OMRON

Vision Sensor

FH Series

# Vision System

## Hardware Setup Manual for 3D Robot Vision

**FH-505□**
**FH-SMDA-GS050B**

Z436-E1-05

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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.

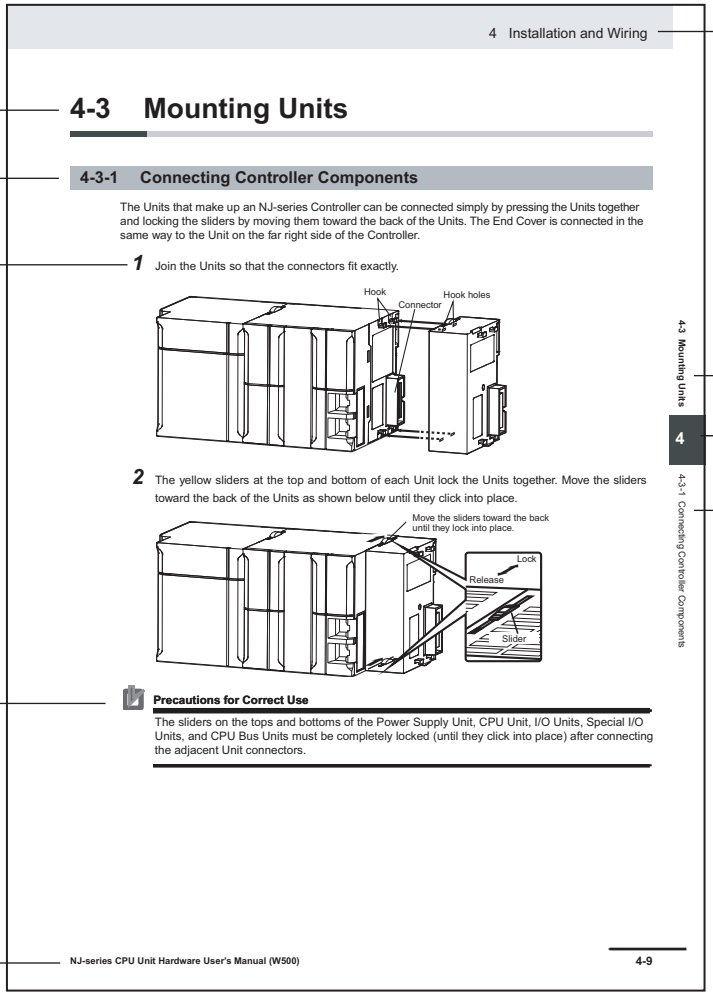
- FH-505□, FH-SMDA-GS050B
  FH-505□-10, FH-505□-20, FH-555□, FH-555□-10, and FH-555□-20 are not applicable.

Part of the specifications and restrictions are given in other manuals. Refer to Relevant Manuals on *Related Manuals* on page 29.

# Manual Structure

## Page Structure

The following page structure is used in this manual.




**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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2 Overview of FH series
3 Configuration
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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** | Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may result in serious injury or death.<br>Additionally there may be significant property damage. |
| **Caution** | Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage. |

## Meanings of Alert Symbols

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

## 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, a failure of a 3D Vision Sensor, 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.<br>An abnormal operation may result in a serious accident. | |
| FH series must be handled by those who have the expertise in electricity. Read the reference manuals carefully to understand the contents well and make the proper use of this product accordingly. Keep this document safely for ready reference at any time.<br>Note that this document does not include detailed information on the use of this product, including safety precautions. Please obtain manuals and instructions of the devices and equipment that constitute the system, and thoroughly read precautions such as "Safety Precautions", "Precautions for Safe Use", and "Precautions for Correct Use" before using the system. | |
| According to Article 36, 31 and 32 of the Occupational Health and Safety Regulations, work to teach, inspect, repair and adjust industrial robots falls under "dangerous or harmful work" as defined in the Occupational Health and Safety Act. Under Article 59 of the Occupational Safety and Health Act, operators are obliged to provide workers with "special training for safety or health". | |
| Check the measurement results before operating the robot. Otherwise the robot may act in an unintended manner. Change the workpiece position and angle of picking/placing and check the operation thoroughly. | |
| The scene variables and system variables that are set in advance for the scene loaded with the environment copy function are automatically set using operations on the dialog box. Do not directly set them using the processing item setting screen or the TDM editor. | |

FH series does not comply with the laws and regulations for industrial robot safety. When using the FH series in a robot system that includes an industrial robot, be sure to check for compliance with laws and regulations regarding the safety of industrial robots. Take steps to ensure safety as needed.

It is your responsibility to implement appropriate safety measures based on the results of risk assessment. Compliance with the Robot Safety Guide and all of the information contained in our Robotic System Product Information does not guarantee that personal injury or damage to equipment caused by an industrial robot will be avoided.

During maintenance, disconnect the robot's AC power supply and lock out or tag out the power supply to prevent powering up. If the following safety measures are not taken, the subject robot may cause death or serious injury or damage to the robot itself or its peripheral equipment.

- Workers who install, operate, teach, program, or maintain the system should read the "Robot Connection Guide (Cat. No. Z448, Z447)" and "Robot Safety Guide (Cat. No. I590)" and take a training course on their responsibilities with the robot.
- Those who design a robot system must read this document and the Robot Safety Guide and follow the safety regulations and laws in the area where the robot will be installed.
- Do not use the subject robot for any purpose other than those described in this document and the manuals referred to in the Robot Connection Guide. If you are not sure whether your application is compatible, please contact us.
- The user is responsible for installing safety barriers around the robot to prevent workers from entering the work area and coming into contact with it while it is in operation.
- During maintenance, the power to the robot and the main power supply must be locked out and tagged out (measures and indication of prohibition from being turned on) to prevent them from being turned on.

If you proceed to the next step before registering the HandEye calibration start position, the robot may operate unintentionally. Be sure to register the start position.

The robot is driven by pressing the Jog Move button and the Robot Move button. The operation must be done by shoes who have completed special health and safety training. The system must be operated so that it can be stopped at any time by an emergency stop button.

Check the measurement results before operating the robot. Otherwise the robot may act in an unintended manner. Change the workpiece position and angle and check the operation thoroughly.

If the robot is operated with an incorrectly shaped hand, the robot may pick and hold the workpiece in an unintended position and/or posture, damaging the workpiece, container, or hand and causing it to fly out into the environment. Check the dimensions of the drawing and the actual product and make registration securely. Change the workpiece position and angle of picking/placing and check the operation thoroughly. The system must be operated so that it can be stopped at any time by an emergency stop button.

If the robot is operated with an incorrectly selected picking and holding DB or hand data, the robot may pick and hold the workpiece in an unintended position and/or posture, damaging the workpiece, container, or hand and causing it to fly out into the environment. Select the proper picking and holding DB in the picking and holding plan setting. Make sure to perform offline measurement before operating the robot to confirm that the proper hand is selected.

If the robot is operated with incorrect environment data, it may act in an unintended manner, resulting in contact with humans, scattering of workpieces, and contact with surrounding objects. Make sure that the proper environment file for the robot is loaded.

If the robot is operated after changing the floor or container height, it may collide with the floor. If the container position or floor level is changed, register the floor level and container again.

If the 3D Vision Sensor shape is not registered, the 3D Vision Sensor may collide with the container and be damaged. Please register the 3D Vision Sensor shape when you register the hand data.

Do not perform camera calibration during the warm-up operation of the 3D Vision Sensor.

Measurement errors occur when the geometric positional relationship between the lighting section and imaging section of the 3D Vision Sensor changes due to factors such as aging, temperature changes, or impact on the 3D Vision Sensor. Perform a camera calibration check on a regular basis and calibrate the camera if necessary.

Do not perform hand-eye calibration during the warm-up operation of the 3D Vision Sensor.

Complete sensor calibration before performing hand-eye calibration.

**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 Controller or taking appropriate management measures for removable media, by means of locking the installation area, entrance management, etc., by yourself.

## ⚠ Caution

Danger of burns. Do not touch the case while the power is ON or just after power is turned OFF, since it remains extremely hot.

If the camera calibration is performed with the target tilted, the measurement error may deteriorate. Ensure that the calibration target is placed in a stable position on a flat floor.

If the camera calibration is performed while the target is dirty, the measurement error may deteriorate. If the camera calibration target is dirty, wring out a wet towel, wipe it clean, and dry it with a soft cloth before performing the calibration.

If the camera calibration is performed while the 3D Vision Sensor is dirty, the measurement error may deteriorate. If the 3D Vision Sensor window surface is dirty, wring out a wet towel, wipe the dirt off, and dry with a dry cloth.

When operating the jog, check the actual robot visually instead of the camera image.

The robot is driven when using the motion sample program. The operation must be done by shoes who have completed special health and safety training. The system must be operated so that it can be stopped at any time by an emergency stop button.

If the operation range of hand-eye calibration is not set correctly, the robot may act in an unexpected position and/or posture that may result in contact with surrounding objects. Make sure that the calibration trajectory is clear and that there are no obstacles or people in the vicinity. The system must be operated so that it can be stopped at any time by an emergency stop button.

When placing the camera calibration target, place it slowly so that your hands do not get caught on the floor.

# Precautions for Safe Use

Be sure to respect following items for safety.

## Condition of the Fitness of OMRON Products

- *Omron products* are designed and manufactured as general-purpose products for use in general industrial applications. They are not intended to be used in the following critical applications. If you are using *Omron products* in the following applications, *Omron* shall not provide any warranty for such *Omron products*, unless otherwise specifically agreed or unless the specific applications are intended by Omron.
  a) Applications with stringent safety requirements, including but not limited to nuclear power control equipment, combustion equipment, aerospace equipment, railway equipment, elevator/lift equipment, amusement park equipment, medical equipment, safety devices and other applications that could cause danger/harm to people's body and life.
  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-505☐)

- 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.
- When mounting the product, be sure to tighten all screws.

## Power Supply and Wiring (FH-505☐)

- 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 is the S8VS-□□□24 (manufactured by OMRON) or S8VK-G-□□□24 (manufactured by OMRON).
- Select and use the appropriate wire size (AWG16 to 10) based on consumption current.
- 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 supply correct? (24 VDC)
  - 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 (FH-505□)

- 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, the circuits may cause short-circuit with FG if the base is not used to mount the camera and result in malfunction or damage.
- 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.
- 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 (FH-505□)

- 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 (FH-505□)

- 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 (FH-505□)

- 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.

## Installation Environment (FH-SMDA-GS050B)

- Do not use the product in the environment with flammable or explosive gases.
- To secure safety for operation and maintenance, install the product apart from high-voltage devices and power devices.
- Avoid installing the product in places with vibration as much as possible.

## Power Supply and Wiring (FH-SMDA-GS050B)

- Make sure to use the product with the power supply voltage specified. If a DC voltage exceeding the rating or an AC voltage is applied, the circuit parts may be burnt or exploded.
- Do not connect the power supply with polarity reversed.
- Use a DC power supply with safety measures against high-voltage spikes (safety extra low-voltage circuits on the secondary side).
- Use an independent power source for this product. Do not use a shared power source.

- Never apply more than the rated voltage or AC power supply to this product. It may cause malfunction.
- The recommended power supplies are as follows:
  - When not attaching the lighting module, use S8VK-G06024 (OMRON) or S8VS-06024 (OMRON).
- Wire high-voltage cables or power cables are separated from the cables of this product. If the same cable or duct is used, the product may receive induction and it may cause malfunctioning or breakage.
- Do not short-circuit the load on the open collector output.
- Apply load not exceeding the rating.
- Before wiring an I/O cable, attach a crimping terminal. Do not connect cables just twisted together to the power supply or terminal block directly.
- Insulate unnecessary signal cables so that they do not contact any other signal cables.
- After wiring the cables, confirm if the power supply is appropriate, if there is miswiring such as short-circuit of load, if the load current is appropriate, and if FG is connected appropriately. Otherwise, the product may be broken due to miswiring etc.
- Take enough safety measures such as a failsafe circuit before using the product.
- Be sure to apply Class D grounding (100Ω or lower grounding resistance) to the ground wire of the I/O cable.
- Do not share the ground wire with some other devices or connect it to the beam of the building. The product may be adversely affected.
- Determine the contact point as near as possible to shorten the ground wire as much as possible. The product may be adversely affected.
- For positive ground, please refer to cautions described in the setup manual.
- Do not touch the optical surface of the camera or the lighting section during wiring or installation. It may affect the characteristics.

## Mounting (FH-SMDA-GS050B)

- When doing the following, be sure to turn OFF the power of the 3D vision sensor or connected peripheral devices. Not doing so leads to a product failure.
  - Cable connection and wiring
  - Connector mounting/removal
- Tighten the mounting screws securely using the defined torque. (Screw: M4 x 4, Tightening torque: 1.2 N•m)
- Do not apply torsional stress to the cable. Doing so may cause cable breakage.
- Secure the minimum bending radius of the cable. If it cannot be secured, the cable may be broken.

## Others (FH-SMDA-GS050B)

- Use only the dedicated cable (FHV-VNBX / FHV-VNLBX and FHV-VSDX-BX / FHV-VSDX-LBX). Otherwise, the product may malfunction or be broken.
- If anything abnormal occurs, for example, strange smell/sound is detected, the main unit gets very hot, or a smoke comes, stop using the product, turn OFF the product, and consult OMRON’s branch or sales office.
- Do not disassemble, deform by pressurizing, incinerate, repair, or alter this product.
- When disposing of the product, treat as industrial waste.
- Do not use the product for atomic power or safety circuits endangering human lives.

- Do not drop the product or expose it to abnormal vibration or impact. Doing so may lead to product failure.
- When operating the robot by using the vision sensor measurement results, be sure to check the measurement result data on the robot side and take fail-safe measures, such as operating the robot only after confirming that the data is within the robot's range of motion.
- 3D Vision Sensor measurements are relative, not absolute. It cannot be used as a measurement sensor.

## Camera Calibration Target (FH-XCAL-S)

- Install and store the product in a location that meets the following conditions:
  - Ambient temperature and relative humidity do not exceed the range of specifications
  - 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 oils or chemicals
- Do not drop the product nor apply excessive vibration or shock to the product. Doing so may cause malfunction or burning.
- Place the camera calibration target in a stable position on a flat floor.
- Set the camera calibration target within the measurement distance and measurement range of the 3D Vision Sensor to calibrate the camera.
- Before performing camera calibration automatically, make sure that the robot is in a coordinate position that does not collide with the target.

## HandEye Calibration Target (FH-XCAL-R)

- 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 oils or chemicals
- Do not drop the product nor apply excessive vibration or shock to the product. Doing so may cause malfunction or burning.
- Set the hand-eye calibration target within the measurement distance and measurement range of the 3D Vision Sensor to performing hand-eye calibration.
- When performing hand-eye calibration, make sure that there is no workpiece around the hand-eye calibration target.
- Install the hand-eye calibration target on a flat floor in a stable condition without vibration.
- If the hand-eye calibration target is dirty, wring out a wet towel, wipe off the dirt, and dry with a soft cloth.
- If the 3D Vision Sensor window surface is dirty, wring out a wet towel, wipe the dirt off, and dry with a dry cloth.
- Check that the hand-eye calibration result shows an error of approximately 1 or less.

# Precautions for Correct Use

Please observe the following precautions to prevent failure to operate, malfunction, or undesirable effect.

## Installation and Storage Sites (FH-505□)

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

- Surrounding temperature of 0 to +45°C (-20 to +65°C in storage)
- 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

## Orientation of Product (FH-505□)

- 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 (FH-505□)

- 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 (FH-505□)

- 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 (FH-505□)

- 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.

## Installation Location (FH-SMDA-GS050B)

In order to prevent the product from becoming inoperable or malfunction, and to prevent other adverse effects to the performance or equipment, please observe the following.

- A location where the ambient temperature does not exceed the rated range.
- A location where the temperature does not vary sharply (condensation occurs).
- A location where relative temperature does not exceed a range of 35-85%.
- A location not exposed to corrosive gases or combustible gases.
- A location not exposed to dust, salt, or metal powder.
- A location not exposed to direct vibration or impact.
- A location not exposed to strong disturbance light (laser light, arc welding light, or ultraviolet light).
- A location not near a heating appliance or exposed to direct sunlight.
- A location not exposed to mist of water, oil, or chemicals or misty atmosphere.
- A location not exposed to strong magnetic/electric fields.
- A location not near a high-voltage device or power device

## Power Supply, Connection, and Wiring (FH-SMDA-GS050B)

- If using a commercially available switching regulator, earth the frame ground terminal.
- If the power supply line has surge, connect a surge absorber according to the operational environment to use the product.
- After wiring the cables, confirm if the power supply is appropriate, if there is miswiring such as short-circuit of load, or if the load current is appropriate. Otherwise, the product may be broken due to miswiring etc.
- Do not put load on the cables and connectors before wiring them.
- Turn on the power of the 3D Vision Sensor at the same time as or before turning on the power of the FH sensor controller.
- When turning OFF the power, confirm that data have been saved completely before starting operations.
  - When data are saved by operating the 3D vision sensor, the saving process must have been completed and the following user operations must be possible.
  - When data are saved using communication commands, processing of the applicable commands must have been completed and the busy state is OFF.
- Attach the cable straight with the terminal correctly aligned. Forcibly attaching the cable may bend the terminal, resulting in failure or communication error.
- Insulate the unused signal lines of the I/O cable so that the signal lines do not come into contact with other signal lines.

## Maintenance (FH-SMDA-GS050B)

- Turn OFF the power and confirm safety before starting maintenance.
- Remove dirt on the window using the special cloth for lens or an air brush.
- Do not use thinner, alcohol, benzene, acetone, or kerosene to clean his product.

## Optical axis (FH-SMDA-GS050B)

- The field of view may vary product by product. When mounting this product, be sure to confirm video using the sensor controller.

## Image Sensor (FH-SMDA-GS050B)

- For this product, a line may appear depending on the measurement condition or sensitivity because of the specification of the image sensor.
  However, this is not a fault or failure of the product. In addition, although there may be multiple defective pixels, this is not a fault or failure of the product. Use the product as confirming the actual image.

## Failsafe Measures (FH-SMDA-GS050B)

- When operating the robot by using the vision sensor measurement results, be sure to check the measurement result data on the robot side and take fail-safe measures, such as operating the robot only after confirming that the data is within the robot's range of motion.

## Warm-up (FH-SMDA-GS050B)

- The correct brightness and focus may not be achieved or may fluctuate until the product function is stabilized (approximately 15 minutes) after power-on. Check the WARM UP indicator LED or the warm-up completion flag in the camera image input processing item on the FH software before using the product.

## Camera Installation (FH-SMDA-GS050B)

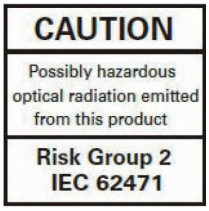
- In an environment exposed to high humidity and sharp temperature fluctuation, the window may become cloudy in rare cases.

## Connection and Operation with the Robot (FH-SMDA-GS050B)

- For an example design of a robot program to build an application, see the sample program (fhsample_main()) of the Robot Connection Guide.
- For the processing to move the robot to the imaging position, refer to the Robot Connection Guide.
- If you proceed to the next step before registering the workpiece reference position, the robot may operate unintentionally. Be sure to register the start position.
- If you proceed to the next step before registering the robot's picking and holding position, the robot may operate unintentionally. Be sure to register the start position.

