OMRON

ZP-series

RS-232C Communication Unit

User's Manual

ZP-RSA

RS-232C Communication Unit

Z499-E1-01

NOTE

Trademarks

Introduction

Thank you for purchasing a ZP-series RS-232C Communication Unit.
This manual contains information that is necessary to use the ZP-series RS-232C Communication Unit. Please read this manual and make sure you understand the functionality and performance of the product before you attempt to build a system.
Keep this manual in a safe place where it will be available for reference during operation.

Intended Audience

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

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

Applicable Products

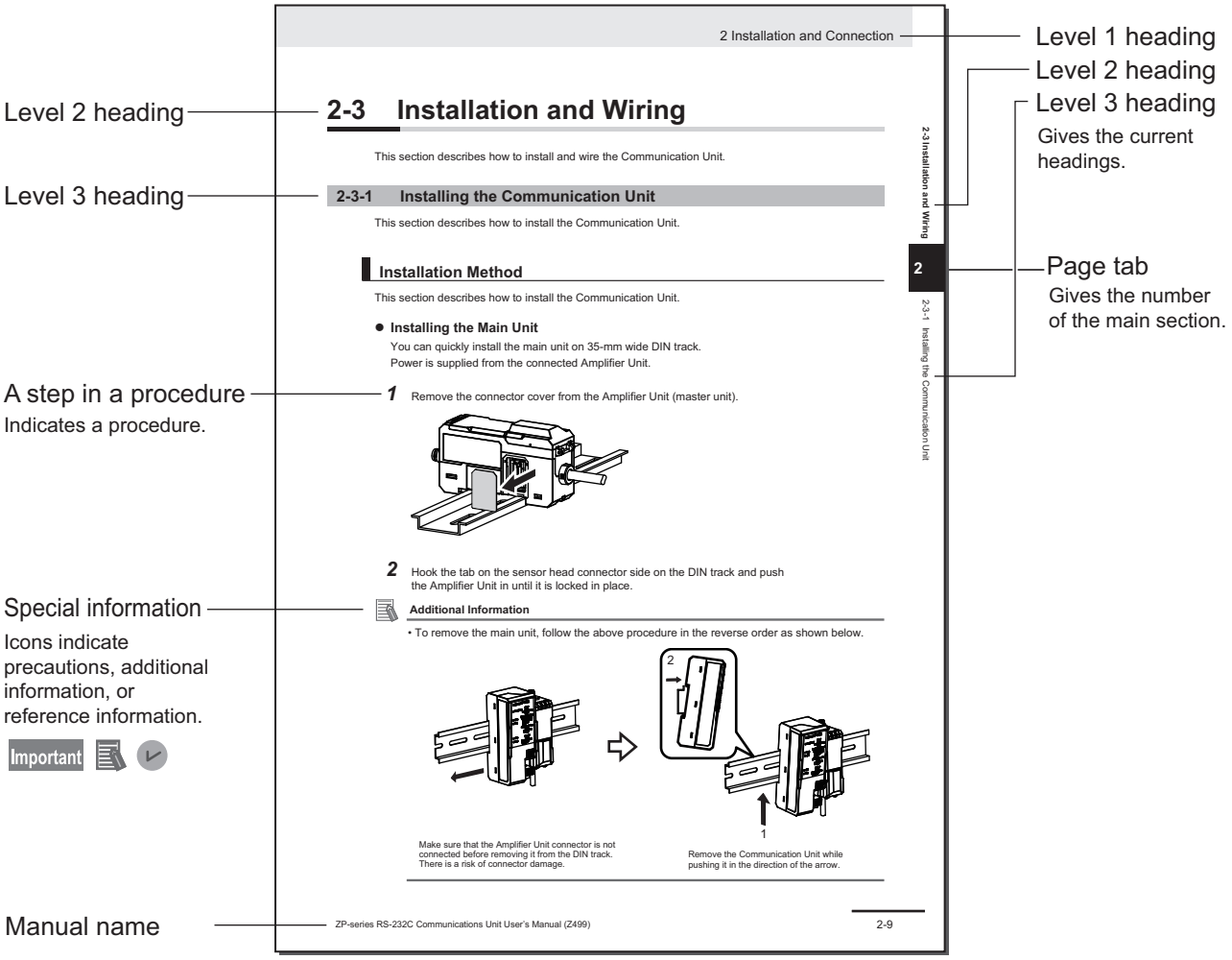
This manual covers the following product.

- ZP-series RS-232C Communication Unit
  ZP-RSA

Manual Structure

Page Structure

The following page structure is used in this manual.



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

Special Information

Special information in this manual is classified as follows:

Important

This summarizes particularly important points about its performance, including the things to be observed during operation and the advice on usage.

Additional Information

Additional information to read as required.
This information is provided to increase understanding or make operation easier.

Version Information

Information on differences in specifications and functionality for products with different unit versions and for different versions of the Support Software is given.

Sections in this Manual

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Section 4 Troubleshooting

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Terms and Conditions Agreement

Warranty, Limitations of Liability

Warranties

- **Exclusive Warranty**

  Omron's exclusive warranty is that the Products will be free from defects in materials and workmanship for a period of twelve months from the date of sale by Omron (or such other period expressed in writing by Omron). Omron disclaims all other warranties, express or implied.

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  Omron's sole obligation hereunder shall be, at Omron's election, to (i) replace (in the form originally shipped with Buyer responsible for labor charges for removal or replacement thereof) the non-complying Product, (ii) repair the non-complying Product, or (iii) repay or credit Buyer an amount equal to the purchase price of the non-complying Product; provided that in no event shall Omron be responsible for warranty, repair, indemnity or any other claims or expenses 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. Return of any Products by Buyer must be approved in writing by Omron before shipment. Omron Companies shall not be liable for the suitability or unsuitability or the results from the use of Products in combination with any electrical or electronic components, circuits, system assemblies or any other materials or substances or environments. Any advice, recommendations or information given orally or in writing, are not to be construed as an amendment or addition to the above warranty.

  See https://www.omron.com/global/ or contact your Omron representative for published information.

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OMRON COMPANIES SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR PRODUCTION OR COMMERCIAL LOSS IN ANY

WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED IN CONTRACT, WARRANTY, NEGLIGENCE OR STRICT LIABILITY.

Further, in no event shall liability of Omron Companies exceed the individual price of the Product on which liability is asserted.

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Omron Companies shall not be responsible for conformity with any standards, codes or regulations which apply to the combination of the Product in the Buyer's application or use of the Product. At Buyer's request, Omron will provide applicable third party certification documents identifying ratings and limitations of use which apply to the Product. This information by itself is not sufficient for a complete determination of the suitability of the Product in combination with the end product, machine, system, or other application or use. Buyer shall be solely responsible for determining appropriateness of the particular Product with respect to Buyer's application, product or system. Buyer shall take application responsibility in all cases.

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

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Omron Companies shall not be responsible for the user's programming of a programmable Product, or any consequence thereof.

Disclaimers

Performance Data

Data presented in Omron Company websites, catalogs and other materials 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 user must correlate it to actual application requirements. Actual performance is subject to the Omron's 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 part 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 part numbers may be assigned to fix or establish key specifications for your application. Please consult with your Omron's representative at any time to confirm actual specifications of purchased Product.

Errors and Omissions

Information presented by Omron Companies has been checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical or proofreading errors or omissions.

Statement of security responsibilities for assumed use cases and against threats

OMRON SHALL NOT BE RESPONSIBLE AND/OR LIABLE FOR ANY LOSS, DAMAGE, OR EXPENSES DIRECTLY OR INDIRECTLY RESULTING FROM THE INFECTION OF OMRON PRODUCTS, ANY SOFTWARE INSTALLED THEREON OR ANY COMPUTER EQUIPMENT, COMPUTER PROGRAMS, NETWORKS, DATABASES OR OTHER PROPRIETARY MATERIAL CONNECTED THERETO BY DISTRIBUTED DENIAL OF SERVICE ATTACK, COMPUTER VIRUSES, OTHER TECHNOLOGICALLY HARMFUL MATERIAL AND/OR UNAUTHORIZED ACCESS.

It shall be the users sole responsibility to determine and use adequate measures and checkpoints to satisfy the users particular requirements for (i) antivirus protection, (ii) data input and output, (iii) maintaining a means for reconstruction of lost data, (iv) preventing Omron Products and/or software installed thereon from being infected with computer viruses and (v) protecting Omron Products from unauthorized access.

Safety Precautions

Definition of Precautionary Information

The following notation is used in this manual to provide precautions required to ensure safe usage of the ZP-series RS-232C Communication Unit.
The safety precautions that are provided are extremely important to safety. Always read and heed the information provided in all safety precautions.
The following notation is used.

⚠WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Additionally, there may be severe property damage.

Symbols

	The ○ and slash symbol indicates operations that you must not do. The specific operation is shown in the ○ and explained in text. This example indicates a general prohibition for something that you must not do.
	The ● symbol indicates operations that you must do. The specific operation is shown in the ● and explained in text. This example shows a general precaution for something that you must do.

Warnings

⚠ WARNING

This product is not designed or rated for ensuring safety of persons either directly or indirectly. Do not use it for such purpose.

Virus protection
Install and maintain the latest commercially available antivirus software on computers connected to control systems.

Prevention of unauthorized access

To prevent unauthorized access to OMRON products, implement the following measures.

- Introduction of physical controls that allow only authorized users to access control systems and equipment
- Prevention of access from untrusted devices by minimizing network connections to control systems and equipment
- Separation from IT networks through introduction of firewalls (blocking unused communications ports, restricting communications hosts)
- Use of virtual private networks (VPNs) when remote access to control systems and equipment is necessary
- Introduction of multi-factor authentication for remote access to control systems and equipment
- Use and frequent change of strong passwords
- Preliminary virus scanning for use of external storage devices such as USB memory sticks in control systems and equipment

Protection of I/O data

Confirm the validity of backup, range check, etc. in case of unintended modification of I/O data to control systems and equipment.

- Data range check
- Validation and preparation of backup and restore processes in case of data tampering or errors
- Safety design such as emergency stop and fallback operation in anticipation of data tampering and errors

Restoration of lost data

Periodically back up and maintain setting data as a measure against data loss.

When an intranet environment is used via a global address, connecting to an unauthorized terminal or server, such as SCADA or HMI, may result in network security issues such as spoofing or tampering. Take adequate measures on your own, such as restricting access to terminals, using terminals with secure functions, and locking the installation area.

When building an intranet, communications problems may occur due to cable disconnection or unauthorized network equipment.
Take adequate measures to restrict physical access to network equipment, for example, by locking the installation area.

Equipment with SD Memory Card functionality poses a security risk that a third party may remove or illegally unmount removable media to illegally acquire, tamper with, or replace files and data contained in them.
Take adequate measures on your own to restrict physical access to the Controller, for example, by locking the installation area, controlling entry to the room, or taking appropriate control measures for the removable media.

Precautions for Safe Use

- Never use this product with AC power supply. Otherwise it may explode.
- Before turning on the product's power, make sure that the supply voltage does not exceed the maximum power supply voltage.
- When attaching or detaching the sensor head, amplifier slave unit, or Communication Unit, be sure to turn off the power to the amplifier master unit. If you do this while the power is on, it may cause a malfunction.
- Do not use the product if the case is damaged.
- If you notice an abnormal condition such as a strange odor, extreme heating of the unit, or smoke, immediately stop using the product, turn off the power, and consult your dealer.
- Always turn off the power of the unit before connecting or disconnecting cables.
- Burn injury may occur. The product surface temperature rises depending on application conditions, such as the ambient temperature and the power supply voltage. Attention must be paid during operation or cleaning.

Precautions for Correct Use

- Do not install in the following locations:
  Locations where the ambient temperature exceeds the rated temperature range.
  Locations subject to sudden temperature changes (where condensation will form).
  Locations where the relative humidity is below or above 35% to 85%.
  Locations where there are corrosive or flammable gases.
  Locations where there is dust, salt, or iron powder.
  Locations where there is strong scattered light (laser light, arc welding light, ultraviolet light, etc.)
  Locations where the device will be subject to direct vibration or shock.
  Locations exposed to direct sunlight or next to a heater.
  Locations where there is splashing or spraying of water, oil, or chemicals.
  Locations where there is a strong electrical or magnetic field.
- Be sure to mount the unit to the DIN track until it clicks.
- Always use two end plates to keep certainly connection side by side.
- Do not attempt to disassemble, deform by pressure, incinerate, repair, or modify this product.
- After wiring and before turning on the power, check whether the power supply is correct, whether there are any incorrect connections such as load short circuits, and whether the load current is appropriate. There is a risk of malfunction due to incorrect wiring, etc.
- When changing settings, please check safety by stopping the device, etc.
- Do not exceed 100,000 writing operations of the EEPROM (non-volatile memory). Setting information is written to the EEPROM when various setting changes, setting initialization, etc. are performed.
- Do not use organic solvents (e.g. paint thinner and alcohol) for cleaning. Otherwise protective structure may deteriorate.
- If the unit is used with a potential difference between the grounding of the amplifier unit and external devices connected via RS-232C, it may cause a malfunction.
  Make sure that a potential difference does not occur between the grounding of the amplifier unit and external devices.
- A strong force may be required when removing a communication connector. However, applying excessive force may cause damage.
-  Dispose in accordance with applicable regulations.

Regulations and Standards

Conformance to EU Directives

This sensor complies with EN standards as follows:

- EN61326-1
- Electromagnetic environment: Industrial electromagnetic environment (EN/IEC 61326-1 Table 2)

Important

The ZP-series products comply with EU Directives. To ensure that the machine or device in which the ZP-series products are used complies with EU Directives, the following precautions must be observed.

- You must use SELV power supply for the DC power supplies that are connected as the Unit/input power supplies and output power supplies for the ZP-series products.
  We recommend that you use the OMRON S8VK-S/S8VK-G-series Power Supplies. EMC standard compliance was confirmed for the recommended Power Supplies.
- ZP-series products that comply with EU Directives also conform to the Common Emission Standard. Radiated emission characteristics (10-m regulations) may vary depending on the configuration of the control panel used, other devices connected to the control panel, wiring, and other conditions. You must therefore confirm that the overall machine or equipment in which the ZP-series products are used complies with EU Directives.
- You must use power supplies with an output hold time of 10 ms or longer for the DC power supplies that are connected as the Unit/input power supplies and output power supplies for the ZP-series products.
- This is a Class A product (for industrial environments). In a residential environment, it may cause radio interference. If radio interference occurs, the user may be required to take appropriate measures.
- Conformance to EU Directives was confirmed using power supply cables and I/O cables with a cable length of shorter than 30 m.

Conformance to UL and CSA Standards

Some ZP-series products comply with UL and CSA standards.
If you use a product that complies with UL or CSA standards and must apply those standards to your machinery or devices, pay attention to the following requirements during use.

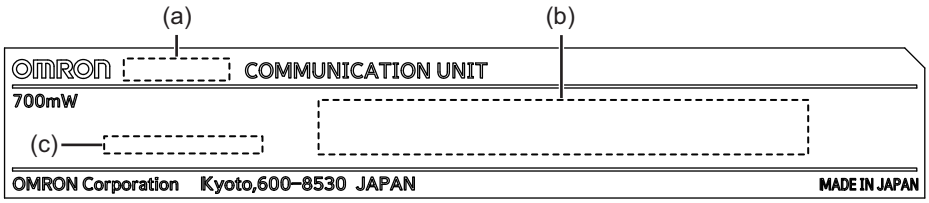
- Installation environment
  Ambient operating temperature: -10 to 50°C
  Ambient humidity range: 35% to 85% (with no condensation)
  For indoor use only
  Altitude: 2,000 m max.
  Pollution degree: 3
- Use a Class 2 power supply with 10 to 30 VDC.

