KEYENCE

96081E

RS-232C Communication Unit

DL-RS1A

User's Manual (IL Edition)

Read this manual before using the system in order to achieve maximum performance.
Keep this manual in a safe place for future reference.

Introduction

This manual provides an overview of the RS-232C communication unit DL-RS1A and describes the functions and procedures of the unit.
Be sure to read this manual carefully to ensure safe performance and function of the unit.
Keep this manual in a safe place for future reference.
Ensure that this manual is passed to the end user.

Symbols

The following symbols alert you to important messages. Be sure to read these messages carefully.

DANGER	**It indicates a hazardous situation which, if not avoided, will result in death or serious injury.**
WARNING	**It indicates a hazardous situation which, if not avoided, could result in death or serious injury.**
CAUTION	**It indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.**
NOTICE	**It indicates a situation which, if not avoided, could result in product damage as well as property damage.**

Important — It indicates cautions and limitations that must be followed during operation.

Point — It indicates additional information on proper operation.

Reference — It indicates tips for better understanding or useful information.

Safety Precautions

General Cautions

- At startup and during operation, be sure to monitor the functions and performance of the DL-RS1A for proper operations.
- We recommend that you take substantial safety measures to avoid any damage in the event that a problem occurs.
- Do not modify the DL-RS1A or use it in any way other than described in the specifications.
- When the DL-RS1A is used in combination with other instruments, functions and performance may be degraded, depending on the operating conditions and surrounding environment.
- Do not use the DL-RS1A for the purpose of protecting the human body.
- Do not change the temperature drastically around the DL-RS1A and other devices including the accessories. Otherwise condensation may be generated.

Handling Errors

NOTICE	**Turn off the power immediately in the following cases. Using the unit in abnormal conditions could cause fire, electric shock, or accident. Contact the nearest KEYENCE office for repair.** **• If fluids including water, chemicals, or debris enter the unit** **• If the unit is dropped or the case is damaged** **• If abnormal smoke or odor is present**

Operating Precautions

WARNING	**• Do not use the DL-RS1A with a voltage other than specified voltage, as this may cause fire, electric shock or equipment failure.** **• Do not disassemble or modify the DL-RS1A. Doing so may cause fire or electric shock.**
NOTICE	**• Be sure to turn off the power to the DL-RS1A and any connected devices before connecting or disconnecting the cables. Failure to do so may damage the unit.** **• Do not turn off the power while setting a parameter. Otherwise, the settings may be partially or completely lost.**

■ Installation environment

To use the DL-RS1A correctly and safely, avoid installing it in the following locations. Failure to do so to may cause fire, electric shock, and malfunction.

- Locations that are humid, dusty, or poorly ventilated
- Locations with a high temperature, such as a place exposed to direct sunlight
- Locations where there are flammable or corrosive gases
- Location where the unit may be directly subjected to vibration or impact
- Locations where water, oil, or chemicals may splash onto the DL-RS1A
- Locations where static electricity is easily generated

■ Noise countermeasures

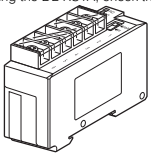
Isolate the unit from devices that generate high frequency electrical signals, power supply lines, or power lines. Otherwise, noise could cause a malfunction.

Contents

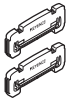
Before Using the Unit

Checking the Package Contents

Before using the DL-RS1A, check that the following items are all included.



RS-232C communication unit
DL-RS1A



End unit x 2
OP-26751

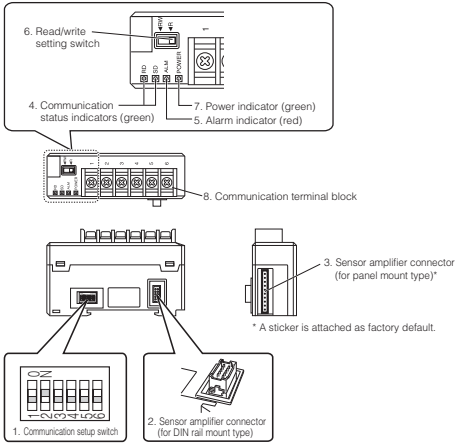
Expansion connector cover

Instruction manual

Switch protection sticker

All possible care was taken in packaging before shipment. However, in the event of defective broken, or missing items, please contact your nearest KEYENCE office.

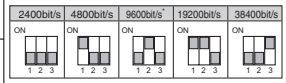
Part Names and Functions



(1) Communication setup switches

You can use different ON/OFF combinations to configure the communication settings.

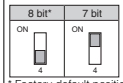
Setting	Switch No.	Combination
Baud rate	1	2400bit/s, 4800bit/s, 9600bit/s*, 19200bit/s, 38400bit/s
	2	
	3	



* Factory default positions are shown.

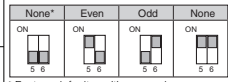
Important: Do not use combinations other than those shown above for switches 1, 2, and 3.

Setting	Switch No.	Combination
Data bit length	4	8 bit*, 7 bit



* Factory default positions are shown.

Setting	Switch No.	Combination
Parity	5	None*, Even, Odd, None
	6	



* Factory default positions are shown.

Important:
- Make sure you cycle the power to the unit after modifying the communication settings. The modifications are not applied to the unit until it is powered down and power has been reapplied.
- Place the switch protection sticker supplied with the unit over the switches after you modify the settings.

Switch protection sticker

(2) Sensor amplifier connector (for DIN-rail mount type)

Use this connector to connect DL-RS1A to a DIN-rail mount type sensor amplifier.

(3) Sensor amplifier connector (for panel mount type)

Use this connector to connect DL-RS1A to a panel mount type sensor amplifier.
The optional extension cable (OP-35361) must be used for connection.

Point: You cannot connect DL-RS1A simultaneously to a DIN-rail mount type sensor amplifier and a panel mount type sensor amplifier.

(4) Communication status indicators

These indicators show the communication status of DL-RS1A.

Indicator	Behavior
SD	Lights up in green while data is being transmitted.
RD	Lights up in green while data is being received.

(5) Alarm indicator

This indicator lights up in red.
For information on the actions you should take when an alarm occurs, refer to "Troubleshooting" (page 19).
After turning on the power, the alarm indicator lights for the following amount of time, and communication cannot be performed during this time.

No. of connected units	Incommunicable time
1 to 5	Approx. 2 s
6 to 8	Approx. 4 s

(6) Read/write setting switch

Use this switch to allow or prohibit writing to the sensor amplifiers. (You can only manipulate this switch while the unit is active (turned on).)

Position of the switch	Description
R (Factory default position)	The unit can read data from the sensor amplifiers. However, it cannot write settings to the sensor amplifiers.
RW	The unit can both read data from and write settings to the sensor amplifiers.

Point

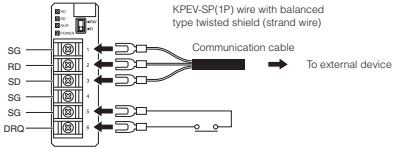
Turn the read/write setting switch to the RW side and the key-lock function will be applied to the sensor amplifier of the IL Series, thus any setting operations conducted by buttons, apart from the display changeover button, will be disabled.

(7) Power indicator

Lights up in green when the unit has power.

(8) Communication terminal block

Use the terminals on the terminal block to attach communication cables for connecting the unit with external devices.



* Recommended communication cable
KPEV-SP(1P) wire with balanced type twisted shield (strand wire)
Nominal cross-section area 0.16mm^2(AWG25) min.

Terminal No.	Terminal	Description
1	SG	Connects to the shielded wire of the communication cable. The terminals for SG (Nos. 1, 4, and 5) are internally short-circuited.
2	RD (input)	Connects to the SD terminal of an external device via a communication cable.
3	SD (output)	Connects to the RD terminal of an external device via a communication cable.
4	SG	The terminals for SG (Nos. 1, 4, and 5) are internally short-circuited.
5	SG	The terminals for SG (Nos. 1, 4, and 5) are internally short-circuited.
6	DRQ (input)	When there is a short-circuit between DRQ and SG, the sensor amplifier data is transmitted even without a command from the external device.

Point

A terminal cover is attached to the terminal block.
The terminal cover must be placed over the terminal block when you finish connecting the cables.

