Flame Monitor

Model AUR355

User's Manual for Communication Functions

Thank you for purchasing this product.

This manual contains information for ensuring the safe and correct use of the product.

Those designing or maintaining equipment that uses this product should first read and understand this manual. This user's manual contains information not only for installation, but also for maintenance, troubleshooting, etc. Be sure to keep it nearby for handy reference.

Azbil Corporation

NOTICE

Please make sure that this manual is available to the user of the product.

Unauthorized duplication of this user's manual in part or in whole is forbidden. The information and specifications in this manual are subject to change without notice.

Considerable effort has been made to ensure that this manual is complete and accurate, but if you should find an omission or error, please contact us.

In no event is Azbil Corporation liable to anyone for any indirect, special, or consequential damages as a result of using this product.

Conventions Used in This Manual

■ The safety precautions explained below aim to prevent injury to you and others, and to prevent property damage.

⚠ **WARNING** — **Warnings are indicated when mishandling this product may result in death or serious injury.**

⚠ **CAUTION** — **Cautions are indicated when mishandling this product may result in minor injury or property damage only.**

■ In describing the product, this manual uses the icons and wording listed below.

⚠ — Indicates that caution is required in handling.

🚫 — The indicated action is prohibited.

❗ — Be sure to follow the indicated instructions.

Handling Precautions:
Information to be aware of when handling.

Note: — Indicates information that may be useful.

☞ : — Indicates an item or page to which the user may refer.

(1) (2) (3): — Steps in a sequence or parts of a figure, etc.

Safety Precautions

⚠ WARNING

⚡	**Before mounting, removing, or wiring, be sure to turn off the power to this device and all connected devices. Failure to do so may result in an electric shock.**
🚫	**Do not use communication output for control. The communication output of this device is for monitoring the status of equipment and combustion.**

⚠ CAUTION

❗	**Be sure to check that this device has been correctly wired before turning on the power. Incorrect wiring of the device may damage it or lead to hazardous conditions.**
🚫	**Do not attempt to write to a write-protected address or an address that is not described in this manual. Doing so may cause a malfunction of communication or display.**

Contents

Chapter 1.   Overview

1 - 1   Overview

This flame monitor, model AUR355 (hereinafter also "this device"), has RS-485 communication functions and can communicate with a PC, PLC, or other host device using a user-configured program.
The communication protocol is CPL.*
For example, if the host device is a PC, it is possible to use CPL to monitor the operating status of this device or to delete data via the RS-232C port or RS-485.

*CPL (Controller Peripheral Link) is Azbil's host communication protocol.

■ Features

The features of this device's communication function are as follows:

- Up to 32 modules can be connected to a single master station acting as a host device.

- The separately sold Smart Device Gateway, model NX-SVG, is required for communication with the host device.

- Transmission speeds can be up to 19200 bps.

- Besides continuous access commands, random access commands are available. Reading or writing to noncontiguous addresses is supported.

■ Communication functions

This device has two communication ports.
One is for host communication (RS-485), and the other is for loader communication (limited to use with the SLP-A55 loader).
Host communication is through the front connector on the front of this device, and loader communication is through the loader jack on the front of this device.
Host communication can be used for hard-wired communication between devices within the equipment and for monitoring the status of multiple AUR355 units.
On the other hand, loader communication is for connection to the SLP-A55 (a PC-based software tool) and uses a special cable.
Loader communication is useful for data analysis in the field. For example, it can be used when doing equipment maintenance.
For loader communication, refer to CP-UM-5956JE.
The purpose of the present manual is to explain host communication.

Using the RS-485 protocol, up to 32 devices (slave stations) can be connected to a host device (master station). Also, device addresses are used to communicate with specific slave stations.
With RS-485, using a procedure like the following, various kinds of data can be read from a device, and error history and number of errors can be cleared.

1. The master station transmits command messages to the slave stations.

2. The master station receives response messages from the slave stations.

- The master station sends read or write commands.

- You can freely select the type of data to read or write by using data addresses.

1

Examples:

● **When connected to the NX-SVG**

```
      ┌──────────────┐
      │  Host device │
      └──────┬───────┘
             │ Ethernet
      ┌──────┴───────┐
      │    NX-SVG    │
      └──────┬───────┘
             │ RS-485
  ┌────────┐  ┌────────┐  ┌────────┐          ┌────────┐
  │ AUR355 │  │ AUR355 │  │ AUR355 │  · · ·   │ AUR355 │
  └────────┘  └────────┘  └────────┘          └────────┘
```
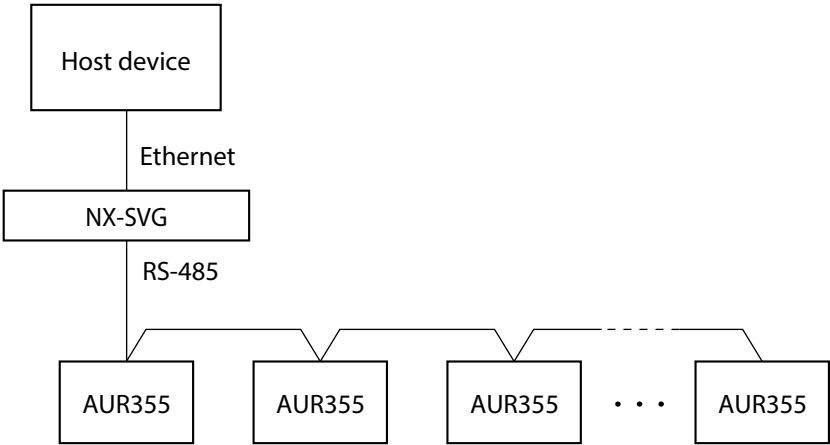
Chapter 2.   Wiring

■ **RS-485 communication**

The RS-485 cable for this device consists of three wires.
Connect the cable as shown below using the front wiring connector for this device (sold separately).

Connector for front wiring (sold separately)

Connector for front wiring (sold separately)

81447514-001
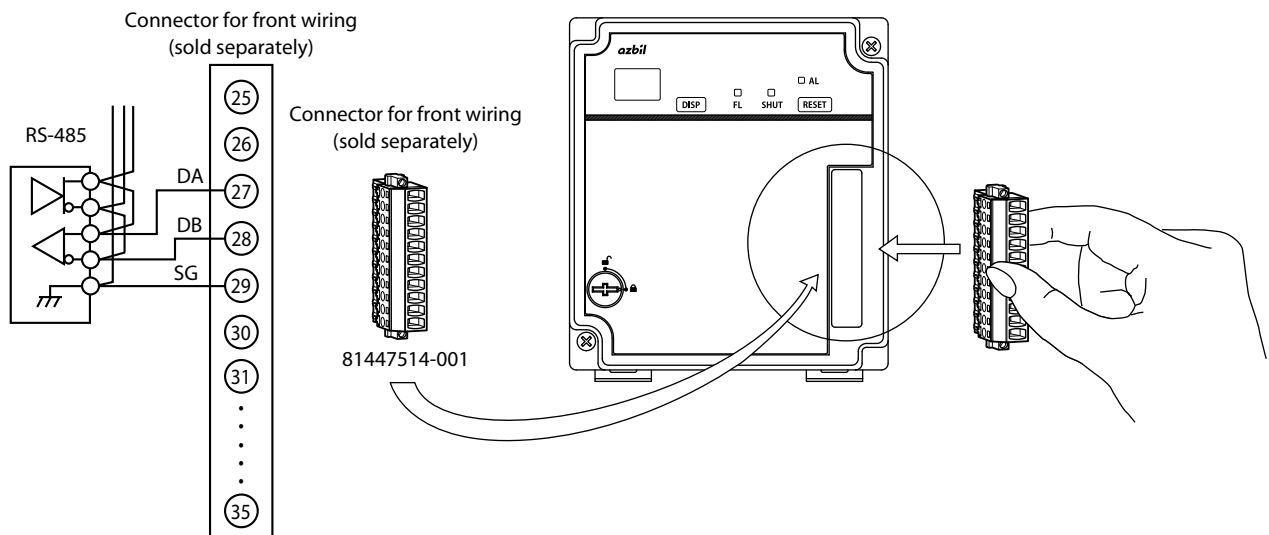
⚠ **Handling Precautions**

- Attach terminating resistors (½ W or more, 150 Ω ±5 %) at each end of the communications lines.
  However, if a device that does not allow a terminating resistor is connected to the same communications line, follow the specifications for that device.

- Be sure to connect the signal ground (SG) terminals to each other. Otherwise, communication may be unreliable.

- Use twisted-pair cable for communication wiring.

