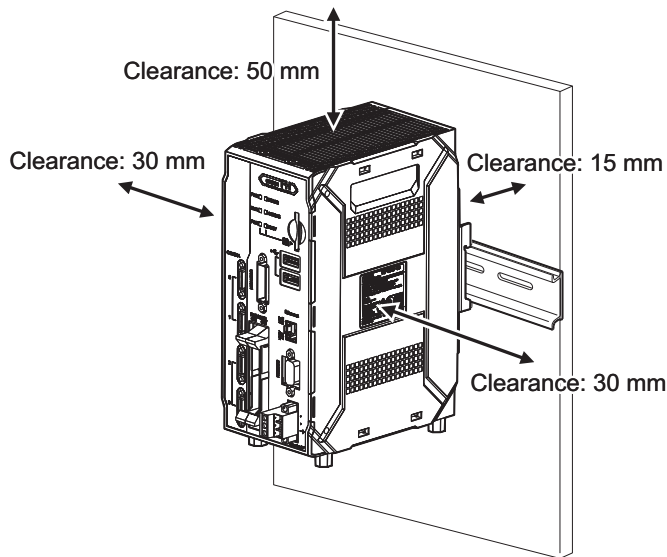


- Recommended tightening torque: 0.54 to 0.6 N•m
- The tolerance: ± 0.2 mm

- Dimensions of DIN rail mounting bracket: FH-XDM-L

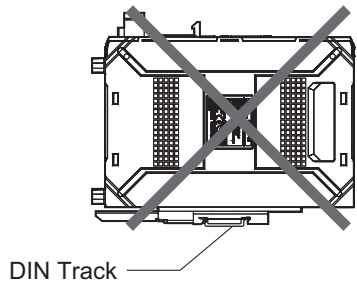


- When mounting the DIN rail, for improvement of heat dissipation, install the product in the following orientation only.

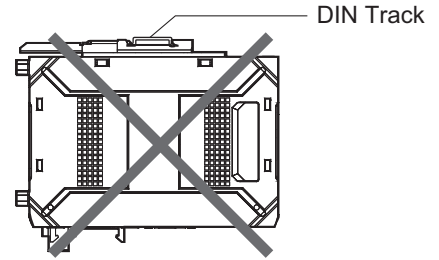


- Do not install in this orientation.

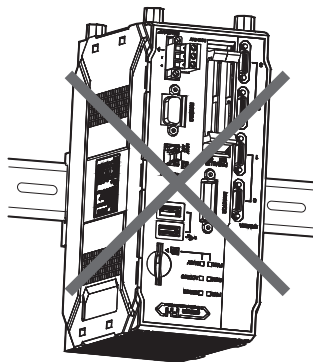
Set DIN rail to the bottom of the sensor controller.



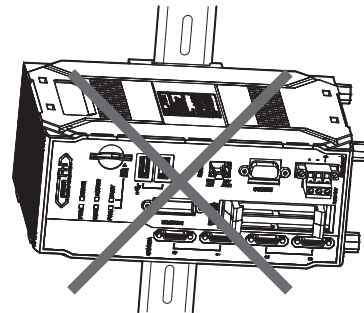
Set DIN rail on the top of the sensor controller.



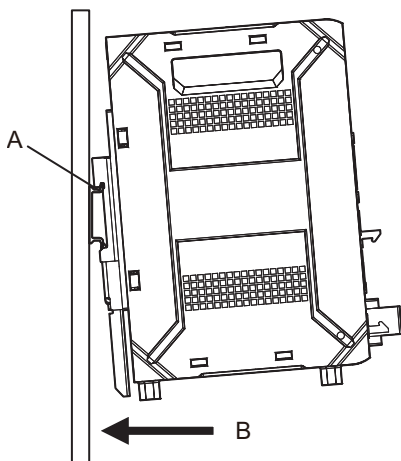
Set DIN rail vertically to the sensor controller.



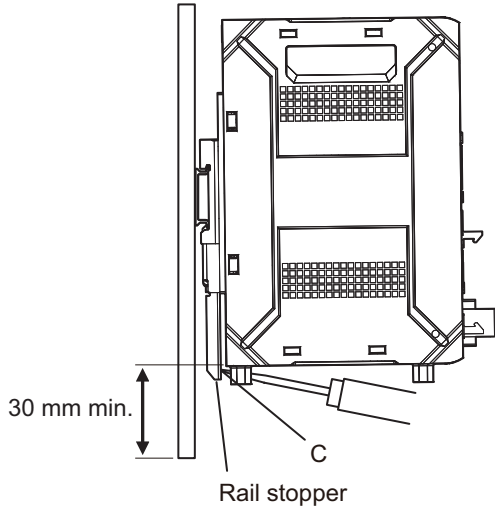
Set DIN rail horizontally to the sensor controller.



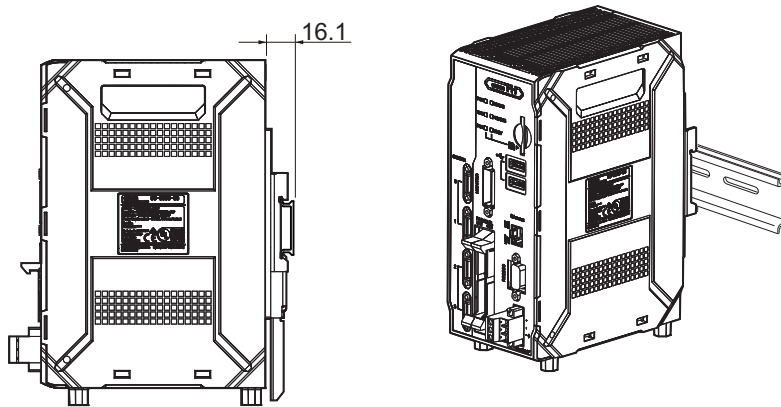
- When mounting the sensor controller to the DIN rail, click the rail stoppers, hook the part of A to rail one to the end, and then push up the rail stoppers with pushing to B direction.



- When removing, insert a flat-head screwdriver to the part of C and pull off.



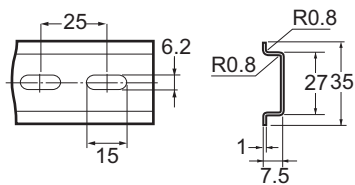
- The back clearance of DIN rail when mount the DIN rail is 16.1 mm.



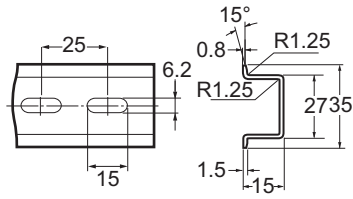
- The following items are recommended for mounting DIN rail.

| Name | Model | Manufacturer | Note |
|---------------|-----------------|-----------------|---|
| DIN35 mm rail | NS 35/ 7,5 PERF | PHOENIX CONTACT | <ul style="list-style-type: none"> • Length: 75.5/95.5/115.5/200 cm • Material: Iron • Surface: Conductive |
| | NS 35/ 15 PERF | | |
| End plate | CLIPFIX 35 | | Need 2 pieces each sensor controller. |

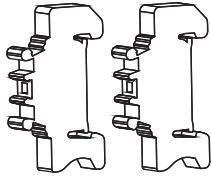
- DIN rail Dimensions:
NS 35/7.5 PERF



NS 35/165 PERF

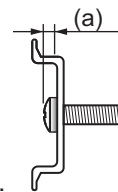


- End plate



For screw or washer, refer to the followings.

| Model | Screw Diameter | (a) |
|-----------------|----------------|-------------|
| NS 35/ 7,5 PERF | M6 | 4.6 mm max. |
| NS 35/ 15 PERF | | 10 mm max. |



(a): Length between head of screw and fastening surface.

6

I/O Interface

| | | |
|------------|--|-------------|
| 6-1 | Parallel Interface | 6-2 |
| 6-1-1 | All Series..... | 6-2 |
| 6-1-2 | FH-2000/FH-5000 Series..... | 6-3 |
| 6-1-3 | FH-L Series..... | 6-15 |
| 6-1-4 | Other (Parallel Converter Cable) | 6-24 |
| 6-2 | Encoder Interface | 6-35 |
| 6-2-1 | FH-2000/FH-5000 Series..... | 6-35 |
| 6-3 | EtherCAT Interface | 6-38 |
| 6-3-1 | FH-2000/FH-5000 Series..... | 6-38 |
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| 6-4-2 | FH-L Series..... | 6-41 |
| 6-5 | Serial Interface | 6-44 |
| 6-5-1 | All Series..... | 6-44 |

6-1 Parallel Interface

Parallel interfaces vary by sensor controller series. Refer to the appropriate series for information.

6-1-1 All Series



Precautions for Safe Use

- Always turn OFF the power of the FH-L series sensor controller and peripheral devices before connecting or disconnecting a camera or cable. Connecting the cable with power supplied may result in damage of the camera or peripheral devices.
 - Since cables to which bending is frequently applied is easily broken, use the robotic cable type (bending resistant cable) to prevent damages.
 - Do not apply torsion stress to cables. If not, it may cause damage to cables.
 - Secure the minimum bending radius of cables. If not, it may cause damage to cables.
-



Precautions for Correct Use

- Check the following items on the communications cables that are used in the network.
 - Are there any breaks?
 - Are there any shorts?
 - Are there any connector problems?
 - When you connect the cable to the communications connectors on devices, firmly insert the communications cable connector until it locks in place.
 - Do not lay the communications cables together with high-voltage lines.
 - Do not lay the communications cable near devices that generate noise.
 - Do not lay the communications cables in locations subject to high temperatures or high humidity.
 - Do not lay the communications cables in locations subject to excessive dirt and dust or to oil mist or other contaminants.
-

6-1-2 FH-2000/FH-5000 Series

The parallel interface can be used for both NPN and PNP. An appropriate wiring is required according to the external device.

The encoder interface, open collector type, is also included.

The encoder interface, open collector type, is ENCTRIG_A, ENCTRIG_B, ENCTRIG_Z. Connect the corresponding pins to the encoder properly.

Interface Specification

- Specifications vary depending on the pin's role.
- The pins for the encoder interface, open collector type, are ENCTRIG_A (No. 8 and 11), ENCTRIG_B (No. 12 and 13), ENCTRIG_Z (No. 4 and 5). The response frequency of the encoder is 4 [KHz].

● [Input]

Object signals:

- No.14 pin: Use the COMIN1 terminal when using these signals.
- No.37 to 46 pins: Use the COMIN2 terminal when using these signals.

| Item | Specifications |
|---------------|-------------------------|
| Input voltage | 12 to 24 VDC $\pm 10\%$ |
| ON current*1 | 5 mA min. |
| ON voltage*1 | 8.8 V min. |
| OFF current*2 | 0.5 mA max. |
| OFF voltage*2 | 1.1 V max. |
| ON delay | 5 ms max. |
| OFF delay | 0.7 ms max. |

*1. ON current and ON voltage:

These are the current value or voltage value to turn ON from OFF. The value for the ON voltage is the potential difference between COMIN and each input terminal.

*2. OFF current and OFF voltage:

These are the current value or voltage value to turn OFF from ON. The value for the OFF voltage is the potential difference between COMIN and each input terminal.

● [Input]

Object signals:

- No.4 to 6, 9 to 11 pins: Use the COMIN1 terminal when using these signals.
- No.7, 8, 12, 13 pins: Use the COMIN0 terminal when using these signals.

| Item | Specifications |
|---------------|-------------------------|
| Input voltage | 12 to 24 VDC $\pm 10\%$ |
| ON current*1 | 5 mA min. |
| ON voltage*1 | 8.8 V min. |
| OFF current*2 | 0.5 mA max. |
| OFF voltage*2 | 0.8 V max. |
| ON delay | 0.1 ms max. |

| Item | Specifications |
|-------------------------|----------------|
| OFF delay | 0.1 ms max. |
| Max. response frequency | 4 KHz |

*1. ON current and ON voltage:

These are the current value or voltage value to turn ON from OFF. The value for the ON voltage is the potential difference between COMIN and each input terminal.

*2. OFF current and OFF voltage:

These are the current value or voltage value to turn OFF from ON. The value for the OFF voltage is the potential difference between COMIN and each input terminal.

● [Output]

Object signals:

- No.15 to 19 pin, No.28 to 32 pin: Use the COMOUT0 terminal when using these signals.
- No.48 to 57 pins: Use the COMOUT2 terminal when using these signals.
- No.58 to 66 pins: Use the COMOUT3 terminal when using these signals.

| Item | Specifications |
|---------------------|-------------------------|
| Output voltage | 12 to 24 VDC $\pm 10\%$ |
| Load current*1 | 45 mA max. |
| ON residual voltage | 2 V max. |
| OFF leakage current | 0.2 mA max. |

*1. The load current must be the specified current value or lower. Exceeding the specified current value may cause damage to the output circuit.

● [Output]

Object signals:

- No.20 to 27 pins: Connect the COMOUT1 and COMIN0 terminals when using these signals.

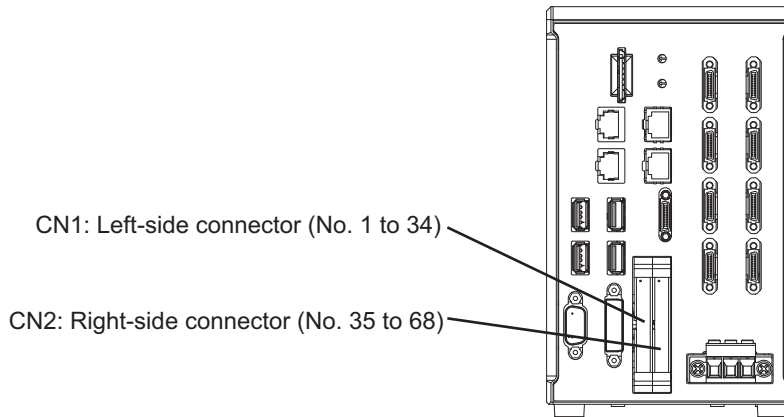
| Item | Specifications |
|---------------------|-------------------------|
| Output voltage | 12 to 24 VDC $\pm 10\%$ |
| Load current*1 | 45 mA max. |
| ON residual voltage | 2 V max. |
| OFF leakage current | 0.2 mA max. |

*1. The load current must be the specified current value or lower. Exceeding the specified current value may cause damage to the output circuit.

● Connection

Connect the parallel I/O cable with more than the minimum bending radius.

● Pin Assignment

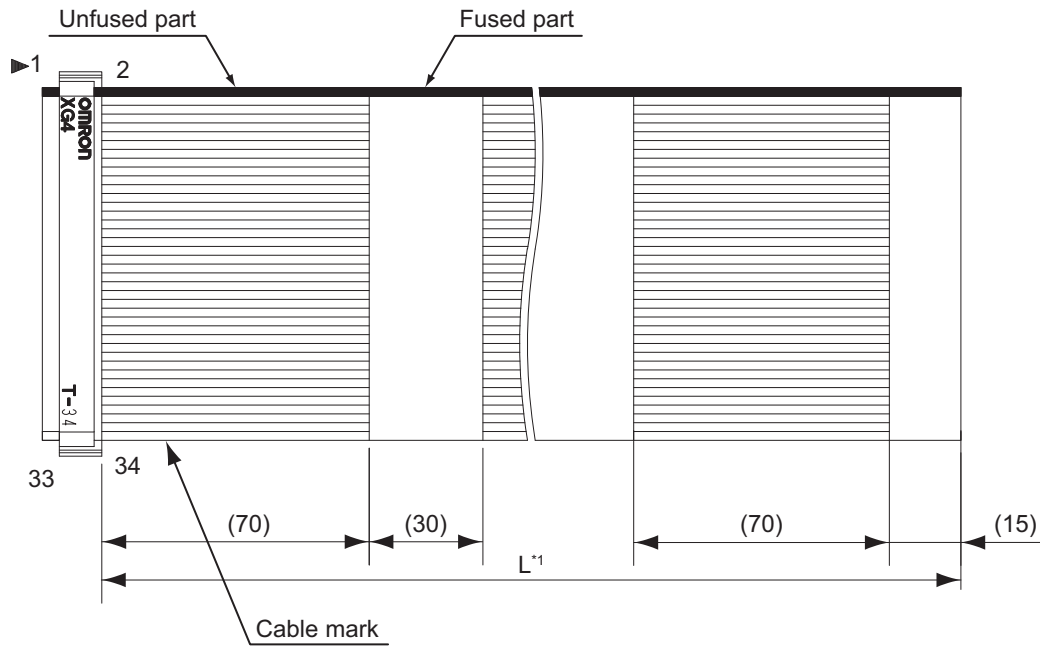


Cable, I/O connector and Terminal Block

Use the following parallel I/O cable.

| Name | Model | Description | Remark |
|---|--------------|---|---|
| Parallel I/O cable | XW2Z-S013-□ | Specialized for FH series Cable length: 2 m, 5 m Min. bending radius: 10 mm | <ul style="list-style-type: none"> Two these cables are needed to use all I/O signals. One side of this cable is flat cable and another side of it is a connector. Connect the parallel I/O cable with securing the minimum bending radius and more. Cable length is set to □ in the model number. (2 = 2 m, 5 = 5 m) |
| Parallel I/O cable for Connector-Terminal Conversion Unit | XW2Z-□□□EE | Specialized for FH series Cable length: 0.5 m, 1 m, 1.5 m, 2 m, 3 m, 5 m Min. bending radius: 83.2 mm | <ul style="list-style-type: none"> Two these cables are needed to use all I/O signals. One side of this cable is flat cable and another side of it is a connector. Connect the parallel I/O cable with securing the minimum bending radius and more. Cable length is set to □ in the model number. (050 = 0.5 m, 100 = 1 m, 150 = 1.5 m, 2 = 2 m, 300 = 3 m, 500 = 5 m) Terminal Blocks Recommended Products: OMRON XW2K-34G-T or XW2R-□34GD-T |
| Terminal Blocks | XW2K-34G-T | Ultra-Compact Interface Wiring System (General-Purpose) | Refer to the <i>XW2K Series Datasheet (Cat. No. G152)</i> for details. |
| | XW2R-□34GD-T | Connector-Terminal Conversion Unit for general-purpose | The following is set to □ in the model number. For details, refer to the <i>XW2R (General-purpose devices) Data Sheet</i> . |

● XW2Z-S013-□



*1. Cable is available in 2 m/5 m.