Reference

The terminals for SG (Nos. 1, 4, and 5) are used in common with the blue wire of the sensor amplifier main unit.

Connecting the Unit to Sensor Amplifiers

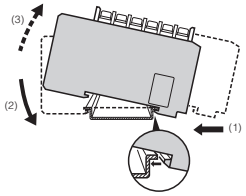
This section describes how to mount a DL-RS1A and connect it to sensor amplifiers.

Mounting the Unit

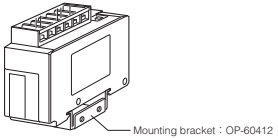
■ Mounting the unit on the DIN rail

1 **Fit the tab of the lower part of the unit to the DIN rail. While inserting the unit in the direction of arrow (1), push the body down in the direction of arrow (2).**

2 **To detach the unit, lift the unit in the direction of arrow (3) while pushing it in the direction of arrow (1).**



When using the mounting bracket (OP-60412), install it as shown in the illustration below.



Connecting the Unit to Sensor Amplifiers

You use DL-RS1A by connecting it to sensor amplifiers. The connection method varies according to the mounting type of the sensor amplifiers.
Before connecting DL-RS1A, you must install the main unit and expansion units of the sensor amplifiers. For installation method, see the operating instructions for the IL Series.

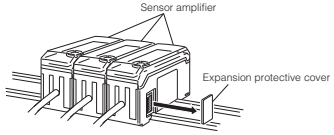
NOTICE	**Make sure that the sensor amplifiers are turned off before connecting the RS-232C communication unit DL-RS1A to them. Connecting the unit while the sensor amplifiers are turned on may damage the unit.**

■ Available sensor amplifiers

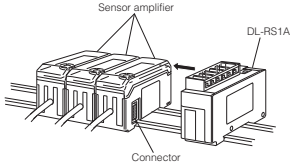
Name	Type of amplifier	Main unit	Expansion unit	Max. connectable number
IL Series	DIN-rail mount	IL-1000	IL-1050	8 units (Main: 1, Expansion: 7)
	Panel mount	IL-1500	IL-1550	8 units (Main: 1, Expansion: 7)

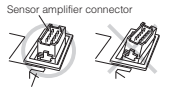
■ Connecting the DL-RS1A to DIN rail mount sensor amplifiers

1 Remove the expansion protective cover from the sensor amplifier that you want to connect to the DL-RS1A.

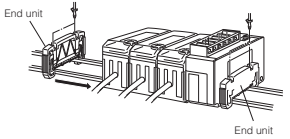


2 Mount the DL-RS1A on the DIN rail and connect it to the sensor amplifier.
Make sure there is no space between the unit and the sensor amplifier.



NOTICE	**Check that the sensor amplifier connector (for DIN rail mounting) located on the side of DL-RS1A is not installed at an angle as shown in the illustration to the right. Connecting the unit with its connector installed at an angle to a sensor amplifier may damage the unit.** 

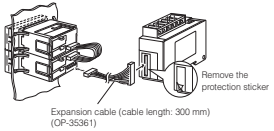
3 Mount the end units (OP-26751, two units included) on either side of the sensor amplifier and DL-RS1A unit and tighten the two screws on the top of each end unit.
(You can mount the end units in the same way you mount DL-RS1A.)



NOTICE	**Make sure you firmly insert DL-RS1A all the way into the sensor amplifier. Turning the power on when the unit is not inserted straight or firmly connected may damage the unit.**

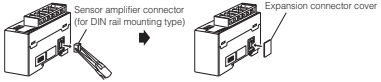
■ Connecting the unit to panel mount sensor amplifiers

1 Connect DL-RS1A to the sensor amplifiers using the optional expansion cable (OP-35361).



NOTICE	• Make sure you securely connect the expansion cable while the unit is turned off. Turning the power on when the cable is not inserted straight or firmly connected may damage the unit. • Removing or inserting the cable while the power is on may damage the unit.

2 Remove the sensor amplifier connector with pliers (for DIN rail mounting when using with panel mounted sensor amplifiers) from DL-RS1A unit and install the expansion connector cover supplied with the unit.

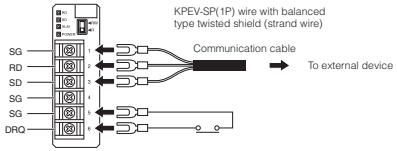


Connecting the Unit to External Devices

Communication Terminal Block

You can connect external devices such as a PC or PLC to the communication terminal block of DL-RS1A via the communication cables.

■ Terminal connection



* Recommended communication cable
KPEV-SP(1P) wire with balanced type twisted shield (strand wire)
Nominal cross-section area 0.16mm^2 (AWG25) min.

Terminal No.	Terminal	Description
1	SG	Connects to the shielded wire of the communication cable. The terminals for SG (Nos. 1, 4, and 5) are internally short-circuited.
2	RD (input)	Connects to the SD terminal of an external device via a communication cable.
3	SD (output)	Connects to the RD terminal of an external device via a communication cable.
4	SG	The terminals for SG (Nos. 1, 4, and 5) are internally short-circuited.
5	SG	The terminals for SG (Nos. 1, 4, and 5) are internally short-circuited.
6	DRQ (input)	When there is a short-circuit between DRQ and SG, the sensor amplifier data is transmitted even without a command from the external device.

Point
A terminal cover is attached to the terminal block.
The terminal cover must be placed over the terminal block when you finish connecting the cables.

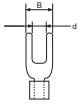
Reference
The terminals for SG (Nos. 1, 4, and 5) are used in common with the blue wire of the sensor amplifier main unit.

● Crimp-type terminal

Use the Y or round terminal for wiring to the I/O terminal.
Use the Y or round terminal with the following dimensions.

Y terminal

Excerpted from dimensions of the Y terminal areas	Applicable dimension
B: Outer size of Y area	B: 6mm max.
d: Width of inner Y area (joint area with screw)	d: 3.2mm min.

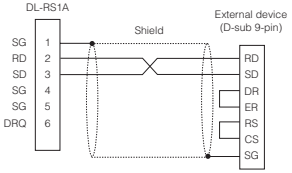


Round terminal

Excerpted from dimensions of the round terminal areas	Applicable dimension
B: Outer diameter	B: 6mm max.
d: Inner diameter (joint area with screw)	d: 3.2mm min.

■ Connection wiring

Refer to the connection wiring diagram shown below when connecting DL-RS1A to an external device such as a PC.



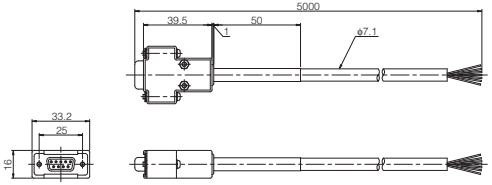
Point

- The length of the communication cable must not exceed 15 m.
- Connect the shield wire of the communication cable to the SG terminal of the external device.
- Make sure that the shield wire does not touch other signal wires or the other terminals on the terminal block.

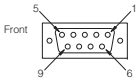
■ Optional cable

An optional cable shown below is used to connect to an external device such as a PC that has a D-sub 9-pin I/O connector.

Part number: OP-81283



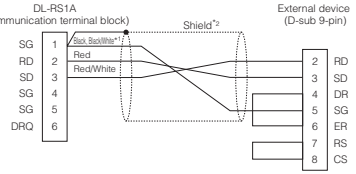
Pin layout for D-sub 9-pin connector



Pin No.	Cable color
1	-
2	Red/white
3	Red
4 *1	-
5	Black, black/white *3
6 *1	-
7 *2	-
8 *2	-
9	-

*1 Pin numbers 4 and 6 are connected inside the connector.
*2 Pin numbers 7 and 8 are connected inside the connector.
*3 Two cables (black and black/white) are connected to the pin number 5.

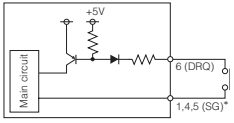
Sample wiring



*1 Insulate either the black or black/white cable that is not used.
*2 Connect the shield wire to the SG terminal of DL-RS1A. (Shield wire is connected to the connector casing.)

Reference The green and green/white-striped wires are not connected to any of the connector pins.