## LED Safety (FH-SMDA-GS050B)

This product is classified into the following risk groups by IEC62471.

| LED safety | Display |
|---|---|
| Risk group 2 |  |

## Camera Calibration Target (FH-XCAL-S)

- Do not use thinner, alcohol, benzene, acetone, or kerosene to clean his product.
- Before calibrating the camera, make a backup of the AOS camera information file.
- After calibrating the camera, check the results to confirm that the calibration was successful. When an abnormal AOS camera information file is read, the measurement error increases and the wrong coordinate position is output.
- When disposing of this product, treat it as industrial waste and never heat or incinerate it at 100 °C or higher.

## HandEye Calibration Target (FH-XCAL-R)

- Do not use thinner, alcohol, benzene, acetone, or kerosene to clean his product.

- When disposing of this product, treat it as industrial waste and never heat or incinerate it at 100 °C or higher.

# Regulations and Standards

## FH-505□

### 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:

This product contains a lithium battery for which the following notice applies: Perchlorate Material - special handling may apply.
See "www.dtsc.ca.gov/hazardouswaste/perchlorate".

### 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.

### WEEE Directive

Dispose of in accordance with WEEE Directive

### 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

# FH-SMDA-GS050B

## 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.

## Conformance to KC Standards

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

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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 EU Directives

The product is compliant with the standards below:

- EU Directive 2014/30/EU EN61326-1 Electromagnetic environment: Industrial electromagnetic environment (EN/IEC 61326-1 Table 2)
- 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.

# Related Manuals

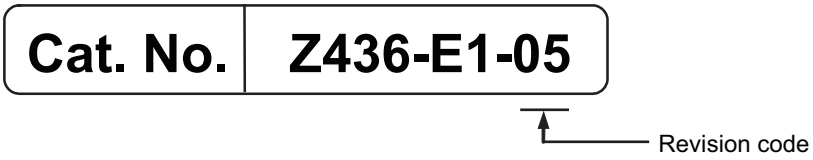
The followings are the manuals related to this manual. Use these manuals for reference.

| Name of Manual | Cat. No. | Model | Purpose | Contents |
|---|---|---|---|---|
| Vision System<br>FH Instruction Sheet | 3648743-1 | FH-2□□2<br>FH-2□□2-□□<br>FH-5□□2<br>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<br>FH Instruction Sheet | 3102269-4 | FH-2□□□<br>FH-2□□□-□□<br>FH-5□□□<br>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. |
| 3D Vision Sensor<br>FH-SMDA Instruction Sheet | 3290410-0 | FH-SMDA-GS050B | To confirm the safety and usage precautions of the 3D Vision Sensor FH-SMDA. | Describes the definitions of basic terms, the meaning of signal words, and precautions for correct use of 3D Vision Sensor FH-SMDA in the manual. |
| FH Application Software<br>FH-UM3D1 Instruction Sheet | 5665477-6 | FH-UM3D1 | To confirm the safety and usage precautions of the FH Application Software FH-UM3D1. When User want to know about the hardware specifications or to setup the FH Application Software FH-UM3D1. | Describes the definitions of basic terms, product specifications, how to use, meaning of signal words, and precautions for correct use of FH Application Software FH-UM3D1 in the manual. |
| Vision System<br>FH series<br>3D Robot Vision Application Construction Guide | Z446 | FH-505□<br>FH-SMDA-GS050B | When User want to know about the FH series 3D robot vision system. | Describes the soft functions, setup, and operations to use FH series 3D robot vision system. |
| Vision System<br>FH series<br>Hardware Setup Manual for 3D Robot Vision | Z436 | | When User want to know about the Hard-ware specifications or to setup the Sensor Controller of the FH series 3D robot vision system. | Describes FH series 3D robot vision system specifications, dimensions, part names, I/O information, installation information, and wiring information. |
| Vision System<br>FH series<br>Processing Item Function Reference Manual for 3D Robot Vision | Z445 | | 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 series 3D robot vision system. |

| Name of Manual | Cat. No. | Model | Purpose | Contents |
|---|---|---|---|---|
| Vision System<br>FH/FHV Series<br>User's Manual | Z365 | FH-2□□□<br>FH-2□□□-□□<br>FH-5□□□<br>FH-5□□□-□□<br>FH-L□□□<br>FH-L□□□-□□<br>FHV7□-□□□□□-□□□ | When User want to know about the FH/FHV series. | Describes the soft functions, setup, and operations to use FH/FHV series. |
| Vision System<br>FH/FHV series<br>Processing Item Function Reference Manual | Z341 | | 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<br>FH/FHV Series<br>User's manual for Communications 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.<br>The following communications protocol are described.<br>Parallel, PLC Link, EtherNet/IP, EtherCAT, and Non-procedure. |
| Vision System<br>FH series<br>Macro Customize Functions Programming Manual | Z367 | FH-2□□□<br>FH-2□□□-□□<br>FH-5□□□<br>FH-5□□□-□□<br>FH-L□□□<br>FH-L□□□-□□ | When User operate or programming using Macro Customize functions. | Describes the functions, settings, and operations for using Macro Customize function of the FH series. |

# Revision History

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




| Rev. Code | Rev. Date | Revision Contents |
|---|---|---|
| 01 | Feb. 2021 | Original product |
| 02 | Sep. 2022 | Revisions for adding safety precautions regarding security<br>Removed FAE-5002 and FAE-5004<br>Removed HMC-SD491 and HMC-SD291<br>Added HMC-SD492 and HMC-SD292<br>Touch panel monitor specification change |
| 03 | Dec. 2022 | Revisions for update *Precautions for Safe Use*, *Precautions for Correct Use*, *Regulations and Standards*, *Related Manuals*.<br>Added models for camera cables. |
| 04 | Jun. 2024 | Revisions for update *Precautions for Safe Use*, *Precautions for Correct Use*, *Related Manuals*.<br>Additional support for FH-5051 and FH-5052.<br>Removed FZ-VM and FH-VMRGB.<br>FH-VMDA specification changed.<br>Added HMC-SD293, HMC-SD493 and HMC-SD1A3.<br>Removed HMC-SD292 and HMC-SD492.<br>Corrected mistakes |
| 05 | Aug. 2024 | Revisions for update *Recommended EtherCAT and EtherNet/IP Communications Cables*.<br>Added XW2K-34G-T. |

# 1



# Confirm the Package

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1-2-3 Camera I/O Cable ..... 1-3
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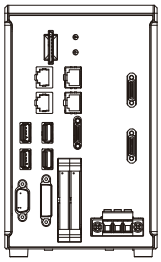
# 1-1 Sensor Controller

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

## 1-1-1 FH-505□



- Sensor Controller: 1
  FH-505□: 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

# 1-2 3D Cameras and Related

## 1-2-1 Camera

| Appearance | Type | Field of vision | Imaging area | Model |
|---|---|---|---|---|
| | 3D vision sensor | 400 x 300 mm | 400 to 600 mm | FH-SMDA-GS050B |

## 1-2-2 Camera Cable

| Appearance | Description | Model |
|---|---|---|
| | Ethernet cable super bending resistance straight<br>Cable length: 5 m, 10 m | FHV-VNBX2<br>□M*1 |
| | Ethernet cable super bending resistance right-angle *3<br>Cable length: 5 m, 10 m | FHV-VNLBX2<br>□M*1 |
| | Ethernet cable super bending resistance straight<br>Cable length: 3 m, 5 m, 10 m | FHV-VNBX □M*2 |
| | Ethernet cable super bending resistance right-angle *3<br>Cable length: 3 m, 5 m, 10 m | FHV-VNLBX<br>□M*2 |

*1. Insert the cables length into □ in the model number as follows. 5 m = 5, 10 m = 10
*2. Insert the cables length into □ in the model number as follows. 3 m = 3, 5 m = 5, 10 m = 10
*3. This Cable has an L-shaped connector on the Camera end.

## 1-2-3 Camera I/O Cable

| Appearance | Description | Model |
|---|---|---|
| | I/O cable super bending resistance straight<br>Cable length: 3 m, 5 m, 10 m | FH-VSDX-BX<br>□M*1 |
| | I/O cable super bending resistance right-angle*2<br>Cable length: 3 m, 5 m, 10 m | FH-VSDX-LBX<br>□M*1 |

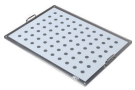
*1. Insert the cables length into □ in the model number as follows. 3 m = 3, 5 m = 5, 10 m = 10
*2. This Cable has an L-shaped connector on the Camera end.

# 1-3 FH Application Software

| Appear-ance | Description | Model |
|---|---|---|
| | 3D Robot Vison Software Installer *1 | FH-UM3D1 |

*1. This product can be installed on the FH-505□ (version 6.40 or later).

# 1-4 Calibration Target

| Appear-ance | Description | Model |
|---|---|---|
| | Handeye Calibration Target | FH-XCAL-R |
|  | Camera Calibration Target | FH-XCAL-S |

# 1-5 Sold Separately

## 1-5-1 Monitor

### Monitor

| Appear-ance | 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

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

## 1-5-2 Lighting and Lighting Controller

| Appearance | Description | | | Model |
|---|---|---|---|---|
| - | External Lighting | | - | FLV Series |
| | | | - | FL Series |
| | Lighting Controller (Required to control external lighting from a Controller) | For FLV-Series | Analog Lighting Controller | FLV-ATC Series |

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

## 1-5-3 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<br>(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 |

## 1-5-4 Cable

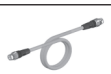
### Parallel I/O Cables

| Appear-ance | Description | Model |
|---|---|---|
| | Parallel I/O Cable *1<br>Cable length: 2 m, 5 m or 15 m | XW2Z-S013-□ *2 |
| | Parallel I/O Cable for Connector-terminal Conversion Unit *1<br>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 |

*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.

### 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 | Appear-ance | Recom-mended manufac-turer | Cable length (m) | Model |
|---|---|---|---|---|
| Cable with Connectors on Both Ends (RJ45/RJ45)<br>tandard RJ45 plugs type *1<br>Wire Gauge and Number of Pairs: AWG26, 4-pair Cable<br>Cable Sheath material: PUR<br>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)<br>Rugged RJ45 plugs type *1<br>Wire Gauge and Number of Pairs: AWG22, 2-pair Cable<br>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 |
| Cable with Connectors on Both Ends (M12 Straight/M12 Straight)<br>Shield Strengthening Connector cable *3<br>M12/Smartclick Connectors<br>Wire Gauge and Number of Pairs: AWG22, 2-pair Cable<br>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 |

| Item | Appear-ance | Recom-mended manufac-turer | Cable lengt h (m) | Model |
|---|---|---|---|---|
| Cable with Connectors on Both Ends (M12 Straight/RJ45)<br>Shield Strengthening Connector cable *3<br>M12/Smartclick Connectors<br>Wire Gauge and Number of Pairs: AWG22, 2-pair Cable<br>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)<br>Wire gauge and number of pairs: AWG24, 4-pair cable | Cable | Kuramo Electric Co. | KETH-SB *1 |
| | RJ45 Con-nector | Panduit Corpora-tion | MPS588-C *1 |
| Products for EtherCAT or EtherNet/IP (1000BASE-TX/100BASE-T)<br>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 As-sembly 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.

# 2



# Overview of FH series

**2-1 Basic System of Measurement ..... 2-2**
2-1-1 System Configuration ..... 2-4
**2-2 Flow of Use Procedure ..... 2-5**

# 2-1 Basic System of Measurement

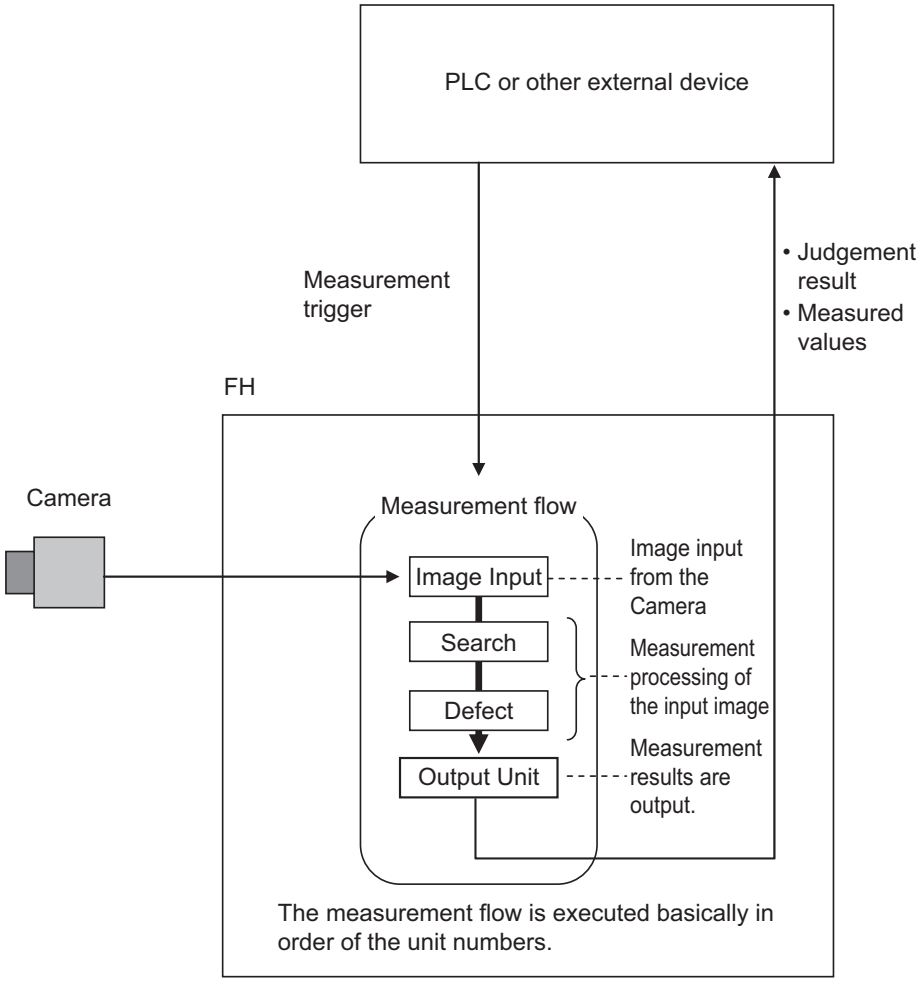
An FH series Sensor Controller uses pre-built packages that contain all the processing tasks (for image input, measurement processing, displays, outputs, etc.) that are required for vision inspections. You arrange these packaged processes in order of execution of the vision inspection.
An FH series Sensor 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 series 3D Robot Vision Application Construction Guide (Cat.No. Z446)* and *Vision System FH/FHV series User's Manual (Cat.No. Z365)*.)

## Concept of Measurement Processing

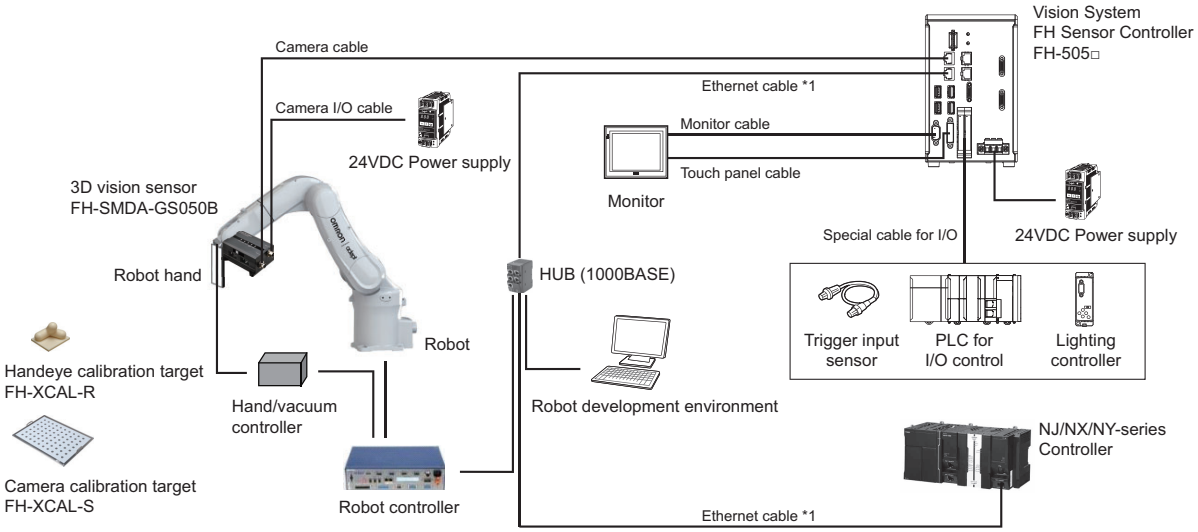
When the FH receives a measurement trigger from the PLC or other external device, the image input from a Camera, measurement processing, and output of measurement results (e.g., OK/NG judgement results) are executed in the order that those processing items are registered in the measurement flow.




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.

# 2-1-1 System Configuration

## The Example of a System Configuration




**Camera cable**

Straight Ethernet cable
FHV-VNBX2
(5 m, 10 m, min. bending radius: 40 mm)
FHV-VNBX
(3 m, 5 m, 10 m, min. bending radius: 38 mm)
Right-angle Ethernet cable
FHV-VNLBX2
(5 m, 10 m, min. bending radius: 40 mm)
FHV-VNLBX
(3 m, 5 m, 10 m, min. bending radius: 38 mm)

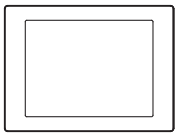
**Camera I/O cable**

Straight I/O cable
FH-VSDX-BX
(3 m, 5 m, 10 m, min. bending radius: 35 mm)
Right-angle I/O cable
FH-VSDX-LBX
(3 m, 5 m, 10 m, min. bending radius: 35 mm)

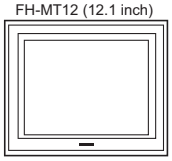
**Monitor**

Use the monitor to check images and display the condition-setting menus.

