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OMRON

Displacement Sensor

ZW series

Confocal Fiber Type Displacement Sensor

User's Manual

ZW-C1□ T

Z322-E1-05

Introduction

Thank you for purchasing the ZW.
This manual provides information regarding functions, performance and operating methods that are required for using the ZW.
When using the ZW, be sure to observe the following:

- The ZW must be operated by personnel knowledgeable in electrical engineering.
- To ensure correct use, please read this manual thoroughly to deepen your understanding of the product.
- Please keep this manual in a safe place so that it can be referred to whenever necessary.

User's Manual

Confocal Fiber Type
Displacement Sensor

ZW

READ AND UNDERSTAND THIS DOCUMENT

Please read and understand this document before using the products. Please consult your OMRON representative if you have any questions or comments.

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OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

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The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this document.

- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

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PERFORMANCE DATA

Performance data given in this document is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

CHANGE IN SPECIFICATIONS

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It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the product may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

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Precautions for Safe Use

Please observe the following precautions for safe use of the products.

1. Installation Environment

- Do not use the product in environments where it can be exposed to inflammable/explosive gas.
- To secure the safety of operation and maintenance, do not install the product close to high-voltage devices and power devices.

2. Power Supply and Wiring

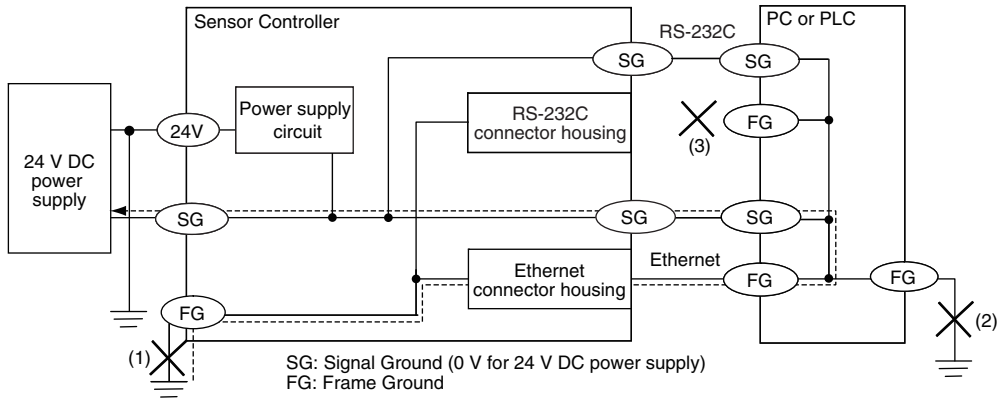
- Take care when using a power supply with an overcurrent detector, because this sensor uses DC-DC converter for its power supply circuit and inrush current may activate the protective circuit for a power supply with an overcurrent detector.
  Recommended power supply: S8VS-06024 (Omron, DC24 V 2.5 A 60 W)
- The supply voltage must be within the rated range (DC24 V ± 10 %).
- Reverse connection of the power supply is not allowed.
- Open-collector outputs should not be short-circuited.
- Use the power supply within the rated load.
- High-voltage lines and power lines must be wired separately from this product. Wiring them together or placing them in the same duct may cause induction, resulting in malfunction or damage.
- Use adequate safety measures, for example fail-safe circuits.
- Use a specified-sized wire when wiring. Do not connect wires other than those of the specification to the terminal block.
- For a power supply, use a DC power supply unit provided with a remedy, for example, safety ultralow voltage circuit, to prevent a high voltage from being generated.
- Route so that power supply wires are as short as possible.
- Use a power supply dedicated for this product, without sharing it with other products.
- Tighten fixing screws securely at a torque specified in this manual.
- Before performing any of the following activities, be sure to turn off the product, or breakdown may result.
  - Connecting or wiring cables
  - Connecting or disconnecting connectors
  - Installing or removing Calibration ROM

3. Grounding

- Use a frame ground terminal of the specified size to be grounded. Do not connect a wire with an only twisted end directly to a terminal block.
  - Terminal screw: M4
  - Crimp-type terminal:

- Use D-type grounding (ground resistance of 100 Ω or less). Make the ground point as close as possible and make the ground wire used as short as possible.
- Never a ground wire with other equipment and never ground to building beams. Doing so could cause negative impacts.
- The power supply circuit of the Sensor Controller is not insulated from the internal circuits.
- When grounding the positive (+) terminal of the 24 VDC power supply, do not connect the Sensor Controller's frame ground terminal or PLC's frame ground terminal to ground. [(1), (2)]
  The PC housing may be internally connected to the SG (0 V), in which case current will flow through the path shown below and may cause seizure.

