MODBUS-RTU

COSEL

AEA Series (-I4 option)
MODBUS Communication Manual

Ver1.0E 2024.3.4

AEA series ---*MODBUS-RTU*---

Ver1.0E 2024.3.4

1. Overview

This product (-I4 option) can monitor the operating status of the power supply and change various settings through MODBUS-RTU communication. In addition, by saving various setting values in the non-volatile memory inside the main unit, it is possible to retain them even if the input voltage is cut off.

Power for the communication line is supplied from AUX2. Therefore, communication is not possible if an error occurs that causes AUX2 to stop.

2.Wiring and Connection

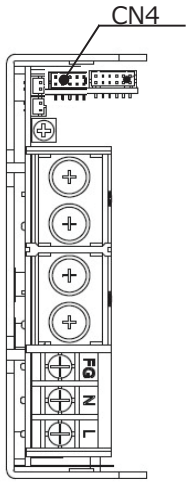
2.1 AEA series communication terminal

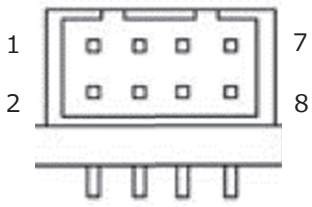
Table 2.1 shows the pin numbers and functions of the communication terminals.

Table 2.1 Function of CN4

Pin No.	Function
1	N.C.
2	N.C.
3	SGND Signal ground (Same potential as AUX2G)
4	SGND Signal ground (Same potential as AUX2G)
5	B RS485_differential signal(－、Inverted)
6	B RS485_differential signal(－、Inverted)
7	A RS485_differential signal(＋、Non-inverting)
8	A RS485_differential signal(＋、Non-inverting)

Do not connect anything to N.C. terminal.





CN4 : S8B-PHDSS (J.S.T.)

Fig 2.1 Example of option -I4 (AEA600F)

Table 2.2 Matching connectors and terminals on CN4

Connector		Housing	Terminal	Mfr.
CN4	S8B-PHDSS	PHDR-08VS	Strip form : SPHD-001T-P0.5 SPHD-002T-P0.5 Loose piece : BPHD-001T-P0.5 *1 BPHD-002T-P0.5 *1	J.S.T.

*1 The manufacturer can only use ratchet hand tool.

2.2 Connection method

Connect terminal A on master (+, non-inverting) to terminal A on CN4 of AEA, connect terminal B on master (- , inverting) to terminal B on CN4 of AEA and connect terminal SG on master to terminal SG on CN4 of AEA as shown in Fig. 2.2.

We recommend using shielded twisted pair cables. Connect the shielded cable to terminal SG on Master.

Note that the polarity of A and B terminals on master may be inverted depending on the manufacturer. (Ensure that the non-inverting terminal on master shall be connected to non-inverting terminal on AEA each other, and inverting terminal on master shall be connected to inverting terminal on AEA likewise.)

Connect a terminating resistor to both ends of the bus line. If there is no terminating resistor on the master side, connect a terminating resistor to the bus line on the master side. Also, connect a terminating resistor to the bus line of the power supply farthest from the master (Fig. 2.2).

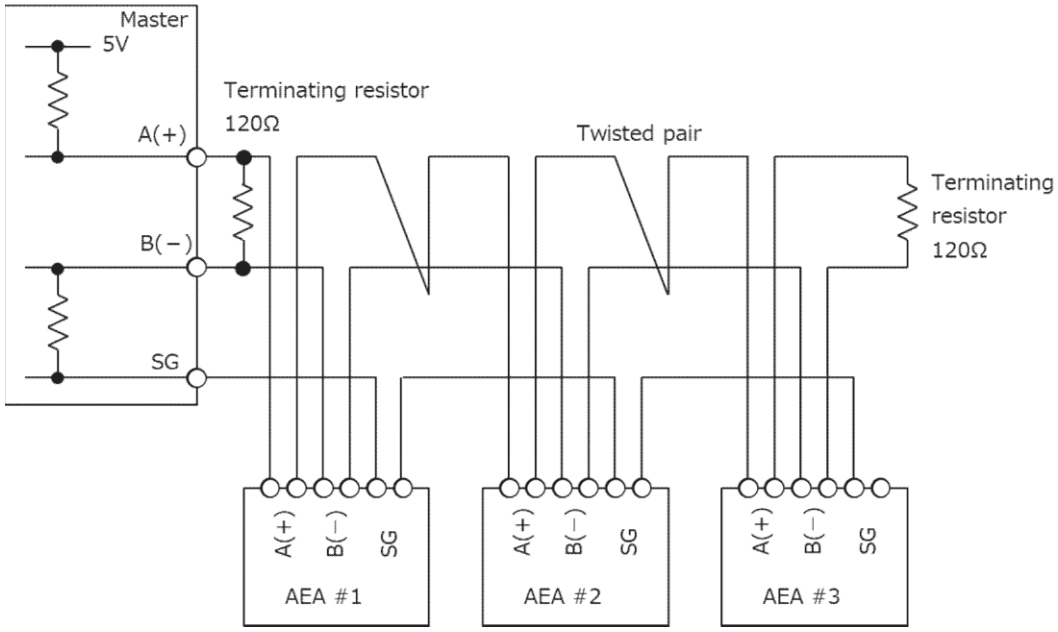


Fig2.2 Connected to multiple units example

2.3 Setting the communication address

AEA communication operates as a slave. When connecting other slave devices, set the communication address so that they do not overlap. If the communication address is duplicated, the master cannot get a correct response.

The factory default setting of the address is "1".

When changing the communication address, operate the Holding register (register address: 53). Also, by performing the operation to save the setting value (register address of the Holding register: 51), the changed communication address setting will remain valid even after the AEA input voltage is turned off and restarted. Refer to section "6.2 Holding register details" for more details of address setting.

Communication address "0" is reserved for broadcast, so it cannot be used.

3. Communication specifications

3.1 Electrical specifications

Table 3.1 shows the Electrical specifications.

Table 3.1 Electrical specifications

No.	Name	Specifications
1	Power supply	Powered by AUX2 Functional isolation from secondary output (+Vo/-Vo)
2	Transceiver voltage	5V
3	Transmission standard	TIA/EIA-485
4	Allowable transmission wire length	100m
5	Maximum number of devices	32max

3.2 Transmission specifications

Table 3.2 shows the transmission specifications.