Pin Layout

Terminal assignments and signal names should be set according to the FH sensor controller's operation mode settings. Verify that the wiring conforms to that.



Additional Information

For Operation Mode, refer to the *Multi-line Random-trigger Mode* in the *Vision Sensor FH/FHV Series User's Manual (Cat. No. Z365)*.

| No. | I/O | XW2Z-S013-□ Wire color | Terminal Blocks | Signal name | | | |
|-----|-----|---------------------------|-----------------|---|---|--------------------------|--------------------------|
| | | | | 1-line mode | 2-line random mode | 3- to 4-line random mode | 5- to 8-line random mode |
| CN1 | | | | | | | |
| 1 | - | Red | A1 | COMIN0 | | | |
| 2 | - | Gray | B1 | COMIN1 | | | |
| 3 | - | Gray | A2 | Vacant | | | |
| 4 | IN | Gray | B2 | STEP0/ ENC- TRIG_Z0* ¹ | STEP0/ ENC- TRIG_Z0* ² | STEP0 | STEP0 |
| 5 | IN | Green | A3 | Not used* ³ | STEP1/ ENC- TRIG_Z1* ² | STEP1 | STEP1 |
| 6 | IN | Gray | B3 | Not used* ³ | Not used* ³ | STEP2 | STEP2 |
| 7 | IN | Gray | A4 | Not used* ³ | Not used* ³ | STEP3 | STEP3 |

| No. | I/O | XW2Z-S013-□ Wire color | Terminal Blocks | Signal name | | | |
|-----|-----|---------------------------|-----------------|-------------------|--------------------|--------------------------|--------------------------|
| | | | | 1-line mode | 2-line random mode | 3- to 4-line random mode | 5- to 8-line random mode |
| 8 | IN | Gray | B4 | ENC-TRIG_A0*1 | ENC-TRIG_A0*1 | Not used*3 | Not used*3 |
| 9 | IN | Gray | A5 | Not used*3 | Not used*3 | Not used*3 | STEP4 |
| 10 | IN | Green | B5 | Not used*3 | Not used*3 | Not used | STEP5 |
| 11 | IN | Gray | A6 | Not used*3 | ENC-TRIG_A1 | Not used | STEP6 |
| 12 | IN | Gray | B6 | Not used*3 | ENC-TRIG_B1*2 | Not used | STEP7 |
| 13 | IN | Gray | A7 | ENC-TRIG_B0*1 | ENC-TRIG_B0*2 | Not used*3 | Not used*3 |
| 14 | IN | Gray | B7 | Not used*3 | DILINE0 | | |
| 15 | OUT | Green | A8 | RUN0 | RUN0 | RUN0 | READY0 |
| 16 | OUT | Gray | B8 | READY0 | READY0 | READY0 | BUSY0 |
| 17 | OUT | Gray | A9 | BUSY0 | BUSY0 | BUSY0 | OR0 |
| 18 | OUT | Gray | B9 | OR0 | OR0 | OR0 | READY1 |
| 19 | OUT | Gray | A10 | ERROR0 | ERROR0 | ERROR0 | BUSY1 |
| 20 | OUT | Green | B10 | STGOUT0*4/SHTOUT0 | | | |
| 21 | OUT | Gray | A11 | STGOUT1*4/SHTOUT1 | | | |
| 22 | OUT | Gray | B11 | STGOUT2*4/SHTOUT2 | | | |
| 23 | OUT | Gray | A12 | STGOUT3*4/SHTOUT3 | | | |
| 24 | OUT | Gray | B12 | STGOUT4*4/SHTOUT4 | | | |
| 25 | OUT | Green | A13 | STGOUT5*4/SHTOUT5 | | | |
| 26 | OUT | Gray | B13 | STGOUT6*4/SHTOUT6 | | | |
| 27 | OUT | Gray | A14 | STGOUT7*4/SHTOUT7 | | | |
| 28 | OUT | Gray | B14 | Not used*3 | RUN1 | RUN1 | OR1 |
| 29 | OUT | Gray | A15 | Not used*3 | READY1 | READY1 | READY2 |
| 30 | OUT | Green | B15 | Not used*3 | BUSY1 | BUSY1 | BUSY2 |
| 31 | OUT | Gray | A16 | Not used*3 | OR1 | OR1 | OR2 |
| 32 | OUT | Gray | B16 | Not used*3 | ERROR1 | ERROR1 | READY3 |
| 33 | - | Gray | A17 | COMOUT0 | | | |
| 34 | - | Gray | B17 | COMOUT1 | | | |
| CN2 | | | | | | | |
| 35 | - | Red | A1 | COMIN2 | | | |
| 36 | - | Gray | B1 | Vacant | | | |
| 37 | IN | Gray | A2 | DSA0 | DSA0 | DILINE1 | DILINE1 |
| 38 | IN | Gray | B2 | Not used*3 | DSA1 | Not used*3 | DILINE2 |
| 39 | IN | Green | A3 | DI0 | | | |
| 40 | IN | Gray | B3 | DI1 | | | |
| 41 | IN | Gray | A4 | DI2 | | | |
| 42 | IN | Gray | B4 | DI3 | | | |
| 43 | IN | Gray | A5 | DI4 | | | |
| 44 | IN | Green | B5 | DI5 | | | |

| No. | I/O | XW2Z-S013-□ Wire color | Terminal Blocks | Signal name | | | |
|-----|-----|---------------------------|-----------------|-------------|--------------------|--------------------------|--------------------------|
| | | | | 1-line mode | 2-line random mode | 3- to 4-line random mode | 5- to 8-line random mode |
| 45 | IN | Gray | A6 | DI6 | | | |
| 46 | IN | Gray | B6 | DI7 | | | |
| 47 | IN | Gray | A7 | Vacant | | | |
| 48 | OUT | Gray | B7 | ACK | | | |
| 49 | OUT | Green | A8 | GATE0 | GATE0 | RUN2 | BUSY3 |
| 50 | OUT | Gray | B8 | Not used*3 | GATE1 | READY2 | OR3 |
| 51 | OUT | Gray | A9 | DO0 | DO0 | BUSY2 | READY4 |
| 52 | OUT | Gray | B9 | DO1 | DO1 | OR2 | BUSY4 |
| 53 | OUT | Gray | A10 | DO2 | DO2 | ERROR2 | OR4 |
| 54 | OUT | Green | B10 | DO3 | DO3 | RUN3 | READY5 |
| 55 | OUT | Gray | A11 | DO4 | DO4 | READY3 | BUSY5 |
| 56 | OUT | Gray | B11 | DO5 | DO5 | BUSY3 | OR5 |
| 57 | OUT | Gray | A12 | DO6 | DO6 | OR3 | READY6 |
| 58 | OUT | Gray | B12 | DO7 | DO7 | ERROR3 | BUSY6 |
| 59 | OUT | Green | A13 | DO8 | DO8 | Not used*3 | OR6 |
| 60 | OUT | Gray | B13 | DO9 | DO9 | Not used*3 | READY7 |
| 61 | OUT | Gray | A14 | DO10 | DO10 | Not used*3 | BUSY7 |
| 62 | OUT | Gray | B14 | DO11 | DO11 | Not used*3 | OR7 |
| 63 | OUT | Gray | A15 | DO12 | DO12 | Not used*3 | Not used*3 |
| 64 | OUT | Green | B15 | DO13 | DO13 | Not used*3 | Not used*3 |
| 65 | OUT | Gray | A16 | DO14 | DO14 | Not used*3 | Not used*3 |
| 66 | OUT | Gray | B16 | DO15 | DO15 | Not used*3 | ERROR*5 |
| 67 | - | Gray | A17 | COMOUT2 | | | |
| 68 | - | Gray | B17 | COMOUT3 | | | |

Remarks:

COMIN0 to 2: Common for input signals, COMOUT0 to 3: Common for output signals,
 DI0 to 7: Command inputs, DILINE0 to 2: Command inputs (Line specified),
 ENCTRIG_A0 to 1: Encoder trigger input for phase A, ENCTRIG_B0 to 1: Encoder trigger input for phase B,
 ENCTRIG_Z0 to 1: Encoder trigger input for phase Z, STEP0 to 7: Measurement trigger,
 ACK: Instruction execution complete flag, BUSY0 to 7: ON during processing,
 DO0 to 15: Data outputs, ERROR: ON when an error occurs*5,
 ERROR0 to 3: ON when an error occurs, GATE0 to 1: ON during set output time,
 OR0 to 7: Overall judgment results, READY0 to 7: ON when image input is permitted,
 RUN0 to 3: ON when switched to output specified layout,
 SHTOUT0 to 7: Shutter output signals, STGOUT0 to 7: Strobe trigger signals*4

- *1. Use the STEP signal when using measurement trigger inputs. Use the ENCTRIG_A0/B0/Z0 when using encoder inputs
- *2. When using one measurement trigger and one encoder input in the 2-line random mode, use ENCTRIG_A0/B0/Z0 and STEP1.
- *3. Do not connect anything for "Not used".
- *4. This signal is used when the strobe signal is used for the sensor controller.
- *5. The ERROR signal is shared among No.1 to 8 line.

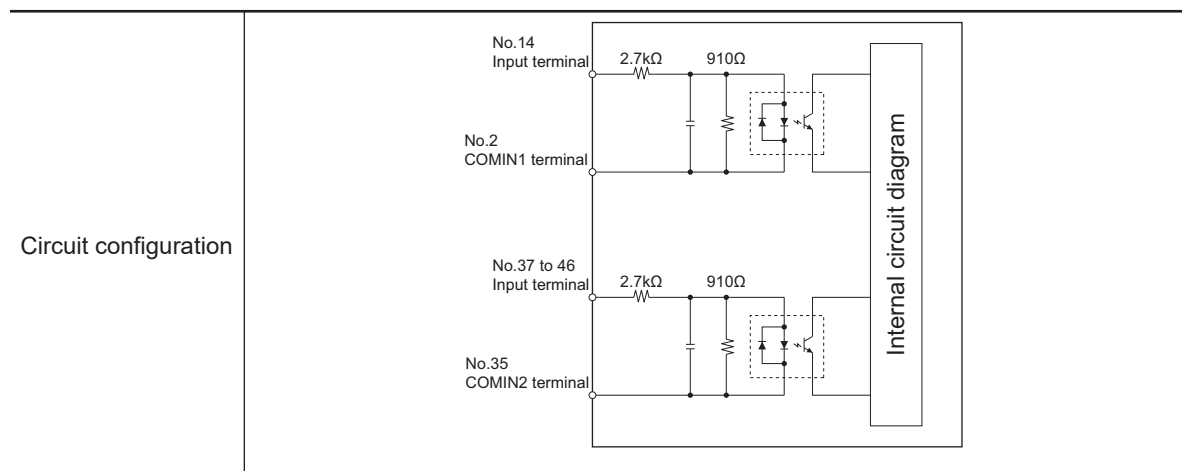
Internal Specifications for Parallel Interface

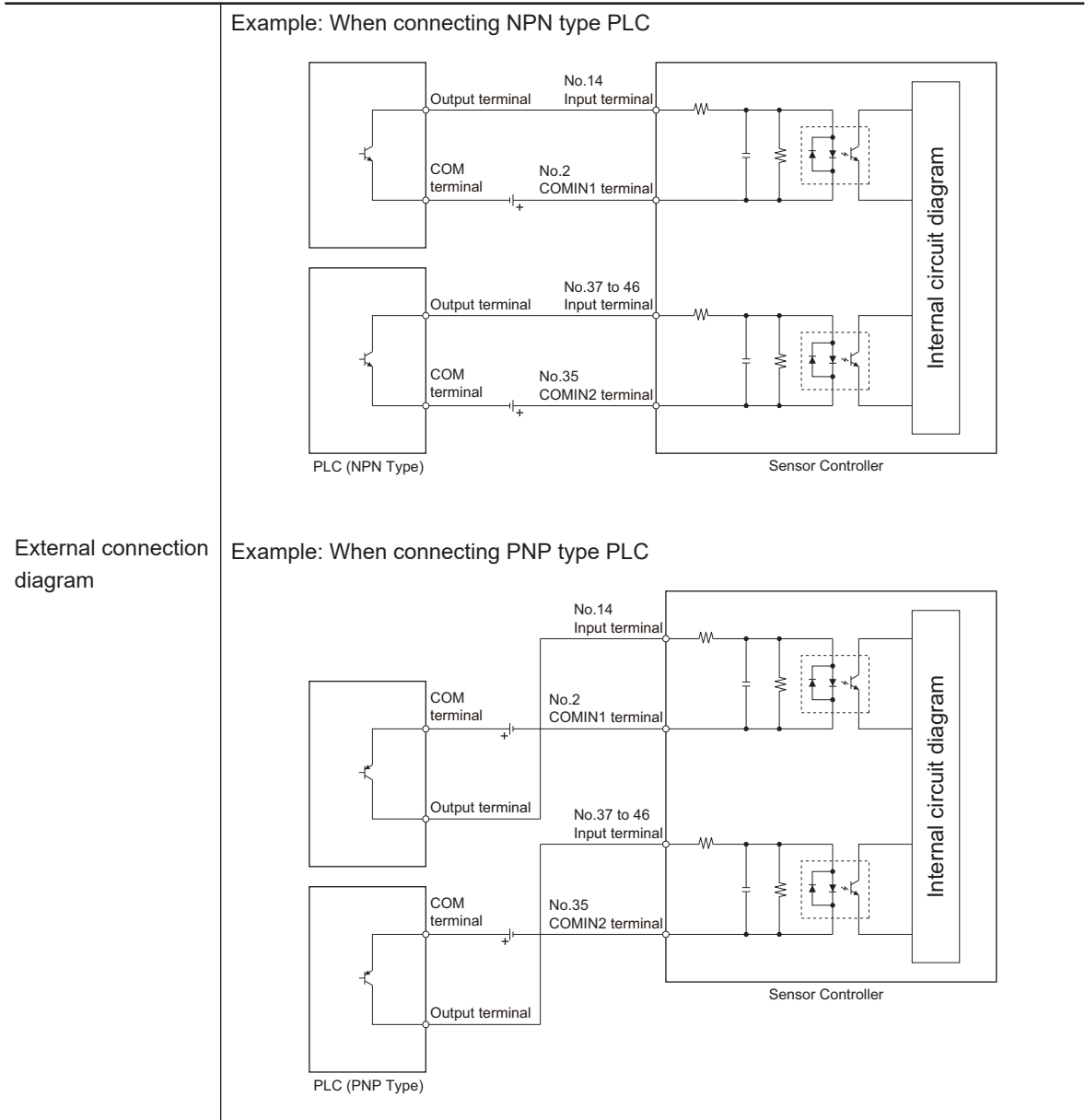
The parallel interface can be used for both NPN and PNP. Connect the pins properly according to the specifications of external devices.