- If there is no PC, or specifically there is no SG (0 V)/FG short-circuiting path, grounding the Sensor Controller's frame ground terminal will not cause seizure. Wire the PLC after checking the specification of your PLC.
- The dedicated RS-232C cable (ZW-XRS2/XPT2) has its cable shield isolated from the connector housing. [(3)]



4. Regulations and Standards

- EN61326-1
- Electromagnetic environment : Industrial electromagnetic environment (EN/IEC 61326-1 Table 2)
- The following condition is applied to the immunity test of this product:
  There may be cases that current or voltage output fluctuate within ± 3%F.S. when a sensor is experienced electromagnetic interference.
- Notice for Korea Radio Law

  Ａ급 기기 （업무용 방송통신기자재）
  이 기기는 업무용 (Ａ급) 전자파적합기기로서 판매자
  또는 사용자는 이 점을 주의하시기 바라며 , 가정외의
  지역에서 사용하는 것을 목적으로 합니다.

5. Others

- Do not use this product for nuclear facilities, or safety circuits involving human lives.
- Do not attempt to disassemble, repair, modify, apply pressure to deform or burn up the body.
- Dispose of this product as industrial waste.
- Use exclusive devices, including a sensor head, Calibration ROM, fiber cable or RS-232C cable, to connect, or ignition, burst, false operation or breakdown may be caused.
- Do not cut fiber cable. Glass at the cut section may cause injury. Also, if cut, it will not work normally anymore.
- Whenever any trouble, including, strange odor smelled, the body overheated or smoke escaped, was found, immediately stop the operation, and consult an OMRON branch or sales office with the system shut down.
- Do not drop or make a strong impact on the unit.
- Before using any equipment provided with a lock mechanism, make sure that it has been locked.

Precautions for Correct Use

Please observe the following precautions to prevent failure to operate, malfunctions, or undesirable effects on product performance.

1. Installation Site

Do not install the product in locations subjected to the following conditions:

- Ambient temperature outside the rating
- Rapid temperature fluctuations (causing condensation)
- Relative humidity outside the range of 35 to 85 %
- Presence of corrosive or flammable gases
- Presence of dust, salt, or iron particles
- Direct vibration or shock
- Reflection of intense light (such as other laser beams, electric arc-welding machines or ultraviolet shine)
- Direct sunlight or near heaters
- Water, oil, or chemical fumes, spray or mist atmospherics
- Strong magnetic or electric field

2. Power Supply and Wiring

- When using a commercially available switching regulator, make sure that the FG terminal is grounded.
- If surge currents are present in the power lines, connect surge absorbers that suit the operating environment.
- Before turning ON the power after the product is connected, make sure that the power supply voltage is correct, there are no incorrect connections (e.g. load short-circuit) and the load current is appropriate. Incorrect wiring may result in breakdown of the product.
- Use the specified voltage. If voltage exceeding the rating or AC voltage is applied, circuit parts may be burnt or rupture.
- Use the Extension Fiber Cable (ZW-XF□□R) for extending the fiber cable between the Sensor extension fiber cable, five total lengths, 2, 5, 10, 20 or 30 m, are available.
- Handling fiber cables
  Use them in compliance with the following. This may result in damage to the fiber cable.
  -Fiber cable bend radiuses must be at least 20 mm.
  - Do not let bending cause stress at the root section of a fiber connector.
  - Do not yank hard on a fiber cable.
  - Do not step on a fiber cable or place anything heavy on it.
  - Do not apply any twisting stress to the fiber cable.
- Be sure to use a Sensor Head and Calibration ROM with the same serial number. A pair with different serial numbers cannot operate normally.
- Use the configuration software with the combination specified in this manual, or the system may operate faultily.
- Do not shut down the power supply when saving any data into the memory built in the Sensor Controller, or the data may be corrupted.
- While a fiber cable is disconnected, be sure to attach the included protective cap on both the Sensor Controller side and the fiber cable side. Leaving the fiber cable with the protective cap not attached, the optical fiber may fail due to any adhered foreign matter.