Conformance to Korea KC Mark

- The conformance to the Korean KC Mark can be checked at the following URL.

http://www.rra.go.kr/selform/OMR-ZP-RSA

- The serial number on the label on the main unit indicates the date of manufacture.



No.	Name	Description
(a)	Model	Indicates product model.
(b)	Standard	Indicates the mark of a standard to which certification has been obtained and conformity declared.
(c)	Serial number	Indicates serial number “SSSSMYYA”. SSSS: Identification number M: Months of production 1-9 for Jan-Sep, X for Oct, Y for Nov, Z for Dec YY: Year of manufacture (last 2 digits of year) A: OMRON’s control number

Related Manuals

The following table shows related manuals. Use these manuals for reference.

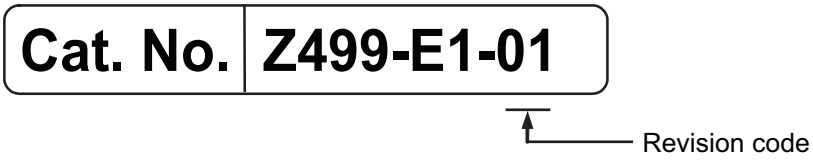
Manual name	Cat. No.	Models	Application	Contents
ZP Series Laser Displacement Sensor User's Manual	Z495	ZP-LS□□ ZP-L3□□□	Learning how to use ZP-series Sensor Head and Amplifier Unit.	The hardware configuration, installation method, and functions of the ZP-series Sensor Head and Amplifier Unit are described.

Terminology

Term	Abbreviation	Description
CPU Unit	---	A CPU Unit is the central part of a Controller that processes inputs from sensors and actuators, and outputs control signals based on a program. It manages the entire system.
CR + LF	---	CR (Carriage Return) and LF (Line Feed) are control characters that indicate line breaks in a text file. CR returns the cursor to the beginning of the line. LF moves the cursor to the next line.
Measured value	MV	As opposed to RV, MV refers to the measured value after calculation, hold, differential, zero reset, and keep processing.
PLC	---	PLC (Programmable Logic Controller) is a computer used for automation control in factories and plants. It processes inputs from sensors, gives instructions to actuators, and controls machines and processes based on a program. It features high environmental resistance, flexible programming, and real-time control.
Real value	RV	RV refers to the measured value after averaging, measurement direction processing, and scaling.
RS-232C	---	An acronym for Recommended Standard 232C. It is an interface standard for serial communications (a communications method in which data is sent one bit at a time).
Amplifier Unit	---	A ZP-series Amplifier Unit adjacent to the Communication Unit.
Event log	---	A function that records status changes, errors, and important operations of a devices. It facilitates the diagnosis of system operations and problems. Event logs help device administrators and engineers with troubleshooting and performance analysis, thus improving reliability and efficiency.
Status indicators	---	Indicator lights that indicate the status of the Communication Unit and adjacent Amplifier Unit.
Time stamp	---	Time information that is internally held by the Communication Unit. This information is set when measured values are retrieved and stored.
Communication Unit	---	A ZP-series Communication Unit. In this manual, it refers to the ZP-RSA.
Data bit length	---	The number of bits that represent actual information within a single data frame.
Parity check	---	A mechanism for detecting a single-bit error that may occur during data communications. It adds a parity bit (i.e., an error detection bit) to allow the receiving side to check the integrity of the send data.
Baud rate	---	The baud rate is a unit of measurement that represents how many times a signal changes (modulation) per second.
No-protocol communications	---	A communications method that follows the RS-232C procedures, but is not restricted to a specific protocol in data portions that consist of ASCII characters, binary numbers, and delimiters.
Rotary switch	---	A switch that uses a rotating knob to switch contacts. It is used for selecting various communications settings and the R/RW setting.

Revision History

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



Revision code	Date	Revised content
01	June 2025	Original production

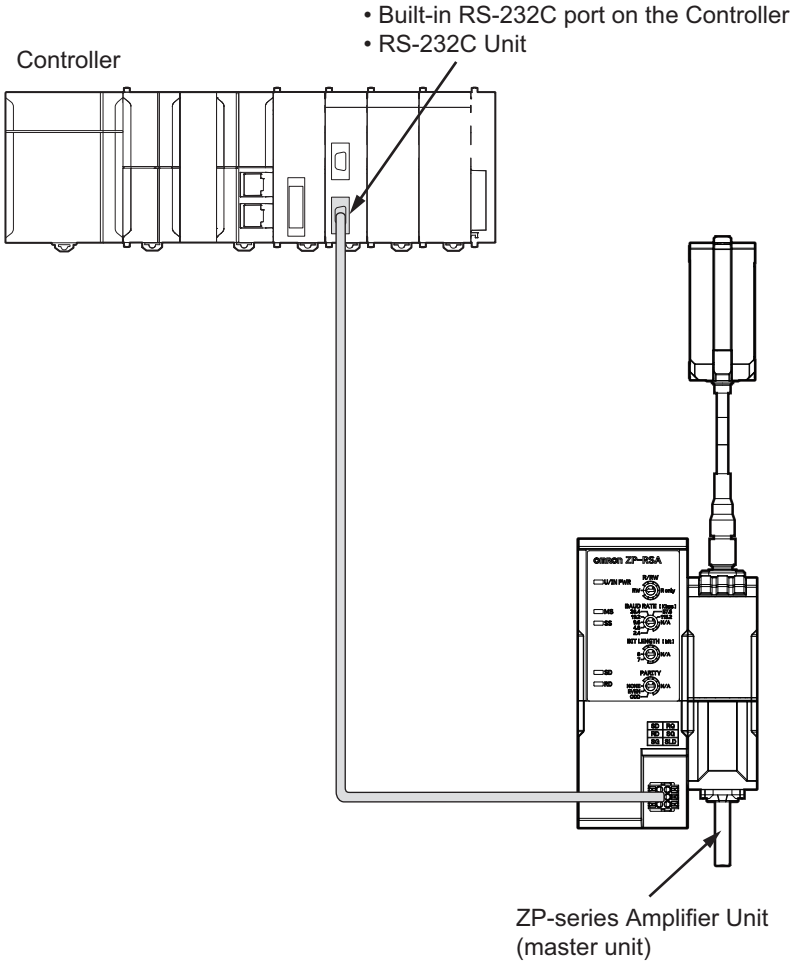
1

Basic Configuration

This section describes the basic configuration of ZP-series RS-232C Communication Units.

1-1 Introduction to the Communication Unit

The ZP-series RS-232C Communication Unit can be connected to ZP-series Amplifier Units.
The ZP-series RS-232C Communication Unit sends measured data from a ZP-series Amplifier Unit through RS-232C communications.



1-2 Features of the Communication Unit

The features of the ZP-series RS-232C Communication Unit are described below.

● Reading the Settings of the Adjacent Amplifier Unit

You can change the settings and read the set values of the Amplifier Unit adjacent to the Communication Unit.

● Various Communications Settings

You can individually set the communications speed, data bit length, and parity check.
In addition, to prevent incorrect settings, you may disable changing the settings through communications.

1-3 Application Procedures

This section describes the basic application procedures for the Communication Unit.

Step	Item		Description	Reference
1	Preparing for Work	Confirming Suitability of Specifications	Confirm that the following restrictions for the Communication Unit are met. • Confirm the model of Amplifier Unit for power supply.	*1-1 Introduction to the Communication Unit* on page 1-2
2	Making Hardware Settings and Installing and Wiring the Communication Unit	Setting Up the Communication Unit	Perform various settings for the Communication Unit using the rotary switches. • Communications speed setting • Data bit length setting • Parity check setting • R/RW setting	*2-2-3 Rotary Switches* on page 2-7
		Installation	Mount the Communication Unit on the DIN track.	*Installation Method* on page 2-9
		Wiring	Wire the Communication Unit. • Wire the communications cable. • Wire the request input cable.	• *1-1 Introduction to the Communication Unit* on page 1-2 • *2-3-2 Wiring the Communications Connector* on page 2-11
3	Turning ON the Power Supply		Turn ON the power supply to the Amplifier Unit that supplies power to the Communication Unit.	*1-1 Introduction to the Communication Unit* on page 1-2
4	Checking Operation	Checking the Indicators*1	Check the indicators and displays on the Controller, Communication Unit, and Amplifier Unit to confirm that there is no error.	• User's manual for the CPU Unit that you use • User's manual for the Amplifier Unit that you use
		Checking the Wiring	Use the Support Software depending on the Controller that you connect. In Watch tab page, etc., read input data from and write output data to the Communication Unit to confirm that the wiring is completed correctly.	• Operation manual for the Support Software that you use

*1. To send a command, after turning ON the power supply, wait at least 10 seconds before you do so. Immediately after turning ON the power supply, sending a command may not return a response.

2

Installation and Connection

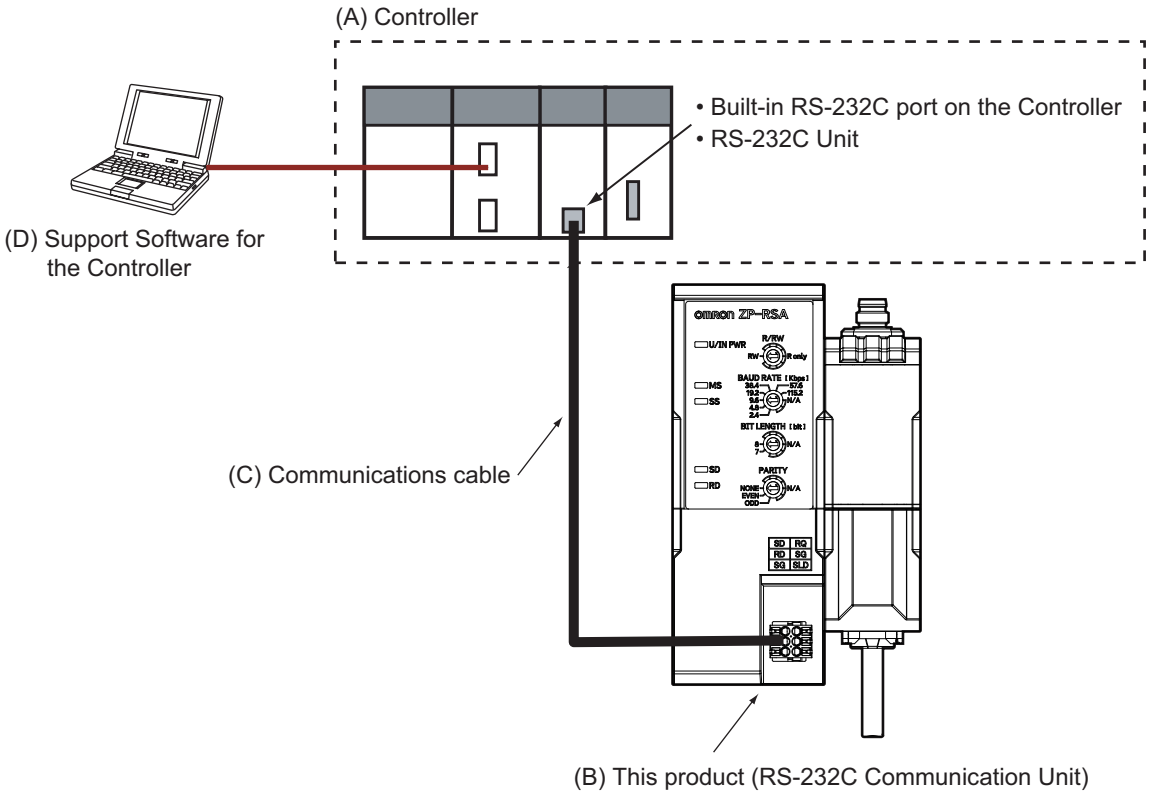
This section describes the installation and connection procedures for the Communication Unit.

2-1 System Configuration

This section describes the system configuration of the ZP-series RS-232C Communication Unit.

2-1-1 System Configuration of the Communication Unit

An example of a system configuration for the ZP-series RS-232C Communication Unit is shown below.



The description of each item is given below.

Letter	Item	Description
(A)	Controller	This is an OMRON CPU Unit or a controller from another company, connected to the Communication Unit through an RS-232C interface. It exchanges I/O data with the Communication Unit and executes a user program through RS-232C communications. The following OMRON Controllers can be connected to the Communication Unit. • Use a Controller with an RS-232C interface. When you use an NJ/NX-series CPU Unit, use the following Communications Interface Unit to establish RS-232C communications. a) NX-series Communications Interface Unit (NX-CIF210 or NX-CIF101)
(B)	This product RS-232C Communication Unit	This product outputs the data received through an RS-232C interface to a connected external device, and sends the data that is input from a connected external device.
(C)	Communications cable	This is a communications cable to an RS-232C adapter.

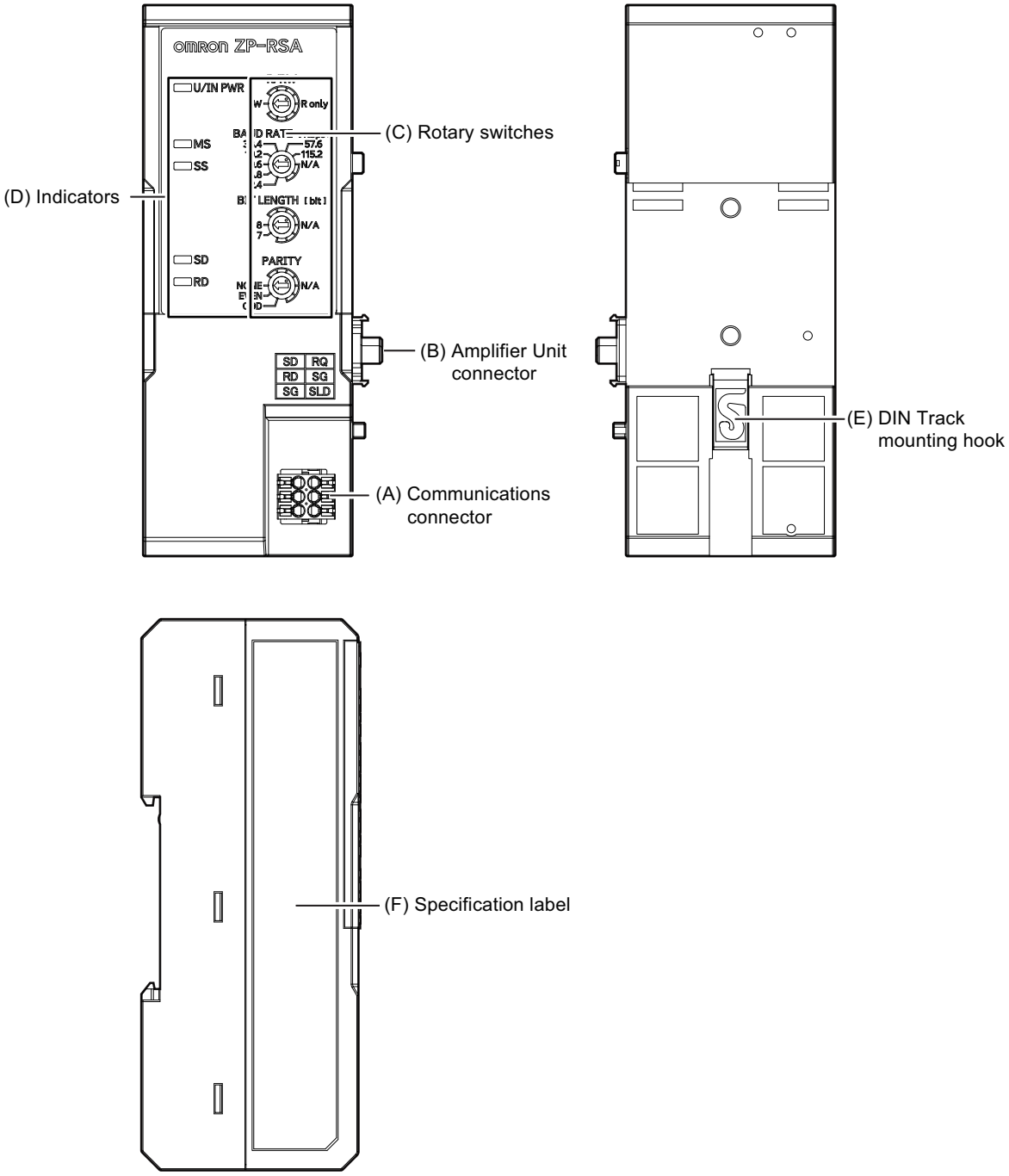
Letter	Item	Description
(D)	Support Software for the Controller	The Support Software is used to configure the Controller, create user programs, and perform monitoring and troubleshooting. The Support Software depends on the Controller that you use.