LCD monitor
FZ-M08 (8.4 inch)



Touch panel monitor
FH-MT12 (12.1 inch)



**Monitor cable**

FH-VMDA
(2 m, 5 m, 10 m, min. bending radius 36 mm)

**Touch panel cable**

FH-VUAB
(USB type, 2 m, 5 m, min. bending radius: 25 mm)

XW2Z-□□□PP-1
(RS-232C type, 2 m, 5 m, 10 m, min. bending radius: 59 mm)

**Power Supply**

The power supply connected to FH Sensor Controller varies depending on the number of connected cameras and types for various consumption current types. Use is accordingly.
Recommended Model by OMRON:
S8VK-G series/S8VS series

The power supply connected to 3D vision sensor varies for appropriate consumption current types. Use is accordingly.
Recommended Model by OMRON:
S8V-NFS206 or equivalent products

**Peripheral Device**

| USB flash drive | SD Memory Card |
|---|---|
| FZ-MEM2G | HMC-SD293 |
| FZ-MEM16G | HMC-SD493 |
| | HMC-SD1A3 |

Switcher
In case of switching multiple of sensor controllers with a single monitor or touch panel monitor, please make sure to use an appropriate product.
Recommended model by OMRON: FZ-DU

**Input Device**

Mouse, track ball
(Commercially available USB devices)

**FH Application Software**

3D Robot Vison Software Installer
FH-UM3D1

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

# 2-2 Flow of Use Procedure



The following table shows the flow for using the FH.

| Procedure | Description | Reference |
|---|---|---|
| Preparations | Installation and Wiring | *Section 4 Handling and Installation Environment* on page 4-1<br>*Section 5 Setup and Wiring* on page 5-1 |
| | ↓ | |
| | Turning ON Power | *5-1 When turning ON and OFF* on page 5-2 |
| | ↓ | |
| | Language Selection in Dialog Box (only when the Sensor Controller is started for the first time) | *Vision System FH series 3D Robot Vision Application Construction Guide (Cat.No. Z446)* and *Vision System FH/FHV series User's Manual (Cat.No. Z365)* |
| | ↓ | |
| | Main Window (Layout 0) Display | *Vision System FH series 3D Robot Vision Application Construction Guide (Cat.No. Z446)* and *Vision System FH/FHV series User's Manual (Cat.No. Z365)* |
| | ↓ | |
| | Camera Adjustments (Display the settings dialog box for a Camera Image Input processing item.) | *Vision System FH series 3D Robot Vision Application Construction Guide (Cat.No. Z446)* and *Vision System FH/FHV series User's Manual (Cat.No. Z365)* |
| | ↓ | |
| | Select **Tool** - **System settings**, and then under **Startup setting**, set the settings for *Basic*, *Communication*, and *Operation mode*. | *Vision System FH series 3D Robot Vision Application Construction Guide (Cat.No. Z446)* and *Vision System FH/FHV series User's Manual (Cat.No. Z365)* |
| | ↓ | |
| | Click the **Data save** button, and then select **Function** - **System restart**. | *Vision System FH series 3D Robot Vision Application Construction Guide (Cat.No. Z446)* and *Vision System FH/FHV series User's Manual (Cat.No. Z365)* |
| | ↓ | |
| | Select **Tool** - **System settings**, and then set the settings for *Camera*, *Communication* and *Other*. | *Vision System FH series 3D Robot Vision Application Construction Guide (Cat.No. Z446)* and *Vision System FH/FHV series User's Manual (Cat.No. Z365)* |
| | ↓ | |
| | Click the **Data save** button. | *Vision System FH series 3D Robot Vision Application Construction Guide (Cat.No. Z446)* and *Vision System FH/FHV series User's Manual (Cat.No. Z365)* |
| ↓ | | |

| Procedure | Description | Reference |
|---|---|---|
| Scene Editing | In the Main Window (layout 0), edit the measurement flow.<br>• Register processing items.<br>• Set the properties for each processing item. | *Vision System FH series 3D Robot Vision Application Construction Guide (Cat.No. Z446)* and *Vision System FH/FHV series User's Manual (Cat.No. Z365)* |
| | ↓ | |
| | Click the **Data save** button. | *Vision System FH series 3D Robot Vision Application Construction Guide (Cat.No. Z446)* and *Vision System FH/FHV series User's Manual (Cat.No. Z365)* |
| ↓↑ | | |
| Testing | Execute test measurements.<br>(In the Main Window (layout 0), click the **Measure** button.) | *Vision System FH series 3D Robot Vision Application Construction Guide (Cat.No. Z446)* and *Vision System FH/FHV series User's Manual (Cat.No. Z365)* |
| | ↓ | |
| | Adjust the parameters for each processing item. | *Vision System FH series Processing Item Function Reference Manual for 3D Robot Vision (Cat. No. Z445)* and *Vision System FH/FHV series Processing Item Function Reference Manual (Cat. No. Z341)* |
| | ↓ | |
| | Click the **Data save** button. | *Vision System FH series 3D Robot Vision Application Construction Guide (Cat.No. Z446)* and *Vision System FH/FHV series User's Manual (Cat.No. Z365)* |
| ↓ | | |
| Measuring (Operation) | In the Main Window (layout 0), click the **Switch layout** button, and then select *Main Window (Layout 1)*. | *Vision System FH series 3D Robot Vision Application Construction Guide (Cat.No. Z446)* and *Vision System FH/FHV series User's Manual (Cat.No. Z365)* |
| | ↓ | |
| | In the Main Window (layout 1), check the communications with the PLC. | Vision System FH/FHV series User's Manual for Communications Settings (Cat. No. Z342) |
| | ↓ | |
| | In the Main Window (layout 1), execute commands from the PLC, such as measurement trigger commands. | Vision System FH/FHV series User's Manual for Communications Settings (Cat. No. Z342) |
| ↓ | | |
| Management and Analysis | Save and analyze measurement data and images. | *Vision System FH series 3D Robot Vision Application Construction Guide (Cat.No. Z446)* and *Vision System FH/FHV series User's Manual (Cat.No. Z365)* |

# 3

# Configuration



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3-2-1 3D Vision Sensor ..... 3-9
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# 3-1 Sensor Controller

## 3-1-1 FH-505□

### Specification

● **FH-505□ for 3D Robot Vision**

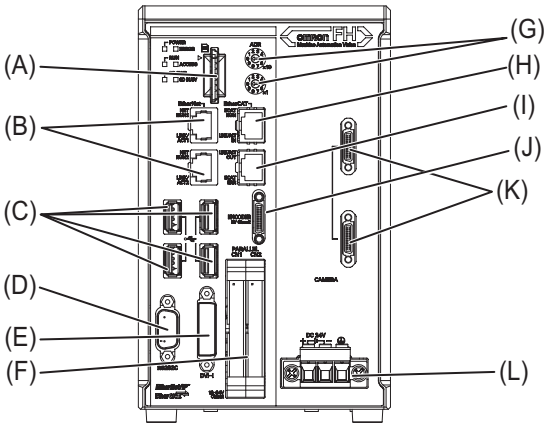
| Series | | | FH-5000 Series |
|---|---|---|---|
| Type | | | High-speed, Large-capacity Controller(4 cores) |
| Model | | | FH-5052/FH-5051/FH-5050 |
| Controller Type | | | Box type |
| Parallel IO polarity | | | NPN/PNP (common) |
| Memory, Storage | | | FH-5052/FH-5051: 8GB RAM, 64GB ROM<br>FH-5050: 8GB RAM, 32GB ROM |
| Number of cores | | | FH-5052: 8 cores<br>FH-5051/FH-5050: 4 cores |
| Main Functions | Operation Mode | Standard | Yes |
| | | Double Speed Multi-input | No |
| | | Non-stop adjustment mode | No |
| | | Multi-line random-trigger mode | No |
| | Parallel Processing | | Yes |
| | Number of Connectable Camera | | 1 (Connect to the Ethernet port.) |
| | Supported Camera | | FH-SMDA-GS050B |
| | Possible Number of Logging Images to Sensor Controller | | Both 3D and 2D imaging: Up to 14 images<br>3D imaging only, 2D imaging only: Up to 29 images |
| | Possible Number of Scenes | | Approximately 10 scenes<br>(Varies depending on usage conditions.) |
| | 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 | | Japanese, English |
| External Interface | Serial Communication | | RS-232C x 1 |
| | Ethernet Communication | Protocol | Non-procedure (TCP/UDP) |
| | | I/F | 1000BASE-T x 2 |
| | EtherNet/IP Communication | | Yes (Target/Ethernet port) |
| | PROFINET Communication | | • Yes (Slave/Ethernet port)<br>• Conformance class A |
| | EtherCAT Communication | | Yes (slave) |
| | Parallel I/O | | 9 inputs/22 outputs |

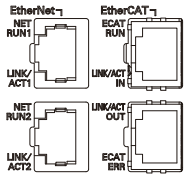
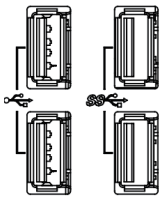
| Series | | | FH-5000 Series |
|---|---|---|---|
| Type | | | High-speed, Large-capacity Controller(4 cores) |
| Model | | | FH-5052/FH-5051/FH-5050 |
| | Encoder Interface | | Not supported. |
| | Monitor Interface | | DVI-I output (Analog RGB & DVI-D single link) x 1 |
| | USB I/F | | USB2.0 host x 2 (BUS Power: 5 V/0.5 A per port)<br>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<br>ERROR: Red<br>RUN: Green<br>ACCESS: Yellow |
| | Ethernet | | NET RUN1: Green<br>LINK/ACT1: Yellow<br>NET RUN2: Green<br>LINK/ACT2: Yellow |
| | SD Card | | SD POWER: Green<br>SD BUSY: Yellow |
| | EtherCAT | | ECAT RUN: Green<br>LINK/ACT IN: Green<br>LINK/ACT OUT: Green<br>ECAT ERR: Red |
| Supply Voltage | | | 20.4 VDC to 26.4 VDC |
| Current consumption | | | 4.2A max. |
| Built-in FAN | | | Yes |
| Usage Environment | Ambient temperature range | | Operating: 0°C to +45°C<br>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 $m/s^2$<br>Sweep time: 8 minute/count, Sweep count: 10, Vibration direction: up and down/front and behind/left and right |
| | Shock resistance | | Impact force: 150 $m/s^2$<br>Test direction: up and down/front and behind/left and right |
| | Noise immunity | Fast Transient Burst | • DC power:<br>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.<br>• I/O line:<br>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) *1 |

| Series | | FH-5000 Series |
|---|---|---|
| Type | | High-speed, Large-capacity Controller(4 cores) |
| Model | | FH-5052/FH-5051/FH-5050 |
| External Features | Dimensions | 190 mm x 115 mm x 182.5 mm<br>Note Height: Including the rubber at the base. |
| | Weight | Approx.3.4kg |
| | Degree of protection | IEC60529 IP20 |
| | Case material | Cover: zinc-plated steel plate, Side plate: aluminum (A6063) |

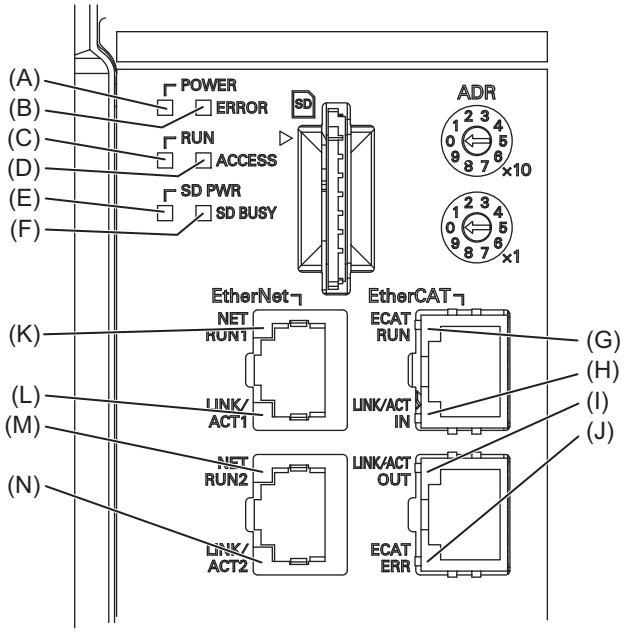
*1. Existing the third class grounding

## 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 | Connect an Ethernet device.<br>Upper port :<br>Ethernet port<br>Lower port :<br>Ethernet port, EtherNet/IP port, and PROFINET port are sharing use.<br>  <br>Connect the camera cable (Ethernet cable FHV-VN□BX: sold separately) to the upper port. |
| (C) | USB connector | Connect a USB device.<br>Do not plug or unplug it during measurement. Otherwise measurement time may be affected or data may be destroyed.<br>Left ports: USB2.0<br>Right ports: USB3.0<br>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.<br>Also, when used in combination with a USB3.0 device, you can expect higher transfer speed than USB2.0.<br>  |
| (D) | RS-232C connector | Connect an external device such as a touch panel monitor. |
| (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. |

| | Connector name | Description |
|---|---|---|
| (H) | EtherCAT communication connector (IN) | Connect the opposed EtherCAT device. |
| (I) | EtherCAT communication connector (OUT) | Connect the opposed EtherCAT device. |
| (J) | Encoder connector | Not supported. |
| (K) | Camera connector | Not supported.<br>Do not connect cameras. |
| (L) | Power supply terminal connector | Connect a DC power supply. Wire the FH Sensor Controller independently on other devices.<br>Wire the ground line. Be sure to ground the FH Sensor Controller alone.<br>Use an attachment power terminal (male) for installation. For details, refer to *5-3 Sensor Controller Installation* on page 5-5. |



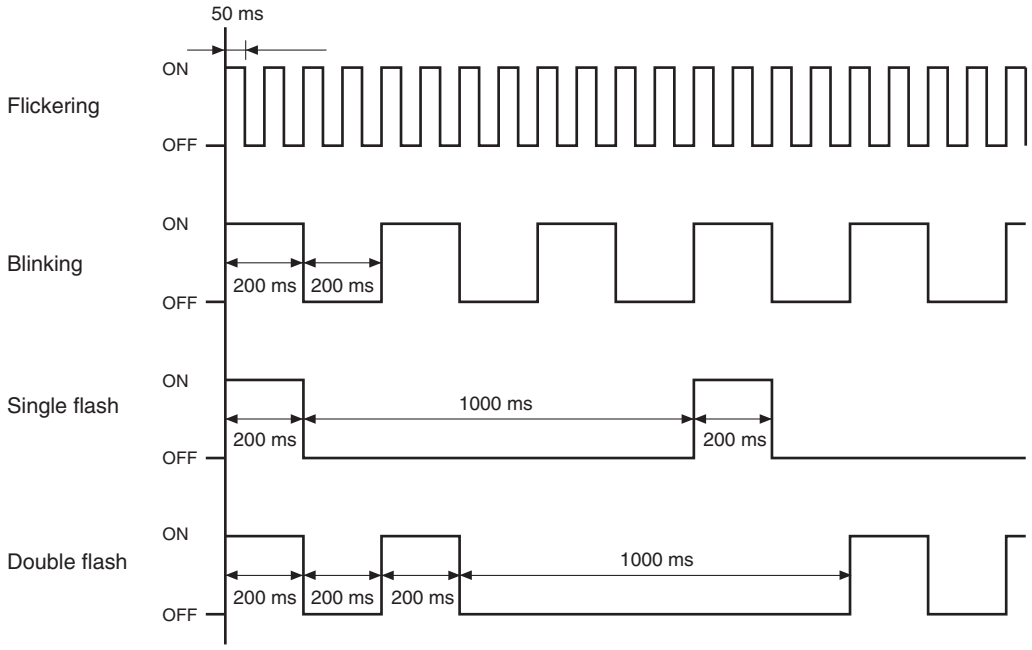

| | LED name | Description |
|---|---|---|
| (A) | POWER LED | Lit while power is ON. |
| (B) | ERROR LED | Lit when an error has occurred. |
| (C) | RUN LED | Lit while the layout turned on output setting is displayed. |
| (D) | ACCESS LED | Blinks while the internal nonvolatile memory is accessed.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

| | LED name | Description |
|---|---|---|
| (K) | Ethernet NET RUN1 LED | Lit while Ethernet communications are usable. |
| (L) | Ethernet LINK/ ACT1 LED | Lit when connected with an Ethernet device, and blinks while performing communications. |
| (M) | Ethernet NET RUN2 LED | Lit while Ethernet communications are usable. |
| (N) | Ethernet LINK/ ACT2 LED | Lit when connected with an Ethernet device, and blinks while performing communications. |

## EtherCAT status indicator LED

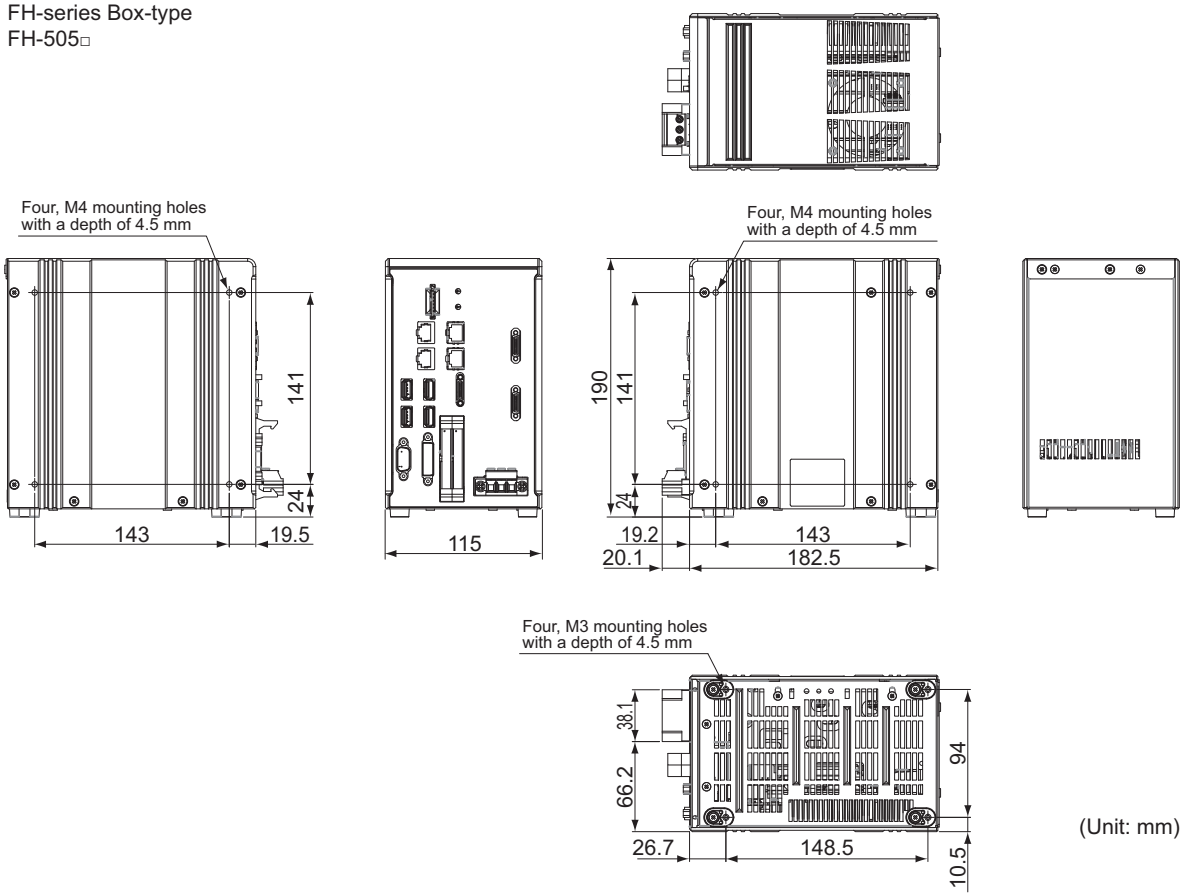
Detailed LED specifications are given below.