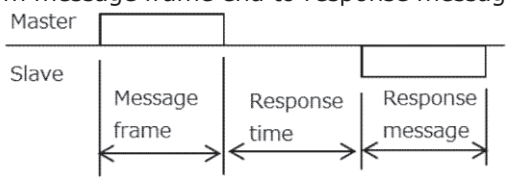
Table 3.2 Transmission specifications

No.	Name		Specifications
1	Communication method		Half duplex
2	Synchronous system		Start stop synchronization
3	Connection configuration		1: N (Master: Slave)
4	Communication speed		19200 bps ±2% error tolerance
5	Flow control		NA
6	Data configuration	Data length	8 bits
7		Stop bit	1 bit
8		Parity	Even
9		Transfer direction	LSB first

3.3 Protocol specifications

Table 3.3 shows the protocol specifications.

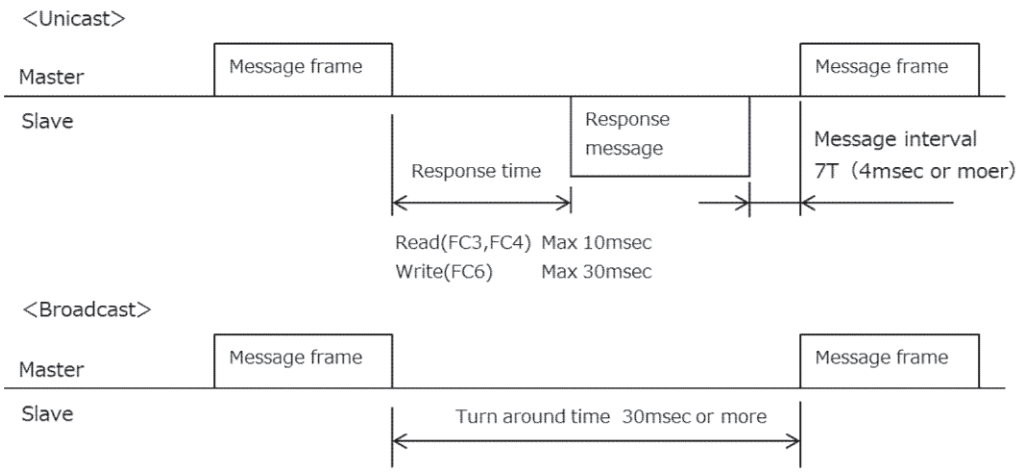
Table 3.3 Protocol specifications

No.	Name	Specifications
1	Message type	MODBUS-RTU
2	Character	T = 11bit/19200bps =572.9μsec
3	Character transfer interval	1.5T or less (When receiving, any character spacing exceeding 1.5T will discard the message frame.)
4	Message interval	7T or more (4msec or more)
5	Response time	Read (FC3, FC4) Max 10msec Write (FC6) Max 30msec (From message frame end to response message start) 
6	Turn around time	30msec or more
7	Unicast timeout period on the master side	60msec or more

4. Communication protocol

4.1 Communication protocol overview

The communication protocol is MODBUS-RTU.
MODUBS is a master/slave (1: N) protocol. Communication is always initiated by the master. For unicast (transmission to individual slaves), the master transmits a message frame to the slave, and the specified slave transmits a response message to the master after completing the requested processing.
The slave does not communicate with other slaves.
If the requested process ends abnormally, an exception response message is transmitted.
If a transmission error occurs in the message frame from the master, the slave does not return a response message. In this case, the master should detect the communication timeout and take appropriate action.
Set the master communication timeout to 60msec or more, in consideration of the slave response processing time.
When broadcasting (transmission to all slaves), each slave performs only the requested processing and does not reply with a response message, so the master should send a message frame after the turnaround time (more than 30msec) has elapsed before sending the next message frame.



For detailed specifications of the MODBUS protocol, please refer to the documents shown below.
Publisher : Modbus Organization(http://modbus.org/)
MODBUS APPLICATION PROTOCOL SPECIFICATION V1.1b
MODBUS over Serial Line Specification and Implementation Guide V1.02

4.2 Message frame structure

Numerical values
A number ending with "h" indicates a hexadecimal number. A number ending in "b" indicates a binary number. A number without "h" or "b" indicates a decimal number.

Communication address : 1 byte specifying the address of the power supply to be communicated with
(numerals from 0 to 247 can be selected)
FC (function code) : "3", "4" or "6" are available
Data : Data field (Order from big endian, upper byte and lower byte)
CRC check : 16-bit cyclic redundancy check from communication address to data
Generation polynomial : A001h
CRC initial value : FFFFh
Note that only the CRC check field is little endian
(Order from lower byte and upper byte).
For CRC calculation, refer to "MODBUS over Serial Line Specification and Implementation Guide" recognized as MODBUS specifications.

(1) Message frame from master to slave

Communication address	FC	Data	CRC check
1 byte	1 byte	n bytes	2 bytes

(2) Response message frame from slave to master

Communication address	FC	Data	CRC check
1 byte	1 byte	n bytes	2 bytes

FC has the same value as the FC of the message frame from the master.

(3) Message frame for an exception response

Communication address	FC	Exception code	CRC check
1 byte	1 byte	1 byte	2 bytes

FC value becomes "80h" + FC of the message frame from the master.
The exception code indicates the contents of the exception in 1 byte.

Table 4.1 Exception codes

No.	Name	Content
1	ILLEGAL FUNCTION	Unsupported function code (ie. other than FC: 3, 4, 6)
2	ILLEGAL DATA ADDRESS	Undefined register address
3	ILLEGAL DATA VALUE	Incorrect data
4	SLAVE DEVICE FAILURE	Slave device error/Slave device busy *1

*1 Even if there is a reply with exception code 4, the sent settings may still be applied.

4.3 FC: 4 Input register "Read"

Read register contents from Input register. Broadcast is disabled.

(1) Master to slave message frame

Field	Communication address	FC	Starting address	Qty of registers	CRC check	
Qty of bytes	1 byte	1 byte	2 bytes	2 bytes	2 bytes	
Field value	1-247(F7h)	4(04h)	See the register list	1~16(0010h)	LSB	MSB

Starting address : Specifies the address of the Input register to start reading from.
Qty of registers : Specifies the quantity of registers read from the starting address.