● **If the system includes 5-wire devices**
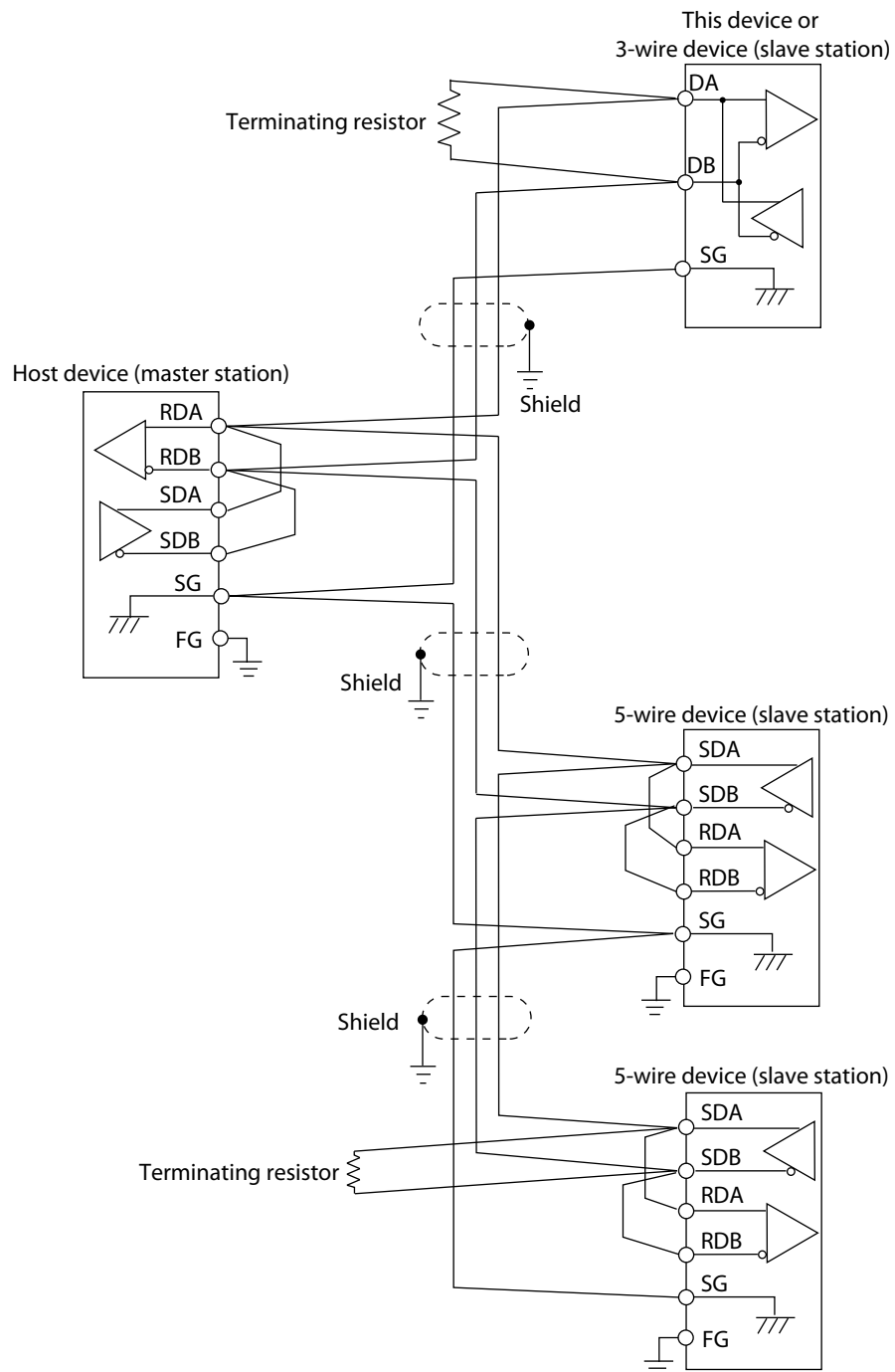
● **If the system includes 3-wire devices only**
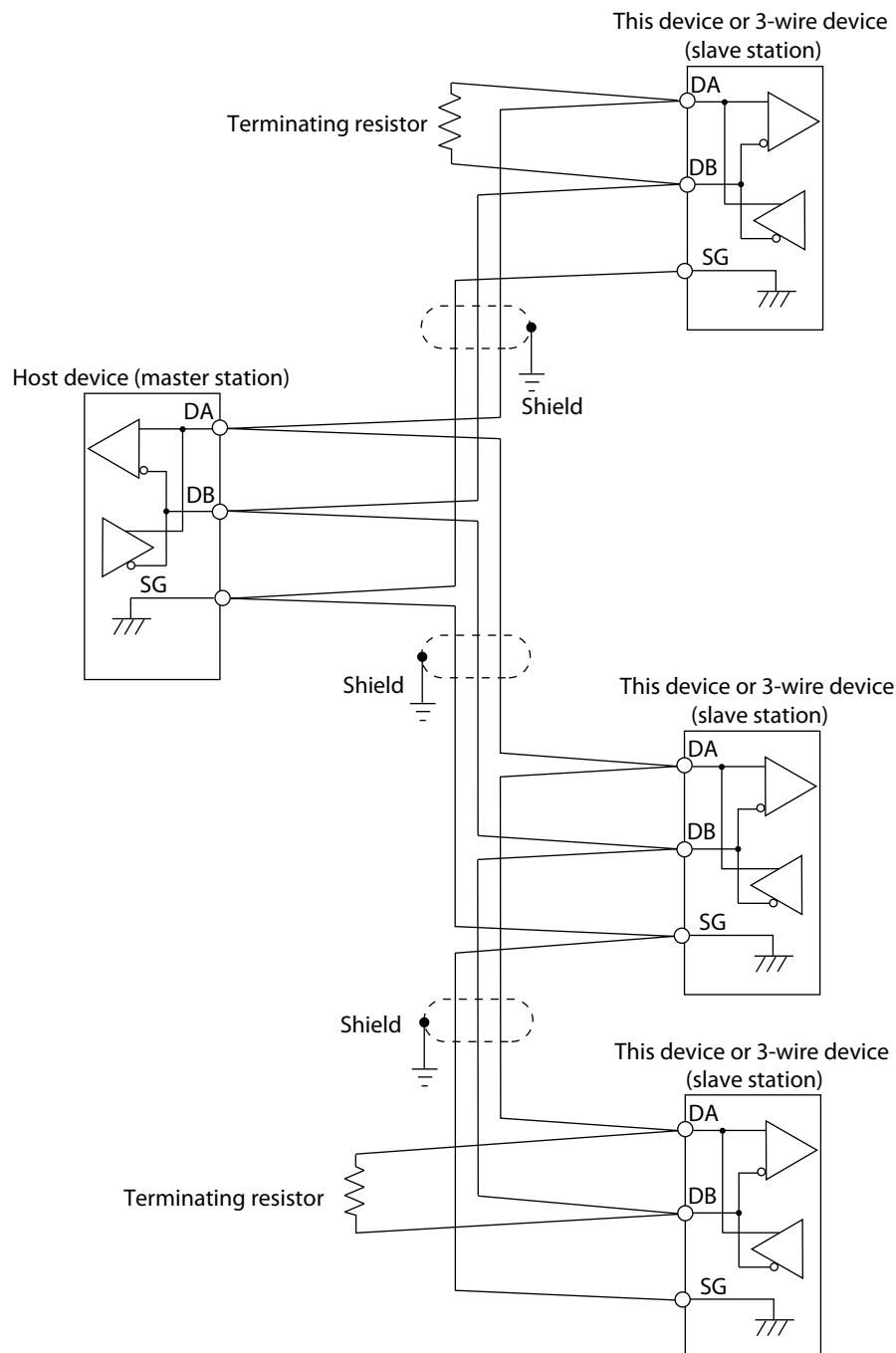
■ **Loader communication**

To use the Smart Loader Package (SLP), connect the special cable between the loader jack of this device and the PC running the SLP.

Chapter 3. Communication Settings

For communications with this device, the following settings must be configured.

1. Device address

2. Transmission speed

3. Data format

Each setting is explained below.

Each setting can be configured either in the setting mode of this device or with the Smart Loader Package.

📖 **Note**

- For details about each setting, refer to ☞ *Installation and Usage Guide for Smart Loader Package Model SLP-A55 for Burner Controller Model AUR_55*, Document No. CP-UM-5956JE.

⚠ **Handling Precautions**

- After setting the device address, transmission speed, and data format, it is necessary to briefly turn off the power to this device and then turn it back on again.
  When the power is turned on, the new device address, transmission speed, and data format settings will take effect.

■ **Device address**

The setting range is from 1 to 32.

Make sure that there are no duplicate device addresses on the same transmission line.

The default setting is 1.

■ **Transmission speed**

The speed can be selected from 4800, 9600, and 19200 bps.

The preset speed is 19200 bps.

■ **Data format**

The format can be selected from:
- 8 bits, even parity, 1 stop bit
- 8 bits, even parity, 2 stop bits
- 8 bits, odd parity, 1 stop bit
- 8 bits, odd parity, 2 stop bits

The preset format is 8 bits, even parity, 1 stop bit.

Chapter 4.   Communication

4 - 1   Overview of Communication

■ Communication procedure

The simplest way to describe the communication procedure is as follows.

1. The master station sends a command message to the specified slave station.

2. The slave station processes the message, which is a command to read or write data.

3. Additionally, the slave station sends a response message whose contents correspond to the type of processing.

4. The master station receives and processes the response.

■ Message structure

The following shows the message structure.
Messages are broadly classified into two layers: the data link layer and the application layer.

- Data link layer
  This layer contains the basic information required for communication. For example, it has the destination of the command message and the checksum information.

- Application layer
  Data is read and written in this layer. The content of the layer varies according to the purpose of the message.

Messages include parts 1 to 9 in the figure below.
The command in a command message from the master station and the response in a response message from the slave station are stored in the application layer.

02H			30H	30H	58H				03H			0DH	0AH
STX			0	0	X				ETX			CR	LF
①	②		③		④		⑤		⑥	⑦		⑧	⑨

Data link layer	Application layer	Data link layer

1 frame
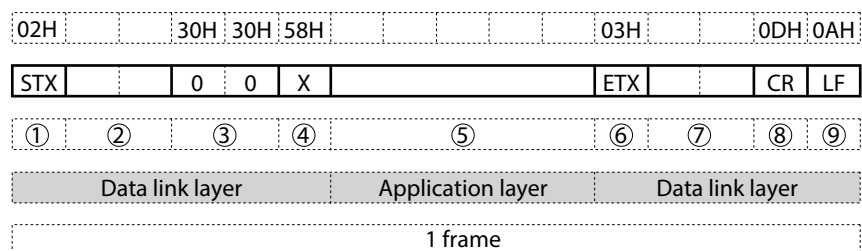
① STX (start of message)   ⑥ ETX (end of command or response)
② Device address   ⑦ Checksum
③ Subaddress (fixed at "00")   ⑧ CR (delimiter)
④ Device code   ⑨ LF (delimiter)
⑤ In command message = the command, in response message = the response

■ Data link layer
● Overview

The data link layer has a fixed length. The relative position of each item of data and its length are prescribed. Note, however, that the position of data in the data link layer from ETX onwards shifts according to the number of characters in the application layer. The length of the data link layer text remains unchanged.

● **Response start conditions**

The slave station sends a response message only if all the message components (device address, subaddress, and checksum) in the data link layer are correct. If even one of these is incorrect, no response message is sent, and the slave device stands by to receive STX.

If the message exceeds the allowed length (160 bytes), no response message is sent, and the slave station waits for a new message.

● **List of data link layer data definitions**

The following table describes the data in the data link layer.

Data name	Character code	Bytes	Meaning
STX	02H	1	Start of message
Device address	Hexadecimal	2	The device to communicate with
Subaddress	Hexadecimal	2	Always 00
Device distinction code	"X" (58H) or "x" (78H)	1	Type of device
ETX	03H	1	End of application layer
Checksum	2 hexadecimal digits from 00H to FFH	2	Checksum of message
CR	0DH	1	End of message marker (part 1)
LF	0AH	1	End of message marker (part 2)

● **Description of data**

● **STX (02H)**

When STX is received, this device interprets it as the start of a transmitted message. It follows that, no matter what has been received previously, upon receiving STX the device begins processing a new message. The purpose of this is to enable recovery of the device's responsiveness when the next message (for example, a RETRY message) comes from the master station in the event that electromagnetic noise, for example, caused an error in the command message.

● **Device address**

The slave station only creates response messages to messages that contain its device address. Device addresses in the messages are expressed as two-digit hexadecimal characters.

The setting range for the device address is 1–32.

When the slave station responds, it adds its device address to the response message.

● **Subaddress**

The AUR355 does not use subaddresses. For this reason, set the subaddress to "00" (30H 30H). When the slave station responds, it adds the subaddress to the response message.

● **Device distinction code**

Either X (58H) or x (78H) can be used. This code is determined for each device series, and other characters cannot be used. The slave station adds the same device

distinction code as that of the received message to the response message and returns it. It is convenient to use X (58H) in messages the first time and use x (78H) for resent messages in order to distinguish them.

● **ETX**

ETX indicates the end of the application layer.

● **Checksum**

This value is for checking whether something abnormal (e.g., electromagnetic noise) has caused the message content to change during transmission. The checksum is expressed as two hexadecimal characters.

- How to create a checksum
  (1) Add up the hex codes from STX to ETX in increments of 1 byte.
  (2) Take the two's complement of the addition result.
  (3) Convert it to character codes.

Example:
The example below is based on a message that includes the following elements.
Device address   : 10 (0AH)
Subaddress   : 00 (fixed)
Device distinction code : X (58H)

02H	30H	41H	30H	30H	58H	52H	53H	2CH	31H	30H	30H	31H	57H	2CH	32H	03H	38H	41H	0DH	0AH
STX	0	A	0	0	X	R	S	,	1	0	0	1	W	,	2	ETX	8	A	CR	LF

1. Add the character codes byte by byte in the message from STX through ETX.
   The lowest order byte of the sum is 76H.

2. Take the two's complement of the sum.
   The result is 8AH (8A (hex)).

3. Convert the characters of the result to character codes. Use this as a checksum.
   The characters "8A" are converted to their character codes 38H and 41H.

● **CR/LF**

This indicates the end of the message. Immediately after LF is received, the device is ready to receive and process another message.

■ Application layer
● Configuration of application layer

The table below shows the configuration of the application layer.

Item	Description
Command	RS (decimal format continuous address data read command)
	WS (decimal format continuous address data write command)
	RD (hex format continuous address data read command)
	WD (hex format continuous address data write command)
	RU (hex format random address data read command)
	WU (hex format random address data write command)
Data delimiter	RS, WS　　　　　　　: "," (comma)
	RD, WD, RU, WU　　: (none)
Word address	RS, WS　　　　　　　: "501 W," etc.
	RD, WD, RU, WU　　: "01F5," etc.
Read count	A number expressed as a character (e.g., "1")
Number to write	RS, WS　　　　　　　: Expressed in characters, like "100"
	RD, WD, RU, WU　　: A hexadecimal expression like "0064"

● Number of data words accessible by a single frame

Type	Description of commands	Data count
RS	Read command in decimal format	16 words
WS	Write command in decimal format	16 words
RD	Read command in hexadecimal format	16 words
WD	Write command in hexadecimal format	16 words
RU	Random read command in hexadecimal format	16 words
WU	Random write command in hexadecimal format	16 words

4 - 2　Numerical Representation in the Application Layer

Each numerical value must be expressed with unnecessary zeros suppressed.