3. Warming Up

After turning ON the power supply, allow the product to stand for at least 30 minutes before use. The circuits are still unstable immediately after the power supply is turned ON, so measured values may fluctuate gradually.

4. Maintenance and Inspection

Do not use thinner, benzene, acetone or kerosene to clean the Sensor Head, fiber cable and Sensor Controller.
If large dust particles adhere to the emitter/receiver of the Sensor Head or Sensor Controller, use a blower brush (used to clean camera lenses) to blow them off. Do not blow the dust particles with your mouth.
To remove smaller dust particles, dirt, oil, and fat, wipe gently with a soft cloth (for cleaning lenses). Do not use excessive force to wipe off dust particles. Scratches on the emitter/receiver may cause false operations or measuring errors.
For details on the method for cleaning the ends of fiber cables, refer to "Connecting Fiber Cable" (p.34).
Clean the ventilation port periodically to prevent any build up of dirt and dust. If the ventilation port is blocked, heat builds up inside and can cause breakdown.

5. Sensing Objects

The product sometimes cannot accurately measure the following types of objects: Transparent objects, objects with an extremely low reflection factor, objects smaller than the spot diameter, objects with a large curvature, excessively inclined objects, target objects with a thin film on the surface etc.

6. Effect caused by peripheral lights

Do not install the Sensor Head in a place where strong light hits the laser emitter/receiver section of the Sensor Head. Also, if an object has a shiny surface, the light from the lighting will be reflected and a malfunction may occur. In such a case, prevent reflection by, for example, covering the light to stop reflection.

Basic precautions for installation p.26

7. Influence by Air Turbulences

Slow air turbulences around the Sensor Head may disperse measured values.
To avoid these possible air turbulences, wrap the Sensor Head with an appropriate cover.

8. Operations Outside Measurement Range

This sensor is highly sensitive, it may operate incorrectly outside the measurement range (too close in). In such a case, the problem can be solved by reducing the exposure time.

Editor's Note

■ Meaning of Symbols

Menu items that are displayed on the main or sub-display, and windows, dialog boxes and other GUI elements displayed on the personal computer are indicated enclosed by brackets [ ].

■ Visual Aids

Important	Indicates points that are important to achieve the full product performance, such as operational precautions.
Note	Indicates application procedures.
	Indicates pages where related information can be found.
Optional	Indicates that the setting is optional in a configuration procedure.

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- Please understand that the specifications and other contents of this manual are subject to change for improvement without notice.
- Every effort has been made to ensure the accuracy of the contents of this manual, but if you should notice any mistake, questionable section, or the like in this manual, please contact an OMRON branch or sales office.
- If you do so, please also tell us the manual number, which is found at the end of the manual.