By specifying the start address and the quantity of registers, consecutive register values can be read from the Input register.
An exception response (exception code: 02h) is returned when a starting address not in the Input register list is specified.
An exception response (exception code: 03h) is returned when the message frame length is not 8 bytes.

(2) Slave to master response message frame

Field	Communication address	FC	Byte count	Register value	CRC check	
Qty of bytes	1 byte	1 byte	1 byte	2×N bytes	2 bytes	
Field value	1-247(F7h)	4(04h)	2×N	Read data	LSB	MSB

N: quantity of registers specified in the message frame from master to slave

Byte count : Returns the byte count of the register value in the response message.
Register value : Register values for the specified quantity of registers are returned from the start address specified in the message frame from the master.

(3) Exception response message frame

Field	Communication address	FC	Exception code	CRC check	
Qty of bytes	1 byte	1 byte	1 byte	2 bytes	
Field value	1-247(F7h)	132(84h)	See table 4.1	LSB	MSB

FC : "132 (84h)" is returned. It is the value of "4(04h)" + "128 (80h)".
Exception code : An exception code is returned indicating the reason for the error detected during processing. (See Table 4.1 for exception codes)

(4) Example message

Communication address : 1(01h)　Starting address : 2(02h)　Qty of register : 1(01h)

Master to slave message frame

Message frame	Communication address	FC	Starting address		Qty of registers		CRC check	
			Upper	Lower	Upper	Lower	Lower	Upper
	1 (01h)	4 (04h)	0 (00h)	2 (02h)	0 (00h)	1 (01h)	144 (90h)	10 (0Ah)

Slave to master response message frame

Response message	Communication address	FC	Byte count	Register value		CRC check	
				Upper	Lower	Lower	Upper
	1 (01h)	4 (04h)	2 (02h)	39 (27h)	18 (12h)	34 (22h)	205 (CDh)

The starting address "2 (0002h)" of the master message is the monitored value of the input voltage, and the register value of the response message can be read as follows:

2712h = 10002 → 100.02V

4.4 FC : 3 Holding register "Read"

Read register contents from Holding register. Broadcast is disabled.

(1) Master to slave message frame

Field	Communication address	FC	Starting address	Qty of registers	CRC check	
Qty of bytes	1 byte	1 byte	2 bytes	2 bytes	2 bytes	
Field value	1-247(F7h)	3(03h)	See the register list	1~4(0004h)	LSB	MSB

Starting address : Specifies the address of the Holding register to start reading from.
Qty of registers : Specifies the quantity of registers to read from the starting address.

By specifying the start address and the quantity of registers, consecutive register values can be read from the Holding register.

An exception response (exception code: 02h) is returned when a starting address not in the Holding register list is specified.

An exception response (exception code: 03h) is returned when the message frame total is not 8 bytes.

(2) Slave to master response message frame

Field	Communication address	FC	Byte count	Register value	CRC check	
Qty of bytes	1 byte	1 byte	1 byte	2×N bytes	2 bytes	
Field value	1-247(F7h)	3(03h)	2×N	Read data	LSB	MSB

N: quantity of registers specified in the message frame from master to slave

Byte count : Returns the byte count of the register value in the response message.
Register value : Register values for the specified quantity of registers are returned from the start address specified in the message frame from the master.

(3) Exception response message frame

Field	Communication address	FC	Exception code	CRC check	
Qty of bytes	1 byte	1 byte	1 byte	2 bytes	
Field value	1-247(F7h)	131(83h)	See table 4.1	LSB	MSB

FC : "131 (83h)" is returned. It is the value of "128 (80h)" + FC code "3 (03h)".
Exception code : An exception code is returned indicating the reason for the error detected during processing. (See Table 4.1 for exception codes)

(4) Example message

Communication address : 1(01h) Starting address : 8(0008h)

Master to slave message frame

Message frame	Communication address	FC	Starting address		Qty of registers		CRC check	
			Upper	Lower	Upper	Lower	Lower	Upper
	1 (01h)	3 (03h)	0 (00h)	8 (08h)	0 (00h)	1 (01h)	5 (05h)	200 (C8h)

Slave to master response message frame

Response message	Communication address	FC	Byte count	Register value		CRC check	
				Upper	Lower	Lower	Upper
	1 (01h)	3 (03h)	2 (02h)	00 (00h)	240 (F0h)	184 (B8h)	0 (00h)

The starting address "8 (0008h)" of the master message is the set value of the output voltage, and the register value of the response message can be read as follows:
00F0h = 240 → 24.0V

4.5 FC : 6 Holding register "Write"

Writes the contents of one register in the Holding register.
Broadcast enabled.

(1) Master to slave message frame

Field	Communication address	FC	Register address	Register value	CRC check	
Qty of bytes	1 byte	1 byte	2 bytes	2 bytes	2 bytes	
Field value	0-247(F7h)	6(06h)	See the register list	Write data	LSB	MSB

Register address : Specifies the address of the Holding register to be written to.
Register value : Specifies the data to be written to the Holding register specified by the register address.

An exception response (exception code: 02h) is returned when a register address not in the Holding register list is specified.
If the register data is out of the allowable range, an exception response (exception code: 03h) is returned.
When broadcasting, no response message will be returned.
An exception response (exception code: 03h) is returned when the message frame length is not 8 bytes.

(2) Slave to master response message frame

Field	Communication address	FC	Register address	Register value	CRC check	
Qty of bytes	1 byte	1 byte	2 bytes	2 bytes	2 bytes	
Field value	1-247(F7h)	6(06h)	See the register list	Write data	LSB	MSB

Register address : The register address specified in the master message frame is returned.
Register value : The register value specified in the master message frame is returned.