■ Input circuit diagram



(Short-circuit current: 1 mA max.)

* The terminals for SG (Nos. 1, 4, and 5) are connected internally with the blue wire of the sensor amplifier main unit.

Communication Specifications

This section provides the communication specifications of DL-RS1A and describes how to configure the unit.

Communication Specifications

The following table lists the communication specifications for DL-RS1A.

Item	Specifications
Communication method	Full duplex
Synchronization method	Asynchronous
Transmission code	ASCII
Communication speed	2400, 4800, 9600, 19200, 38400 bit/s (Factory default: 9600 bit/s)
Data bit length	7 or 8 bits (Factory default: 8 bits)
Parity check	None, even, odd (Factory default: none)
Stop bit length	1 bit
Data delimiter	Receive: automatically detect CR or CR + LF Send: fixed to CR + LF

For communication settings, refer to page 2.

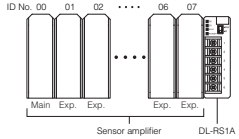
Sensor Amplifier ID Number Assignments

When the main sensor amplifier that is connected to DL-RS1A supports expansion units, the main sensor amplifier ID number "00" is automatically assigned to the main unit and ID numbers "01 to 07" to the expansion units.

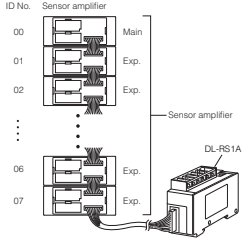
Point

You **cannot** change the assignment of sensor amplifier ID numbers.

■ DIN rail mount sensor amplifiers

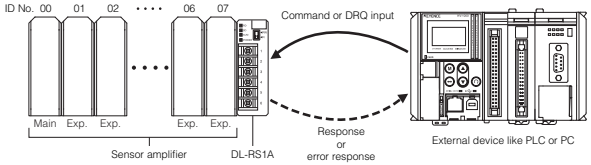


■ Panel mount sensor amplifiers



Commands and Responses

Overview of Commands and Responses



■ Command format

You can send specific commands based on ASCII codes from an external device to DL-RS1A. For information on the parameters used in the command, refer to "Parameters of Commands and Responses" (page 10).

Sample command format structure

(1) With the first two bytes, specify the communication command.
(2) Specify the ID number assigned to the target sensor amplifier using two digits (ASCII characters).
(3) Specify the data number for the data you want to read from or write to the sensor amplifier using three digits (ASCII characters).
(4) Insert CR or CR + LF as the command delimiter.

Important

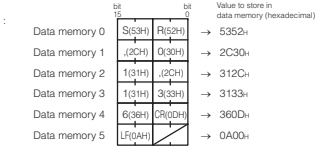
You must use commas (,) to separate (1), (2), and (3).

Example

When reading the "Hold function setting (data number: 136)" of the IL Series (ID number: 01) being activated:

Command :

ASCII character conversion :



From an external device, 11-byte data will be sent to the DL-RS1A.

Important

The last byte of the command you send must be CR (0DH) or LF (0AH). Specifying a value other than CR or LF results in an error response (error number: 00). For information on the error responses, refer to "Error numbers" (page 15).

■ Response

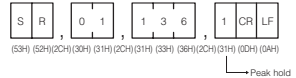
When DL-RS1A successfully receives a command from the external device, it automatically returns a response based on ASCII codes.
For information on the parameters used in the response, refer to "Parameters of Commands and Responses" (page 10).

Sample response structure

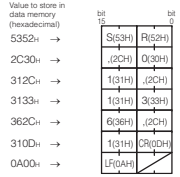
(1) Contains the same communication command as the received command.
(2) Contains the same ID number as the received command.
(3) Contains the same data number as the received command.
(4) Contains the data that DL-RS1A retrieved from the specified sensor amplifier. Contains maximum of 10 bytes according to the specified data number (3).
(5) Contains CR + LF as the response delimiter.

Example When sending the command format "SR, 01, 136CRLF" of the IL Series (ID number: 01) being activated and receiving a response that the hold function setting is "Peak hold"

Response format :



ASCII character conversion :

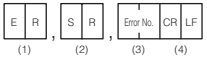


DL-RS1A sends the response to the external device.

■ Error response

If DL-RS1A could not receive a command from the external device or if the received command included an error, it automatically returns an "error response" based on ASCII codes.
For information on the parameters used in the error response, refer to page 10.

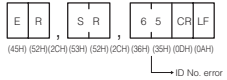
Sample error response structure



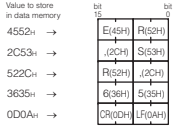
(1) Contains "ER".
(2) Contains the same communication command as the received command.
(3) Contains a two-digit error number (ASCII characters) indicating the error type.
For information on the error numbers, refer to "Error numbers" (page 16).
(4) Contains CR + LF as the error response delimiter.

Example An error response indicating an "ID number error" as a response to the command "SR,01,136CRLF":

Error response :



ASCII character conversion :



DL-RS1A sends the error response to the external device.

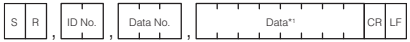
Reading

External devices such as PLC's use the following communication commands to read data from DL-RS1A.

■ Read from the specified sensor amplifier (SR command)

Command

Response

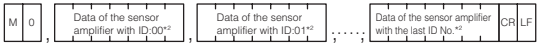


Error response

■ Read all data from all sensor amplifiers (M0 command)

Command

Response

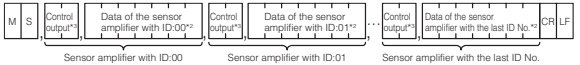


Error response

■ Read output states and data from all sensor amplifiers (MS command)

Command

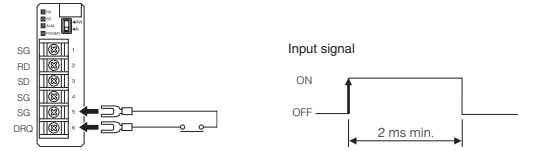
Response



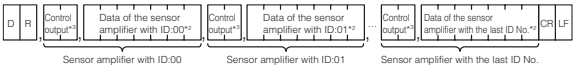
Error response

■ Read with external input to the DRQ terminal (DRQ read)

You can send an input signal (by short-circuiting DRQ (terminal number 6) and SG (terminal number 1, 4, or 5)) from an external device such as a PLC instead of sending a command.



Response



Error response

*1 The data length is different depending on the data being read. (Up to 10 characters)

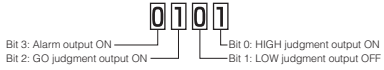
*2 For IL-S025/IL-030/IL-S065/IL-065/IL-S100/IL-100: ±**.*** (reading range is -99.999 to +99.999)
For IL-300/600: ±***.** (reading range is -999.99 to +999.99)
For IL-2000: ±****.* (reading range is -9999.9 to +9999.9)

*3 Data length: 2 characters
On the IL Series, the judgment output (HIGH/LOW/GO output) and the alarm output ON/OFF are displayed with 2-digit number (ASCII characters). Convert the 2-digit number (ASCII characters) read to a binary number and check the ON/OF status of each bit to check the judgment output status.

Bit	Judgment output	
	When N.O.	When N.C.
0	0: HIGH judgment output OFF, 1: HIGH judgment output ON	0: HIGH judgment output ON, 1: HIGH judgment output OFF
1	0: LOW judgment output OFF, 1: LOW judgment output ON	0: LOW judgment output ON, 1: LOW judgment output OFF
2	0: GO judgment output OFF, 1: GO judgment output ON	0: GO judgment output ON, 1: GO judgment output OFF
3	0: Alarm output ON, 1: Alarm output OFF	0: Alarm output ON, 1: Alarm output OFF

Reference

- When the read data is "05":
"05" is converted to the binary number "0101".
When N.O.



Writing

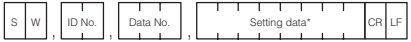
External devices such as PLC's use the following communication commands to write data to DL-RS1A.

Point

Attempting to write data with "read-only" attribute results in a communication error and an error response (error number: 22).

■ Write to the specified sensor amplifier (SW command)

Command



Response

Error response

■ Write to all sensor amplifiers (AW command)

Command

Response

Error response

Parameters of Commands and Responses

This section describes the parameters used with various commands and responses.