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4.Settings for Function

5.Convenient Functions

6.Communications with External Devices

7.Offline Settings

8.Troubleshooting

9.Sensor controller operations

10.APPENDICES

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Settings	Set by Sysmac Studio	Set by Sensor Controller
Setting the Material for the Target to Measure	p.71	p.228
Setting Exposure Time Control Mode	p.75	p.230
Measuring the Height	p.79	p.231
Measuring the Thickness	p.81	p.232
Calculating	p.82	p.233
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Setting the Scaling	p.83	p.240
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Changing the Bank Mode	p.106	p.253
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Saving the Bank/System Settings	p.108	p.255
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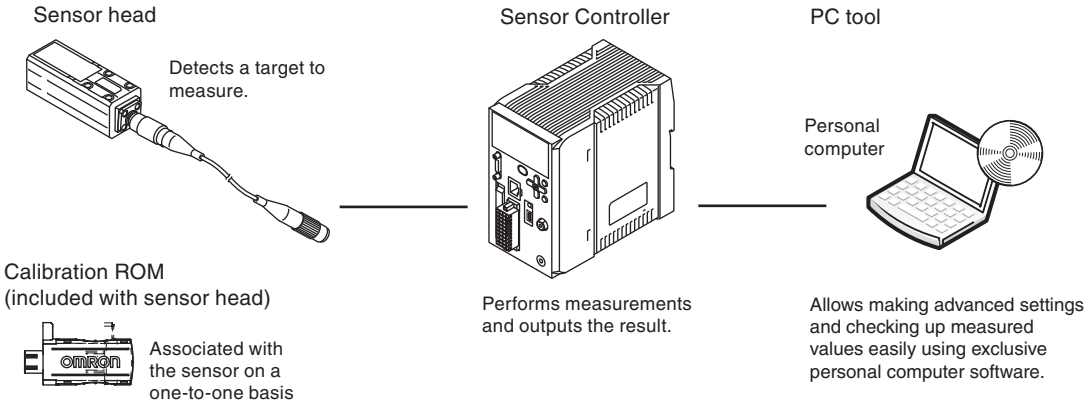
Basic configuration

1-1 ZW-series Displacement Sensors

The ZW-series is a line of fiber coaxial displacement sensors.
They consist of Sensor Head and Sensor Controller, calibration ROM, and exclusive setting PC tool which runs on personal computers for system settings and monitoring.