2-2 Part Names and Functions

This section describes the names and functions of the parts of the Communication Unit.

2-2-1 Parts and Names

This section gives the names of the parts of the Communication Unit.

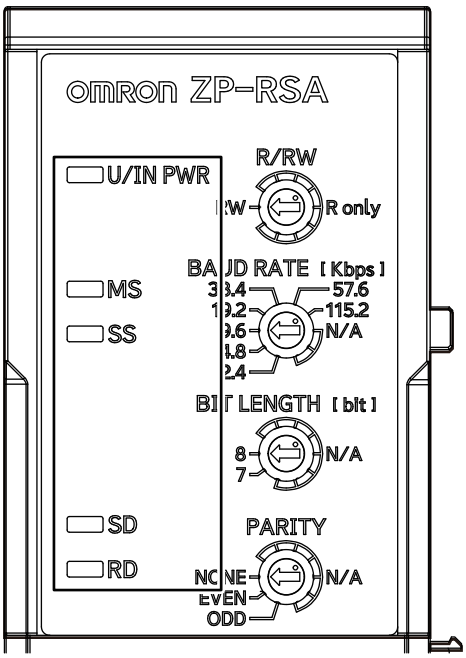


Letter	Name	Function
(A)	Communications connector	The connector for connecting external devices. Connect a communications cable and a request input cable.

Letter	Name	Function
(B)	Amplifier Unit connector	The connector for supplying power from the Amplifier Unit.
(C)	Rotary switches	The switches for setting up the Communication Unit.
(D)	Indicators	The indicators that show the present operating status of the Communication Unit.
(E)	DIN Track mounting hook	The hook for mounting the Communication Unit on the DIN track.
(F)	Specification label	The label that displays the model, specifications, serial number, etc.

2-2-2 Indicators

This section describes the indicators of the Communication Unit.



● MS Indicator

The module status indicator. This indicator shows the operating status of the Unit.

Color	Status		Description
Green		Lit	The Unit is operating normally.
		Flashing	The Unit is starting or restarting.
Red		Lit	One of the following unrecoverable errors was detected. • Non-volatile Memory Hardware Error • Unit Processing Error • Hardware failure
		Flashing	One of the following nonfatal errors was detected. • Non-volatile Memory Checksum Error • Communications Setting Error
Green/Red		Flashing	Initializing

Color	Status		Description
---		Not lit	The Unit/input power is not supplied.

● SD Indicator

The send data indicator. This indicator shows the data send status of the Communication Unit.

Color	Status		Description
Green		Lit	The Communication Unit is sending data.
---		Not lit	Data is not sent.

● RD Indicator

The receive data indicator. This indicator shows the data receive status of the Communication Unit.

Color	Status		Description
Green		Lit	The Communication Unit is receiving data.
---		Not lit	Data is not received.

● U/IN PWR Indicator

This indicator shows the status of the Unit/input power supply.

Color	Status		Description
Green		Lit	The Unit/input power is supplied.
---		Not lit	The Unit/input power is not supplied.

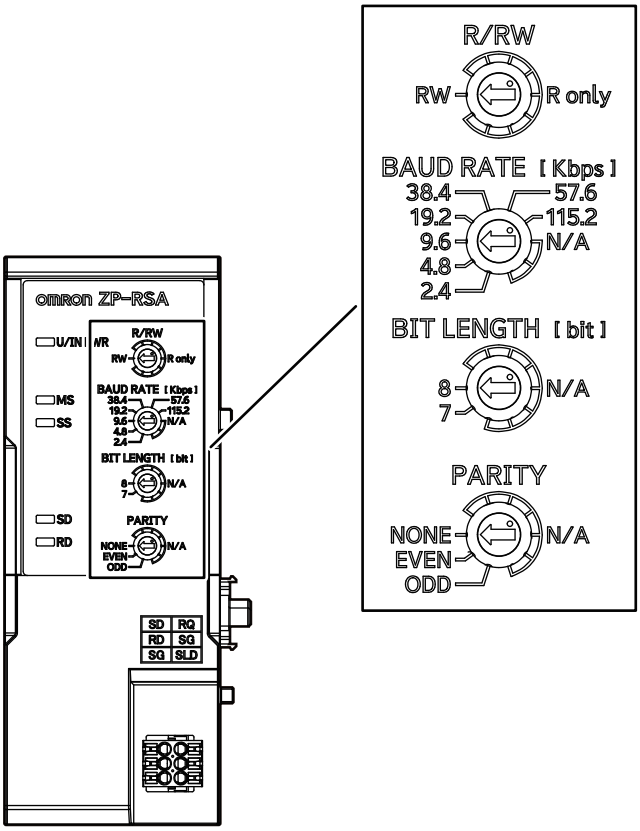
● SS Indicator

The sensor status indicator. This indicator shows the Amplifier Unit connection status when Amplifier Units are connected.

Color	Status		Description
Green		Lit	Communications between the Amplifier Units are normal
		Flashing	A warning has occurred in one of the connected Amplifier Units.
Red		Lit	One of the following conditions has occurred at startup when a connection was established with the Amplifier Unit. • The number of Amplifier Unit channels exceeds 16. • A communications error has occurred at startup.
		Flashing	A system error has occurred in one of the connected Amplifier Units after start-up. (When Hold Setting For Error Status is OFF, the indicator will be lit or flashing green once the Amplifier Unit's system error is removed).
---		Not lit	Initializing

2-2-3 Rotary Switches

Use the rotary switches to configure the communications settings for the Communication Unit.
Perform the R/RW setting, communications speed setting, data bit length setting, and parity check setting.



R/RW: Data write/read settings

BAUD RATE: Communications speed setting

BIT LENGTH: Data bit length setting

PARITY: Parity check setting

2-2-4 Communications Connector

The connector for connecting external devices.
Connect the applicable wires listed below.

Applicable wire specifications

Solid wire: 0.14 to 0.5 mm^2

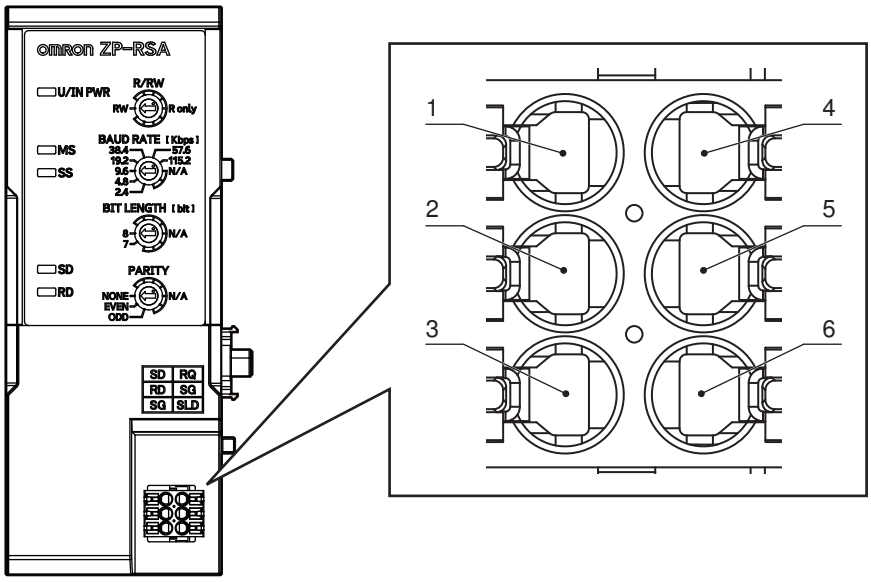
Stranded wire: 0.14 to 0.5 mm^2

Stranded wire with bar terminal (no plastic sleeve): 0.25 to 0.34 mm^2

Stranded wire with bar terminal (plastic sleeve): 0.14 to 0.25 mm^2

AWG: 26 to 20

End processing length: 7 mm



The specifications are as follows:

- Connector structure
  Communications connector
- Pin arrangement

Pin No.	Signal name	Description
1	SD (Output)	This pin connects to the RD of an external device via a communications cable.
2	RD (Input)	This pin connects to the SD of an external device via a communications cable.
3	SG	This is a signal ground. The SG is internally short-circuited.
4	RQ (Input)	Short-circuiting the SG activates the request input function, which sends data from the Amplifier Unit even without command input from an external device. (Data will be sent once every time the RQ and the SG are short-circuited.)
5	SG	This is a signal ground. The SG is internally short-circuited.
6	SLD	This pin connects the shield of the cable. It is internally short-circuited to the SG.

Important

- Make sure that unnecessary signal lines are not in contact with other signal lines.
- Install the communications connector securely to prevent accidental injury when pushing in the release button with a screwdriver.

2-3 Installation and Wiring

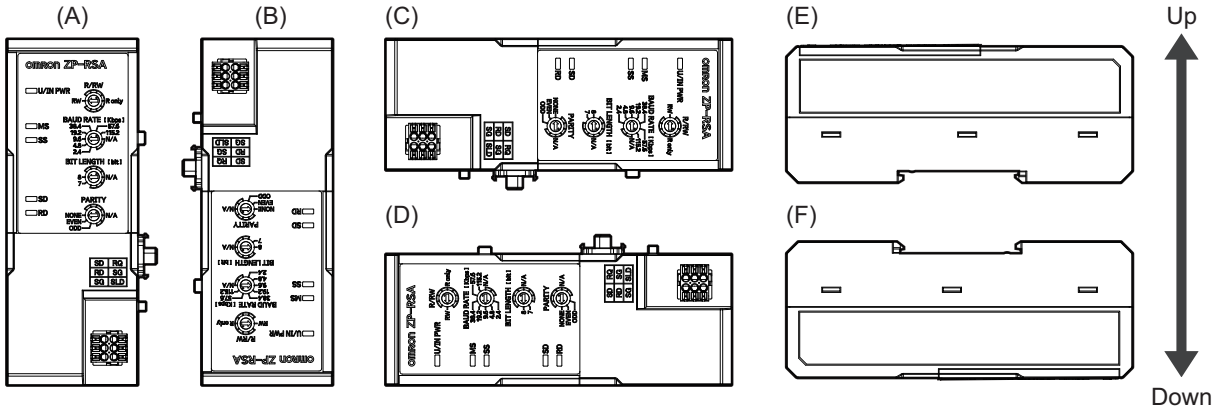
This section describes how to install and wire the Communication Unit.

2-3-1 Installing the Communication Unit

This section describes how to install the Communication Unit.

Installation Orientations

The Communication Unit can be installed in any of the following six orientations.



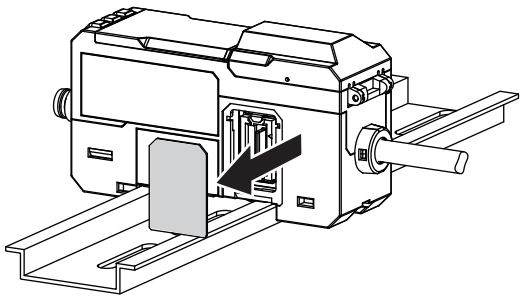
Installation Method

This section describes how to install the Communication Unit.

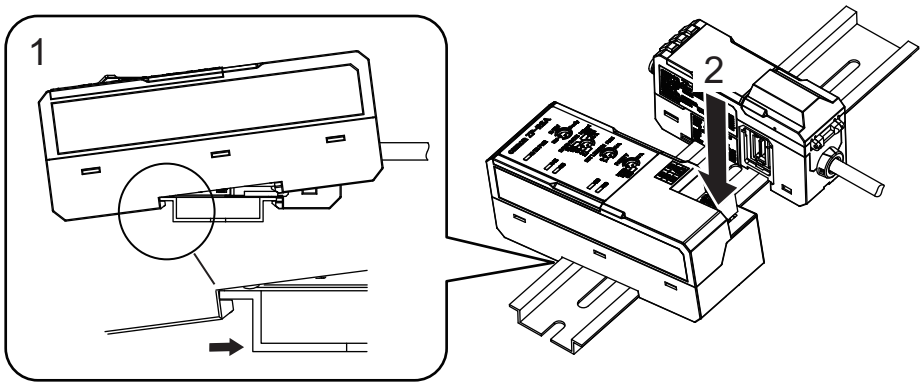
● Installing the Main Unit

You can quickly install the main unit on 35-mm wide DIN track.
Power is supplied from the connected Amplifier Unit.

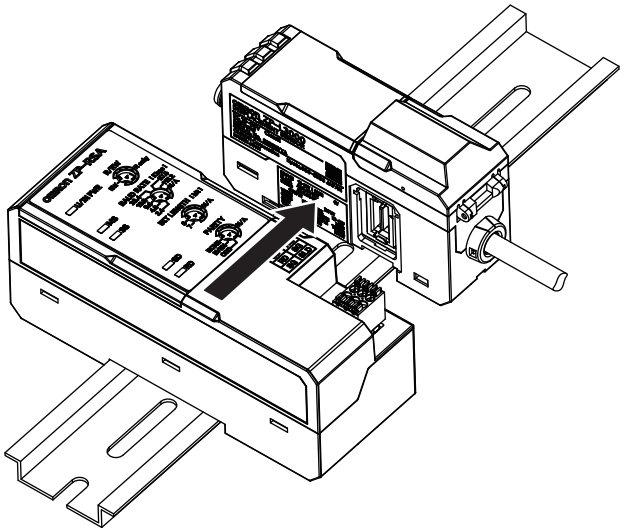
1 Remove the connector cover from the Amplifier Unit (master unit).



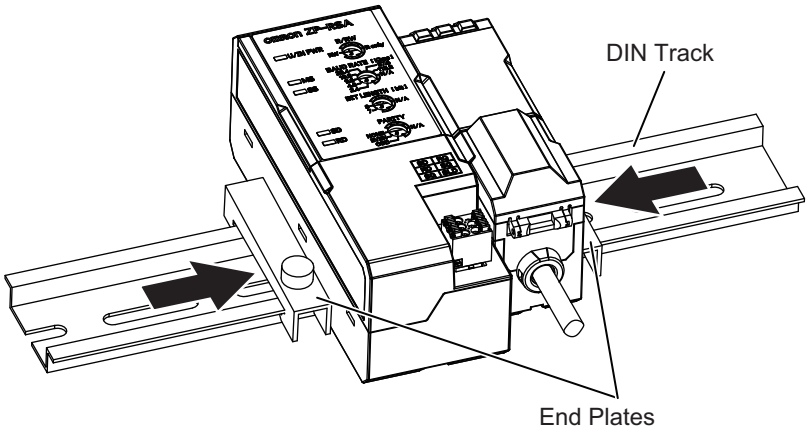
2 Hook the tab on the sensor head connector side on the DIN track and push the Amplifier Unit in until it is locked in place.



