

Energy Measuring Unit
EcoMonitorLight
MODBUS
Interface Specifications

Model name EMU4-FD1-MB

SPEC. NO. **LSPY-9038**

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Note that the content is subject to change without notice.

MITSUBISHI ELECTRIC CORPORATION

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1. Introduction

1.1 MODBUS RTU

MITSUBISHI Energy Measuring Unit EcoMonitorLight*¹ transfers measured data to PCs and programmable controllers via RS-485 communication (MODBUS[®] RTU protocol).

1.2 MODBUS TCP

EcoMonitorLight*¹ with the MODBUS TCP Communication Unit: EMU4-CM-MT provide measurement values with MODBUS TCP protocol to a PLC or PC via an Ethernet.

MODBUS is registered trademark of SCHNEIDER ELECTRIC USA, INC.

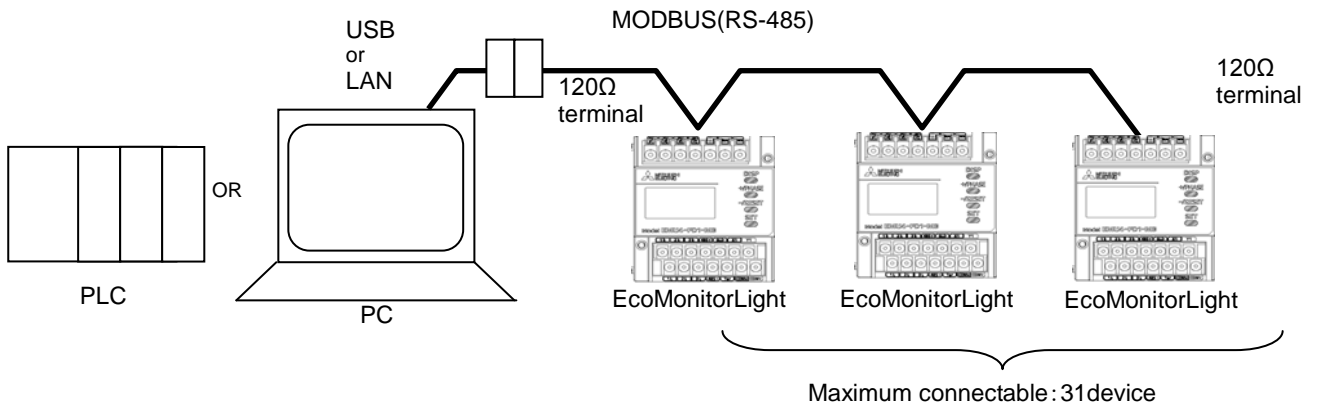
(In some cases, trademark symbols such as "TM", "®" are not specified in this manual.)

*1: Model is showed below.

Series	Model
EcoMonitorLight	EMU4-FD1-MB

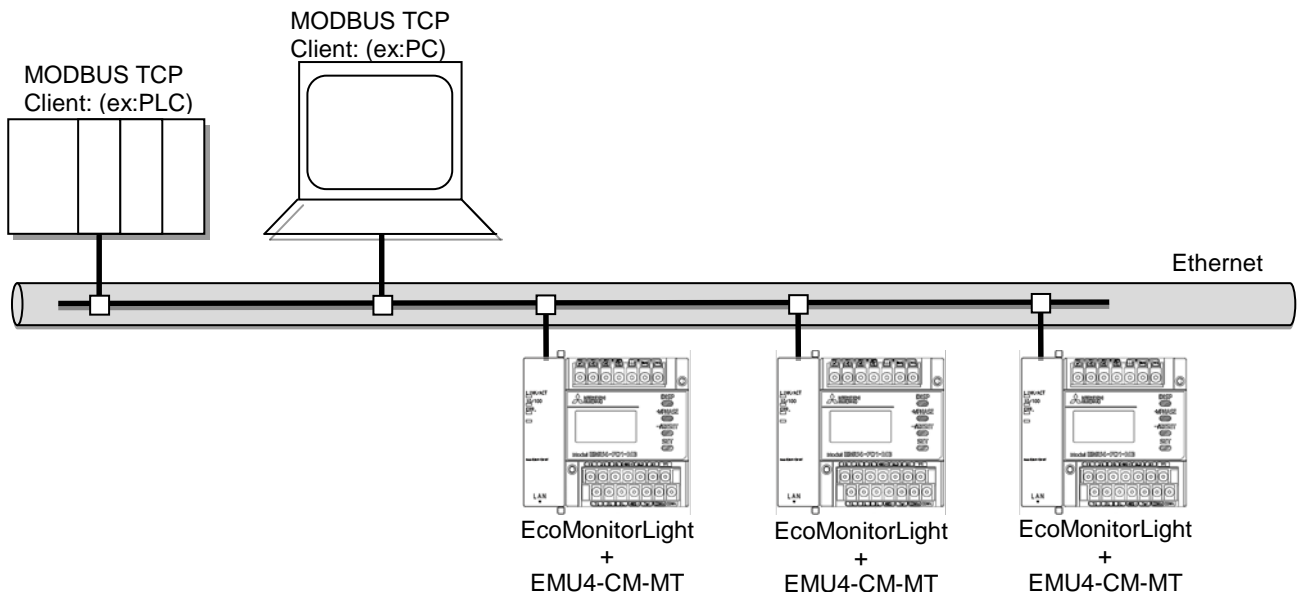
2. System configuration example

2.1 MODBUS RTU Example



* EcoMonitorLight doubles as 120Ω (1/2W) terminal by connecting "485-" and "Ter" terminals.