| 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

Sensor Controllers
FH-series Box-type
FH-505□




(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 Camera and Cables

## 3-2-1 3D Vision Sensor

### Specification

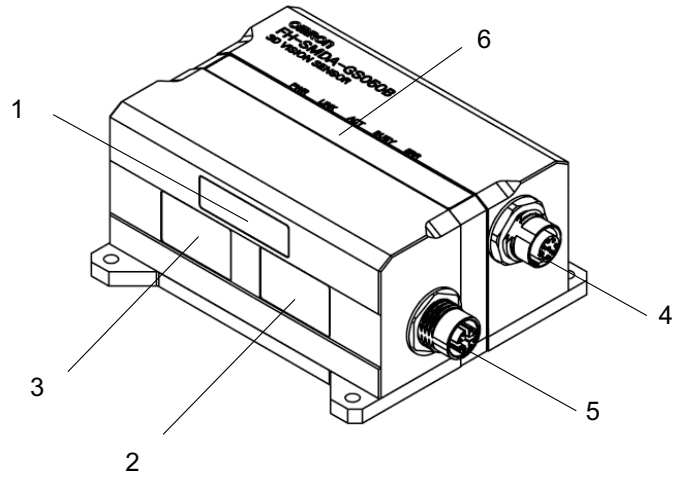
| Model | | FH-SMDA-GS050B |
|---|---|---|
| Image elements | | CMOS image elements |
| Color/Monochrome | | Monochrome |
| Effective pixels | | 1296(H) x 972(V) |
| Shutter function | | Electronic shutter, Shutter speeds can be set from 1 ms to 50 ms. |
| Measurement range (X,Y,Z) | | 400 x 300 x 200 mm |
| Installation distance | | WD: 400 mm |
| Lighting for 2D | Lighting color | blue |
| | LED class | Group 2 (IEC62471) |
| Lighting for 3D | Lighting color | blue |
| | LED class | Group 2 (IEC62471) |
| Indicator Lamps | | PWR: Green<br>LINK: Green<br>ACT: Yellow<br>WARM UP: Yellow<br>ERR: Red |
| External I/F | FH controller connection | GigE (1000BASE-T) x 1<br>100Base cannot be used.<br>PoE is not available. |
| | Power supply, Input / output | Power supply: DC24V<br>I/O: - |
| Warming up time | | 15 minutes or less |
| Supply Voltage | | 21.6 VDC to 26.4 VDC (24VDC ± 10%) |
| Current consumption | | 2A max. |
| Vibration tolerance | | Oscillation frequency: 10 to 150 Hz, Half amplitude: 0.35 mm, Sweep time: 8 minute/count, Sweep count: 10, Vibration direction: X/Y/Z |
| Shock resistance | | Impact force: 150 $m/s^2$, Test direction: up and down/front and behind/left and right |
| Ambient temperature range | | Operating: 0°C to +40°C<br>Storage: -25 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 |
| Grounding | | Class D grounding (100 Ω or less grounding resistance)*1 |
| Dimensions | | 53 mm x 110 mm x 77 mm (Excluding protrusions and connectors) |
| Degree of protection | | IEC60529 IP60 |
| Material | | Aluminium (A5052) |
| Weight | | Approx. 570g |
| Accessories | | • Instruction Sheet<br>• General Compliance Information and Instructions for EU |

*1. Existing the third class grounding

**Precautions for Correct Use**

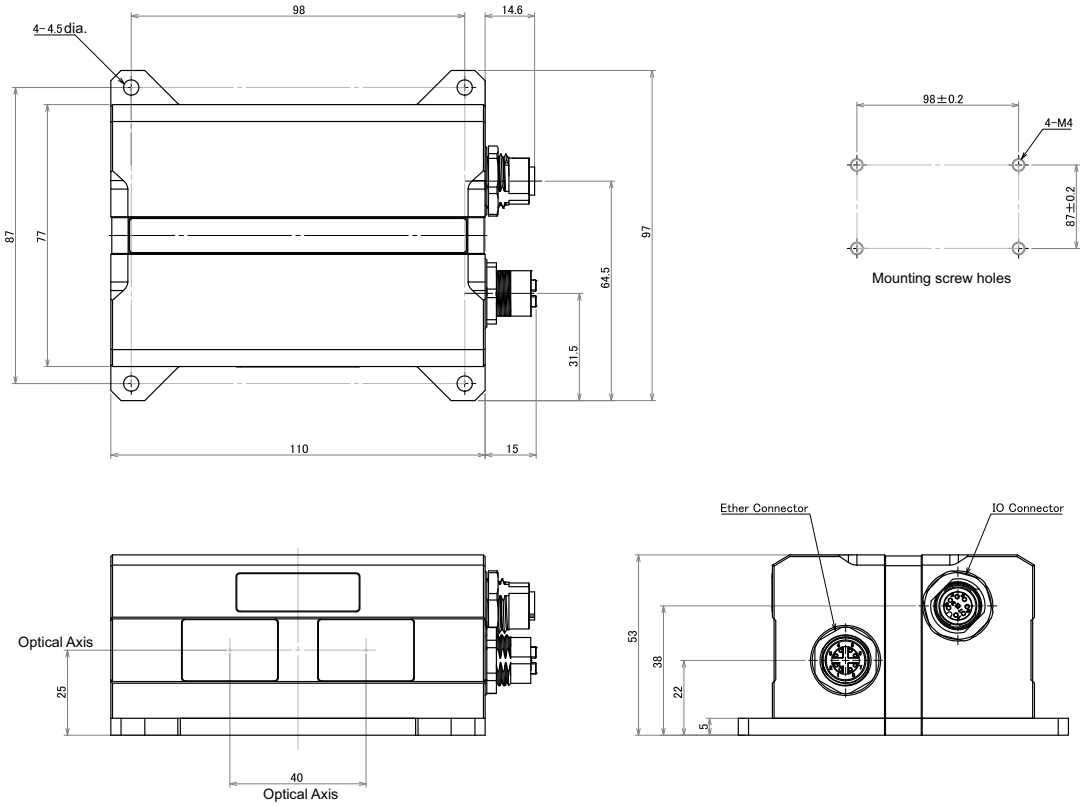
- This camera cannot be used as a measuring instrument, because it is not an absolute distance. Use in combination with robot calibration.
- If there are slight unevennesses, it cannot be recognized. There must consist of a surface of 20 x 20 mm or more
- The minimum recognition workpiece thickness is 5 mm or more.
- If the surface is strongly glossy and the reflection is strong, it cannot be recognized.

## Component Names and Functions




| | Name | | Description |
|---|---|---|---|
| 1 | 2D lighting unit | | Lighting for 2D measurement is arranged to illuminate the light. |
| 2 | 3D lighting unit | | Pattern lighting for 3D measurement is arranged to illuminate the light. |
| 3 | Imaging unit | | Captures images. |
| 4 | Connector for camera I/O cable | | Use this connector when connecting the camera with a power supply using a camera I/O cable.<br>Dedicated camera I/O cable: FH-VSDX-BX / FH-VSDX-LBX) |
| 5 | Connector for camera cable (Ethernet cable) | | Use this connector when connecting the camera with a FH sensor controller using an camera cable (Ethernet cable).<br>Dedicated camera cable (Ethernet cable): FHV-VNBX2 / FHV-VNLBX2 / FHV-VNBX / FHV-VNLBX) |
| 6 | Operation indicator | PWR (Green) | Lights while power is supplied. |
| | | LINK (Green) | Lights when connected with Ethernet equipment. |
| | | ACT (Yellow) | Blinks while communicating with an Ethernet device. |
| | | WARM UP (Yellow) | Lights from startup to completion of warming up. Turns off after warming up. |
| | | ERR (Red) | Lights when an error occurs.<br>For the error (system error), refer to the **Camera Image Input AOS** in the *Vision System FH series Processing Item Function Reference Manual for 3D Robot Vision (Cat. No. Z445)*. |

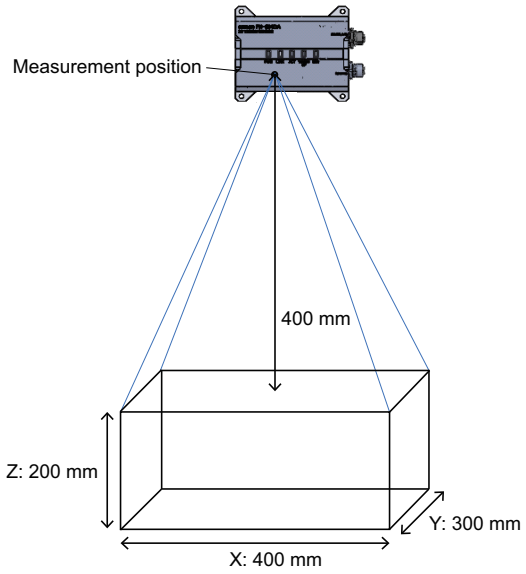
## Dimensions




(Unit: mm)

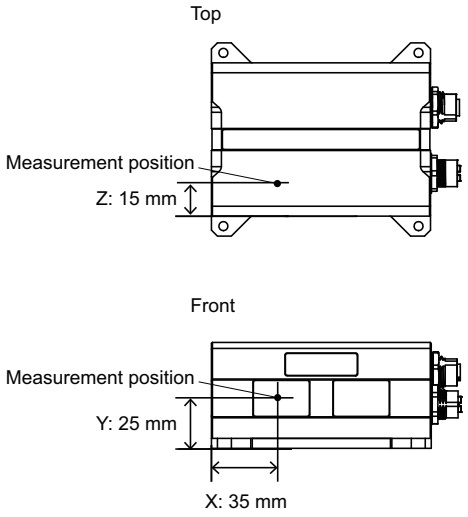
## Measurement Range and Field of View

●Measurement range




| | |
|---|---|
| Measurement range (X,Y,Z) | 400x300x200 mm |
| WD | 400 mm |

●Measurement position



## 3-2-2 Camera Cable

### Specification

- Camera cable (Ethernet, straight)

| Item | | FHV-VNBX2 5M | FHV-VNBX2 10M |
|---|---|---|---|
| Cable length | | 5 m | 10 m |
| Cable type | | Bending resistance cable | |
| Connector type | | Straight connector | |
| Outer diameter | | 6.6 + 0.7 mm dia. | |
| Min. bending radius | | 40 mm | |
| Usage environment | Ambient temperature range | Operating: -10 to +70°C, Storage: -25 to +85°C (with no icing or condensation) | |
| | Ambient humidity range | Operating & Storage: 0 to 93% (With no condensation) | |
| | Ambient atmosphere | No corrosive gases | |
| | Vibration tolerance | Oscillation frequency: 10 to 150Hz, Half amplitude: 0.35 mm, Vibration direction: X/Y/Z, Sweep time: 8 minutes/count, Sweep count: 10 times | |
| | Shock resistance | Impact force: 150 m/s$^2$, Test direction: 6 directions, three time each (up/down, front/behind, left/right) | |
| Material | | Mold part: PVC, Sheath part: PVC | |
| Weight | | Approx. 390 g | Approx. 730 g |

| Item | | FHV-VNBX 3M | FHV-VNBX 5M | FHV-VNBX 10M |
|---|---|---|---|---|
| Cable length | | 3 m | 5 m | 10 m |
| Cable type | | Bending resistance cable | | |
| Connector type | | Straight connector | | |
| Outer diameter | | 6.3 + 0.6 mm dia. | | |
| Min. bending radius | | 38 mm | | |
| Usage environment | Ambient temperature range | Operating: -30 to +80°C, Storage: -30 to +100°C (with no icing or condensation) | | |
| | Ambient humidity range | Operating & Storage: 0 to 93% (With no condensation) | | |
| | Ambient atmosphere | No corrosive gases | | |
| | Vibration tolerance | Oscillation frequency: 10 to 150Hz, Half amplitude: 0.35 mm, Vibration direction: X/Y/Z, Sweep time: 8 minutes/count, Sweep count: 10 times | | |
| | Shock resistance | Impact force: 150 m/s$^2$, Test direction: 6 directions, three time each (up/down, front/behind, left/right) | | |
| Material | | Mold part: Nylon, Thermoplastic polyurethane, Sheath part: Low friction PVC | | |
| Weight | | Approx. 220 g | Approx. 330 g | Approx. 590 g |

- Camera cable (Ethernet, right angle)

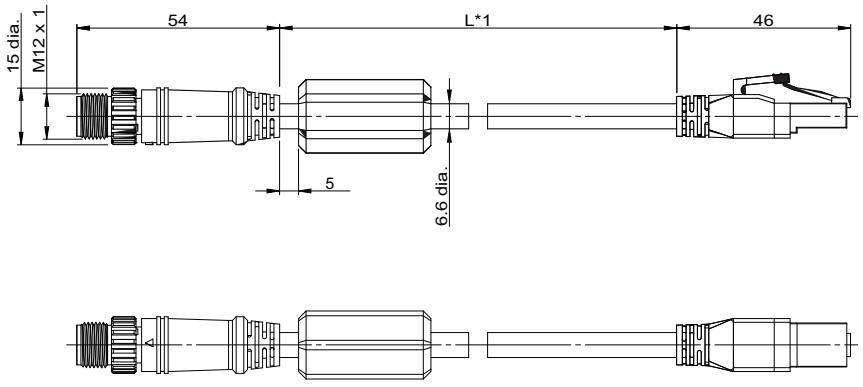
| Item | | FHV-VNLBX2 5M | FHV-VNLBX2 10M |
|---|---|---|---|
| Cable length | | 5 m | 10 m |
| Cable type | | Bending resistance cable | |
| Connector type | | Right angle connector | |
| Outer diameter | | 6.6 + 0.7 mm dia. | |
| Min. bending radius | | 40 mm | |
| Usage environment | Ambient temperature range | Operating: -10 to +70°C, Storage: -25 to +85°C (with no icing or condensation) | |
| | Ambient humidity range | Operating & Storage: 0 to 93% (With no condensation) | |
| | Ambient atmosphere | No corrosive gases | |
| | Vibration tolerance | Oscillation frequency: 10 to 150Hz, Half amplitude: 0.35 mm, Vibration direction: X/Y/Z, Sweep time: 8 minutes/count, Sweep count: 10 times | |
| | Shock resistance | Impact force: 150 $m/s^2$, Test direction: 6 directions, three time each (up/down, front/behind, left/right) | |
| Material | | Mold part: PVC, Sheath part: PVC | |
| Weight | | Approx. 390 g | Approx. 730 g |

| Item | | FHV-VNLBX 3M | FHV-VNLBX 5M | FHV-VNLBX 10M |
|---|---|---|---|---|
| Cable length | | 3 m | 5 m | 10 m |
| Cable type | | Bending resistance cable | | |
| Connector type | | Right angle connector | | |
| Outer diameter | | 6.3 + 0.6 mm dia. | | |
| Min. bending radius | | 38 mm | | |
| Usage environment | Ambient temperature range | Operating: -30 to +80°C, Storage: -30 to +100°C (with no icing or condensation) | | |
| | Ambient humidity range | Operating & Storage: 0 to 93% (With no condensation) | | |
| | Ambient atmosphere | No corrosive gases | | |
| | Vibration tolerance | Oscillation frequency: 10 to 150Hz, Half amplitude: 0.35 mm, Vibration direction: X/Y/Z, Sweep time: 8 minutes/count, Sweep count: 10 times | | |
| | Shock resistance | Impact force: 150 $m/s^2$, Test direction: 6 directions, three time each (up/down, front/behind, left/right) | | |
| Material | | Mold part: Nylon, Thermoplastic polyurethane, Sheath part: Low friction PVC | | |
| Weight | | Approx. 220 g | Approx. 330 g | Approx. 590 g |

## Dimensions

• Ethernet cable (straight)

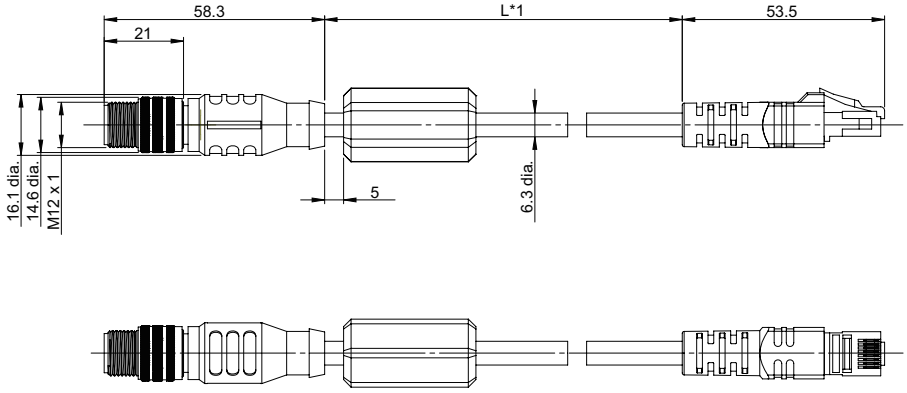
FHV-VNBX2




(Unit: mm)

*1. Cable lengths (L) are 5 m/10 m.

FHV-VNBX

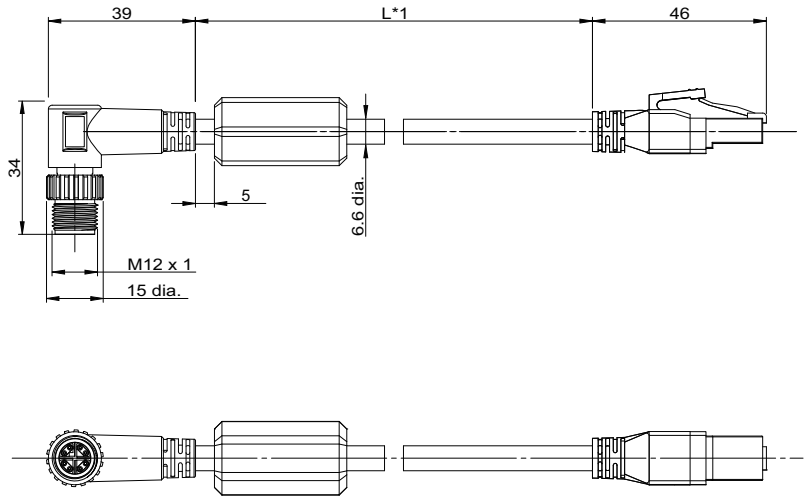



(Unit: mm)

*1. Cable lengths (L) are 3 m/5 m/10 m.

• Ethernet cable (right angle)

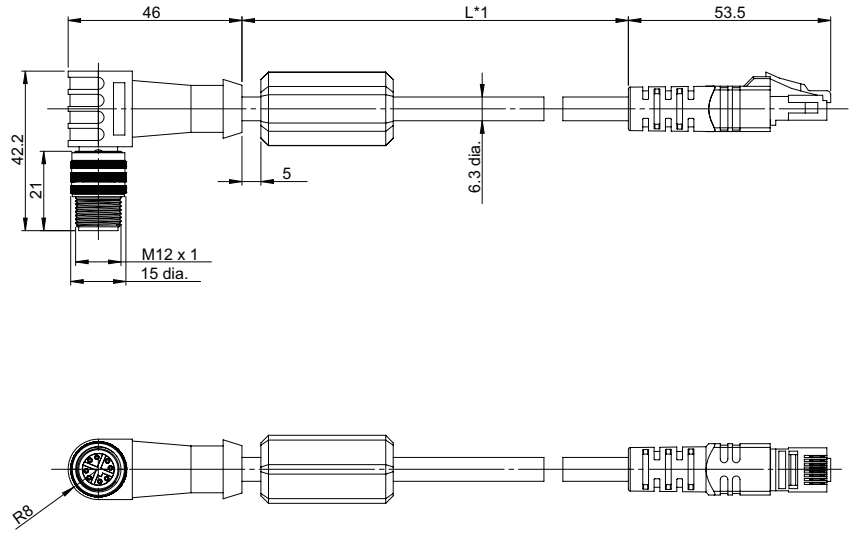
FHV-VNLBX2




(Unit: mm)

*1. Cable lengths (L) are 5 m/10 m.

FHV-VNLBX




(Unit: mm)

*1. Cable lengths (L) are 3 m/5 m/10 m.