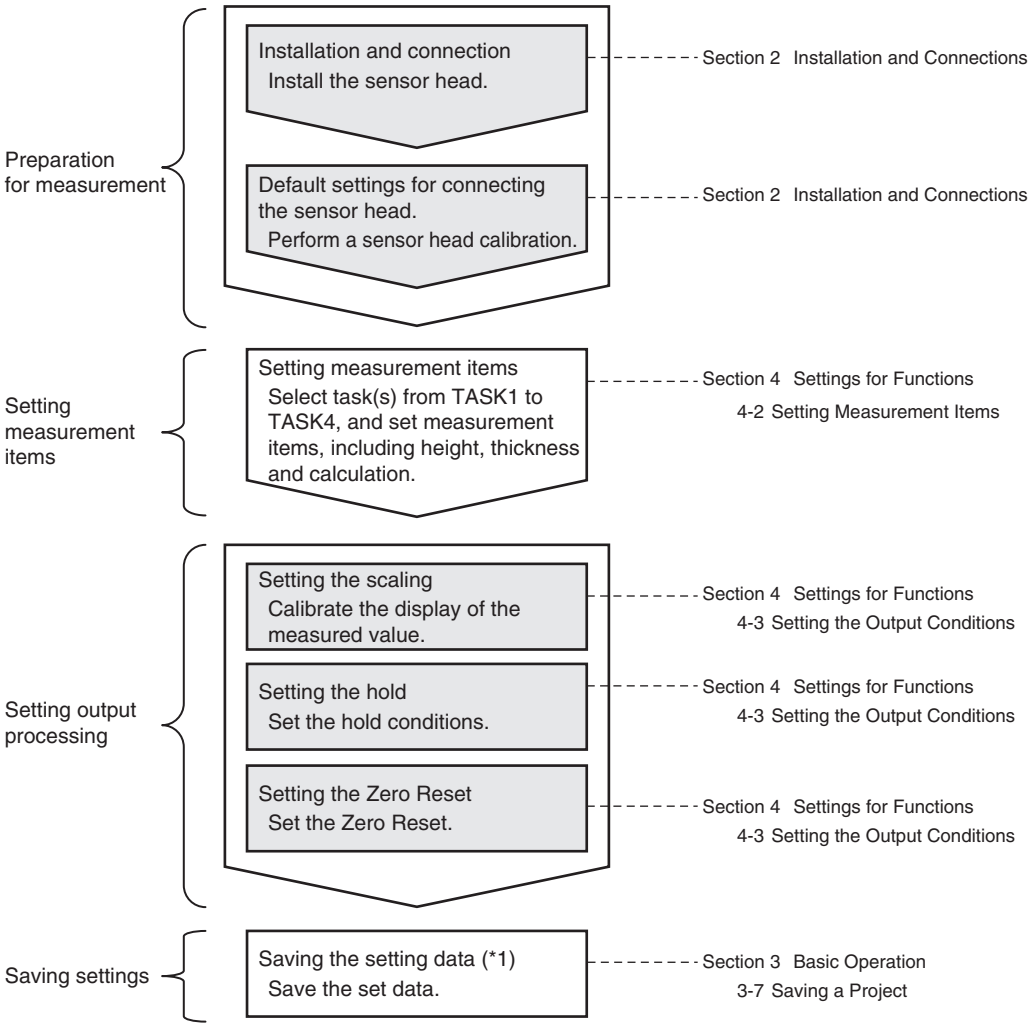
Types of Sensor Controllers

The ZW Series has two types of Controllers (hereinafter be referred to as "Sensor Controller" in this document.). Differences are described below.

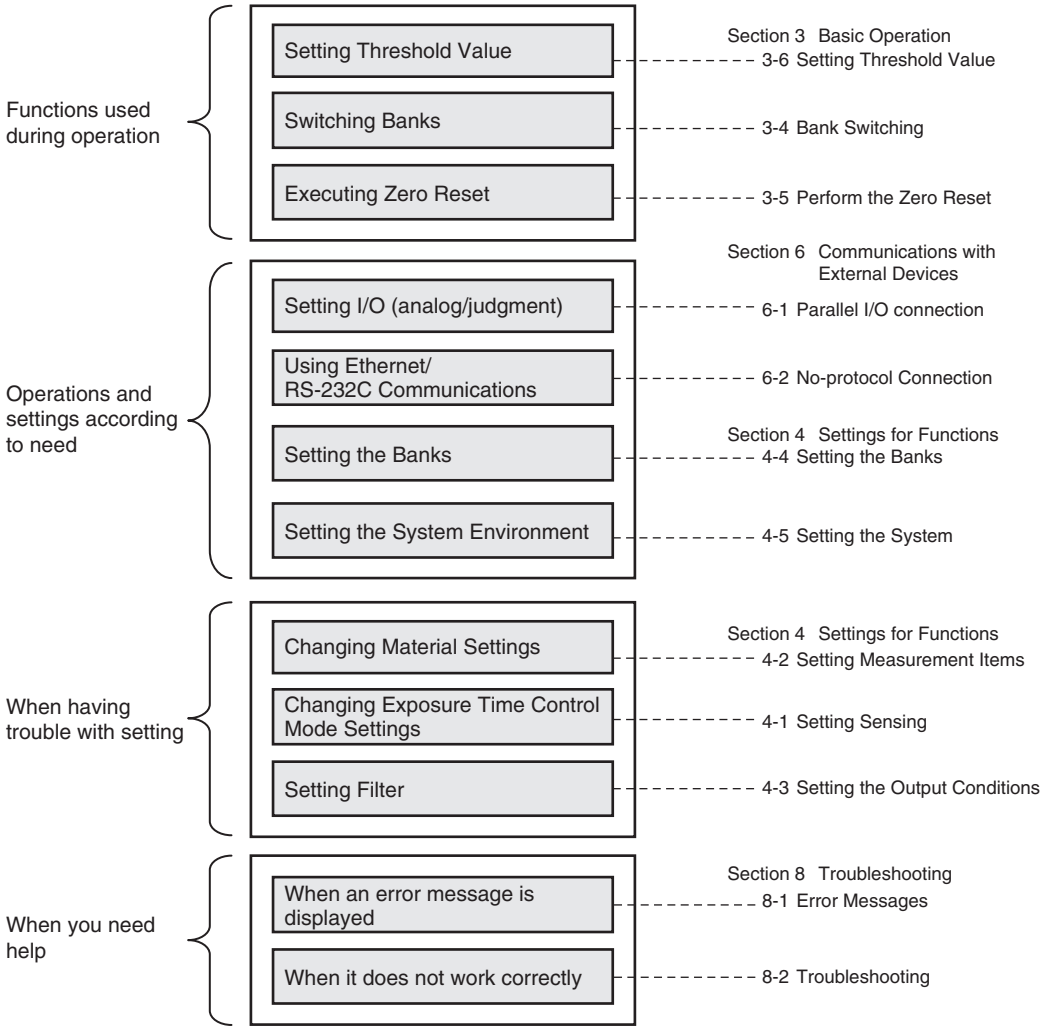
Model	ZW-C1□T/ZW-C1□AT	ZW-CE1□T
I/O Specifications	EtherCAT and EtherNet/IP not mounted, Binary output device mounted	EtherCAT and EtherNet/IP mounted, Binary output device not mounted
PC tool	Sysmac Studio (Measurement Sensor Edition)/ Smart MonitorZW version 1.10 or later	Sysmac Studio (Standard Edition)/ Sysmac Studio (Measurement Sensor Edition)/Smart MonitorZW version 1.10 or later