3 Slide the Communication Unit into the connector of the master unit until it *clicks* into place.

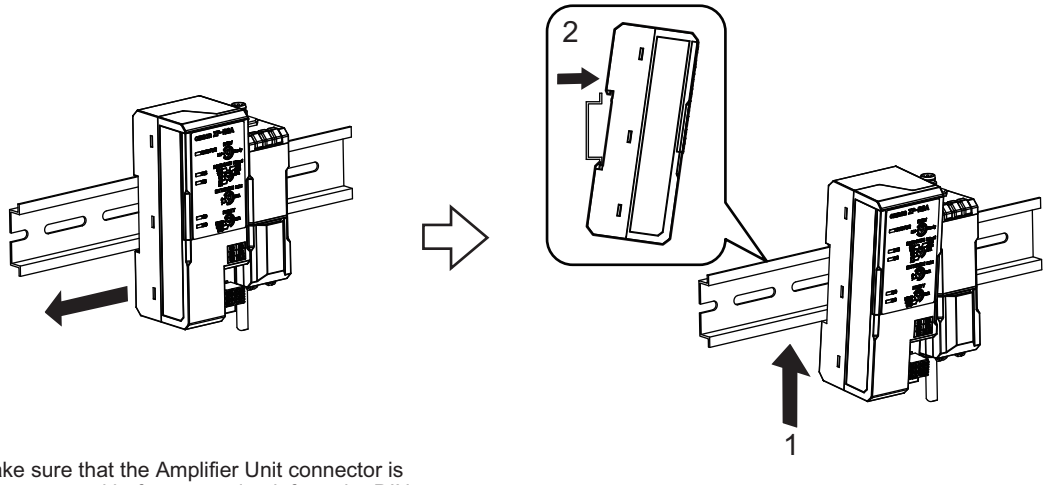


4 Place the End Plates (PFP-M) included with the Communication Unit on both ends of the Communication Unit and Amplifier Unit, and fix them by tightening the screws on the End Plates (two End Plates per location).



Additional Information

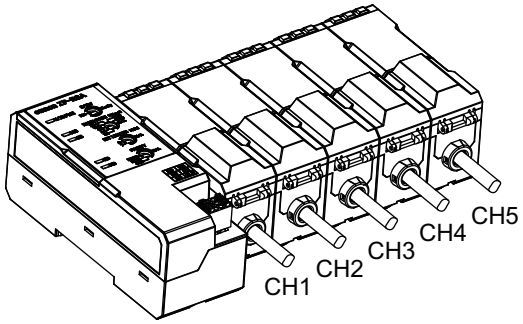
- To remove the main unit, follow the above procedure in the reverse order as shown below.



Make sure that the Amplifier Unit connector is not connected before removing it from the DIN track. There is a risk of connector damage.

Remove the Communication Unit while pushing it in the direction of the arrow.

- When multiple Amplifier Units are connected together, the channel numbers are as shown below.



2-3-2 Wiring the Communications Connector

This section describes how to wire the communications connector for connecting external devices.

Preparing for Wiring

Applicable wire specifications

Solid wire: 0.14 to 0.5 mm^2

Stranded wire: 0.14 to 0.5 mm^2

Stranded wire with bar terminal (no plastic sleeve): 0.25 to 0.34 mm^2

Stranded wire with bar terminal (plastic sleeve): 0.14 to 0.25 mm^2

AWG: 26 to 20

End processing length: 7 mm

Connecting the Communications Connector

The following describes the communications connector connection procedure.

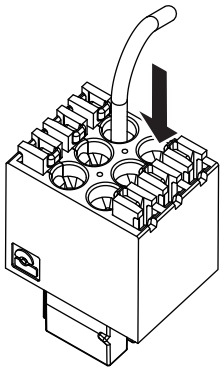
● Connection Procedure

The procedure for connecting the communications connector is as follows.

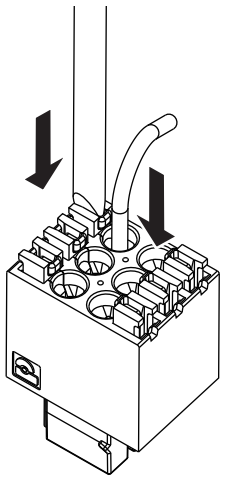
1 Turn OFF the power supply to the Communication Unit.

2 Insert the wire into a communications connector hole.

- When using wire with bar terminal
  Push the wire in.



- When using solid or stranded wire
  While pushing in the release button adjacent to the communications connector hole with a screwdriver, insert the wire all the way into the communications connector hole and remove the screwdriver.



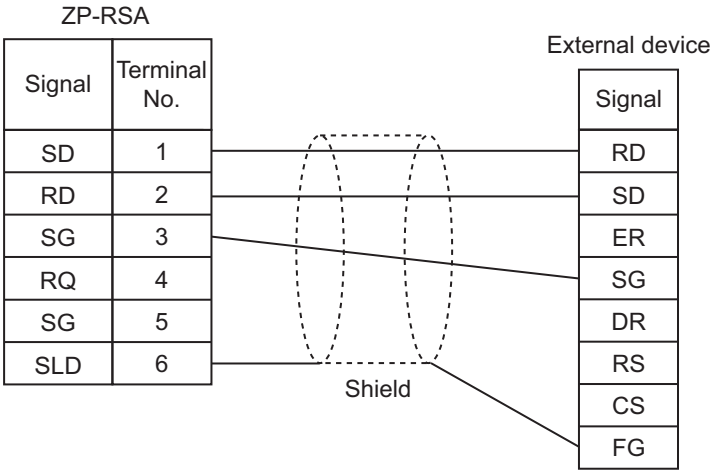
3 Install the communications connector back onto the Communication Unit.

● Removal Procedure

Turn OFF the power supply to the Communication Unit, and then remove it by reversing the installation procedure.

Wiring Example

When connecting the Unit with a computer or other external device, connect it in reference to the following connection diagram.

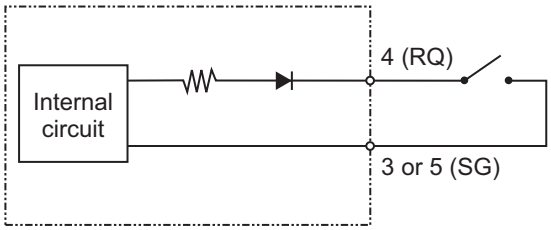


- Terminal numbers 3, 5, and 6 are short-circuited internally.
- Terminal numbers 3, 5, and 6 are common to the blue wire of the master Amplifier Unit.
- The recommended connection method may differ depending on the type and model of the external device to be connected. Check the instruction manual for your PLC or computer. Short-circuit the RS and CS of the external device if necessary.
- Use a communications cable that is within 15 m long.
- Recommended communications cable specifications: Shielded twisted pair cable
- Do not allow the shield wire to contact another signal wire or terminal block.
- If the Unit is used with a potential difference between the Amplifier Unit and external devices, it may result in a malfunction. Make sure that a potential difference does not occur between the grounding of the amplifier unit and external devices.

- Wiring to a D-sub 9-pin Connector
  Use a cable with a D-sub connector (socket) to connect external devices such as a computer that has a D-sub connector.
  For the locking screws for the connector fixture, use inch screws #4-40UNC.
  The recommended wire and D-sub connector are as follows.

Wiring part	Specification	Product example
Wire	Shielded twisted pair wire size: AWG 26 to 20 (0.14 to 0.5 mm^2)	Proterial Ltd. UL-2464-SB 26-24 (UL-compliant product)
D-sub connector	9-pin socket	OMRON Corporation Hood: XM2S-0913 (9-pin, for inch screw) Socket: XM3D-0921 (9-pin)

Input Circuit Diagram



(Short-circuit current: 2 mA max.)

3

Communication Unit Functions and Setup

This section describes how to set up the Communication Unit.

3-1 Communication Unit Functions

This section describes the functions incorporated in the Communication Unit.
The Communication Unit operates as an RS-232C communications device.

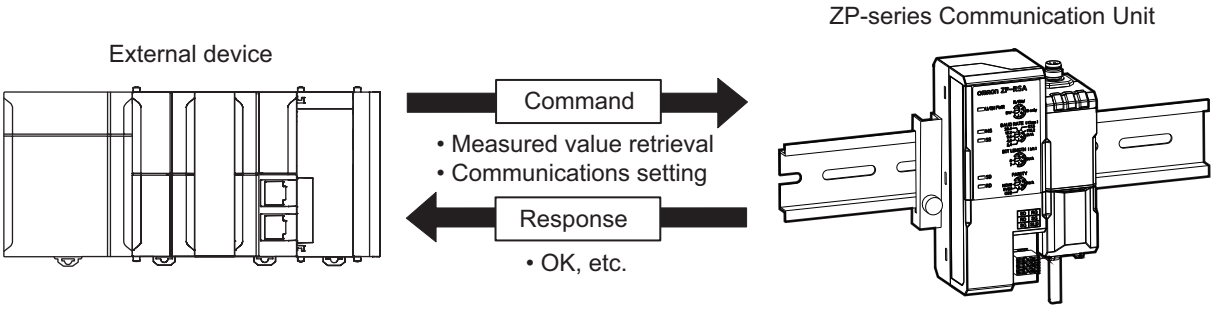
3-1-1 List of Additional Functions

The table below lists the functions of the ZP-series RS-232C Communication Unit.

Category	Function name	Description
Communications setting functions	Communications speed setting function	A function that sets the communications speed of the Communication Unit. Use the rotary switch to select one of the following settings. • 115,200 bps • 57,600 bps • 38,400 bps • 19,200 bps • 9,600 bps (factory default) • 4,800 bps • 2,400 bps
	Data bit length setting function	A function that sets the data bit length of the Communication Unit. Use the rotary switch to select one of the following settings. • 8 bits (factory default) • 7 bits
	Parity check setting function	A function that sets the parity check of the Communication Unit. Use the rotary switch to select one of the following settings. • NONE: No parity (factory default) • EVEN: Even parity • ODD: Odd parity
	R/RW setting function	A function that permits or prohibits changing the settings through communications of the Communication Unit. Use the rotary switch to select one of the following settings. • RW (factory default) Enables reading and writing of the Amplifier Unit and Communication Unit settings. • R only Enables reading only of the Amplifier Unit and Communication Unit settings.
Application functions	Dedicated ZP-series communications function	A function that enables control input, setting changes, and information retrieval to/from the Communication Unit or the adjacent Amplifier Unit.
	Request input function	A function that enables you to obtain the output status of the Amplifier Unit and measured value information through a request input without sending a command.

3-2 RS-232C No-protocol

The RS-232C no-protocol allows an external device (PLC, etc.) to send control commands to and receive responses from the Communication Unit. This enables the Communication Unit and the adjacent Amplifier Unit to perform various controls and setting changes, such as getting measured values and changing communications settings.
Specifically, the external device (PLC, etc.) issues ASCII character commands (e.g., "MS" when getting measured values). Then, the displacement sensor returns a response such as "OK", "NG", or a value.



3-2-1 Overview of Functions and Communications Methods

The following functions are available from the external device.

Function	
Amplifier Unit Setup and Control	Read Status
	Read Present Measured Value
	Read External Output Status
	External Input Control
	Initialize
	Threshold Teaching
	Rewrite/Read Settings
	Key Lock
Communication Unit (Main Unit) Communications Setup	Set Current Time
	Get Event Log Information

3-2-2 List of Commands

Command category	Command name	Command	Description	Reference
Amplifier setting data R/W	Write Amplifier Unit settings	AW	Sends a Rewrite settings command to the sensor.	*3-2-3 Command Format* on page 3-4
	Read Amplifier Unit settings	AR	Sends a Read settings command to the sensor. The maximum number of digits of read data is 8 digits. If the upper digits of data are zeros, only the minimum number of digits is returned without being zero-padded.	
	Amplifier Unit operation command	AD	Sends a sensor operation command.	

Command category	Command name	Command	Description	Reference
Communication Unit main unit commands	Write Communication Unit main unit settings	DW	Sends a Rewrite main unit settings command.	
	Read Communication Unit main unit settings	DR	Sends a Read main unit settings command.	
	Get software version information	VG	Reads firmware version information.	
	Clear error command	EC	Clears the error information currently held. The command executes clear processing for both errors caused by the Communication Unit itself and errors due to a system error in the Amplifier Unit. If an error continues to occur in the Communication Unit or Amplifier Unit, sending this command causes the Communication Unit to enter the error state again.	
	Get latest measured value command	MS	Reads the present measurement information.	
	Get all latest measured value information command	MA	Outputs all measurement information.	
	Get connected Amplifier Unit latest measurement status command	MR	Reads the output status and measured value from the connected Amplifier Unit.	
	Response to get latest measurement status at request input ON	Request Input	Reads the output status and measured value from the connected Amplifier Unit when the request input is ON.	
	Initialize Communication Unit to factory defaults command	NF	Initializes the Communication Unit to the factory defaults.	
	Write error status command	SW	Writes parameters related to the error status.	
	Read error status command	SR	Reads the parameters related to the error status.	
	Write error history command	GW	Writes parameters related to the error history.	
	Read error history command	GR	Reads the parameters related to the error history.	
	Clear error history command	GC	Clears the recorded abnormality history.	

3-2-3 Command Format

● DW Command

	Command		Class ID				Instance ID		Attribute ID			
Offset	0	1	2	3	4	5	6	7	8	9 to 10	11	12 and above	Last 2 bytes
	D	W	,	3	9	0	,	1	,	1	,	Write data	CR + LF

	Response		Class ID				Instance ID		Attribute ID			
	0	1	2	3	4	5	6	7	8	9 to 10	11	12 and above	Last 2 bytes
	D	W	,	3	9	0	,	1	,	1	,	"OK" or "NG"	CR + LF

● DR Command

	Command		Class ID				Instance ID		Attribute ID	
Offset	0	1	2	3	4	5	6	7	8	9 to 10	Last 2 bytes
	D	R	,	3	9	0	,	1	,	1	CR + LF

Offset	Response							Instance ID					
	0	1	2	3	4	5	6	7	8	9 to 10	11	12 and above	Last 2 bytes
	D	R	,	3	9	0	,	1	,	1	,	Read data	CR + LF

● AW Command

Command

Offset	0	1	2	3 to 4	5	6 to 7	8	9 to 10	11	12 to 19	Last 2 bytes
	A	W	, (comma)	Channel number	, (comma)	Index1*1	, (comma)	Index2*1	, (comma)	Write data	CR + LF

Channel number: 01 to 10 (hexadecimal)
Index1: 00 to FF (2-digit hexadecimal), Index specification
Index2: 00 to FF (2-digit hexadecimal), fixed at 0
Write data: 4-byte hexadecimal
*1. Refer to *A-3-1 AW and AR Command Parameter List* on page A-10.

Response

Offset	0	1	2	3 to 4	5	6 to 7	8	9 to 10	11	12 to 13	Last 2 bytes
	A	W	, (comma)	Channel number	, (comma)	Index1*1	, (comma)	Index2*1	, (comma)	"OK" or "NG"	CR + LF

Index1: 00 to FF (2-digit hexadecimal), specified Index
Index2: 00 to FF (2-digit hexadecimal), fixed at 0
*1. Refer to *A-3-1 AW and AR Command Parameter List* on page A-10.