(3) Exception response message frame

Field	Communication address	FC	Exception code	CRC check	
Qty of bytes	1 byte	1 byte	1 byte	2 bytes	
Field value	1-247(F7h)	134(86h)	See table 4.1	LSB	MSB

FC : "134 (86h)" is returned. It is the value of "128 (80h)" + FC code "6 (06h)".
Exception code : An exception code is returned indicating the reason for the error detected during processing. (See Table 4.1 for exception codes)

(4) Example message

Communication address : 1(01h) Register address : 16(0010h) Register value : 1200(04B0h)

Master to slave message frame

Message frame	Communication address	FC	Register address		Register value		CRC check	
			Upper	Lower	Upper	Lower	Lower	Upper
	1 (01h)	6 (06h)	0 (00h)	16 (10h)	4 (04h)	176 (B0h)	139 (8Bh)	123 (7Bh)

Slave to master response message frame

Message frame	Communication address	FC	Register address		Register value		CRC check	
			Upper	Lower	Upper	Lower	Lower	Upper
	1 (01h)	6 (06h)	0 (00h)	16 (10h)	4 (04h)	176 (B0h)	139 (8Bh)	123 (7Bh)

The response message returns the same message to the master.

5. MODBUS-RTU register List

5.1 Input register list

The Input register is a read-only 16-bit register.
Broadcast is disabled.
An exception response (exception code: 02h) is returned if a start address other than that shown in Table 5.1 is specified.
The maximum number of registers that can be read consecutively in the input register is 16.

Table 5.1 Input register list

No.	Register name	Starting address	Qty of register	Register description
1	Output voltage monitor	0 (0000h)	1	Indicates the monitor value of the output voltage
2	Input voltage monitor	2 (0002h)	1	Indicates the monitor value of the input voltage
3	Cumulative output time	8 (0008h)	3	Indicates cumulative output time
4	Cumulative input time	11 (000Bh)	3	Indicates cumulative input voltage applying time
5	Output stop cause	16 (0010h)	1	Indicates the code at present which shows the causes of output stop.
6	Output stop history	17 (0011h)	1	Indicates the code at the last output stop event which shows the causes of output stop.
7	Alarm state	32 (0020h)	1	Indicates alarm status and remote control status
8	Lot number	45 (002Dh)	2	Indicates lot number
9	Model name	48 (0030h)	16	Indicates the model name in ASCII code

5.2 Holding register list

The Holding register is a 16-bit Read/Write register.
Broadcast is disabled when FC=3 (Read).
The register defines the power supply setting. The set data will be cleared when input voltage is shut down. Use to the register address 51(0033h) to keep the settings data after the input voltage shut down.
An exception response (exception code: 02h) is returned if a register address other than that shown in Table 5.2 is specified.
The maximum number of registers that can be read consecutively in the Holding register is 4.

Table 5.2 Holding register list

No.	Register name	Register address	Qty of register	Timing to reflect *	Register description
1	Remote control	0 (0000h)	1	receive	Controls ON/OFF of power supply output by communication
2	Latch stop release	1 (0001h)	1	receive	Releases the latch stop state
3	Output voltage setting value	8 (0008h)	1	receive	Sets the output voltage value
4	Input start delay time setting value	16 (0010h)	1	reboot	Sets startup delay time from turning on input
5	RC pin startup delay time setting value	17 (0011h)	1	receive	Sets the startup delay time from RC pin operation.
6	RC pin stop delay time setting value	18 (0012h)	1	receive	Sets the stop delay time from RC pin operation.
7	Startup voltage setting value (AC)	19 (0013h)	1	reboot	Sets the startup voltage setting value (AC voltage) of the power supply
8	Stop voltage setting value (AC)	21 (0015h)	1	reboot	Sets the stop voltage setting value (AC voltage) of the power supply
9	Stop mode switching	36 (0024h)	1	receive	Selects auto return/latch stop for each stop mode.
10	PR alarm signal judgement value	41 (0029h)	1	reboot	Sets the PR alarm signal judgment value.
11	PG alarm signal judgement value	42 (002Ah)	1	receive	Sets the PG alarm signal judgment value.
12	Save settings	51 (0033h)	1	receive	Saves the setting of the Holding register
13	Initialize settings	52 (0034h)	1	reboot	Restores the value of the Holding register to the factory default after reboot
14	Communication address	53 (0035h)	1	receive	Sets communication address
15	Write protection mode	54 (0036h)	1	receive	Selects write protection/release for Holding register

* Timing to reflect
receive : Reflected in power supply operation at the timing of reception
reboot : Reflected at restart after 2 minutes or more from input stop

6. Register details

6.1 Input register details

Register name	Output voltage monitor	
Starting address	0(0000h)	Qty of register : 1
Register description	Indicates the monitor value of the output voltage	
Register value	Register value/10 → Output voltage value [V] Ex. 240(00F0h) → 24.0V	
Content details	Resolution : 0.1V Accuracy : ± 1%FS（Ta=25℃）	

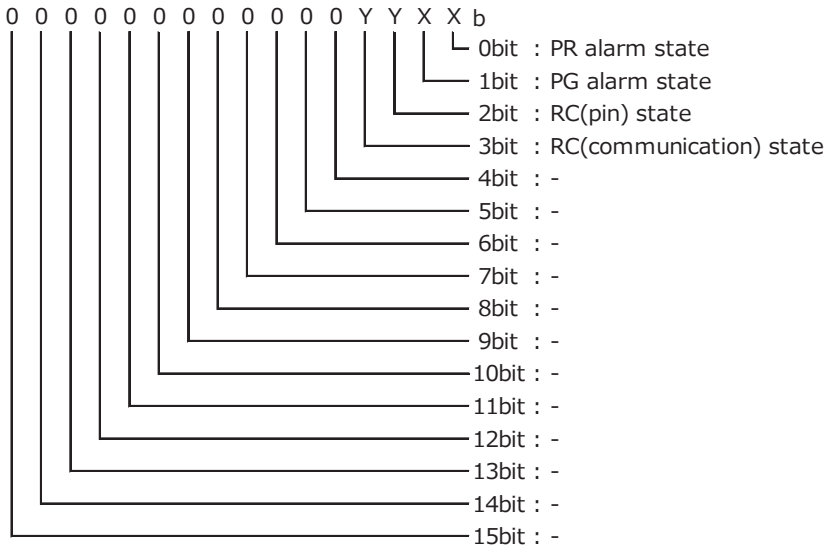
Register name	Input voltage monitor	
Starting address	2(0002h)	Qty of register : 1
Register description	Indicates the monitor value of the input voltage	
Register value	Register value/100 → Input voltage value [Vac] Ex. 9800(2580h) → 98.00 [Vac]	
Content details	Resolution :0.01V Accuracy :±3%FS（Ta=25℃） If the input voltage is distorted, the register value may show a value that is out of accuracy.	

