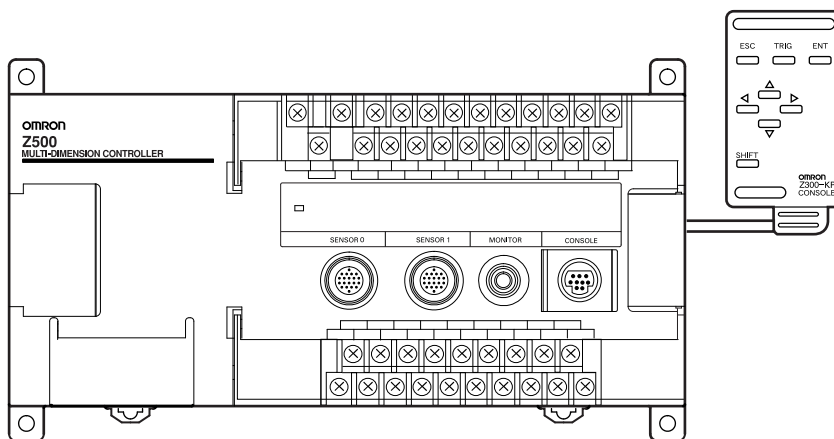


Profile Measuring System

Z500

Setup Manual



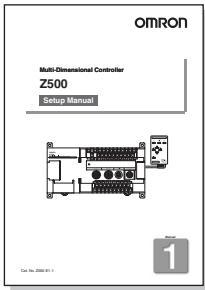
Manual



About this Manual

Please read the following manuals carefully and be sure you understand the information provided before attempting to install or operate the Z500.

Manual 1: Setup Manual



Cat. No. Z158

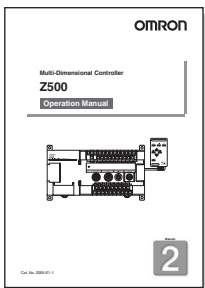
Installation

Wiring

This manual describes the hardware for the Z500 (Multi-Dimensional Controller) and how to install the components.

Be sure to read this manual first.

Manual 2: Operation Manual



Cat. No. Z159

Starting the Z500 and Positioning the Workpiece

Adjusting Images

Setting Measurement Conditions and Executing

Outputting to External Devices

SECTION 2 Basic Operations

This section describes how to start the Z500 and how to display images on the monitor.

SECTION 3 Menus for Conversational Menu

- Basic settings required for measurement
- Measurement of consistent workpieces

Menus for Conversational Menu

Settings can be made easily by entering information as requested - just as though you are having a conversation with the Z500.

SECTION 4 Menus for Expert Menu

- Customized settings
- Detailed settings
- Measurement of workpieces placed at different positions

Menus for Expert Menu

More detailed setting, such as position compensation for workpieces placed at different positions, can be made.

SECTION 7 I/O Format

This section provides details on the inputs and outputs used for communications with external devices via terminal blocks or RS-232C.

- Communications settings
- I/O format
- Timing for communications

Profile Measuring System Z500

Z500-MC10E/MC15E

Setup Manual

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Manual



Special or Critical Applications

When the Z500 will be used in one of the conditions or applications listed below, allow extra safety margins in ratings and functions, add extra safety feature such as fail-safe systems, and consult your OMRON representative.

- Operating conditions or environments which are not described in the manual
- Nuclear power control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement equipment, or safety equipment
- Other systems, machines, and equipment that may have a serious influence on lives and property and require extra safety features

Product Availability

Some of the products listed may not be available in some countries. Please contact your nearest OMRON sales office by referring to the addresses provided at the back of this manual.

Regulations and Standards

The Z500 complies with the international regulations and standards below:

- EC Regulations
EMC Directive: No.89/336/EEC
- EN Standards (European Standards)
EN61326:1997 + A1:1998 + A2:2001 (EMI:Class A)

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No patent liability is assumed with respect to the use of the information contained herein. Moreover, because OMRON is constantly striving to improve its high-quality products, the information contained in this manual is subject to change without notice. Every precaution has been taken in the preparation of this manual. Nevertheless, OMRON assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained in this publication.

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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.

WARRANTY

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.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

In no event shall responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

SUITABILITY FOR USE

THE PRODUCTS CONTAINED IN THIS DOCUMENT ARE NOT SAFETY RATED. THEY ARE NOT DESIGNED OR RATED FOR ENSURING SAFETY OF PERSONS, AND SHOULD NOT BE RELIED UPON AS A SAFETY COMPONENT OR PROTECTIVE DEVICE FOR SUCH PURPOSES. Please refer to separate catalogs for OMRON's safety rated products.

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the product.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

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.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCT IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

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

Product specifications and accessories may be changed at any time based on improvements and other reasons.

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.

DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

ERRORS AND OMISSIONS

The information in this document has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

PROGRAMMABLE PRODUCTS

OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.

COPYRIGHT AND COPY PERMISSION

This document shall not be copied for sales or promotions without permission.

This document is protected by copyright and is intended solely for use in conjunction with the product. Please notify us before copying or reproducing this document in any manner, for any other purpose. If copying or transmitting this document to another, please copy or transmit it in its entirety.

Precaution on Safety

OMRON products are manufactured for use according to proper procedures by a qualified operator and only for the purposes described in this manual.

The following conventions are used to indicate and classify precautions in this manual. Always heed the information provided with them. Failure to heed precautions can result in injury to people or damage to property.

Meanings of Signal Words

The following signal word is used in this manual.



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. Additionally there may be significant property damage.

Meanings of Alert Symbols

The following alert symbol is used in this document.



Laser Beam Hazard

Cautions to Indicate Potential Laser Beam Hazard

Laser Safety

WARNING

Do not to expose your eyes to the laser radiation either directly or indirectly (i.e., after reflection from a mirror or shiny surface).
The laser radiation has a high power density and exposure may result in loss of sight.



The Z500-SW2T Sensor Head is a Class 2 Laser Product according to EN60825-1 (IEC60825-1) and Class II Laser Product according to FDA (21 CFR1040.10) (see note). The Z500-SW6 and Z500-SW17 Sensor Heads are Class 3B and Class IIIB Laser Products, respectively. The Z500 Series is meant to be built into final system equipment. Pay special attention to the following precautions for the safe use of the product:

Note: Europe: Class 2 and Class 3B of EN60825-1: 1994 = IEC60825-1: 1993
U.S.A.: Class II and Class IIIB of FDA (21 CFR1040.10)

	Z500-SW2T	Z500-SW6/Z500-SW17
Wavelength	658 nm	658 nm
Maximum pulse duration	17.5 ms	17.5 ms
Cycle	0.5 to 10 ms	0.5 to 25 ms
Peak power	1 mW max.	15 mW max.
Class	2	3B

- (1) Use this product as specified in the operation manual. Otherwise, you may be exposed to hazardous laser radiation.
- (2) The Z500 series radiates laser beams in the visible light range. Do not expose your eyes directly to the laser radiation. Ensure that the laser beam path is terminated during use. If a mirror or shiny surface is positioned in the laser beam path, ensure that the reflected beam path is also terminated. If the Unit must be used without terminating the laser beam path, position the laser beam path so that it is not at eye level.
- (3) To avoid exposure to hazardous laser radiation, do not displace nor remove the protective housing during operation, maintenance, and any other servicing.
- (4) The user should return the product to OMRON for all repair and servicing.
- (5) As for countries other than those of Europe and the U.S.A., observe the regulations and standards specified by each country.

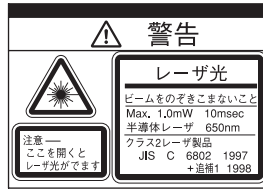
As for the Laser Product Classifications, refer to the Appendix.

REFERENCE

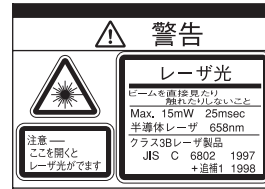
Refer to page 72.

Labeling on Laser Use

The Z500 has, on the side of its sensor, a warning label as shown below.



Z500-SW2T



Z500-SW6
Z500-SW17

Re-labeling

The following labels are provided, to be used selectively according to countries.

- for use in the U.S.: FDA label (Aperture label, Caution logo label, Certification and Identification label)
- for use in countries other than the U.S.: Warning label according to EN/IEC standards.

Be sure to turn off the sensor before replacing the label, or your hand or other body parts may be exposed to the hazardous laser beam radiating from the sensor.

Use in the U.S.

When a laser product mounted on a certain device is to be used in the U.S., it has to meet the requirements set forth by the FDA (regulations for laser products set forth by the Food and Drug Administration). Three different FDA labels are enclosed in the sensor package. Attach them to the sensor body.

Applications have been approved by CDRH (Center for Devices and Radiological Health) for Z500-SW6 and Z500-SW17. Z500-SW2T should not be used in the U.S. at this moment since the application for this model has not been approved yet.

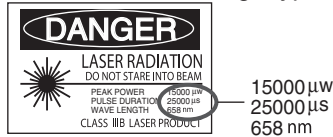
FDA Labels for Laser Products

The Z500 is designed to be built into the finished system unit. Refer to the following technical standard for installation.

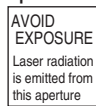
21CFR1040.10 and 1040.11

FDA Labels

Class III B Caution logo type



Aperture Label



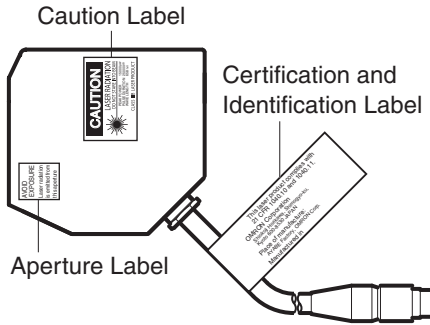
Certification and Identification Label



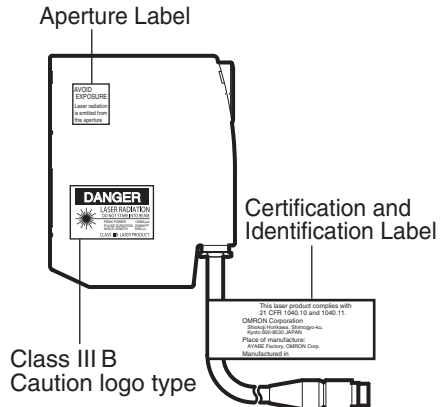
Be sure to attach FDA labels; do not attach EN/IEC WARNING label by mistake.

Areas to Attach Labels

Z500-SW2T



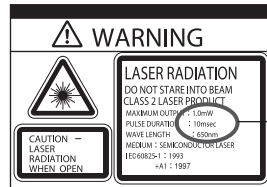
Z500-SW6/Z500-SW17



Use in Countries Other than the U.S.

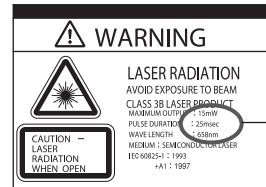
Replace the warning label in Japanese on the sensor main body with the attached EN/IEC warning label upon use in countries other than the U.S. Attach the label in the area where the original Japanese warning label was provided. EN60825-1 (IEC60825-1) standard is applied to products exported to European countries. The Z500 conforms to the standard.

EN/IEC Warning Labels



1.0 mW
10 msec
650 nm

Z500-SW2T



15 mW
25 msec
658 nm

Z500-SW6
Z500-SW17

Precautions for Safe Use

Installation Environment Precautions

- Do not use the Z500 in environments with flammable or explosive gases.
- Install the Z500 away from high-voltage devices and moving machinery to allow safe access during operation and maintenance.

Power Supply and Wiring Precautions

- Use the Z500 with the power supply voltages specified in this manual.
- Use crimp terminals for wiring. Do not connect the power supply wires by just twisting stranded wire and connecting directly to the terminals.
- Use the wire and crimp terminals of the proper sizes as specified in this manual.
- Confirm that wiring has been performed correctly before turning ON the power supply.
- Cover the terminal blocks with the Terminal Block Protection Covers. Uncovered terminal blocks can result in electric shock.
- Use a DC power supply with countermeasures against high-voltage spikes (safe extra low-voltage circuits on the secondary side).
- Be sure to securely tighten the screws when mounting the Z500.

Other Precautions

- Do not attempt to dismantle, repair, or modify the Z500.
- Dispose of the Z500 as industrial waste.

Notice

The Z500 is highly reliable and resistant to most environment factors. The following guidelines, however, must be followed to ensure reliability and optimum use of the Z500.

Installation of the Controller

Installation Site

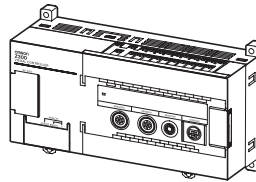
Do not install the Z500 in locations subjected to the following conditions:

- Ambient temperature outside of 0 to +50 °C
- Condensation due to rapid temperature fluctuations
- Relative humidities outside 35 to 85%
- Corrosive or flammable gases
- Dust, salt, or iron particles
- Direct vibration or shock
- Reflection of intense light
(such as other laser beams or electric arc-welding machine)
- Strong magnetic fields
- Direct sunlight
- Water, oil, or chemical fumes or spray

Mounting of the Controller

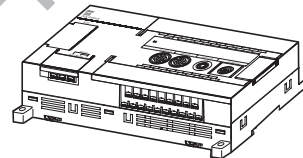
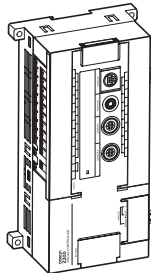
To improve heat dissipation, install the Controller in the following direction only:

CORRECT



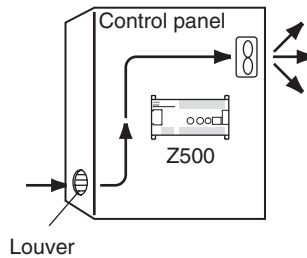
Do not install the Controller in the orientations shown in the following diagram.

INCORRECT



Ambient temperature

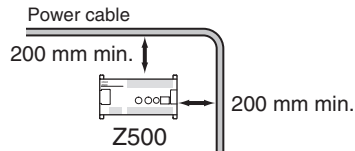
- Maintain a minimum clearance of 50 mm above and below the Z500 to improve air circulation.
- Do not install the Z500 immediately above significant heat sources, such as heaters, transformers, or large-capacity resistors.
- Do not let the ambient temperature exceed 50 °C.
- Provide a forced-air fan cooling or air conditioning if the ambient temperature is near 50 °C so that the ambient temperature never exceeds 50 °C.

**Ambient illumination**

- Do not let the ambient illumination exceed 3000lx.
- When using the Z500 near lighting equipment that turns ON and OFF continuously, reduce the influence of the light by, for example, using a light baffle.

Noise resistance

- Do not install the Z500 in a cabinet containing high-voltage equipment.
- Do not install the Z500 within 200 mm of power cables.

**Sensor Maintenance**

Install the Sensor in a clean environment and keep the filter on the front panel of the Sensor free from oil and dust. If affected by oil or dust, clean the filter as follows:

- Use a blower brush (used to clean camera lenses) to blow large dust particles from the surface. Do not blow the dust away with your mouth.
- Use a soft cloth (for lenses) with a small amount of alcohol to remove the remaining dust. Do not use a scrubbing action when cleaning as scratches on the filter could result in the Sensor malfunctioning.

Sensor replacement

To replace the sensor being connected to the controller, turn OFF the download function.

If the sensor is replaced while the download function is ON, measurements cannot be taken correctly with the new sensor, because the old sensor information (such as the measurement range) is still stored.

REFERENCE

Refer to page 146 in the Operation Manual.

Environment

The Sensor cannot accurately detect the following types of objects:

- * Objects with an extremely low reflection ratio
- * Objects with a small curvature
- * Largely inclined objects

Component Installation and Handling

Components

The Sensor and Console must be products designed specifically for the Z500.

- Sensor (Z500-SW2T, Z500-SW6, Z500-SW17)
- Console (Z300-KP)

Connecting Cables

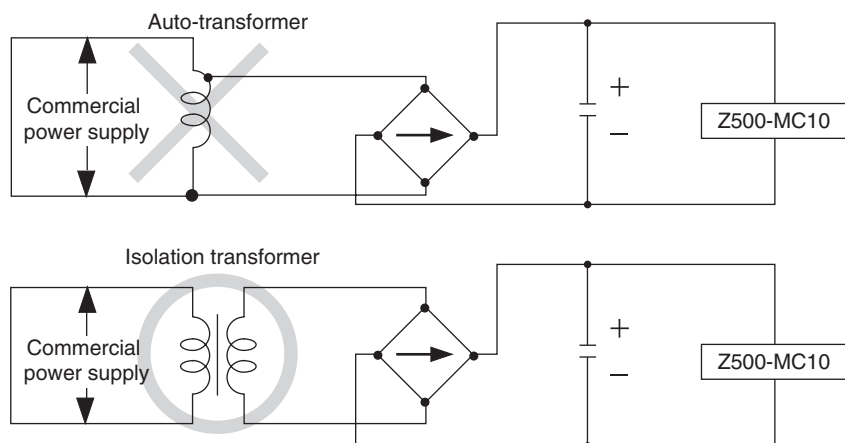
Always turn OFF the Z500's power before connecting or disconnecting cable.

Touching Signal Lines in Connectors or Terminals

To prevent damage from static electricity, use a wrist strap or another device for preventing electrostatic discharges when touching terminals or signal lines in connectors.

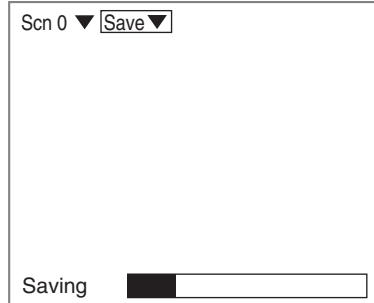
Wiring

When using a transformer for the Z500's driving power supply, use an isolation transformer in the way shown below. Do not use an auto-transformer. Doing so may result in equipment failure.



Turning OFF the Power

Do not turn OFF the power while a message is being displayed indicating that processing is being performed. Data in memory will be destroyed, and the Z500 may not operate correctly the next time it is started.

**Using the RESET Signal**

Do not input the RESET input immediately after power is turned ON. When using the RESET input to synchronize startup timing, wait at least 1 second after the Z500's power supply is turned ON before turning ON the RESET terminal.

Securing the Video Monitor (When Using the Recommended F150-M09)

If the video monitor case is metallic, observe the following precautions to prevent noise interference, because the video monitor case is connected to the 0V line in the internal circuits.

- Do not ground the video monitor.
- Do not ground the metallic part of the connector.
- Secure the video monitor with plastic screws if it is being mounted to a metallic surface.

Warming Up

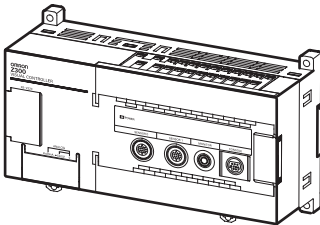
After turning ON the power supply, allow the Z500 to stand for at least 30 minutes before use. The circuits are unstable immediately after the power supply is turned ON and attempting measurement may result in inconsistent measurement values.