The following shows the specifications, including a case where zero is not suppressed. All master station command messages must be sent with unnecessary zeros suppressed.

■ RS, WS commands

Item	Specification	Error Handling
Unnecessary spaces	Cannot be appended.	An error end code is returned in the response message.
Numerical value = zero	Cannot be omitted. "0" must be used.	
Other unnecessary characters	To represent a negative number, add "−" to the beginning of the number. Other characters cannot be appended. For positive numbers, "+" must not be added.	
Range of available numerical values	−32768 to +32767 This range must not be exceeded.	

■ RD, WD, RU, WU commands

Item	Specification	Error Handling
Unnecessary spaces	Cannot be appended.	An error end code is returned in the response message.
Numerical value = zero	Cannot be omitted. "0000" must be used.	
Other unnecessary characters	Cannot be appended.	
Range of available numerical values	0000H–FFFFH	

4-3   List of End Codes

The result of the application layer processing of the command message can be understood from the end code of the response message.

Results other than "Normal" are on two levels. "Error" is returned when nothing is processed, and "Warning" is returned when there is a possibility that some kind of processing was done.

■ End codes for the read command

End code	Description	Operation
00 (Normal)	Normal end	The value that was read is returned.
99 (Error)	Undefined command	Only the end code is returned (no data is appended).
40 (Error)	Error in the number of data words	Only the end code is returned (no data is appended).
41 (Error)	Data address error	Only the end code is returned (no data is appended).

■ End codes for the write command

End code	Description	Operation
00 (Normal)	Normal end	All data was written.
99 (Error)	Undefined command	No data was written.
40 (Error)	Error in the number of data words	No data was written.
41 (Error)	Data address error	No data was written.
42 (Error)	Data range error	No data was written.
43 (Error)	Could not write	No data was written.
20 (Warning)	Error in the number of data words	Data was written to the accessible data addresses.
21 (Warning)	Data address error	Data was written to the accessible data addresses.
22 (Warning)	Data range error	Valid data was written.
23 (Warning)	Could not write	No data was written to read-only data addresses. If there was data for accessible data addresses, it was written.

- In the case of a command to write multiple data words, if multiple warnings are generated, the last warning code is returned.

- In the case of a command to write multiple data words, if multiple warnings are generated, and all the command messages eventually result in warnings, the error code corresponding to the last warning code is returned instead of the warning code.

  Ex.) If multiple warnings occur and all the command messages eventually result in warnings
  If the last warning code generated was "21" (data address error), the error code "41" (data address error) is returned as the end code.

4-4   Timing Specifications

■ Timing specifications for command and response messages

When the master and slave stations are connected directly with RS-485, the following points regarding the timing of command/response messages from the master/slave stations must be observed.

● Response monitoring time

The maximum response time from the end of command message transmission by the master station to the start of response message reception from the slave station is 2 seconds (#1 in the figure below).
Therefore, the response monitor time should be set to 2 seconds.
If a response time-out occurs, the command message should be resent.

● Transmission start time

After the master station finishes receiving a response message (#2 in the figure below), a wait time of 10 ms is required before it begins to transmit a command message (to the same or a different slave station).

● RS-485 3-wire system
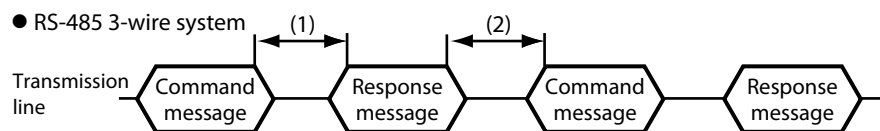
(1) End of master station transmission – Start of slave station transmission = 2000 ms max.

(2) End of slave station transmission – Start of master station transmission = 10 ms min.

RS-485 driver control timing specifications
When the transmission/reception on a 3-wire RS-485 system is directly controlled by the master station, care should be paid to the timing shown below.
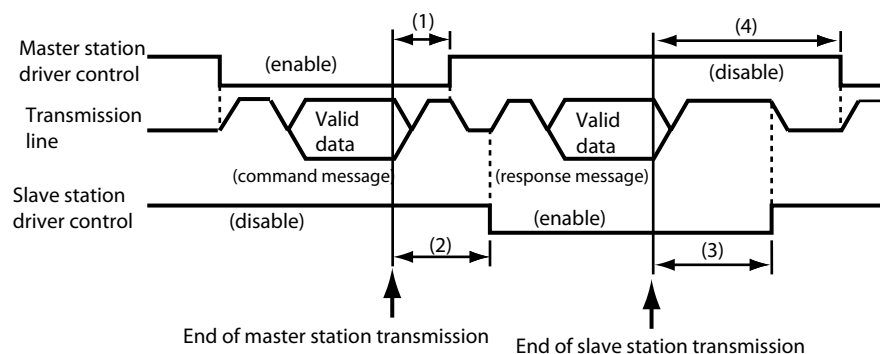
(1) End of master station transmission – Master station driver disabled time = 500 μs max.
(2) End of slave station reception – Slave station driver enabled time = 1 ms or more
(3) End of slave station transmission – Slave station driver disabled time = 10 ms or less
(4) End of master station reception – Master station driver enabled time = 10 ms or more

4 - 5   Description of Commands

■ Consecutive data read command (RS command)

This command reads data from consecutive addresses. This command can read and return data from consecutive addresses in one message starting from the specified read start address.

● Command message

Example of reading the present operating status

R	S	,	3	0	3	3	W	,	1
(1)		(2)			(3)			(2)	(4)

Application layer

(1) Command
(2) Data delimiter
(3) Address
(4) Read count

● Response message

• Normal end (reading of single data record)

0	0	,				
(1)		(2)		(3)		

• Normal end (reading of multiple data records)

0	0	,				,			,			
(1)		(2)		(3)		(2)		(4)	(2)		(5)	

• Abnormal end

| X | X | The end code (error) is entered in place of XX.
|---|---|
| (1) | |

(1) End code
(2) Data delimiter
(3) Data 1
(4) Data 2 to (n−1)
(5) Data n

● **End codes**

End code	Description	Condition	Operation
00 (Normal)	Normal end*	• The transmitted message was normal.	The value that was read is returned.
99 (Error)	Undefined command	• The first two characters in the application layer were an undefined command.	Only the end code is returned (no data is appended).
40 (Error)	Error in the number of data words	• A non-numeric character was used for the number of data words. • The number of data words was 0. • The number of data words was greater than the number of accessible data words. • A character other than a comma (",") was immediately before the number of data words.	Only the end code is returned (no data is appended).
41 (Error)	Data address error	• A non-numeric character was used for the data address. • The start data address was not specified. • The data address was 255 or lower. • The data address was 32678 or higher. • A character other than a comma (",") was immediately before the data address.	Only the end code is returned (no data is appended).

*If the start address was normal but a later address causes a data address error, "0" is returned as the data from the abnormal address.

● **Maximum number of data words read per message**

16

■ Continuous data write command (WS command)

This command writes data to consecutive addresses.

● Command message

Example of setting "UV flame detector check (combustion time)" for Event Settings

W	S	,	7	1	0	0	W	,	0	1	,	5	3
(1)		(2)			(3)			(2)	(4)		(2)	(5)	

(1) Command
(2) Data delimiter
(3) Write start address
(4) Write data (1st word)
(5) Write data (2nd word)

● Response message

• Normal end

0	0
(1)	

• When there is an error/warning

| X | X | The end code (error/warning) is entered in place of XX.
|---|---|
| (1) | |

(1) End code

● **End codes**

End code	Description	Condition	Operation
00 (Normal)	Normal end	• The transmitted message was normal.	All specified data was written.
99 (Error)	Undefined command	• The first two characters in the application layer were an undefined command.	No data was written.
40 (Error)	Error in the number of data words	• The number of data words was greater than the number of accessible data words. and No data could be written. (All data in the transmitted message met the conditions for an error or alarm.)	No data was written.
41 (Error)	Data address error	• A non-numeric character was used for the start data address. • The start data address was not specified. • The start data address was 255 or lower. • The start data address was 32678 or higher. • A character other than a comma (",") was immediately before the data address. • A character other than a comma (",") was immediately after the data address.	No data was written.
42 (Error)	Data range error	• A non-numeric character was included in the write data. • Write data was out of the data range • Write data was 32768 or greater, −32769 or less, or −0 • A character other than a comma (",") separated the data words. and No data could be written. (All data in the transmitted message met the conditions for an error or alarm.)	No data was written.
43 (Error)	Could not write	• The process did not have write permission for a data address. and No data could be written. (All data in the transmitted message met the conditions for an error or alarm.)	No data was written.
20 (Warning)	Data count warning	• The number of data words was greater than the number of accessible data words.	Data was written to the accessible data addresses.
21 (Warning)	Data address error	• The data address was not specified (other than the start address).	Data was written to the accessible data addresses.
22 (Warning)	Data range error	• A non-numeric character was included in the write data. • Write data was out of the data range • Write data was 32768 or greater, −32769 or less, or −0 • A character other than a comma (",") separated the data words.	Valid data was written.
23 (Warning)	Could not write	• The process did not have write permission for a data address.	No data was written to read-only data addresses. If there was data for accessible data addresses, it was written.

● **Maximum number of write data words per message**

16

■ Fixed length consecutive data read command (RD command)

This command reads continuous data in two-byte units. This command is suitable for handling data in ladder programs sent by PLC communications because the data has a fixed length.
The data start address is expressed as four hexadecimal digits for RD. The number of data words to read is expressed as four digits, and data is expressed as four × n (n is a positive integer) hexadecimal digits.

● Command message

The read start address (four hexadecimal digits) and the number of data words to read (four hexadecimal digits) are sent.

R	D								
(1)		(2)				(3)			

(1) Command
(2) Data start address
(3) Number of data records

● Response message

If the command is successful, the end code is Normal (two decimal digits) and is returned with the specified number of data words (four hexadecimal digits × number of data words to read) appended. If there was an error, the Error end code (two decimal digits) is returned without read data appended.

• Normal end (reading of single data record)

0	0				
(1)		(2)			

• Normal end (reading of multiple data records)

0	0									
(1)		(2)			(3)		(4)			

• Abnormal end

X	X	The end code (error) is entered in place of XX.
(1)		

(1) End code
(2) Data 1
(3) Data 2 to (n−1)
(4) Data n

● **End codes**

End code	Description	Condition	Operation
00 (Normal)	Normal end*	• The transmitted message was normal.	The value that was read is returned.
99 (Error)	Undefined command	• The first two characters in the application layer were an undefined command.	Only the end code is returned (no data is appended).
40 (Error)	Error in the number of data words	• A character other than 0H to FH was used for the number of data words. • The number of data words was less than 0. • The number of data words was greater than the number of accessible data words.	Only the end code is returned (no data is appended).
41 (Error)	Data address error	• A character other than 0H–FH was included in the data address. • The start data address was not specified. • The data address was 255 or lower.	Only the end code is returned (no data is appended).

*If the start address was normal but a later address causes a data address error, "0" is returned as the data from the abnormal address.

● **Maximum number of data words read per message**

16

■ Fixed length continuous data write command (WD command)

This command writes continuous data in two-byte units. This command is suitable for handling data in ladder programs sent by PLC communications because the data has a fixed length.
The start data address is expressed as four hexadecimal digits for WD. Data is expressed as four × n (n is a positive integer) hexadecimal digits.

● **Command message**

The write start address (four hexadecimal digits) and the number of data words to write (four hexadecimal digits) are sent. (The letter n stands for the write count.)

• Writing of single data record

W D		
(1)	(2)	(3)

• Writing of multiple data records

W D				
(1)	(2)	(3)	(4)	(5)

(1) Command
(2) Data start address
(3) Data 1
(4) Data 2 to (n−1)
(5) Data n

● **Response message**

If the command is successful, the Normal end code (two decimal digits) is returned. If only part of the data is written, the Warning end code (two decimal digits) is returned. If none of the data is written, the Error end code (two decimal digits) is returned.