**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 Camera I/O Cable

### Specification

- Camera I/O cable (straight)

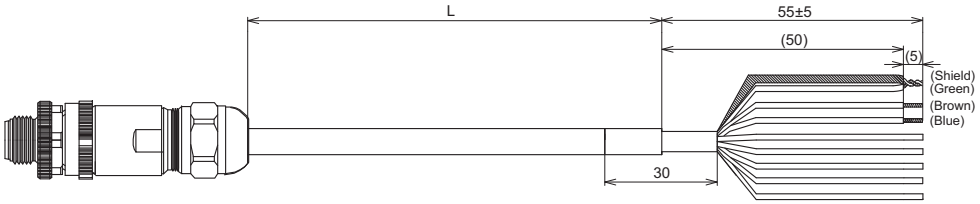
| Item | | FH-VSDX-BX 3M | FH-VSDX-BX 5M | FH-VSDX-BX 10M |
|---|---|---|---|---|
| Cable length | | 3 m | 5 m | 10 m |
| Cable type | | Bending resistance cable | | |
| Connector type | | Straight connector | | |
| Size | | AWG26 | | |
| Outer diameter | | 5.8 mm dia. | | |
| Min. bending radius | | 35 mm | | |
| Usage environment | Ambient temperature range | Operating: 0°C to +80°C, Storage: -20 to +80°C (with no icing or condensation) | | |
| | Ambient humidity range | Operating & Storage: 0 to 93% (With no condensation) | | |
| | Ambient atmosphere | No corrosive gases | | |
| | Vibration tolerance | Oscillation frequency: 10 to 150Hz, Half amplitude: 0.35 mm, Vibration direction: X/Y/Z, Sweep time: 8 minutes/count, Sweep count: 10 times | | |
| | Shock resistance | Impact force: 150 $m/s^2$, Test direction: 6 directions, three time each (up/down, front/behind, left/right) | | |
| Material | | Shell: Zinc alloy, brass, Sheath part: oil-resistant and heat-resistant polyvinyl chloride | | |
| Weight | | Approx. 220 g | Approx. 320 g | Approx. 570 g |

- Camera I/O cable (right angle)

| Item | | FH-VSDX-LBX 3M | FH-VSDX-LBX 5M | FH-VSDX-LBX 10M |
|---|---|---|---|---|
| Cable length | | 3 m | 5 m | 10 m |
| Cable type | | Bending resistance cable | | |
| Connector type | | Right angle connector | | |
| Size | | AWG26 | | |
| Outer diameter | | 5.8 mm dia. | | |
| Min. bending radius | | 35 mm | | |
| Usage environment | Ambient temperature range | Operating: 0°C to +80°C, Storage: -20 to +80°C (with no icing or condensation) | | |
| | Ambient humidity range | Operating & Storage: 0 to 93% (With no condensation) | | |
| | Ambient atmosphere | No corrosive gases | | |
| | Vibration tolerance | Oscillation frequency: 10 to 150Hz, Half amplitude: 0.35 mm, Vibration direction: X/Y/Z, Sweep time: 8 minutes/count, Sweep count: 10 times | | |
| | Shock resistance | Impact force: 150 $m/s^2$, Test direction: 6 directions, three time each (up/down, front/behind, left/right) | | |
| Material | | Shell: Zinc alloy, brass, Sheath part: oil-resistant and heat-resistant polyvinyl chloride | | |
| Weight | | Approx. 230 g | Approx. 330 g | Approx. 580 g |

## Dimensions

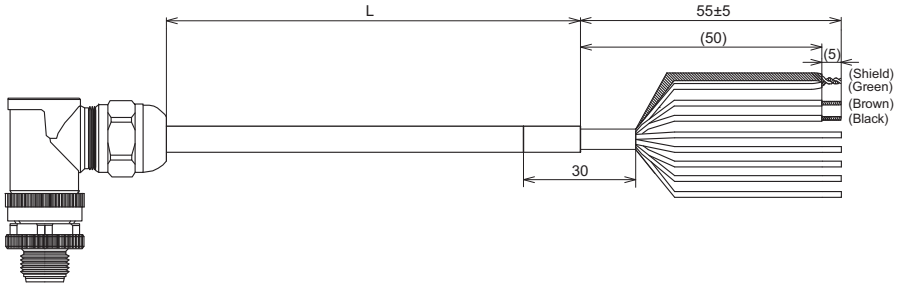
- Camera I/O cable (straight)




(Unit: mm)

*1. Cable lengths (L) are 3 m/5 m/10 m.

- Camera I/O cable (right angle)




(Unit: mm)

*1. Cable lengths (L) are 3 m/5 m/10 m.

**Additional Information**

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

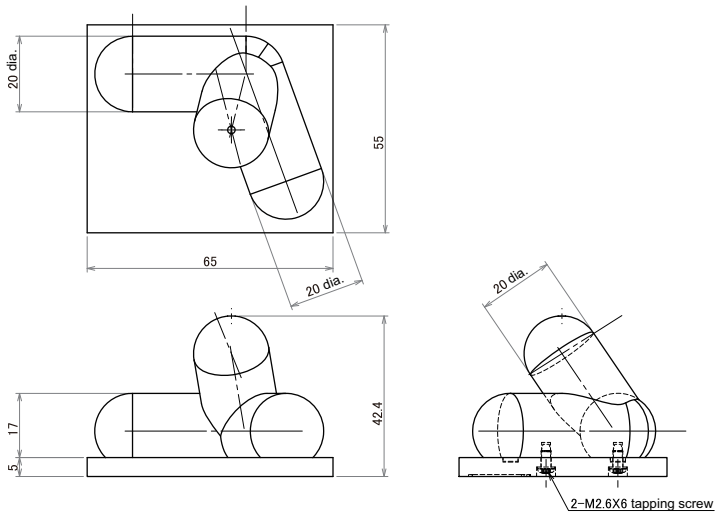
# 3-3 Calibration Target

## Specification

| Model | FH-XCAL-R | FH-XCAL-S |
|---|---|---|
| Name | HandEye calibration target | Camera calibration target |
| Ambient temperature range | -25 to +65°C (with no icing or condensation) | |
| Ambient humidity range | 35 to 85% (with no condensation) | |
| Ambient atmosphere | No corrosive gases | |
| Vibration tolerance | Oscillation frequency: 10 to 150 Hz, Half amplitude: 0.35 mm, Sweep time: 8 minute/count, Sweep count: 10, Vibration direction: X/Y/Z | |
| Shock resistance | Impact force: 150 m/s$^2$, Test direction: up and down/front and behind/left and right | |
| Dimensions | 65 mm × 55 mm × 42.4 mm | 350 mm × 470 mm × 25 mm |
| Material | ABS | Aluminium |
| Weight | Approx. 50 g | Approx. 1,400 g |
| Accessories | - | - |

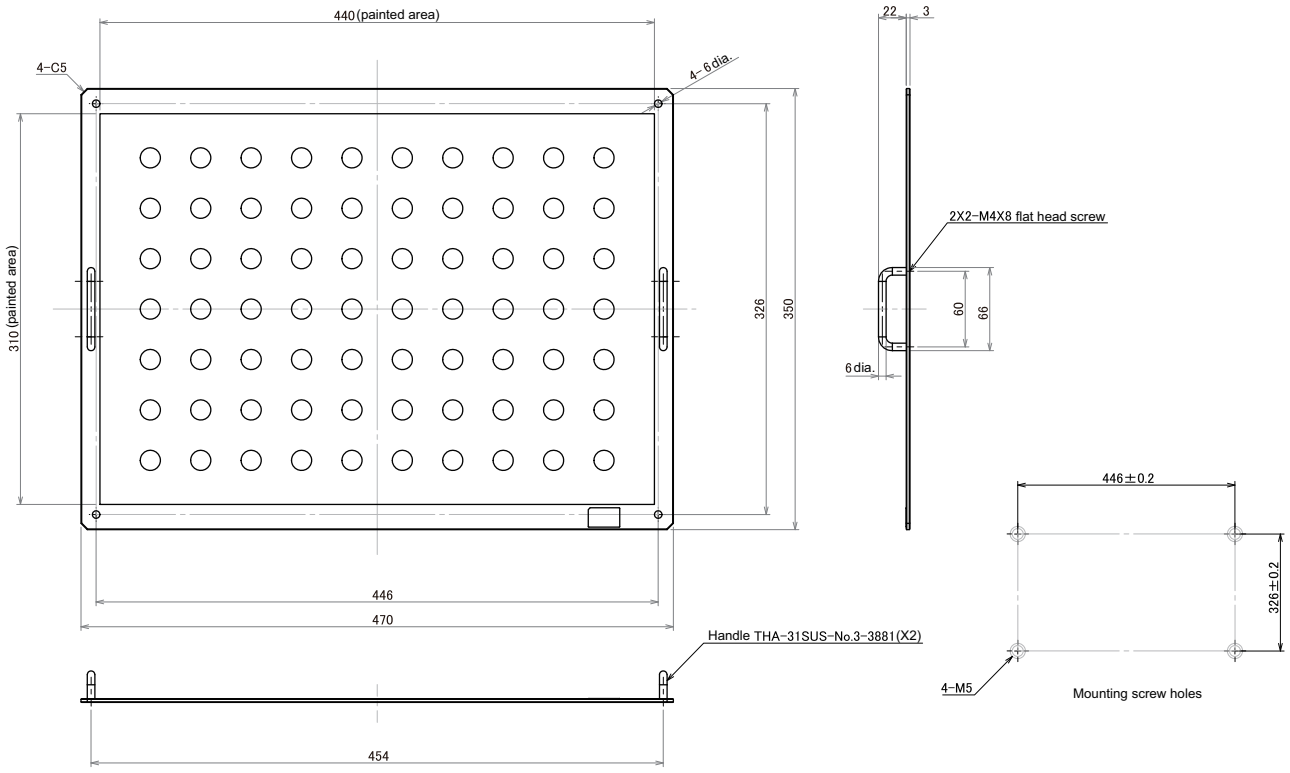
## Dimensions

- HandEye calibration target (FH-XCAL-R)




(Unit: mm)

- Camera calibration target (FH-XCAL-S)




(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.

# 3-4 Touch Panel Monitor and Cable



Touch Panel Monitor of FH-MT12 is connectable with FH 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.

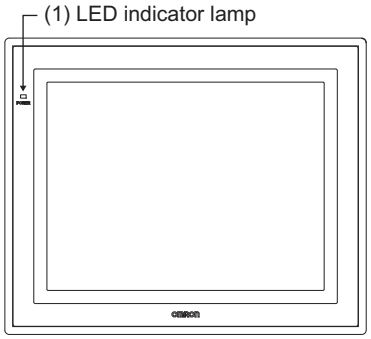
## Touch Panel Monitor

### ● Specification

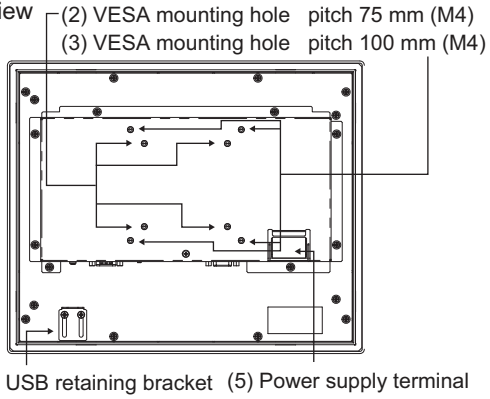
| Model | | FH-MT12 |
|---|---|---|
| Major Function | Display area | 12.1 inch |
| | Resolution | 1024 (V) x 768 (H) |
| | Number of color | 16,200,000 colors (8 bit/color) |
| | Brightness | 500 cd/m$^2$ (Typ) |
| | Contrast Ratio | 700 : 1 (Typ) |
| | Viewing angle | Horizontal (left and right): -80° to 80° (typ)<br>Vertical (top and bottom): -70° to 70° (typ) |
| | Backlight Unit | LED, edge-light |
| | Backlight lifetime | About 100,000 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

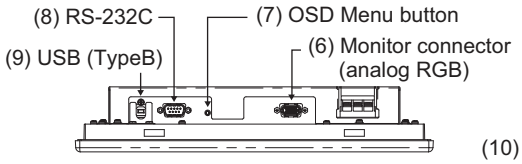
●Front view

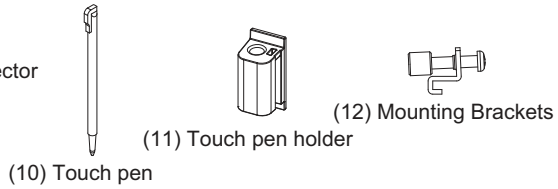



●Rear view




●Connection terminal




| | Name | Description |
|---|---|---|
| (1) | LED indicator lamp | Lit up green when power is ON.<br>Lit up orange when video signal is no input.<br>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.<br>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.

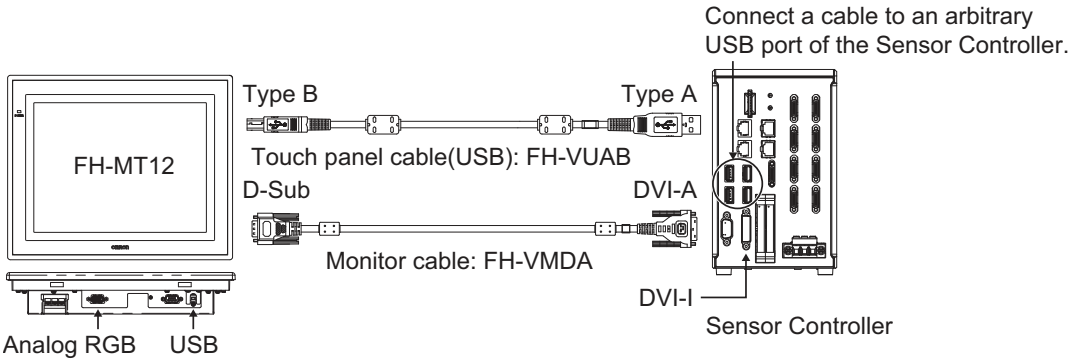
- When Touch Panel Monitor is taken apart 5 m or more from FH Sensor Controller.
- When the USB port of the FH Sensor Controller is used for other I/O connection and cannot be used for Touch Panel communications.

### ● Specification

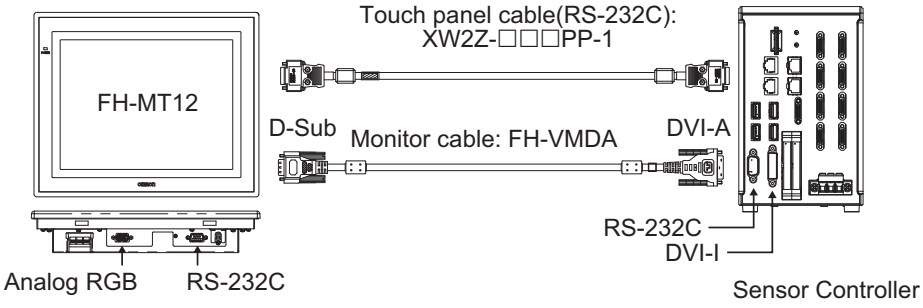
| Model | FH-VMDA (2m) | FH-VUAB (2m) | XW2Z-200PP-1 (2m) |
|---|---|---|---|
| Cable type | DVI-Analog Conversion Cable | USB Cable | RS-232C Cable |
| Vibration (resistance) | 10 to 150 Hz, Single amplitude 0.1 mm, 10 times for 8 minutes for each three direction | | |
| Ambient temperature range | 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)

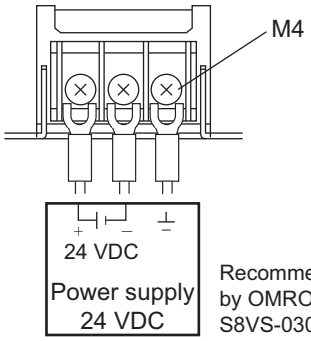



A video signal cable and an operation signal cable are required to connect the Touch Panel Monitor.

| 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.

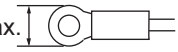



Recommended model by OMRON: S8VS-03024

| 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.<br>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 |

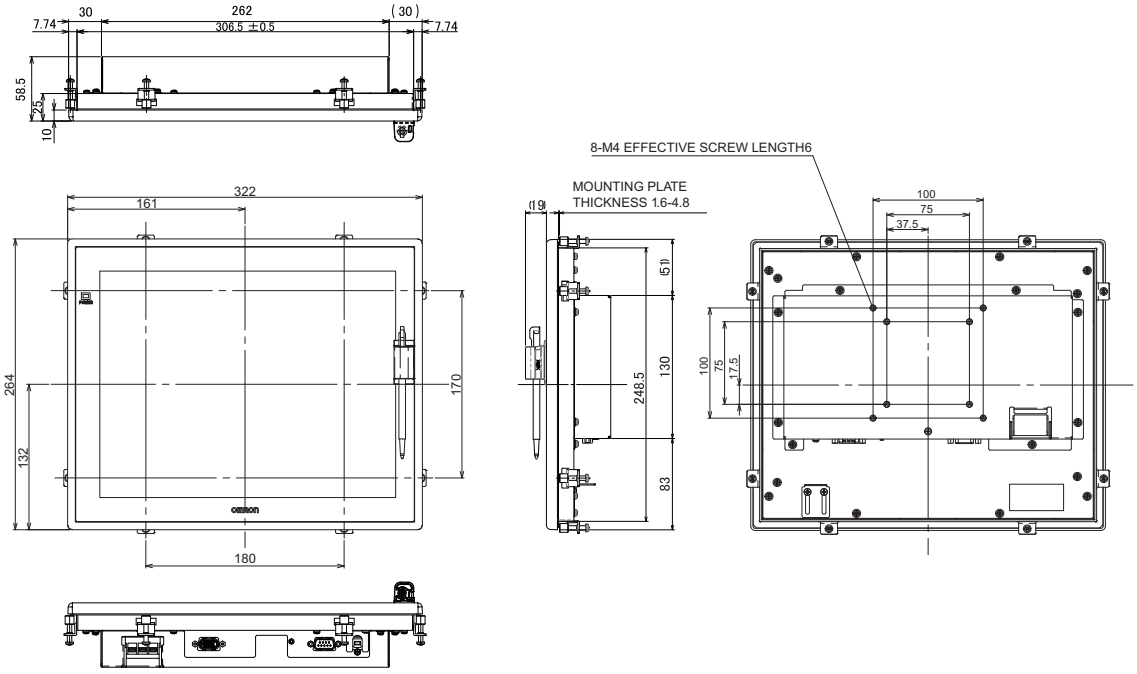
- Wire the power supply wires as short as possible. (Max.2 m)
- If UL's certification is required, use a UL class II power supply.
- Use the cables and crimping terminals with the specified dimensions.
  Do not directly connect an electric wire that is simply twisted to the terminal block.

- Recommended wire size: AWG 13 to 22 (0.326 to 2.62 $mm^2$)
- Terminal screw: M4 (Tightening torque: 1.0 N•m)
- Crimping Terminal

8.0 mm max. 8.0 mm max. 