● [Input]

Object signals:

- No.14 pin: Use the COMIN1 terminal when using these signals.
- No.37 to 46 pins: Use the COMIN2 terminal when using these signals.

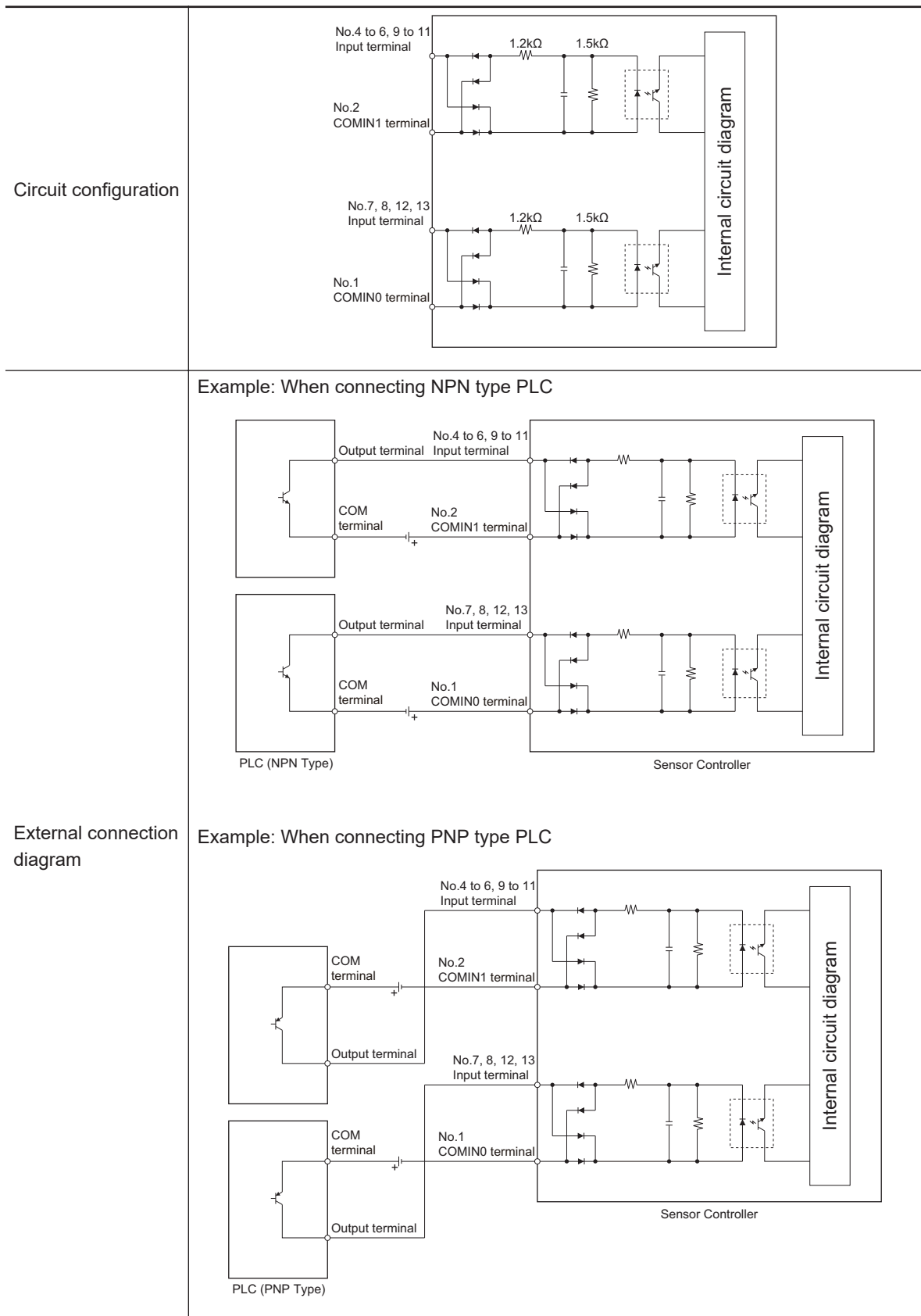




● [Input]

Object signals:

- No.4 to 6, 9 to 11 pins: Use the COMIN1 terminal when using these signals.
- No.7, 8, 12, 13 pins: Use the COMIN0 terminal when using these signals.

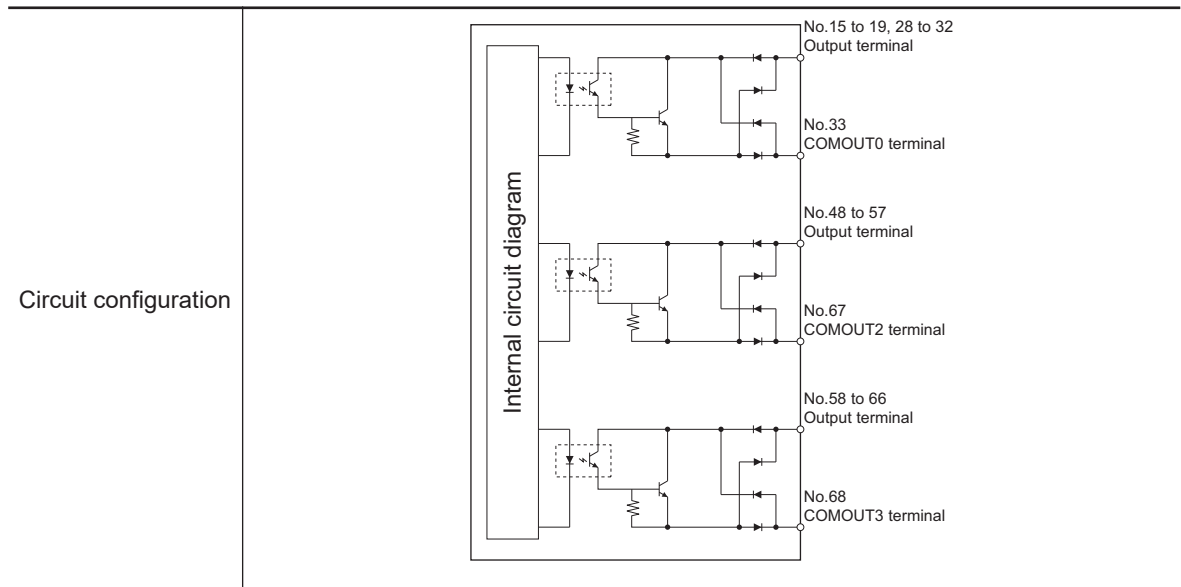


● [Output]

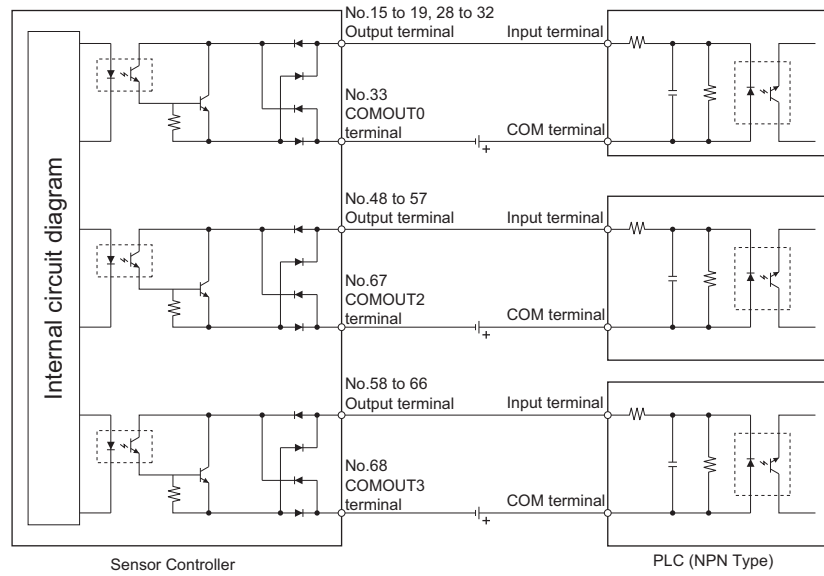
Object signals:

- No.15 to 19 pin, No.28 to 32pin: Use the COMOUT0 terminal when using these signals.
- No.48 to 57 pins: Use the COMOUT2 terminal when using these signals.

- No.58 to 66 pins: Use the COMOUT3 terminal when using these signals.

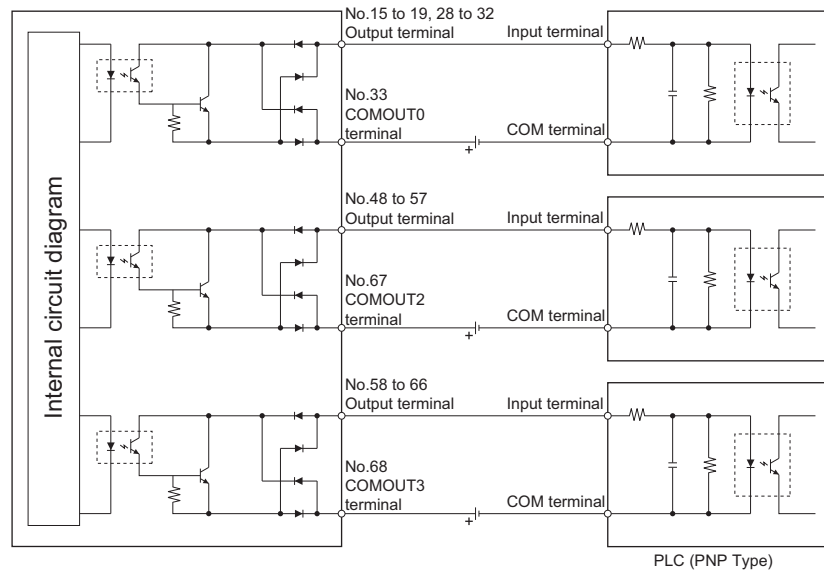


Example: When connecting NPN type PLC



External connection diagram

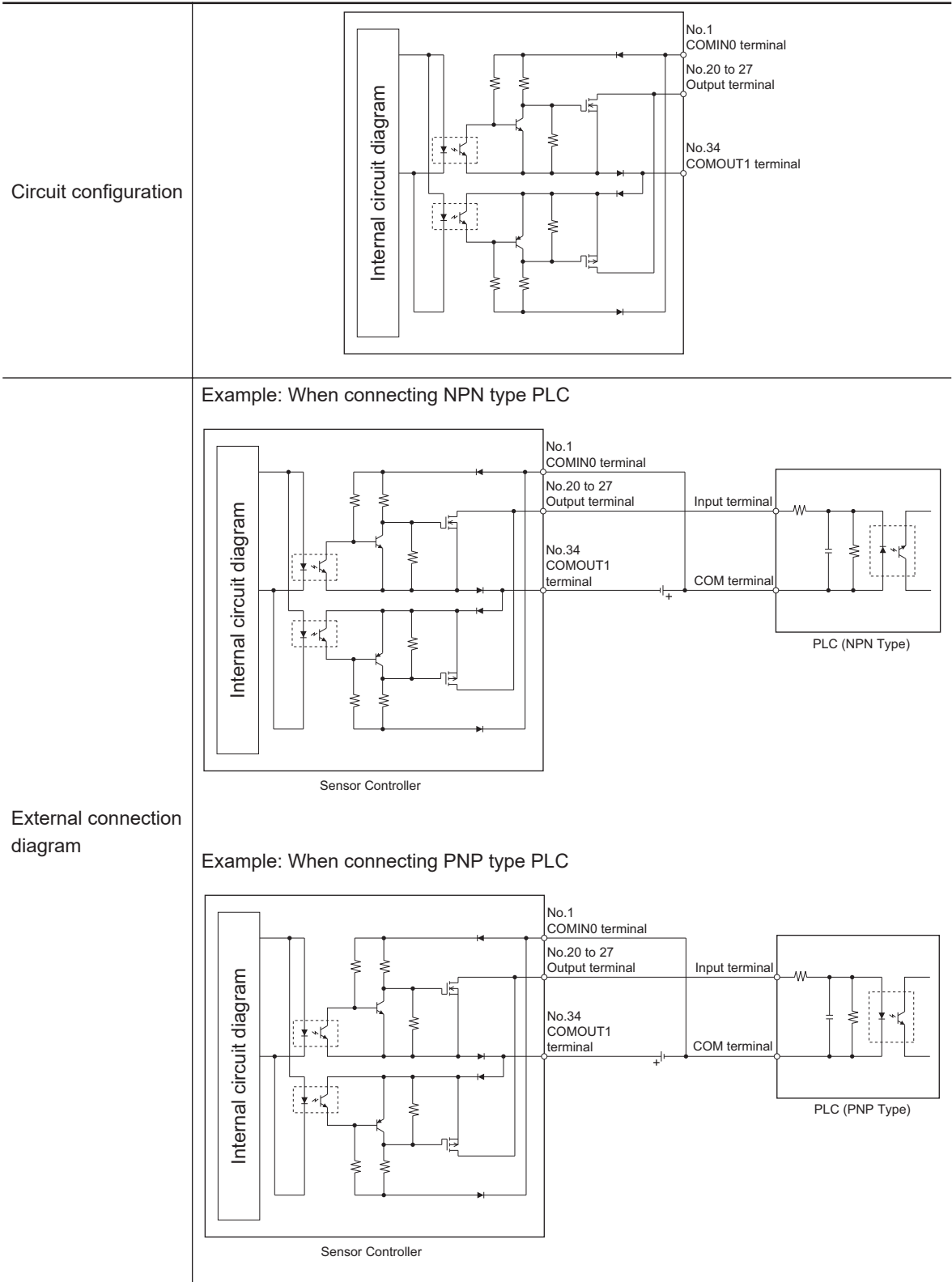
Example: When connecting PNP type PLC



● [Output]

Object signals:

- No.20 to 27 pins: Connect the COMOUT1 and COMIN0 terminals when using these signals.



6-1-3 FH-L Series

The parallel interface can be used for both NPN and PNP. Connect the pins properly according to the specifications of external devices.

Interface Specification

Specifications vary depending on the pin's role.

● [Input]

Object signals:

- No.37, 39 to 46 pins: Use the COMIN2 terminal when using these signals.

| Item | Specifications |
|---------------|-------------------------|
| Input voltage | 12 to 24 VDC $\pm 10\%$ |
| ON current*1 | 5 mA min. |
| ON voltage*1 | 8.8 V min. |
| OFF current*2 | 0.5 mA max. |
| OFF voltage*2 | 1.1 V max. |
| ON delay | 5 ms max. |
| OFF delay | 0.7 ms max. |

*1. ON current and ON voltage:

These are the current value or voltage value to turn ON from OFF. The value for the ON voltage is the potential difference between COMIN and each input terminal.

*2. OFF current and OFF voltage:

These are the current value or voltage value to turn OFF from ON. The value for the OFF voltage is the potential difference between COMIN and each input terminal.

● [Input]

Object signals:

- No.4 pin: Use the COMIN1 terminal when using these signals.

| Item | Specifications |
|---------------|-------------------------|
| Input voltage | 12 to 24 VDC $\pm 10\%$ |
| ON current*1 | 5 mA min. |
| ON voltage*1 | 8.8 V min. |
| OFF current*2 | 0.5 mA max. |
| OFF voltage*2 | 0.8 V max. |
| ON delay | 0.1 ms max. |
| OFF delay | 0.1 ms max. |

*1. ON current and ON voltage:

These are the current value or voltage value to turn ON from OFF. The value for the ON voltage is the potential difference between COMIN and each input terminal.

*2. OFF current and OFF voltage:

These are the current value or voltage value to turn OFF from ON. The value for the OFF voltage is the potential difference between COMIN and each input terminal.

● [Output]

Object signals:

- No.15 to 19 pin: Use the COMOUT0 terminal when using these signals.
- No.49, 51 to 57 pins: Use the COMOUT2 terminal when using these signals.
- No.58 to 66 pins: Use the COMOUT3 terminal when using these signals.

| Item | Specifications |
|---------------------|-------------------------|
| Output voltage | 12 to 24 VDC \pm 10 % |
| Load current*1 | 45 mA max. |
| ON residual voltage | 2 V max. |
| OFF leakage current | 0.2 mA max. |

*1. The load current must be the specified current value or lower. Exceeding the specified current value may cause damage to the output circuit.

● [Output]

Object signals:

- No.20 to 23 pins: Use COMOUT1 and COMIN0 when using these signals.