■ Communication commands

There are two types of communication commands: read commands and write commands.

Communication command	Attribute	Description
SR	Read	Reads the data for the specified data number from the sensor amplifier with the specified ID number.
M0		Reads the comparator value (P.V. value) that DL-RS1A periodically retrieves from all sensor amplifiers.
MS		Reads the ON/OFF state of the judgment output and alarm output, and the comparator value (P.V. value) that DL-RS1A periodically retrieves from all sensor amplifiers.
DRQ input		Reads the ON/OFF state of the judgment output and alarm output, and the comparator value (P.V. value) that DL-RS1A periodically retrieves from all sensor amplifiers when a DRQ input is received.
SW	Write	Writes setting data for the specified data number onto the sensor amplifier with the specified ID number.
AW		Writes setting data for the specified data number onto all sensor amplifiers.

Point

- For information on the data, refer to the IL Series user's manual supplied with the sensor amplifiers.
- If commands are sent during the period of approx. 3 seconds after the power is turned on, the communication error (error number: 22) will occur.

■ ID numbers

This parameter is used with communication commands "SR" and "SW". Specify the ID number of the target sensor amplifier using two digits (ASCII characters).
(Example) Sensor amplifier with the ID number 00 = 00, sensor amplifier with the ID number 03 = 03

■ Data numbers

Specify the data number using three digits (ASCII characters).

● Read-only data

The following table lists the types of data that can only be read from the IL Series sensor amplifiers.

Point

Writing read-only data results in a communication error (error number: 22).

Data number	Data name	Data type*1	Number of characters	Attribute*2	Readout range*15
033	Sensor amplifier error*3	*****	5	R	0 to 65535
036	Judgment output/Alarm output*4	**	2	R	0 to 15
037	Judgment value (P.V. value)*5		7	R	
038	Internal measurement value (R.V. value)*5	±*** ***	7	R	-99.999 to +99.999
039	Peak hold value during hold period*5	(±*** **)	7	R	(-999.99 to +999.99)
040	Bottom hold value during hold period*5	((±****.*))	7	R	((-9999.9 to +9999.9))
041	Calculation value (CALC value)*5*6		7	R	
042	Analog output value*6	±*.*** or **.**	Voltage output 6 Current output 5	5	Voltage output -5.000 to +5.000*7 Current output 04.00 to 20.00*7
043	Bank status	*	1	R	0 to 3
044	Timing status	*	1	R	0: During sampling 1: Not during sampling
050	Laser emission stop state	*	1	R	0: Laser emitting 1: Laser stopped
051	Abnormal setting*8	*	1	R	0: Normal setting 1: Abnormal setting
052	External input status	**	2	R	0 to 15*14
053	EEPROM write result*12	*	1	R	0: Executing 1: Normal termination 2: Execution impossible
054	Zero shift/Zero shift reset result*9	*	1	R	0: Executing 1: Normal termination 2: Execution impossible
055	Reset request result	*	1	R	0: Executing 1: Normal termination 2: Execution impossible
056	Current system parameters*13	**	2	R	0 to 15
060	Tolerance tuning/2 point tuning result*10	*	1	R	0: Executing 1: Normal termination 2: Execution impossible
061	Calibration result*11	*	1	R	0: Executing 1: Normal termination 2: Execution impossible
193	Product code	****	4	R	Main unit: 4022 Exp. units: 4023
195	Connected sensor head	****	4	R	0000: No connection 0001: IL-030 0002: IL-065 0003: IL-100 0004: IL-300 0005: IL-600 0106: IL-S025 0107: IL-S065 0208: IL-S100 0311: IL-2000

1 In the Data format column, "±" indicates that the value can be either "+" or "-" and "" signifies a number from "0 to 9". The values shown in parentheses apply for the IL-300/600, and the values shown in double parentheses apply for the IL-2000.

*2 R: Indicates that the data type can only be read from the sensor amplifiers.

*3 You can read data number "033" to check the error status of the sensor amplifiers. Convert the five digit number (ASCII characters) read from the sensor amplifiers to a binary number and check the ON/OFF state of each bit to check the error.

Bit	Sensor amplifier error details
0	Overcurrent error
1	EEPROM error
2	Sensor head error
3	Unused
4	Unused
5	Unused
6	Unused
7	Spot light laser error
8	Incompatable model error
9	Unused
10	Unused
11	Amplifier communication error
12	Number of units error
13	Calculation error

For information on each error, refer to "IL Series User's Manual"

Reference

- When the data read from a sensor amplifier is "00257":
  "257" converted to binary number is "0000 0001 0000 0001".

  Therefore, this data indicates that an "Overcurrent error" and a "Model mismatch error" have simultaneously occurred at the sensor amplifier from which it was read.

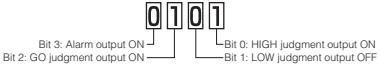
- If no error has occurred at the sensor amplifier, the data "00000" is returned.

*4 You can read data number "036" to check the judgment output status.
Convert the two digit number (ASCII characters) read from the sensor amplifiers to a binary number and check the ON/OFF state of each bit to check the judgment output status.

Bit	Judgment output	
	N.O.	N.C
0	0: HIGH Judgment output OFF, 1: HIGH judgment output ON	0: HIGH Judgment output ON, 1: HIGH judgment output OFF
1	0: LOW Judgment output OFF, 1: LOW Judgment output ON	0: LOW Judgment output ON, 1: LOW Judgment output OFF
2	0: GO Judgment output OFF, 1: GO Judgment output ON	0: GO Judgment output ON, 1: GO Judgment output OFF
3	0: Alarm output ON, 1: Alarm output OFF	0: Alarm output ON, 1: Alarm output OFF

Reference

When the data read from a sensor amplifier is "05":
"05" converted to binary number is "0101".
During N.O.



*5 When the data read from the sensor amplifiers is one of the following values, it is not a comparator value but has a specific meaning.

Readout data	Details
+EE.EEE (+EEE.EE) ((+EEEE.E))	The sensor amplifier encountered an error.
+99.999 (+999.99) ((+9999.9))	The value is +99.999 (+999.99) ((+9999.9)) or exceeds the upper display range.
-99.999 (-999.99) ((-9999.9))	The value is -99.998 (-999.98) ((-9999.8)), -99.999 (-999.99) ((-9999.9)), or exceeds the lower display range.
-99.998 (-999.98) ((-9999.8))	The value is "-----".

The values shown in parentheses apply for the IL-300/600, and the values shown in double parentheses apply for the IL-2000.

*6 Sending the following commands to an expansion unit results in the following responses.

Data number	Data name	Readout data
041	Calculated value (CALC Value)	-99.998 (-999.98) ((-9999.8))
042	Analog output value	+0.000

The values shown in parentheses apply for the IL-300/600, and the values shown in double parentheses apply for the IL-2000.

*7 When the sensor amplifier is in the error state or displaying "-----", the analog voltage output is +5.500 and analog current output is +03.00.

*8 When writing is performed to set the prohibited combination of functions, the value becomes 1. For details of each function, refer to User's Manual.

*9 The execution result for the item last requested, either the zero shift execution request or zero shift reset execution request, is read.

*10 The execution result reading is for the most recent data No. 014 to 018 tuning request item.

*11 The execution result reading is for the most recent data No. 019 to 025 calibration request item.

*12 This item includes the results for the initial reset execution.

*13 You can read data number "56" to check the system parameter of the sensor amplifier. The system parameter means the polarity of judgment output and alarm output, and the setting for analog output. Convert the two digit number (ASCII characters) read from the sensor amplifiers to a binary number and check the ON/OFF state of each bit to check the system parameter.

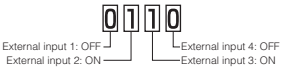
Bit	Initial setting details
0	0: NPN output, 1: PNP output
3, 2, 1	000: Analog output OFF 001: 0 to 5 V 010: -5 to +5 V 011: 1 to 5 V 100: 4 to 20 mA

Reference When the data read from a sensor amplifier is "006":
"6" converted to binary number is "0110".

Therefore, the setting of the amplifier from which the data is read is "NPN output" and "Analog output 1 to 5 V".