## Dimensions

### ● Touch Panel Monitor

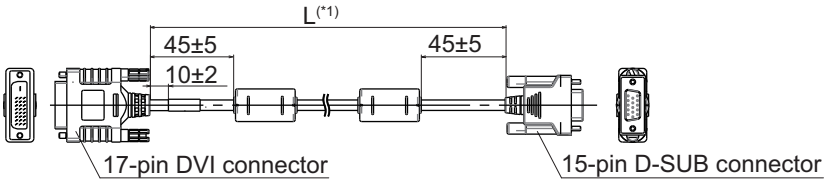



(Unit: mm)

Note:

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

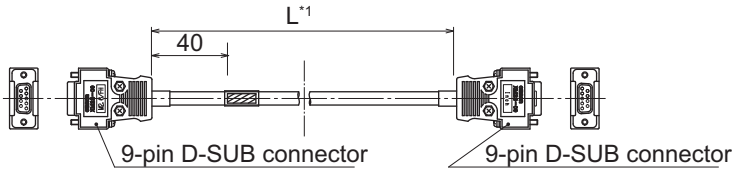
### ● DVI-Analog Conversion Cable for Touch Panel Monitor: FH-VMDA




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

(Unit: mm)

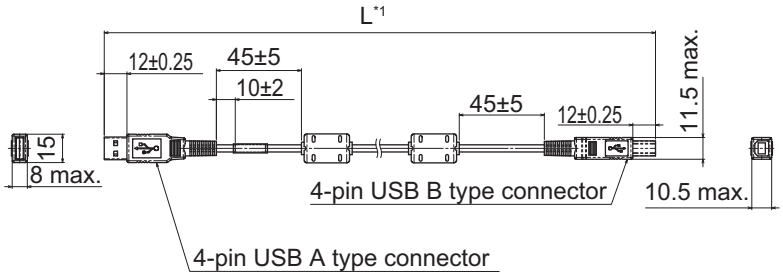
### ● RS-232C Cable for Touch Panel Monitor: XW2Z-□□□PP-1



*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)

# 3-5 LCD and Cable

## Specification

### ● LCD Monitor

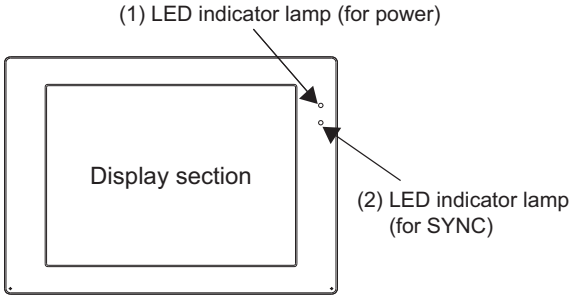
| Model | FZ-M08 |
|---|---|
| Size | 8.4 inches |
| Type | Liquid crystal color TFT |
| Resolution | 1,024 x 768 dots |
| Input signal | Analog RGB video input 1 channel |
| Supply Voltage | 21.6 to 26.4 VDC |
| Current consumption | Approx. 0.7 A max. |
| Ambient temperature range | Operating: 0 to +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

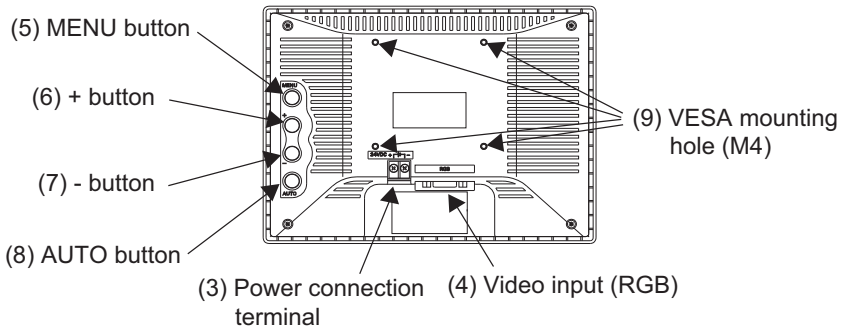
| Model | FH-VMDA |
|---|---|
| Vibration (resistance) | 10 to 150 Hz, Single amplitude 0.1 mm, 10 times for 8 minutes for each three direction |
| Ambient temperature range | Operating Condition: 0 to +50°C, Storage Condition: -10 to +60°C (with no icing or condensation) |
| Ambient humidity range | 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<br>FH-VMDA 5M: Approx. 380g<br>FH-VMDA 10M: Approx. 650g |

## Component Names and Functions

### ● Front View



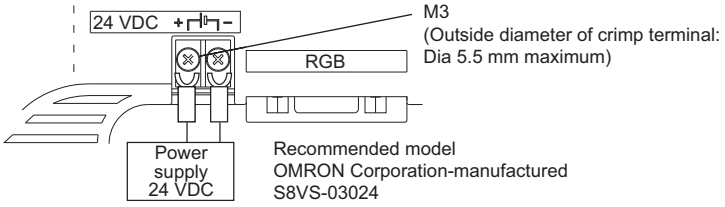

### ● Rear




| | 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.



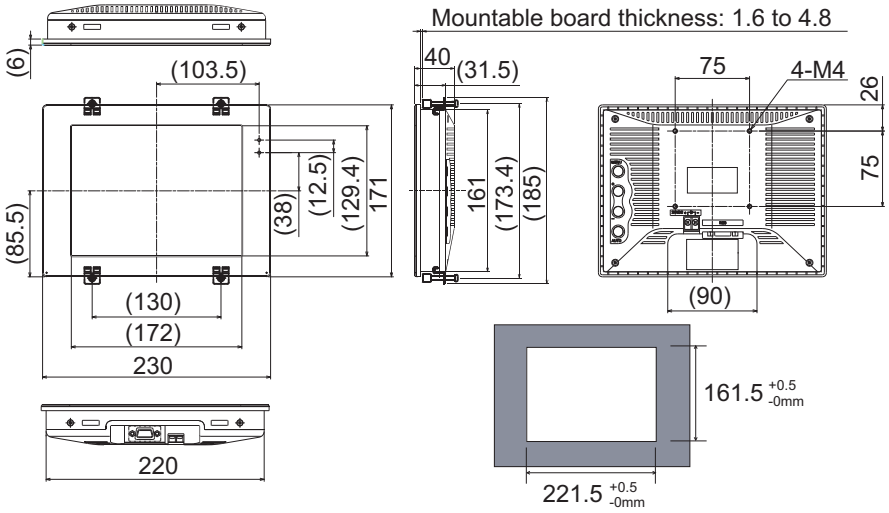

- Keep the power supply wires as short as possible (maximum 10 m).

• 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.

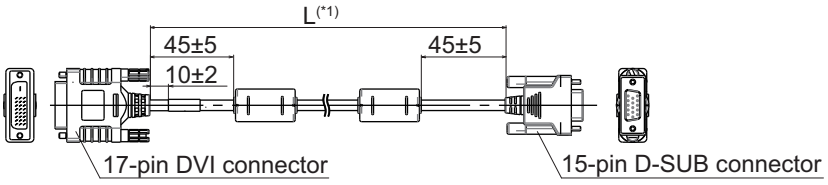
## Dimensions

### ● LCD Monitor: FZ-M08




Panel cut drawing (Unit: mm)

### ● Monitor Cable: FH-VMDA




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

(Unit: mm)

# 4

# Handling and Installation Environment



4-1 FH-505□ ..... 4-2

# 4-1 FH-505□

## ⚠ 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:

- Surrounding temperature of 0 to +45°C (-20 to +65°C in storage)
  Do not let the ambient temperature exceed 45°C (117°F).
  Provide a forced-air fan cooling or air conditioning if the ambient temperature is near 45°C (117°F) so that the ambient temperature never exceeds 45°C (117° F).
- Relative humidity of between 35 to 85%
- 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.

**Handling of Sensor Controller**

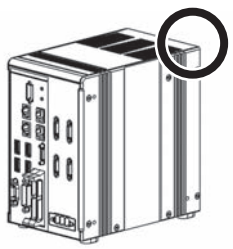
- When touching a terminal part or a signal wire in a connector, take anti-static measures using a wrist strap or another device to prevent damage from static electricity.
- Be sure to execute Device Information Storage Tool described in the *Vision System FH/FHV Series User's Manual (Cat. No. Z365)* 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.

**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.

# 5

# Setup and Wiring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**5-2 Fail-Safe Measures ..... 5-4**
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# 5-1 When turning ON and OFF

## 5-1-1 FH-505□

### ⚠ 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 supply correct? (24 VDC)
  - 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.

# 5-2 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, a failure of a 3D Vision Sensor, 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 FH-505□

**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.
- 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, the circuits may cause short-circuit with FG if the base is not used to mount the camera and result in malfunction or damage.
- 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 FH 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.

**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.

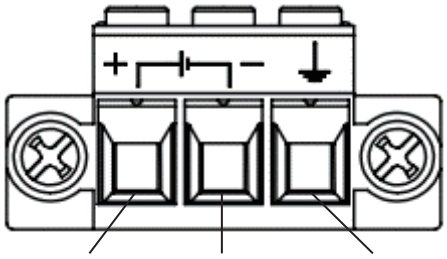
### Connection of Terminal Block

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).

**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

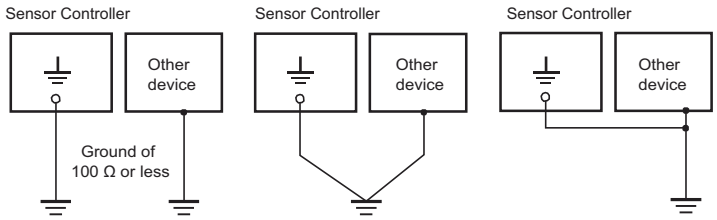
**2** Connect the wire to the terminal block connector (male) depending on the indicated terminal block connector.




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.<br>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 $mm^2$ 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.

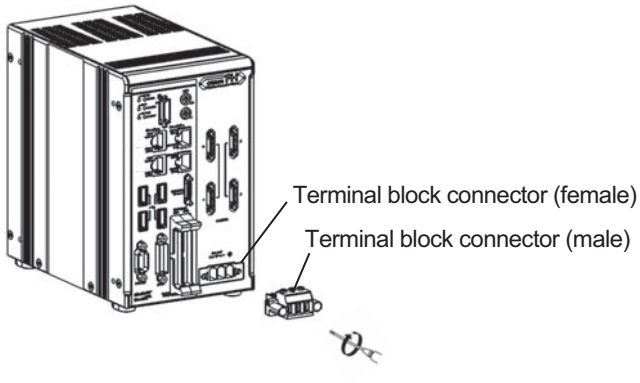



(a) Independent grounds: Best | (b) Common ground: Acceptable | (c) Common ground: Incorrect

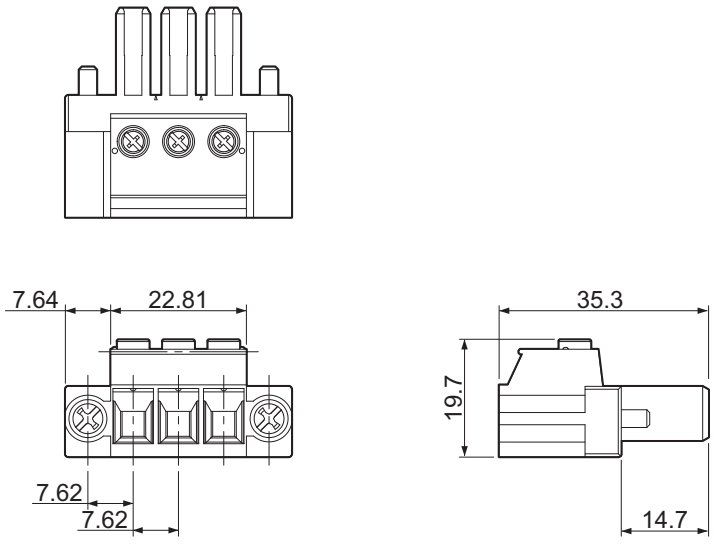
Grounding Methods

***3*** Insert the terminal block connector (male) to the terminal block connector (female) of Sensor Controller.

***4*** Tightens 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 Sensor Controller

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.

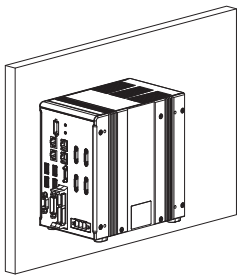
When you connect your camera to the lighting via Light Controller, the current consumption is same as when the Intelligent Compact Digital camera is connected.

| Item | Connected camera, Lighting controller, and Lighting type | FH-505□ |
|---|---|---|
| Recommended Power Source<br>S8VK-G<br>S8VS | • When connecting intelligent compact digital cameras:<br>• When connecting the following lightings or light controllers without external power supplies:<br>  • FLV-TCC1<br>  • FLV-TCC4<br>  • FLV-TCC3HB<br>  • FLV-TCC1EP<br>  • FL-TCC1<br>• When connecting the following lighting or light controllers:<br>  • FL-TCC1PS<br>  • FL-MD□MC | S8VK-G24024<br>S8VS-18024 |
| | Other than above case | S8VK-G12024<br>S8VS-12024 |

## Mounting of Sensor Controller

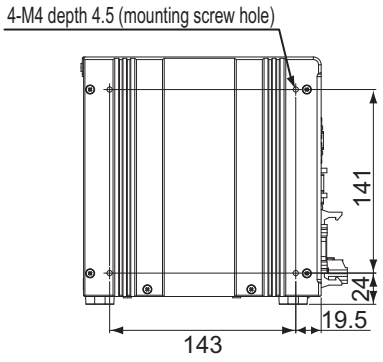
- Make sure to tighten all screws in mounting.
- For good ventilation, provide a clearance of 50 [mm] or more above the Sensor Controller away from other devices in the normal floor mounting. For the right and left sides, provide a clearance of 30 [mm] or more, and for the back side, 15 [mm] or more. 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

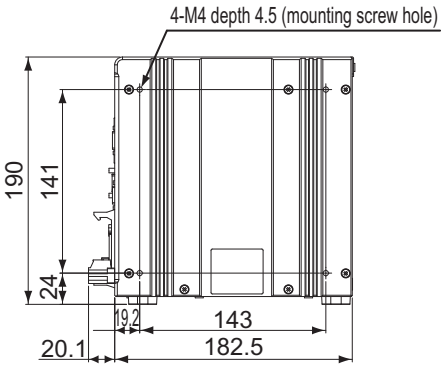


(Unit: mm)

• Left side

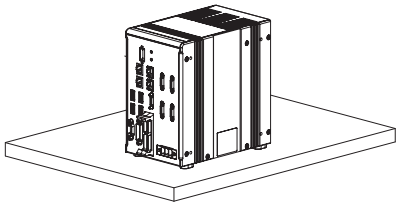



• Right side



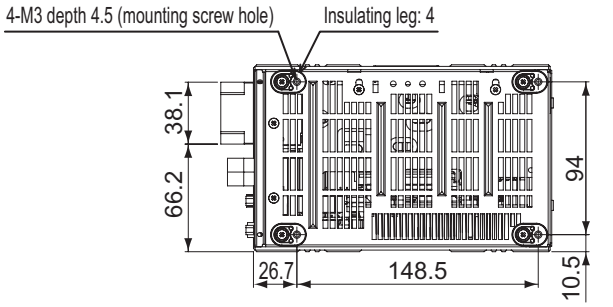

* Recommended tightening torque: 1.2 N•m to 1.3 N•m
* The tolerance is ±0.2 mm.

## ● Bottom Mounting



• Bottom

(Unit: mm)




* 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.

# 5-4 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.

## 5-4-1 FH-505□

### 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.
- DVI-I 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 FH-505□

**⚠ 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**

Danger of burns. Do not touch the case while the power is ON or just after power is turned OFF, since it remains extremely hot.

### 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.
- Do not ground the positive terminal of the 24 VDC power supply.

### Precautions for Correct Use

**Maintenance**

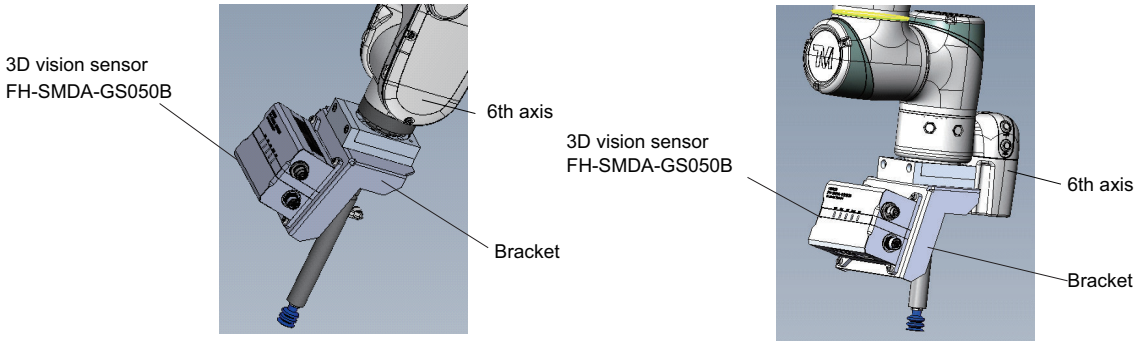
- Turn OFF the power and ensure the safety before maintenance.
- Clean the lens with a lens-cleaning cloth or air brush.
- Lightly wipe off dirt with a soft cloth.
- Dirt on the image element must be removed using an air brush.
- Do not use thinners or benzine.
- When installing / replacing the camera,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

## 5-5-2 Installation of 3D Vision Sensor

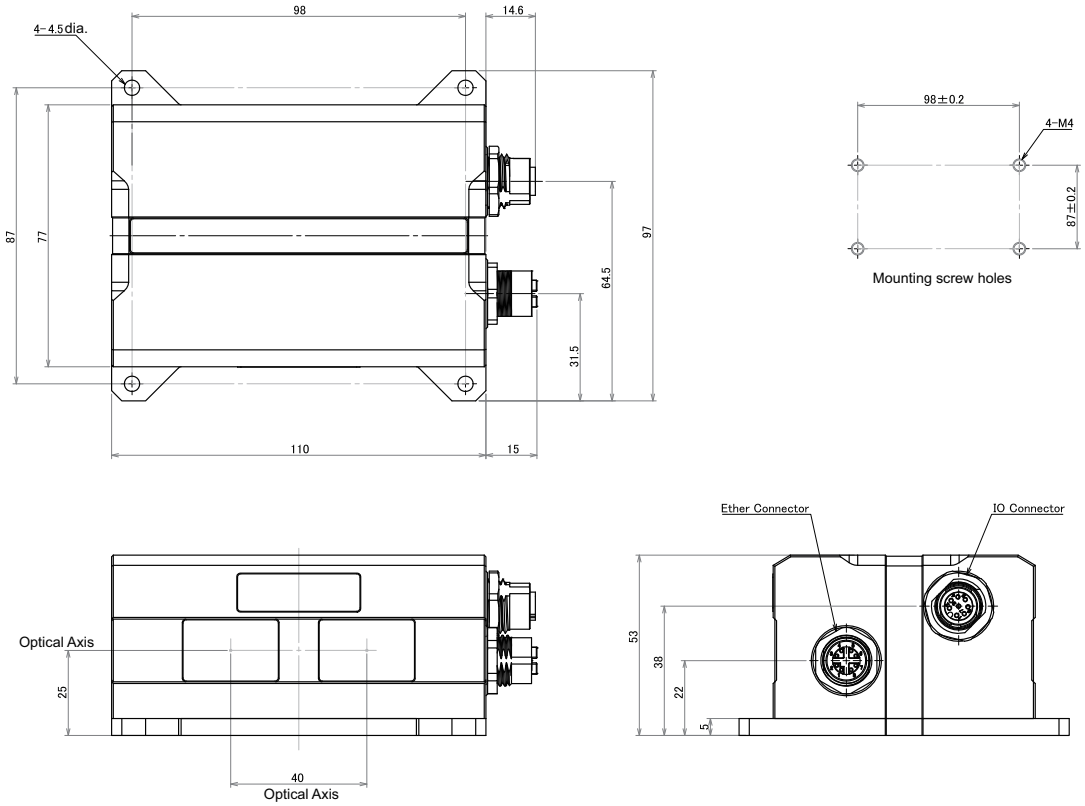
### Mounting

Attach the camera to the 6th axis of the 6-axis articulated robot using a jig.
Securely secure the camera in four places using M4 screws. (Tightening torque: 1.2 N•m)