1-2 Basic Operation Flow

The following is the basic operation flow for ZW Series.



(*1) After you have made or changed settings, be sure to save the setup data.
All set data will be cleared if you turn the power OFF without saving the data.


Functions used during operation
Setting Threshold Value
Switching Banks
Executing Zero Reset
Section 3 Basic Operation
3-6 Setting Threshold Value
3-4 Bank Switching
3-5 Perform the Zero Reset
Operations and settings according to need
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Setting the Banks
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6-2 No-protocol Connection
Section 4 Settings for Functions
4-4 Setting the Banks
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Changing Exposure Time Control Mode Settings
Setting Filter
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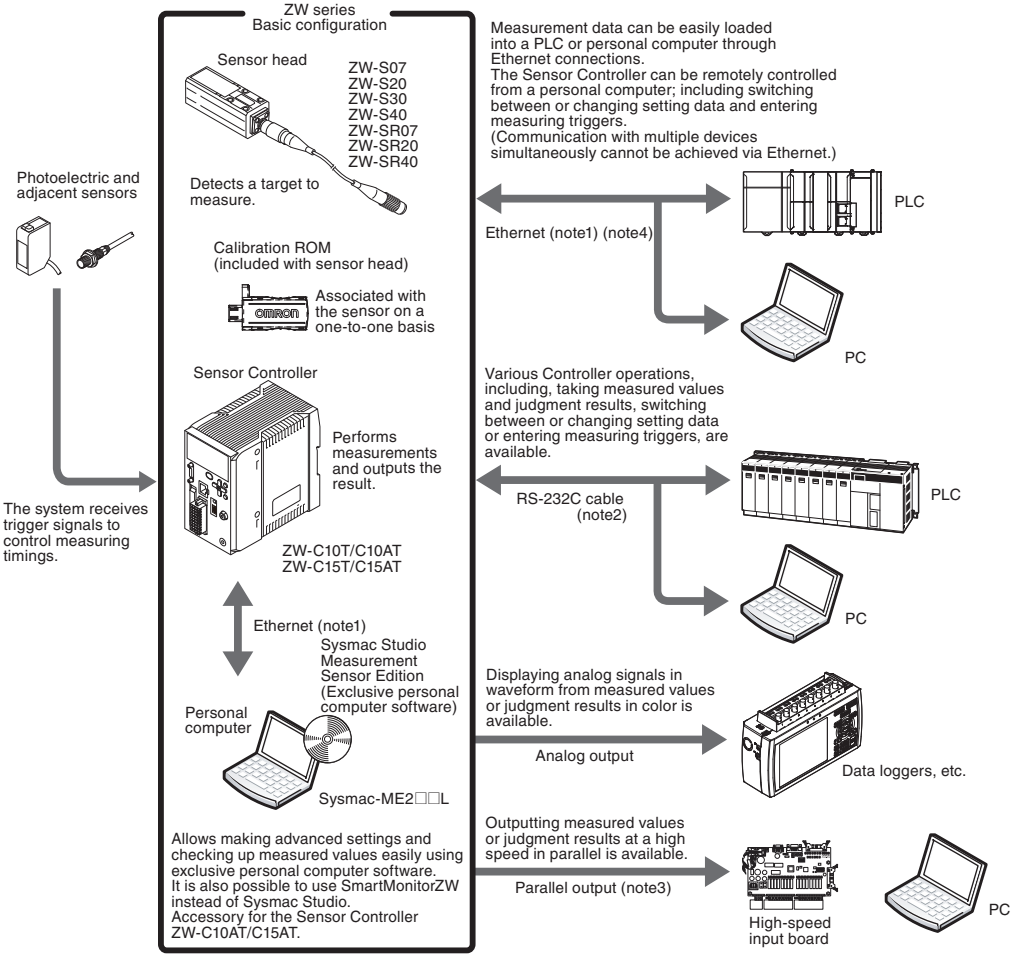
4-1 Setting Sensing
4-3 Setting the Output Conditions
When you need help
When an error message is displayed
When it does not work correctly
Section 8 Troubleshooting
8-1 Error Messages
8-2 Troubleshooting