Confirming Package Contents

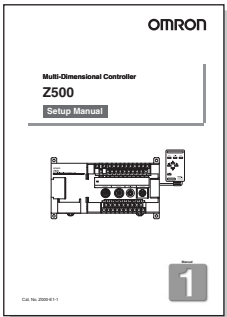
Check the contents of the package as soon as you receive the Z500.

It is extremely rare for components to be missing, but contact the nearest OMRON representative if any of the following items are missing.

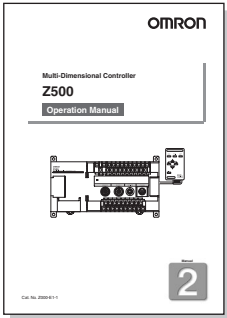
Z500 Controller Qty: 1



Manual 1: Setup Manual (This Manual) Qty: 1



Manual 2: Operation Manual Qty: 1



Editor's Note

Visual Aids

The following headings appear in the left column of the manual to help you locate different types of information.



NOTICE

Indicates information required to take full advantage of the functions and performance of the product. Incorrect application methods may result in the loss or damage to the product. Read and follow all precautionary information.



CHECK

Indicates points that are important in using product functions or in application procedures.



REFERENCE

Indicates where to find related information.



HELP

Indicates information helpful in operation.

OMRON Product References

All OMRON products are capitalized in this manual. The word "Unit" is also capitalized when it refers to an OMRON product, regardless of whether or not it appears in the proper name of the product.



Z500
Setup Manual

SECTION 1

Wiring and Connection

1-1 Basic System Configuration	20
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1-4 Power Supply and Ground	26

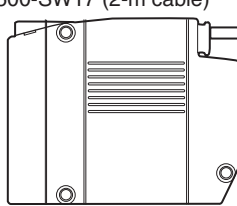
1-1 Basic System Configuration



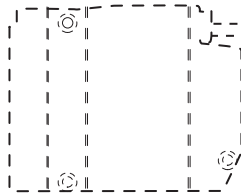
NOTICE

- The following diagram shows the basic Z500 system configuration. Some of the components shown in the configuration diagram are special OMRON products that cannot be substituted with comparable devices. These items are indicated with an asterisk.
- Always turn OFF the power supply before connecting or disconnecting cables. The peripheral device may be damaged if connected or disconnected with the power supply turned ON.

- * **Sensor**
Z500-SW2T (2-m cable)
Z500-SW6 (Can be connected to controller of Ver. 1.2 or upper grade; 0.5-m cable)
Z500-SW17 (2-m cable)



- * **Sensor Extension Cable**
Z309-SC1R (1.5 m, 3 m, 6 m, 8 m or 13 m)
Specify the required cable length when ordering.



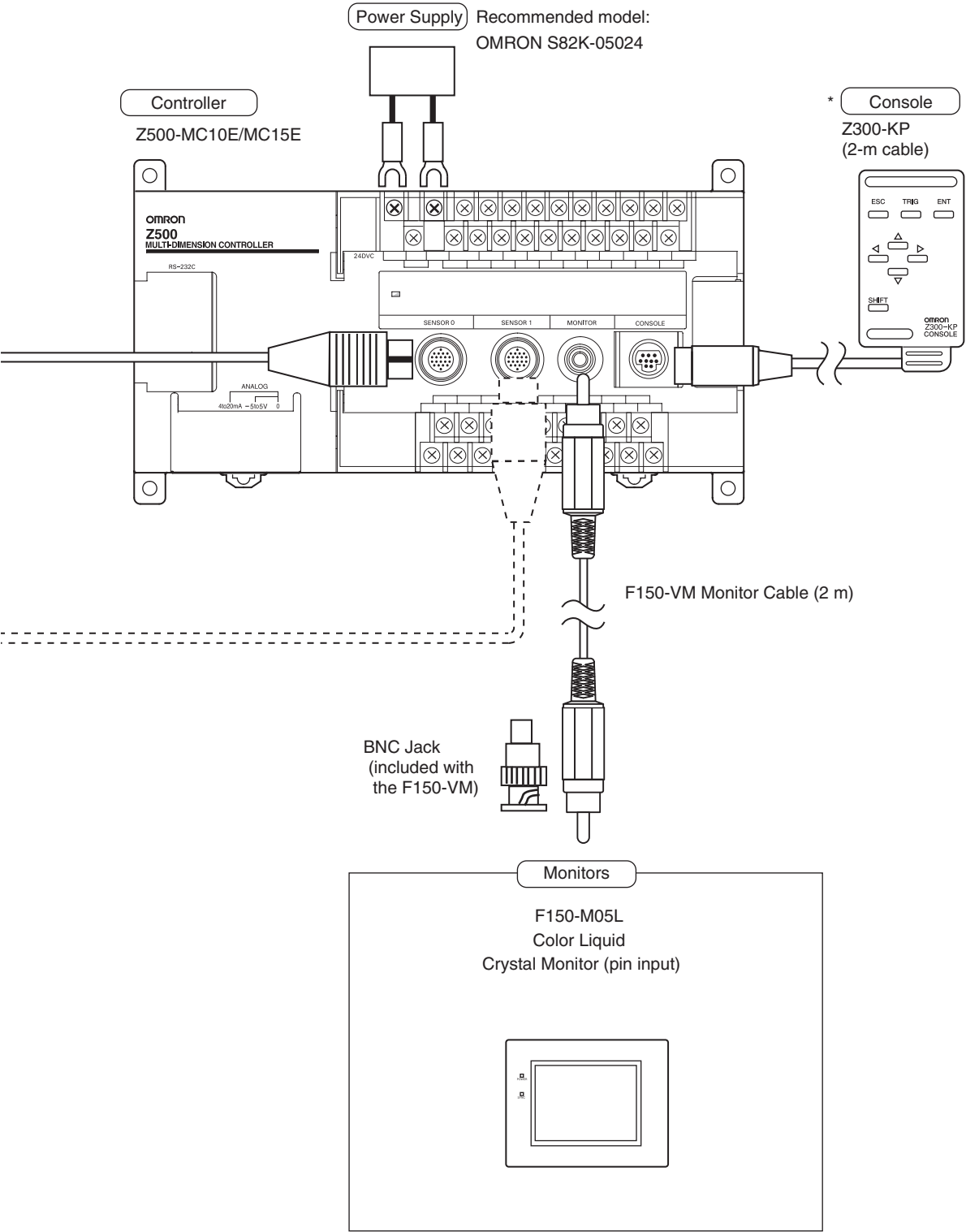
CHECK

- Up to 2 Sensors can be connected.
- To replace the sensor being connected to the controller, turn OFF the download function.



REFERENCE

Refer to page 146 in the *Operation Manual*.

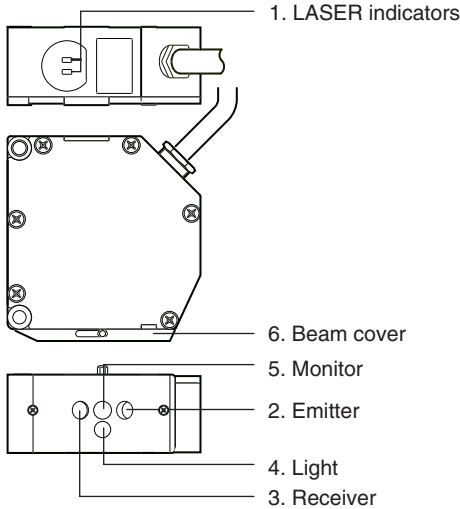


The Monitor is used to check the image and display menu where making settings.

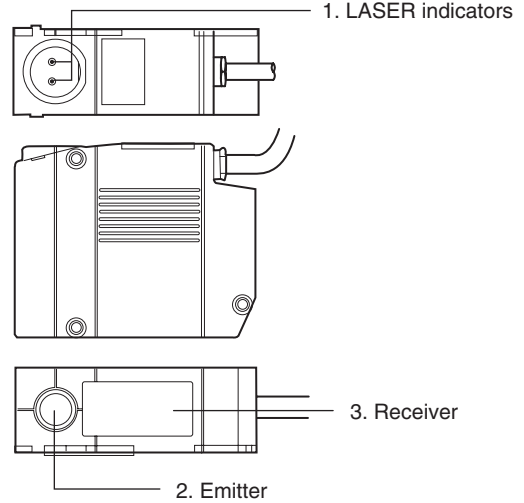
1-2 Component Names and Functions

1-2-1 Sensor

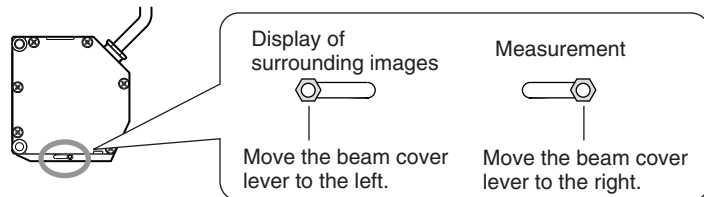
Z500-SW2T



Z500-SW6/Z500-SW17



1. Provides laser beam warning indicators.
 - For 15 to 25 seconds after the power supply is turned ON, both indicators will be OFF indicating that the laser beam is OFF.
 - When the laser beam turns ON, both indicators will light.
 - When the laser beam turns OFF, both indicators will turn OFF.
2. Emits laser beam.
3. Receives laser beam.
4. Light used when displaying surrounding images.
5. Captures surrounding images.
6. Used for switching between display of surrounding images and measurement. To display surrounding images, move the beam cover lever to the left. To perform measurement, move the lever to the right.

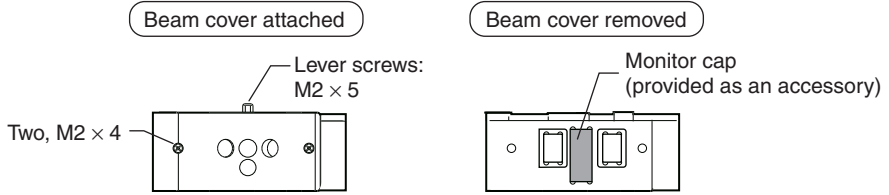


Tighten the lever screws with a flat-bladed screwdriver to a torque in the range 0.15 to 0.3 N·m (1.5 to 3 kgf·cm).



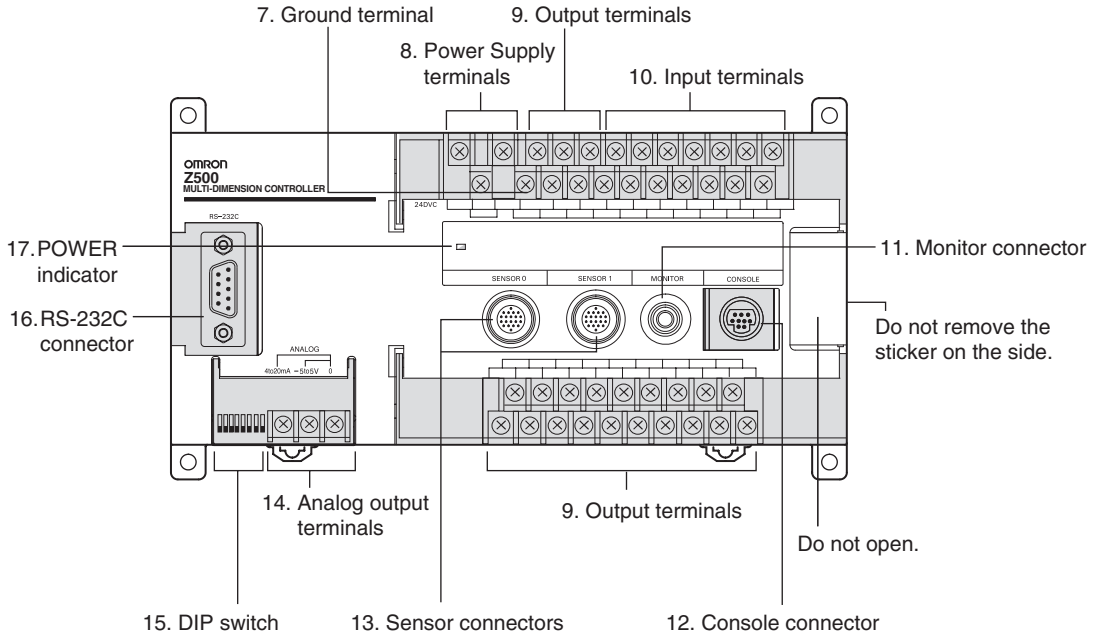
When Using the Z500-SW2T

- When performing measurement with the beam cover removed, attach the monitor cap provided with the Sensor over the Light and Monitor in the way shown on the next page.
- When displaying surrounding images, be sure to attach the beam cover. Surrounding images cannot be displayed correctly without the beam cover attached.



1-2-2 Controller

Z500-MC10E/MC15E



Shading indicates parts that are lifted to see the terminals underneath.

- 7. Connected to the ground wire.
- 8. Connected to the power supply.
- 9. Connected to external devices such as a PLC.
- 10. Connected to external devices such as a PLC.
- 11. Connected to the monitor.
- 12. Connected to a console.
- 13. Connected to the sensor.
- 14. Connected when using analog output.
- 15. Do not use. (Turn OFF the DIP switch.)
- 16. Connected to external devices such as a personal computer or PLC.
- 17. Lit while power is ON.

1-3 Connecting Peripheral Devices

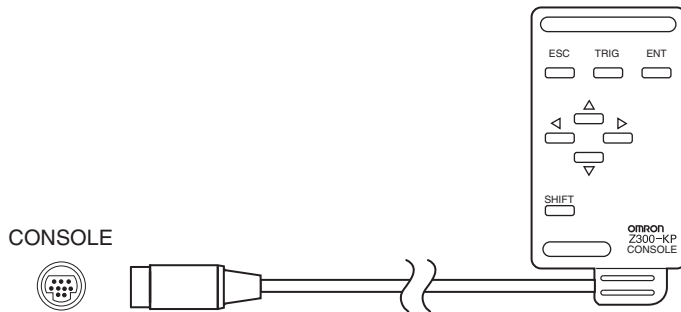
This section shows how to connect peripheral devices to the Z500.



- Be sure to turn OFF the power supply before connecting or disconnecting cables. The peripheral device may be damaged if connected or disconnected with the power supply turned ON.
- The connector for each peripheral device is capped when the Z500 is shipped. For a connector not in use, leave the cap in place to protect against dust, dirt, and static electricity.

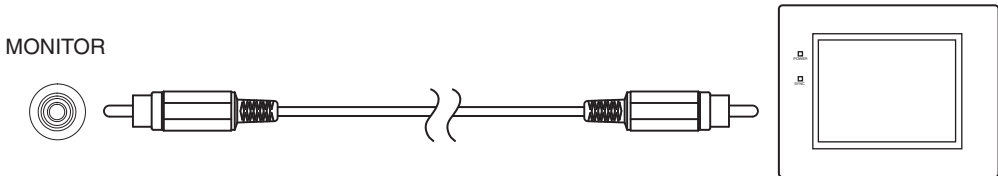
1-3-1 Connecting a Console

Connect the Z300-KP console to the Z500's CONSOLE connector.



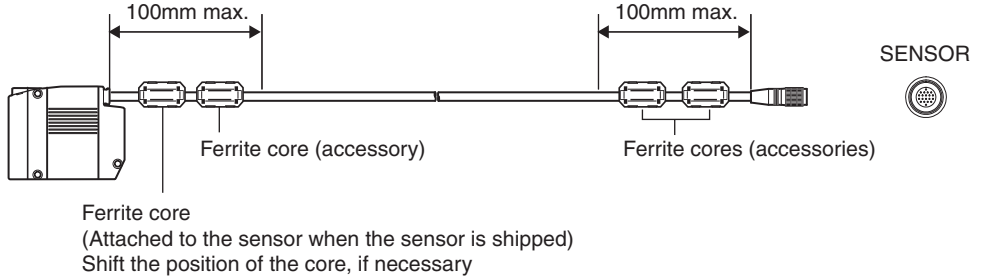
1-3-2 Connecting a Monitor

Connect the F150-VM monitor cable to the Z500's MONITOR connector.

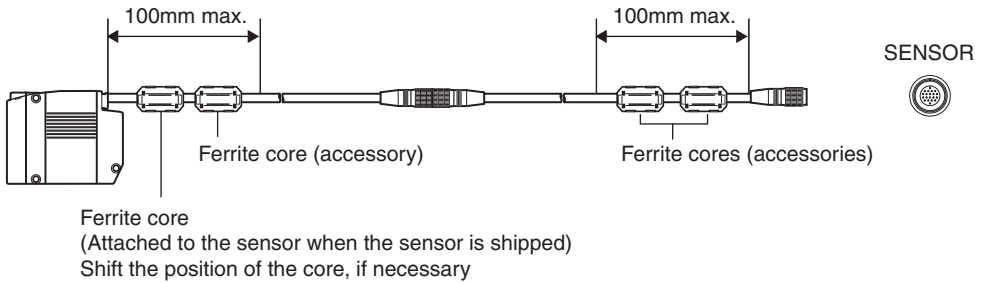


1-3-3 Connecting a Sensor

Be sure to attach the three ferrite cores (the sensor's accessories) to the sensor cable. Two ferrite cores should be attached to the cable within 100 mm of the controller's SENSOR connector, and another two should be attached within 100 mm of the sensor.



When using an extension cable, attach two ferrite cores to the cable within 100 mm of the sensor, and another two within 100 mm of the controller's connector.



1-4 Power Supply and Ground

Wire the power supply and the ground to their respective terminals. Tighten the screws to a torque of between 0.5 and 0.6 N·m. After wiring, confirm that the wiring is correct.



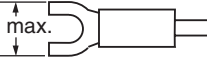

NOTICE

Re-cover the terminal blocks with the Terminal Block Protection Covers. Uncovered terminal blocks can result in electric shock.

1-4-1 Crimp Terminals and Cables

The terminal block uses M3 terminal screws. Use appropriate crimp terminals for M3 screws as shown below.