Register name	Cumulative output time	
Starting address	8(0008h), 9(0009h), 10(000Ah)	Qty of register : 3
Register description	Indicates cumulative output time	
Register value	8(0008h) Upper 16 bits of cumulative output time (hour) 9(0009h) Lower 16 bits of cumulative output time (hour) 10(000Ah) Cumulative output time (minutes) Ex. Register address 8 : 0001 h → Cumulative output time 82300 hours 30 minutes Register address 9 : 417C h Register address 10 : 001Eh	
Content details	Resolution : hour, minute Address 8 (0008h) indicates the upper 16 bits of the accumulated output time and Address 9 (0009h) indicates the lower 16 bits of the accumulated output time. They represent the accumulated output time (unit: hour) as 32-bit data. Address 10 (000Ah) indicates a minute and is reset to "0" in every 60 minutes. These values are not accumulated during output stop periods such as turning off by remote control etc. Information within 1 minute before input stop may not be accumulated.	

Register name	Cumulative input time	
Starting address	11(000Bh), 12(000Ch), 13(000Dh)	Qty of register : 3
Register description	Indicates cumulative input voltage applying time	
Register value	11(000Bh) Upper 16 bits of cumulative input time (hour) 12(000Ch) Lower 16 bits of cumulative input time (hour) 13(000Dh) Cumulative input time (minutes) Ex. Register address 11 : 0001 h → Cumulative input time 68200 hours 45 minutes Register address 12 : 0A68 h Register address 13 : 002Dh	
Content details	Resolution : hour, minute Address 11 (000Bh) indicates the upper 16 bits of the accumulated input time and Address 12 (000Ch) indicates the lower 16 bits of the accumulated input time. They represent the accumulated output time (unit: hour) as 32-bit data. Address 13 (000Dh) indicates minutes and is reset to "0" in every 60 minutes. Information within 1 minute before input stop may not be accumulated.	

Register name	Output stop cause	
Starting address	16(0010h)	Qty of register : 1
Register description	Indicates the code at present which shows the causes of output stop.	
Register value	0 : The output doesn't stop 1 : Stopped by RC pin operation 2 : Stopped by communication operation (Holding register address 0) 10, 20 : Stopped by input voltage drop 50 : Stopped by overcurrent protection operation 58 : Stopped by internal circuit error 62 : Stopped by Peakcurrent protection operation 101 : Stopped by output overvoltage protection or overheat protection operation 105 : Stopped by continuation of overcurrent protection operation 106 : Stopped by overheat protection operation	
Content details	Indicates the present status of the power supply. Indicates "0" when the output doesn't stop and other codes when the output stops. If a code which aren't listed above is displayed, there is a possibility that the power supply is failed.	

Register name	Output stop history	
Starting address	17(0011h)	Qty of register : 1
Register description	Indicates the code at the last output stop event which shows the causes of output stop.	
Register value	0 : The output doesn't stop 1 : Stopped by RC pin operation 2 : Stopped by communication operation (Holding register address 0) 10, 20 : Stopped by input voltage drop 50 : Stopped by overcurrent protection operation 58 : Stopped by internal circuit error 62 : Stopped by Peakcurrent protection operation 101 : Stopped by output overvoltage protection or overheat protection operation 105 : Stopped by continuation of overcurrent protection operation 106 : Stopped by overheat protection operation	
Content details	Indicates the last stop event status of the power supply. If a code which aren't listed above is displayed, there is a possibility that the power supply is failed.	

Register name	Alarm state	
Starting address	32(0020h)	Qty of register : 1
Register description	Indicates alarm status and remote control status	
Register value	 Alarm state X : 0 → Normal state 1 → Abnormal state Remote control state Y : 0 → Set "ON" 1 → Set "OFF"	
Content details	PR Alarm: Indicates "1" when the input voltage is in a low-input-state. PG Alarm: Indicates "1" when the output voltage is in a low-output-state.	

Register name	Lot number	
Starting address	45(002Dh), 46(002Eh)	Qty of register : 2
Register description	Indicates lot number	
Register value	45(002Dh) Upper 16 bits of lot number 46(002Eh) Lower 16 bits of lot number Ex. Register address 45 : 0015 h → Lot Number : 1379470 Register address 46 : 0C8E h	
Content details	Lot Number range : 0000000 - 9539999 Address 45 (002Dh) indicates the upper 16 bits of the lot number and Address 46 (002Eh) indicates the lower 16 bits of the lot number. They represent the lot number as 32-bit data.	

Register name	Model name	
Starting address	48(0030h), 49(0031h), 50(0032h), 51(0033h), 52(0034h), 53(0035h), 54(0036h), 55(0037h), 56(0038h), 57(0039h), 58(003Ah), 59(003Bh), 60(003Ch), 61(003Dh), 62(003Eh), 63(003Fh)	Qty of register : 16
Register description	Indicates the model name in ASCII code	
Register value	48(0030h) : ASCII code for the 1st and 2nd characters of the Model name 49(0031h) : ASCII code for the 3rd and 4th characters of the Model name 50(0032h) : ASCII code for the 5th and 6th characters of the Model name 51(0033h) : ASCII code for the 7th and 8th characters of the Model name 52(0034h) : ASCII code for the 9th and 10th characters of the Model name 53(0035h) : ASCII code for the 11th and 12th characters of the Model name 54(0036h) : ASCII code for the 13th and 14th characters of the Model name 55(0037h) : ASCII code for the 15th and 16th characters of the Model name 56(0038h) : ASCII code for the 17th and 18th characters of the Model name 57(0039h) : ASCII code for the 19th and 20th characters of the Model name 58(003Ah) : ASCII code for the 21th and 22th characters of the Model name 59(003Bh) : ASCII code for the 23th and 24th characters of the Model name 60(003Ch) : ASCII code for the 25th and 26th characters of the Model name 61(003Dh) : ASCII code for the 27th and 28th characters of the Model name 62(003Eh) : ASCII code for the 29th and 30th characters of the Model name 63(003Fh) : ASCII code for the 31th and 32th characters of the Model name Ex. AEA600F-24-I4（ASCII） 48(0030h) : 4145h (AE) 49(0031h) : 4136h (A6) 50(0032h) : 3030h (00) 51(0033h) : 462Dh (F-) 52(0034h) : 3234h (24) 53(0035h) : 2D49h (-I) 54(0036h) : 3400h (4) 55(0037h) : 0000h 56(0038h) : 0000h 57(0039h) : 0000h 58(003Ah) : 0000h 59(003Bh) : 0000h 60(003Ch) : 0000h 61(003Dh) : 0000h 62(003Eh) : 0000h 63(003Fh) : 0000h	
Content details	Indicates the model name with an ASCII code of up to 32 characters. The model name is placed in big endian starting from register address 48 (0030h), and the remainder at the end is a NULL character.	