*14 The external input status is where the external input is [1] when input status is ON, [0] when status is OFF, and the 0,1,2,3 bits correlate with external input 1,2,3,4.

Reference When the data read from a sensor amplifier is "06":
"6" converted to binary number is "0110".



*15 The values shown in parentheses apply for the IL-300/600, and the values shown in double parentheses apply for the IL-2000.

● **Read/write data**

The following table lists the types of data that can be read from and written to IL Series sensor amplifiers.

Point
- A communication error (error No. 22) occurs if improper data was written to an expansion unit.
- A parameter error (error No. 22) occurs if writing is attempted during an initial reset operation. After the completion of an initial reset, verify that the EEPROM writing result (data No. 053) is "1: Normal termination" before executing a writing operation.

Data number	Data name	Data type*1	Number of characters	Attribute*2	Readout range*14	Initial value*14
001	Zero shift execution request	*	1	R	0-1: Last written value	1
				W	0→1: Perform zero shift*3	
002	Zero shift reset execution request	*	1	R	0-1: Last written value	1
				W	0→1: Perform zero shift reset*3	
003	Reset request	*	1	R	0-1: Last written value	1
				W	0→1: Perform reset*3	
005	Initial reset request	*	1	R	0-1: Last written value	1
				W	0→1: Perform initial reset*3	
006	System parameter set request*4	*	1	R	0-1: Last written value	1
				W	0→1: Perform system parameter set*3	
014	Tolerance tuning request	*	1	R	0-1: Last written value	1
				W	0→1: Perform tolerance tuning request*3	
015	Two-point tuning HIGH side 1st point confirmation operation request	*	1	R	0-1: Last written value	1
				W	0→1: Perform 2 point tuning*3	
016	Two-point tuning HIGH side 2nd point confirmation operation request (Determine HIGH setting value.)	*	1	R	0-1: Last written value	1
				W	0→1: Perform two-point tuning HIGH 2nd point request*3	
017	Two-point tuning LOW side 1st point confirmation operation request	*	1	R	0-1: Last written value	1
				W	0→1: Perform two-point tuning LOW 1st point request*3	
018	Two-point tuning LOW side 2nd point confirmation operation request (Determine LOW setting value.)	*	1	R	0-1: Last written value	1
				W	0→1: Perform two-point tuning LOW 2nd point request*3	
019	Calibration SET1 Confirmation operation request *12*13	*	1	R	0-1: Last written value	1
				W	0→1: Perform calibration 1st point request*3	
020	Calibration SET2 Confirmation operation request (Perform calibration.) *12*13	*	1	R	0-1: Last written value	1
				W	0→1: Perform calibration 2nd point request*3	
021	Calculated value two-point calibration SET1 Confirmation operation request *5*12*13	*	1	R	0-1: Last written value	1
				W	0→1: Perform calculated value two-point calibration 1st point request*3	
022	Calculated value two-point calibration SET2 Confirmation operation request (Perform calculated value two-point calibration.)*5*12*13	*	1	R	0-1: Last written value	1
				W	0→1: Perform calculated value two-point calibration 2nd point request*3	
023	Calculated value three-point calibration SET1 Confirmation operation request*5*12*13	*	1	R	0-1: Last written value	1
				W	0→1: Perform calculated value three-point calibration 1st point request*3	

Data number	Data name	Data type*1	Number of characters	Attribute*2	Readout range*14	Initial value*14
024	Calculated value three-point calibration SET2 Confirmation operation request*5*12*13	*	1	R	0-1: Last written value	1
				W	0→1: Perform calculated value three-point calibration 2nd point request*3	
025	Calculated three-point calibration SET3 Confirmation operation request (Perform calculated three-point calibration.)*5*12*13	*	1	R	0-1: Last written value	1
				W	0→1: Perform calculated three-point calibration 3rd point request*3	
026	One-point tuning request for diff. count filter	*	1	R	0-1: Last written value	1
				W	One-point tuning request for diff. count filter*3	
027	Two-point tuning 1st point confirmation operation request for diff. count filter	*	1	R	0-1: Last written value	1
				W	Two-point tuning for diff. count filter*3	
028	Two-point tuning 2nd point confirmation operation request for diff. count filter (Determine HIGH and LOW setting value.)	*	1	R	0-1: Last written value	1
				W	Two-point tuning for diff. count filter*3	
065	HIGH setting value (BANK 0)	±**.*** (±***.**) ((±****.*))	7	R/W	-99.999 to +99.999 (-999.99 to +999.99) ((-9999.9 to +9999.9))	5.000 (+50.00) ((+500.0))
066	LOW setting value (BANK 0)		7	R/W		-5.000 (-50.00) ((-500.0))
067	Shift target value (BANK 0)		7	R/W		0.000 (0.00) ((0.0))
068	Analog output - upper limit value (BANK 0)*5*6		7	R/W		10.000 (100.00) ((1000.0))
069	Analog output - lower limit value (BANK 0)*5*6		7	R/W		-10.000 (-100.00) ((-1000.0))
070	HIGH setting value (BANK 1)		7	R/W		5.000 (50.00) ((500.0))
071	LOW setting value (BANK 1)		7	R/W		-5.000 (-50.00) ((-500.0))
072	Shift target value (BANK 1)		7	R/W		0.000 (0.00) ((0.0))
073	Analog output - upper limit value (BANK 1)*5*6		7	R/W		10.000 (100.00) ((1000.0))
074	Analog output - lower limit value (BANK 1)*5*6		7	R/W		-10.000 (-100.00) ((-1000.0))
075	HIGH setting value (BANK 2)		7	R/W		5.000 (50.00) ((500.0))
076	LOW setting value (BANK 2)		7	R/W		-5.000 (-50.00) ((-500.0))
077	Shift target value (BANK 2)		7	R/W		0.000 (0.00) ((0.0))
078	Analog output - upper limit value (BANK 2)*5*6		7	R/W		10.000 (100.00) ((1000.0))
079	Analog output - lower limit value (BANK 2)*5*6		7	R/W		-10.000 (-100.00) ((-1000.0))
080	HIGH setting value (BANK 3)		7	R/W		5.000 (50.00) ((500.0))
081	LOW setting value (BANK 3)		7	R/W		-5.000 (-50.00) ((-500.0))
082	Shift target value (BANK 3)		7	R/W		0.000 (0.00) ((0.0))
083	Analog output - upper limit value (BANK 3)*5*6		7	R/W		10.000 (100.00) ((1000.0))
084	Analog output - lower limit value (BANK 3)*5*6		7	R/W		-10.000 (-100.00) ((-1000.0))
097	Key lock function	*	1	R/W	0: Not key locked state 1: Key locked state	0
098	Bank function*7	*	1	R/W	0 to 3	0
099	Timing input *8	*	1	R/W	0: Timing input OFF 1: Timing input ON	0
100	Laser emission stop input *8	*	1	R/W	0: Emission stop input OFF 1: Emission stop input ON	0