• Normal end

0 0
(1)

• When there is an error/warning

| X X | The end code (error/warning) is entered in place of XX.
|---|
| (1) |

(1) End code

● **End codes**

End code	Description	Condition	Operation
00 (Normal)	Normal end	• The transmitted message was normal.	All specified data was written.
99 (Error)	Undefined command	• The first two characters in the application layer were an undefined command.	No data was written.
40 (Error)	Error in the number of data words	• The number of data words was greater than the number of accessible data words. and No data could be written. (All data in the transmitted message met the conditions for an error or alarm.)	No data was written.
41 (Error)	Data address error	• A character other than 0H–FH was used for the start data address. • The start data address was not specified. • The start data address was 255 or lower.	No data was written.
42 (Error)	Data range error	• A character other than 0H–FH was included in the write data. • Write data was out of the data range and No data could be written. (All data in the transmitted message met the conditions for an error or alarm.)	No data was written.
43 (Error)	Could not write	• The process did not have write permission for a data address. and No data could be written. (All data in the transmitted message met the conditions for an error or alarm.)	No data was written.
20 (Warning)	Data count warning	• The number of data words was greater than the number of accessible data words.	Data was written to the accessible data addresses.
21 (Warning)	Data address error	• The data address was not specified (other than the start address).	Data was written to the accessible data addresses.
22 (Warning)	Data range error	• A character other than 0H–FH was included in the write data. • Write data was out of the data range	Valid data was written.
23 (Warning)	Could not write	• The process did not have write permission for a data address.	No data was written to read-only data addresses. If there was data for accessible data addresses, it was written.

● **Maximum number of write data words per message**

16

■ Fixed length random data read command (RU command)

This command reads random (discontinuous) data words in two-byte units.

● Command message

The data addresses (four hexadecimal digits each) of the data words to read are sent in the specified order.

R	U	0	0							
(1)		(2)		(3)			(4)		(5)	
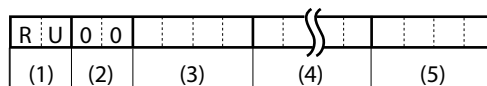
(1) Command
(2) Subaddress, fixed at "00"
(3) Address 1
(4) Address 2 to (n−1)
(5) Address n

● Response message

If the command is successful, the Normal end code (two decimal digits) is returned with the specified number of data words (four hexadecimal digits × number of data words to read) appended. If there was an error, the Error end code (two decimal digits) is returned without any read data appended.

• Normal end

0	0							
(1)		(2)		(3)		(4)		

• Abnormal end

X	X
(1)	

The end code (error) is entered in place of XX.

(1) End code
(2) Data 1
(3) Data 2 to (n−1)
(4) Data n

● End codes

End code	Description	Condition	Operation
00 (Normal)	Normal end*	• The transmitted message was normal.	The value that was read is returned.
99 (Error)	Undefined command	• The first two characters in the application layer were an undefined command. • The subaddress was not 00.	Only the end code is returned (no data is appended).
40 (Error)	Error in the number of data words	• The number of data words was greater than the number of accessible data words.	Only the end code is returned (no data is appended).
41 (Error)	Data address error	Only if all data addresses in the transmitted message meet the following conditions: • A character other than 0H–FH was included in the data address. • The data address was not specified. • The data address was 255 or lower.	Only the end code is returned (no data is appended).

*If a data address causes the data address error, "0" is returned as the data from the abnormal address.

● **Maximum number of data words read per message**

16

■ Fixed length random data write command (WU command)

This command writes data to random (discontinuous) addresses in two-byte units. Data is expressed in four hexadecimal digits.

● **Command message**

Data is sent for the specified number of data words to write, with the addresses (four hexadecimal digits each) for the data and the data (four hexadecimal digits) as a pair.

W	U	0	0												
(1)		(2)		(3)			(4)			(5)		(6)		(7)	

(1) Command
(2) Subaddress, fixed at "00"
(3) Address 1
(4) Write data 1
(5) Address/write data 2 to (n−1)
(6) Address n
(7) Write data n

● **Response message**

If the data is written, the Normal end code (two decimal digits) is returned. If only part of the data is written, the Warning end code (two decimal digits) is returned. If none of the data is written, the Error end code (two decimal digits) is returned.

• Normal end

0	0
(1)	

• When there is an error/warning

| X | X | The end code (error) is entered in place of XX.
|---|---|
| (1) | |

(1) End code

● **End codes**

| End code	Description	Condition	Operation
00 (Normal)	Normal end	• The transmitted message was normal.	All specified data was written.
99 (Error)	Undefined command	• The first two characters in the application layer were an undefined command. • The subaddress was not 00.	No data was written.
40 (Error)	Error in the number of data words	• The number of data words was greater than the number of accessible data words. and No data could be written. (All data in the transmitted message met the conditions for an error or alarm.)	No data was written.
41 (Error)	Data address error	• A character other than 0H–FH was included in the data address. • The data address was not specified. • The data address was 255 or lower. and No data could be written. (All data in the transmitted message met the conditions for an error or alarm.)	No data was written.
42 (Error)	Data range error	• A character other than 0H–FH was included in the write data. • Write data was out of the data range and No data could be written. (All data in the transmitted message met the conditions for an error or alarm.)	No data was written.
20 (Warning)	Error in the number of data words	• The number of data words was greater than the number of accessible data words.	Data was written to the accessible data addresses.
21 (Warning)	Data address error	• A character other than 0H–FH was included in the data address. • The data address was not specified. • The data address was 255 or lower.	Data was written to the accessible data addresses.
22 (Warning)	Invalid write data	• A character other than 0H–FH was included in the write data.	Valid data was written.
23 (Warning)	Could not write	• The process did not have write permission for a data address.	No data was written to read-only data addresses. If there was data for accessible data addresses, it was written.

● **Maximum number of write data words per message**

16

Chapter 5.   Communication Data

■ Communication data table

Access to read/write data
    No symbol   : Accessible
    x   : Not accessible
CPL communication RS/WS commands
    Put "W" after the decimal data address.
CPL communication RD/WD/RU/WU commands
    Use hexadecimal data addresses.

! **Handling Precautions**

- Do not access addresses that are not listed.
  Operation is not guaranteed if an address that is not listed is accessed.

Data type	Data name	Address		Access		Description	Note
		Decimal (W)	Hex (H)	Read	Write		

Maintenance data	Model setup
	
	(Bits 0–7, 12–15 undefined)
	 15 12 11 8 7 4 3 0 (bits)
	 Flame sensor 2: AUD300 3: flame rod
	 How to read the table
	 ■ : 1 (bit ON)
	 □ : 0 (bit OFF)
		3000	0BB8		x	Bits 0 to 7
						   Undefined
						Bits 8 to 11: flame sensor
						   1: undefined
						   2: AUD300
						   3: flame rod
						   4: undefined
						Bits 12 to 15
						   Undefined	

	Version	3001	0BB9		x		
	Check SUM	3003	0BBB		x		
	Check SUM	3004	0BBC		x		
	Product serial number	3005	0BBD		x		
	Date code	3006	0BBE		x		

	Start signal / reset switch	3016	0BC8		x	Bit 0: contact reset input
						   0: open
						   1: short circuit
						Bit 1: startup input
						   0: open
						   1: short circuit
						Bit 2: DISP switch
						   0: not pushed
						   1: pushed
						Bit 3: reset switch
						   0: not pushed
						   1: pushed
						Bits 4 to 15
						   Undefined	

	Flame signal	3019	0BCB		x	Bit 0: flame
						   0: no
						   1: yes
						Bits 1 to 15
						   Undefined	

	Event output	3020	0BCC		x	Bit 0: event output
						   0: OFF
						   1: ON
						Bits 1 to 15
						   Undefined	

	Relay output	3022	0BCE		x	Bits 0 to 3
						   Undefined
						Bit 4: start check relay
						   0: OFF
						   1: ON
						Bit 5: flame relay
						   0: OFF
						   1: ON
						Bits 6 to 12
						   Undefined
						Bit 13: event relay
						   0: OFF
						   1: ON
						Bit 14: K7
						   0: OFF
						   1: ON
						Bit 15: K8
						   0: OFF
						   1: ON	

Data type	Data name	Address		Access		Description	Note
		Decimal (W)	Hex (H)	Read	Write		
Maintenance data	Host communication status	3028	0BD4		x	005AH = communication setting mode Other than 005AH = normal operation	

	Input	3029	0BD5		x	Bit 0: contact reset input
						  0: open
						  1: short circuit
						Bit 1: startup input
						  0: open
						  1: short circuit
						Bits 2 to 6
						  Undefined
						Bit 7: flame
						  0: no
						  1: yes
						Bits 8 to 15
						  Undefined	

	Output	3030	0BD6		x	Bits 0 to 1
						  Undefined
						Bit 2: flame relay
						  0: OFF
						  1: ON
						Bit 3: start check relay
						  0: OFF
						  1: ON
						Bits 4 to 6
						  Undefined
						Bit 7: K8
						  0: OFF
						  1: ON
						Bit 8: K7
						  0: OFF
						  1: ON
						Bit 9: event output relay
						  0: OFF
						  1: ON
						Bits 10 to 15
						  Undefined	

	Flame voltage	3031	0BD7		x	0 to 50 (0.0 to 5.0 V)	Present flame voltage
	Alarm (code)	3032	0BD8		x	Refer to the "Alarm indexes & codes" table in 6-1	Present alarm code
	Operating status No.	3033	0BD9		x	Refer to the "Operating status numbers" table in 6-1	Present operating status code
	Alarm occurrence information	3035	0BDB		x	0001H = Alarm triggered Other than 0001H = No alarm	
	Flame level (shutter open)	3036	0BDC		x	0 to 60	The number of times the flame level (shutter open) is maintained for 1 second
	Flame level (shutter closed)	3037	0BDD		x	0 to 60	The number of times the flame level (shutter closed) is maintained for 1 second
	Shutter cycle	3038	0BDE		x	0 to 10000 (0.00 to 10.000 seconds)	Total shutter open time plus shutter closed time
	Shutter open time	3039	0BDF		x	0 to 5000 (0.00 to 5.000 seconds)	Timing stops at 5000 after 5 seconds passes with the shutter open.
	Shutter shut time	3040	0BE0		x	0 to 5000 (0.00 to 5.000 seconds)	Timing stops at 5000 after 5 seconds passes with the shutter closed.
	Shutter cycles (1 min)	3041	0BE1		x	0 to 255 times	Shutter operation count Automatically updated every minute.