- Example:

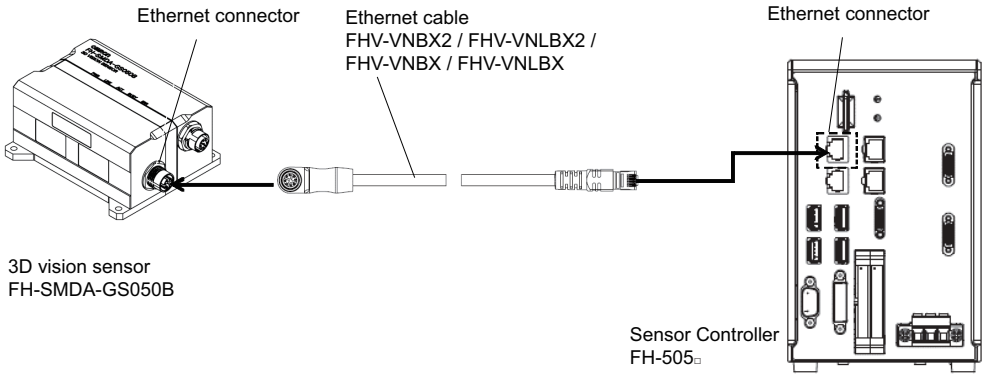



- Mounting dimensions(Unit: mm)



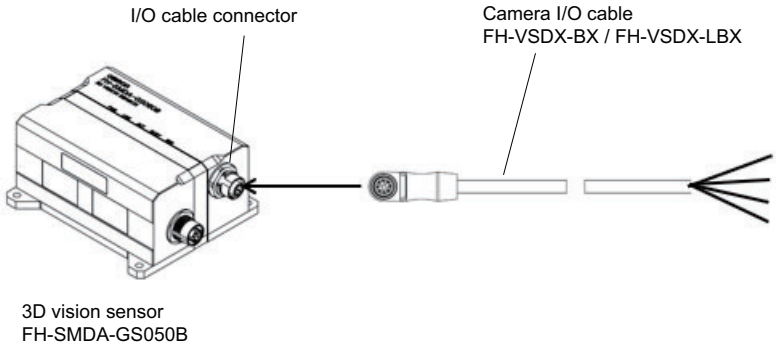
## Connecting

Connect the camera cable (Ethernet cable FHV-VNBX2 / FHV-VNLBX2 / FHV-VNBX / FHV-VNLBX: sold separately) to the Ethernet connector on the 3D vision sensor. Then connect it to the top of the two Ethernet connectors on the sensor controller.




## Wiring

Wire the signal line of the camera I/O cable (FH-VSDX-BX / FH-VSDX-LBX: sold separately) with a crimp terminal. Insulate unnecessary signal lines and avoid contact with other signal lines.




**Wire color of camera I/O cable**

| Signal name | Wire color |
|---|---|
| 24VDC (For camera power supply) | Brown |
| 0V (For camera power supply) | Blue |
| Unused*1 | Yellow |
| Unused*1 | Black |
| Unused*1 | Red |
| Unused*1 | Orange |
| NC | Gray |
| FG | Green |
| FG | Black (thick line) |

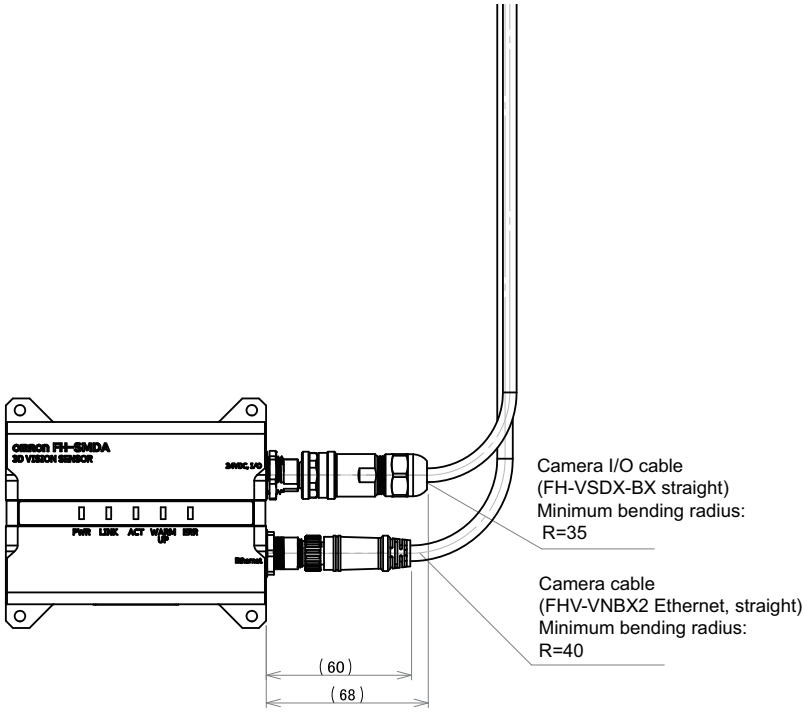
*1. Avoid contact with other power lines, ground lines, and signal lines.

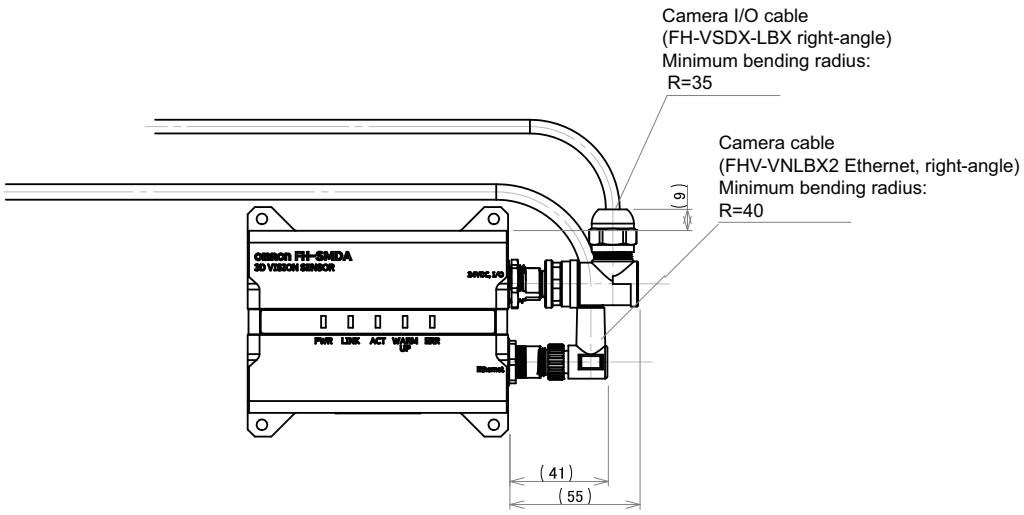
## Camera cable mounting

**Precautions for Safe Use**

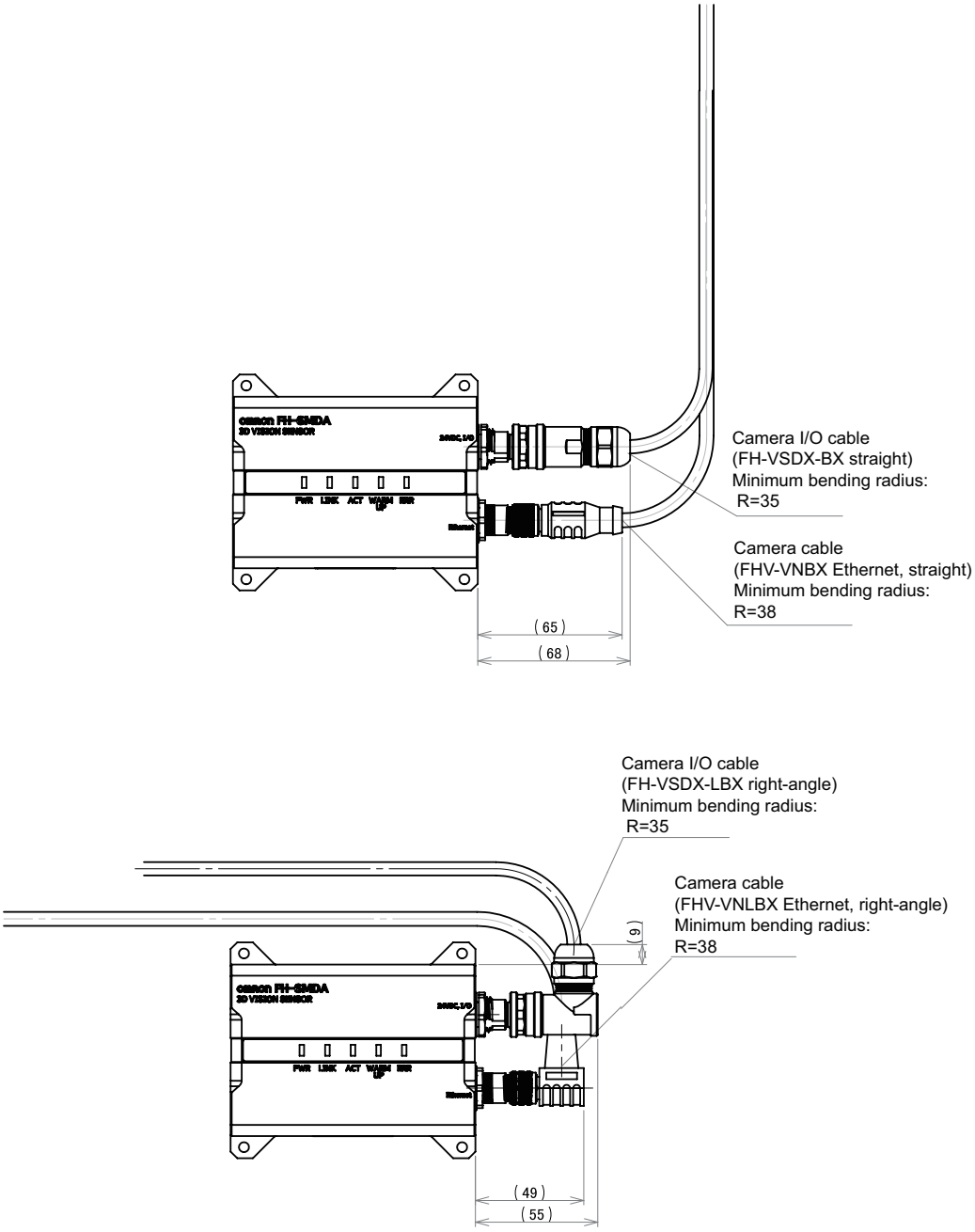
- To prevent the cables from being caught in the rotating robot, connect them with a sufficient clearance, taking into account the minimum bending radius.
- To prevent the connectors from interfering with the robot, adjust the rotation angle of the robot.

(Unit: mm)



(Unit: mm)


Camera I/O cable
(FH-VSDX-BX straight)
Minimum bending radius:
R=35
Camera cable
(FHV-VNBX Ethernet, straight)
Minimum bending radius:
R=38
( 65 )
( 68 )
Camera I/O cable
(FH-VSDX-LBX right-angle)
Minimum bending radius:
R=35
Camera cable
(FHV-VNLBX Ethernet, right-angle)
Minimum bending radius:
R=38
( 6 )
( 49 )
( 55 )

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

## 5-6-1 FH-505□

**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

Simulation Software is dedicated software.

## 5-7-1 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 FH-505□

**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.

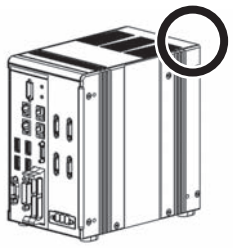
**Precautions for Correct Use**

**Ambient Temperature**

- Install and store the product in a location that meets the following conditions:
  - Surrounding temperature of 0 to +45°C (-20 to +65°C in storage)
  - Relative humidity of between 35 to 85%
- Do not let the ambient temperature exceed 45°C (117°F).
- Provide a forced-air fan cooling or air conditioning if the ambient temperature is near 45°C (117°F) so that the ambient temperature never exceeds 45°C (117° 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.

## 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.

# 6

# I/O Interface


**6-1 Parallel Interface ..... 6-2**
6-1-1 FH-505□ ..... 6-2
**6-2 EtherCAT Interface ..... 6-14**
6-2-1 FH-505□ ..... 6-14
**6-3 Ethernet Interface ..... 6-16**
6-3-1 FH-505□ ..... 6-16

# 6-1 Parallel Interface

Parallel interfaces vary by Sensor Controller series. Refer to the appropriate series for information.

## 6-1-1 FH-505□

**Precautions for Safe Use**

- 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.

The parallel interface can be used for both NPN and PNP. An appropriate wiring is required according on 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 ±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 ±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. |
| 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 pins, No.28 to 32 pins: 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 ±10 % |
| Load current*1 | 45 mA max. |
| ON residual voltage | 2 V max. |

| Item | Specifications |
|---|---|
| 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.

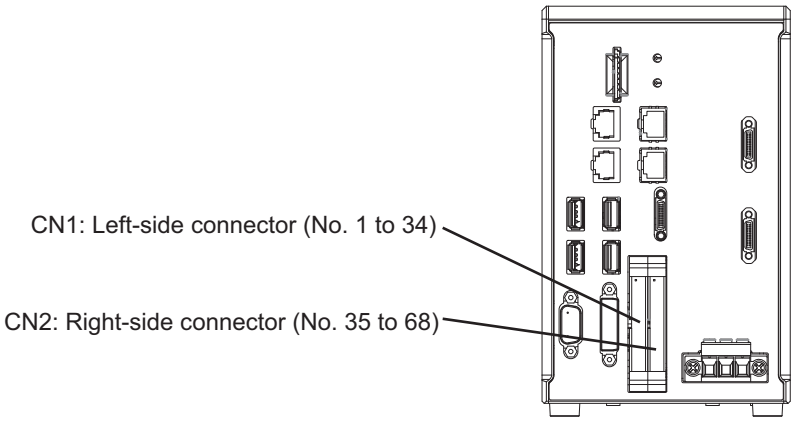
| Item | Specifications |
|---|---|
| Output voltage | 12 to 24 VDC ±10 % |
| Load current*1 | 45 mA max. |
| ON residual voltage | 2 V max. |
| OFF leakage current | 0.2 mA max. |

*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



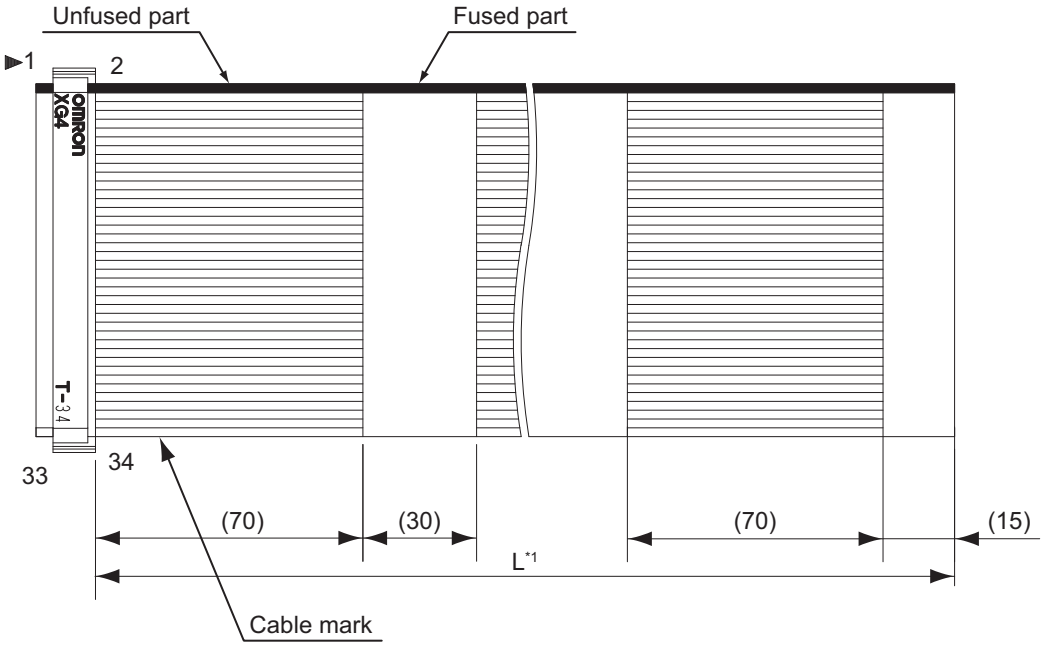

## Cable, I/O connector and Terminal Block

Use the following parallel I/O cable.

| Name | Model | Description | Remark |
|---|---|---|---|
| Parallel I/O cable | XW2Z-S013-☐ | Specialized for FH series<br>Cable length: 2 m, 5 m<br>Min. bending radius: 10 mm | • Two these cables are needed to use all I/O signals.<br>• One side of this cable is flat cable and another side of it is a connector.<br>• Connect the parallel I/O cable with securing the minimum bending radius and more.<br>• Cable length is set to ☐ in the model number. (2 = 2 m, 5 = 5 m) |

| Name | Model | Description | Remark |
|---|---|---|---|
| Parallel I/O cable for Connector-Terminal Conversion Unit | XW2Z-□□ □EE | Specialized for FH series<br>Cable length: 0.5 m, 1 m, 1.5 m, 2 m, 3 m, 5 m<br>Min. bending radius: 83.2 mm | • Two these cables are needed to use all I/O signals.<br>• One side of this cable is flat cable and another side of it is a connector.<br>• Connect the parallel I/O cable with securing the minimum bending radius and more.<br>• 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)<br>• Terminal Blocks Recommended Products: OMRON XW2K-34G-T |
| Ultra-Compact Interface Wiring System (General-Purpose) | XW2K-34G-T | - | Refer to the *XW2K Series Datasheet (Cat. No. G152)* for details. |

● **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.

### Precautions for Correct Use

The following terminals are not supported by 3D robot vision.

- STEP0/ENCTRIG_Z0
- ENCTRIG_A0
- ENCTRIG_B0
- READY0
- STGOUT0/SHTOUT0
- STGOUT1-7

### Additional Information

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

| No. | I/O | XW2Z-S013-☐ Wire color | XW2K-34G-T Ultra-Compact Interface Wiring System (General-Purpose) | Signal name |
|---|---|---|---|---|
| | | | | 1-line mode |
| CN1 | | | | |
| 1 | - | Red | A1 | COMIN0 |
| 2 | - | Gray | B1 | COMIN1 |
| 3 | - | Gray | A2 | Vacant |
| 4 | IN | Gray | B2 | STEP0/ENCTRIG_Z0*1 |
| 5 | IN | Green | A3 | Not used*3 |
| 6 | IN | Gray | B3 | Not used*3 |
| 7 | IN | Gray | A4 | Not used*3 |
| 8 | IN | Gray | B4 | ENCTRIG_A0*1 |
| 9 | IN | Gray | A5 | Not used*3 |
| 10 | IN | Green | B5 | Not used*3 |
| 11 | IN | Gray | A6 | Not used*3 |
| 12 | IN | Gray | B6 | Not used*3 |
| 13 | IN | Gray | A7 | ENCTRIG_B0*1 |
| 14 | IN | Gray | B7 | Not used*3 |
| 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*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 |

| No. | I/O | XW2Z-S013-□ Wire color | XW2K-34G-T Ultra-Compact Interface Wiring System (General-Purpose) | Signal name |
|---|---|---|---|---|
| | | | | 1-line mode |
| 28 | OUT | Gray | B14 | Not used*3 |
| 29 | OUT | Gray | A15 | Not used*3 |
| 30 | OUT | Green | B15 | Not used*3 |
| 31 | OUT | Gray | A16 | Not used*3 |
| 32 | OUT | Gray | B16 | Not used*3 |
| 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 | Not used*3 |
| 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 | IN | Gray | A7 | Vacant |
| 48 | OUT | Gray | B7 | ACK |
| 49 | OUT | Green | A8 | GATE0 |
| 50 | OUT | Gray | B8 | Not used*3 |
| 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 |
| 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.