6.2 Holding register details

Register name	Remote control	
Register address	0(0000h)	Qty of register : 1
Register description	Controls ON/OFF of power supply output by communication	Timing to reflect : receive
Register value		

Digit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Setting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X

X : 1 → Output ON
0 → Output OFF

Content details	When the RC pin is turned ON and the output setting by communication is set ON (1), the output of the power supply turns ON. When the RC pin is turned OFF or the output setting by communication is set OFF (0), the output of the power supply turns OFF. The register value indicates the value set by communication, not the ON/OFF status of the power supply output. Returns an exception response (exception code: 3) at the following conditions; - When writing a value other than "0" or "1";

Register name	Latch stop release	
Register address	1(0001h)	Qty of register : 1
Register description	Releases the latch stop state	Timing to reflect : receive
Register value		

Digit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Setting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X

X : 1 Release the latch stop condition. (The register value returns to "0".)

Content details	If the cause of the latch stop is not removed, it will latch stop again. Returns an exception response (exception code: 3) at the following conditions; - When writing anything other than "1"; When the register value is read, it always shows "0000h".

<table>
<tr><td>Register name</td><td colspan="2">Output voltage setting value</td></tr>
<tr><td>Register address</td><td>8(0008h)</td><td>Qty of register : 1</td></tr>
<tr><td>Register description</td><td>Sets the output voltage value</td><td>Timing to reflect : receive</td></tr>
<tr><td>Register value</td><td colspan="2">
<table>
<tr><td>Digit</td><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Initial value</td><td colspan="16">Rated output voltage value</td></tr>
<tr><td>Setting</td><td colspan="16">Output voltage setting value</td></tr>
</table>

Output voltage setting value [V] → Register value = Setting value × 10

Ex. 24.5V → 245(00F5h)</td></tr>
<tr><td>Content details</td><td colspan="2">Resolution : 0.1V
Accuracy : ± 1%FS（Ta=25℃）
Specified range : Rated output voltage ± 11% (AEA600/AEA800)
Rated output voltage + 11% ～ - 6% (AEA1000)

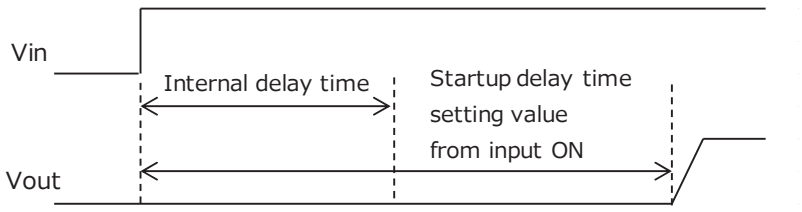
When using this register do not operate the built-in potentiometer for voltage adjustment. When the built-in potentiometer is operated, a difference will occur between the set value of this register and the output voltage.
If you want to adjust the voltage again using this register after operating the built-in potentiometer, please follow steps below.
①Set this register value to the rated voltage value.
② Operate the built-in potentiometer and set the output voltage within ±0.5% of the rated voltage.
(However, the setting accuracy using this register is approximately ±2%FS.)

Returns an exception response (exception code: 3) at the following conditions;
- When setting out-of-range value;</td></tr>
</table>

<table>
<tr><td>Register name</td><td colspan="2">Input start delay time setting value</td></tr>
<tr><td>Register address</td><td>16(0010h)</td><td>Qty of register : 1</td></tr>
<tr><td>Register description</td><td>Set startup delay time from turning on input</td><td>Timing to reflect : reboot</td></tr>
<tr><td>Register value</td><td colspan="2">
<table>
<tr><td>Digit</td><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Initial value</td><td colspan="16">560</td></tr>
<tr><td>Setting</td><td colspan="16">Startup delay time from input ON (msec)</td></tr>
</table>
Ex. 1500msec → 1500
</td></tr>
<tr><td>Content details</td><td colspan="2">Resolution : 1msec
Accuracy : ±2% or ±50msec
Specified range : 560～65,000

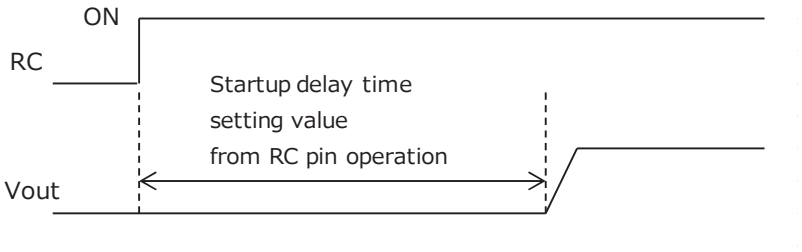
Returns an exception response (exception code: 3) at the following conditions;
- When writing out-of-range value;

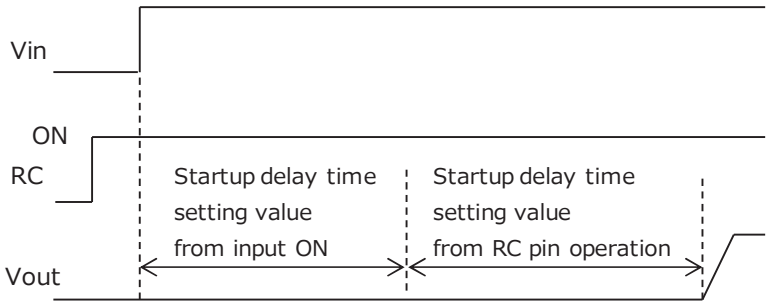
The settings are reflected by writing to the "Setting save register (register address 51 (0033h))" and rebooting.