● AR Command

Command

Offset	0	1	2	3 to 4	5	6 to 7	8	9 to 10	Last 2 bytes
	A	R	, (comma)	Channel number	, (comma)	Index1*1	, (comma)	Index2*1	CR + LF

Channel number: 01 to 10 (hexadecimal)
Index1: 00 to FF (2-digit hexadecimal), Index specification
Index2: 00 to FF (2-digit hexadecimal), fixed at 0
*1. Refer to *A-3-1 AW and AR Command Parameter List* on page A-10.

Response

Offset	0	1	2	3 to 4	5	6 to 7	8	9 to 10	11	12 to 19	Last 2 bytes
	A	R	, (comma)	Channel number	, (comma)	Index1*1	, (comma)	Index2*1	, (comma)	Read data	CR + LF

Read data: 4-byte hexadecimal
Index1: 00 to FF (2-digit hexadecimal), specified Index
Index2: 00 to FF (2-digit hexadecimal), fixed at 0
*1. Refer to *A-3-1 AW and AR Command Parameter List* on page A-10.

● AD Command

Command

Offset	0	1	2	3 to 4	5	6 to 7	8	9 to 20	Last 2 bytes
	A	D	, (comma)	Channel number	, (comma)	Command ID*1	, (comma)	Write data	CR + LF

Channel number: 01 to 10 (hexadecimal)
Command ID: 00 to FF (2-digit hexadecimal)
Write data: 6-byte hexadecimal
*1. Refer to the table in Attribute ID in *A-3-2 AD Command List* on page A-14.

Response

Offset	0	1	2	3 to 4	5	6 to 7	8	9 to 20	Last 2 bytes
	A	D	, (comma)	Channel number	, (comma)	Command ID*1	, (comma)	Read data	CR + LF

Channel number: 01 to 10 (hexadecimal)
Command ID: 00 to FF (2-digit hexadecimal)
Read data: 6-byte hexadecimal
*1. Refer to the table in Attribute ID in *A-3-2 AD Command List* on page A-14.

● VG Command

Command

Offset	0	1	Last 2 bytes
	V	G	CR + LF

Response

Offset	0	1	2	3 to 6	Last 2 bytes
	V	G	, (comma)	Read data	CR + LF

Read data: 4-digit version information (ASCII character string)

● EC Command

Command

Offset	0	1	Last 2 bytes
	E	C	CR + LF

Response

Offset	0	1	2	3 to 4	Last 2 bytes
	E	C	, (comma)	"OK"	CR + LF

● MS Command

Command

Offset	0	1	2	3 to 4	5	6	Last 2 bytes
	M	S	, (comma)	Channel number 0: All channels 1 to 16: Channel	, (comma)	Additional information 0: Time Stamp 1: Communications external input 2: Time Stamp + External Input	CR + LF

Response

Offset	0	1	2	3 to 14	15	12 to 19 (for 1 channel)	20	21, 22	Last 2 bytes
	M	S	, (comma)	Time Stamp	, (comma)	Measured value MV	, (comma)	Communications external input	CR + LF

Channel number: 01 to 10 in hexadecimal. For Channel number 0, measured values for all channels are returned as comma-delimited values.
Time, measured value: Hexadecimal (ASCII character string, 0x7FFF0000 → "7FFF0000")

● MA Command

Command

Offset	0	1	Last 2 bytes
	M [0x4D]	A [0x41]	CR + LF [0x0D0A]

Response

Offset	0	1	2	3 to 8	9	10	11	12	13	14	15	16	17
	M [0x4D]	A [0x41]	, (comma)	Time [hex]	, (comma) [0x2C]	Communications error external input [hex]	, (comma) [0x2C]	AMPSTATUS (CH1) [hex]	AMPOUT (CH1) [hex]	Measured value MV (CH1) [hex]			

18	19	20	21	22	to	177	178	179	180	181	182	183	184	185	186	Last 2 bytes
Internal measured value RV (CH1) [hex]				, (comma) [0x2C]	to	AMPSTATUS (CH16)	AMPOUT (CH16)	Measured value MV (CH16)				Internal measured value RV (CH16) [hex]				CR + LF [0x0D0A]

Time, measured value: Hexadecimal (binary data)
Communications error external input: Error and external input information on the Communication Unit, where bit 0 is the input status of External Input 1, bit 1 is the input status of External Input 2, and bit 7 is the error status
Measured value MV: MV value. 0x7FFF0000 for unconnected Amplifier Units
Measured value RV: RV value. 0x7FFF0000 for unconnected Amplifier Units

AMPSTATUS(CHx): Status information in PV data

Bit	Name	Description
0	Busy	ON when the sender Amplifier Unit is in a command executing state or in the SETTING mode, OFF otherwise.
1	Enable	Measurement status of the sender Amplifier Unit
2	Warning	A warning occurred in the sender Amplifier Unit.
3	Err	A system error occurred in the sender Amplifier Unit.
4	Input Status1(LD OFF)	External Input Status 1 (Laser OFF)
5	Input Status2(Zero)	External Input Status 2 (Zero Reset)
6	Input Status3(Timing/Bank A)	External Input Status 3 (Timing input/Bank Change)
7	Input Status4(Reset/Bank B)	External Input Status 4 (Reset input/Bank Change)

AMPOUT: Data that shows the control output status of the Amplifier Unit

Bit	Name	Description
0	---	---

Bit	Name	Description
1	---	---
2	High	High judgment output (0: OFF, 1: ON)
3	Pass	Pass judgment output (0: OFF, 1: ON)
4	Low	Low judgment output (0: OFF, 1: ON)
5	Error	Error output (0: Normal, 1: Error)
6	---	---
7	---	---

Command response

Example

	ASCII	Binary
Command	MA[CRLF]	0x4d410d0a
Response Time Stamp: 0x123456789ABC External input: 0x00 or 01 AMPSTATUS 1CH: 0xF8 AMPOUT 1CH: 0x08 mv 0x12345678 rv 0x87654321	MA...	0x[4d41][2c][123456789ABC][2c][00 or 01][2c][F8081234567887654321][2c] ... **Note** Brackets [ ] are used as a delimiter for convenience.

● MR Command

Command

Offset

1	2	Last 2 bytes
M	R	CR + LF

Response

Offset

1	2	3	4 to 5 (CH1)	6	7 to 14 (CH1)	15	to	X to X+1 (Last channel)	X+2	X+3 to X+10 (Last channel)	Last 2 bytes
M	R	,	AMPOUT [hex]	,	Measured value MV	,	to	AMPOUT [hex]	,	Measured value MV	CR + LF

Measured values for the number of Amplifier Unit connected channels are returned as comma-delimited values.
Refer to MA Command for the control output (AMPOUT).

● NF Command

Command

Offset

0	1	Last 2 bytes
N	F	CR + LF

Response

Offset

0	1	2	3 to 4	Last 2 bytes
N	F	, (comma)	"OK"	CR + LF

● GW Command

Command Class ID Instance ID Attribute ID

Offset

0	1	2	3	4	5	6	7	8 to 9	10	11	12	13	14	15	16	17	18	Last 2 bytes
G	W	,	4	1	,	1	,	9	,	Write data								CR + LF

Response

0	1	2	3	4	5	6	7	8 to 9	10	11	12	13	14	15	16	17	18	Last 2 bytes
G	W	,	4	1	,	1	,	9	,	"OK" or "NG"								CR + LF

Note Class ID, instance ID, and attribute ID are specified in hexadecimal and do not require zero-padding.
Write data does not require zero-padding.

● GR Command

Command Class ID Instance ID Attribute ID

Offset

0	1	2	3	4	5	6	7	8 to 9	Last 2 bytes
G	R	,	4	1	,	1	,	E	CR + LF

Response

0	1	2	3	4	5	6	7	8 to 9	10	11 and above	Last 2 bytes
G	R	,	4	1	,	1	,	E	,	Read data	CR + LF

Note Class ID, instance ID, and attribute ID are specified in hexadecimal and do not require zero-padding.
Read data requires zero-padding.

● GC Command

Command Class ID

Offset

0	1	2	3	Last 2 bytes
G	C	,	Erase specification	CR + LF

0: RAM only
1: Logs in ROM also erased

Response

0	1	2	3	4	Last 2 bytes
G	C	,	OK or NG		CR + LF

● SW Command

Command Class ID Instance ID Attribute ID

Offset

0	1	2	3	4	5	6	7	8	9	10	11 and above	Last 2 bytes
S	W	,	3	9	1	,	1	,	1	,	Write data	CR + LF

Response Class ID Instance ID Attribute ID

0	1	2	3	4	5	6	7	8	9	10	11 and above	Last 2 bytes
S	W	,	3	9	1	,	1	,	1	,	"OK" or "NG"	CR + LF

● SR Command

Command Class ID Instance ID Attribute ID

Offset

0	1	2	3	4	5	6	7	8	9	Last 2 bytes
S	R	,	3	9	1	,	1	,	1	CR + LF

Offset	Response						Instance ID					
0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11 and above**	**Last 2 bytes**
S	R	,	3	9	1	,	1	,	1	,	Read data	CR + LF

3-2-4 Communications Response Time

This section describes the communications response time for the setting change commands (DW and AW), status acquisition command (SR), and measured value acquisition commands (MS and MR).

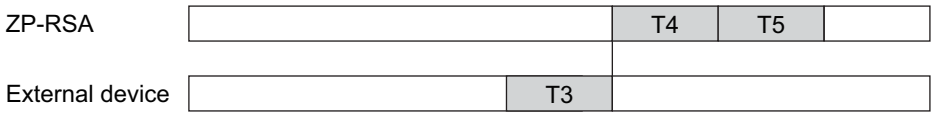
Communication Response Time and Timing Chart

This section describes the concept of communications response time and the timing chart for no-protocol commands.

● SR and DW Commands

The SR command reads data directly from the Sensor Amplifier Unit in T4 (ZP-RSA command processing time).

- Timing chart

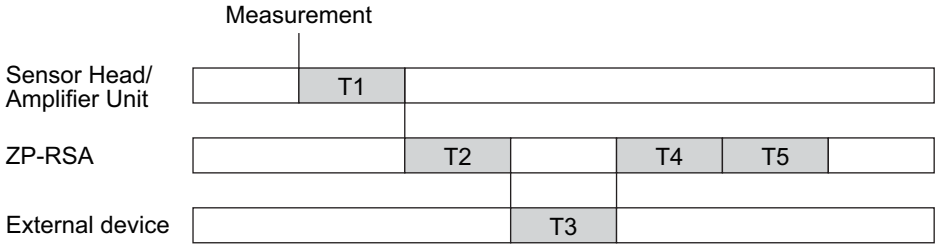


T3: Command send time from external device
T4: ZP-RSA command processing time
T5: Response send time from ZP-RSA

● MS and MR Commands

The MS and MR commands enable the ZP-RSA to return the latest data received from the adjacent Amplifier Unit in response to the command reception.
This means that the latest data detected by the sensor can be read only after T2 (ZP-RSA data processing time) in which data is taken from the Amplifier Unit has elapsed.

- Timing chart



T1: Response time (Refer to the *ZP Series Laser Displacement Sensor User's Manual (Cat. No. Z495)*.)
T2: ZP-RSA data processing time
T3: Command send time from external device

T4: ZP-RSA command processing time

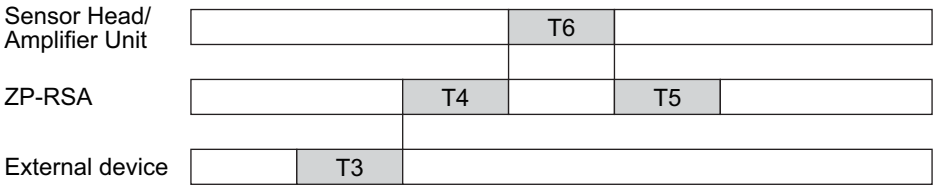
T5: Response send time from ZP-RSA

Note Refer to *Communications Response Time Values* on page 3-11 for the specific values of T2 to T5.

● AW and AR Commands

The AW command writes the settings for the adjacent Amplifier Unit, while the DW command writes the settings for the ZP-RSA.

- Timing chart



T3: Command send time from external device

T4: ZP-RSA command processing time

T5: Response send time from ZP-RSA

T6: Setting change response time

Communications Response Time Values

The following describes the communications time (T2 to T6).

Note Each communication response time value represents a theoretical value. This means that more time may be required depending on the communications environment and the processing load in the communications device.

● T2 (ZP-RSA Data Processing Time)

Inside the ZP-RSA, the data processing time is constant regardless of the number of Amplifier Units connected.

Number of Amplifier Units connected	Data processing time (T2) [ms]
1	2
2	
3	
4	
5	
6	
7	
8	
16	

● T3 (Command Send Time from External Device)

Refer to the instruction manual for the connected external device.

● T4 (ZP-RSA Command Processing Time)

The command processing time is constant regardless of the Write or Read command and the number of Amplifier Units connected.

Number of Amplifier Units connected	Other than DW command	DW command
	Data processing time (T4) [ms]	Data processing time (T4) [ms]
1	1	4
2		
3		
4		
5		
6		
7		
8		
16		

● T5 (Response Send Time from ZP-RSA)

The response send time depends on the communications speed and the data bit length per character.

Refer to *2-2-3 Rotary Switches* on page 2-7 for the communications speed.

The calculation formula for the response send time is as follows.

T5 = (Number of response characters) × (Data bit length + 4) / (Communications speed)

- Amount of response data by command

Command	Number of response characters
SR command	16
MS command	148
MR command	12 × Number of connected Units + 4
Request input	12 × Number of connected Units + 4
DW, DR, AW, or AR command	(Number of characters written)*1

*1. This includes the delimiter (CR+LF).

- Calculation example

Number of response characters	Data bit length [bits]	Communications speed [bps]	Response send time [ms]
40	8	38,400	11.5
100	7	38,400	26.0
40	7	115,200	3.5
100	8	115,200	9.5

● T6 (Setting Change Time)

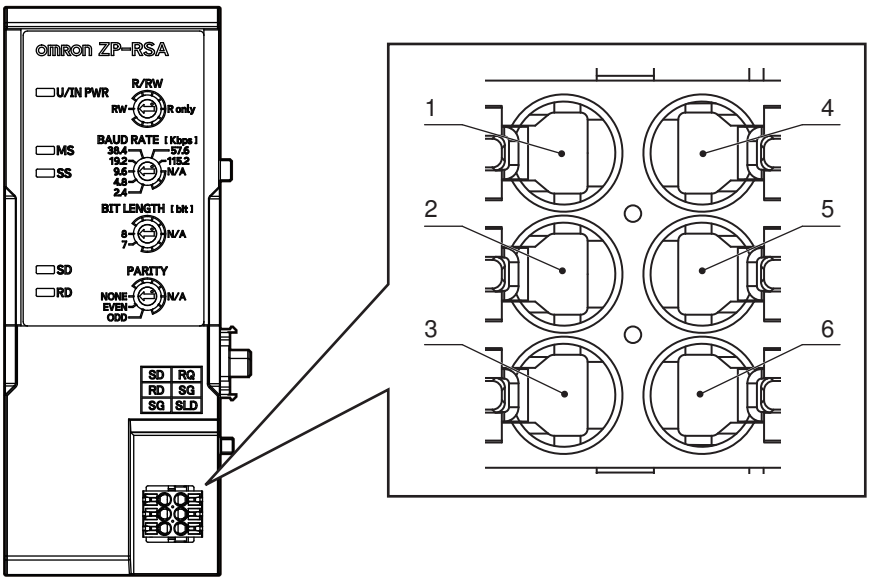
The Sensor Amplifier Unit completes changing the setting in T6 hours after completion of the T4 command processing time.