Data type	Data name	Address		Access		Description	Note
		Decimal (W)	Hex (H)	Read	Write		
Maintenance data	Event flag	3044	0BE4		x	Bit 0: UV flame detector check (combustion time) 　　0: no 　　1: yes Bit 1: product service life check (total operating time) 　　0: no 　　1: yes Bit 2: product service life check (total combustion count) 　　0: no 　　1: yes Bit 3: false flame 　　0: no 　　1: yes Bit 4: flame relay OFF 　　0: no 　　1: yes Bit 5: flame relay OFF (shutter closed) 　　0: no 　　1: yes Bits 6 to 15 　　Undefined	Present event occurrence status
	Power frequency flag	3045	0BE5		x	Bit 0: power frequency flag 　　0: 50 Hz 　　1: 60 Hz	
	Flame level (shutter open) (0 to 100 %)	3046	0BE6		x	0 to 100 %	The number of times the flame level (shutter open) is maintained for 1 second is converted to a number from 0 to 100.
	Flame level (shutter closed) (0 to 100 %)	3047	0BE7		x	0 to 100 %	The number of times the flame level (shutter closed) is maintained for 1 second is converted to a number from 0 to 100.
	Flame level (100 ms)	3048	0BE8		x	0 to 5 times	The number of times the flame level is reached for 100 ms
	Model Type	3101	0C1D		x	3C3CH	
	Flame sensor	3105	0C21		x	CC33H: AUD300 9966H: flame rod	
	Flame failure response time	3123	0C33		x	BF40H = 2 seconds max. 7F80H = 4 seconds max.	
	Host communication: Address (RS-485)	3182	0C6E		x	08XXH = XX, device address (1 to 32) in hex notation	Change this setting using Smart Loader Package model SLP-A55.
	Host communication: Baud rate (RS-485)	3183	0C6F		x	0900H = 4800 bps 0940H = 9600 bps 0980H = 19200 bps	Change this setting using Smart Loader Package model SLP-A55.
	Host communication: Data format (RS-485)	3184	0C70		x	0A00H = Even parity, 1 stop bit 0A33H = Even parity, 2 stop bits 0A66H = Odd parity, 1 stop bit 0A99H = Odd parity, 2 stop bits	Change this setting using Smart Loader Package model SLP-A55.
	Apparatus information 1	3189	0C75		x	0000H to FFFFH	Model information (ASCII character string that indicates the model)
	Apparatus information 2	3190	0C76		x	0000H to FFFFH	
	Apparatus information 3	3191	0C77		x	0000H to FFFFH	
	Apparatus information 4	3192	0C78		x	0000H to FFFFH	
	Apparatus information 5	3193	0C79		x	0000H to FFFFH	
	Apparatus information 6	3194	0C7A		x	0000H to FFFFH	
	Apparatus information 7	3195	0C7B		x	0000H to FFFFH	
	Apparatus information 8	3196	0C7C		x	0000H to FFFFH	
	Apparatus information 9	3197	0C7D		x	0000H to FFFFH	
	Apparatus information 10	3198	0C7E		x	0000H to FFFFH	

Data type	Data name		Address		Access		Description	Note
			Decimal (W)	Hex (H)	Read	Write		
Time and count data	Integrated Value: Integral Number Power ON	(High)	3300	0CE4		x	0 to 9999999 (0098967FH)	Counted every time the power is turned on.
		(Low)	3301	0CE5		x		
	Integrated Value: Integral Number start signal	(High)	3302	0CE6		x		Counted at every startup (every time the operating status changes from controlled shutdown to flame monitoring).
		(Low)	3303	0CE7		x		
	Integrated Value: Integral Number reset signal	(High)	3304	0CE8		x		Counted every time a fault stop is canceled with the RESET switch or contact reset input.
		(Low)	3305	0CE9		x		
	Integrated Value: Integral Number of flame relay ON	(High)	3308	0CEC		x		Counted every time the flame relay is output.
		(Low)	3309	0CED		x		
	Integrated Value: Integral Number of start check relay	(High)	3310	0CEE		x		Counted every time the start check relay is output.
		(Low)	3311	0CEF		x		
	Integrated Value: Integral Number of event relay output	(High)	3316	0CF4		x		Counted every time the event output relay is output.
		(Low)	3317	0CF5		x		
	Integrated Value: Integral Number of flame relay output	(High)	3318	0CF6		x		Counted every time there is output from the flame output relay.
		(Low)	3319	0CF7		x		
	Integrated Value : Internal error (flame circuit)		3350	0D16		x	0 to 9999 (0 to 270 FH) times	Counted when an alarm occurs.
	Integrated Value : Alarm at power-on		3351	0D17		x		An alarm that occurs 9999 times or more is not recorded
	Integrated Value : Internal error ROM checksum		3352	0D18		x		
	Integrated Value : Internal error EEPROM read		3353	0D19		x		
	Integrated Value : Internal error EEPROM write		3354	0D1A		x		
	Integrated Value : Internal error memory data value		3355	0D1B		x		
	Integrated Value : System error		3356	0D1C		x		
	Integrated Value : Internal error (input-circuit)		3357	0D1D		x		
	Integrated Value : Internal error (input-circuit)		3358	0D1E		x		
	Integrated Value :Internal error (EEPROM data value)		3359	0D1F		x		
	Integrated Value :Internal error (CPU mutual check)		3360	0D20		x		
	Integrated Value :Internal error(CPU mutual check)		3362	0D22		x		
	Integrated Value : Internal error (CPU mutual check)		3363	0D23		x		
	Integrated Value : Internal error (CPU mutual check)		3365	0D25		x		
	Integrated Value : Internal error (flame circuit)		3366	0D26		x		
	Integrated Value : host communication setting data		3367	0D27		x		
	IntegralTime Power ON		3381	0D35		x	Upper 3 bytes: hours (0 to 999999 (0 to F423FH))	Total operating time
			3382	0D36		x	Lower 1 byte: minutes (0 to 59 (0 to 38H))	
	IntegralTime combustion		3383	0D37		x	Upper 3 bytes: hours (0 to 999999 (0 to F423FH))	Total time when flame signal is ON
			3384	0D38		x	Lower 1 byte: minutes (0 to 59 (0 to 38H))	
	Total combustion count	(High)	3385	0D39		x	0 to 9999999 (0 to 0098967FH) times	The total number of times the flame signal turned ON
		(Low)	3386	0D3A		x		
	Operating time		3387	0D3B		x	Upper 3 bytes: hours (0 to 999999 (0 to F423FH))	Operating time
			3388	0D3C		x	Lower 1 byte: minutes (0 to 59 (0 to 38H))	

Data type	Data name		Address		Access		Description	Note
			Decimal (W)	Hex (H)	Read	Write		
Time and count data	Combustion time		3389	0D3D		x	Upper 3 bytes: hours (0 to 999999 (0 to F423FH)) Lower 1 byte: minutes (0 to 59 (0 to 38H))	Amount of time the flame signal was ON
			3390	0D3E		x		
	Combustion count	(High)	3391	0D3F		x	0 to 9999999 (0 to 0098967FH) times	The number of times the flame signal turned ON
		(Low)	3392	0D40		x		
	Event A1 count		3393	0D41		x	0 to 9999 (0 to 270 FH) times	Counted when an event occurs. An event that occurs 9999 times or more is not recorded.
	Event A2 count		3394	0D42		x		
	Event A3 count		3395	0D43		x		
	Event A4 count		3396	0D44		x		
	Event A5 count		3397	0D45		x		
	Event A6 count		3398	0D46		x		

Data type	Data name	Address		Access		Description		Note
		Decimal (W)	Hex (H)	Read	Write			
Initialization	Alarm count clear	3552	0DE0			Write: clear request = 5AH, Read: clear complete = 00H		Clears the cumulative values of all alarms to zero at once.
	Alarm monitor clear	3553	0DE1			Write: clear request = 5AH, Read: clear complete = 00H		Clears all alarm records at once.
	Event clear	3555	0DE3			Write	Clears A1 : CA51H Clears A2 : CA52H Clears A3 : CA53H Clears A4 : CA54H Clears A5 : CA55H Clears A6 : CA56H Clears A1 to A6 : CAFFH	Events can be individually cleared. You can also clear all events at the same time.
						Read	Clear operation completed : 3CH	
	Reset all event counts to 0	3557	0DE5			Write	Clears A1 : CA51H Clears A2 : CA52H Clears A3 : CA53H Clears A4 : CA54H Clears A5 : CA55H Clears A6 : CA56H Clears A1 to A6 : CAFFH	Event counts can be individually reset to zero. You can also reset all event counts to zero at the same time.
						Read	Clear operation completed : 3CH	
	Initialization of operating time / combustion time / combustion count	3558	0DE6			Write	Clears the operating time : CA51H Clears the combustion time : CA52H Clears the combustion count : CA53H Clears all : CAFFH	Data can be individually reset to zero. You can also reset all data records to zero at the same time.
						Read	Initialization complete : 3CH	

Data type	Data name		Address		Access		Description	Note
			Decimal (W)	Hex (H)	Read	Write		
Playback monitor	Event code & operating status No. when an event occurs		4000	0FA0		x	☞ ■ Playback monitor recorded information (p. 44)	
	Index		4001	0FA1		x	☞ ■ Playback monitor recorded information (p. 44)	
	Recorded data 8.0 s before event		4002	0FA2		x	☞ ■ Playback monitor recorded information (p. 44)	
	Recorded data 8.0 s before event		4003	0FA3		x	☞ ■ Playback monitor recorded information (p. 44)	
	–		–	–		x		
	Recorded data 1.9 s after event		4200	1068		x	☞ ■ Playback monitor recorded information (p. 44)	
	Recorded data 1.9 s after event		4201	1069		x	☞ ■ Playback monitor recorded information (p. 44)	
	Playback monitor data processing status		4202	106A		x	Processing under way = 5AH, Normal ≠ 5AH	
	Integrated Value:Play-back	(High)	4205	106D		x	0 to FFFFFFFFH (times)	The number of times playback data was saved in nonvolatile memory. Record is kept for up to 100,000 times. The count continues to be incremented after 100,000 times but it is not saved in nonvolatile memory. As a result, the count returns to 100,000 when the power is turned on.
		(Low)	4206	106E		x		

Data type	Data name		Address		Access		Description	Note
			Decimal (W)	Hex (H)	Read	Write		
Alarm history data	Alarm record-1		5000	1388		x	☞ ■ Alarm index/code table (p. 35)	
	Operating status No. when alarm occurs		5001	1389		x	☞ ■ Operating status No. table (p. 36)	
	IntegralTime Power ON		5002	138A		x	Upper 3 bytes: hours (0 to 999999 (0 to F423FH))	
	IntegralTime Power ON		5003	138B		x	Lower 1 byte: minutes (0 to 59 (0 to 38H))	
	Integrated Value:Integral Number start signal	(High)	5004	138C		x	0 to 9999999 (0 to 0098967FH) times	
	Integrated Value:Integral Number start signal	(Low)	5005	138D		x		
	Alarm record-2		5006	138E		x	Same as alarm record-1 addresses 5000–5005.	
	Operating status No. when alarm occurs		5007	138F		x		
	IntegralTime Power ON		5008	1390		x		
	IntegralTime Power ON		5009	1391		x		
	Integrated Value:Integral Number start signal	(High)	5010	1392		x		
	Integrated Value:Integral Number start signal	(Low)	5011	1393		x		
	Alarm record-3		5012	1394		x	Same as alarm record-1 addresses 5000–5005.	
	Operating status No. when alarm occurs		5013	1395		x		
	IntegralTime Power ON		5014	1396		x		
	IntegralTime Power ON		5015	1397		x		
	Integrated Value:Integral Number start signal	(High)	5016	1398		x		
	Integrated Value:Integral Number start signal	(Low)	5017	1399		x		
	Alarm record-4		5018	139A		x	Same as alarm record-1 addresses 5000–5005.	
	Operating status No. when alarm occurs		5019	139B		x		
	IntegralTime Power ON		5020	139C		x		
	IntegralTime Power ON		5021	139D		x		
	Integrated Value:Integral Number start signal	(High)	5022	139E		x		
	Integrated Value:Integral Number start signal	(Low)	5023	139F		x		
	Alarm record-5		5024	13A0		x	Same as alarm record-1 addresses 5000–5005.	
	Operating status No. when alarm occurs		5025	13A1		x		
	IntegralTime Power ON		5026	13A2		x		
	IntegralTime Power ON		5027	13A3		x		
	Integrated Value:Integral Number start signal	(High)	5028	13A4		x		
	Integrated Value:Integral Number start signal	(Low)	5029	13A5		x		
	Alarm record-6		5030	13A6		x	Same as alarm record-1 addresses 5000–5005.	
	Operating status No. when alarm occurs		5031	13A7		x		
	IntegralTime Power ON		5032	13A8		x		
	IntegralTime Power ON		5033	13A9		x		
	Integrated Value:Integral Number start signal	(High)	5034	13AA		x		
	Integrated Value:Integral Number start signal	(Low)	5035	13AB		x		
	Alarm record-7		5036	13AC		x	Same as alarm record-1 addresses 5000–5005.	
	Operating status No. when alarm occurs		5037	13AD		x		
	IntegralTime Power ON		5038	13AE		x		
	IntegralTime Power ON		5039	13AF		x		
	Integrated Value:Integral Number start signal	(High)	5040	13B0		x		
	Integrated Value:Integral Number start signal	(Low)	5041	13B1		x		
	Alarm record-8		5042	13B2		x	Same as alarm record-1 addresses 5000–5005.	
	Operating status No. when alarm occurs		5043	13B3		x		
	IntegralTime Power ON		5044	13B4		x		
	IntegralTime Power ON		5045	13B5		x		
	Integrated Value:Integral Number start signal	(High)	5046	13B6		x		
	Integrated Value:Integral Number start signal	(Low)	5047	13B7		x		