Data number	Data name	Data type*1	Number of characters	Attribute*2	Readout range*14	Initial value*14
104	Sub display's screen	*	1	R/W	0: R.V. value screen 1: Analog value screen 2: HI setting value screen 3: LO setting value screen 4: Zero shift value screen 5: CALC value screen	0
105	System parameter settings*9	**	2	R/W	0 to 15	0
106	Tolerance tuning - tolerance setting range	±**.*** (±***.**) ((±****.*))	7	R/W	-99.999 to +99.999 (-999.99 to +999.99) ((-9999.9 to +9999.9))	5.000 (50.00) ((500.0))
107	Calibration function	*	1	R/W	0: Initial state 1: User setting	0
108	Calibration function SET1	±**.*** (±***.**) ((±****.*))	7	R/W	-99.999 to +99.999 (-999.99 to +999.99) ((-9999.9 to +9999.9))	0.000 (0.00) ((0.0))
109	Calibration function SET2		7	R/W		5.000 (50.00) ((500.0))
110	Calculated value calibration function*5	*	1	R/W	0: Initial settings 1: Calculated two-point calibration 2: Calculated three-point calibration	0
111	Calculated value two-point calibration function SET1*5	±**.*** (±***.**) ((±****.*))	7	R/W	-99.999 to +99.999 (-999.99 to +999.99) ((-9999.9 to +9999.9))	5.000 (50.00) ((500.0))
112	Calculated value two-point calibration function SET2*5		7	R/W		10.000 (100.00) ((1000.0))
113	Calculated value three-point calibration function SET1*5		7	R/W		5.000 (50.00) ((500.0))
114	Calculated value three-point calibration function SET3*5		7	R/W		10.000 (100.00) ((1000.0))
129	Calculation function*5	*	1	R/W	0: OFF 1: Addition mode 2: Subtraction mode	0
131	Measurement direction	*	1	R/W	0: nor 1: rEv	0
132	Sampling cycle	*	1	R/W	0: Initial settings 1: 0.33 ms 2: 1 ms 3: 2 ms 4: 5 ms	0
133	Averaging/Diff. count filter/High-pass filter	**	2	R/W	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: 1024 times 11: 2048 times 12: 4096 times 13: Diff. count filter 14: High-pass filter	4
134	Output mode	*	1	R/W	0: N.O. (Normally open) 1: N.C. (Normally closed)	0
136	Hold function setting	*	1	R/W	0: Sample hold 1: Peak hold 2: Bottom hold 3: Peak-to-peak hold 4: Auto peak hold 5: Auto bottom hold	0
137	Auto peak hold or auto bottom hold trigger level	±**.*** (±***.**) ((±****.*))	7	R/W	-99.999 to +99.999 (-999.99 to +999.99) ((-9999.9 to +9999.9))	1.000 (10.00) ((100.0))
138	Timing input setting	*	1	R/W	0: Level 1: Edge	0
139	Delay timer	*	1	R/W	0: OFF 1: Delay ON 2: Delay OFF 3: One-shot	0
140	Timer duration	****	4	R/W	5 to 9999	60

Data number	Data name	Data type*1	Number of characters	Attribute*2	Readout range*14	Initial value*14
141	Hysteresis	**.*** (***.**) ((****.*))	6	R/W	0 to 99.999 (0 to 999.99) ((0 to 9999.9))	0.000 (0.00) ((0.0))
142	Analog output scaling*5	*	1	R/W	0: Initial state 1: Free range 2: Bank	0
143	Analog output - upper limit value*5 *10	±**.*** (±***.**) ((±****.*))	7	R/W	-99.999 to +99.999 (-999.99 to +999.99) ((-9999.9 to +9999.9))	10.000 (100.00) ((1000.0))
144	Analog output - lower limit value*5 *10		7	R/W		-10.000 (-100.00) ((-1000.0))
145	External input*11	*	1	R/W	0: Initial state 1: User setting	0
146	External input 1*11	*	1	R/W	0: Zero shift input 1: Bank A input 2: Bank B input 3: Laser emission stop input 4: Not used	0
147	External input 2*11	*	1	R/W	0: Reset input 1: Bank A input 2: Bank B input 3: Laser emission stop input 4: Not used	0
148	External input 3*11	*	1	R/W	*0: Timing input 1: Bank A input 2: Bank B input 3: Laser emission stop input 4: Not used	0
149	External input 4*11	*	1	R/W	0: Not used 1: Bank A input 2: Bank B input 3: Laser emission stop input	0
150	Bank switching method	*	1	R/W	0: Button 1: External input	0
152	Zero shift value memory function	*	1	R/W	0: OFF 1: ON	0
153	Mutual interference prevention function*5	*	1	R/W	0: Interference prevention OFF 1: Interference prevention ON	0
154	Display columns	*	1	R/W	0: Initial settings 2: 0.001 3: 0.01 4: 0.1 5: 1	0
155	Power saving function	*	1	R/W	0: OFF 1: Half 2: All	0
156	Head display mode	*	1	R/W	0: Initial state 1: OK/NG display 2: OFF	0
157	Display color	*	1	R/W	0: GO Green 1: GO Red 2: Always red	0
158	Timer duration of diff. count filter	****	4	R/W	2 to 9999	10
159	Cutoff frequency of high-pass filter	*	1	R/W	0: 0.1Hz 1: 0.2Hz 2: 0.5Hz 3: 1Hz 4: 2Hz 5: 5Hz 6: 10Hz 7: 20Hz 8: 50Hz 9: 100Hz	3
161	Alarm setting	*	1	R/W	0: Initial state 1: Clamp 2: User setting	0
162	Alarm count	****	4	R/W	2 to 1000	7

1 In the Data format column, "±" indicates that the value can be either "+" or "-" and "" signifies a number from "0 to 9". The values shown in parentheses apply for the IL-300/600, and the values shown in double parentheses apply for the IL-2000.

*2 Indicates that the data can only be read from (R), can only be written to (W), or can be both read from and written to (R/W) the sensor amplifiers.

*3 The request is executed only when the data is changed from 0 to 1. To re-execute the request, first change the setting to 0, then change it to 1. Otherwise, the request is not executed. If the sensor amplifier is turned off after a zero shift operation, the system returns to the status which existed prior to the zero shift. In order to maintain the shift condition even after a power off, the "zero shift status save" function must be set to ON.

*4 The system parameter means the polarity of judgment output and the setting for analog output.

*5 Writing data to the expansion unit results in a communication error (error number: 22).

*6 Enabled when "Analog output scaling" is set to "Bank".

*7 Enabled when "Bank switching method" is set to "Button".

*8 Only when data 0 is written and the external input is OFF for wiring, it operates as OFF.

*9 Specify the system parameter set when data number 06 (System parameter set request) is written. Convert the two digit number (ASCII characters) to a binary number and check the ON/OFF state of each bit to specify the system parameter.

Bit	Initial setting details
0	0: NPN output, 1: PNP output
3, 2, 1	000: Analog output OFF 001: 0 to 5 V 010: -5 to +5 V 011: 1 to 5 V 100: 4 to 20 mA

Reference When the specified data is "006":
"6" converted to binary number is "0110".

Therefore, the setting of the amplifier to which the data is written is "NPN output" and "Analog output 1 to 5 V".

*10 Enabled when "Analog output scaling" is set to "Free range".

*11 To reflect the setting written for the data number 146 to 149 to the sensor amplifier, write 1 (user setting) for the data number 145 or set the external input setting to "User setting" with the button operation on the sensor amplifier.

*12 Correction is not possible if the setting is changed between the 1st and 2nd execution requests. If a correction is desired, avoid making setting changes during the correction operation.

*13 Execution requests are enabled only if the "Calibration function" is set as "User setting". Moreover, these requests can be executed only if the "Calibration function" is set as "Calculated two-point calibration" and "Calculated three-point calibration".

*14 The values shown in parentheses apply for the IL-300/600, and the values shown in double parentheses apply for the IL-2000.

■ Relation between the data number 001 to 025 (data requesting the sensor amplifier operation) and the data number 053 to 061 (data presenting the result of request/execution)

When writing the data number 001 to 025 (data requesting the sensor amplifier operation), read the data number 053 to 061 (data presenting the result of request/execution) and check that the request is correctly reflected (1: Normal termination is read or the system parameter status is now the set value.). If the request is not correctly reflected and abnormal termination occurs, data other than 1: Normal termination may be read by reading the data number 053 to 061. Thus, the request may not be reflected to the sensor amplifier.

When 0 → 1 is written for the data number 001 to 025, the previous state of the data number 053 to 061 is cleared and the condition is updated. The data number 053 to 061 holds the result until 0 → 1 is written for the next data number 001 to 025.

Example Data numbers

- The data number 051 (Zero shift/zero shift reset execution result) holds the result of writing which either the data number 001 (Zero shift reset execution request) or data number 002 (Zero shift execution request) performed last.
- The execution result reading in response to a data No. 061 (Calibration result) request, is for the most recent of the following: calibration request, calculated two-point calibration request, or calculated three-point calibration request.
- The data number 066 (Tolerance tuning/Two-point tuning execution result) holds the result of writing which any of the data number 014 (Tolerance tuning request), data number 016 (Two-point tuning HIGH side 2nd point confirmation) or data number 018 (Two-point tuning LOW side 2nd point confirmation) performed last.
- The data number 053 (EEPROM writing result) holds "0: Writing" for 2 seconds after the contents written onto the nonvolatile memory (EEPROM) using the writing commands (SW, AW) are sent last. If writing starts after 2 seconds and finishes normally, 1: Normal termination results.