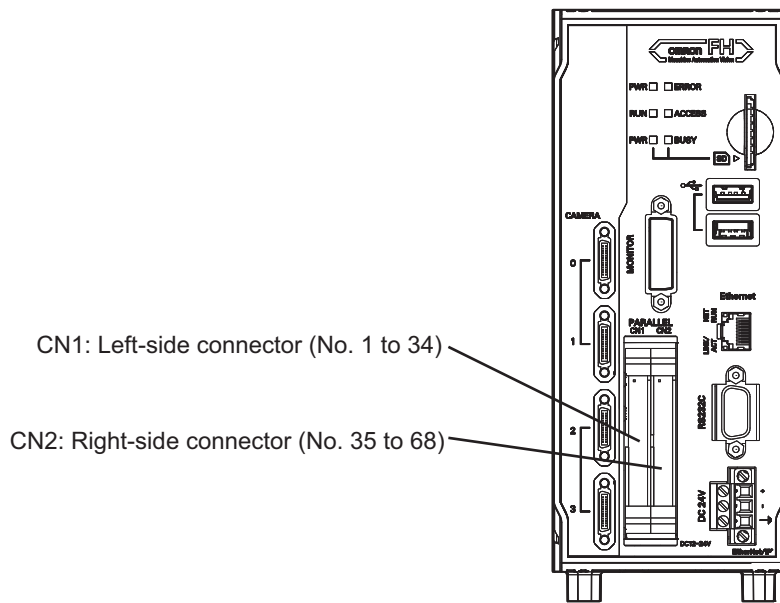
| Item | Specifications |
|---------------------|-------------------------|
| Output voltage | 12 to 24 VDC \pm 10 % |
| Load current*1 | 45 mA max. |
| ON residual voltage | 2 V max. |
| OFF leakage current | 0.2 mA max. |

*1. The load current must be the specified current value or lower. Exceeding the specified current value may cause damage to the output circuit.

● Connection

Connect the parallel I/O cable with more than the minimum bending radius.

● Pin AssignmentCN1

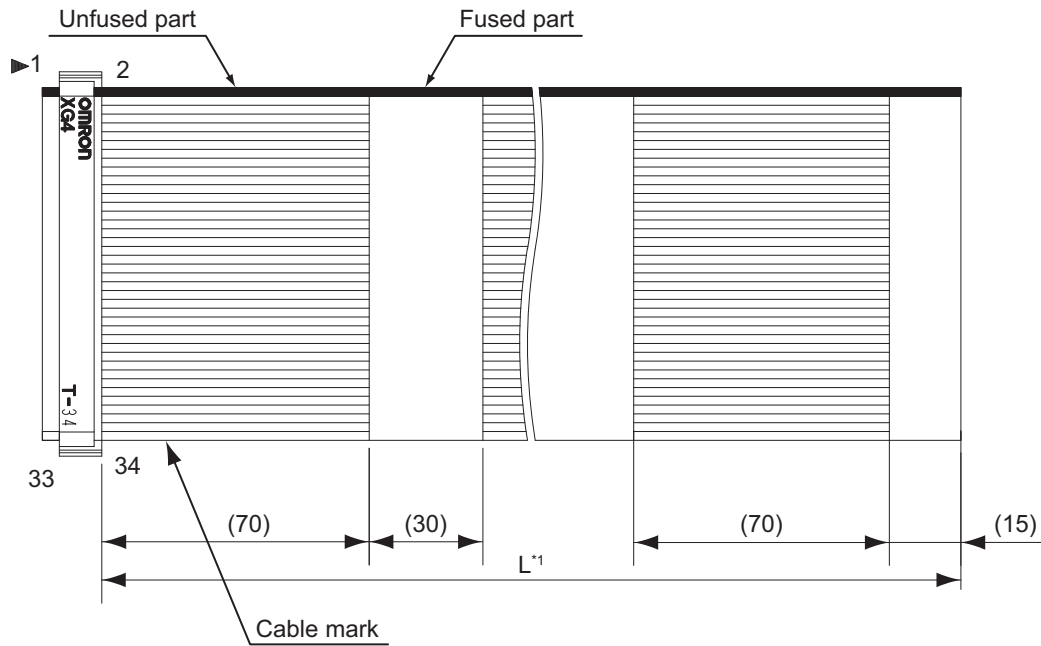


Cable, I/O connector and Terminal Block

Use the following parallel I/O cable.

| Name | Model | Description | Remark |
|---|----------------|---|---|
| Parallel I/O cable | XW2Z-S013-□ | Specialized for FH series Cable length: 2 m, 5 m Min. bending radius: 10 mm | <ul style="list-style-type: none"> Two these cables are needed to use all I/O signals. One side of this cable is flat cable and another side of it is a connector. Connect the parallel I/O cable with securing the minimum bending radius and more. Cable length is set to □ in the model number. (2 = 2 m, 5 = 5 m) |
| Parallel I/O cable for Connector-Terminal Conversion Unit | XW2Z-□□ □EE | Specialized for FH series Cable length: 0.5 m, 1 m, 1.5 m, 2 m, 3 m, 5 m Min. bending radius: 83.2 mm | <ul style="list-style-type: none"> Two these cables are needed to use all I/O signals. One side of this cable is flat cable and another side of it is a connector. Connect the parallel I/O cable with securing the minimum bending radius and more. Cable length is set to □ in the model number. (050 = 0.5 m, 100 = 1 m, 150 = 1.5 m, 2 = 2 m, 300 = 3 m, 500 = 5 m) Terminal Blocks Recommended Products: OMRON XW2K-34G-T or XW2R-□34GD-T |
| Terminal Blocks | XW2K-34G-T | Ultra-Compact Interface Wiring System (General-Purpose) | Refer to the <i>XW2K Series Datasheet (Cat. No. G152)</i> for details. |
| | XW2R-□34GD-T | Connector-Terminal Conversion Unit for general-purpose | The following is set to □ in the model number. For details, refer to the <i>XW2R (General-purpose devices) Data Sheet</i> . |

● XW2Z-S013-□



*1. Cable is available in 2 m/5 m.

Pin Layout

| No. | I/O | XW2Z-S013-□ Wire color | Terminal Blocks | Signal name |
|-----|-----|---------------------------|--------------------|-----------------|
| CN1 | | | | |
| 1 | - | Red | A1 | COMIN0 |
| 2 | - | Gray | B1 | COMIN1 |
| 3 | - | Gray | A2 | Vacant |
| 4 | IN | Gray | B2 | STEP0 |
| 5 | IN | Green | A3 | Vacant |
| 6 | IN | Gray | B3 | Vacant |
| 7 | IN | Gray | A4 | Vacant |
| 8 | IN | Gray | B4 | Vacant |
| 9 | IN | Gray | A5 | Vacant |
| 10 | IN | Green | B5 | Vacant |
| 11 | IN | Gray | A6 | Vacant |
| 12 | IN | Gray | B6 | Vacant |
| 13 | IN | Gray | A7 | Vacant |
| 14 | IN | Gray | B7 | Vacant |
| 15 | OUT | Green | A8 | RUN0 |
| 16 | OUT | Gray | B8 | READY0 |
| 17 | OUT | Gray | A9 | BUSY0 |
| 18 | OUT | Gray | B9 | OR0 |
| 19 | OUT | Gray | A10 | ERROR0 |
| 20 | OUT | Green | B10 | STGOUT0/SHTOUT0 |
| 21 | OUT | Gray | A11 | STGOUT1 |
| 22 | OUT | Gray | B11 | STGOUT2 |

| No. | I/O | XW2Z-S013-□ Wire color | Terminal Blocks | Signal name |
|-----|-----|---------------------------|--------------------|-------------|
| 23 | OUT | Gray | A12 | STGOUT3 |
| 24 | OUT | Gray | B12 | Vacant |
| 25 | OUT | Green | A13 | Vacant |
| 26 | OUT | Gray | B13 | Vacant |
| 27 | OUT | Gray | A14 | Vacant |
| 28 | OUT | Gray | B14 | Vacant |
| 29 | OUT | Gray | A15 | Vacant |
| 30 | OUT | Green | B15 | Vacant |
| 31 | OUT | Gray | A16 | Vacant |
| 32 | OUT | Gray | B16 | Vacant |
| 33 | - | Gray | A17 | COMOUT0 |
| 34 | - | Gray | B17 | COMOUT1 |
| CN2 | | | | |
| 35 | - | Red | A1 | COMIN2 |
| 36 | - | Gray | B1 | Vacant |
| 37 | IN | Gray | A2 | DSA0 |
| 38 | IN | Gray | B2 | Vacant |
| 39 | IN | Green | A3 | DI0 |
| 40 | IN | Gray | B3 | DI1 |
| 41 | IN | Gray | A4 | DI2 |
| 42 | IN | Gray | B4 | DI3 |
| 43 | IN | Gray | A5 | DI4 |
| 44 | IN | Green | B5 | DI5 |
| 45 | IN | Gray | A6 | DI6 |
| 46 | IN | Gray | B6 | DI7 |
| 47 | - | Gray | A7 | Vacant |
| 48 | OUT | Gray | B7 | ACK |
| 49 | OUT | Green | A8 | GATE0 |
| 50 | OUT | Gray | B8 | Vacant |
| 51 | OUT | Gray | A9 | DO0 |
| 52 | OUT | Gray | B9 | DO1 |
| 53 | OUT | Gray | A10 | DO2 |
| 54 | OUT | Green | B10 | DO3 |
| 55 | OUT | Gray | A11 | DO4 |
| 56 | OUT | Gray | B11 | DO5 |
| 57 | OUT | Gray | A12 | DO6 |
| 58 | OUT | Gray | B12 | DO7 |
| 59 | OUT | Green | A13 | DO8 |
| 60 | OUT | Gray | B13 | DO9 |
| 61 | OUT | Gray | A14 | DO10 |
| 62 | OUT | Gray | B14 | DO11 |
| 63 | OUT | Gray | A15 | DO12 |
| 64 | OUT | Green | B15 | DO13 |
| 65 | OUT | Gray | A16 | DO14 |
| 66 | OUT | Gray | B16 | DO15 |
| 67 | - | Gray | A17 | COMOUT2 |

| No. | I/O | XW2Z-S013-□ Wire color | Terminal Blocks | Signal name |
|-----|-----|---------------------------|--------------------|-------------|
| 68 | - | Gray | B17 | COMOUT3 |

COMIN0 to 2: Common for input signals, COMOUT0 to 3: Common for output signals,
 DI0 to 7: Command inputs, DSA0: Data send request,
 STEP0: Measurement trigger 0, ACK: Instruction execution complete flag,
 BUSY0: ON during processing, DO0 to 15: Data outputs,
 ERROR0: ON when an error occurs, GATE0: ON during set output time,
 OR0: Overall judgment result, READY0: ON when image input is permitted,
 RUN0: ON when switched to output specified layout,
 SHTOUT0: Shutter output signal, STGOUT0 to 3: Strobe trigger signals

Note: When the signal is vacant, do not connect anything.

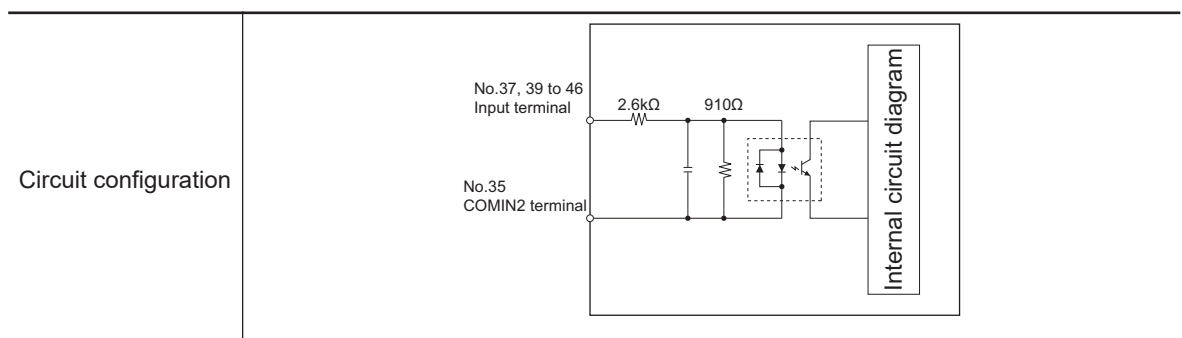
Internal Specifications for Parallel Interface

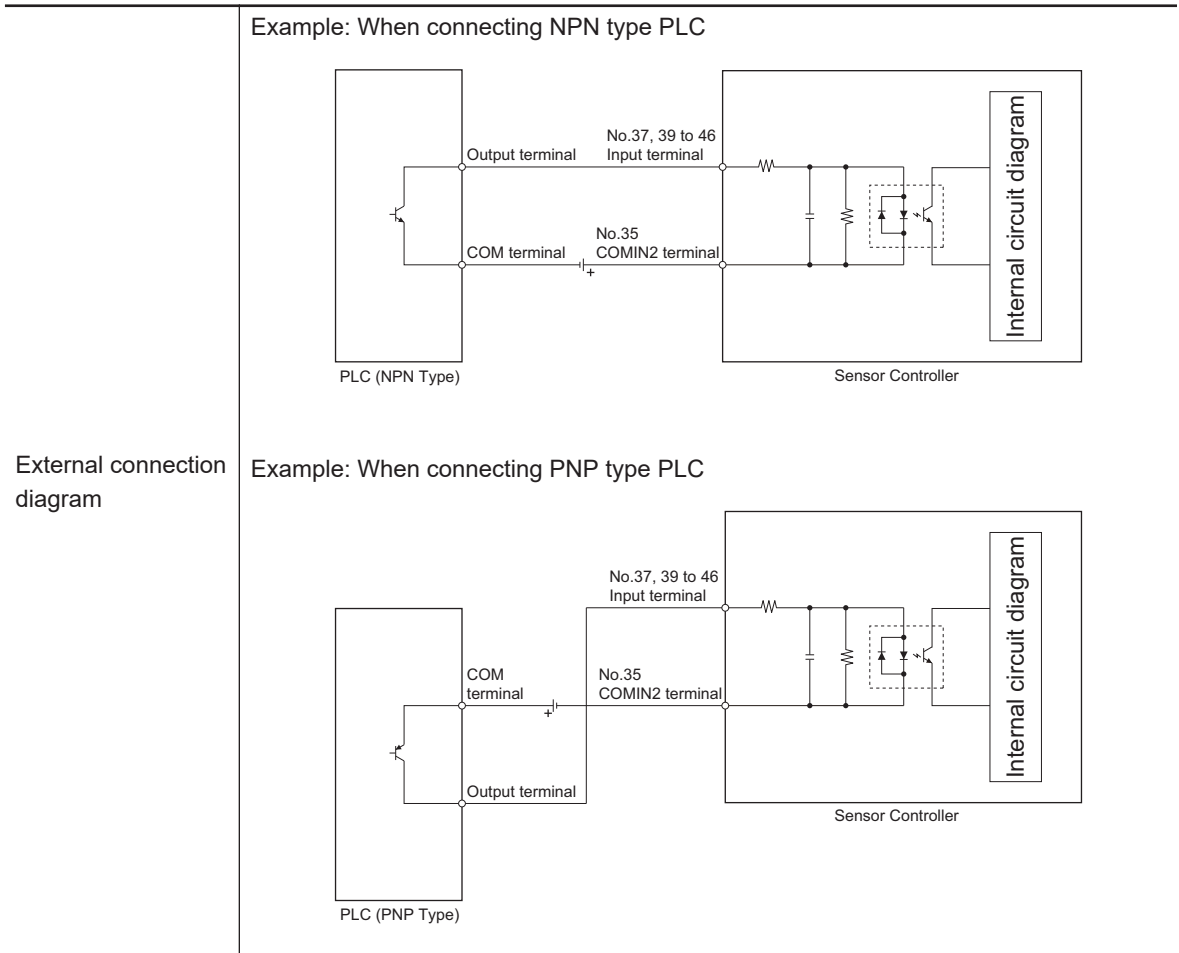
The parallel interface can be used for both NPN and PNP. Connect the pins properly according to the specifications of external devices.

● [Input]

Object signals:

- No.37, 39 to 46 pin: Use the COMIN2 terminal when using these signals.