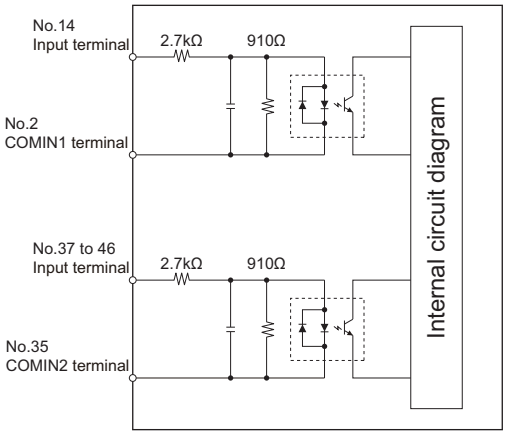
## Internal Specifications for Parallel Interface

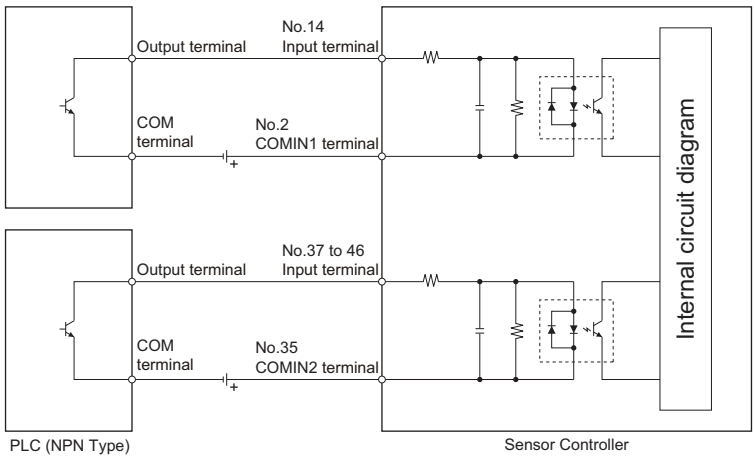
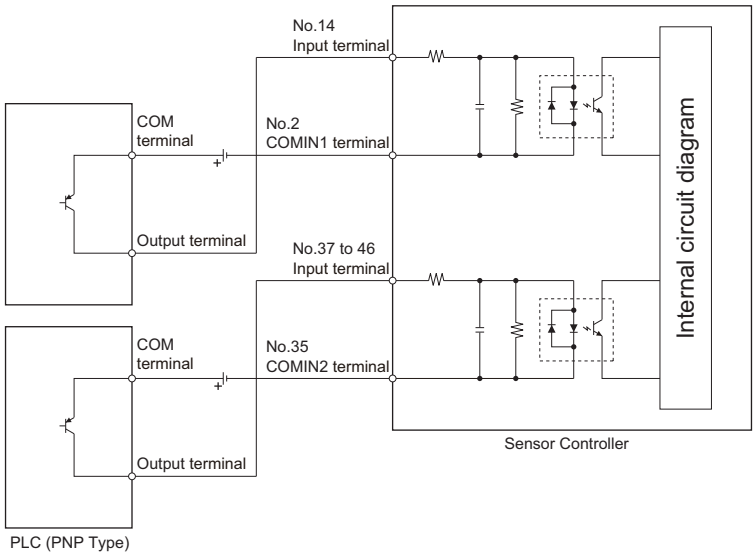
The parallel interface can be used for both NPN and PNP. Connect the pins properly according to the specifications of external devices.

### ● [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.

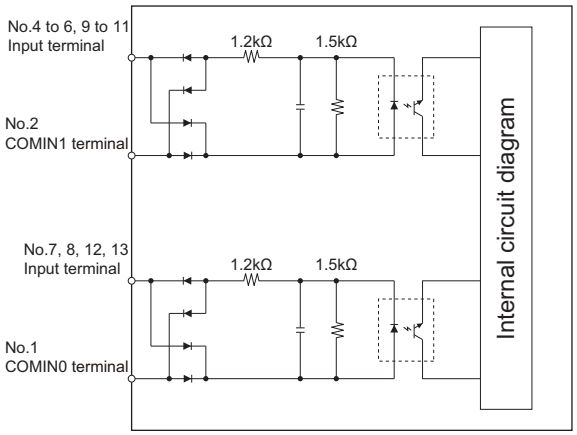
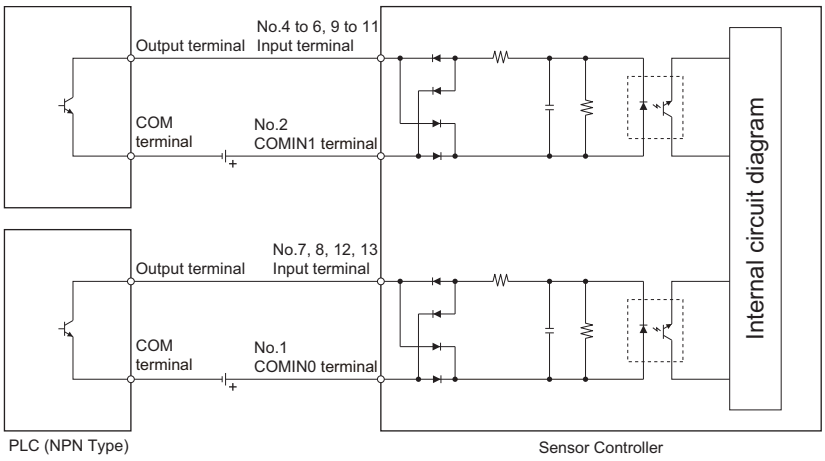
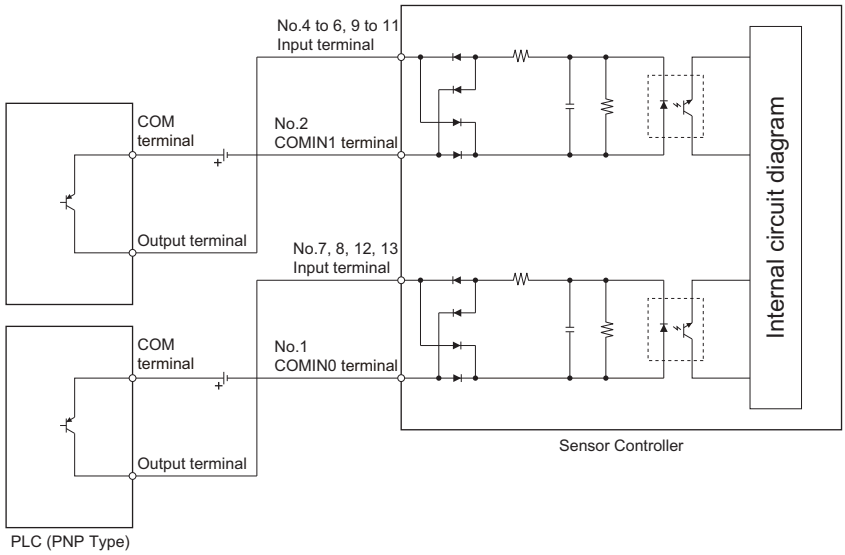
| | |
|---|---|
| Circuit configuration |  |

| | |
|---|---|
| External connection diagram | Example: When connecting NPN type PLC<br>  <br><br>Example: When connecting PNP type PLC<br>  <br> |

## ● [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.

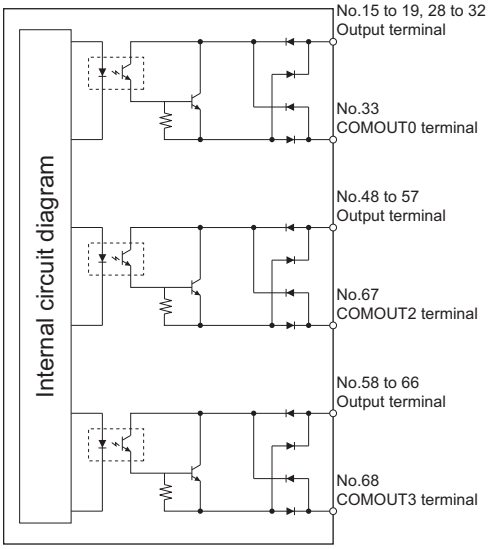
| | |
|---|---|
| Circuit configuration |  |
| External connection diagram | Example: When connecting NPN type PLC<br>  <br>Example: When connecting PNP type PLC<br>  |

## ● [Output]

Object signals:

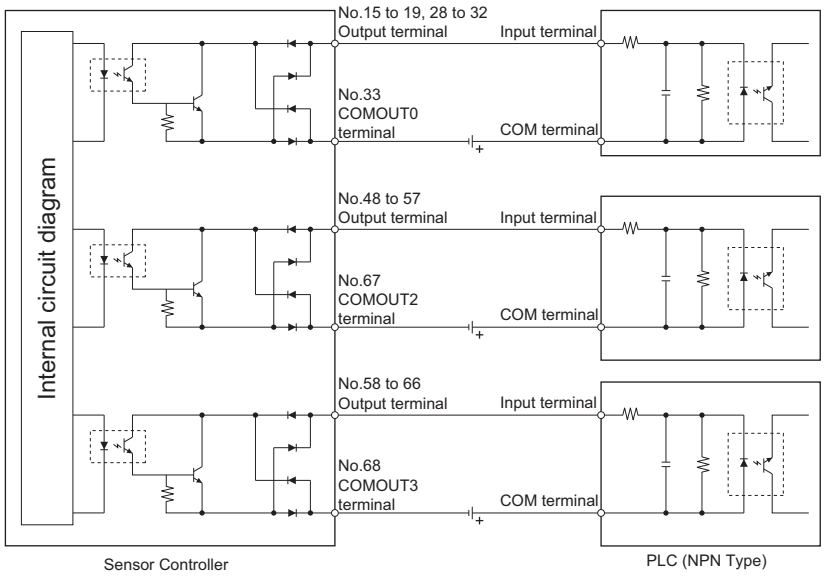
- No.15 to 19 pin, No.28 to 32pin: Use the COMOUT0 terminal when using these signals.
- No.48 to 57 pins: Use the COMOUT2 terminal when using these signals.

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

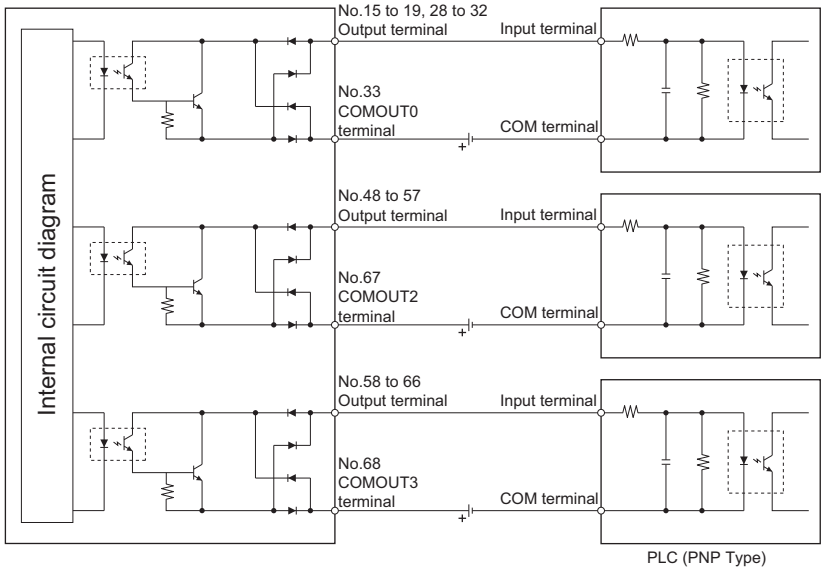
| | |
|---|---|
| Circuit configuration |  |

External connection diagram

Example: When connecting NPN type PLC



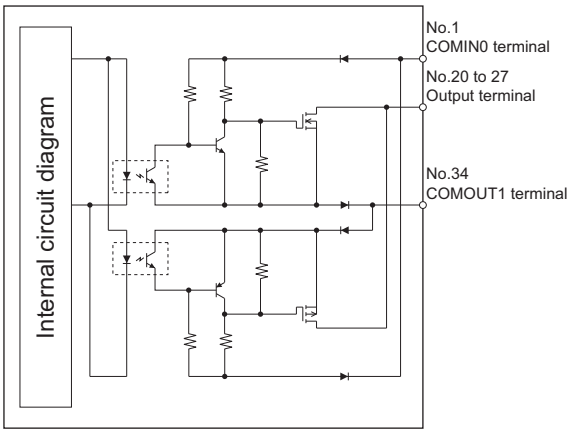
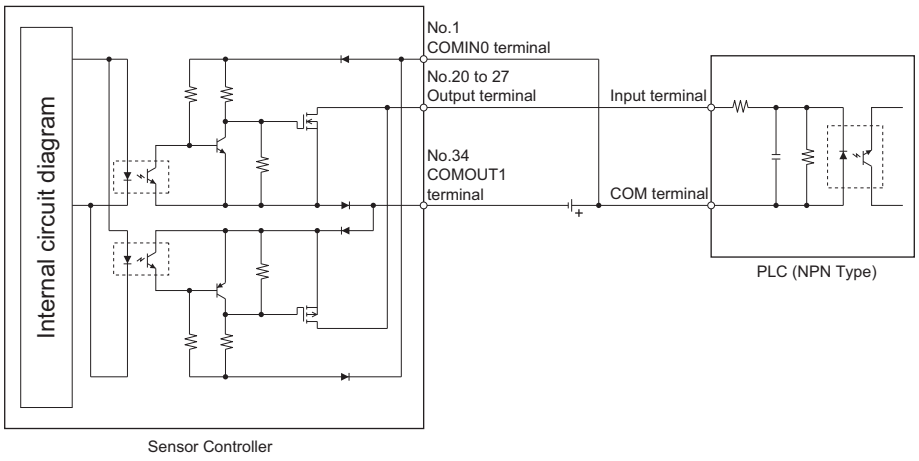
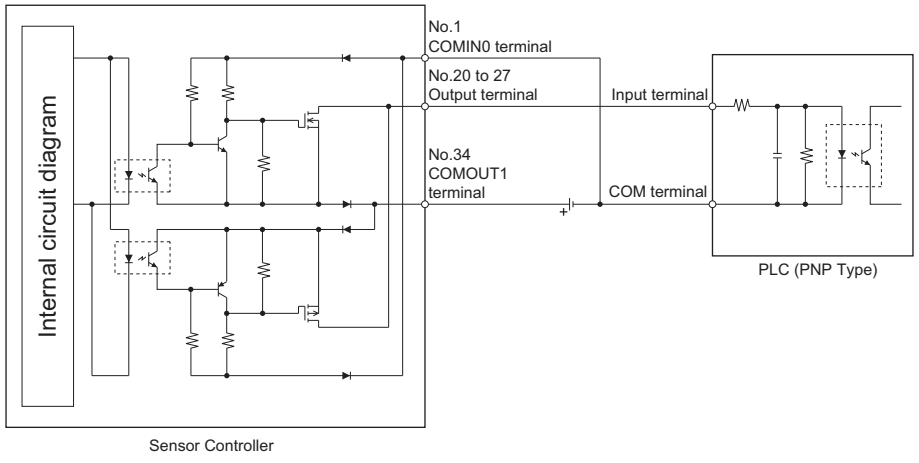

Example: When connecting PNP type PLC




## ● [Output]

Object signals:

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

| | |
|---|---|
| Circuit configuration |  |
| External connection diagram | Example: When connecting NPN type PLC<br>  <br>Example: When connecting PNP type PLC<br>  |

# 6-2 EtherCAT Interface

EtherCAT interface is supported FH-505□ series.

## 6-2-1 FH-505□

**Precautions for Safe Use**

- 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.

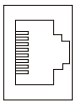
### Cable

- 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.

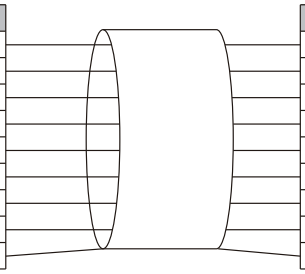
## Pin Layout

| 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 | Security ground | FG | - |

## Wring

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

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



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

# 6-3 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.

## 6-3-1 FH-505□

**Precautions for Safe Use**

- 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.

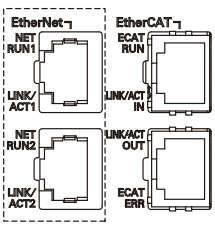
**Precautions for Correct Use**

- 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.

Ethernet port is 2.

**FH-505□**

- Upper port: Ethernet port for connecting a 3D vision sensor.
- Lower port: Ethernet port for connecting a robot controller.




### Cable

- Use the camera cable (Ethernet cable FHV-VNBX2 / FHV-VNLBX2 / FHV-VNBX / FHV-VNLBX: sold separately) to connect to the 3D vision sensor.
- Connect a straight or cross LAN cable.

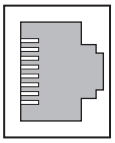
- The transmission rate you use determines available cables and connectors.
- For 100BASE-TX or 10BASE-T, use an STP (shielded twist pair) cable with category 5 or higher.
- For 1000BASE-T, use an STP cable (double-shielded with aluminum tape and braided cord) with category 5e or higher.

## 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.

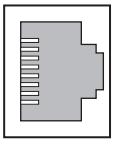
## Pin Layout

### ● 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.

# I

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**OMRON Corporation** **Industrial Automation Company**

**Kyoto, JAPAN** **Contact : www.ia.omron.com**

***Regional Headquarters***

**OMRON EUROPE B.V.**
Wegalaan 67-69, 2132 JD Hoofddorp
The Netherlands
Tel: (31) 2356-81-300 Fax: (31) 2356-81-388

**OMRON ELECTRONICS LLC**
2895 Greenspoint Parkway, Suite 200
Hoffman Estates, IL 60169 U.S.A.
Tel: (1) 847-843-7900 Fax: (1) 847-843-7787

**OMRON ASIA PACIFIC PTE. LTD.**
438B Alexandra Road, #08-01/02 Alexandra
Technopark, Singapore 119968
Tel: (65) 6835-3011 Fax: (65) 6835-3011

**OMRON (CHINA) CO., LTD.**
Room 2211, Bank of China Tower,
200 Yin Cheng Zhong Road,
PuDong New Area, Shanghai, 200120, China
Tel: (86) 21-6023-0333 Fax: (86) 21-5037-2388

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**Cat. No. Z436-E1-05** 0824