Command	Setting change time [ms]
AW command	22

3-3 Request Input Function

You can obtain the output status of the Amplifier Unit and measured value information through a request input (signal name: RQ) without sending a command.

3-3-1 Wiring the Request Input cable



- Pin arrangement

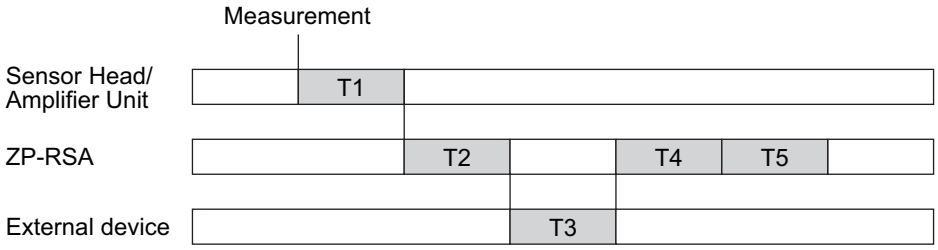
Pin No.	Signal name	Description
3	SG	This is a signal ground. The SG is internally short-circuited.
4	RQ (Input)	Short-circuiting the SG activates the request input function, which sends data from the Amplifier Unit even without command input from an external device. (Data will be sent once every time the RQ and the SG are short-circuited.)
5	SG	This is a signal ground. The SG is internally short-circuited.

3-3-2 Communications Response Time

Request Input

Request input enables the ZP-RSA to output the latest data received from the adjacent Amplifier Unit in response to the input.
This means that the latest data detected by the sensor can be read only after T2 (ZP-RSA data processing time) in which data is taken from the Amplifier Unit has elapsed.

- Timing chart



T1: Response time (Refer to the *ZP Series Laser Displacement Sensor User's Manual (Cat. No. Z495)*.)
T2: ZP-RSA data processing time
T3: Request input time from external device (4 ms min.)
T4: ZP-RSA command processing time
T5: Response send time from ZP-RSA

3-3-3 Command Format

Request Input Response

Response

Offset	1	2	3	4 to 5 (CH1)	6	7 to 14 (CH1)	15	to	X to X+1 (Last channel)	X+2	X+3 to X+10 (Last channel)	Last 2 bytes
	R	Q	,	AMPOUT [hex]	,	Measured value MV	,	to	AMPOUT [hex]	,	Measured value MV	CR + LF

Measured values for the number of Amplifier Unit connected channels are returned as comma-delimited values.
Refer to MA Command for the control output (AMPOUT).

4

Troubleshooting

This section describes troubleshooting, inspection, and maintenance for the Communication Unit.

4-1 Checking for Errors

This section describes how an error is notified to you, and what and how you should check for errors.

4-1-1 How an Error Is Notified and What Information to Check

The Communication Unit notifies you of a detected error by the methods shown below.
If an error is notified, check for the error status and perform troubleshooting.

Notification method	Checking method	Information to check	Reference
Notification of Communication Unit errors by indicators	Visually checking the status of each indicator on the Communication Unit	Check the indicators on the Communication Unit. There are several status indicators. The status indicators show the status of the Communication Unit and the status of the Amplifier Unit and RS-232C communications.	*4-2 Checking for Errors and Troubleshooting with Indicators* on page 4-3
Notification of the occurrences of errors in the Communication Unit and information on them by event logs	Reading and checking the event logs of the Communication Unit through a no-protocol command	You can check the following information recorded by the Communication Unit. • Errors that occurred in the Communication Unit • Status changes in the Communication Unit The above information that is called events is stored with the time of occurrence in the Communication Unit. *1	*4-3 Checking for Errors and Troubleshooting with the Event Codes of the Communication Unit* on page 4-6

*1. Some settings are required to record the time of occurrence in event logs. Refer to *A-2-1 Event Log Function (Class ID: 41 Hex)* on page A-4 for details.

4-1-2 How to Check for Errors

The following table shows the basic procedure to check for errors.

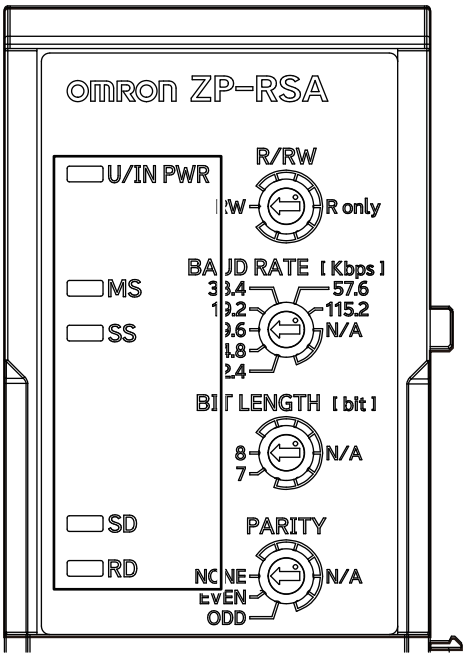
Step	Item	Description	Reference
1	Finding the occurrence of an error	Find whether or not an error occurred using the indicator status.	*4-2 Checking for Errors and Troubleshooting with Indicators* on page 4-3
2	Isolating the error cause	If there is an error, perform the following checks to isolate the cause of the error.	---
		Check the status of each indicator according to *4-2 Checking for Errors and Troubleshooting with Indicators* on page 4-3.	*4-2 Checking for Errors and Troubleshooting with Indicators* on page 4-3
		Check the event logs of the Communication Unit.	*4-3 Checking for Errors and Troubleshooting with the Event Codes of the Communication Unit* on page 4-6
3	Troubleshooting the error	After you isolate the cause of the error, perform troubleshooting.	---

4-2 Checking for Errors and Troubleshooting with Indicators

This section describes how to check for errors with indicators and perform troubleshooting.

4-2-1 Checking for Errors and Troubleshooting with Status Indicators

The status indicators show the status of the Communication Unit, Amplifier Unit, and RS-232C communications.
The status indicators include the following indicators. The checking and troubleshooting methods with each indicators are described below.



Name	Description	Reference
MS Indicator	The module status indicator. This indicator shows the operating status of the Unit.	*Checking for Primary Errors and Troubleshooting with the MS Indicator* on page 4-4
SD Indicator	The send data indicator. This indicator shows the send status of RS-232C communications.	---
RD Indicator	The receive data indicator. This indicator shows the receive status of RS-232C communications.	---
U/IN PWR Indicator	This indicator shows the status of the Unit/input power supply.	*Checking for Errors and Troubleshooting with the U/IN PWR Indicator* on page 4-4
SS Indicator	The Amplifier Unit status indicator. This indicator shows the operating status and communications status of the Amplifier Unit.	*Checking for Errors and Troubleshooting with the SS Indicator* on page 4-5

Checking for Errors and Troubleshooting with the U/IN PWR Indicator

U/IN PWR Green	Unit status	Cause	Correction
Lit	Power supply provided	Power is supplied.	(This is the normal status.)
Not lit	No power supply	Power is not supplied, or is insufficient.	Check the following items and make sure that power is correctly supplied from the power supply. • Make sure the Amplifier Unit is connected correctly. • Make sure that the supply voltage is within the rated range. • Make sure that the power supply has enough capacity. • Make sure that the power supply has not failed.

Checking for Primary Errors and Troubleshooting with the MS Indicator

MS	Unit status	Cause	Correction
Not lit	No power supply	Power is not supplied.	Check the following items and make sure that power is correctly supplied from the power supply. • Make sure that the Amplifier Unit is connected. • Make sure that the supply voltage is within the rated range. • Make sure that the power supply has enough capacity. • Make sure that the power supply has not failed. Also check the U/IN PWR indicator status. Refer to *Checking for Errors and Troubleshooting with the U/IN PWR Indicator* on page 4-4.
Lit green	The Unit is operating normally.	An RS-232C communications connection is established.	(This is the normal status.)
Lit red	Non-volatile Memory Hardware Error	The non-volatile memory failed.	Cycle the power supply. If cycling the power supply does not clear the error, replace the Unit.
	Unit Processing Error	An error occurred in the software.	Cycle the power supply. If cycling the power supply does not clear the error, replace the Unit. If this error occurs again even after you replace the Unit, contact your OMRON representative.
	Hardware Failure	A hardware error occurred in the Unit.	Cycle the power supply. If cycling the power supply does not clear the error, replace the Unit.

MS	Unit status	Cause	Correction
Flashing red	Non-volatile Memory Checksum Error	The power supply to the Communication Unit was turned OFF while settings were written. Or, Support Software communications were disconnected.	Initialize the settings of the Communication Unit. Do not turn OFF the power supply to the Communication Unit or disconnect communications with the Support Software while you transfer the settings to the Unit.
	Communications Setting Error	Some communications setting is incorrect (N/A).	Change the communications setting rotary switch from N/A to the correct position. Then, cycle the power supply.

Checking for Errors and Troubleshooting with the SS Indicator

SS	Unit status	Cause	Correction
Lit green	Communicating with Amplifier Units	The Communication Unit is successfully communicating with the Amplifier Units.	(This is the normal status.)
Lit red	Communications error with Amplifier Units	The Communication Unit is not communicating with the Amplifier Units correctly.	Check the following items, connect and configure the Communication Units correctly, and then cycle the power supply. • Make sure that the connector is inserted properly and not disconnected. • Make sure that the registration of the number of connected channels is correct. • Make sure that 17 or more Amplifier Units are not connected.
Flashing red	Amplifier Unit System Error	In one of the Amplifier Units, a system error has occurred at least once since startup. Or the system error state has been persisting.	Clear the system error in the connected Amplifier Units and either perform the *Clear Error Status Flag* service or cycle the power supply.

4-3 Checking for Errors and Troubleshooting with the Event Codes of the Communication Unit

This section describes how to check for errors and troubleshoot them with the event codes of the Communication Unit.

Overview

The Communication Unit records events, such as errors and status changes, that occur in it. Reading recorded event codes from event logs allows you to easily correct errors that occurred.

4-3-1 Checking with No-protocol Commands

Reading Event Logs

Send the GR command with the following contents to read the event log.

Class ID	Event Log parameter (41 hex)
Instance ID	01 hex
Attribute ID (Instance)	0D hex Event/Data Log Size 0E hex Event/Data Log

Clearing Event Logs

Send the GC command with the following contents to clear the event log.

Class ID	Event Log parameter (41 hex)
Instance ID	01 hex
Attribute ID (Instance)	Not specified

Refer to *A-2-1 Event Log Function (Class ID: 41 Hex)* on page A-4.

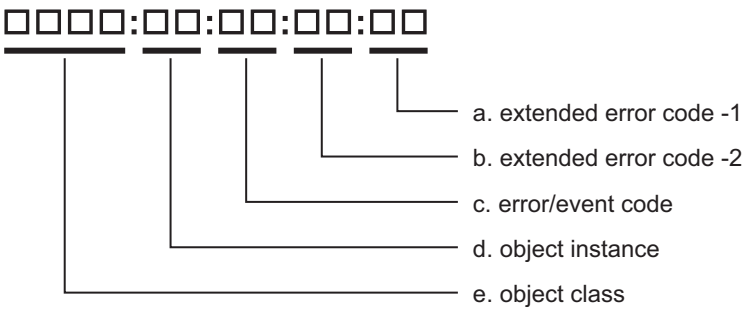
4-3-2 Event Codes for Errors and Troubleshooting Procedures

This section describes how to read the event codes of errors and troubleshoot them according to the event logs.

Format and Meaning of Event Codes

An event code consists of 12 hexadecimal digits. It is formatted as follows.

Format of event codes



a. extended error code -1	Lower digits of the expansion error code. This contains the detailed error code.
b. extended error code -2	Upper digits of the expansion error code. This contains the error code in the class. The most significant bit of these digits indicates the event category: 1 for warning and 0 for information.
c. error/event code	This is the general status code. It contains IF hex that indicates a vendor-specific error for all events.
d. object instance	This is the instance ID for the event source.
e. object class	This is the class ID for the event source.

Details on Events

Details on each event are described below.

Event code	Category	Retained or Not retained	Event name	Cause	Correction
0041:01:1F:01:00	Information	Retained	Clearing Event Logs	The event log was cleared.	---
0392:01:1F:01:xx xx: Channel number where the event occurred	Warning	Retained	Amp Information Consecutive Reception Error	Data reception from the Amplifier Unit in a certain channel has failed consecutively 16 times, or error data has been received.	Check the connection status with the Amplifier Unit and cycle the power supply. If cycling the power supply does not clear the error, replace the Communication Unit or Amplifier Unit. Check the surrounding noise environment and implement noise countermeasures.
0392:01:1F:02:00	Warning	Retained	Amplifier Unit Alive Check Error	There is no data coming from the Amplifier Units.	Check the connection status with the Amplifier Unit and cycle the power supply. If cycling the power supply does not clear the error, replace the Communication Unit or Amplifier Unit.

Event code	Category	Retained or Not retained	Event name	Cause	Correction
0392:01:1F:03:00	Warning	Retained	Amplifier Unit Channel Recognition Error	The Unit failed to recognize the channel during startup.	Check the connection status with the Amplifier Unit and cycle the power supply. If cycling the power supply does not clear the error, replace the Communication Unit or Amplifier Unit.
0392:01:1F:04:xx xx: Channel number where the system error occurred	Warning	Retained	Amplifier Unit System Error	A system error has occurred in the Amplifier Unit with a certain channel number.	Correct the system error in the Amplifier Unit and cycle the power supply. If cycling the power supply does not clear the error, replace the Amplifier Unit.
0390:01:1F:01:xx xx: Setting that caused the error Bit 0: Communications speed Bit 1: Data bit length Bit 2: Parity check	Warning	Retained	Communications Setting Error	The communications setting is incorrect (N/A).	Set the communications setting rotary switch correctly and cycle the power supply.

4-4 Resetting Errors

This section describes how to reset errors in the Communication Unit.

4-4-1 Overview of Resetting Errors

If an error occurs in a Communication Unit, and you remove the cause of the error, the Communication Unit automatically recovers and starts operating normally.

4-4-2 Hold Setting For Error Status

Use the following setting to set the behavior of the error status when the error cause is removed.

Use no-protocol commands to configure the following setting.

Setting	Description	Default	Setting range	Update timing
Hold Setting For Error Status	Set the behavior of the error status when the error cause is removed.	TRUE	TRUE or FALSE*1	After restart

*1. The set values are described as follows:

Set value	Description
TRUE	The error status does not change to FALSE when the error cause is removed. To clear the error, use the Clear Error Status Flag service.
FALSE	The error status changes to FALSE when the error cause is removed.

Refer to *A-2-3 Error Status Function (Class ID: 391 Hex)* on page A-5 for setting with the SW command.

4-4-3 Clearing the Error Status

Send the no-protocol command EC to change the error status to FALSE (cleared).