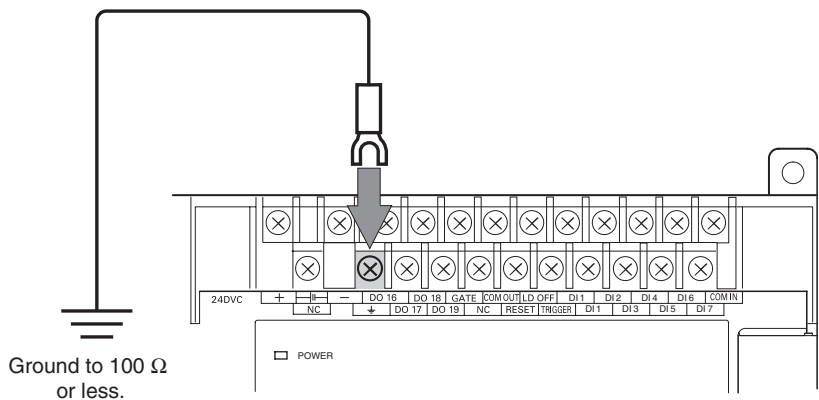
Recommended Crimp Terminals

Type	Manufacturer	Model	Recommended wire size
Forked 	J.S.T. Mfg Co., Ltd.	V1.25-N3A	1.31 to 1.65 mm ²
Round 	J.S.T. Mfg Co., Ltd.	V1.25-MS3	

1-4-2 Ground Wiring

To avoid grounding problems, do not share the ground wire with any other devices or wire the ground to the building's steel framing. Always connect a ground wire to the Z500's ground terminal.

Use a grounding point that is as close as possible and keep the ground wiring as short as possible.



1-4-3 Wiring the Power Supply

Wire the Power Supply Unit independently of other devices. In particular, keep the power supply wired separately from inductive loads.

Use a power supply that meets the following specifications.

Recommended Power Supply

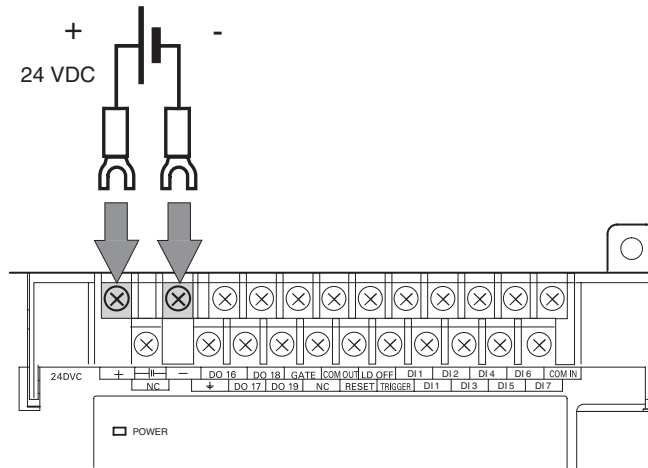
Output current	Power supply voltage
1.6 A min.	24 VDC (21.6 to 26.4VDC)

Recommended Model

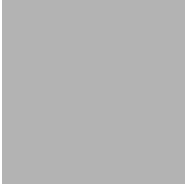
Manufacturer	Model
OMRON Corp.	S82K-05024



- Use a DC power supply with countermeasures against high-voltage spikes (safe extra low-voltage circuits on the secondary side). Excessively high voltages can result in electric shock.
- If UL recognition is required, use a UL class II power supply.
- Keep the power supply wiring as short as possible (less than 10 m).



MEMO



Z500
Setup Manual

SECTION 2

Installation

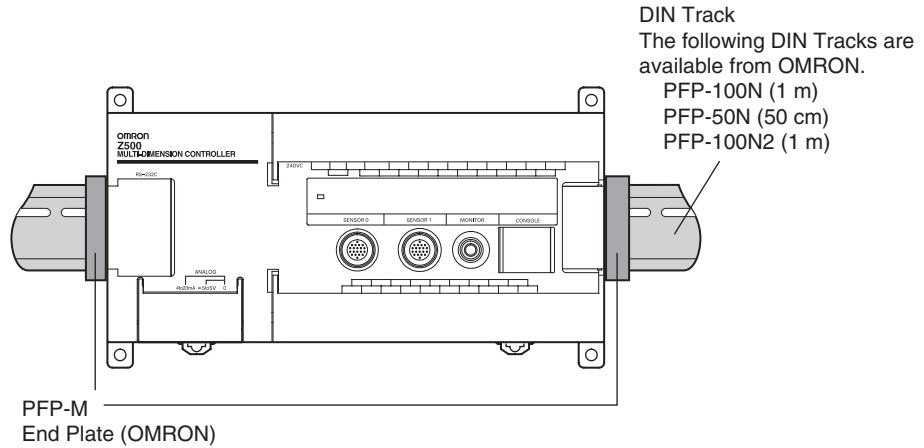
2-1 Mounting the Controller	30
2-2 Mounting the Sensor	32

2-1 Mounting the Controller

There are two ways to mount the Controller: DIN Track mounting or surface-mounting.

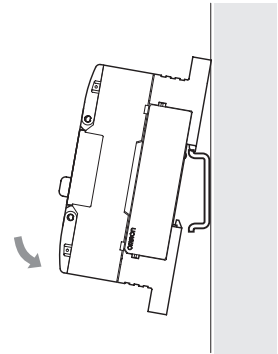
2-1-1 DIN Track Mounting

The Controller can be easily mounted to or removed from 35-mm DIN Track.



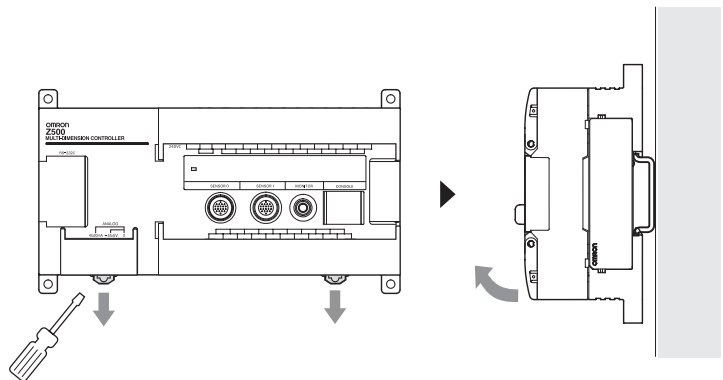
Mounting the Controller

Hook the Controller into the DIN Track as shown in the diagram and then press in at the bottom until the Controller locks into place.

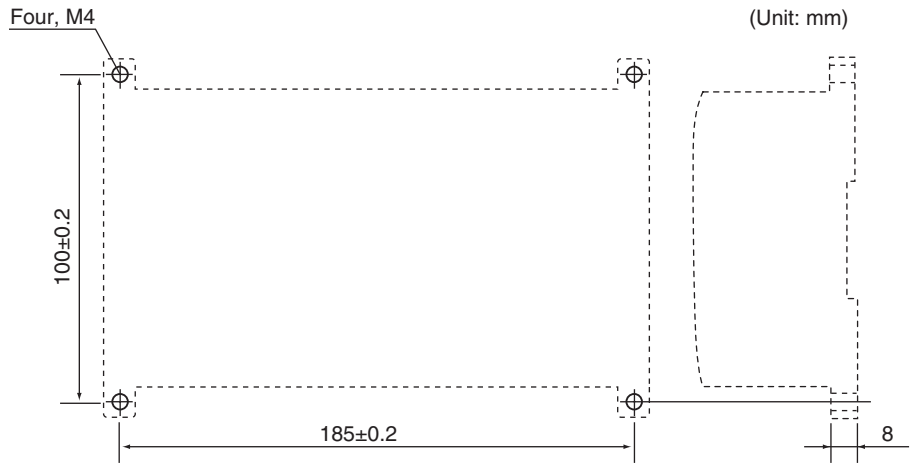


Removing the Controller

Use a flat-bladed screwdriver to pull the hook down and then pull out the Controller from the bottom.



2-1-2 Surface Mounting



2-2 Mounting the Sensor

Up to 2 Sensors can be connected per Controller.



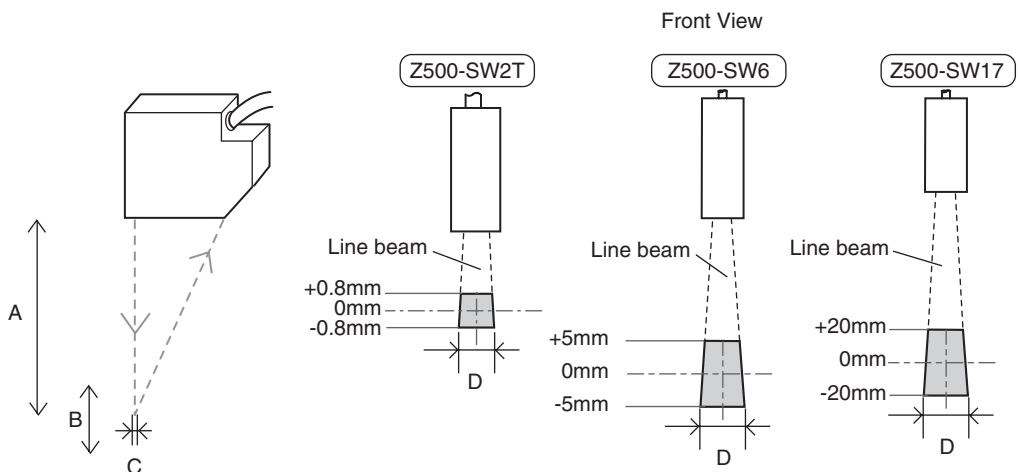
Only controllers designed specifically for the Z500 can be used.
Using another type of controller may result in damage to the sensor or controller.

2-2-1 Sensor Types

Type	Distance to measurement center (A)	Measurement range		Spot diameter (C)
		Height (B)	Width (D)	
Super High-precision Model Z500-SW2T	20 mm	±0.8 mm	B= +0.8 mm : 4.0 mm (The width of the measurement region is 2.2 mm.) B= 0 mm : 4.0 mm (The width of the measurement region is 2.3 mm.) B= -0.8 mm : 4.0 mm (The width of the measurement region is 2.4 mm.)	B= +0.8 mm : 40 μm B= 0 mm : 20 μm B= -0.8 mm : 40 μm
Z500-SW6	50 mm	±5 mm	B= + 5 mm : 23.0 mm (The width of the measurement region is 6.0 mm) B= 0 mm : 24.0 mm (The width of the measurement region is 6.3 mm) B= - 5 mm : 26.0 mm (The width of the measurement region is 6.8 mm)	B= + 5 mm : 140 μm B= 0 mm : 30 μm B= - 5 mm : 140 μm
Long-range Model Z500-SW17	100 mm	±20 mm	B= +20 mm : 40 mm (The width of the measurement region is 14.5 mm.) B= 0 mm : 45 mm (The width of the measurement region is 17.3 mm.) B= -20 mm : 50 mm (The width of the measurement region is 20.1 mm.)	B= +20 mm : 280 μm B= 0 mm : 60 μm B= -20 mm : 280 μm

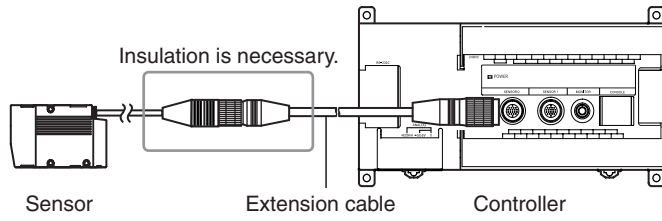


Distance to measurement center (A), Height (B), Width (D), and Spot diameter (C)



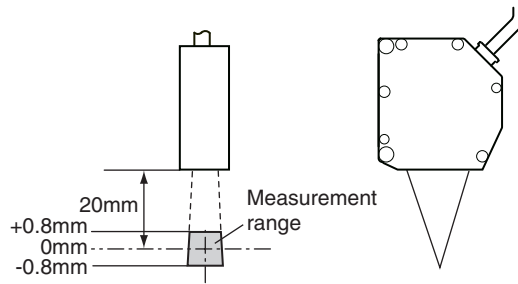


If the connector chassis of a sensor or extension cable makes contact with a noise source, operation may not proceed normally. Insulate the connector chassis before use.

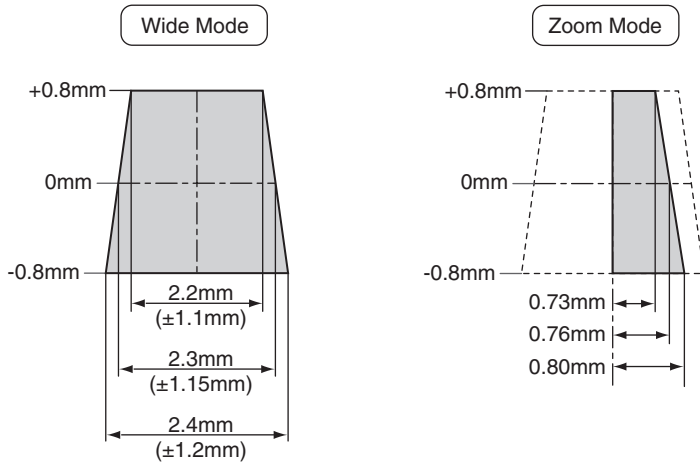


2-2-2 Measurement Range

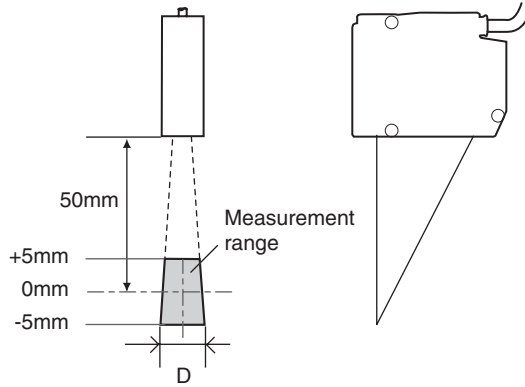
Super High-precision Model: Z500-SW2T



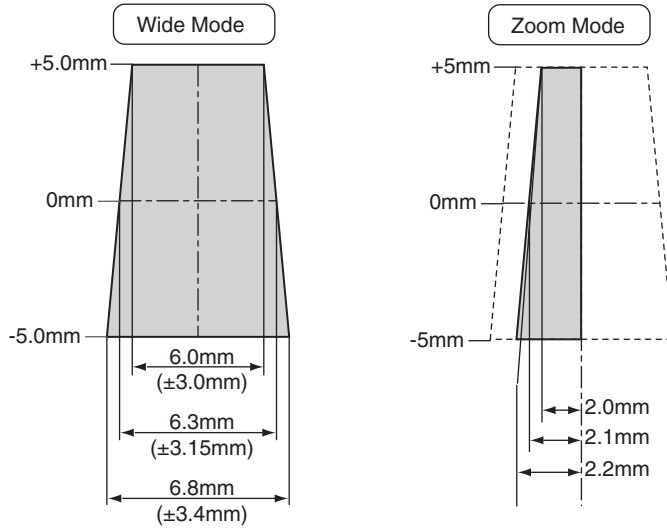
Relation between Measurement Mode and Measurement Range



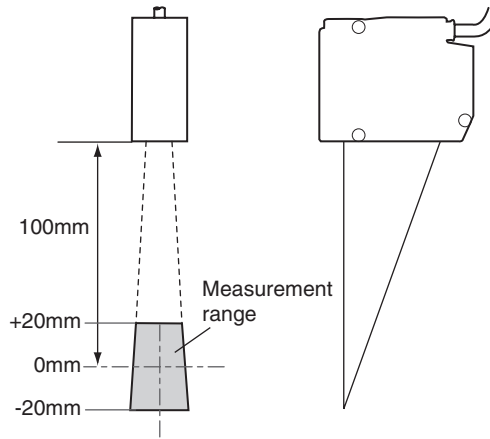
Z500-SW6



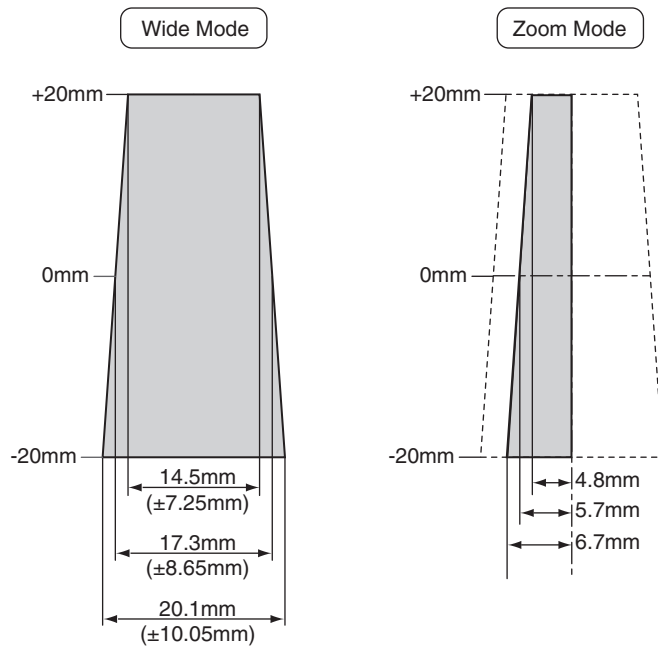
Relation between Measurement Mode and Measurement Range



Long-range Model: Z500-SW17



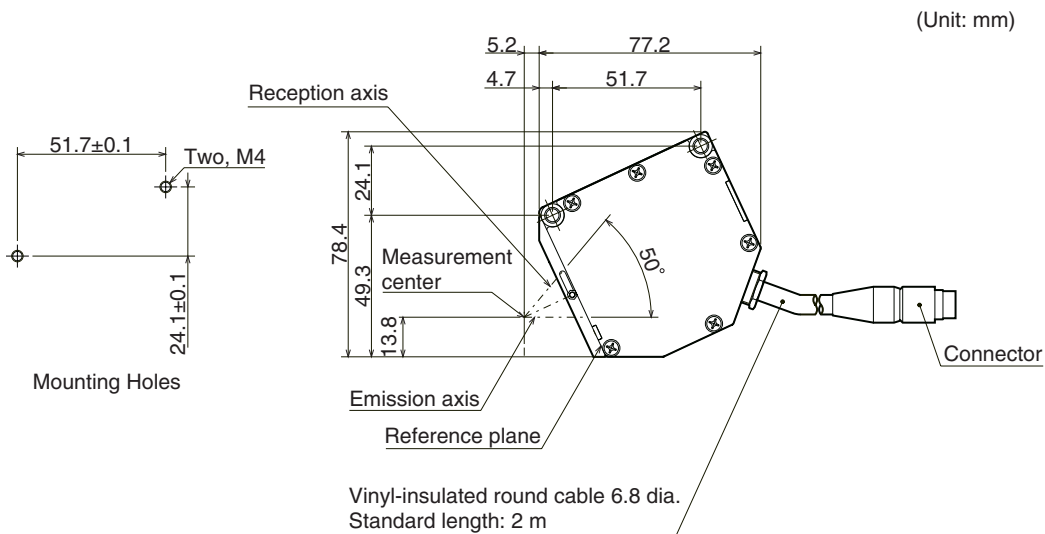
Relation between Measurement Mode and Measurement Range