Data type	Data name		Address		Access		Description	Note
			Decimal (W)	Hex (H)	Read	Write		
Alarm history data	Alarm record-9		5048	13B8		x	Same as alarm record-1 addresses 5000–5005.	
	Operating status No. when alarm occurs		5049	13B9		x		
	IntegralTime Power ON		5050	13BA		x		
	IntegralTime Power ON		5051	13BB		x		
	Integrated Value:Integral Number start signal	(High)	5052	13BC		x		
	Integrated Value:Integral Number start signal	(Low)	5053	13BD		x		
	Alarm record-10		5054	13BE		x	Same as alarm record-1 addresses 5000–5005.	
	Operating status No. when alarm occurs		5055	13BF		x		
	IntegralTime Power ON		5056	13C0		x		
	IntegralTime Power ON		5057	13C1		x		
	Integrated Value:Integral Number start signal	(High)	5058	13C2		x		
	Integrated Value:Integral Number start signal	(Low)	5059	13C3		x		
	Alarm record-11		5060	13C4		x	Same as alarm record-1 addresses 5000–5005.	
	Operating status No. when alarm occurs		5061	13C5		x		
	IntegralTime Power ON		5062	13C6		x		
	IntegralTime Power ON		5063	13C7		x		
	Integrated Value:Integral Number start signal	(High)	5064	13C8		x		
	Integrated Value:Integral Number start signal	(Low)	5065	13C9		x		
	Alarm record-12		5066	13CA		x	Same as alarm record-1 addresses 5000–5005.	
	Operating status No. when alarm occurs		5067	13CB		x		
	IntegralTime Power ON		5068	13CC		x		
	IntegralTime Power ON		5069	13CD		x		
	Integrated Value:Integral Number start signal	(High)	5070	13CE		x		
	Integrated Value:Integral Number start signal	(Low)	5071	13CF		x		
	Alarm record-13		5072	13D0		x	Same as alarm record-1 addresses 5000–5005.	
	Operating status No. when alarm occurs		5073	13D1		x		
	IntegralTime Power ON		5074	13D2		x		
	IntegralTime Power ON		5075	13D3		x		
	Integrated Value:Integral Number start signal	(High)	5076	13D4		x		
	Integrated Value:Integral Number start signal	(Low)	5077	13D5		x		
	Alarm record-14		5078	13D6		x	Same as alarm record-1 addresses 5000–5005.	
	Operating status No. when alarm occurs		5079	13D7		x		
	IntegralTime Power ON		5080	13D8		x		
	IntegralTime Power ON		5081	13D9		x		
	Integrated Value:Integral Number start signal	(High)	5082	13DA		x		
	Integrated Value:Integral Number start signal	(Low)	5083	13DB		x		
	Alarm record-15		5084	13DC		x	Same as alarm record-1 addresses 5000–5005.	
	Operating status No. when alarm occurs		5085	13DD		x		
	IntegralTime Power ON		5086	13DE		x		
	IntegralTime Power ON		5087	13DF		x		
	Integrated Value:Integral Number start signal	(High)	5088	13E0H		x		
	Integrated Value:Integral Number start signal	(Low)	5089	13E1H		x		
	Alarm record-16		5090	13E2H		x	Same as alarm record-1 addresses 5000–5005.	
	Operating status No. when alarm occurs		5091	13E3H		x		
	IntegralTime Power ON		5092	13E4H		x		
	IntegralTime Power ON		5093	13E5H		x		
	Integrated Value:Integral Number start signal	(High)	5094	13E6H		x		
	Integrated Value:Integral Number start signal	(Low)	5095	13E7H		x		

Data type	Data name	Address		Access		Description	Note
		Decimal (W)	Hex (H)	Read	Write		
AUR tag*	AUR tag	7000 ˎ 7016	1B58 ˎ 1B68			0000H to FFFFH	34 characters in ASCII code (17 characters in 2-byte code) can be stored.
AUR Memo*	AUR Memo	7017 ˎ 7059	1B69 ˎ 1B93			0000H to FFFFH	86 characters in ASCII code (43 characters in 2-byte code) can be stored
Event (read only)*	Condition for event	7060	1B94		x	0035H (fixed)	
		7061	1B95		x	Bit 0: UV flame detector check (combustion time). 0: not set 1: set Bit 1: product service life check (total operating time). 0: not set 1: set Bit 2: product service life check (total combustion count). 0: not set 1: set Bit 3: false flame 0: not set 1: set Bit 4: flame relay OFF 0: not set 1: set Bit 5: flame relay OFF (shutter closed) 0: not set 1: set Bits 6 to 15 Undefined	Reads set events with bits.
	UV flame detector check (combustion time)	7069	1B9D		x	0036H	
		7070	1B9E		x	0 to 25000 (0 to 61A8H) hours	
	Product service life check (total operating time)	7071	1B9F		x	0037H	
		7072	1BA0		x	0 to 65000 (0 to FDE8H) hours	
	Product service life check (total combustion count)	7073	1BA1		x	0038H	
		7074	1BA2		x	0 to 10 (0 to AH) times	
	Event relay output condition setting	7075	1BA3		x	405AH: event output 403CH: synchronized with start check relay	
Event (write only)	Condition for event	7100	1BBC			Bit 0: UV flame detector check (combustion time). 0: not set 1: set Bit 1: product service life check (total operating time). 0: not set 1: set Bit 2: product service life check (total combustion count). 0: not set 1: set Bit 3: false flame 0: not set 1: set Bit 4: flame relay OFF 0: not set 1: set Bit 5: flame relay OFF (shutter closed) 0: not set 1: set Bits 6 to 15 Undefined	☞ ■ Writing 2-word event settings (p. 38) The count returns to 0 when the power is turned on or after data is written to EEPROM.
		7101	1BBD			0035H	

Data type	Data name	Address		Access		Description	Note
		Decimal (W)	Hex (H)	Read	Write		
Event (write only)	UV flame detector check (combustion time)	7109	1BC5			0 to 61A8H (0 to 25000 hours)	☞ ■ Writing 2-word event settings (p. 38) The count returns to 0 when the power is turned on or after data is written to EEPROM.
		7110	1BC6			0036H	
	Product service life check (total operating time)	7111	1BC7			0 to FDE8H (0 to 65000 hours)	
		7112	1BC8			0037H	
	Product service life check (total combustion count)	7113	1BC9			0 to AH (0 to 10 times)	The value calculated by multiplying the data range by 10000 is used to determine whether an event has occurred. ☞ ■ Writing 2-word event settings (p. 38) The count returns to 0 when the power is turned on or after data is written to EEPROM.
		7114	1BCA			0038H	
	Event relay output condition setting	7115	1BC8			405AH: event output 403CH: synchronized with start check relay	The event output is set up before the product is shipped. The count returns to 0 when the power is turned on or after data is written to EEPROM.
EEPROM write request	Write AUR settings to EEPROM request	7200	1C20			5AH: request to write data to EEPROM 3CH: writing to EEPROM complete	Writes values from addresses 7100 to 7115 to EEPROM. After changing a value, be sure to write it to EEPROM. After you write values to EEPROM, the values at addresses 7100 to 7115 change to 0.
Flame logger	Flame logger processing status	8000			x	5AH: processing in progress Other than 5AH: normal	
	Recorded data 0.1 s after trigger	8100			x	Bit 0: undefined Bit 1: startup input 0: no start input 1: start input Bits 2 to 3 Undefined Bit 4: flame input 0: no flame input 1: flame input Bit 5 Undefined Bit 6: start check relay 0: OFF 1: ON Bit 7: flame relay 0: OFF 1: ON Bit 8 Undefined Bit 9: shutter (AUR355C only) 0: OFF 1: ON Bit 10 Undefined Bits 11 to 13: flame level (AUR355C only) 0 to 5 Bits 14 to 15 Undefined	
	Recorded data 0.1 s after trigger	8101			x	Bits 0 to 7: operating status No. when an event occurs ☞ ■ Operating status No. table (p. 36) Bits 8 to 15: flame voltage 0 to 50 [0.1 V]	
	–	–	–		x		
	Recorded data 10.0 s after trigger	8298			x	Address: same as 8100	
	Recorded data 10.0 s after trigger	8299			x	Address: same as 8101	

* Settings can also be changed using Smart Loader Package model SLP-A55.

Chapter 6. Details of Functions via Communication

6 - 1　Monitoring Function

■ Alarm index/code table

Index	Code	Description
0	000	None
27	964	Internal error (flame circuit)
28	908	Alarm at power-on
29	950	Internal error ROM checksum
30	951	Internal error EEPROM read
31	952	Internal error EEPROM write
32	953	Internal error memory data value
33	954	System error
34	955	Internal error (input-circuit)
35	956	Internal error (input-circuit)
36	957	Internal error (EEPROM data value)
37	958	Internal error (CPU mutual check)
39	960	Internal error (CPU mutual check)
40	961	Internal error (CPU mutual check)
42	963	Internal error (CPU mutual check)
43	965	Internal error (flame circuit)
44	971	Host communication setting data

■ Operating status No. table

Value	Description
0	Controlled shutdown
12	Fault stop
15	False flame is detected
16	Flame is being monitored

■ Event code table

Value	Description
0	UV flame detector check (combustion time)
1	Product service life check (total operating time)
2	Product service life check (total combustion count)
3	False flame
4	Flame relay OFF
5	Flame relay OFF (shutter closed)

6-2   Event Function

■ Event items

The following items can be processed as events by this device.

Event item name	Event No.	Overview
UV flame detector check (combustion time)	A1	This event occurs if the combustion time exceeds the value set for "UV flame detector check (combustion time)." Use this event for maintenance when the flame sensor needs to be replaced
Product service life check (total operating time)	A2	This event occurs if the total operating time exceeds the value set for "Product service life check (total operating time)." Use this event for maintenance when this device or all connected devices should be replaced.
Product service life check (total combustion count)	A3	This event occurs if the total combustion count exceeds the value set for "Product service life check (total combustion count)." Use this event for maintenance when this device or all connected devices should be replaced.
False flame	A4	This event occurs if the flame relay is on before startup and the start check relay does not turn on after startup. This event can be caused by false flame or flame relay contact welding.
Flame relay OFF	A5	This event occurs if startup input is on during flame monitoring (PF) and the flame relay is turned OFF (flame failure). Use this event to check the flame detection status.
Flame relay OFF (shutter closed)	A6	AUR355C: This event occurs if startup input is on and the shutter remains closed for about 5 seconds. Use this event for fault diagnosis of the flame detector or this device. AUR355B: This event does not occur.

Name	Address	Event status

Event flag	3044W	Bit 0: UV flame detector check (combustion time)
		  0: no
		  1: yes
		Bit 1: product service life check (total operating time)
		  0: no
		  1: yes
		Bit 2: product service life check (total combustion count)
		  0: no
		  1: yes
		Bit 3: false flame
		  0: no
		  1: yes
		Bit 4: flame relay OFF
		  0: no
		  1: yes
		Bit 5: flame relay OFF (shutter closed)
		  0: no
		  1: yes
		Bits 6 to 15
		  Undefined

If an event occurs, the relevant bit in the communication data event flag (3044W) is set to "1." In addition, the 7-segment display shows the event code.

! Handling Precautions

- If an alarms has occurred, pressing the DISP switch does not display the event code even if an event has occurred.

- If multiple events have occurred, the displayed event codes are automatically cycled.

- Once an event occurs, it is retained until the user clears it.

■ To use events

To use the event function, set up using host communication or Smart Loader Package model SLP-A55.

■ Writing 2-word event settings

When writing a setting for a 2-word event, write the two words consecutively.
Be sure to observe the order of the addresses.
Writing data in the wrong order results in an error. In this case, the setting is not written.
The following is a list of 2-word event items.