A

Appendices

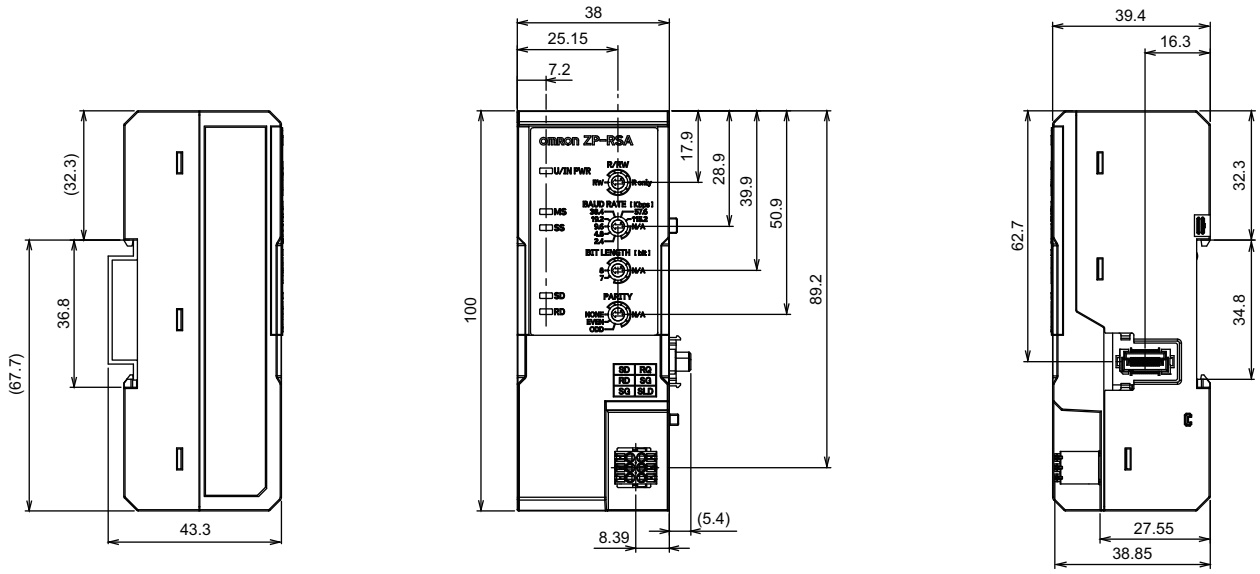
The appendices provide information that supplements the main body of this manual, including supported advanced functions, sample programs, etc.

A-1 Specifications

This section describes the following specifications of the Communication Unit.

- General Specifications
- RS-232C Communications Specifications

A-1-1 Dimensions



[UNIT : mm]

A-1-2 General Specifications

Item	Specification
Sensor that can be connected	ZP-series Amplifier Unit
Power supply voltage	10 to 30 VDC, including 10% ripple (p-p) (supplied from Amplifier Unit)
Power consumption	700 mW max. (not including Amplifier Unit)
Indicators	MS (Green/Red), SS (Green/Red), RD (Green), SD (Green)
External input	Request input When ON: 0 V short-circuit or 1.2 V max. When OFF: Open (Leakage current: 0.1 mA max.)
Ambient temperature range	Operating: -10 to 50°C Storage: -15 to 70°C (with no icing or condensation)
Ambient humidity range	Operating and storage: 35% to 85% RH each (with no condensation)
Vibration resistance	10 to 150 Hz, double amplitude 0.7 mm, 80 minutes each in X, Y, and Z directions
Shock resistance	300 m/s^2, 3 times each in 6 directions along X, Y, and Z axes
Dielectric strength	1,000 VAC, 50/60 Hz for 1 minute
Insulation resistance	20 MΩ min. (at 500 VDC)
Maximum number of connected sensors	16 units max.
Degree of protection*1	IP20 (IEC60529)

Item	Specification
Material	Polycarbonate
Weight (Main unit only)	Approx. 75 g
Accessories	Instruction manual, compliance sheet, End Plates (2)

*1. This indicates the degree of protection when connected to an Amplifier Unit.

A-1-3 RS-232C Communications Specifications

Item		Specification
Communications port		RS-232C (terminal block)
Communications method		Full duplex
Synchronization method		Start/stop synchronization
Transmission code		ASCII
Communications speed*1		2,400, 4,800, 9,600 (default) 19,200, 38,400, 57,600, or 115,200 bps
Data bit length*1		7 bits or 8 bits (default)
Parity check*1		None (default), Even, or Odd
Stop bit length		1 bit
Data delimiter	When receiving	CR or CR + LF automatically recognized
	When sending	CR + LF fixed

*1. Use the rotary switches on the front panel of the ZP-RSA to switch between settings. Turn OFF the power supply before changing the switch settings. The settings will be reflected when the power supply is turned ON next time.

A-2 Supported Advanced Functions

The supported advanced functions are listed below.
To access the advanced functions of the Communication Unit, use no-protocol commands.

Object name	Function	Reference
Event log function	Reads errors and events that occurred in the Communication Unit.	*A-2-1 Event Log Function (Class ID: 41 Hex)* on page A-4
Unit management function	Aggregates unit information on the Communication Unit.	*A-2-2 Unit Management Function (Class ID: 390 Hex)* on page A-5
Error status function	Sets the hold setting for error status and provides the error cause or information for troubleshooting the Communication Unit.	*A-2-3 Error Status Function (Class ID: 391 Hex)* on page A-5

A-2-1 Event Log Function (Class ID: 41 Hex)

The event log function reads errors and events that occurred in the Communication Unit.

● Parameters

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
02	State	Instance state	Read	USINT	00: Non-existent 02: Empty 03: Available 04: Full/Overwrite
09	Logged Data Configuration	Event Log Logged Data Configuration	Read/Write	BYTE	00: Event Identifier 01: Event Identifier + Time Stamp Default: 00
0C	Event/Data Log Maximum Size	Maximum number of event log entries	Read	UDINT	00000028
0D	Event/Data Log Size	Number of currently registered event logs	Read	UDINT	00000000 to 00000028
0E	Event/Data Log	Event logs	Read	ARRAY OF STRUCT	*1
18	Event Identifier Format	Event log format	Read	USINT	01: 48-bit object model/error format

*1. The data format for each event log is shown in the following table. All the registered event logs are read in order from the oldest. Refer to *4-3-2 Event Codes for Errors and Troubleshooting Procedures* on page 4-6 for details on event codes for errors and troubleshooting procedures.
The data format differs depending on the value of attribute ID 09 hex (Logged Data Configuration).

- When attribute ID 09 hex is 00 hex (Event Identifier)

Byte offset	Data type	Description
0	UINT	Class ID for the event source
2	USINT	Instance ID for the event source
3	USINT	1F hex fixed

Byte offset	Data type	Description
4	UINT	Expansion error code: • Lower byte: Error code in the class • Upper byte: Detailed code

- When attribute ID 09 hex is 01 hex (Event Identifier + Time Stamp)

Byte offset	Data type	Description
0	UINT	Class ID for the event source
2	USINT	Instance ID for the event source
3	USINT	1F hex fixed
4	UINT	Expansion error code: • Lower byte: Error code in the class • Upper byte: Detailed code
5	TIME or DATE AND TIME	Time of event occurrence: • When automatic clock adjustment is disabled: TIME (4 bytes) • When automatic clock adjustment is enabled: DATE AND TIME (6 bytes)

A-2-2 Unit Management Function (Class ID: 390 Hex)

The Unit management function aggregates unit information on the Communication Unit.

● Parameters

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
01	Unit Version	Unit version	Read	DWORD	Unit version of Communication Unit
02	Hardware Version	Hardware version	Read	DWORD	Hardware version of the Communication Unit
03	Software Version	Software version	Read	DWORD	Software version of the Communication Unit
04	Lot Number	Lot number	Read	DWORD	Unique number assigned to each Communication Unit
0B	Total Power-ON Time	Total power-ON time (Unit: h)	Read	UDINT	00000000 to 2AAAAAAA
10	Connected CH	Gets the number of connected Amplifier Units.	Read	BYTE	1 to 16 0: Channel recognition failure Default: 0
11	Register number of connected CH	Registration of the number of connected channels	Read/ Write	BYTE	1 to 16: Number of connected channels 0: No check for number of connected channels Default: 0

A-2-3 Error Status Function (Class ID: 391 Hex)

The error status function sets the hold setting for error status and provides the error cause or information for troubleshooting the Communication Unit.

● Parameters

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
01	Hold Setting For Error Status	Hold setting for error status	Read/ Write	BOOL	• TRUE: The error status does not change to FALSE when the error cause is removed. To change the error status to FALSE, use the *Clear Error Status Flag* service. • FALSE: The error status changes to FALSE when the error cause is removed. Default: TRUE
04	Unit Error Aggregation Status	Unit error aggregation status	Read	BYTE	• 20: The value is 20 hex when any of the attributes 01 to 05 hex is TRUE. • 00: The above errors did not occur.
05	UNIT Error bit	Unit error bit	Read	WORD	Notification of the error status in the Unit. When an error occurs, the corresponding bit is turned ON (1). Bit 0: Hardware failure in the Communication Unit Bit 1: Unit Processing Error Bit 2: Communications Error between Amplifier Units Bit 3: EEPROM Error Bit 4: Amplifier Unit Recognition Error at Startup Bit 11: Connected Amplifier Unit System Error Bits 12 to 15: Reserved (always 0)

A-3 Supported Message Communications

Object name	Class ID (hex)	Instance ID	Attribute ID (hex)	Parameter name	Description
Event Log	41	00	20	Time Format	Format of time information
		00	21	Present Time	Current time
		01	02	State	Instance state
		01	09	Logged Data Configuration	Event Log Logged Data Configuration
		01	0C	Event/Data Log Maximum Size	Maximum number of event log entries
		01	0D	Event/Data Log Size	Number of currently registered event logs
		01	0E	Event/Data Log	Event logs
		01	18	Event Identifier Format	Event log format
Unit management	390	01	01	Unit Version	Unit version
		01	02	Hardware Version	Hardware version
		01	03	Software Version	Software version
		01	04	Lot Number	Lot number
		01	0B	Total Power-ON Time	Total power-ON time (Unit: h)
		01	10	Connected CH	Gets the number of connected Amplifier Units.
		01	11	Register number of connected CH	Registration of the number of connected channels
Error status	391	01	01	Hold Setting For Error Status	Hold setting for error status
		01	04	Unit Error Aggregation Status	Unit error aggregation status
		01	05	UNIT Error bit	Unit error bit
		01	---	---	---

● Parameter Specification Comparison Table

Object name	Class ID (hex)	Instance ID	Attribute ID (hex)	Data type	Default (hex)	Value (Value range)	Role
Event Log	41	00	20	USINT	DB	DB: TIME CF: DATE AND TIME	Format of internally held time information

Object name	Class ID (hex)	Instance ID	Attribute ID (hex)	Data type	Default (hex)	Value (Value range)	Role
		00	21	Set value of Time Format	0	• TIME 80000000 to 7FFFFFFF Default: 00000000 • DATE AND TIME DT#1972010100:00:00.000 to DT#2151060623:59:59.999 Default: 000000000000 **Note 1.** Any unused areas should be zero-padded. **Note 2.** When time is retrieved from the SNTP server using the data type TIME, the lower 4 bytes of the 6-byte time information in ms are used. Thereafter, time is managed by using 0x00000000 to 0xFFFFFFFF.	Current time information
		01	02	USINT	00	00 02 03 04	Non-Existent Empty Available Full/Overwrite
		01	09	BYTE	00	00 01 Default: 00	0 (default): Logs Event Identifier in log data. 1: Logs Event Identifier and Time Stamp in log data.
		01	0C	UDINT	00000028	00000028 (fixed)	Maximum number of event log entries
		01	0D	UDINT	00000000	00000000 to 00000028	Number of currently registered event logs
		01	0E	ARRAY OF STRUCT	Refer to *Parameters* on page A-4.	Refer to *Parameters* on page A-4.	Refer to *Parameters* on page A-4.
		01	18	USINT	1 (48-bit object model/error format)	1 (48-bit object model/error format)	48-bit object model/error format
		01	---	---	---	---	Clears the event log.
Unit management	390	01	01	DWORD	10000000	Unit version of the Unit	Unit version of the Unit
		01	02	DWORD	10000000	Hardware version of the Unit	Hardware version of the Unit
		01	03	DWORD	10000000	Software version of the Unit	Software version of the Unit
		01	04	DWORD	Unit-specific	Unique number assigned to each Unit	Unique number assigned to each Unit
		01	0B	UDINT	0000	00000000 to 2AAAAAAA	Total power-ON time (Unit: h)
		01	10	BYTE	0	1 to 16 0: Channel recognition failure	Gets the number of connected Amplifier Units after completion of startup. If connection fails, 0 will be returned.

Object name	Class ID (hex)	Instance ID	Attribute ID (hex)	Data type	Default (hex)	Value (Value range)	Role
		01	11	BYTE	0	1 to 16: Number of connected channels 0: No check for number of connected channels	Registers the number of connected channels. If the number of connected channels does not match the specified number, a channel recognition error will occur.
Error status	391	01	01	BOOL	TRUE	TRUE FALSE	The error status does not change to FALSE when the error cause is removed. The error status changes to FALSE when the error cause is removed.
		01	04	BYTE	00	00: Normal status 20: Error occurred	The above error does not occur when any of the error causes in Attribute 05 to 5B hex is TRUE.
		01	05	WORD	0000	Bit 0: Hardware failure in the Communication Unit Bit 1: Unit Processing Error Bit 2: Communications Error between Amplifier Units Bit 3: EEPROM Error Bit 4: Amplifier Unit Recognition Error at Startup Bit 11: Connected Amplifier Unit System Error Bits 12 to 15: Reserved (always 0)	Notification of the error status in the Communication Unit. When an error occurs, the corresponding bit is turned ON (1).
		01	---	---	---	Clear error status	Clears all error status values.

● Command Comparison Table

Object name	Class ID (hex)	Instance ID	Attribute ID (hex)	Parameter name	Description	Corresponding no-protocol command	Immediately applied or restart required No-protocol
Event Log	41	00	20	Time Format	Format of time information	GW/GR	Applied by restart
		00	21	Present Time	Current time	GW/GR	Immediately applied
		01	02	State	Instance state	GR	
		01	09	Logged Data Configuration	Event Log Logged Data Configuration	GW/GR	Applied by restart

Object name	Class ID (hex)	Instance ID	Attribute ID (hex)	Parameter name	Description	Corresponding no-protocol command	Immediately applied or restart required No-protocol
		01	0C	Event/Data Log Maximum Size	Maximum number of event log entries	GR	
		01	0D	Event/Data Log Size	Number of currently registered event logs	GR	
		01	0E	Event/Data Log	Event logs	GR	
		01	18	Event Identifier Format	Event log format	GR	
		01	---	---	---	GC	
Unit management	390	01	01	Unit Version	Unit version	DR	
		01	02	Hardware Version	Hardware version	DR	
		01	03	Software Version	Software version	DR	
		01	04	Lot Number	Lot number	DR	
		01	0B	Total Power-ON Time	Total power-ON time (Unit: h)	DR	
		01	10	Connected CH	Gets the number of connected Amplifier Units.	DR	
		01	11	Register number of connected CH	Registration of the number of connected channels	DW/DR	Applied by restart
Error status	391	01	01	Hold Setting For Error Status	Hold setting for error status	SW/SR	Applied by restart
		01	04	Unit Error Aggregation Status	Unit error aggregation status	SR	
		01	05	UNIT Error bit	Unit error bit	SR	
		01	---	---	---	EC	

A-3-1 AW and AR Command Parameter List

The parameters used to send the AW or AR command are shown in the table below.