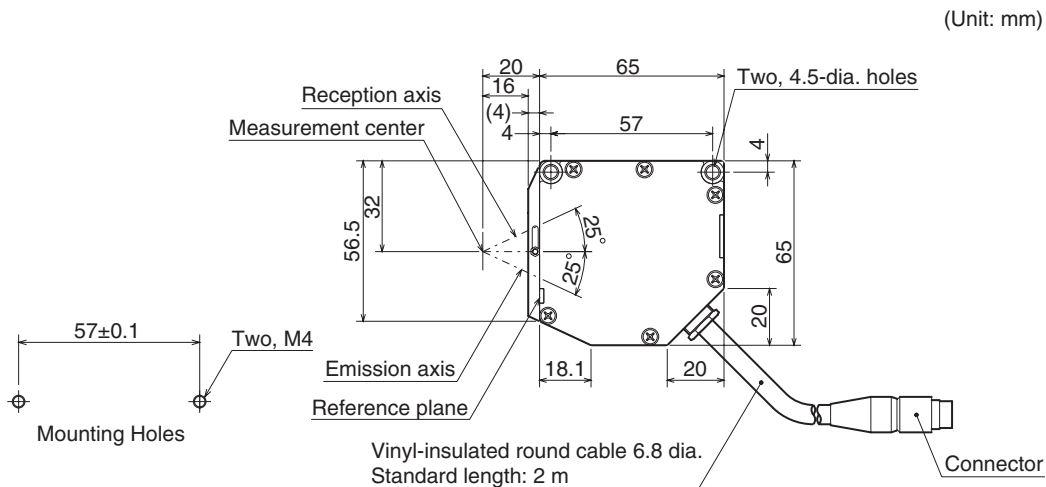
2-2-3 Mounting Dimensions

Super High-precision Model: Z500-SW2T

• Dimensions for Diffuse Reflection

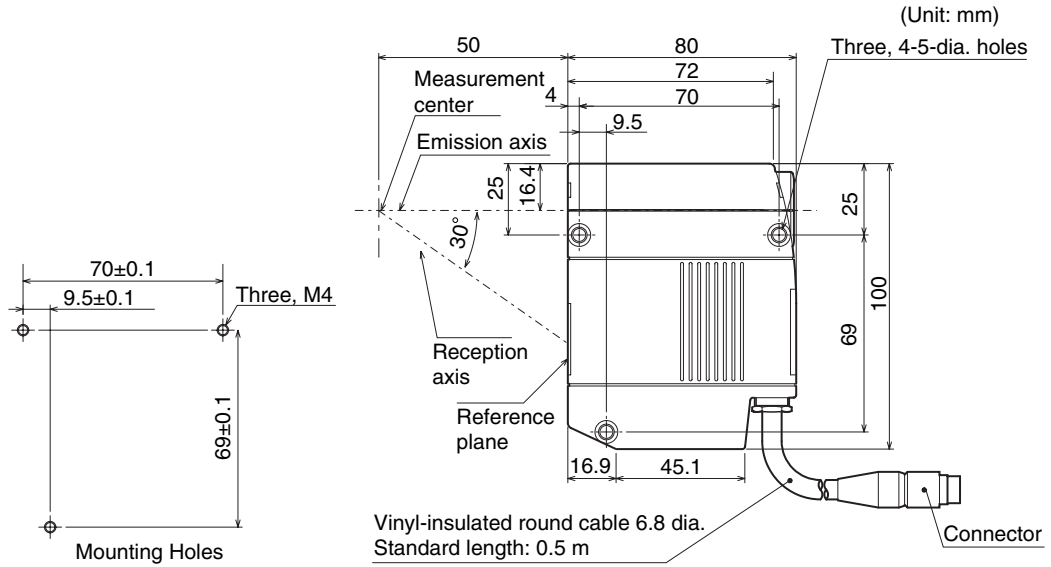


• Dimensions for Mirror Reflection

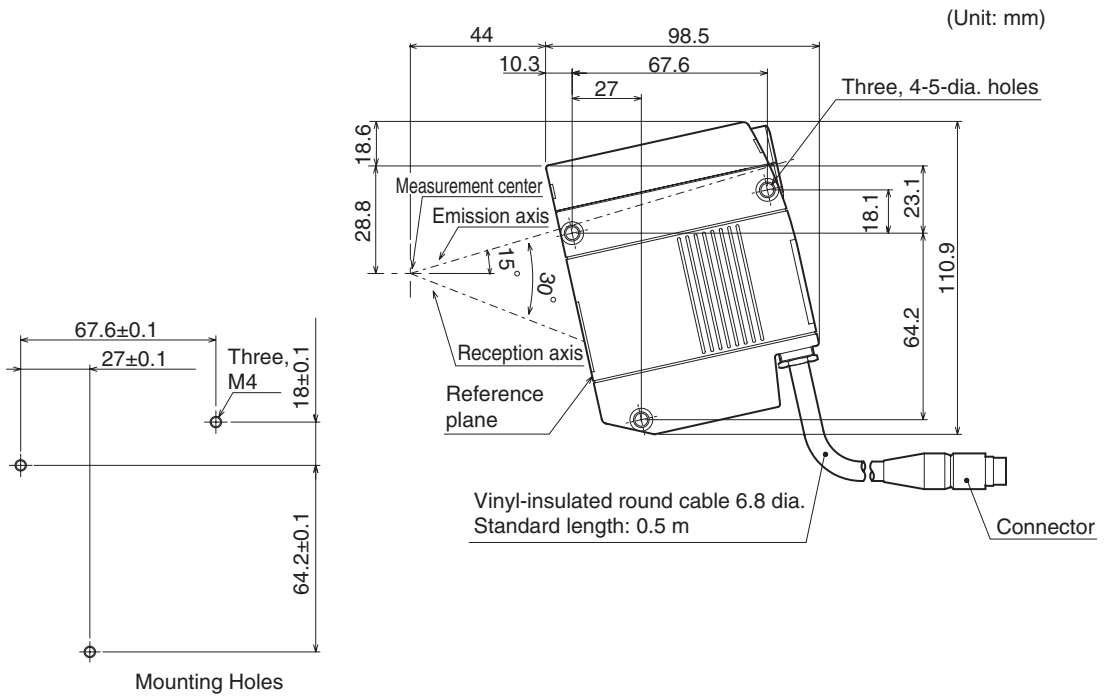


Z500-SW6

• Dimensions for Diffuse Reflection

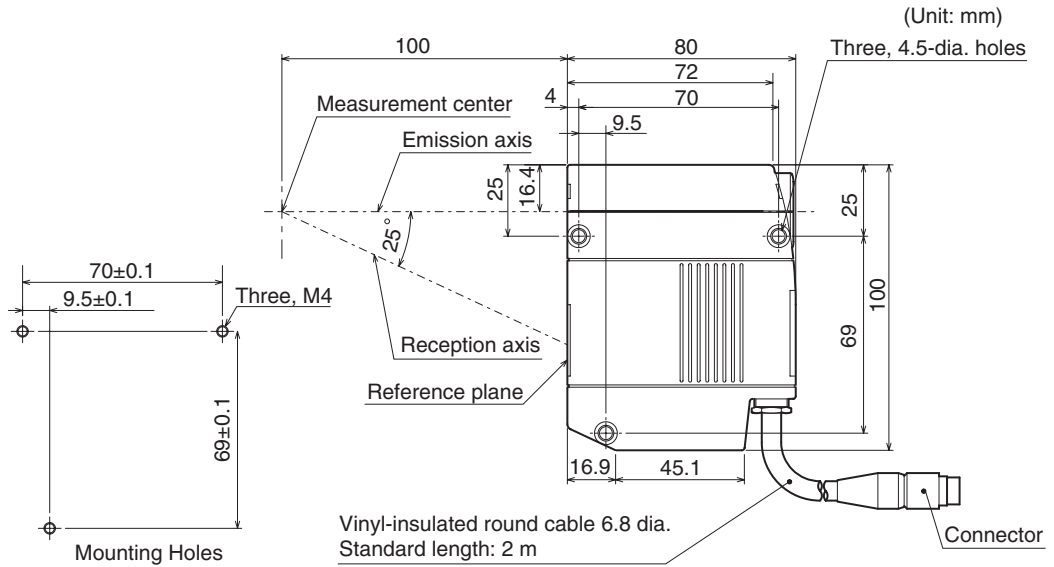


• Dimensions for Mirror Reflection

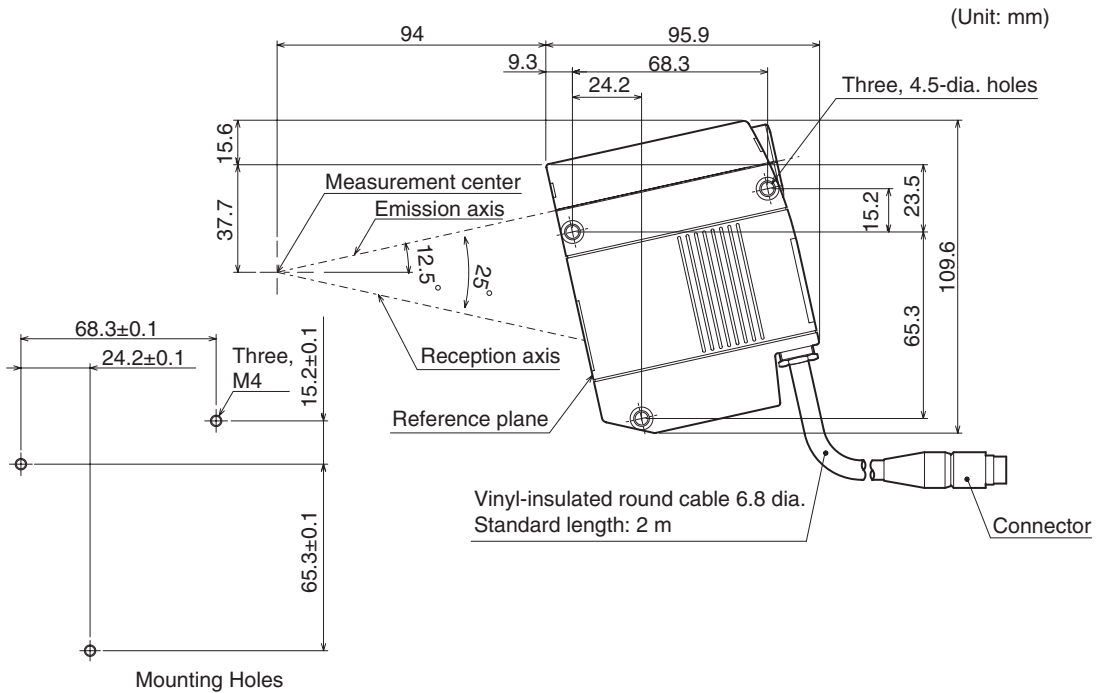


Long-range Model: Z500-SW17

• Dimensions for Diffuse Reflection



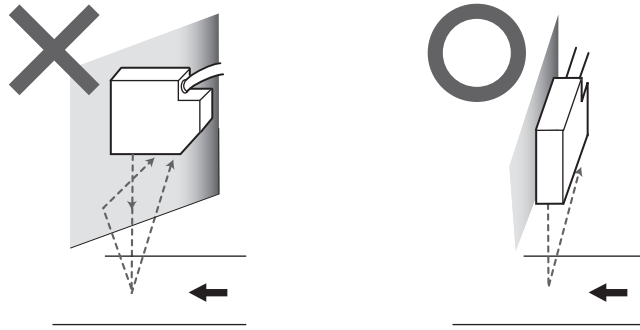
• Dimensions for Mirror Reflection



2-2-4 Mounting Orientation

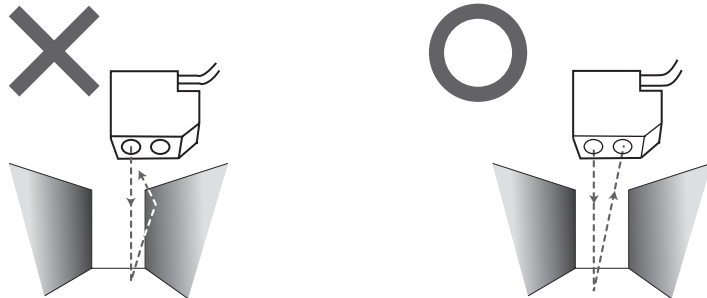
Mounting Near Walls

Errors will occur if light reflected off a wall surface is received by the Sensor. If it is not possible to mount the Sensor away from the wall, mount in the way shown below, i.e., so that the plane containing the emission axis and the reception axis is parallel to the wall surface. Also, applying matt black coating to the wall surface will help to reduce the amount of light reflected.



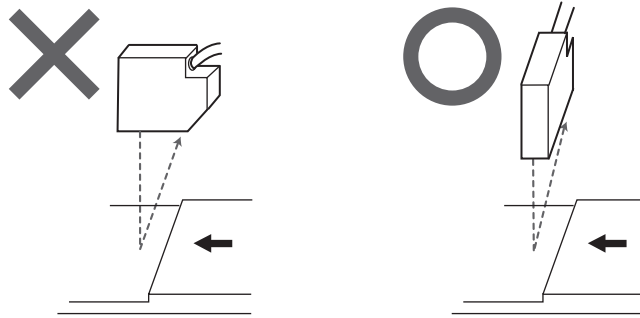
Narrow Grooves or Indentations

If measurement is performed in an indentation between two walls, or in a groove, mount the Sensor in the way shown below, i.e., so that the path along the emission and reception axes is not interrupted by a wall.



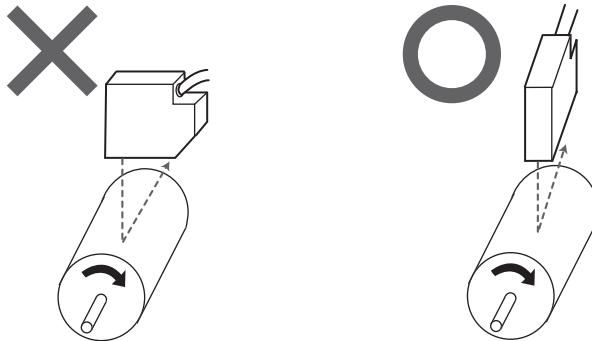
Level Differences

When measuring workpieces with level differences, the influence of the level difference can be minimized by mounting the Sensor so that the plane containing the emission axis and the reception axis is parallel to the boundary between the different levels.



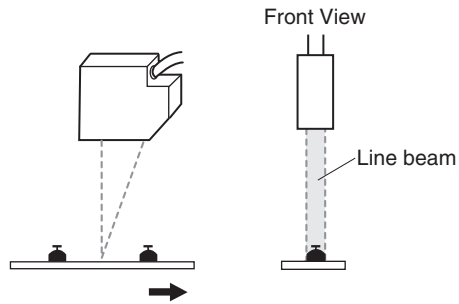
Rotating Workpieces

When measuring rotating workpieces, the influence of position displacement and blurring of the rotating workpiece can be minimized by mounting the Sensor so that the plane containing the emission axis and the reception axis is parallel to the axis of rotation.



Projections

When measuring the tops of projections on the workpieces, mount the Sensor so that the entire projection passes through the line beam.



2-2-5 Mounting Distance

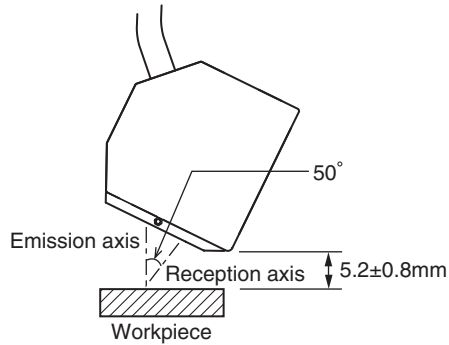
After selecting the Sensor mounting status in the menu item **Environment**, mount the Sensor in a location where the status can be measured correctly.

 **REFERENCE**

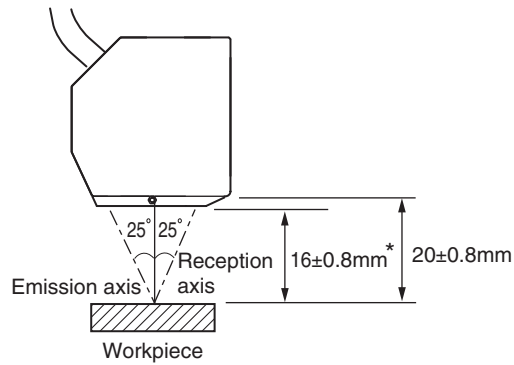
Refer to page 146 in the *Operation Manual*.