When the input voltage is less than 95V, the delay may be longer than the specified delay time.
 
</td></tr>
</table>

<table>
<tr><td>Register name</td><td colspan="2">RC pin startup delay time setting value</td></tr>
<tr><td>Register address</td><td>17(0011H)</td><td>Qty of register : 1</td></tr>
<tr><td>Register description</td><td>Sets the startup delay time from RC pin operation</td><td>Timing to reflect : receive</td></tr>
<tr><td>Register value</td><td colspan="2">
<table>
<tr><td>Digit</td><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Initial value</td><td colspan="16">0</td></tr>
<tr><td>Setting</td><td colspan="16">Startup delay time from RC pin operation (msec)</td></tr>
</table>
Ex. 50msec → 50
</td></tr>
<tr><td>Content details</td><td colspan="2">
Resolution : 1msec
Accuracy : ±2% or ±10msec
Specified range : 0～39、000

Returns an exception response (exception code: 3) at the following conditions;
- When writing out-of-range value;

The startup delay time from RC pin operation is applied when the RC pin is ON or output is set ON by communication (register address “0 (0000h)”).


At startup, the startup delay time from the RC pin operation is applied after the startup delay time from input ON.


</td></tr>
</table>

Register name	RC pin stop delay time setting value	
Register address	18(0012h)	Qty of register : 1
Register description	Sets the stop delay time from RC pin operation.	Timing to reflect : receive
Register value		

Digit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial value	0															
Setting	Stop delay time from RC pin operation (msec)															

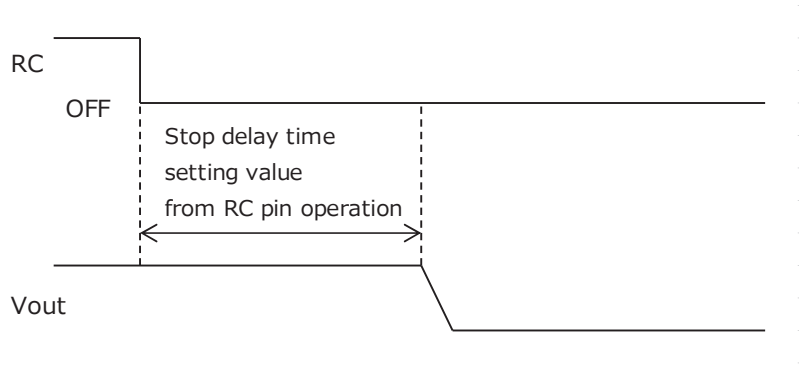
Ex. 50msec → 50

Content details

Resolution : 1msec
Accuracy : ±2% or ±10msec
Specified range :0～39、000

Returns an exception response (exception code: 3) at the following conditions;
- When writing out-of-range value;

The stop delay time from the RC pin operation is applied when the RC pin is OFF or output is set OFF by communication (register address “0 (0000h)”).



<table>
<tr><td>Register name</td><td colspan="2">Startup voltage setting value (AC)</td></tr>
<tr><td>Register address</td><td>19(0013h)</td><td>Qty of register : 1</td></tr>
<tr><td>Register description</td><td>Sets the startup voltage setting value (AC voltage) of the power supply</td><td>Timing to reflect : reboot</td></tr>
<tr><td>Register value</td><td colspan="2">
<table>
<tr><td>Digit</td><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Initial value</td><td colspan="16">80</td></tr>
<tr><td>Setting</td><td colspan="16">Startup voltage setting value</td></tr>
</table>
Ex. 100V → 100
</td></tr>
<tr><td>Content details</td><td colspan="2">Resolution : 1V
Accuracy : ±3%FS(Ta=25°C)
Specified range : 80Vac ～ 240Vac

Returns an exception response (exception code: 3) at the following conditions;
- When writing out-of-range value;
- When writing a value less than stop voltage setting plus 5V;
- When writing a value less than PR alarm judgment value;

The settings are reflected by writing to the "Setting save register (register address 51 (0033h))" and rebooting.

If the input waveform is distorted, there may be a difference between the startup voltage and the set value.
Since the PR alarm signal judgment value is not changed by this register, set it individually.</td></tr>
</table>

<table>
<tr><td>Register name</td><td colspan="2">Stop voltage setting value (AC)</td></tr>
<tr><td>Register address</td><td>21(0015h)</td><td>Qty of register : 1</td></tr>
<tr><td>Register description</td><td>Sets the stop voltage setting value (AC voltage) of the power supply</td><td>Timing to reflect : reboot</td></tr>
<tr><td>Register value</td><td colspan="2">
<table>
<tr><td>Digit</td><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Initial value</td><td colspan="16">74</td></tr>
<tr><td>Setting</td><td colspan="16">Stop voltage setting value</td></tr>
</table>
Ex. 100V → 100
</td></tr>
<tr><td>Content details</td><td colspan="2">Resolution : 1V
Accuracy : ±3%FS(Ta=25°C)
Specified range : 74Vac ～ 200Vac

Returns an exception response (exception code: 3) at the following conditions;
- When writing a value out-of-range value;
- When writing a value more than startup voltage minus 5V;

The settings are reflected by writing to the "Setting save register (register address 51 (0033h))" and rebooting.

If the input waveform is distorted, there may be a difference between the stop voltage and the set value.</td></tr>
</table>

Register name	Stop mode switching	
Register address	36(0024h)	Qty of register : 1
Register description	Selects auto recovery/latch stop for each stop mode.	Timing to reflect : receive
Register value	Initial value 0 0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 b Setting 0 0 0 0 0 0 0 X X X X X 0 0 0 0 0bit : - 1bit : - 2bit : - 3bit : - 4bit : Overcurrent protection 5bit : Peakcurrent protection 6bit : Overheat protection 7bit : Output overvoltage protection 8bit : Continuation of overcurrent protection 9bit : - 10bit : - 11bit : - 12bit : - 13bit : - 14bit : - 15bit : - X : 1 → Latch stop 0 → Auto return	
Content details	Returns an exception response (exception code: 3) at the following conditions; - When writing a value out-of-range value; If the setting of function which is set as “latch stop” is changed to “auto recovery” during latch stop, it will be released.	