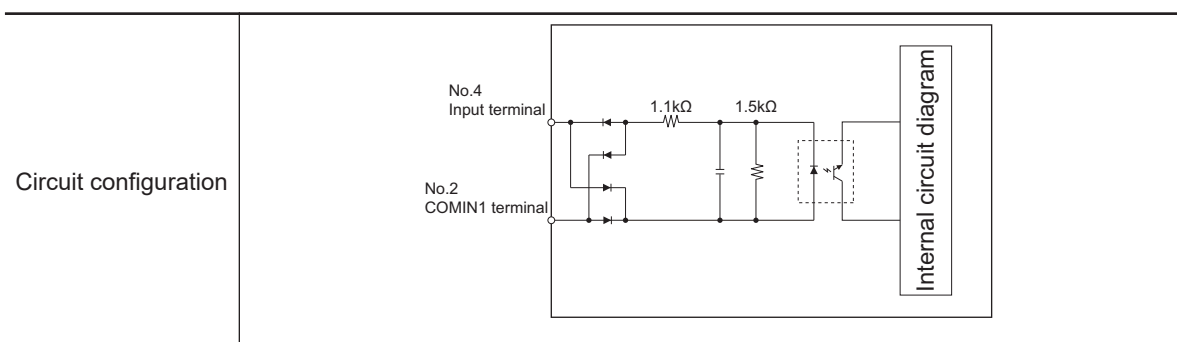


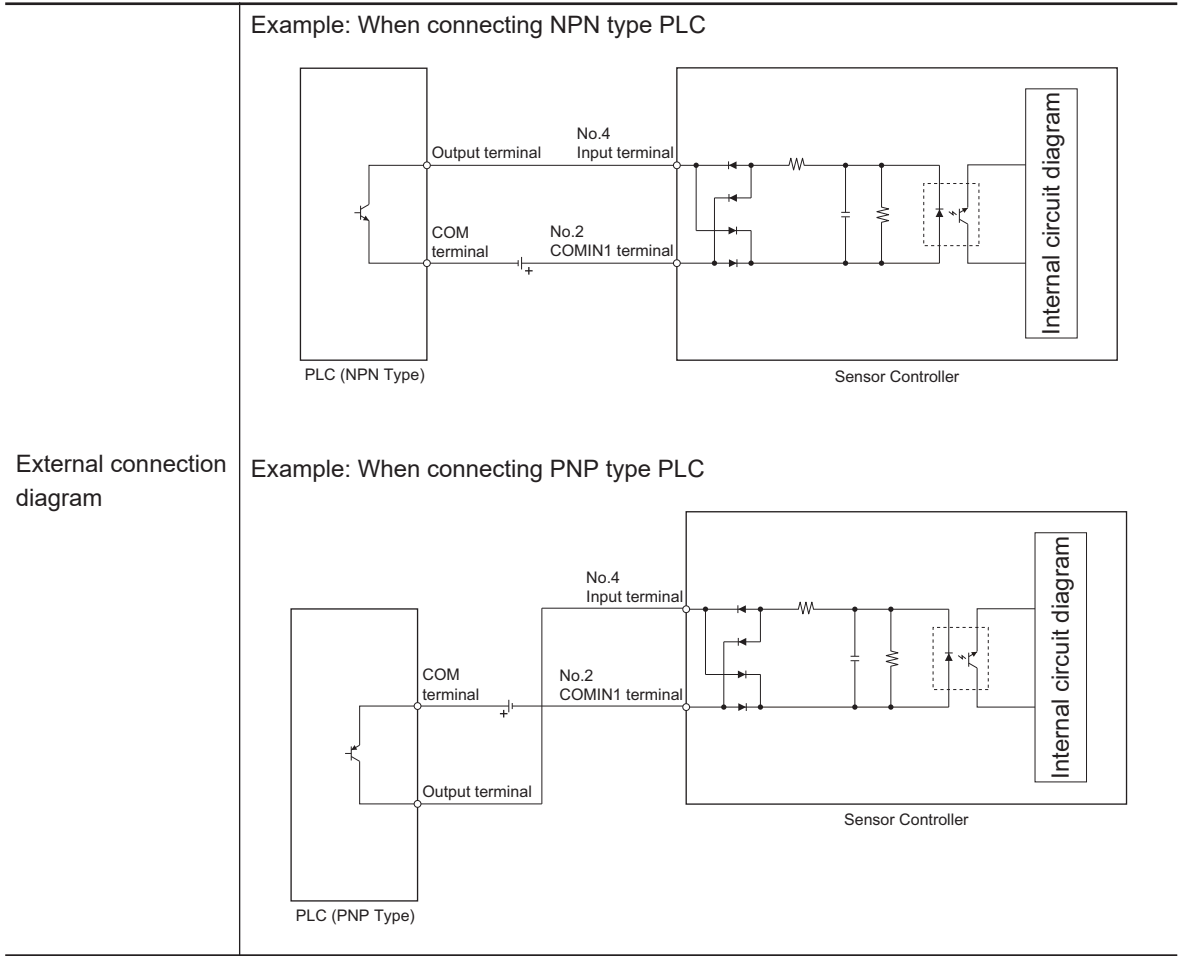


● [Input]

Object signals:

- No.4 pin: Use the COMIN1 terminal when using these signals.

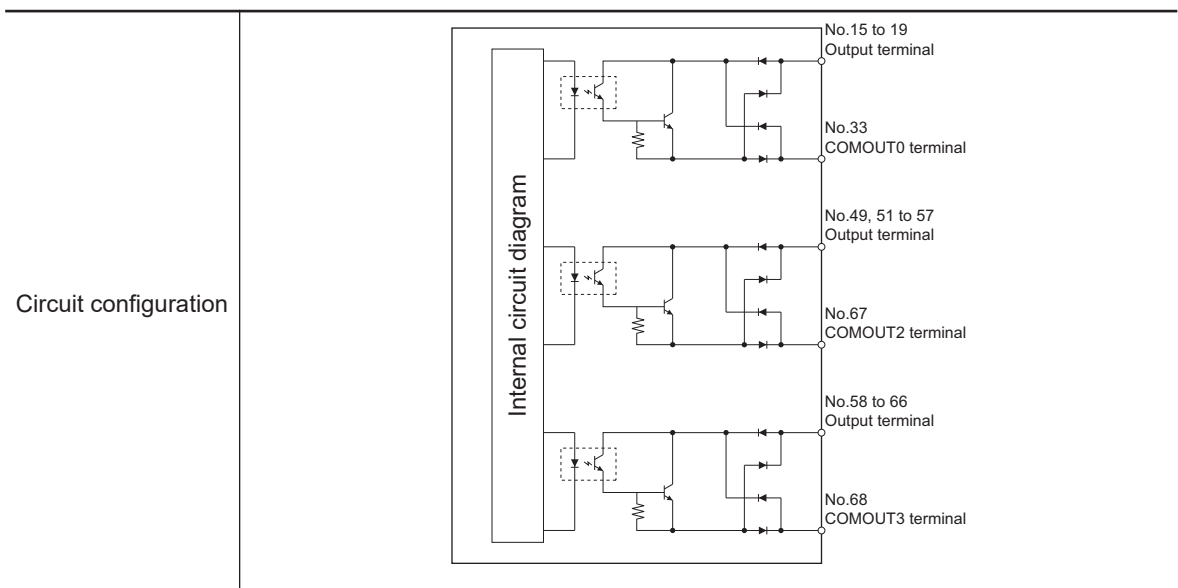




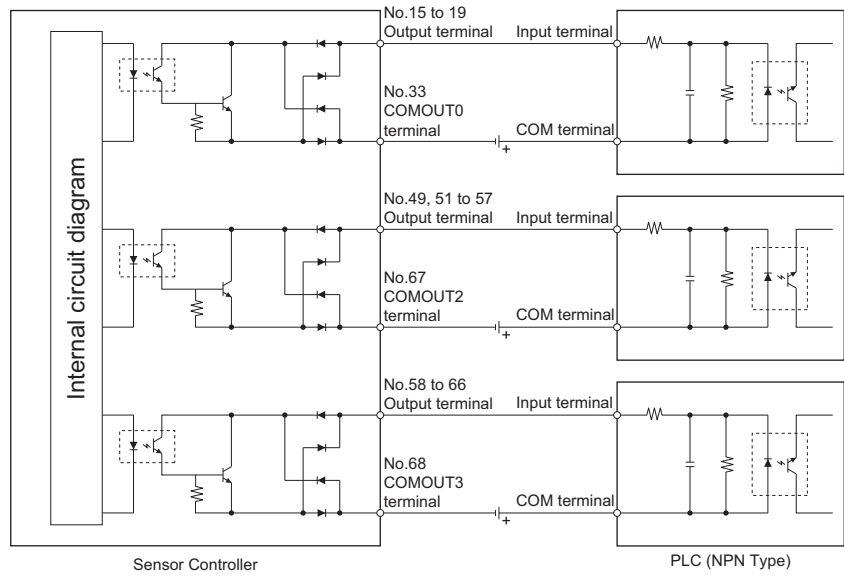
● [Output]

Object signals:

- No. 15 to 19 pin: Use the COMOUT0 terminal when using these signals.
- No. 48, 49, 51 to 57 pins: Use the COMOUT2 terminal when using these signals.
- No.58 to 66 pins: Use the COMOUT3 terminal when using these signals.

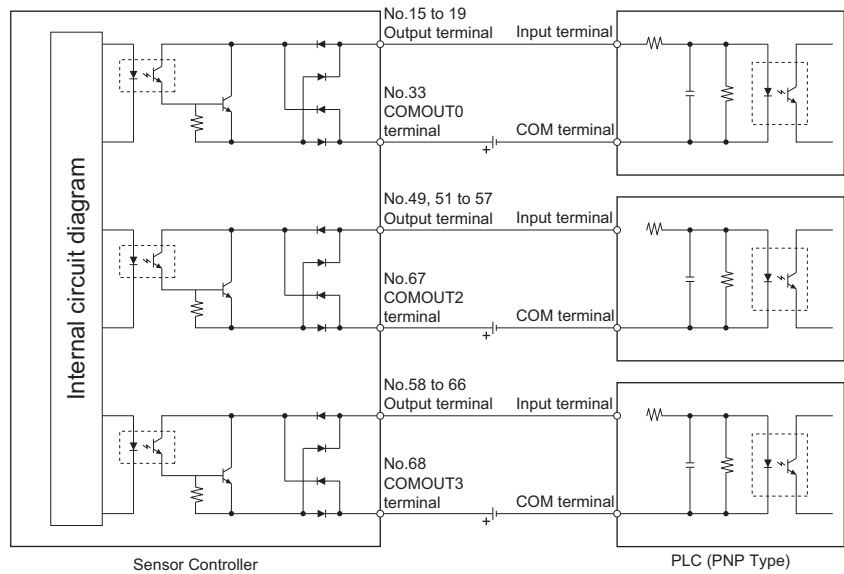


Example: When connecting NPN type PLC



External connection diagram

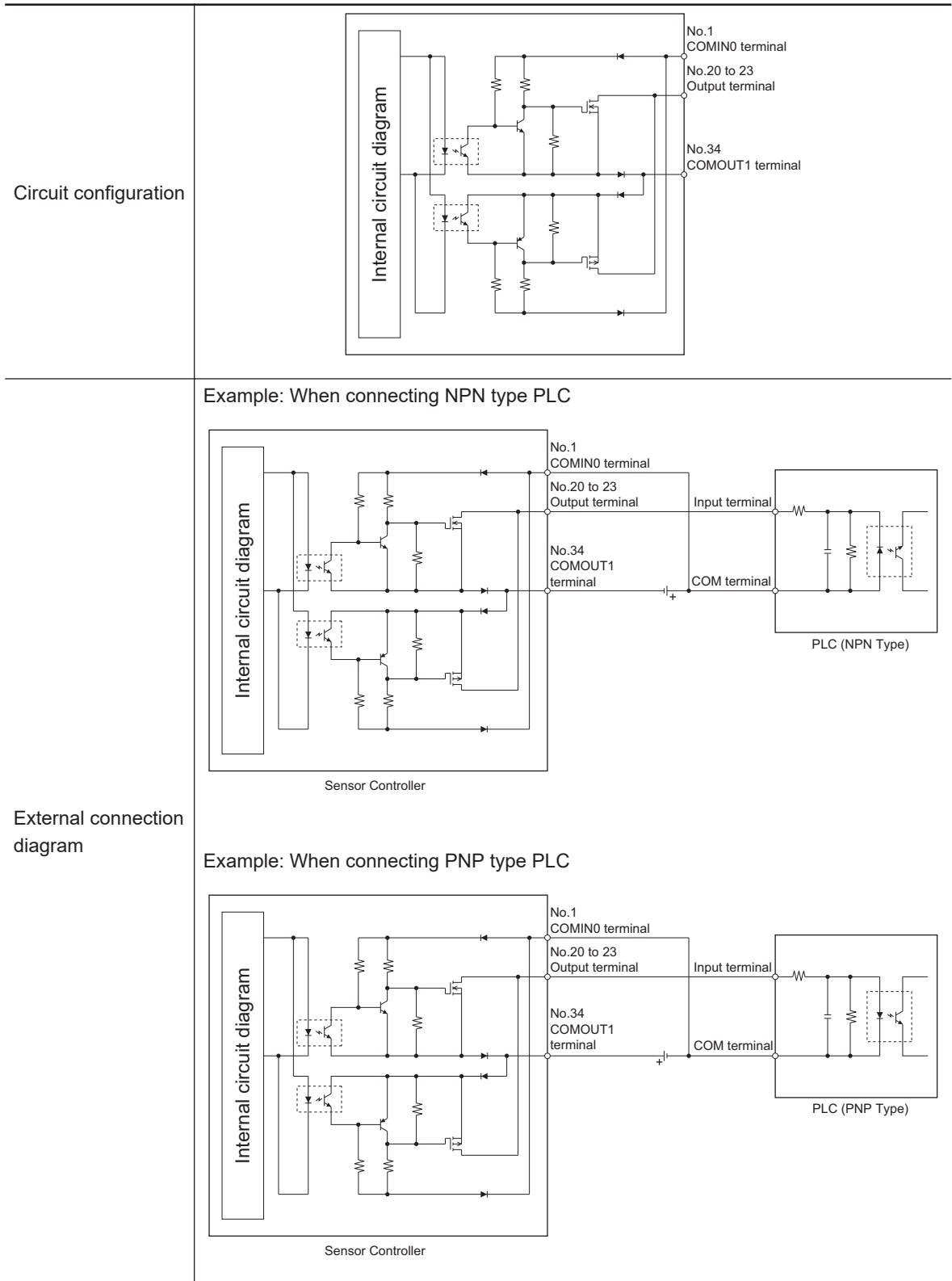
Example: When connecting PNP type PLC



● [Output]

Object signals:

- No.20 to 23 pins: Connect the COMOUT1 and COMIN0 terminals when using these signals.



6-1-4 Other (Parallel Converter Cable)

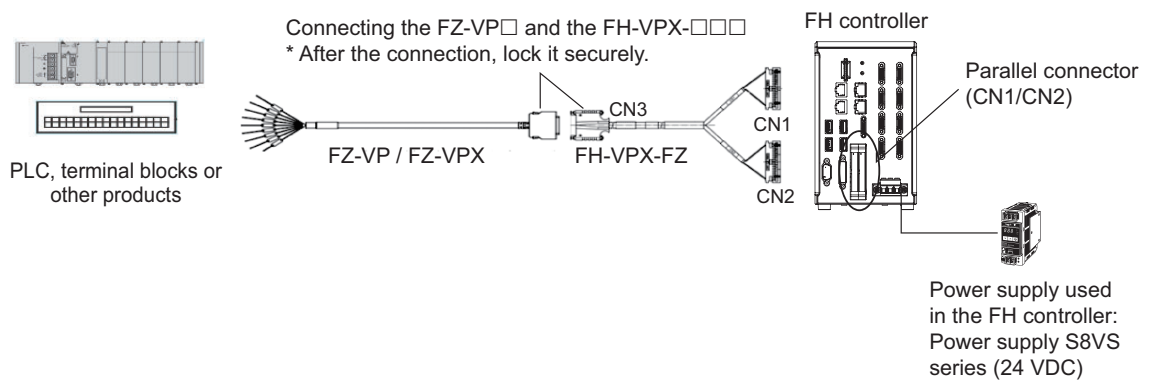
When you change to connect the F series, FZ5 series, or FZ5-L series to FH series sensor controller, you can convert by using the appropriate parallel converter cable of FH-VPX series under the usable condition.

| Corresponding model | | Con-vertible | Applicable parallel conversion cable | Required conditions |
|---------------------|--------------|--------------|--------------------------------------|---|
| FZ□ series | | Yes | FH-VPX-FZ | <ul style="list-style-type: none"> RESET is not used.*1 The same power supply is shared in COMIN and COMOUT. |
| FZ□-L35□ series | | Yes | FH-VPX-FZL | <ul style="list-style-type: none"> RESET is not used.*1 |
| F160 series | F160-C10 | Yes | FH-VPX-F160 | <ul style="list-style-type: none"> RESET is not used.*1 The same power supply is shared in COMIN and COMOUT. Do not use DI5 and DI6. |
| | F160-C10CP | No | - | - |
| | F160-C10CF | No | - | - |
| F210 series | F210-C10 | Yes | FH-VPX-F210 | <ul style="list-style-type: none"> RESET is not used.*1 The same power supply is shared in COMIN and COMOUT. Do not use DI8 and DI9. |
| | F210-C10-ETN | Yes | FH-VPX-F210 | |
| F500 series | F500-C10 | Yes | FH-VPX-F210 | |
| F250 series | | No | - | - |
| F270 series | | No | - | - |

*1. If the RESET signal becomes unavailable by conversion even though the signal has been used, but it causes no problem, the conversion is possible by satisfying other required conditions.