○: Possible/×: Not possible

Data	Index1 (hex)	Parameter	Default	Write data setting range or output range	Unit	Re-trieval	Set-ting
BANK0	0	High Threshold [BANK0]	Measurement range × 0.1	-999,999,999 to 999,999,999	0.01 µm	○	○
	1	Low Threshold [BANK0]	- (Measure-ment range × 0.1)	-999,999,999 to 999,999,999	0.01 µm	○	○
	2	Zero Reset Indicator Value [BANK0]	0	-999,999,999 to 999,999,999	0.01 µm	○	○
	3	Zero Reset Level [BANK0]	0	-999,999,999 to 999,999,999	0.01 µm	○	×
	4	Zero Reset Flag [BANK0]	0	0: Zero reset not executed (OFF), 1: Zero reset executed (ON)	---	○	×
	5	Analog Output Scal-ing [BANK0]	0	0: Disable analog output scaling, 1: Enable analog output scaling	---	○	○
	6	Analog Output Scal-ing Upper Limit [BANK0]	Maximum measurement value	-999,999,999 to 999,999,999	0.01 µm	○	○
	7	Analog Output Scal-ing Lower Limit [BANK0]	Minimum measurement value	-999,999,999 to 999,999,999	0.01 µm	○	○
BANK1	20	High Threshold [BANK0]	Measurement range × 0.1	-999,999,999 to 999,999,999	0.01 µm	○	○
	21	Low Threshold [BANK0]	- (Measure-ment range × 0.1)	-999,999,999 to 999,999,999	0.01 µm	○	○
	22	Zero Reset Indicator Value [BANK0]	0	-999,999,999 to 999,999,999	0.01 µm	○	○
	23	Zero Reset Level [BANK0]	0	-999,999,999 to 999,999,999	0.01 µm	○	×
	24	Zero Reset Flag [BANK0]	0	0: Zero reset not executed (OFF), 1: Zero reset executed (ON)	---	○	×
	25	Analog Output Scal-ing [BANK0]	0	0: Disable analog output scaling, 1: Enable analog output scaling	---	○	○
	26	Analog Output Scal-ing Upper Limit [BANK0]	Maximum measurement value	-999,999,999 to 999,999,999	0.01 µm	○	○
	27	Analog Output Scal-ing Lower Limit [BANK0]	Minimum measurement value	-999,999,999 to 999,999,999	0.01 µm	○	○

Data	Index1 (hex)	Parameter	Default	Write data setting range or output range	Unit	Re-trieval	Set-ting
BANK2	40	High Threshold [BANK0]	110% of measurement range	-999,999,999 to 999,999,999	0.01 µm	○	○
	41	Low Threshold [BANK0]	90% of measurement range	-999,999,999 to 999,999,999	0.01 µm	○	○
	42	Zero Reset Indicator Value [BANK0]	0	-999,999,999 to 999,999,999	0.01 µm	○	○
	43	Zero Reset Level [BANK0]	0	-999,999,999 to 999,999,999	0.01 µm	○	×
	44	Zero Reset Flag [BANK0]	0	0: Zero reset not executed (OFF), 1: Zero reset executed (ON)	---	○	×
	45	Analog Output Scaling [BANK0]	0	0: Disable analog output scaling, 1: Enable analog output scaling	---	○	○
	46	Analog Output Scaling Upper Limit [BANK0]	Maximum measurement value	-999,999,999 to 999,999,999	0.01 µm	○	○
	47	Analog Output Scaling Lower Limit [BANK0]	Minimum measurement value	-999,999,999 to 999,999,999	0.01 µm	○	○
BANK3	60	High Threshold [BANK0]	Measurement range × 0.1	-999,999,999 to 999,999,999	0.01 µm	○	○
	61	Low Threshold [BANK0]	- (Measurement range × 0.1)	-999,999,999 to 999,999,999	0.01 µm	○	○
	62	Zero Reset Indicator Value [BANK0]	0	-999,999,999 to 999,999,999	0.01 µm	○	○
	63	Zero Reset Level [BANK0]	0	-999,999,999 to 999,999,999	0.01 µm	○	×
	64	Zero Reset Flag [BANK0]	0	0: Zero reset not executed (OFF), 1: Zero reset executed (ON)	---	○	×
	65	Analog Output Scaling [BANK0]	0	0: Disable analog output scaling, 1: Enable analog output scaling	---	○	○
	66	Analog Output Scaling Upper Limit [BANK0]	Maximum measurement value	-999,999,999 to 999,999,999	0.01 µm	○	○
	67	Analog Output Scaling Lower Limit [BANK0]	Minimum measurement value	-999,999,999 to 999,999,999	0.01 µm	○	○
Basic Sensor Settings	80	Measurement Cycle	3	0: 125 µs, 1: 250 µs, 2: 500 µs, 3: 1 ms, 4: 2 ms, 5: 4 ms, 6: 20 ms, 7: 50 ms, 8: 100 ms		○	○
	81	Calculation	0	0: OFF, 1: Thickness calculation mode, 2: Subtraction mode		○	○
	82	- Thick	0	0 to 999,999,999	0.01 µm	○	○
	83	Analog Output	2	0: ±5 V, 1: 1 to 5 V, 2: 4 to 20 mA, 3: 0 to 5 V, 4: OFF		○	○

Data	Index1 (hex)	Parameter	Default	Write data setting range or output range	Unit	Re-trieval	Set-ting
Advanced Sensor Settings (Meas-urement)	90	Number of Samples to Average	4	(0: 1 time, 1: 2 times, 2: 4 times, 3: 8 times, 4: 16 times, 5: 32 times, 6: 64 times, 7: 128 times, 8: 256 times, 9: 512 times/10: 1,024 times, 11: 2,048 times, 12: 4,096 times)		○	○
	91	Meas. Scaling	0	0: 2-point scaling OFF, 1: 2-point scaling ON		○	○
	92	- Scale1 Before	Maximum measurement value	-999,999,999 to 999,999,999	0.01 µm	○	○
	93	- Scale1 After	Maximum measurement value	-999,999,999 to 999,999,999	0.01 µm	○	○
	94	- Scale2 Before	Minimum measurement value	-999,999,999 to 999,999,999	0.01 µm	○	○
	95	- Scale2 After	Minimum measurement value	-999,999,999 to 999,999,999	0.01 µm	○	○
	96	Sensing Surface	0	0: MAX, 1: NEAR, 2: FAR		○	○
	97	Meas. Direction	0	0: Normal (NEAR plus), 1: Reverse (FAR plus)		○	○
	98	Diff. Calculation	0	0: OFF, 1: ON		○	○
	99	Diff. Cycle	1	1 to 8,000	Number of times	○	○
Advanced Sensor Settings (I/O)	A0	Output Logic	0	0: N.O., 1: N.C.		○	○
	A1	Hold Function	0	0: OFF, 1: Peak, 2: Bottom, 3: Sample, 4: Peak to Peak, 5: Auto Peak/6: Auto Bottom		○	○
	A2	- Trigger Level	0	-999999999 to 999999999	0.01 µm	○	○
	A3	Timer Mode	0	0: OFF, 1: ON-delay timer, 2: OFF-delay timer, 3: One-shot timer		○	○
	A4	- Timer Time	1	1 to 9,999	ms	○	○
	A5	Hysteresis	0	0 to 999,999,999	0.01 µm	○	○
	A6	Input Select	0	0: Button, 1: External Input		○	○
	A7	External Input	0	0: Timing Reset, 1: Bank A/Bank B		○	○
	A8	Zero Reset Memory	0	0: Memory storage OFF, 1: Memory storage ON		○	○
	A9	Synchronization	0	0: Timing A, 1: Timing B		○	○
	AA	Keep Function	0	0: OFF, 1: ON		○	○
	AB	Keep Count	0	0 to 1000	Number of times	○	○
	AC	Initial Output (at ±5 V)	11	0: -5 V, 1: -4 V, ... , 10: 5 V, 11: MAX (5.5 V)		○	○
	AD	Initial Output (at 1 to 5 V)	5	0: 1 V, 1: 2 V, ... , 4: 5 V, 5: MAX (5.5 V)		○	○
	AE	Initial Output (at 0 to 5 V)	6	0: 0 V, 1: 1 V, ... , 4: 4 V, 5: 5 V, 6: MAX (5.5 V)		○	○
	AF	Initial Output (at 4 to 20 mA)	17	0: 4 mA, 1: 5 mA, ... , 16: 20 mA, 17: MAX (22 mA)		○	○

Data	Index1 (hex)	Parameter	Default	Write data setting range or output range	Unit	Re-trieval	Set-ting
Advanced Sensor Settings (Display/ Operation)	C0	Reverse	0	0: OFF, 1: ON		○	○
	C1	Brightness	0	0: Normal, 1: OFF		○	○
	C2	Number of Display Digits	LS025, LS050, LS100: 1 LS300, LS600: 2	0: 0.001, 1: 0.01, 2: 0.1/ 3: 1 [mm]		○	○
	C3	Head Display Mode	0	0: Measurement mode, 1: OFF		○	○
	C4	Display Select	0	0: Normal, 1: High Thresh, 2: Low Thresh, 3: Analog, 4: Resolution, 5: Real Value, 6: Channel No., 7: En-large View		○	○
Shortcut	CA	Change BANK	0	0: BANK0, 1: BANK1, 2: BANK2, 3: BANK3		○	×
	CB	Key Lock	0	0: Lock OFF, 1: Lock ON		○	○
	CC	Setting Tolerance	LS025: 10000 LS050: 20000 LS100: 50000 LS300: 200000 LS600: 800000	0 to 999,999,999	0.01 μm	○	○
Others	E0	Amplifier Unit Control Status	0x00	0x00 to 0xFF (Bit control) Bit 0: Laser emission status (0: Emitting, 1: OFF) Bit 1: Zero reset status (0: Cancel, 1: Execute) Bit 2: Timing status (0: Non-sampling, 1: Sampling) Bit 3: Reset status (0: Not reset, 1: Resetting) Bit 4: Find-me status (0: Not executed, 1: Executing) Bit 5: Reserved Bit 6: Reserved Bit 7: Reserved		○	×
	E1	Language	1	1: English, 2: Japanese, 3: Simplified Chinese, 4: Korean		○	○

A-3-2 AD Command List

The command format of AD commands is shown in the table below.

Command code (hex)	Command	Amplifier Unit operation at reception	Parameter data			Response data			
			1 byte	1 byte	4 bytes	1 byte	1 byte	1 byte	4 bytes
03	Read Set Value	Reads the set value from the Amplifier Unit.	Index1*1	Index2 (Fixed to 0x00)	0x00	Normally received: 03 Not received: F1 Parameter error: F2	Index1	Index2 (0x00)	Read data

Command code (hex)	Command	Amplifier Unit operation at reception	Parameter data			Response data			
			1 byte	1 byte	4 bytes	1 byte	1 byte	1 byte	4 bytes
04	Write Set Value	Writes the set value to the Amplifier Unit.	Index1*1	Index2 (Fixed to 0x00)	Write data	Normally received: 04 Not received: F1 Parameter error: F2	Index1	Index2 (0x00)	0x00
05	Read Model IDs	Reads the model IDs of the Amplifier Unit and Sensor Head.	PARAM1 (0x00: Amplifier Unit) (0x01: Sensor Head)	0x00		Normally received: 05 Not received: F1 Parameter error: F2	PARAM1 (0x00: Amplifier Unit) (0x01: Sensor Head)	0x00	Read data
06	Read Model Information	Reads the model information of the Amplifier Unit and Sensor Head.	PARAM1 (0x00: Amplifier Unit) (0x01: Sensor Head)	ID (0x01 to 0x08)	0x00	Normally received: 06 Not received: F1 Parameter error: F2	PARAM1 (0x00: Amplifier Unit) (0x01: Sensor Head)	ID (0x01 to 0x08)	Read data (4-byte ASCII, 32 bytes in total (Send data split into 8 parts by ID))
07	Read Serial Numbers	Reads the serial numbers of the Amplifier Unit and Sensor Head.	PARAM1 (0x00: Amplifier Unit) (0x01: Sensor Head)	ID (0x01 to 0x02)	0x00	Normally received: 07 Not received: F1 Parameter error: F2	PARAM1 (0x00: Amplifier Unit) (0x01: Sensor Head)	ID (0x01 to 0x02)	Read data (4-byte ASCII, 8 bytes in total (Send data split into 2 parts by ID))
08	Read Hardware Versions	Reads the hardware versions of the Amplifier Unit and Sensor Head.	PARAM1 (0x00: Amplifier Unit) (0x01: Sensor Head)	0x00		Normally received: 08 Not received: F1 Parameter error: F2	PARAM1 (0x00: Amplifier Unit) (0x01: Sensor Head)	0x00	Read data (4-byte ASCII)
09	Read Software Versions	Reads the software versions of the Amplifier Unit and Sensor Head.	PARAM1 (0x00: Amplifier Unit) (0x01: Sensor Head)	0x00		Normally received: 09 Not received: F1 Parameter error: F2	PARAM1 (0x00: Amplifier Unit) (0x01: Sensor Head)	0x00	Read data (4-byte ASCII)
10	Initialize to Factory Defaults	Initializes the Amplifier Unit's EEPROM settings to the factory defaults.	0x00			Normally received: 10 Not received: F1 Parameter error: F2	0x00		

Command code (hex)	Command	Amplifier Unit operation at reception	Parameter data			Response data			
			1 byte	1 byte	4 bytes	1 byte	1 byte	1 byte	4 bytes
20	Execute Automatic Measurement Cycle Adjustment	Sends a command to execute sampling period teaching to the Sensor Head.	0x00			Normally received: 20 Not received: F1 Parameter error: F2	PARAM1 (0x00: OK) (0x0F: NG)	PARAM2 Sampling period adjustment result	0x00
21	Execute Threshold Teaching	Executes threshold teaching using tolerances set in advance.	0x00			Normally received: 21 Not received: F1 Parameter error: F2	PARAM1 (0x00: OK) (0x0E: Teaching executed during non-measurement) (0x0F: Threshold out of measurement range)	0x00	
22	Control Laser Emission OFF	Controls laser emission OFF.	PARAM1 (0x00: ON) (0x01: OFF)	0x00		Normally received: 22 Not received: F1 Parameter error: F2	PARAM1 (0x00: OK) (0x0F: NG)	0x00	
23	Control Zero Reset	Executes or cancels zero reset.	PARAM1 (0x00: Cancel) (0x01: Execute)	0x00		Normally received: 23 Not received: F1 Parameter error: F2	PARAM1 (0x00: OK) (0x0F: NG)	0x00	
24	Control Bank Change	Executes bank change.	PARAM1 (0x00: BANK0) (0x01: BANK1) (0x02: BANK2) (0x03: BANK3)	0x00		Normally received: 24 Not received: F1 Parameter error: F2	PARAM1 (0x00: OK) (0x0F: NG)	0x00	
25	Control Timing Input	Executes timing input.	PARAM1 (0x00: Cancel) (0x01: Execute)	0x00		Normally received: 25 Not received: F1 Parameter error: F2	PARAM1 (0x00: OK) (0x0F: NG)	0x00	

Command code (hex)	Command	Amplifier Unit operation at reception	Parameter data			Response data			
			1 byte	1 byte	4 bytes	1 byte	1 byte	1 byte	4 bytes
26	Control Reset Input	Executes reset input.	PARAM1 (0x00: Cancel) (0x01: Execute)	0x00		Normally received: 26 Not received: F1 Parameter error: F2	PARAM1 (0x00: OK) (0x0F: NG)	0x00	
27	Control Find-me Enable	Executes find-me control.	PARAM1 (0x00: Cancel) (0x01: Execute)	0x00		Normally received: 27 Not received: F1 Parameter error: F2	PARAM1 (0x00: OK) (0x0F: NG)	0x00	

*1. Refer to the *Index1* column in *A-3-1 AW and AR Command Parameter List* on page A-10.

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