Super High-precision Model: Z500-SW2T

- Dimensions for Diffuse Reflection



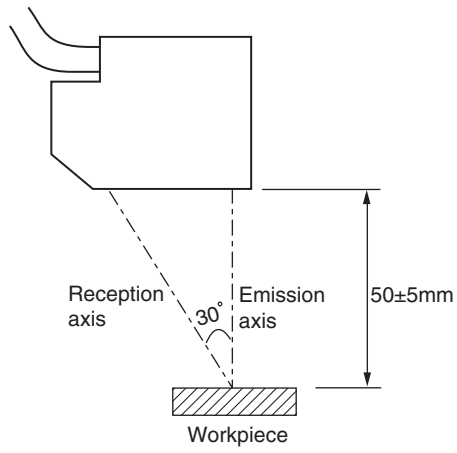
- Dimensions for Mirror Reflection



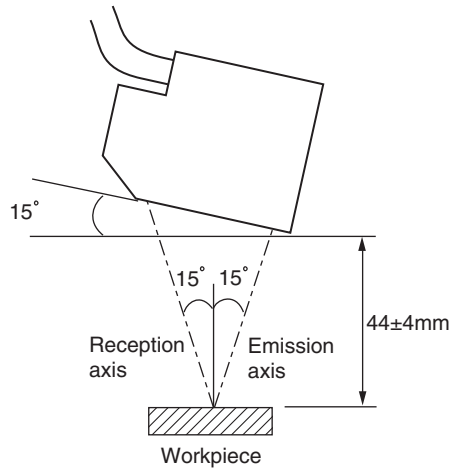
* Beam cover attached

Z500-SW6

• **Dimensions for Diffuse Reflection**

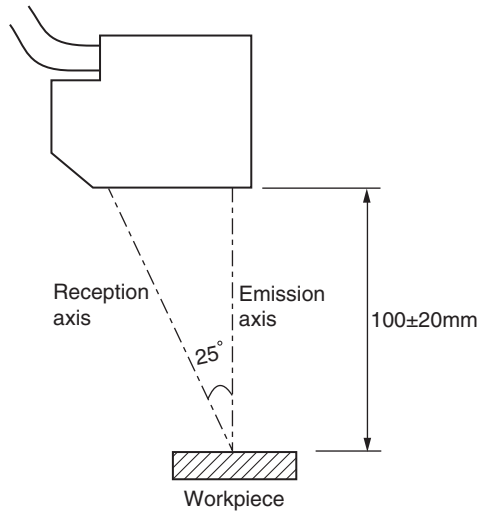


• **Dimensions for Mirror Reflection**

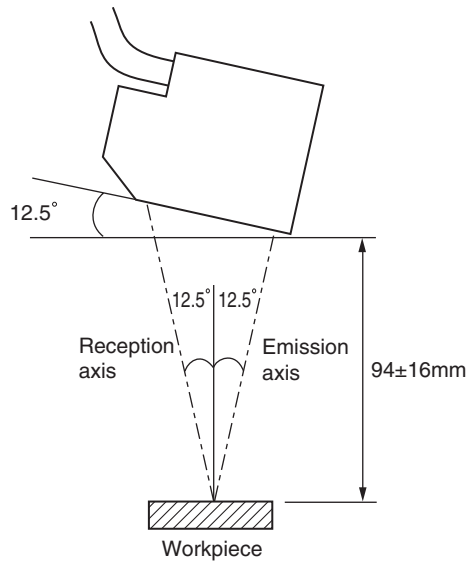


Long-range Model: Z500-SW17

• Dimensions for Diffuse Reflection



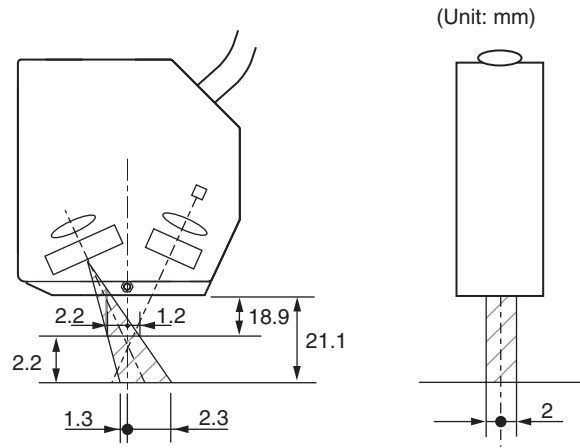
• Dimensions for Mirror Reflection



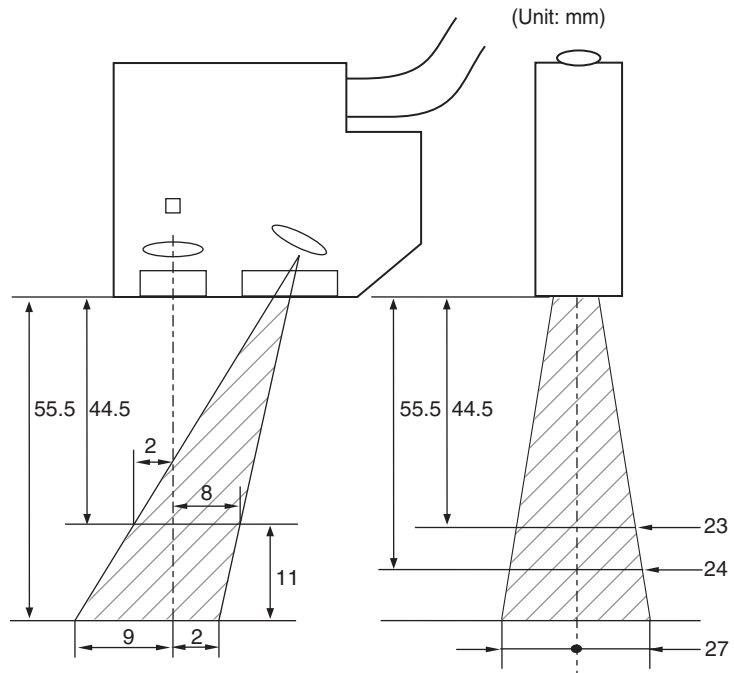
2-2-6 Mutual Interference

When using 2 or more Sensors mounted adjacently, make sure that the spots (shown below) for other Sensors are outside the shaded areas.

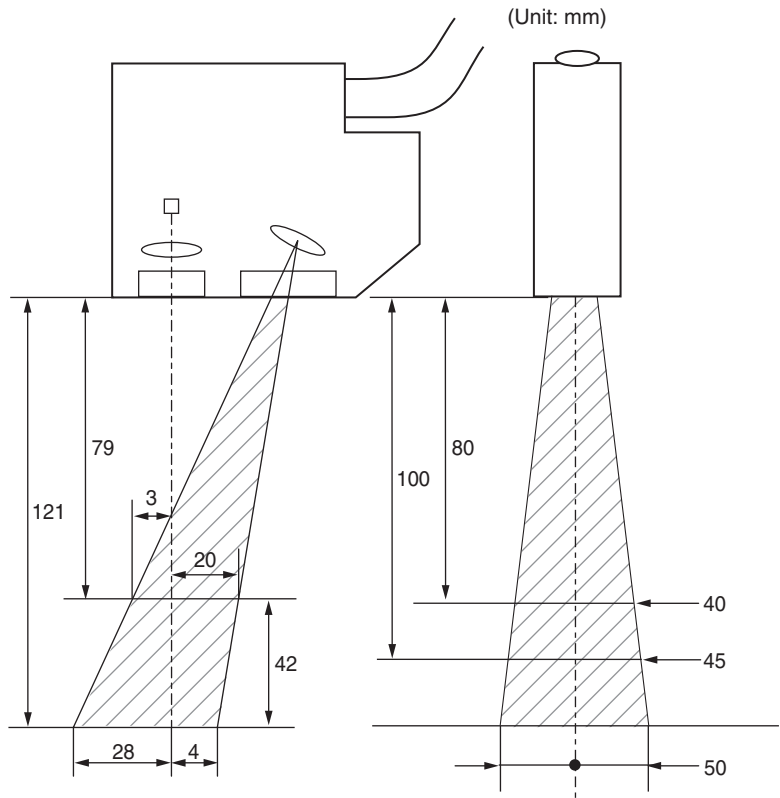
Super High-precision Model: Z500-SW2T

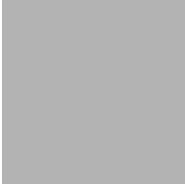


Z500-SW6



Long-range Model: Z500-SW17





Z500
Setup Manual

SECTION 3

Connecting External Devices

3-1 Terminal Block Connections	48
3-2 RS-232C Connections	52
3-3 Linear Sensor Controller Connections	54

3-1 Terminal Block Connections

This section explains how to connect I/O to the Z500 through its terminal block to input signals such as measurement commands or output signals such as measurement results.

Refer to the *Operation manual* for details on I/O formats.



NOTICE

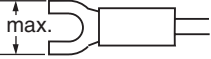

Re-cover the terminal blocks with the Terminal Block Protection Covers. Uncovered terminal blocks can result in electric shock.

3-1-1 Crimp Terminals and Cables

The terminal block uses M3 terminal screws.

Use appropriate crimp terminals for M3 screws as shown below. Tighten the screws to a torque of between 0.5 and 0.6 N·m.

Recommended Crimp Terminals

Type	Manufacturer	Model	Recommended wire size
Forked 	J.S.T. Mfg Co., Ltd.	V1.25-N3A	1.31 to 1.65 mm ²
Round 	J.S.T. Mfg Co., Ltd.	V1.25-MS3	

3-1-2 Internal Specifications



Use a DC power supply with countermeasures against high-voltage spikes (safe extra low-voltage circuits on the secondary side). Excessively high voltages can result in electric shock.

Input Specifications

Item	Specification	
Model	Z500-MC10E (NPN mode)	Z500-MC15E (PNP mode)
Input voltage	12 to 24 VDC \pm 10%	
ON current (See note 1)	5 to 15 mA	
ON voltage (See note 1)	8.8 V max.	
OFF current (See note 2)	0.1 mA max.	
OFF voltage (See note 2)	4.5 V min.	
ON delay	RESET input: 10 ms max. Other inputs: 0.5 ms max	
OFF delay	RESET input: 15 ms max. Other inputs: 0.7 ms max.	
Internal circuits		

Output Specifications

Item	Specification	
Model	Z500-MC10E (NPN mode)	Z500-MC15E (PNP mode)
Output voltage	12 to 24 VDC \pm 10%	
Load current	45 mA max.	
ON residual voltage	2 V max.	
OFF leakage current	0.1 mA max.	
Internal circuits		



Do not exceed the maximum load current specified for the Controller.

Note 1: ON Current/ON Voltage

This refers to the current or voltage values needed to shift from the OFF→ON state.

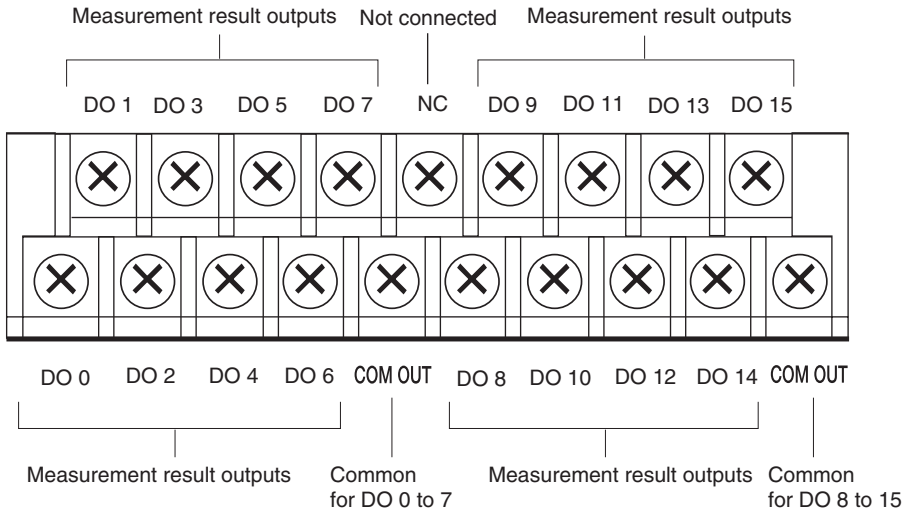
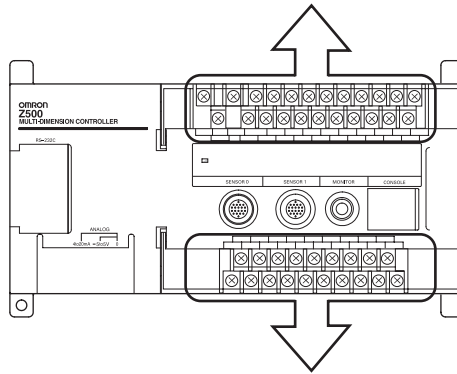
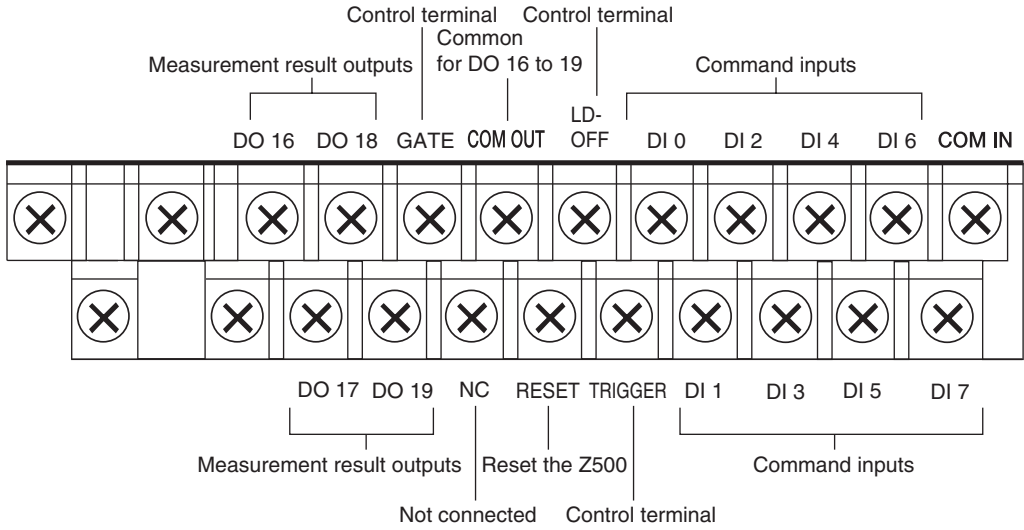
The ON voltage value is the potential difference between each of the input terminals and COM IN.

Note 2: OFF Current/OFF Voltage

This refers to the current or voltage values needed to shift from the ON→OFF state.

The OFF voltage value is the potential difference between each of the input terminals and COM IN.

3-1-3 Terminal Names



Refer to page 154 in the *Operation Manual* for details on control terminal function.



NOTICE

- Do not reverse the connections of the signal terminals and COM terminals.
- Using the RESET Signal
Do not input the RESET input immediately after turning ON the power. When using RESET input to synchronize startup timing, wait at least 1 second after turning ON the Z500's power supply before turning ON the RESET terminal.



CHECK

The initial status of the output terminals is OFF. The terminals, however, may turn ON for approximately 0.5 seconds when the power is turned ON.
Be sure to allow for this when connecting to an external device.

3-2 RS-232C Connections

The Z500's RS-232C port can be used to connect input signals such as measurement triggers or output signals such as measurement results. Additionally, data that has been set in the Z500 can be backed up in a personal computer.

Refer to the *Operation manual* for details on communications settings and I/O formats.



NOTICE

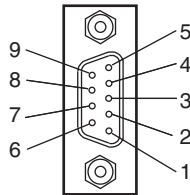
In some situations, the RS-232C terminal transmits signals whether the power supply is ON, OFF, or RESET.

Be sure to allow for this when connecting to an external device.

3-2-1 Connector

The Z500's RS-232C connector uses 9-pin D-SUB female connectors.

Pin arrangement



Pin No.	Signal	Function
1	FG (GND)	Protective frame ground
2	SD (TXD)	Send Data
3	RD (RXD)	Receive Data
4	RS (RTS)	Request to Send
5	CS (CTS)	Clear to Send
6	NC	Not connected
7	NC	Not connected
8	NC	Not connected
9	SG (GND)	Signal ground

Use a compatible connector.

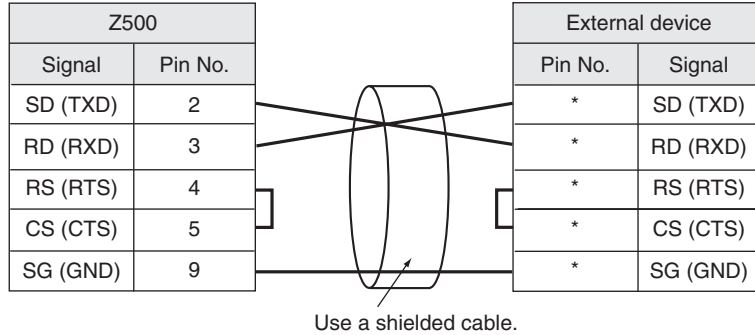
Recommended Plug and Hood

Type	Manufacturer	Model
Plug	OMRON Corp.	XM2A-0901
Hood	OMRON Corp.	XM2S-0911

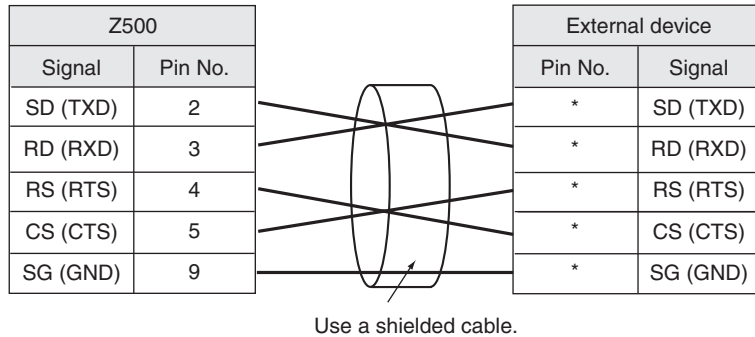
3-2-2 Wiring

The maximum cable length is 15 m.

Standard Wiring



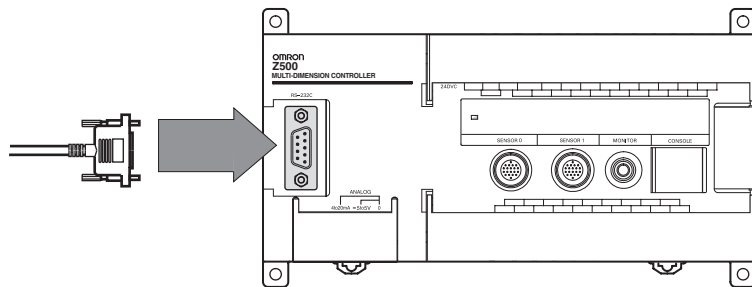
Wiring for RS/CS Control



* Pin numbers on the external device will depend on the device being connected. Refer to the manual for the personal computer or PLC being connected.

3-2-3 Connection

Align the connector with the socket and press the connector straight into place. Tighten the two screws on the edges of the connector.



NOTICE

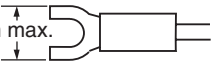
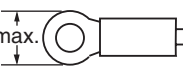
- Always turn OFF the power supply before connecting or disconnecting cables. The peripheral device may be damaged if connected or disconnected with the power supply turned ON.
- Always tighten the connector screws.

3-3 Linear Sensor Controller Connections

3-3-1 Crimp Terminals and Cables

The terminal block uses M3 terminal screws.
Use appropriate crimp terminals for M3 screws as shown below.
Tighten the screws to a torque of between 0.5 and 0.6 N·m.

Recommended Crimp Terminals

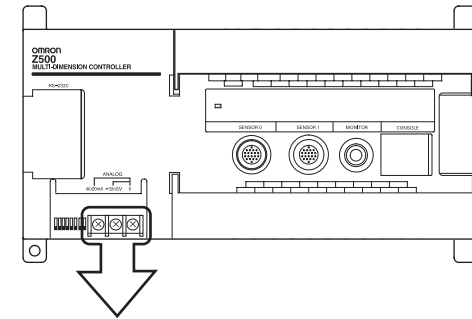
Type	Manufacturer	Model	Recommended wire size
Forked 6.0 mm max. 	J.S.T. Mfg Co., Ltd.	V1.25-B3A	1.31 to 1.65 mm ²
Round 6.0 mm max. 	J.S.T. Mfg Co., Ltd.	V1.25-MS3	

3-3-2 Terminal Names



NOTICE

Re-cover the terminal blocks with the Terminal Block Protection Covers. Uncovered terminal blocks can result in electric shock.