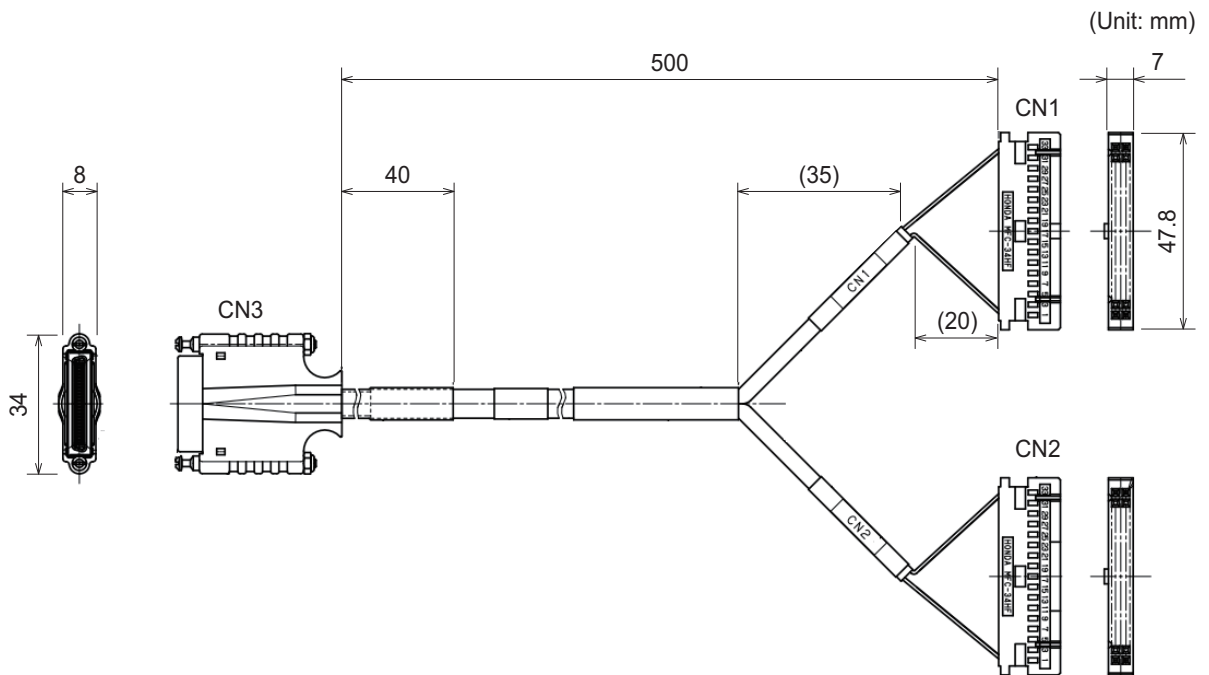
FH-VPX-FZ

● Connection Structure (FH-VPX-FZ)



| Connector No. | Connection destination | Note |
|---------------|--|---|
| CN1 | Connect to the parallel port CN1 on the sensor controller. | Even if you connect the CN1 and CN2 reversely by mistake, it does not work but will not be damaged. |
| CN2 | Connect to the parallel port CN2 on the sensor controller. | |
| CN3 | Connect to the parallel I/O cable, FZ-VP□ | - |

● Cable (FH-VPX-FZ)



● Pin Layout (FH-VPX-FZ)

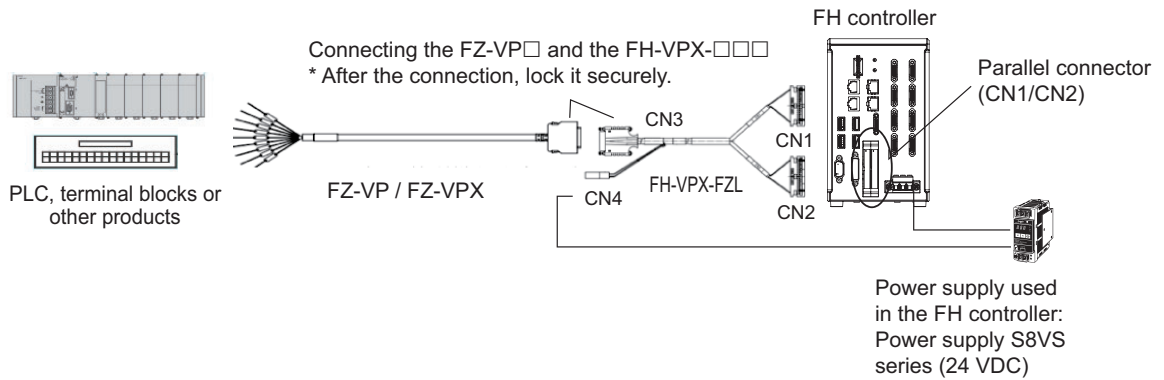
| Connection connector for FZ-VP□ | | Connection connector on the sensor controller | | |
|---------------------------------|------------------|---|-----|------------------|
| Pin No. | Signal name | Pin No. | | Signal name |
| CN3 | | CN1 | CN2 | |
| 1 | COMIN | 1 | - | COMIN0 |
| | | 2 | - | COMIN1 |
| | | - | 1 | COMIN2 |
| 2 | ENCTRIG_A1 | 11 | - | STEP1/ENCTRIG_A1 |
| 3 | ENCTRIG_B1 | 12 | - | STEP1/ENCTRIG_B1 |
| 4 | STEP1/ENCTRIG_Z1 | 5 | - | STEP1/ENCTRIG_Z1 |
| 5 | DSA1 | - | 4 | DSA1 |
| 6 | DI1 | - | 6 | DI1 |
| 7 | DI3 | - | 8 | DI3 |
| 8 | DI5 | - | 10 | DI5 |
| 9 | DI7 | - | 12 | DI7 |
| 10 | STGOUT1 | 21 | - | STGOUT1/SHTOUT1 |
| 11 | STGOUT3 | 23 | - | STGOUT3 |
| 12 | ERROR | 19 | - | ERROR0 |
| 13 | COMOUT1 | 33 | - | COMOUT0 |
| | | 34 | - | COMOUT1 |
| 14 | GATE1 | - | 16 | GATE1 |
| 15 | OR1 | 31 | - | OR1 |
| 16 | READY1 | 29 | - | READY1 |
| 17 | COMOUT2 | - | 33 | COMOUT2 |
| 18 | DO1 | - | 18 | DO1 |
| 19 | DO3 | - | 20 | DO3 |
| 20 | DO5 | - | 22 | DO5 |

| Connection connector for FZ-VP□ | | Connection connector on the sensor controller | | |
|---------------------------------|------------------|---|-----|------------------|
| Pin No. | Signal name | Pin No. | | Signal name |
| CN3 | | CN1 | CN2 | |
| 21 | DO7 | - | 24 | DO7 |
| 22 | DO9 | - | 26 | DO9 |
| 23 | DO11 | - | 28 | DO11 |
| 24 | DO13 | - | 30 | DO13 |
| 25 | COMOUT3 | - | 34 | COMOUT3 |
| 26 | RESET | - | - | - |
| 27 | ENCTRIG_A0 | 8 | - | ENCTRIG_A0 |
| 28 | ENCTRIG_B0 | 13 | - | ENCTRIG_B0 |
| 29 | STEP0/ENCTRIG_Z0 | 4 | - | STEP0/ENCTRIG_Z0 |
| 30 | DSA0 | - | 3 | DSA0 |
| 31 | DI0 | - | 5 | DI0 |
| 32 | DI2 | - | 7 | DI2 |
| 33 | DI4 | - | 9 | DI4 |
| 34 | DI6 | - | 11 | DI6 |
| 35 | STGOUT0 | 20 | - | STGOUT0 |
| 36 | STGOUT2 | 22 | - | STGOUT2 |
| 37 | RUN0 | 15 | - | RUN0 |
| 38 | BUSY0 | 17 | - | BUSY0 |
| 39 | GATE0 | - | 15 | GATE0 |
| 40 | OR0 | 18 | - | OR0 |
| 41 | READY0 | 16 | - | READY0 |
| 42 | DO0 | - | 17 | DO0 |
| 43 | DO2 | - | 19 | DO2 |
| 44 | DO4 | - | 21 | DO4 |
| 45 | DO6 | - | 23 | DO6 |
| 46 | DO8 | - | 25 | DO8 |
| 47 | DO10 | - | 27 | DO10 |
| 48 | DO12 | - | 29 | DO12 |
| 49 | DO14 | - | 31 | DO14 |
| 50 | DO15 | - | 32 | DO15 |

Note: COMOUT is unified in 1 system with shorting PIN No.13, No.17, and No.25.

FH-VPX-FZL

● Connection Structure (FH-VPX-FZL)

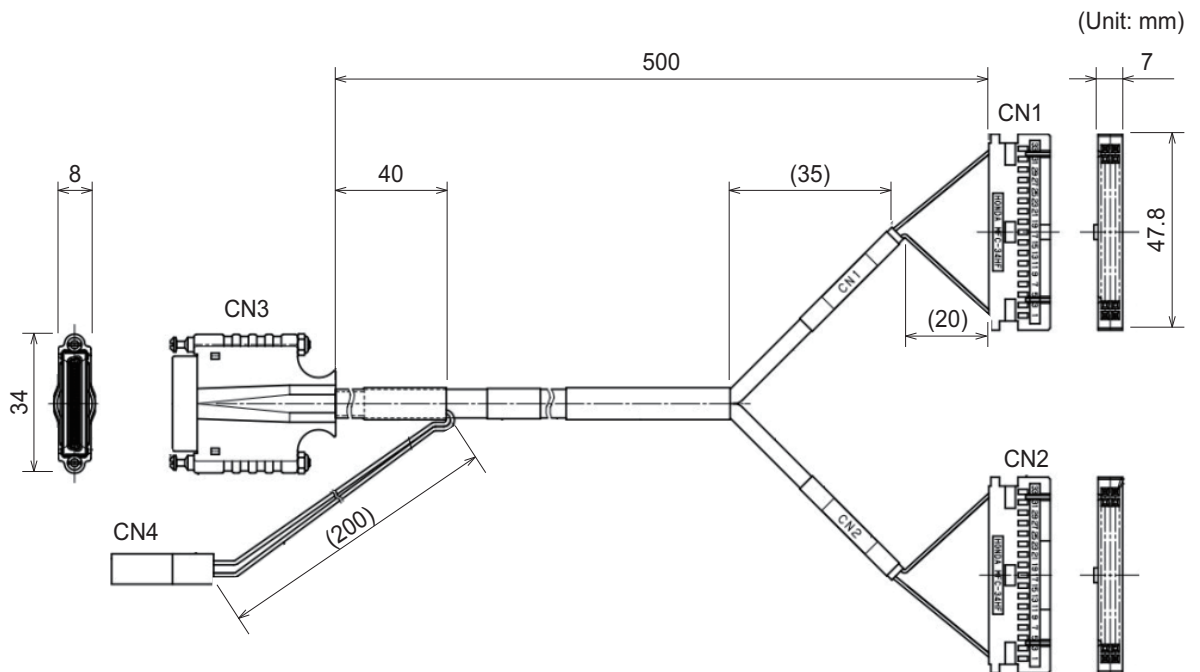


| Connector No. | Connection destination | Note |
|---------------|---|---|
| CN1 | Connect to the parallel port CN1 on the sensor controller. | Even if you connect the CN1 and CN2 reversely by mistake, it does not work but will not be damaged. |
| CN2 | Connect to the parallel port CN2 on the sensor controller. | |
| CN3 | Connect to the parallel I/O cable, FZ-VP□ | - |
| CN4 | Connect to 24 V power source depending on the NPN/PNP polarity as below table. *1 | <ul style="list-style-type: none"> When the power source and DIO are non-isolated and no problem: Possible to connect the same power source for the FH series. When you want to isolate the power source and DIO: The power source for the FH series cannot be used. Use another power source. Recommendations: S8VS series, 24 VDC |

*1. COM terminal polarity in NPN/PNP:

| | NPN | PNP |
|--------|-----|-----|
| COMIN | +V | -V |
| COMOUT | -V | +V |

● Cable (FH-VPX-FZL)



● Pin Layout (FH-VPX-FZL)

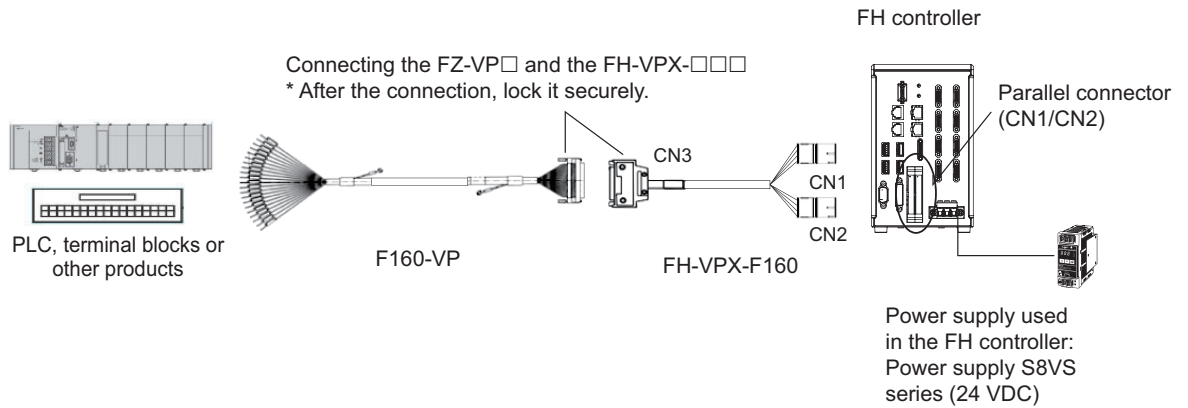
| Connection connector for FZ-VP□ | | | Connection connector on the sensor controller | | |
|---------------------------------|-----|-------------|---|-----|-----------------|
| Pin No. | | Signal name | Pin No. | | Signal name |
| CN3 | CN4 | | CN1 | CN2 | |
| - | 1 | - | 1 | - | COMIN0 |
| | | | 2 | - | COMIN1 |
| | | | - | 1 | COMIN2 |
| | 2 | - | 33 | - | COMOUT0 |
| | | | 34 | - | COMOUT1 |
| | 2 | - | - | 33 | COMOUT2 |
| | 2 | - | - | 33 | COMOUT3 |
| A1 | - | N/A | - | - | - |
| A2 | | N/A | - | - | - |
| A3 | | N/A | - | - | - |
| A4 | | N/A | - | - | - |
| A5 | | N/A | - | - | - |
| A6 | | DI1 | - | 6 | DI1 |
| A7 | | DI3 | - | 8 | DI3 |
| A8 | | DI5 | - | 10 | DI5 |
| A9 | | DI7 | - | 12 | DI7 |
| A10 | | STGOUT1 | 21 | - | STGOUT1/SHTOUT1 |
| A11 | | STGOUT2 | 23 | - | STGOUT3 |
| A12 | | ERROR | 19 | - | ERROR0 |
| A13 | | N/A | - | - | - |
| A14 | | N/A | - | - | - |
| A15 | | N/A | - | - | - |
| A16 | | N/A | - | - | - |

| Connection connector for FZ-VP□ | | | Connection connector on the sensor controller | | |
|---------------------------------|-----|-------------|---|-----|------------------|
| Pin No. | | Signal name | Pin No. | | Signal name |
| CN3 | CN4 | | CN1 | CN2 | |
| A17 | | N/A | - | - | - |
| A18 | | DO1 | - | 18 | DO1 |
| A19 | | DO3 | - | 20 | DO3 |
| A20 | | DO5 | - | 22 | DO5 |
| A21 | | DO7 | - | 24 | DO7 |
| A22 | | DO9 | - | 26 | DO9 |
| A23 | | DO11 | - | 28 | DO11 |
| A24 | | DO13 | - | 30 | DO13 |
| A25 | | N/A | - | - | - |
| B1 | - | RESET | - | - | - |
| B2 | | N/A | - | - | - |
| B3 | | N/A | - | - | - |
| B4 | | STEP0 | 4 | - | STEP0/ENCTRIG_Z0 |
| B5 | | DSA0 | - | 3 | DSA0 |
| B6 | | DI0 | - | 5 | DI0 |
| B7 | | DI2 | - | 7 | DI2 |
| B8 | | DI4 | - | 9 | DI4 |
| B9 | | DI6 | - | 11 | DI6 |
| B10 | | STGOUT0 | 20 | - | STGOUT0/SHTOUT0 |
| B11 | | STGOUT2 | 22 | - | STGOUT2 |
| B12 | | RUN0/BUSY1 | 15 | - | RUN0 |
| B13 | | BUSY0 | 17 | - | BUSY0 |
| B14 | | GATE0 | - | 15 | GATE0 |
| B15 | | OR0 | 18 | - | OR0 |
| B16 | | READY0 | 16 | - | READY0 |
| B17 | | DO0 | - | 17 | DO0 |
| B18 | | DO2 | - | 19 | DO2 |
| B19 | | DO4 | - | 21 | DO4 |
| B20 | | DO6 | - | 23 | DO6 |
| B21 | | DO8 | - | 25 | DO8 |
| B22 | | DO10 | - | 27 | DO10 |
| B23 | | DO12 | - | 29 | DO12 |
| B24 | | DO14 | - | 31 | DO14 |
| B25 | | DO15 | - | 32 | DO15 |

- Note:
1. PIN_No.1 of CN4 is unified in 1 system with shorting COMIN0-2 of FH series.
 2. PIN_No.2 of CN4 is unified in 1 system with shorting COMOUT0-3 of FH series.