Item name	Address		Description	Sample write command

Condition for event	7100	1BBC	Bit 0: UV flame detector check (combustion time)
			    0: not set
			    1: set
			Bit 1: product service life check (total operating time)
			    0: not set
			    1: set
			Bit 2: product service life check (total combustion count)
			    0: not set
			    1: set
			Bit 3: false flame
			    0: not set
			    1: set
			Bit 4: flame relay OFF
			    0: not set
			    1: set
			Bit 5: flame relay OFF (shutter closed)
			    0: not set
			    1: set
			Bits 6 to 15
			    Undefined
				<u>"UV flame detector check (combustion time) A1" event</u>
				Fixed length continuous data write command (WD command):
				    WD1BBC000100351
				    or
				    WD1BBC0001
				    WD1BBD0035
				
				Continuous data write command (WS command):
				    WS,7100W,1,53
				    or
				    WS,7100W,1
				    WS,7101W,53

	7101	1BBD	0035H	

UV flame detector check (combustion time)	7109	1BC5	0 to 61A8H (0 to 25000 hours)	<u>To set a value of 25000 hours</u>
				Fixed length continuous data write command (WD command):
				    WD1BC561A80036
				    or
				    WD1C5C61A8
				    WD1C6D0036
				
				Continuous data write command (WS command):
				    WS,7109W,25000,54
				    or
				    WS,7109W,25000
				    WS,7110W,54

	7110	1BC6	0036H	

Item name	Address		Description	Sample write command

Product service life check (total operating time)	7111	1BC7	0 to FDE8H (0 to 65000 hours)	Fixed length continuous data write command (WD command):
				  WD1BC7FDE80037
				  or
				  WD1BC7FDE8
				  WD1BC8 0037
				
				Continuous data write command (WS command):
				  WS,7111W,65000,55
				  or
				  WS,7111W,65000
				  WS,7112W,55

	7112	1BC8	0037H	

Product service life check (total combustion count)	7113	1BC9	0 to AH (0 to 10 times)	Fixed length continuous data write command (WD command):
				  WD1BC9000A0038
				  or
				  WD1BC9000A
				  WD1BCA0038
				
				Continuous data write command (WS command):
				  WS,7113W,10,56
				  or
				  WS,7113W,10
				  WS,7114W,56

	7114	1BCA	0038H	

■ Writing event-related items to EEPROM

Values at addresses 7100–7115 are written to EEPROM.

After changing values at addresses 7100–7115, be sure to write them to EEPROM.

Address	Name	Description
7200	Write AUR settings to EEPROM request	5AH: request to write to EEPROM 3CH: writing to EEPROM completed

After values are written to EEPROM, the values at addresses 7100–7115 change to zero.

You can check the written values at addresses 7060–7075.

[!] Handling Precautions

- Avoid making frequent requests to write data to EEPROM.
  Frequent requests might cause an EEPROM failure.

- Do not turn off this device while data is being written to EEPROM. Doing so might cause an EEPROM failure.

■ Details of event items

● UV flame detector check (combustion time) (A1)

This device measures the time during which the flame signal is ON as the combustion time. This event occurs if the combustion time exceeds the value preset for UV flame detector check (combustion time).

Write address*	Condition settings				Measured data
	Condition item	Address	Data range	Factory settings	Combustion time
7101W (bit 0) Factory setting: 1	UV flame detector check (combustion time)	7069W	0036H (fixed)	0036H	3389W,3390W
		7070W	0 to 25000	25000	

*Use address 7061W (bit 0) when reading data.

● Product service life check (total operating time) (A2)

This device measures the total operating time.
This event occurs if the operating time exceeds the value preset for "Product service life check (total operating time)".

Write address*	Condition settings				Measured data
	Condition item	Address	Data range	Factory settings	Time Power ON
7101W (bit 1) Factory setting: 0	Product service life check (total operating time)	7071W	0037H (fixed)	0037H	3381W,3382W
		7072W	0 to 65000	61000	

*Use address 7061W (bit 1) when reading data.

● Product service life check (total combustion count) (A3)

This device counts the cumulative combustion ON times.
This event occurs if the combustion count exceeds the value preset for "Product service life check (total combustion count)".

Write address*[1]	Condition settings				Measured data
	Condition item	Address	Data range	Factory settings	Total combustion count
7101W (bit 2) Factory setting: 0	Product service life check (total combustion count)	7073W	0038H (fixed)	0038H	3385W,3386W
		7074W	0 to 10 (× 10000)*[2]	10	

*1. Use address 7061W (bit 2) when reading data.

*2. Although the data range is 0–10, the value calculated by multiplying the data range by 10000 is compared with the measured data to make a determination.

● **False flame (A4)**

This event occurs if the flame relay is on before startup and the start check relay does not turn on after startup.

Write address*	Note
7101W (bit 3)	Factory setting: 0

*Use address 7061W (bit 3) when reading data.

● **Flame relay OFF (A5)**

This event occurs if startup input is on during flame monitoring (PF) and the flame relay is turned OFF (flame failure).

Write address*	Note
7101W (bit 4)	Factory setting: 0

*Use address 7061W (bit 4) when reading data.

● **Flame relay OFF (shutter closed) (A6)**

AUR355C: This event occurs if startup input is on and the shutter remains closed for about 5 seconds.

AUR355B: This event does not occur.

Write address*	Note
7101W (bit 5)	Factory setting: 0

*Use address 7061W (bit 5) when reading data.

■ Clearing events

You can clear the event flag (3044W) for an event that occurred with any of the following three operations:

- Clearing events through communication

- Holding down the RESET switch or shorting the contact reset input

- Turning the power on

● Clearing events by communication

To clear an event through communication, write the data in the following table to 3555W using the WD or WU command.

Item name	Address	Description of event	Data to write
Event Clear	3555W	UV flame detector check (combustion time) (A1)*	CA51H
		Product service life check (total operating time) (A2)	CA52H
		Product service life check (total combustion count) (A3)	CA53H
		False flame (A4)	CA54H
		Flame relay OFF (A5)	CA55H
		Flame relay OFF (shutter closed) (A6)	CA56H
		Clear all events	CAFFH

*If event A1 has occurred, reset the combustion time (3389W/3390W) to zero at the same time.

For example, writing "CA51H" to 3555W clears UV flame detector check (combustion time) (A1).
If there are other events at the same time, they are not cleared.
Write "CAFFH" to clear all the events at once.

! Handling Precautions

- When you clear all the events at once, the 7-segment display changes to the operating status code display mode.

● Clearing events with the RESET switch or contact reset input

When you press the RESET switch for 3 seconds or more or short the contact reset input for 3 seconds or more while the event code is displayed, all the events are cleared at once.
If event A1 has occurred, clear the combustion time (3389W/3390W) to zero at the same time.

! Handling Precautions

- When an event is cleared with this operation, the 7-segment display changes to the operating status code display mode.

● Clearing events by turning the power on

All events are cleared when the power is turned on.
However, the combustion time (3389W/3390W) is not cleared to zero.
If a predetermined condition is met after you clear events, the corresponding event occurs.

6-3   Data Initialization

To initialize each type of data record, write the value shown in the following table using the WD or WU command. For example, writing "005AH" to 3552W clears each alarm count to zero.

Item name	Address	Description	Write data
Alarm count clear	3552W	Integrated Value: Internal error (flame circuit) to host communication setting data (3350W to 3367W)	005AH
Alarm monitor clear	3553W	Alarm History-1 to -16 (5000 to 5095W)	005AH
Reset all event counts to 0	3557W	Event A1 count (3393W)	CA51H
		Event A2 count (3394W)	CA52H
		Event A3 count (3395W)	CA53H
		Event A4 count (3396W)	CA54H
		Event A5 count (3397W)	CA55H
		Event A6 count (3398W)	CA56H
		Initialize all	CAFFH
Initialization of operating time / combustion time / combustion count	3558W	Operating time (3387 to 3388W)	CA51H
		Combustion time (3389 to 3390W)	CA52H
		Combustion count (3391 to 3392W)	CA53H
		Initialize all	CAFFH

6-4   Playback Monitor

This function supports equipment maintenance if the playback monitor trigger occurs.
You can read maintenance information (data every 0.1 second) from 8.0 seconds before the playback trigger occurs to 2 seconds after occurrence.

■ Playback triggers

There are the following playback monitor triggers.

Trigger	Trigger condition
Flame relay OFF	If startup input is on during flame monitoring (PF) and the flame relay is turned OFF
Flame relay OFF (shutter closed)	AUR355C: If startup input is on and the shutter remains closed for about 5 seconds AUR355B: Playback data is not obtained.

■ Playback monitor header information

Data name	Address	Description
Event code & operating status No. when an event occurs	4000	Bits 0 to 7 ☞ ■ Event code table Bits 8 to 15 ☞ ■ Operating status No. table
Index	4001	Index No.: 0 to 65535 (recycles) Incremented every time an event occurs.

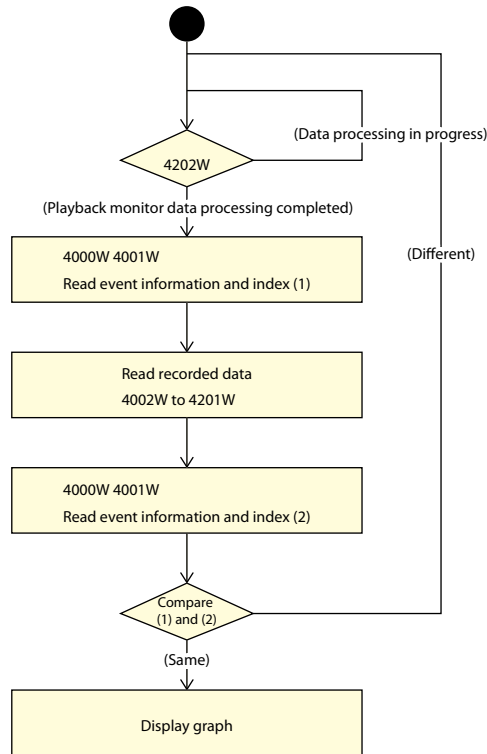## ■ Playback monitor recorded information

Item	Address	Bit position	Data information
-	4002*2	0	
Start input		1	0=OFF/1=ON
-		2	
-		3	
Flame		4	0=OFF/1=ON
-		5	
Start check relay		6	0=OFF/1=ON
Flame relay		7	0=OFF/1=ON
-		8	
Shutter output*1		9	0=OFF/1=ON
-		10	
Flame level*1		11 to 13	[0 to 6]
-		14	
-		15	
Operating status No.	4003*2	0 to 7	☞ ■ Operating status No. table
Flame voltage		8 to 15	0 to 50 [0.1 V]

*1. AUR355C only. Undefined for AUR355B.

*2. Addresses 4004 to 4201 have the same information.

■ To read playback monitor data

The following is the procedure for reading playback monitor data after a trigger occurs.

```
                    ●
                    │────────────────────┐
                    ▼                    │
                  ╱─────╲   (Data processing in progress)
                 ╱ 4202W ╲──────────────→│
                 ╲       ╱               │
                  ╲─────╱                │
       (Playback monitor data            │
        processing completed)            │
                    ▼                    │
       ┌─────────────────────────┐       │ (Different)
       │ 4000W 4001W             │       │
       │ Read event information  │       │
       │ and index (1)           │       │
       └─────────────────────────┘       │
                    ▼                    │
       ┌─────────────────────────┐       │
       │ Read recorded data      │       │
       │ 4002W to 4201W          │       │
       └─────────────────────────┘       │
                    ▼                    │
       ┌─────────────────────────┐       │
       │ 4000W 4001W             │       │
       │ Read event information  │       │
       │ and index (2)           │       │
       └─────────────────────────┘       │
                    ▼                    │
                 ╱───────╲               │
                ╱ Compare  ╲─────────────┘
                ╲(1) and (2)╱
                 ╲─────────╱
                    │
                 (Same)
                    ▼
       ┌─────────────────────────┐
       │ Display graph           │
       └─────────────────────────┘
```

(1)   Check that the playback data processing status (4202) is not "Processing under way."