<table>
<tr><td>Register name</td><td colspan="2">PR alarm signal judgement value</td></tr>
<tr><td>Register address</td><td>41(0029h)</td><td>Qty of register : 1</td></tr>
<tr><td>Register description</td><td>Sets the PR alarm signal judgment value</td><td>Timing to reflect : reboot</td></tr>
<tr><td>Register value</td><td colspan="2">
<table>
<tr><td>Digit</td><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Initial value</td><td colspan="16">74</td></tr>
<tr><td>Setting</td><td colspan="16">PR alarm signal judgment value</td></tr>
</table>
Ex. 100V → 100
</td></tr>
<tr><td>Content details</td><td colspan="2">Resolution : 1V
Accuracy : ±3%FS(Ta=25°C)
Specified range : 74Vac ～ 200Vac

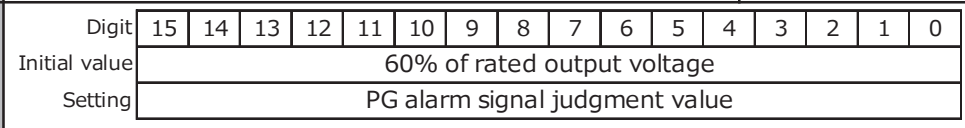
The PR alarm is output when the input voltage remains lower than the PR alarm judgment value.
The PR alarm is reset when the input voltage remains higher than the startup voltage setting value.

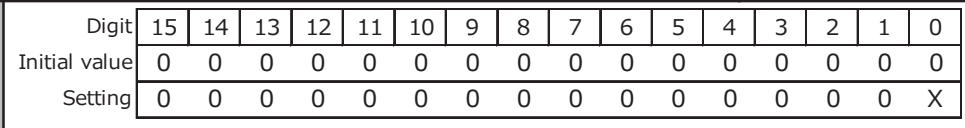
Returns an exception response (exception code: 3) at the following conditions;
- When writing a value outside of the specified range;
- When writing a value more than the startup voltage setting value;

The settings are reflected by writing to the "Setting save register (register address 51 (0033h))" and rebooting.

Startup voltage setting value is not changed by this register, so set it individually.

If the input waveform is distorted, there may be a difference between the PR alarm operation voltage and the set value.</td></tr>
</table>

Register name	PG alarm signal judgement value	
Register address	42(002Ah)	Qty of register : 1
Register description	Sets the PG alarm signal judgment value.	Timing to reflect : receive
Register value	 PG alarm signal judgment value [V] → Register value = setting value ×10 Ex. 30.0V → 300(012Ch)	
Content details	Resolution : 0.1V Accuracy : ±1%FS Specified range : 60% of rated output voltage - rated output voltage The PG alarm is output when the output voltage remains lower than the PG alarm judgment value. The PG alarm is reset when the output voltage remains higher than +5% of the PG alarm judgment value. Returns an exception response (exception code: 3) at the following conditions; - When writing a value outside of the specified range;	

Register name	Save settings	
Register address	51(0033h)	Qty of register : 1
Register description	Saves the setting of the Holding register	Timing to reflect : receive
Register value	 X : 1 Saves the values of the Holding register (The register value returns to "0".)	
Content details	Do not transmit "Initialize settings (register address 52 (0034h))" register and this register continuously within 5 seconds. And do not turn off the input voltage at least 5 seconds after this register is transferred. Otherwise, it may not properly be recorded in the non-volatile memory. Returns an exception response (exception code: 3) at the following conditions; - When writing anything other than "1 (0001h)"; When the register value is read, it always shows "0000h". The saved settings is loaded at the next startup.	

Register name	Initialize settings	
Register address	52(0034h)	Qty of register : 1
Register description	Restores the value of the Holding register to the factory default after reboot	Timing to reflect : reboot
Register value		
Content details	Do not transmit "Save settings (register address 51 (0033h))" register and this register continuously within 5 seconds. And do not turn off the input voltage at least 5 seconds after this register is transferred. Otherwise, it may not properly be recorded in the non-volatile memory. Returns an exception response (exception code: 3) at the following conditions; - When writing anything other than "1 (0001h)"; When the register value is read, it always shows "0000h". The factory default settings is loaded at the next startup. If multiple power supplies are connected to the communication line and this register is broadcast, all communication addresses will become "1" at the next startup, causing a communication error. Remove the multiple connected communication lines and set the communication address of each power supply so that the communication address does not overlap.	

Digit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Setting	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X

X : 1 → Restore the value of the Holding register to the factory default after reboot
(The register value returns to "0".)

Register name	Communication address	
Register address	53(0035h)	Qty of register : 1
Register description	Sets communication address	Timing to reflect : receive
Register value		
Content details	Specified range : 1～247 Returns an exception response (exception code: 3) at the following conditions; - When writing outside the specified range; This register does not support broadcasting to avoid incorrect setting.	

Digit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Initial value	1															
Setting	Communication address															

Ex. Communication address 7 → 7

<table>
<tr><td>Register name</td><td colspan="2">Write protection mode</td></tr>
<tr><td>Register address</td><td>54(0036h)</td><td>Qty of register : 1</td></tr>
<tr><td>Register description</td><td>Selects write protection/release for Holding register</td><td>Timing to reflect : receive</td></tr>
<tr><td>Register value</td><td colspan="2">
<table>
<tr><td>Digit</td><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td>Initial value</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Setting</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>X</td></tr>
</table>
X : 1 → Write protect
0 → Release</td></tr>
<tr><td>Content details</td><td colspan="2">Returns an exception response (exception code: 3) at the following conditions;
- When writing anything other than "0(0000h)" or "1 (0001h)";

Returns an exception response (exception code: 2) at the following conditions;
- Writing to the Holding register during the "Write protect" state;
(However, ”Write protection" state for this register, the "Save settings" register (address 51 "0033h") and the "Initialize settings" register(address 52 "0034h") are exceptions.)</td></tr>
</table>

A. Revision history

No.	Date	Ver	Page	Note
1	2024.3.4	1.0E	-	First edition issued
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				