Installation and Connections

System Configuration

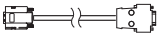


• (Note1) Ethernet cable (sold separately)

Prepare commercially available Ethernet cable satisfying the following requirements:
- Category 5e or more, 30 m or less
- RJ45 connector (8-pin modular jack)
- For direct connection: Select cross cable.
- For connection through an industrial switching hub (note 4): Select straight cable.

• (Note2) RS-232C cable (optional)

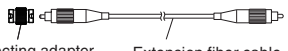
Depending on connecting devices, exclusive cables may be supplied.



For PLC/programmable terminal: ZW-XPT2
For personal computer: ZW-XRS2

• Extension fiber cable (optional)

A exclusive extension fiber cable is available to place the Sensor Head and Sensor Controller far apart than the normal distance to each other.
Use the exclusive product for correct measurements.

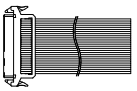


Connecting adapter (included with the fiber cable for extension) ZW-XFC

Extension fiber cable ZW-XF__R (2 m/5 m/10 m/20 m/30 m)

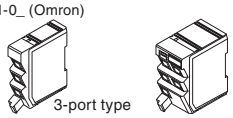
• (Note3) Parallel cable (optional)

A parallel cable for 52-pole extension connector (ZW-XCP2) with 2 m cable is available.



• (Note 4) Industrial network hub (sold separately)

Use the recommended products below:
W4S1-0_ (Omron)



3-port type
5-port type

Connection Compatibility

Connected to ZW-C1□T	Other connection		
	Ethernet (no-protocol)	RS-232C (no-protocol)	I/O Cable
Ethernet (no-protocol)	---	Compatible	Compatible
Ethernet (programmable no-protocol)	Compatible	---	Compatible

Important

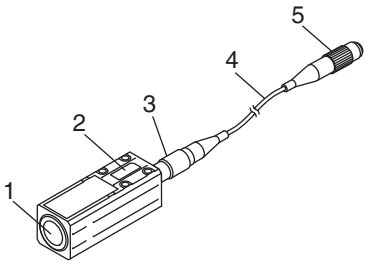
Can be connected simultaneously via Ethernet with PC tools (Sysmac Studio, SmartMonitorZW) and another device (PLC etc). Can be connected simultaneously via Ethernet with PC tools (Sysmac Studio, SmartMonitorZW) and another device (PLC etc). The port number for the PC tool is fixed to 9600. When connecting different devices, set the port number to other than 9600 (default value is 9601).

Product	Model	Application
ZW	ZW-C1□T	This Displacement Sensor performs measurements.
PC Tool	Sysmac Studio Measurement Sensor Edition • SYSMAC-ME2□□L (1 or 3 licences)	This is the setup application. It is part of the Sysmac Studio Package and it runs on Windows. This license provides the functions that are required to set up ZW Vision Sensors from the Sysmac Studio. This model number is for the license only. You must also purchase the DVD for the Sysmac Studio Standard Edition Ver.1.05 or higher.
General-purpose Ethernet cable	---	Prepare commercially available Ethernet cable satisfying the following requirements: • Category 5e or more, 30 m or less • RJ45 connector (8-pin modular jack) • For direct connection: Select cross cable. • For connection through an industrial switching hub: Select straight cable.
Special I/O Cable	For connecting to a PLC or programmable terminal • ZW-XPT2 For connecting to a PC • ZW-XRS2	Connect the sensor with a PLC, programmable terminal, or personal computer etc..
Industrial Ethernet Switching Hub	• W4S1-03B (3 ports type) • W4S1-05B • W4S1-05C (5 ports type)	Used to connect multiple sensors or PLCs using Ethernet.