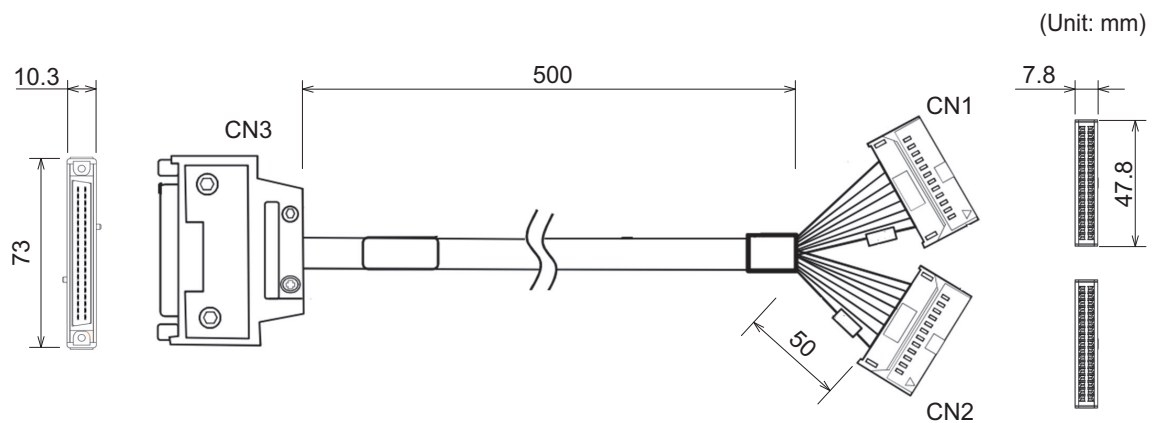
FH-VPX-F160

● Connection Structure (FH-VPX-F160)



| Connector No. | Connection destination | Note |
|---------------|--|---|
| CN1 | Connect to the parallel port CN1 on the sensor controller. | Even if you connect the CN1 and CN2 reversely by mistake, it does not work but will not be damaged. |
| CN2 | Connect to the parallel port CN2 on the sensor controller. | |
| CN3 | Connect to the Parallel I/O cable F160-VP. | - |

● Cable (FH-VPX-F160)



● Pin Layout (FH-VPX-F160)

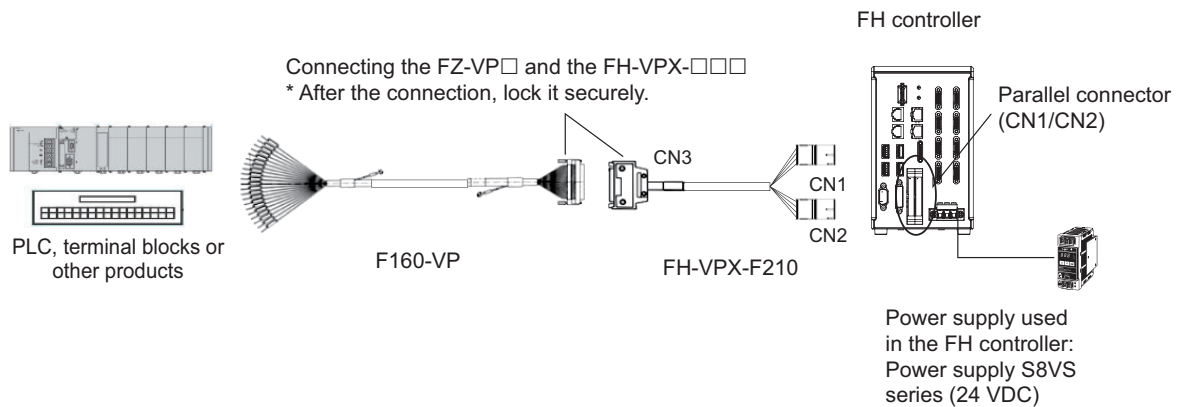
| Connection connector for F160-VP | | Connection connector on the sensor controller | | |
|----------------------------------|-------------|---|-----|------------------|
| Pin No. | Signal name | Pin No. | | Signal name |
| CN3 | | CN1 | CN2 | |
| A1 | RESET | N/A | | - |
| A2 | STEP | 4 | - | STEP0/ENCTRIG_Z0 |
| A3 | DI0 | - | 5 | DI0 |
| A4 | DI2 | - | 7 | DI2 |
| A5 | DI4 | - | 9 | DI4 |
| A6 | DI6 | - | - | - |

| Connection connector for F160-VP | | Connection connector on the sensor controller | | |
|----------------------------------|-------------|---|-----|-----------------|
| Pin No. | Signal name | Pin No. | | Signal name |
| CN3 | | CN1 | CN2 | |
| A7 | DI8 | - | 45 | DI6 |
| A8 | STGOUT0 | 20 | - | STGOUT0/SHTOUT0 |
| A9 | RUN | 15 | - | RUN0 |
| A10 | BUSY | 17 | - | BUSY0 |
| A11 | OR | 18 | - | OR0 |
| A12 | DO0 | - | 17 | DO0 |
| A13 | DO2 | - | 19 | DO2 |
| A14 | DO4 | - | 21 | DO4 |
| A15 | DO6 | - | 23 | DO6 |
| A16 | DO8 | - | 25 | DO8 |
| A17 | DO9 | - | 26 | DO9 |
| A18 | DO11 | - | 28 | DO11 |
| A19 | DO13 | - | 30 | DO13 |
| A20 | DO15 | - | 32 | DO15 |
| B1 | COMIN | 1 | - | COMIN0 |
| | | 2 | - | COMIN1 |
| | | - | 1 | COMIN2 |
| B2 | DSA | - | 3 | DSA0 |
| B3 | DI1 | - | 6 | DI1 |
| B4 | DI3 | - | 8 | DI3 |
| B5 | DI5 | - | - | - |
| B6 | DI7 | - | 10 | DI5 |
| B7 | DI9 | - | 12 | DI7 |
| B8 | STGOUT1 | 21 | - | STGOUT1/SHTOUT1 |
| B9 | ERROR | 19 | - | ERROR0 |
| B10 | GATE | - | 15 | GATE0 |
| B11 | COMOUT1 | 33 | - | COMOUT |
| B12 | DO1 | - | 18 | DO1 |
| B13 | DO3 | - | 20 | DO3 |
| B14 | DO5 | - | 22 | DO5 |
| B15 | DO7 | - | 24 | DO7 |
| B16 | COMOUT2 | 34 | - | COMOUT |
| B17 | DO10 | - | 27 | RUN0 |
| B18 | DO12 | - | 29 | BUSY0 |
| B19 | DO14 | - | 31 | GATE0 |
| B20 | COMOUT3 | - | 33 | COMOUT |
| | | - | 34 | |

Note: COMOUT is unified in 1 system with shorting B11, B16, and B20.

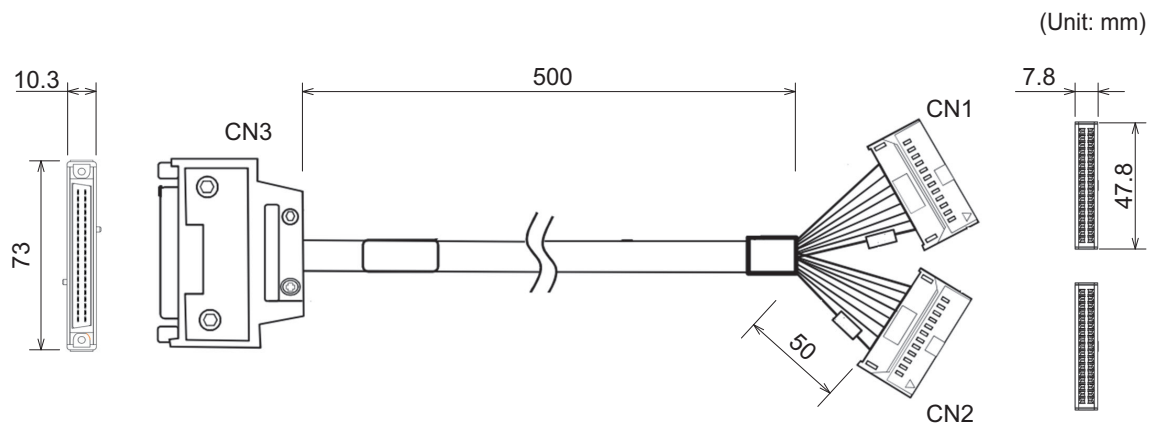
FH-VPX-F210

● Connection Structure (FH-VPX-F210)



| Connector No. | Connection destination | Note |
|---------------|--|---|
| CN1 | Connect to the parallel port CN1 on the sensor controller. | Even if you connect the CN1 and CN2 reversely by mistake, it does not work but will not be damaged. |
| CN2 | Connect to the parallel port CN2 on the sensor controller. | |
| CN3 | Connect to the Parallel I/O cable F160-VP. | - |

● Cable (FH-VPX-F210)



● PIN Layout (FH-VPX-F210)

| Connection connector for F160-VP | | Connection connector on the sensor controller | | |
|----------------------------------|-------------|---|-----|------------------|
| Pin No. | Signal name | Pin No. | | Signal name |
| | | CN1 | CN2 | |
| CN3 | | | | |
| A1 | RESET | N/A | | - |
| A2 | STEP | 4 | - | STEP0/ENCTRIG_Z0 |
| A3 | DI0 | - | 5 | DI0 |
| A4 | DI2 | - | 7 | DI2 |
| A5 | DI4 | - | 9 | DI4 |
| A6 | DI6 | - | 11 | DI6 |
| A7 | DI8 | N/A | | - |
| A8 | STGOUT0 | 20 | - | STGOUT0/SHTOUT0 |
| A9 | RUN | 15 | - | RUN0 |

| Connection connector for F160-VP | | Connection connector on the sensor controller | | |
|----------------------------------|-------------|---|-----|-----------------|
| Pin No. | Signal name | Pin No. | | Signal name |
| CN3 | | CN1 | CN2 | |
| A10 | BUSY | 17 | - | BUSY0 |
| A11 | OR | 18 | - | OR0 |
| A12 | DO0 | - | 17 | DO0 |
| A13 | DO2 | - | 19 | DO2 |
| A14 | DO4 | - | 21 | DO4 |
| A15 | DO6 | - | 23 | DO6 |
| A16 | DO8 | - | 25 | DO8 |
| A17 | DO9 | - | 26 | DO9 |
| A18 | DO11 | - | 28 | DO11 |
| A19 | DO13 | - | 30 | DO13 |
| A20 | DO15 | - | 32 | DO15 |
| B1 | COMIN | 1 | - | COMIN0 |
| | | 2 | - | COMIN1 |
| | | - | 1 | COMIN2 |
| B2 | DSA | - | 3 | DSA0 |
| B3 | DI1 | - | 6 | DI1 |
| B4 | DI3 | - | 8 | DI3 |
| B5 | DI5 | - | 10 | DI5 |
| B6 | DI7 | - | 12 | DI7 |
| B7 | DI9 | N/A | | - |
| B8 | STGOUT1 | 21 | - | STGOUT1/SHTOUT1 |
| B9 | ERROR | 19 | - | ERROR0 |
| B10 | GATE | - | 15 | GATE0 |
| B11 | COMOUT1 | 33 | - | COMOUT0 |
| B12 | DO1 | - | 18 | DO1 |
| B13 | DO3 | - | 20 | DO3 |
| B14 | DO5 | - | 22 | DO5 |
| B15 | DO7 | - | 24 | DO7 |
| B16 | COMOUT2 | 34 | - | COMOUT1 |
| B17 | DO10 | - | 27 | DO10 |
| B18 | DO12 | - | 29 | DO12 |
| B19 | DO14 | - | 31 | DO14 |
| B20 | COMOUT3 | - | 33 | COMOUT2 |
| | | - | 34 | COMOUT3 |

Note: COMOUT is unified in 1 system with shorting B11, B16, and B20.

6-2 Encoder Interface

Encoder interface (line driver type) is supported only FH-2000/FH-5000 series.

6-2-1 FH-2000/FH-5000 Series



Precautions for Safe Use

- Check the following again before turning on the power.
Are the voltage value and polarity of the power supply that is provided to the encoder cable (ENC0 VDD/GND, ENC1 VDD/GND) correct? (5 VDC)
- Use only the cables designed specifically for the product. Use of other products may result in malfunction or damage of the product.
- Always turn OFF the power of the FH-L series sensor controller and peripheral devices before connecting or disconnecting a camera or cable. Connecting the cable with power supplied may result in damage of the camera or peripheral devices.
- Since cables to which bending is frequently applied is easily broken, use the robotic cable type (bending resistant cable) to prevent damages.
- Do not apply torsion stress to cables. If not, it may cause damage to cables.
- Secure the minimum bending radius of cables. If not, it may cause damage to cables.



Precautions for Correct Use

- Check the following items on the communications cables that are used in the network.
 - Are there any breaks?
 - Are there any shorts?
 - Are there any connector problems?
- When you connect the cable to the communications connectors on devices, firmly insert the communications cable connector until it locks in place.
- Do not lay the communications cables together with high-voltage lines.
- Do not lay the communications cable near devices that generate noise.
- Do not lay the communications cables in locations subject to high temperatures or high humidity.
- Do not lay the communications cables in locations subject to excessive dirt and dust or to oil mist or other contaminants.

Interface Specification

| Item | Specifications |
|-------------------------------|--|
| Input voltage | Input voltage: 5 VDC \pm 5 %, Signal level: EIA Standard, RS-422-A line driver level |
| Input impedance *1 | 120 Ω \pm 5 % |
| Differential input voltage | High-level input voltage: 0.1 V Low-level input voltage: -0.1 V |
| Hysteresis voltage | 60 mV |
| Maximum response frequency *2 | Phase A/B/Z: 1 MHz (When using an I/O cable, model FH-VR 1.5M) |

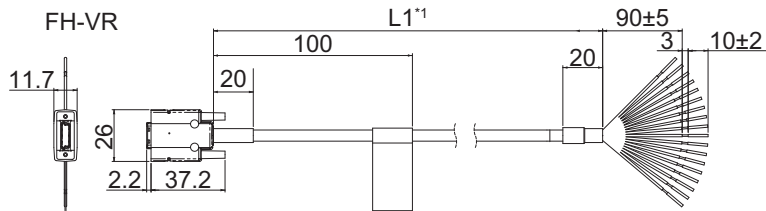
*1. Value when the terminal resistance function is used.

*2. Use this interface as paying attention to the cable length and response frequency of the encoder used.