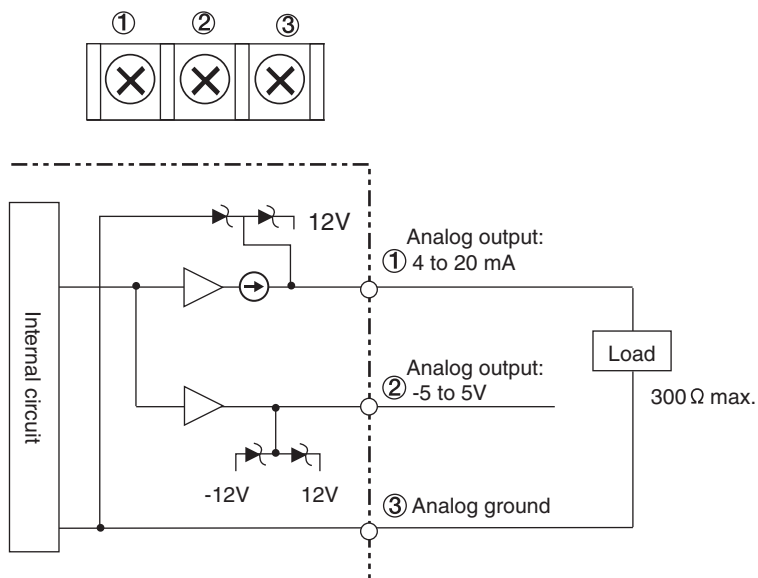


— Analog output ground connected to input devices.

— Analog output terminal for voltage output in the range -5 to 5 V.

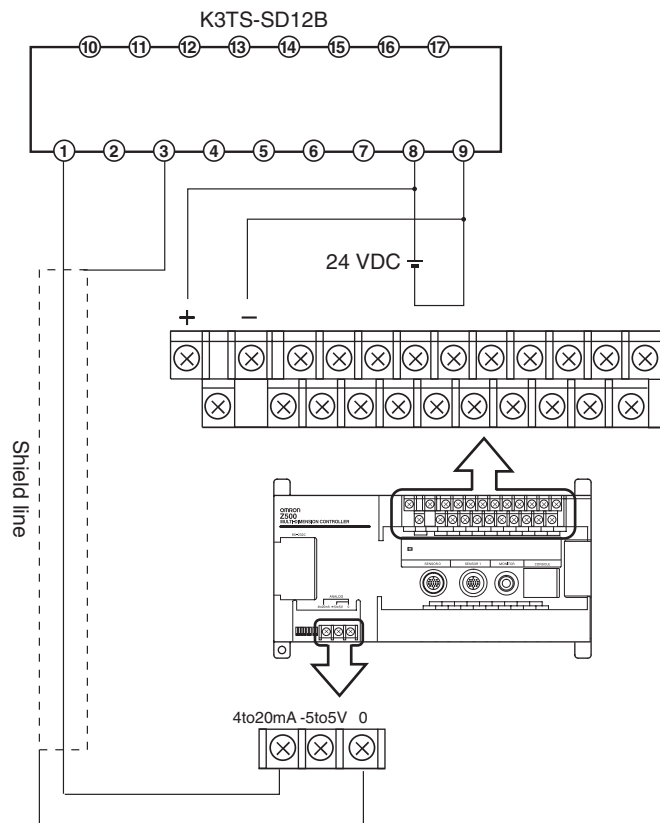
— Analog output terminal for current output in the range 4 to 20 mA.

3-3-3 Internal Specifications

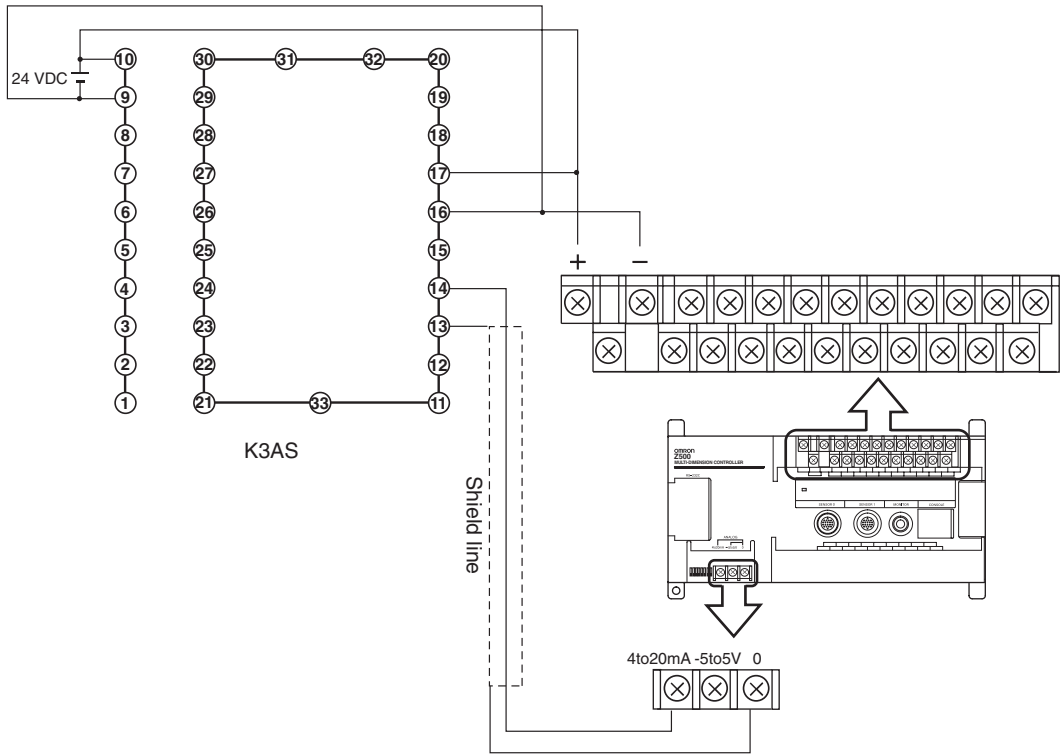


3-3-4 Connection Examples for the Linear Sensor Controller

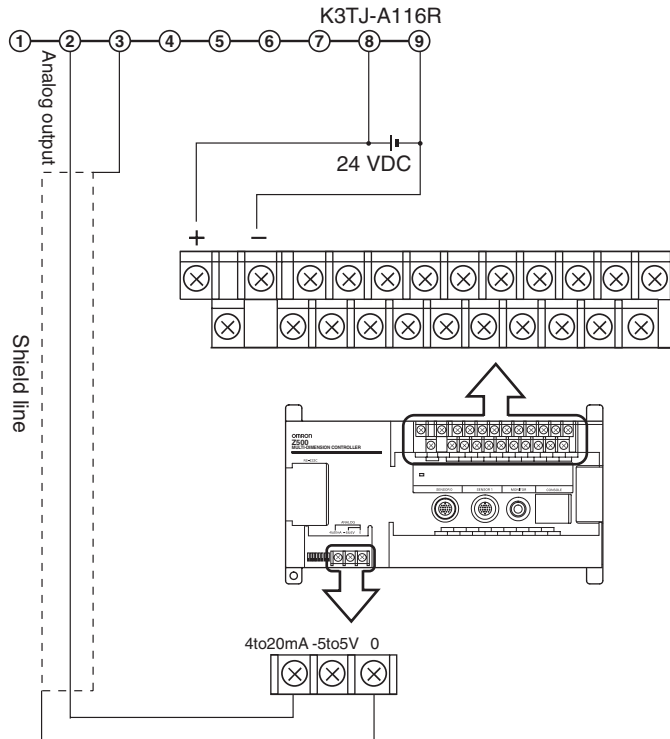
Connecting to the Linear Sensor Digital Panel Meter (K3TS)



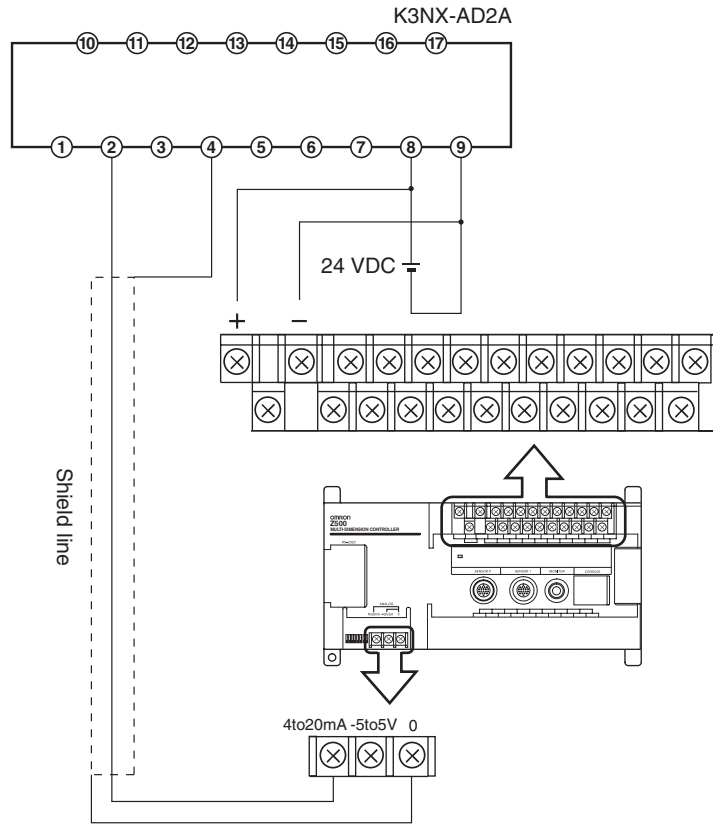
Connecting to the Linear Sensor Controller (K3AS)



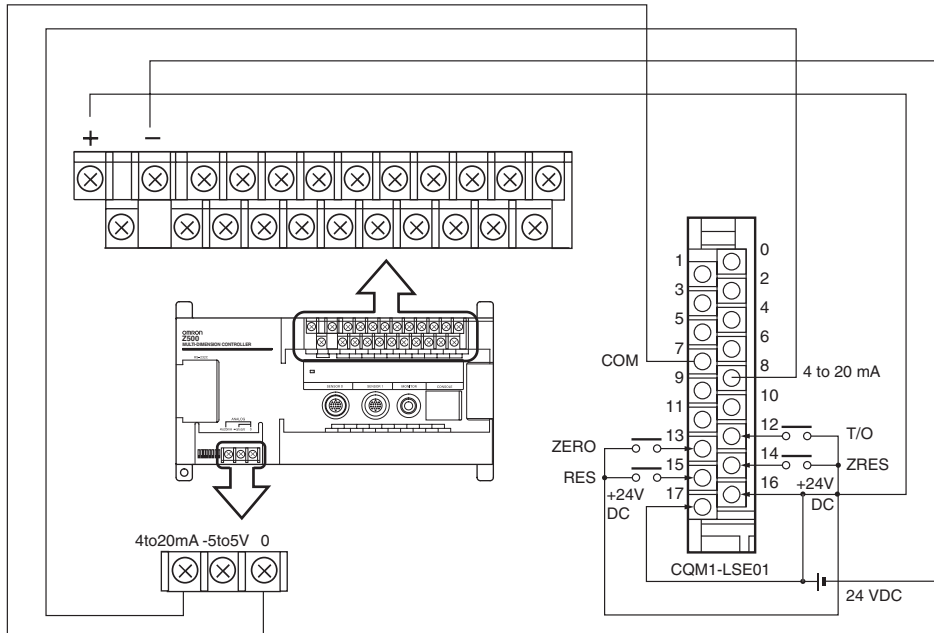
Connecting to the Scaling Meter (K3TJ)



Connecting to the Digital Panel Meter (K3NX)



Connecting to the Linear Sensor Interface Unit (CQM1-LSE)



MEMO



Z500
Setup Manual

SECTION 4

Appendix

4-1 Troubleshooting	60
4-2 Maintenance	62
4-3 Specifications and Dimensions	63
4-4 Laser Product Classifications	72

4-1 Troubleshooting

This section provides information on hardware errors and remedies to be taken. Refer to this section before requesting service from your OMRON representative.



Connection Errors

Problem	Probable cause	References
The Power indicator is not lit.	<ul style="list-style-type: none"> The Power Supply is not connected properly. The 24-VDC (21.6 to 26.4-VDC) supply voltage has dropped. 	p.26
The Video Monitor is blank.	<ul style="list-style-type: none"> The power to the Video Monitor is not ON. The Monitor Cable is not connected properly. The Video Monitor is malfunctioning. When using a Liquid Crystal Monitor, the power supply capacity is insufficient. 	p.21
The Video Monitor image is not clear.	<ul style="list-style-type: none"> There is electric noise entering from the power supply or cables. The Monitor Cable is not connected properly. 	—
Cannot make key inputs from the console.	<ul style="list-style-type: none"> The Console Cable is not correctly connected. 	p.21
No images are displayed.	<ul style="list-style-type: none"> The Sensor cable is not connected to the Controller correctly. There is no workpiece inside the measurement range. The Sensor is not mounted in the correct position. 	p.21 p.32



Sensor Errors

Problem	Probable cause	References
The measurement range is different from that of the sensor specification.	<ul style="list-style-type: none"> The download function has been turned off when the sensor connected to the controller was replaced. 	(Operation) p.146



HELP

Terminal Block Errors

Problem	Probable cause	References
Trigger signals (input signals) are not received.	<ul style="list-style-type: none"> • The cables are not correctly wired. • The signal line is disconnected. • The Z500 is not in Run mode. 	p.48
Signals cannot be output externally.	<ul style="list-style-type: none"> • The trigger signal has not been input. • The cables are not correctly wired. • The signal line is disconnected. • The Z500 is not in Run mode. 	p.48



HELP

RS-232C Communication Errors

Problem	Probable cause	References
No communications are possible.	<ul style="list-style-type: none"> • The cables are not correctly wired. • The Z500's communications specifications do not match those of the external device. • The Z500 is not in Run mode. 	p.52
The Unit operates well initially, but after a while there is no response from the Z500.	<ul style="list-style-type: none"> • The reception buffer on the external device (e.g., personal computer) is full. Check that settings allow the data to be properly received. 	—

4-2 Maintenance

In order to ensure performance, carry out the maintenance procedures given below.



NOTICE

- Turn OFF the power and take safety precautions before conducting inspections. Electric shock can result from attempting safety inspections with the power turned ON.
- Do not use thinners or benzene to clean the Z500.

4-2-1 Cleaning

Optical Filter on Front Panel of Sensor

- Use a blower brush (used to clean camera lenses) to blow large dust particles from the surface. Do not blow the dust away with your mouth.
- Use a soft cloth (for lenses) with a small amount of alcohol to remove the remaining dust.



NOTICE

Do not use a scrubbing action when cleaning as scratches on the filter could result in the Sensor malfunctioning.

Cleaning of Equipment

Remove dirt on equipment by gently wiping with a soft cloth.

4-2-2 Regular Inspections

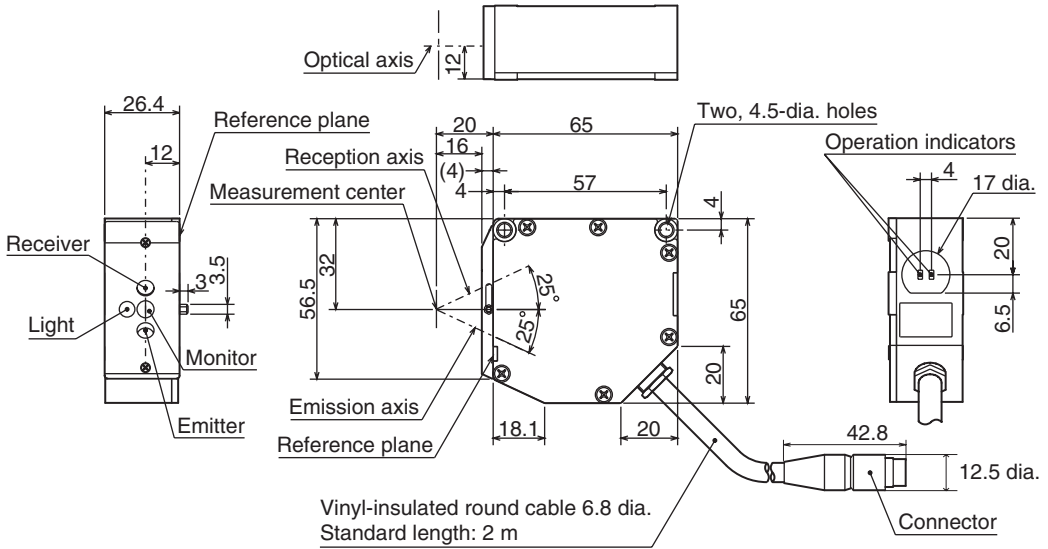
Inspection point	Details	Tools required
Power supply	The voltage measured at the power supply terminals must be 24 VDC + 10 %/ - 10 %.	Circuit tester
Ambient temperature	The operating ambient temperature inside the cabinet must be between 0 and 50 °C	Thermometer
Ambient humidity	The operating ambient humidity inside the cabinet must be between 35% and 85%.	Hygrometer
Installation	Each component must be firmly secured. Each cable connector must be correctly inserted and locked.	Phillips screwdriver

4-3 Specifications and Dimensions

4-3-1 Sensor

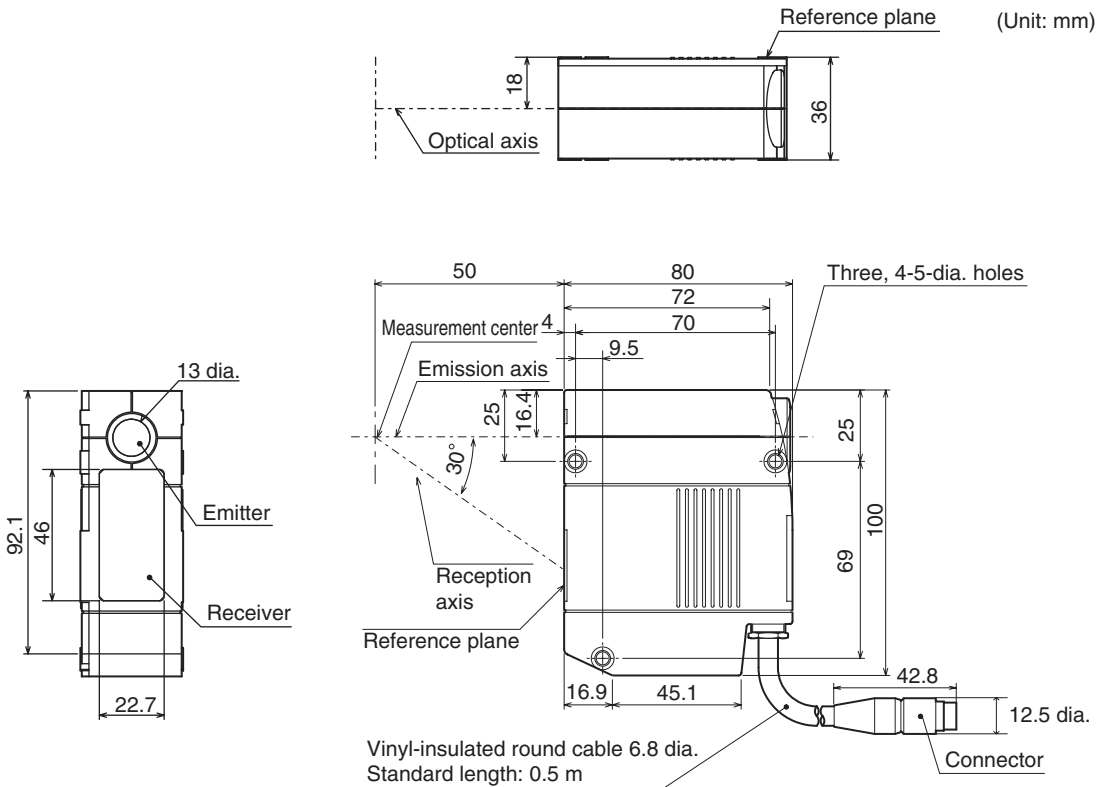
Z500-SW2T Sensor

(Unit: mm)