  Example If the writing commands (SW, AW) are continuously sent every second, 0: Writing is held for 2 seconds. After the last writing commands (SW, AW) are sent, 0: Writing is held for 2 seconds, writing is performed after 2 seconds and 1: Normal termination results.

  However, when the initial reset is performed for the data number 005 (Initial reset request), writing starts immediately. If all the parameters can be saved on the nonvolatile memory (EEPROM) after approx. 3 seconds, 1: Normal termination results.
- Writing for data No. 001 (Zero shift execution request) and data No. 002 (Zero shift reset execution request) begins immediately if the "zero shift status save" function is ON.

■ Error numbers

The following table lists the error numbers that are returned as error responses when errors occur in the communication with the IL Series.
Each error number is identified with two digits (ASCII characters).

Error number	Error name	Problem	Action
00	Invalid command error	An invalid command was received.	Make sure that the external device has sent a command listed in "Communication commands" (page 10).
20	Data length error	Data with the correct length was not received.	Make sure that the external device has sent either "CR" or "CR + LF" as a data delimiter.
21	Number of parameters error	The correct number of parameters for the command was not received.	Make sure that the number of parameters and the positions of the commas used as data delimiters conform to the command format shown in "Commands and Responses" (page 7).
22	Parameter error	· A parameter exceeds its range of value. · The external device is trying to write a data type that cannot be written. · The external device is trying to read a data type that cannot be read. · The data format is incorrect.	Make sure that the external device is sending a command listed in "Communication commands" (page 10).
29	Communication error	An error was detected with RS-232C communication.	Make sure that DL-RS1A and the external device have the same communication settings configured. For information on configuring DL-RS1A, refer to "(1) Communication setup switches" (page 2).
65	ID number error	The ID number specified with the command is incorrect.	Make sure that the sent data specified as the ID number is a 2-digit number (ASCII characters) according to the number of connected units.
66	Expansion line error	The communication could not be established due to a problem with an expansion line.	Check that each of the sensor amplifiers and DL-RS1A are securely and properly connected by referring to "Connecting the Unit to Sensor Amplifiers" (page 3). Make sure that sensor amplifiers that are supported by DL-RS1A are connected (refer to page 4).
67	Write control error	DL-RS1A is not writable.	Change the read/write setting switch to the R/W position to enable writing to DL-RS1A. For information on the read/write setting switch, refer to "Part Names and Functions" (page 2).

Point

The commands are only sent and received when a response is returned from DL-RS1A to the external device within 1 sec.
Take the appropriate action to resolve the problem by referring to "Troubleshooting" (page 19).

Communication Response Time

This section describes the communication response time for each communication command and various time frames.

Communication Response Time and Time Chart

This section describes the concept of communication response time and the time chart for the communication commands.

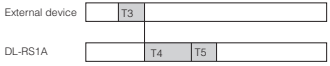
Point

When sending communication commands consecutively from the external device, wait to send the next command after reception of the response for the previous command from DL-RS1A completes.

■ SR command

The SR command directly reads data from a sensor amplifier during T4 (DL-RS1A command processing time).

Time chart

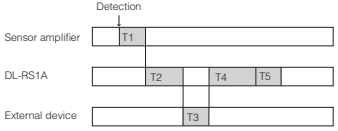


T3: Command format send time from external device
T4: DL-RS1A command processing time
T5: Response send time from DL-RS1A

* For the specific values (times) of T3 to T5, refer to
"Time Frames of Communication Response Time" (page 17).

■ M0 command and MS command

The M0 and MS commands read the buffered data that DL-RS1A periodically retrieves from the sensor amplifiers.
Therefore, the latest data detected by the sensors can only be read after T2 (DL-RS1A data processing time) where DL-RS1A retrieves data from the sensor amplifiers.



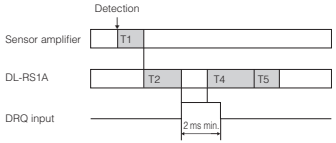
T1: Sensor amplifier response time (Refer to the IL Series user's manual.)
T2: DL-RS1A data processing time
T3: Command format send time from external device
T4: DL-RS1A command processing time
T5: Response send time from DL-RS1A

* For the specific values (times) of T2 to T5, refer to
"Time Frames of Communication Response Time" (page 17).

■ DRQ input

The data read in response to a DRQ input is the buffered data that DL-RS1A periodically retrieves from the sensor amplifiers.
Therefore, the latest data detected by the sensors can only be read after T2 (DL-RS1A data processing time) where DL-RS1A retrieves data from the sensor amplifiers.

Time chart



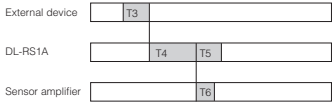
T1: Sensor amplifier response time (Refer to the IL Series user's manual.)
T2: DL-RS1A data processing time
T4: DL-RS1A command processing time
T5: Response send time from DL-RS1A

* For the specific values (times) of T2 to T5, refer to
"Time Frames of Communication Response Time" (page 17).

■ SW command and AW command

The SW and AW commands are write commands.

Time chart



T3: Command format send time from external device
T4: DL-RS1A command processing time
T5: Response send time from DL-RS1A
T6: Sensor amplifier setting change time

* For the specific values (times) of T3 to T5, refer to
"Time Frames of Communication Response Time" (page 17).

Time Frames of Communication Response Time

This section describes the communication time frames (T2 to T6).

Reference The maximum time required is shown for each time frame. However, depending on the actual environment, it may require more time.

■ T2 (DL-RS1A data processing time)

Number of connected sensor amplifiers	Data processing time (T2)
	IL Series
1	9 ms
2	11 ms
3	14 ms
4	18 ms
5	20 ms
6	24 ms
7	27 ms
8	31 ms

■ T3 (Command send time from external device)

Refer to the manual supplied with the external device connected to DL-RS1A.

■ T4 (DL-RS1A command processing time)

The processing time varies according to the command sent from the external device.

● **Read commands**

Communication command	Number of connected sensor amplifiers	Command processing time (T4)
		IL Series
SR	1	13 ms
	2	14 ms
	3	16 ms
	4	18 ms
	5	19 ms
	6	21 ms
	7	22 ms
	8	24 ms
M0/MS/DRQ input	1 to 8	4 ms

● **Write commands**

Communication command	Number of connected sensor amplifiers	Command processing time (T4)
		IL Series
SW	1	27 ms
	2	32 ms
	3	37 ms
	4	45 ms
	5	50 ms
	6	58 ms
	7	63 ms
	8	71 ms
AW	1	59 ms
	2	60 ms
	3	61 ms
	4	63 ms
	5	64 ms
	6	66 ms
	7	68 ms
	8	70 ms

■ T5 (Response send time from DL-RS1A)

The time required to send a response varies depending on the communication speed, data bit length, and number of bytes.
For information on the communication settings, refer to page 2.
The response time can be calculated using the following formula:

T5 = (number of bytes) x (data bit length + 4) / (communication speed)

● Number of bytes for different commands

SR command : (number of bytes in the read data) + 12
M0 command : {(number of bytes in the read data) + 1} × number of connected sensor amplifiers + 4
MS command : {(number of bytes in the read data) + 3} × number of connected sensor amplifiers + 4
DRQ input : {(number of bytes in the read data) + 3} × number of connected sensor amplifiers + 4
SW command : 11
AW command : 8
* For information on the number of bytes in the write data and the number of bytes in the read data, refer to "Parameters of Commands and Responses" (page 10).

Sample calculation

Number of bytes	Data length	Communication speed	Response time
21	8 bit	9600 bps	26 ms
114	8 bit	9600 bps	143 ms
21	7 bit	38400 bps	6 ms
114	7 bit	38400 bps	33 ms

■ T6 (Sensor amplifier settings change time)

SR command : T6 = 0 ms
AW command
Up to 5 amplifier units: T6 = 0 ms
6 amplifier units or more: T6 = 25 ms
From the completion of the T4 command processing until after the T6 period, the sensor amplifier will complete modifying settings. When T6 = 0 ms, the applied data of modified settings after receiving a response (after T5 period), can be read using the read commands (M0, MS) or DRQ input.