Cable, I/O Connector and Terminal Block

Use the following Encoder cable: FH-VR 1.5 M (1.5 m, Min. bending radius: 65 mm).

● Encoder Cable



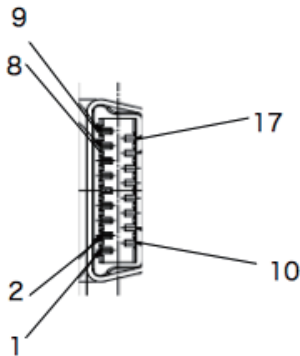
*1: Cable is available in 1.5 m.



Additional Information

We have the 2D CAD data or 3D CAD data.
You can download CAD data from www.fa.omron.co.jp.

Pin Layout



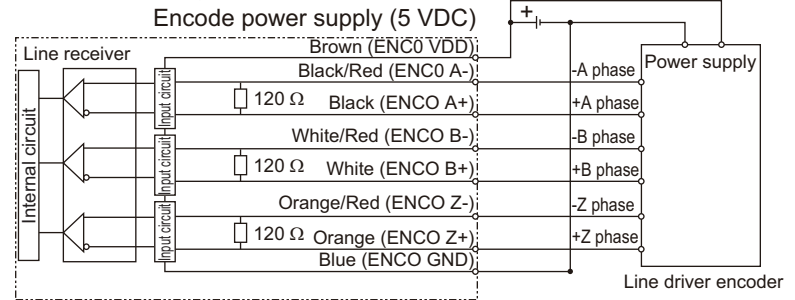
| No. | Signal name | Color | Remark |
|-----|-------------|------------|-----------------------------|
| 1 | ENC0 A+ | Black | Signal CH1 Phase A (+) |
| 2 | ENC0 A- | Black/Red | Signal CH1 Phase A (-) |
| 3 | ENC0 VDD | Brown | Power CH1 power supply (5V) |
| 4 | ENC0 B+ | White | Signal CH1 Phase B (+) |
| 5 | ENC0 B- | White/Red | Signal CH1 Phase B (-) |
| 6 | ENC0 GND | Blue | Power CH1 GND (0V) |
| 7 | ENC0 Z+ | Orange | Signal CH1 Phase Z (+) |
| 8 | ENC0 Z- | Orange/Red | Signal CH1 Phase Z (-) |
| 9 | NC | - | - |
| 10 | ENC1 A+ | Purple | Signal CH2 Phase A (+) |
| 11 | ENC1 A- | Purple/Red | Signal CH2 Phase A (-) |
| 12 | ENC1 VDD | Brown/Red | Power CH2 power supply (5V) |
| 13 | ENC1 B+ | Pink | Power CH2 Phase B (+) |
| 14 | ENC1 B- | Pink/Red | Power CH2 Phase B (-) |
| 15 | ENC1 GND | Blue/Red | Power CH2 GND (0V) |
| 16 | ENC1 Z+ | Yellow | Power CH2 Phase Z (+) |

| No. | Signal name | Color | Remark |
|-----|-------------|------------|-----------------------|
| 17 | ENC1 Z- | Yellow/Red | Power CH2 Phase Z (-) |

Encoder Circuit Schematics

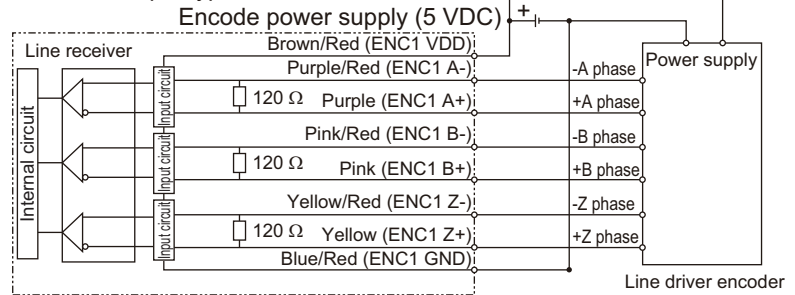
Line driver input type
CH1 (Line 0)

Line driver input type



Line driver input type
CH2 (Line 1)

Line driver input type



6-3 EtherCAT Interface

EtherCAT interface is supported only FH-2000/FH-5000 series.

6-3-1 FH-2000/FH-5000 Series



Precautions for Safe Use

- Always turn OFF the power of the FH-L series sensor controller and peripheral devices before connecting or disconnecting a camera or cable. Connecting the cable with power supplied may result in damage of the camera or peripheral devices.
- Since cables to which bending is frequently applied is easily broken, use the robotic cable type (bending resistant cable) to prevent damages.
- Do not apply torsion stress to cables. If not, it may cause damage to cables.
- Secure the minimum bending radius of cables. If not, it may cause damage to cables.



Precautions for Correct Use

- Check the following items on the communications cables that are used in the network.
 - Are there any breaks?
 - Are there any shorts?
 - Are there any connector problems?
- When you connect the cable to the communications connectors on devices, firmly insert the communications cable connector until it locks in place.
- Do not lay the communications cables together with high-voltage lines.
- Do not lay the communications cable near devices that generate noise.
- Do not lay the communications cables in locations subject to high temperatures or high humidity.
- Do not lay the communications cables in locations subject to excessive dirt and dust or to oil mist or other contaminants.


Cable

- Connect a straight LAN cable.
- Use an STP cable of category 5e or higher, which is double-shielded with aluminum tape and braided cord.
- The maximum cable length is 100 [m]. Some cables, however, are not guaranteed with 100 [m]. Generally, the transmission performance of conductor twisted cables become worse than that of single cables, so that 100 [m] is not guaranteed. For details, contact your cable manufacturer.

I/O Connector

- For electrical specifications, complying with IEEE 802.3 standard and use RJ45 8-pin modular connector (complying with ISO 8877) supporting category 5e or higher.
- When selecting connectors, check that it is suitable for the cable to be used. Items to be checked are conductor size, stranded or single, two pairs or four pairs, outer diameter, and so on.

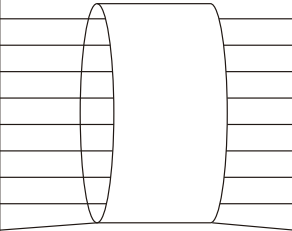
Pin Layout

| Pin assignment | Pin No. | Signal name | Abbr. | Signal direction |
|---|----------------|---------------------|-------|------------------|
|  | 1 | Transmission data + | TD + | Output |
| | 2 | Transmission data - | TD - | Output |
| | 3 | Reception data + | RD + | Input |
| | 4 | Not used | NC | - |
| | 5 | Not used | NC | - |
| | 6 | Reception data - | RD - | Input |
| | 7 | Not used | NC | - |
| | 8 | Not used | NC | - |
| | Connector hood | Shield | - | - |

Wiring

- Connect both ends of the cable shield to the connector hood.
- Apply the T568A method below.

| Pin No. | Wire color | Wire color | Pin No. |
|----------------|----------------|----------------|----------------|
| 1 | White-Green | White-Green | 1 |
| 2 | Green | Green | 2 |
| 3 | White-Orange | White-Orange | 3 |
| 4 | Blue | Blue | 4 |
| 5 | White-Blue | White-Blue | 5 |
| 6 | Orange | Orange | 6 |
| 7 | White-Brown | White-Brown | 7 |
| 8 | Brown | Brown | 8 |
| Connector hood | Shielded cable | Shielded cable | Connector hood |



6-4 Ethernet Interface

Ethernet port of sensor controller is used for EtherNet/IP or Serial (Ethernet) communication. The Ethernet port can be changed depending on sensor controller series. Be sure to check the series you are attempting to use.



Precautions for Safe Use

- Always turn OFF the power of the FH-L series sensor controller and peripheral devices before connecting or disconnecting a camera or cable. Connecting the cable with power supplied may result in damage of the camera or peripheral devices.
- Since cables to which bending is frequently applied is easily broken, use the robotic cable type (bending resistant cable) to prevent damages.
- Do not apply torsion stress to cables. If not, it may cause damage to cables.
- Secure the minimum bending radius of cables. If not, it may cause damage to cables.



Precautions for Correct Use

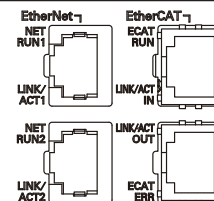
- Check the following items on the communications cables that are used in the network.
 - Are there any breaks?
 - Are there any shorts?
 - Are there any connector problems?
- When you connect the cable to the communications connectors on devices, firmly insert the communications cable connector until it locks in place.
- Do not lay the communications cables together with high-voltage lines.
- Do not lay the communications cable near devices that generate noise.
- Do not lay the communications cables in locations subject to high temperatures or high humidity.
- Do not lay the communications cables in locations subject to excessive dirt and dust or to oil mist or other contaminants.

6-4-1 FH-2000/FH-5000 Series

FH-2000/FH-5000 series are equipped with two Ethernet ports

FH-2000/FH-5000 series

- Upper port: Ethernet port
- Lower port: Ethernet port and EtherNet/IP port are sharing use.



Cable

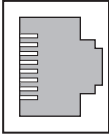
- Connect a straight or cross LAN cable.
- The transmission rate you use determines available cables and connectors.
- For 100BASE-TX or 10BASE-T, use an STP (shielded twist pair) cable with category 5 or higher.
- For 1000BASE-T, use an STP cable (double-shielded with aluminum tape and braided cord) with category 5e or higher.

I/O Connector

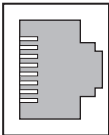
- For electrical specifications, complying with IEEE 802.3 standard and use RJ45 8-pin modular connector (complying with ISO 8877) supporting category 5e or higher.
- When selecting connectors, check that it is suitable for the cable to be used. Items to be checked are conductor size, stranded or single, two pairs or four pairs, outer diameter, and so on.

Pin Layout

● 10Base-T and 100Base-TX

| Pin assignment | Pin No. | Signal name | Abbr. | Signal direction |
|---|---------|---------------------|-------|------------------|
|  | 1 | Transmission data + | TD + | Output |
| | 2 | Transmission data - | TD - | Output |
| | 3 | Reception data + | RD + | Input |
| | 4 | Not used | - | - |
| | 5 | Not used | - | - |
| | 6 | Reception data - | RD - | Input |
| | 7 | Not used | - | - |
| | 8 | Not used | - | - |

● 1000Base-T

| Pin assignment | Pin No. | Signal name | Abbr. | Signal direction |
|---|---------|-------------------------|---------|------------------|
|  | 1 | Communication data DA + | BI_DA + | I/O |
| | 2 | Communication data DA - | DI_DA - | I/O |
| | 3 | Communication data DB + | BI_DB + | I/O |
| | 4 | Communication data DB - | BI_DC + | I/O |
| | 5 | Communication data DC + | BI_DC - | I/O |
| | 6 | Communication data DC - | BI_DB - | I/O |
| | 7 | Communication data DD + | BI_DD + | I/O |
| | 8 | Communication data DD - | BI_DD - | I/O |

Wire

Describes the connection processing to connector hood of shield as the following. The connection processing is changed according to the transfer speed.

- 10 BASE-T/100 BASE-TX
Connect both ends of the cable shield to the connector hood. Or, connect only the shield of one end of the cable, switching hub side, to the connector hood.
- 1000 BASE-T
Connect both ends of the cable shield to the connector hood.

6-4-2 FH-L Series

Cable

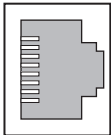
- Connect a straight or cross LAN cable.
- The transmission rate you use determines available cables and connectors.
- For 100BASE-TX or 10BASE-T, use an STP (shielded twist pair) cable with category 5 or higher.
- For 1000BASE-T, use an STP cable (double-shielded with aluminum tape and braided cord) with category 5e or higher.

I/O Connector

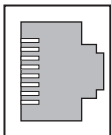
- For electrical specifications, complying with IEEE 802.3 standard and use RJ45 8-pin modular connector (complying with ISO 8877) supporting category 5e or higher.
- When selecting connectors, check that it is suitable for the cable to be used. Items to be checked are conductor size, stranded or single, two pairs or four pairs, outer diameter, and so on.

Pin Layout

● 10Base-T and 100Base-TX

| Pin assignment | Pin No. | Signal name | Abbr. | Signal direction |
|---|---------|---------------------|-------|------------------|
|  | 1 | Transmission data + | TD + | Output |
| | 2 | Transmission data - | TD - | Output |
| | 3 | Reception data + | RD + | Input |
| | 4 | Not used | - | - |
| | 5 | Not used | - | - |
| | 6 | Reception data - | RD - | Input |
| | 7 | Not used | - | - |
| | 8 | Not used | - | - |

● 1000BASE-T

| Pin assignment | Pin No. | Signal name | Abbr. | Signal direction |
|---|---------|-------------------------|---------|------------------|
|  | 1 | Communication data DA + | BI_DA + | I/O |
| | 2 | Communication data DA - | DI_DA - | I/O |
| | 3 | Communication data DB + | BI_DB + | I/O |
| | 4 | Communication data DB - | BI_DC + | I/O |
| | 5 | Communication data DC + | BI_DC - | I/O |
| | 6 | Communication data DC - | BI_DB - | I/O |
| | 7 | Communication data DD + | BI_DD + | I/O |
| | 8 | Communication data DD - | BI_DD - | I/O |

Wiring

Describes the connection processing to connector hood of shield as the following. The connection processing is changed according to the transfer speed.

- 10 BASE-T/100 BASE-TX
Connect both ends of the cable shield to the connector hood. Or, connect only the shield of one end of the cable, switching hub side, to the connector hood.
- 1000 BASE-T
Connect both ends of the cable shield to the connector hood.

6-5 Serial Interface

Serial interface of sensor controller differs by series. Refer to the correct information for the series you are using.

RS-232C interface is used in FH-2000/FH-5000 and FH-L series.

6-5-1 All Series



Precautions for Safe Use

- Always turn OFF the power of the FH-L series sensor controller and peripheral devices before connecting or disconnecting a camera or cable. Connecting the cable with power supplied may result in damage of the camera or peripheral devices.
- Since cables to which bending is frequently applied is easily broken, use the robotic cable type (bending resistant cable) to prevent damages.
- Do not apply torsion stress to cables. If not, it may cause damage to cables.
- Secure the minimum bending radius of cables. If not, it may cause damage to cables.



Precautions for Correct Use

- Check the following items on the communications cables that are used in the network.
 - Are there any breaks?
 - Are there any shorts?
 - Are there any connector problems?
- When you connect the cable to the communications connectors on devices, firmly insert the communications cable connector until it locks in place.
- Do not lay the communications cables together with high-voltage lines.
- Do not lay the communications cable near devices that generate noise.
- Do not lay the communications cables in locations subject to high temperatures or high humidity.
- Do not lay the communications cables in locations subject to excessive dirt and dust or to oil mist or other contaminants.

Cable

- For communication cable, use a shielded twisted-pair cable.
- The maximum cable length is 15 [m].

How to Connect

- Align the connector to the socket and press it straight into place, then tighten it with the screws on both sides of the connector.

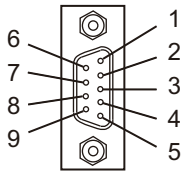
Input and output Connector

Prepare the suitable connector. Recommended connector is the following table.

| Name | Manufacturer | Model |
|---------|-------------------|-----------|
| Sockets | OMRON Corporation | XM3D-0921 |
| Hood | | XM2S-0911 |

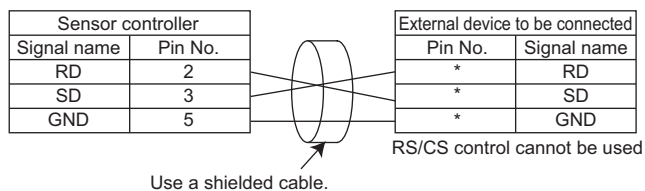
Pin Layout

D-Sub9 Male type connector is used in sensor controller.

| Pin assignment | Pin No. | Signal name | Description |
|---|---------|-------------|-------------------|
|  | 1 | NC | Not used |
| | 2 | RD | Reception data |
| | 3 | SD | Transmission data |
| | 4 | NC | Not used |
| | 5 | GND | Signal ground |
| | 6 | NC | Not used |
| | 7 | NC | Not used |
| | 8 | NC | Not used |
| | 9 | NC | Not used |

Wiring

- Bundle each cable with SG (signal ground) as a twisted pair cable. Connect the bundled SG cables with the connector on the sensor controller and the connector on the other device.
- Connect the communication cable shield to the RS-232C connector shell on the sensor controller.
- The pin numbering will differ depending on type and model of the connected external device.





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