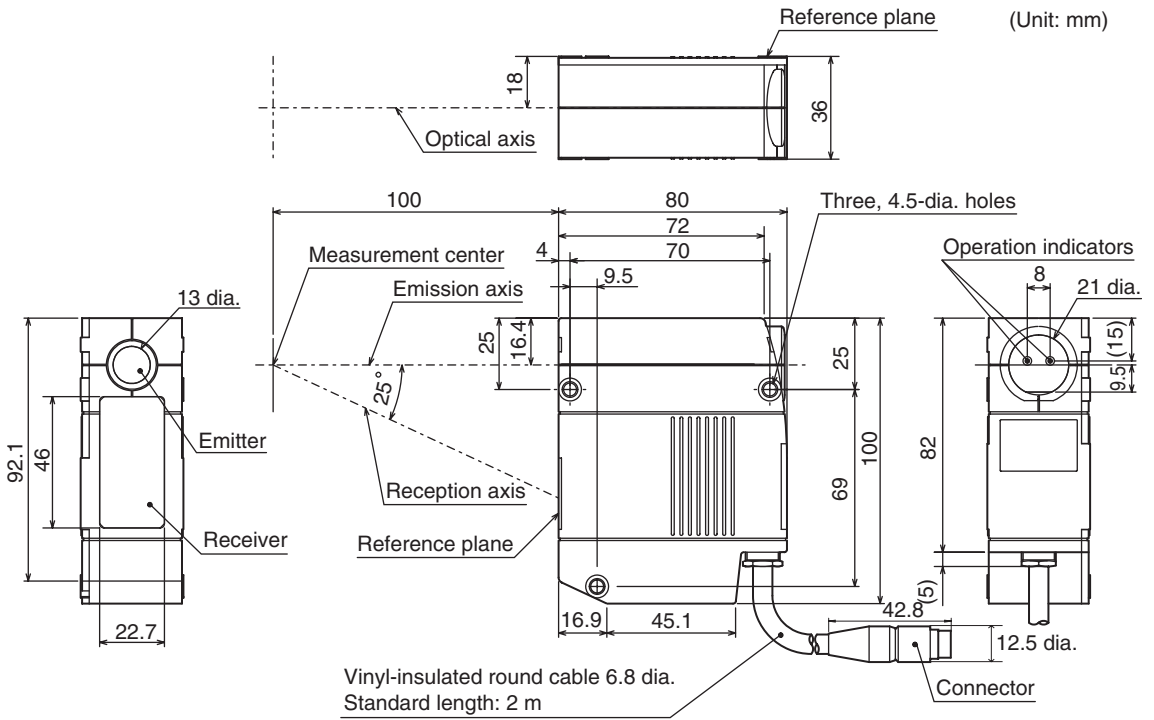


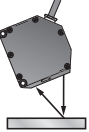

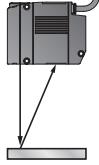
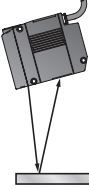
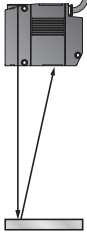
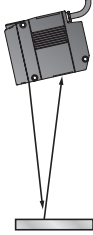
Z500-SW6

(Unit: mm)

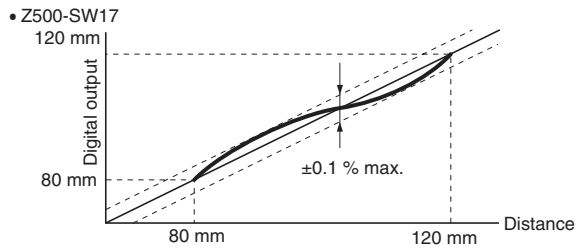


Z500-SW17 Sensor



Model		Z500-SW2T		Z500-SW6		Z500-SW17	
		Diffuse reflection	Mirror reflection	Diffuse reflection	Mirror reflection	Diffuse reflection	Mirror reflection
Item	Measurement mode						
	Distance to measurement center	5.2 mm	20 mm (with beam cover attached: 16 mm)	50 mm	44 mm	100 mm	94 mm
Measurement range		±0.8 mm		±5 mm	±4 mm	±20 mm	±16 mm
Light source		Visible-light semiconductor laser (Wavelength 650 nm, 1 mW max., Class 2)		Visible-light semiconductor laser (Wavelength 658 nm, 15 mW max., Class 3B)			
Beam dimensions (See note 1)		Reference distance: 20 μm × 4 mm TYP. (Measurement region: 2 mm)		Reference distance: 30 μm × 24 mm TYP. (Measurement region: 6.2 mm)		Reference distance: 60 μm × 45 mm TYP. (Measurement region: 17 mm)	
Linearity		±0.1 %F.S. (See note 3)	±0.1 %F.S. (See note 2)	±0.1 %F.S. (See note 4)			
Resolution		0.25 μm (See notes 5 and 6)		0.3 μm (See notes 7 and 8)		1 μm (See notes 7 and 8)	
Sampling cycle		9.96 ms					
LED indicators (LASER indicator)		Lit while laser is ON.					
Temperature characteristic (See note 9)		0.01 %F.S./°C					
Environment resistance	Degree of protection	IEC IP64		IEC IP66			
	Ambient operating illumination	Illumination at light-receiving surface: 3,000 lx max., incandescent light					
	Ambient temperature	Operating: 0 to +50 °C, Storage: -15 to +60 °C (with no icing or condensation)					
	Ambient humidity	Operating and storage: 35 to 85 % RH (with no condensation)					
	Vibration resistance	10 to 150 Hz (single amplitude: 0.35 mm) for 8 min. each in X, Y, and Z directions					
Materials		Unit: Die-cast aluminum Cable sheathing: Heat-resistant chlorinated vinyl Connector: zinc alloy and brass					
Cable length		2 m		0.5 m		2 m	
Minimum bending radius		68 mm					
Weight (including packaging)		Approx. 600 g (Unit: Approx. 350 g)		Approx. 700 g (Unit: Approx. 600 g)		Approx. 800 g (Unit: Approx. 600 g)	
Accessories		3 ferrite cores, laser warning labels (English)					

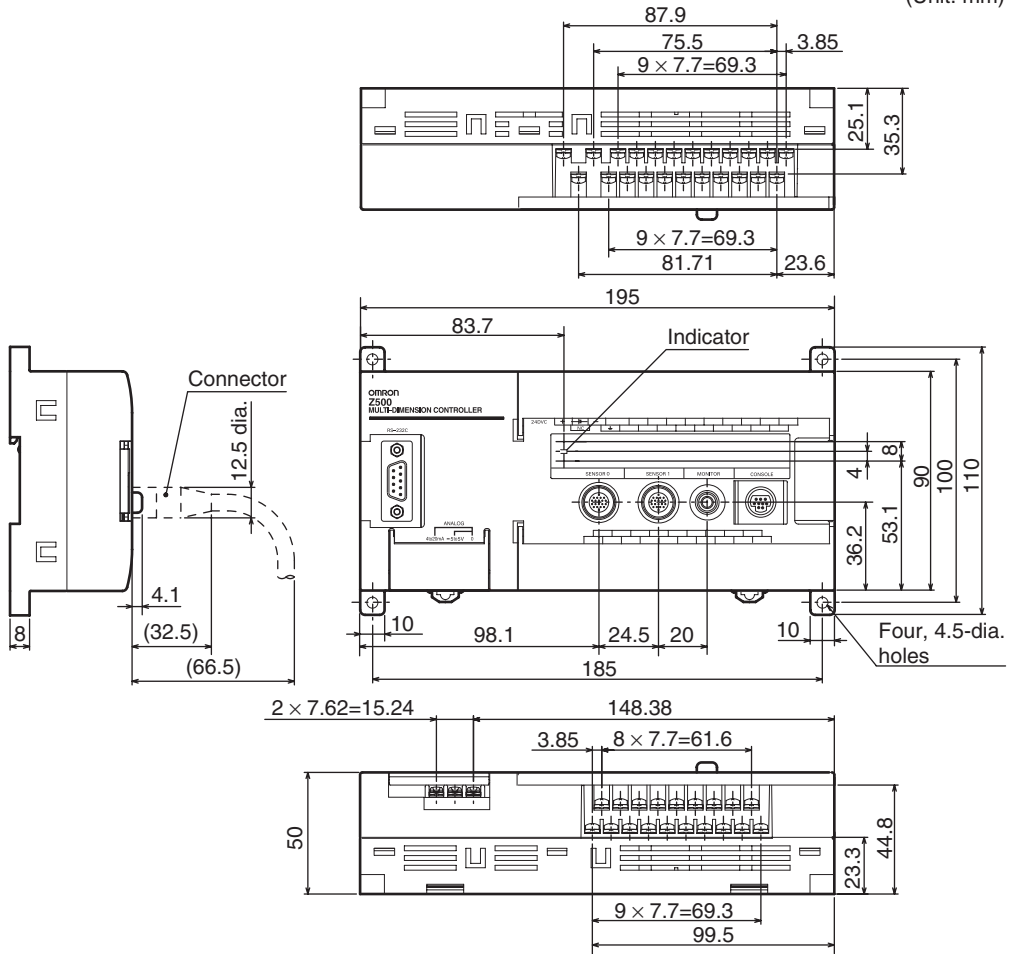
- Note 1:** Defined at $1/e^2$ (13.5%) of the density at the light center. Light may, however, be present outside this range and if the reflection factor of the light around the workpiece is high compared to the workpiece, measurement may be affected.
- Note 2:** Error with respect to the theoretical line representing the displacement output for measurement of OMRON standard quartz glass. The linearity varies with the type of workpiece.
- Note 3:** Error with respect to the theoretical line representing the displacement output for measurement of OMRON standard SUS blocks. The linearity varies with the type of workpiece.
- Note 4:** Error with respect to the theoretical line representing the displacement output for measurement of OMRON standard white alumina ceramics. The linearity varies with the type of workpiece.



- Note 5:** Displacement conversion value for peak-to-peak of displacement output. These figures are for measurement of OMRON standard quartz glass (mirror reflection mode) or OMRON standard SUS blocks (diffuse reflection mode) at the measurement center. In strong magnetic fields, it may not be possible to maintain resolution performance characteristics.
- Note 6:** These figures are for when the Sensor is connected to the Z500-MC10E/MC15E, the average number of measurements is 16. Measurement data are sent to PC via RS-232C cable for calculation of their average values.
- Note 7:** Displacement conversion value for peak-to-peak of displacement output (for measurement of OMRON standard white alumina ceramic at the measurement center). In strong magnetic fields, it may not be possible to maintain resolution performance characteristics.
- Note 8:** With the Z500-MC10E/MC15E, at an average number of measurements of 64. Measurement data are sent to PC via RS-232C cable for calculation of their average values.
- Note 9:** Value for measurement with the space between the Sensor and the workpiece (white alumina ceramic) secured with an aluminum jig.

4-3-2 Controller
Z500-MC10E/MC15E Controller

(Unit: mm)



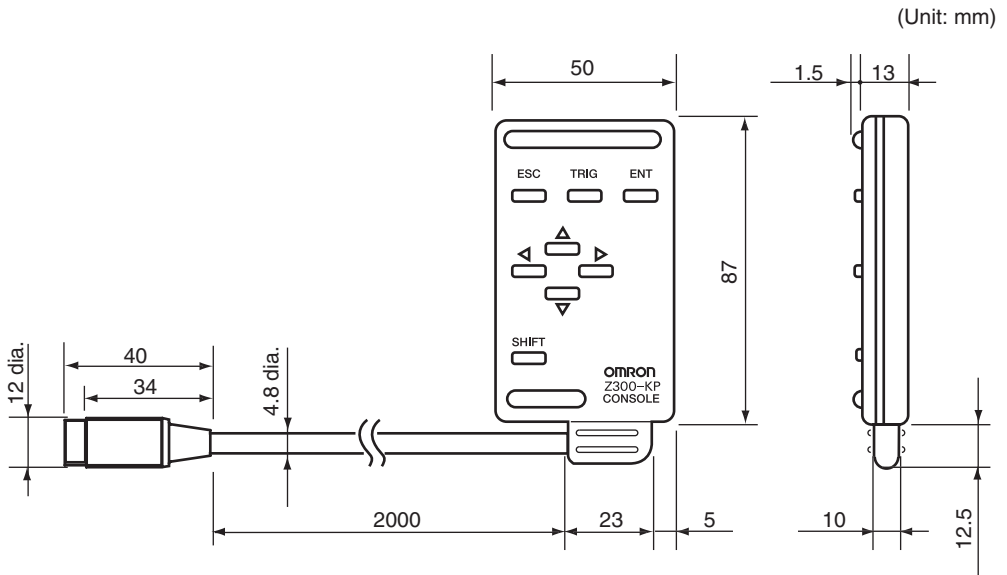
		Model	Z500-MC10E	Z500-MC15E
Item	Input/Output Type		NPN	PNP
Performance specifications	Number of Sensors that can be mounted		2	
	Number of scenes		16	
	Light intensity tracking function		Automatic (The light intensity tracking range can be specified)/Fixed (Select from 31 stages)/Multiple (The light intensity range can be specified)	
	Measurement item		Select from the following 8 types: Height, Step: 2 pts, Step: 3 pts, Edge position, With, Edge center, Peak/Bottom, Define	
	Region specification		Region specification of line beam and displacement direction is possible.	
	Number of data to be stored		2048 points max.	
	Trigger function		Free/External 1/External 2/Auto	

Item		Model	Z500-MC10E	Z500-MC15E
		Input/Output Type	NPN	PNP
Performance specifications	Results output		<ul style="list-style-type: none"> • Judgment output <ul style="list-style-type: none"> → RS-232C output → Terminal block output • Measurement value output (measurement value) <ul style="list-style-type: none"> → RS-232C output → Analog output 	
	Terminal block		11 input points: TRIGGER, LD-OFF, RESET, D10 to D17 21 output points: DO0 to DO19, GATE	
	Monitor interface		1CH (for pin jack or overscan monitor)	
	Analog output resolution		The full scale for output can be divided into a maximum of 40,000 gradations. Resolution (See note 1.): 0.25 mV (± 5 V), 0.4 μ A (4 to 20 mA)	
General specifications	Power supply voltage		21.6 to 26.4 VDC	
	Current consumption		1 A max. (with 2 Sensors connected) (See note 2.)	
	Insulation resistance		20 M Ω min. between all DC external terminals and GR terminal (100 VDC megger) (with internal surge absorber removed)	
	Dielectric strength		1000 VAC, 50/60 Hz between all DC external terminals and GR terminal (with internal surge absorber removed)	
	Leakage current		10 mA max.	
	Noise resistance		1500 Vp-p; pulse width: 0.1 μ s/1 μ s, Rising edge: 1-ns pulse	
	Vibration resistance		10 to 150 Hz (double amplitude: 0.1 mm) for 8 min. each in X, Y, and Z directions	
	Shock resistance		200 m/s ² , 3 times each in 6 directions	
	Ambient temperature		Operating: 0 to +50 °C, Storage: -15 to +60 °C (with no icing or condensation)	
	Ambient humidity		Operating and storage: 35 to 85 %RH (with no condensation)	
	Ambient environment		No corrosive gases	
	Ground		Ground the Z500's ground terminal to less than 100 Ω .	
	Degree of protection		IEC IP20 (in-panel)	
	Material		Unit: ABS	
Weight (including packaging)		Approx. 1300 g (Unit: Approx. 700 g)		
Accessories		2 manuals, 1 resistor (250 Ω , 1/2 W)		

Note 1: For measurement at an average number of times of 64 with an OMRON K3AS Linear Sensor Controller connected.

Note 2: Average current during normal operation after power is turned ON.