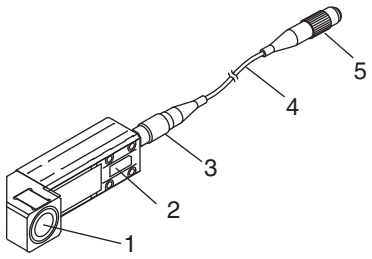
2-2 Part Names and Functions

The following describes the names and functions of parts of the Sensor Head, Calibration ROM and Sensor Controller.

Sensor Head



Straight type

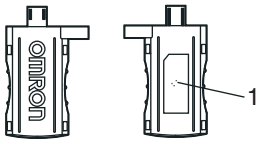


Right angle type

No.	Names	Functions
1	Projector/receiver	Projects and receives light.
2	Serial number.	Serial number. Only a calibration ROM with the same serial number is available.
3	Fiber interface	Interfaces the Sensor Head and optical fiber (unremovable).
4	Fiber Cable	Sends or receives light signals to/from the Sensor Controller.
5	Fiber Connector	Couples the Sensor Controller and fiber cable.

Calibration ROM

This ROM is associated with the sensor on a one-to-one basis, and operates connected to the Sensor Controller.



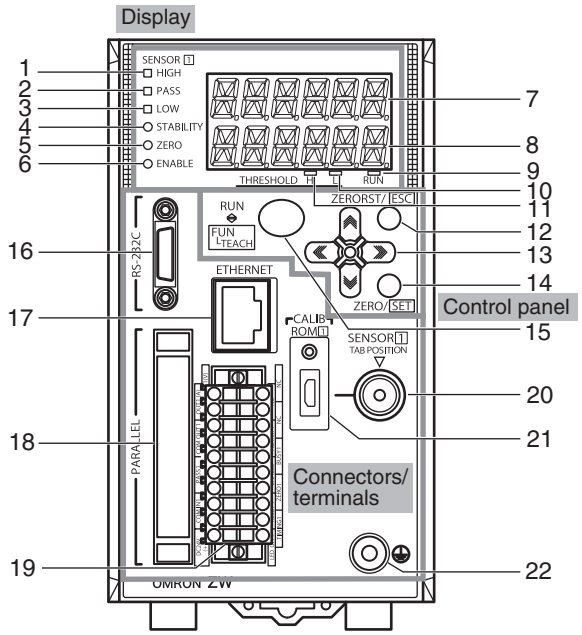
No.	Names	Functions
1	Serial number	Serial number. Only a Sensor Head with the same serial number is available.

Important

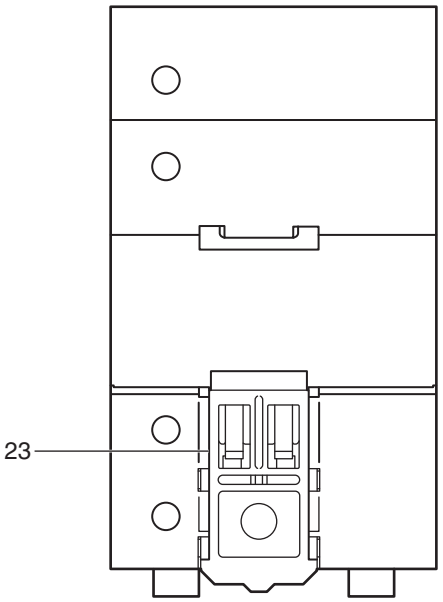
Use with the Calibration ROM always connected. If the Calibration ROM is not connected, an error is displayed.

Sensor Controller

<Front view>



<Rear view>



<Bottom view>