Point

In the event that the below data numbers are written using the SW, AW commands, the sensor amplifier will reset. The measurement values after settings are applied can be read after (T6 + T) period processing. By using the read commands (M0, MS) or DRQ input prior to T period processing, the P.V. values that are read will be (-999.98 for IL-300/600, -9999.8 for IL-2000)" (------).

Data numbers	T
6: Set system parameter request	Response time
129: Calculation function	Response time + 500 ms (When using the calculation function or interference prevention function: response time + 550 ms)
132: Sampling cycle	Response time + 50 ms (When using the calculation function or interference prevention function: response time + 500 ms)
133: Averaging/Diff. count filter/High-pass filter	Response time
153: Interference prevention function	Response time + 500 ms

Specifications

Performance Specifications

The following table shows the performance specifications for DL-RS1A.

Item		Specifications
Model		DL-RS1A
Power supply voltage		20 to 30 VDC, including 10% ripple (P-P). Class2 (Supplied from the connected IL Series)
Current consumption		25 mA max.
Indicators		2 communication status indicators (green), alarm indicator (red), power indicator (green)
Environ-mental	Ambient temperature	-10 to +55°C (No freezing)
	Relative humidity	35 to 85% RH (No condensation)
	Vibration	10 to 55 Hz, compound amplitude 1.5 mm, 2 hours for each of XYZ axes
Material		Main unit housing: polycarbonate
Weight		Approx. 53 g
Accessories		Instruction manual, 2 end units, expansion connector cover, switch protection sticker

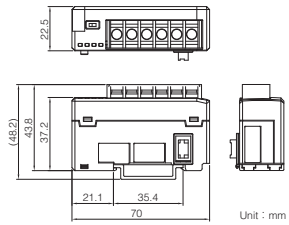
Communication Specifications

The following table shows the communication specifications for DL-RS1A.

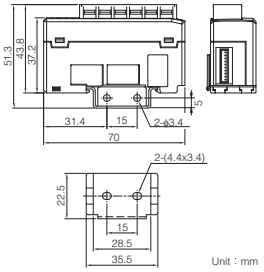
Item	Specifications
Communication method	Full duplex
Synchronization method	Asynchronous
Transmission code	ASCII
Communication speed (Baud rate)	2400, 4800, 9600, 19200, 38400 bit/s (Factory default: 9600 bit/s)
Data bit length	7 or 8 bits (Factory default: 8 bits)
Parity check	None, even, odd (Factory default: none)
Stop bit length	1 bit
Data delimiter	Receive: automatically detect CR or CR + LF Send: fixed to CR + LF

Dimensions

■ When the unit is mounted on the DIN rail



■ When the optional fixture (OP-60412) is used



Troubleshooting

Problem	Cause	Action
The power indicator (POWER) does not light up.	Power is not supplied.	Make sure that the voltage of the power supplied to the sensor amplifier main unit is 20 to 30 VDC.
	DL-RS1A is not properly inserted to the expansion connector of the sensor amplifier.	Reconnect the unit following the instructions in "Connecting the Unit to Sensor Amplifiers" (page 3).
The alarm indicator lights up before communication starts.	DL-RS1A is connected to a sensor amplifier that does not support DL-RS1A.	Make sure that the unit is connected to an appropriate sensor amplifier model (refer to "Available sensor amplifiers" (page 4)).Reconnect the unit following the instructions in "Connecting the Unit to Sensor Amplifiers" (page 3).
The communication status indicator (RD) of DL-RS1A does not flash when you send a command from an external device.	The RD terminal of DL-RS1A is not connected to the SD terminal of the external device.	Check the connection wiring by referring to "Connecting the Unit to External Devices" (page 5).
	No communication data is sent from the external device.	Make sure that communication commands are sent out from the external device.
The alarm indicator lights up while data is transmitted.	Communication settings are incorrect.	Make sure that DL-RS1A and the external device have the same settings specified for communication speed, data bit length, and parity check. For information on configuring DL-RS1A, refer to "Part Names and Functions" (page 2).
The communication status indicator (RD) of DL-RS1A flashes but the communication status indicator (SD) does not flash while data is transmitted.		
The communication status indicator (SD) of DL-RS1A flashes while data is transmitted, but the data cannot be retrieved by an external device.	Proper communication is not established.	Lower the communication speed. Use a shielded cable for the communication cable (refer to "Connecting the Unit to External Devices" (page 5)). Modify the connection wiring so that noise does not enter the communication cable.
A communication error response is returned from DL-RS1A while data is transmitted.	For the cause and action, refer to page 15.	

ASCII Code Table

The following table lists the ASCII codes.

Low-order 4 bits \ High-order 4 bits	0	1	2	3	4	5	6	7	8	9
0	$^{N}_{U}$	$^{D}_{L}$	$^{S}_{P}$	0	@	P	`	p		
1	$^{S}_{O_H}$	$^{D}_{C_1}$	!	1	A	Q	a	q		
2	$^{S}_{T_X}$	$^{D}_{C_2}$	"	2	B	R	b	r		
3	$^{E}_{T_X}$	$^{D}_{C_3}$	#	3	C	S	c	s		
4	$^{E}_{O_T}$	$^{D}_{C_4}$	$	4	D	T	d	t		
5	$^{E}_{N_Q}$	$^{N}_{A_K}$	%	5	E	U	e	u		
6	$^{A}_{C_K}$	$^{S}_{Y_N}$	&	6	F	V	f	v		
7	$^{B}_{E_L}$	$^{E}_{T_B}$	'	7	G	W	g	w		
8	$^{B}_{S}$	$^{C}_{A_N}$	(	8	H	X	h	x		
9	$^{H}_{T}$	$^{E}_{M}$	)	9	I	Y	i	y		
A	$^{L}_{F}$	$^{S}_{U_B}$	*	:	J	Z	j	z		
B	$^{V}_{T}$	$^{E}_{S_C}$	+	;	K	[	k	{		
C	$^{F}_{F}$	→	,	<	L	\	l	|		
D	$^{C}_{R}$	←	—	=	M	]	m	}		
E	$^{S}_{O}$	↑	.	>	N	^	n	~		
F	$^{S}_{I}$	↓	/	?	O	_	o	$^{D}_{E_L}$		

Revision History

Date of printing	Version	Revision contents
March 2010	First edition	Released for each model.
April 2010	Second edition	
July 2010	Third edition	
October 2010	Fourth edition	
December 2010	Fifth edition	
March 2011	Sixth edition	
July 2011	Seventh edition	
July 2012	Ninth Edition	

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KEYENCE CORPORATION

www.keyence.com

1-3-14, Higashi-Nakajima, Higashi-Yodogawa-ku, Osaka, 533-8555, Japan PHONE: +81-6-6379-2211

AUSTRIA
Phone: +43 22 36-3782 66-0

BELGIUM
Phone: +32 1 528 1222

BRAZIL
Phone: +55-11-3045-4011

CANADA
Phone: +1-905-366-7655

CHINA
Phone: +86-21-68757500

CZECH REPUBLIC
Phone: +420 222 191 483

FRANCE
Phone: +33 1 56 37 78 00

GERMANY
Phone: +49 6102 36 89-0

HONG KONG
Phone: +852-3104-1010

HUNGARY
Phone: +36 1 802 73 60

INDIA
Phone: +91-44-4299-4192

ITALY
Phone: +39-02-6688220

KOREA
Phone: +82-31-789-4300

MALAYSIA
Phone: +60-3-2092-2211

MEXICO
Phone: +52-81-8220-7900

NETHERLANDS
Phone: +31 40 20 66 100

POLAND
Phone: +48 71 36861 60

ROMANIA
Phone: +40 269-232-808

SINGAPORE
Phone: +65-6392-1011

SLOVAKIA
Phone: +421 2 5939 6461

SLOVENIA
Phone: +386 1-4701-666

SWITZERLAND
Phone: +41 43-45577 30

TAIWAN
Phone: +886-2-2718-8700

THAILAND
Phone: +66-2-369-2777

UK & IRELAND
Phone: +44-1908-696900

USA
Phone: +1-201-930-0100

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