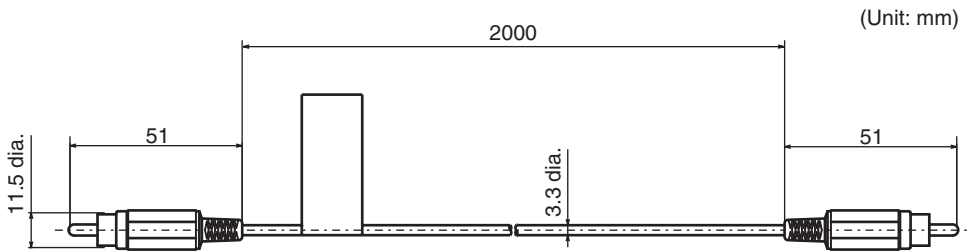
4-3-3 Console
Z300-KP Console



Item	Specification	
General specifications	Vibration resistance	10 to 150 Hz; single-amplitude: 0.15 mm, 4 times for 8 minutes each in 3 directions
	Shock resistance	196 m/s ² ; 3 times each in 6 directions
	Ambient temperature	Operating: 0 to +50 °C (with no icing or condensation) Storage: -25 to +65 °C (with no icing or condensation)
	Ambient humidity	Operating and storage: 35 % to 85 % (with no condensation)
	Ambient environment	No corrosive gases
	Degree of protection	IEC60529 IP20 (in-panel)
	Minimum bending radius	75 mm
	Materials	Console: ABS Cable sheathing: Heat-resistant chlorinated vinyl Connector: PC and PBT
Weight	Approx. 135g	

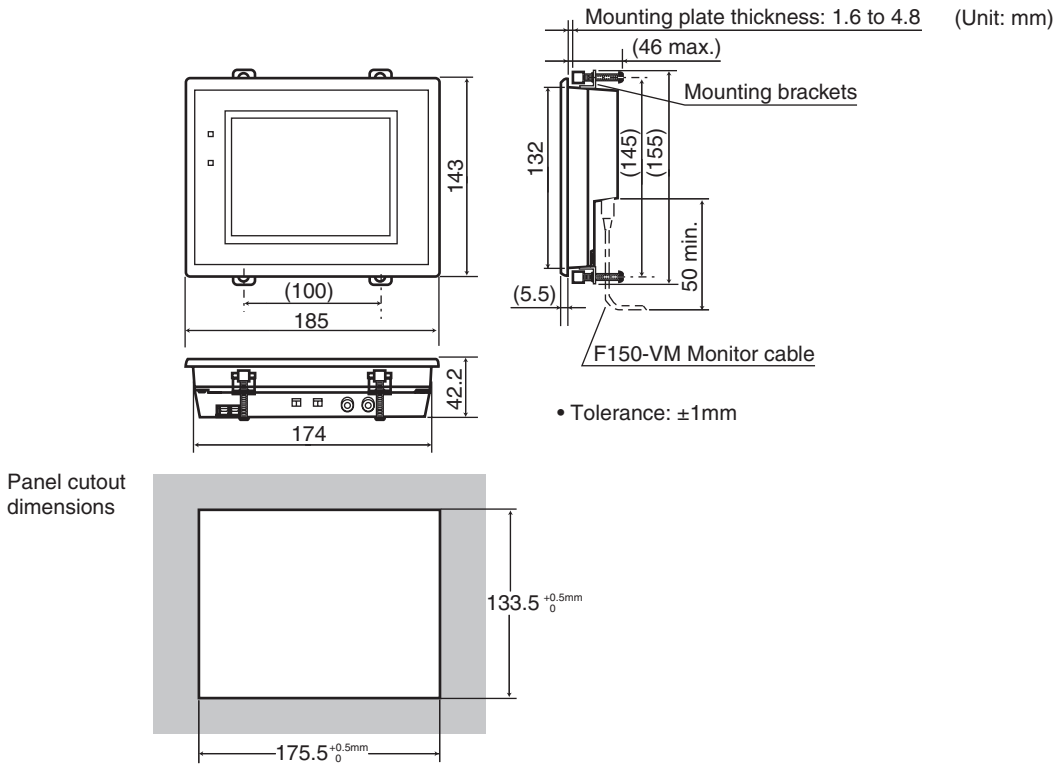
4-3-4 Monitor Cable

F150-VM Monitor Cable



Item		Specification
General specifications	Vibration resistance	10 to 150 Hz; single-amplitude: 0.15 mm, 4 times for 8 minutes each in 3 directions
	Shock resistance	196 m/s ² ; 3 times each in 6 directions
	Ambient temperature	Operating: 0 to +50 °C (with no icing or condensation) Storage: -25 to +65 °C (with no icing or condensation)
	Ambient humidity	Operating and storage: 35 % to 85 % (with no condensation)
	Ambient environment	No corrosive gases
	Materials	Cable sheathing: Super heat-resistant chlorinated vinyl Connector: PVC
	Minimum bending radius	50 mm
Weight	Approx. 40g	
Accessories	BNC Jack Adapter	

4-3-5 Color Liquid Crystal Monitor
F150-M05L Color Liquid Crystal Monitor



Item		Specification
General specifications	Supply voltage	20.4 to 26.4 VDC
	Current consumption	700 mA max.
	Vibration resistance	10 to 150 Hz; single-amplitude: 0.1 mm; maximum acceleration: 15 m/s ² , 10 times for 8 minutes each in 3 directions
	Shock resistance	150 m/s ² , 3 times each in 6 directions
	Ambient temperature	Operating: 0 to +50 °C (with no icing or condensation) Storage: -25 to +65 °C (with no icing or condensation)
	Ambient humidity	Operating and storage: 35 % to 85 % (with no condensation)
	Ambient environment	No corrosive gases
	Degree of protection	IEC60529 IP20
	Materials	Case: ABS/PC Display surface: PMMA (Acrylic)
Performance specifications	Panel size	5.5 inches (111.36 × 83.52 mm (H × V))
	Panel type	TFT color liquid crystal
	Resolution	320 × 240 dots
	Image pitch	0.348 (H) × 0.348 (V) mm
	Contrast	85:1 (typical)
	Viewable angle	25° up/down and 50° left/right (with a contrast ratio > 10)
	Luminance	250 cd/m ² (typical)
	Backlight	Cold cathode fluorescent light
	Response speed	60 ms max.
Input signal	NTSC composite video (1.0 V/75 Ω termination)	
Weight	Approx. 1 kg	
Accessories	4 mounting brackets	

4-4 Laser Product Classifications

EN/JIS

Class	Description
Class 1	Safe inherently by engineering design.
Class 2	Low power in the visible spectrum (wavelength: 400 to 710 nm); eye protection normally afforded by aversion responses.
Class 3A	Direct intrabeam viewing with optical aids may be hazardous. Power of less than 5 mW max. for visible spectrum. Less than five times the output of the Class 1 for wavelengths other than the visible spectrum.
Class 3B	Direct intrabeam viewing may be hazardous. It is not hazardous to view the pulse laser radiation that does not focus due to scattered reflection and the power that allows safe viewing under certain conditions is less than 0.5 W.
Class 4	High power; diffused reflection may be hazardous and may lead to skin hazards or fire.

FDA/ANSI

Class	FDA definition	ANSI description
Class I/1	Limits applicable to devices that have emissions in the ultraviolet, visible, and infrared spectra, and limits below which biological hazards have not been established.	A Class 1 laser is considered to be incapable of producing damaging radiation levels during operation and maintenance and is, therefore, exempt from any control measures or other forms of surveillance.
Class IIa/2a	Limits applicable to products whose visible emission does not exceed Class I limits for emission durations of 1,000 seconds or less and are not intended for viewing.	Class 2 lasers are divided into two sub-classes, 2 and 2a. A Class 2 laser emits in the visible portion of the spectrum (0.4 to 0.7 μm) and eye protection is normally afforded by the aversion response including the blink reflex.
Class II/2	Limits applicable to products that have emissions in the visible spectrum (400 to 710 nm) for emission durations in excess of 0.25 second, providing that emissions for other durations and/or wavelengths do not exceed the Class I limits. Class II products are considered hazardous for direct long-term ocular exposure.	
Class IIIa/3a	Limits to products that have emissions in the visible spectrum and that have beams where the total collectable radiant power does not exceed 5 milliwatts.	Class 3 lasers are divided into two sub-classes, 3a and 3b. A Class 3 laser may be hazardous under direct and specular reflection viewing conditions, but the diffuse reflection is usually not a hazard.
Class IIIb/3b	Limits applicable to devices that emit in the ultraviolet, visible, and infrared spectra. Class IIIb products include laser systems ranging from 5 to 500 milliwatts in the visible spectrum. Class IIIb emission levels are ocular hazards for direct exposure throughout the range of the Class, and skin hazards at the higher levels of the Class.	
Class IV/4	Exceeding the limits of Class IIIb and are a hazard for scattered reflection as well as for direct exposure.	A Class 4 laser is a hazard to the eye or skin from the direct beam and sometimes from a diffuse reflection and also can be fire hazard. Class 4 lasers may also produce laser-generated air contaminants and hazardous plasma radiation.

Requirements from Regulations and Standards

Manufacturer's Requirements

EN60825 (IEC60825) "Radiation Safety of Laser Products, Equipment Classification, Requirements and User's Guide"

Requirements; Sub-clause	Classification				
	Class 1	Class 2	Class 3A	Class 3B	Class 4
Description of hazard class	Safe inherently by engineering design	Low power; eye protection normally afforded by aversion responses	Same as Class 2. Direct intrabeam viewing with optical aids may be hazardous	Direct intrabeam viewing may be hazardous	High power; dif-fused reflection may be hazardous
Protective housing	Required for each laser product; limits access necessary for performance of functions of the products				
Safety interlock in protective housing	Designed to prevent removal of the panel until accessible emission values are below the AEL for the class assigned				
Remote control	Not required			Permits easy addition of external interlock in laser installation	
Key control	Not required			Laser inoperative when key is removed	
Emission warning device	Not required			Give audible or visible warning when laser is switched on or if capacitor bank of pulsed laser is being charged	
Attenuator	Not required			Give means beside ON/OFF switch to temporarily block beam	
Location controls	Not required		Controls located so adjustment does not require exposure to AEL above class 1 or 2		
Viewing optics	Emission from all viewing systems must be below Class 1 AEL's as applicable				
Scanning	Scan failure shall not cause product to exceed its classification				
Class label	Required wording	Warning and explanatory labels and specified wording (Refer to page 9)			
Aperture label	Not required			Specified wording required	
Service entry label	Required as appropriate to the class of accessible radiation				
Override interlock label	Required under certain conditions as appropriate to the class of laser used				
User information	Operation manuals must contain instructions for safe use				
Purchasing and service information	Promotion brochures must reproduce classification labels; service manuals must contain safety information				
Medical products	Special calibration instructions required			Special calibration instructions, means for measurement and target-indicator required	
Fibre optic	Cable service connections require tool to disconnect if disconnection breaks protective housing and permits access above Class 1				

With respect to the requirements of remote interlock connector, key control, emission warning and attenuator, Class 3B laser products not exceeding five times the AEL of Class 2 in the wavelength range of 400 to 700 nm are to be treated as Class 3A laser products.

Note: This table is intended to provide a convenient summary of requirements. See text of standard for complete requirements.

JIS C6802 "Radiation Safety Standards for Laser Products"

Requirements; Sub-clause	Classification				
	Class 1	Class 2	Class 3A	Class 3B	Class 4
Description of hazard class	Safe inherently by engineering design	Low power; eye protection normally afforded by aversion responses	Same as Class 2. Direct intra-beam viewing with optical aids may be hazardous	Direct intrabeam viewing may be hazardous	High power; dif-fused reflection may be hazardous
Protective housing	Required for each laser product; limits access necessary for performance of functions of the products				
Safety interlock in protective housing	Designed to prevent removal of the panel until accessible emission values are below the AEL for the class assigned				
Remote control	Not required			Permits easy addition of external interlock in laser installation	
Key control	Not required			Laser inoperative when key is removed	
Emission warning device	Not required			Give audible or visible warning when laser is switched on or if capacitor bank of pulsed laser is being charged	
Attenuator	Not required			Give means beside On/Off switch to temporarily block beam	
Location controls	Not required		Controls located so adjustment does not require exposure to AEL above class 1 or 2		
Viewing optics	Emission from all viewing systems must be below Class 1 AEL's as applicable				
Scanning	Scan failure shall not cause product to exceed its classification				
Class label	Required wording	Warning and explanatory labels and specified wording (Refer to page 9)			
Aperture label	Not required			Specified wording required	
Service entry label	Required as appropriate to the class of accessible radiation				
Override interlock label	Required under certain conditions as appropriate to the class of laser used				
User information	Operation manuals must contain instructions for safe use				
Purchasing and service information	Promotion brochures must reproduce classification labels; service manuals must contain safety information				
Additional requirements for laser optical fibre transmission system	Cable service connections require tool to disconnect if disconnection breaks protective housing and permits access above Class 1				

With respect to the requirements of remote interlock connector, key control, emission warning and attenuator, Class 3B laser products not exceeding five times the AEL of Class 2 in the wavelength range of 400 to 700 nm are to be treated as Class 3A laser products.

Note: This table is intended to provide a convenient summary of requirements. See text of standard for complete requirements.

FDA (21 CFR1040.10 "Laser Products")

Requirements	Class (see note 1)					
	I	Ila	II	IIla	IIlb	IV
Performance (all laser products)						
Protective housing	R (see note 2)	R (see note 2)	R (see note 2)	R (see note 2)	R (see note 2)	R (see note 2)
Safety interlock	R (see notes 3,4)	R (see notes 3,4)	R (see notes 3,4)	R (see notes 3,4)	R (see notes 3,4)	R (see notes 3,4)
Location of controls	N/A	R	R		R	R
Viewing optics	R	R	R	R	R	R
Scanning safeguard	R	R	R	R	R	R
Performance (laser systems)						
Remote control connector	N/A	N/A	N/A	N/A	R	R
Key control	N/A	N/A	N/A	N/A	R	R
Emission indicator	N/A	N/A	R	R	R (see note 10)	R (see note 10)
Beam attenuator	N/A	N/A	R	R	R	R
Reset	N/A	N/A	N/A	N/A	N/A	R (see note 13)
Performance (specific purpose products)						
Medical	S	S	S	S (see note 8)	S (see note 8)	S (see note 8)
Surveying, leveling, alignment	S	S	S	S	NP	NP
Demonstration	S	S	S	S	S (see note 11)	(see note 11)
Labeling (all laser products)						
Certification & identification	R	R	R	R	R	R
Protective housing	D (see note 5)	D (see note 5)	D (see note 5)	D (see note 5)	D (see note 5)	D (see note 5)
Aperture	N/A	N/A	R	R	R	R
Class warning	N/A	R (see note 6)	R (see note 7)	R (see note 9)	R (see note 12)	R (see note 12)
Information (all laser products)						
User information	R	R	R	R	R	R
Product literature	N/A	R	R	R	R	R
Service information	R	R	R	R	R	R

Abbreviations:

- R:** Required.
- N/A:** Not applicable.
- S:** Requirements: Same as for other products of that Class. Also see footnotes.
- NP:** Not permitted.
- D:** Depends on level of interior radiation.

Footnotes:

Note 1: Based on highest level accessible during operation.

Note 2: Required wherever & whenever human access to laser radiation above Class I limits is not needed for product to perform its function.

Note 3: Required for protective housings opened during operation or maintenance, if human access thus gained is not always necessary when housing is open.

Note 4: Interlock requirements vary according to Class of internal radiation.

Note 5: Wording depends on level & wavelength of laser radiation within protective housing.

Note 6: Warning statement label.

Note 7: CAUTION logotype.

Note 8: Requires means to measure level of laser radiation intended to irradiate the body.

Note 9: CAUTION if 2.5 mW cm^2 or less, DANGER if greater than 2.5 mW cm^{-2} .

Note 10: Delay required between indication & emission.

Note 11: Variance required for Class IIb or IV demonstration laser products and light shows.

Note 12: DANGER logotype.

Note 13: Required after August 20, 1986.

User's Requirements

EN60825 (IEC60825)

Requirements; Sub-clause	Classification				
	Class 1	Class 2	Class 3A	Class 3B	Class 4
Remote interlock	Not required			Connect to room or door circuits	
Key control	Not required			Remove key when not in use	
Beam attenuator	Not required			When in use prevents inadvertent exposure	
Emission indicator device	Not required			Indicates laser in energized	
Warning signs	Not required			Follow precautions on warning signs	
Beam path	Not required	Terminate beam at end of useful length			
Specular reflection	No requirements			Prevent unintentional reflections	
Eye protection	No requirements		Required if engineering and administrative procedures not practicable and MPE exceeded		
Protective clothing	No requirements			Sometimes required	Specific requirements
Training	No requirements		Required for all operator and maintenance personnel		

With respect to the requirements of remote interlock connector, key control, beam attenuator, and emission indicator, Class 3B laser products not exceeding five times the AEL of Class 2 in the wavelength range of 400 to 700 nm are to be treated as Class 3A laser products.

Note: This table is intended to provide a convenient summary of requirements. See text of standard for complete precautions.

JIS C6802

Item	Class 1	Class 2	Class 3A	Class 3B		Class 4
				3B*	3B	
Remote interlock	Not required			Connect the remote interlock of the laser beam to the emergency main interlock, the interlock of the room, or the interlock of the door.		
Key control	Not required			Do not keep the key in the lock when the laser beam is not used.		
Beam breaker or attenuator	Not required			Used to protect people from accidental radiation by the laser beam.		
Warning sign	Not required			Post a proper warning sign on the door to the room where laser beam equipment is installed.		
Beam path	Not required	The laser beam must be terminated and, as a rule, must be enclosed. If the laser beam is exposed, the vertical height of the beam must not be the same as that of the eyes.				
Mirror reflection	Not required			Appropriate optical elements must be securely attached and you must be able to control the optical elements during laser radiation.		
Eye protection	Not required			Use eye protectors except in special, specified locations.		
Protection clothes	Not required		Wear protection clothes if exposure of the skin to the laser beam may exceed the MPE of the skin.			
Training	Not required		The laser system must be operated by only properly trained people.			

Note: *Class 3B applies to any laser beam with a power of 5 mW maximum in the visible range of the laser beam.

ANSI Z136.1:1993 "American National Standard for the Safety Use of Lasers"

Control measures	Classification					
	1	2a	2	3a	3b	4
Engineering Controls	1	2a	2	3a	3b	4
Protective Housing	X	X	X	X	X	X
Without Protective Housing	LSO shall establish Alternate Controls					
Interlocks on Protective Housing	☆	☆	☆	☆	X	X
Service Access Panel	☆	☆	☆	☆	X	X
Key Control	---	---	---	---	•	X
Viewing Portals	---	---	MPE	MPE	MPE	MPE
Collecting Optics	MPE	MPE	MPE	MPE	MPE	MPE
Totally Open Beam Path	---	---	---	---	X NHZ	X NHZ
Limited Open Beam Path	---	---	---	---	X NHZ	X NHZ
Enclosed Beam Path	None is required if 4.3.1 and 4.3.2 fulfilled					
Remote Interlock Connector	---	---	---	---	•	X
Beam Stop or Attenuator	---	---	---	---	•	X
Activation Warning Systems	---	---	---	---	•	X
Emission Delay	---	---	---	---	---	X
Indoor Laser Controlled Area	---	---	---	---	X NHZ	X NHZ
Class 3b Laser Controlled Area	---	---	---	---	X	---
Class 4 Laser Controlled Area	---	---	---	---	---	X
Laser Outdoor Controls	---	---	---	---	X NHZ	X NHZ
Laser in Navigable Airspace	---	---	---	•	•	•
Temporary Laser Controlled Area	☆ MPE	☆ MPE	☆ MPE	☆ MPE	---	---
Remote Firing & Monitoring	---	---	---	---	---	•
Labels	X	X	X	X	X	X
Area Posting	---	---	---	•	X NHZ	X NHZ

Note: LEGEND
X: Shall
•: Should
---: No requirement
☆: Shall if enclosed Class 3b or Class 4
MPE: Shall if MPE is exceeded
NHZ: Nominal Hazard Zone analysis required

Revision History

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

Cat. No. Z158-E1-02D



Revision code

The following table outlines the changes made to the manual during each revision. Page numbers refer to the previous version.

Revision code	Date	Revised content
1	February 2002	Original production
2	January 2003	Added Z500-SW6 Sensor Head, and Download function.
02A	September 2003	Page 68: Note and reference to it added; reference to previous note numbered.
02B	November 2004	Pages 4 to 7: Warranty, liability, disclaimer, and precaution on safety information changed. Pages 63 and 64: Dimensions added to connector in diagrams. Page 65: Measurement region changed from 6 mm to 6.2 mm in table.
02C	July 2006	Pages 21, 24, and 70: Monitor Cable changed. Page 65: Sampling cycle changed from 9.94 ms to 9.96 ms in table. Vibration resistance time changed from 80 min to 8 min in table. Page 66: Note 10 deleted.
02D	May 2008	Page 65: Note 10 deleted.

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