(2)   Read event information (4000) and index (4001) and store them in the host device or other location. ← (1)

(3)   Read recorded information (4002 to 4201).

(4)   Read event information (4000) and index (4001) and store it in the host device or other location. ← (2)

(5)   Compare the data in step (1) with that in (2).

If these values are different, a new trigger has occurred and the recorded information has been rewritten. Redo the procedure from step (1).
If these values are the same, you can use the playback monitor data in the host device (for display, etc.).

Item	Communications address (decimal)	Data information
Event information	4000	Bits 0 to 7 ☞ ■ Event code table (p. 36) Bits 8 to 15 ☞ ■ Operating status No. table (p. 36)
Index	4001	0 to 65535 (recycles)
Playback monitor data processing status	4202	Processing under way = 90, Normal = 60
Recorded information	4002 to 4201	☞ ■ Playback monitor recorded information (p. 44)

6-5   Flame Logger

This function supports maintenance for the playback monitor, etc.
You can read maintenance information (data every 0.1 second) for 10 seconds after a trigger occurs.

■ Trigger

The trigger occurs when flame monitoring (PF) starts.

■ Recorded information

Item	Address	Bit position	Data information
-	8100*2	0	
Start input		1	0=OFF/1=ON
-		2	
-		3	
Flame		4	0=OFF/1=ON
-		5	
Start check relay		6	0=OFF/1=ON
Flame relay		7	0=OFF/1=ON
-		8	
Shutter*1		9	0=OFF/1=ON
-		10	
Flame level*1		11 to 13	[0 to 5]
-		14	
-		15	
Operating status No.	8101*2	0 to 7	☞ ■ Operating status No. table (p. 36)
Flame voltage		8 to 15	0 to 50 [0.1 V]

*1. AUR355C only. Undefined for AUR355B.

*2. Addresses 8102 to 8299 have the same information.

■ To read recorded information

The following is the procedure for reading playback monitor data after a trigger occurs.

Data name	Address	Description
Flame logger processing status	8000	5AH : processing under way Other than 5AH : normal

(1) Check that the flame logger processing status (8000) is not "Processing under way."

(2) Read the recorded information (8100 to 8299).

Chapter 7. Troubleshooting

■ What to check if communication fails

- Is the RS-485 connection correctly configured?

- Are the communication settings on this device the same as on the host device? Communication fails if one of the following settings is different.
  Transmission speed : 4800 bps, 9600 bps, and 19200 bps
  Data length   : 8 bits
  Parity bit   : even or odd parity
  Stop bit   : 1 or 2 bits

- Does the device address in the command message sent from the host device match the address set for this device?
  The address of this device is "1" when the device is shipped.

- Use uppercase characters for all character codes except for the device distinction code ("X" or "x" in this device).

Chapter 8. Specifications

■ **RS-485 specifications**

Item	Specifications
Transmission mode	Balanced
Transmission line	3-wire system
Transmission speed (bps)	4800, 9600, 19200
Transmission distance	500 m max.
Communication system	Half duplex
Synchronization	Start-stop synchronization
Data format	8 data bits, even or odd parity 1 or 2 stop bits
Error detection	Parity check
Device address	1 to 32
Connection method	1:N (32 units max.)
Terminating resistor	☞ ■ RS-485 communication (p. 3) in Chapter 2, "Wiring"
Other	Conforms to RS-485 specifications.

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Revision History (CP-SP-1453E)

Printed date	Edn.	(New) Page No.	Description
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Terms and Conditions

We would like to express our appreciation for your purchase and use of Azbil Corporation's products.

You are required to acknowledge and agree upon the following terms and conditions for your purchase of Azbil Corporation's products (system products, field instruments, control valves, and control products), unless otherwise stated in any separate document, including, without limitation, estimation sheets, written agreements, catalogs, specifications and instruction manuals.

1. Warranty period and warranty scope

    1.1 Warranty period

    Azbil Corporation's products shall be warranted for one (1) year from the date of your purchase of the said products or the delivery of the said products to a place designated by you.

    1.2 Warranty scope

    In the event that Azbil Corporation's product has any failure attributable to azbil during the aforementioned warranty period, Azbil Corporation shall, without charge, deliver a replacement for the said product to the place where you purchased, or repair the said product and deliver it to the aforementioned place. Notwithstanding the foregoing, any failure falling under one of the following shall not be covered under this warranty:

    (1) Failure caused by your improper use of azbil product (noncompliance with conditions, environment of use, precautions, etc. set forth in catalogs, specifications, instruction manuals, etc.);

    (2) Failure caused for other reasons than Azbil Corporation's product;

    (3) Failure caused by any modification or repair made by any person other than Azbil Corporation or Azbil Corporation's subcontractors;

    (4) Failure caused by your use of Azbil Corporation's product in a manner not conforming to the intended usage of that product;

    (5) Failure that the state-of-the-art at the time of Azbil Corporation's shipment did not allow Azbil Corporation to predict; or

    (6) Failure that arose from any reason not attributable to Azbil Corporation, including, without limitation, acts of God, disasters, and actions taken by a third party.

    Please note that the term "warranty" as used herein refers to equipment-only-warranty, and Azbil Corporation shall not be liable for any damages, including direct, indirect, special, incidental or consequential damages in connection with or arising out of Azbil Corporation's products.

2. Ascertainment of suitability

    You are required to ascertain the suitability of Azbil Corporation's product in case of your use of the same with your machinery, equipment, etc. (hereinafter referred to as "Equipment") on your own responsibility, taking the following matters into consideration:

    (1) Regulations and standards or laws that your Equipment is to comply with.

    (2) Examples of application described in any documents provided by Azbil Corporation are for your reference purpose only, and you are required to check the functions and safety of your Equipment prior to your use.

    (3) Measures to be taken to secure the required level of the reliability and safety of your Equipment in your use
    Although azbil is constantly making efforts to improve the quality and reliability of Azbil Corporation's products, there exists a possibility that parts and machinery may break down. You are required to provide your Equipment with safety design such as fool-proof design,*1 and fail-safe design*2 (anti-flame propagation design, etc.), whereby preventing any occurrence of physical injuries, fires, significant damage, and so forth. Furthermore, fault avoidance,*3 fault tolerance,*4 or the like should be incorporated so that the said Equipment can satisfy the level of reliability and safety required for your use.

    *1. A design that is safe even if the user makes an error.
    *2. A design that is safe even if the device fails.
    *3. Avoidance of device failure by using highly reliable components, etc.
    *4. The use of redundancy.

3. Precautions and restrictions on application

    3.1 Restrictions on application

    Please follow the table below for use in nuclear power or radiation-related equipment.

	Nuclear power quality*5 required	Nuclear power quality*5 not required
Within a radiation controlled area*6	Cannot be used (except for limit switches for nuclear power*7)	Cannot be used (except for limit switches for nuclear power*7)
Outside a radiation controlled area*6	Cannot be used (except for limit switches for nuclear power*7)	Can be used

    *5. Nuclear power quality: compliance with JEAG 4121 required
    *6. Radiation controlled area: an area governed by the requirements of article 3 of "Rules on the Prevention of Harm from Ionizing Radiation," article 2 2 4 of "Regulations on Installation and Operation of Nuclear Reactors for Practical Power Generation," article 4 of "Determining the Quantity, etc., of Radiation-Emitting Isotopes,"etc.
    *7. Limit switch for nuclear power: a limit switch designed, manufactured and sold according to IEEE 382 and JEAG 4121.

    Any Azbil Corporation's products shall not be used for/with medical equipment.

    The products are for industrial use. Do not allow general consumers to install or use any Azbil Corporation's product. However, azbil products can be incorporated into products used by general consumers. If you intend to use a product for that purpose, please contact one of our sales representatives.

    3.2 Precautions on application

    you are required to conduct a consultation with our sales representative and understand detail specifications, cautions for operation, and so forth by reference to catalogs, specifications, instruction manual, etc. in case that you intend to use azbil product for any purposes specified in (1) through (6) below. Moreover, you are required to provide your Equipment with fool-proof design, fail-safe design, anti-flame propagation design, fault avoidance, fault tolerance, and other kinds of protection/safety circuit design on your own responsibility to ensure reliability and safety, whereby preventing problems caused by failure or nonconformity.

(1) For use under such conditions or in such environments as not stated in technical documents, including catalogs, specification, and instruction manuals

(2) For use of specific purposes, such as:
  * Nuclear energy/radiation related facilities
    [When used outside a radiation controlled area and where nuclear power quality is not required]
    [When the limit switch for nuclear power is used]
  * Machinery or equipment for space/sea bottom
  * Transportation equipment
    [Railway, aircraft, vessels, vehicle equipment, etc.]
  * Antidisaster/crime-prevention equipment
  * Burning appliances
  * Electrothermal equipment
  * Amusement facilities
  * Facilities/applications associated directly with billing

(3) Supply systems such as electricity/gas/water supply systems, large-scale communication systems, and traffic/air traffic control systems requiring high reliability

(4) Facilities that are to comply with regulations of governmental/public agencies or specific industries

(5) Machinery or equipment that may affect human lives, human bodies or properties

(6) Other machinery or equipment equivalent to those set forth in items (1) to (5) above which require high reliability and safety

4. **Precautions against long-term use**

Use of Azbil Corporation's products, including switches, which contain electronic components, over a prolonged period may degrade insulation or increase contact-resistance and may result in heat generation or any other similar problem causing such product or switch to develop safety hazards such as smoking, ignition, and electrification. Although acceleration of the above situation varies depending on the conditions or environment of use of the products, you are required not to use any Azbil Corporation's products for a period exceeding ten (10) years unless otherwise stated in specifications or instruction manuals.

5. **Recommendation for renewal**

Mechanical components, such as relays and switches, used for Azbil Corporation's products will reach the end of their life due to wear by repetitious open/close operations.

In addition, electronic components such as electrolytic capacitors will reach the end of their life due to aged deterioration based on the conditions or environment in which such electronic components are used. Although acceleration of the above situation varies depending on the conditions or environment of use, the number of open/close operations of relays, etc. as prescribed in specifications or instruction manuals, or depending on the design margin of your machine or equipment, you are required to renew any Azbil Corporation's products every 5 to 10 years unless otherwise specified in specifications or instruction manuals. System products, field instruments (sensors such as pressure/flow/level sensors, regulating valves, etc.) will reach the end of their life due to aged deterioration of parts. For those parts that will reach the end of their life due to aged deterioration, recommended replacement cycles are prescribed. You are required to replace parts based on such recommended replacement cycles.

6. **Other precautions**

Prior to your use of Azbil Corporation's products, you are required to understand and comply with specifications (e.g., conditions and environment of use), precautions, warnings/cautions/notices as set forth in the technical documents prepared for individual Azbil Corporation's products, such as catalogs, specifications, and instruction manuals to ensure the quality, reliability, and safety of those products.

7. **Changes to specifications**

Please note that the descriptions contained in any documents provided by azbil are subject to change without notice for improvement or for any other reason. For inquires or information on specifications as you may need to check, please contact our branch offices or sales offices, or your local sales agents.

8. **Discontinuance of the supply of products/parts**

Please note that the production of any Azbil Corporation's product may be discontinued without notice. After manufacturing is discontinued, we may not be able to provide replacement products even within the warranty period.

For repairable products, we will, in principle, undertake repairs for five (5) years after the discontinuance of those products. In some cases, however, we cannot undertake such repairs for reasons, such as the absence of repair parts. For system products, field instruments, we may not be able to undertake parts replacement for similar reasons.

9. **Scope of services**

Prices of Azbil Corporation's products do not include any charges for services such as engineer dispatch service. Accordingly, a separate fee will be charged in any of the following cases:

(1) Installation, adjustment, guidance, and attendance at a test run
(2) Maintenance, inspection, adjustment, and repair
(3) Technical guidance and technical education
(4) Special test or special inspection of a product under the conditions specified by you

Please note that we cannot provide any services as set forth above in a nuclear energy controlled area (radiation controlled area) or at a place where the level of exposure to radiation is equivalent to that in a nuclear energy controlled area.

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