2.2 MODBUS TCP Example



3. Technical Characteristic

3.1 MODBUS RTU

Item	Specifications
Physical interface	RS-485 2wires half duplex
Protocol	MODBUS RTU mode
Transmission wiring type	Multi-point bus (either directly on the trunk cable, forming a daisy-chain)
Baud rate	2400, 4800, 9600, 19200, 38400bps (default: 19200bps)
Data bit	8
Stop bit	1, 2 (default: 1)
Parity	ODD,EVEN,NONE (default: EVEN)
Slave address	1~255 (FFh) (default: 1) (0: Broadcast, 248 to 255 are reserved)
Response time	1s or shorter from completion of receiving query data to response transmission
Transmission distance	1200m
Maximum connectable devices	31 devices
Termination resistor	120Ω 1/2W
Recommended cable	SPEV(SB)-MPC-0.2 × 1P (Mitsubishi cable industries)

* Transmission speed, parity and stop bit are configured in setting mode of EcoMonitorLight:EMU4-FD1-MB.

3.2 MODBUS TCP

Item	Specifications	
Interface	1port (10BASE-T/100BASE-TX)	
Transmission method	Base band	
Number of cascade connection stages *1	Max. 4 stages (10BASE-T) Max. 2 stages (100BASE-TX)	
Maximum node-to-node distance	200m	
Maximum segment length *2	100m	
Connector applicable for external wiring	RJ45	
Cable	10BASE-T	Cable compliant with the IEEE802.3 10BASE-T Standard (unshielded twisted pair cable (UTP cable), Category 3 or more)
	100BASE-TX	Cable compliant with the IEEE802.3 100BASE-TX Standard (shielded twisted pair cable (STP cable), Category 5 or more)
Protocol	MODBUS TCP (Port Number 502)	
Number of simultaneously connection	Max. 4	
Supported function	Autonegotiation (10BASE-T/100BASE-TX automatically detected)	
	Auto MDIX function (straight/crossover cable automatically detected)	

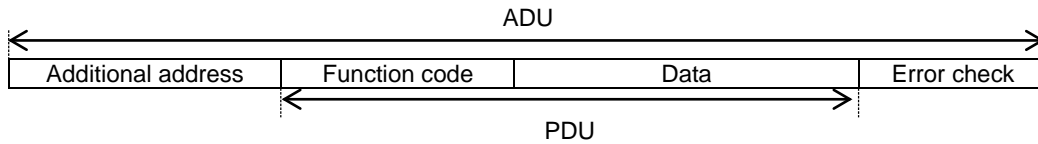
*1: This is the maximum number of cascade connection stages when a repeater hub is used. For the maximum number of cascade connection stages, contact to the manufacturer for the switching hub used.

*2: Length between a hub and a node.

4. Telegraph specifications

4.1 General MODBUS frame

The MODBUS protocol defines a simple protocol data unit (PDU) independent of the underlying communication layers. The mapping of MODBUS protocol on specific buses or network can introduce some additional fields on the application data unit (ADU).

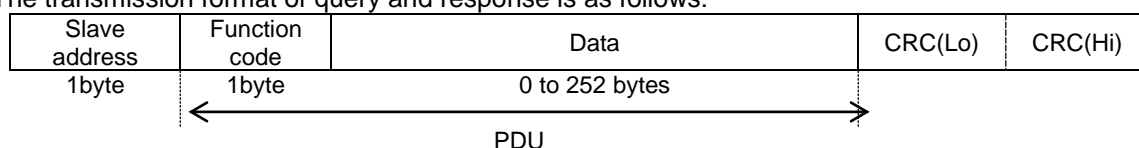


For details, please download and refer to Modbus Technical Resources and Modbus Specifications posted on the following URL; <http://www.modbus.org/>

4.2 MODBUS RTU

(1) MODBUS RTU Frame

The transmission format of query and response is as follows:



- Address : 0 to FFh
 The configurable address for each slave is the range from 01 to F7h.
 0 is the address for broadcast, and in broadcast all slaves execute the function.
- Function : 03h Read register (Monitor)
 : 08h Diagnosis
 : 10h Batch write register (Batch configuration)
- Data : 8-bit HEX data
- CRC : 16-bit CRC from Address to Data $X16 + X15 + X2 + 1$

<Reference> Computation of CRC

1. Input "FFFFh" into CRC register.
2. Input the exclusive OR of the first character of the message and the lower byte of CRC register into CRC register.
3. Shift CRC register to right by one bit.
4. If LSB of CRC register is 0, repeat 3) until it becomes 1.
 If LSB of CRC register is 1, input the exclusive OR of CRC register and the generating polynomial A001h into CRC register.
5. Repeat 3) and 4) until CRC register is shifted by eight bits.
6. Repeat 2) to 5) for the other characters in the same way to apply to all bytes of the message.
7. The last value of CRC register becomes CRC.

(2) Bit format of one byte for serial transmission

Transfer one byte in following order (from left to right).

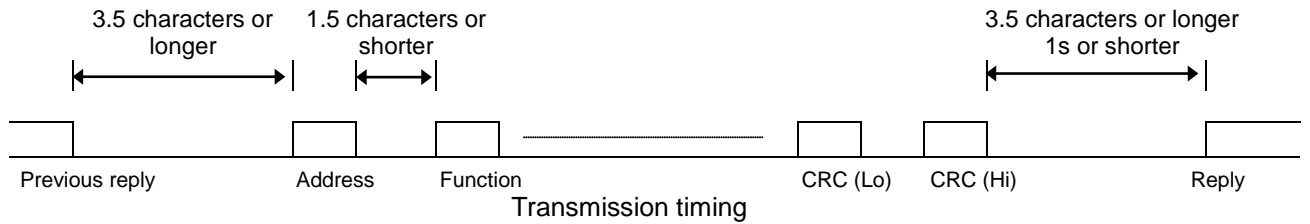
If parity is not "NONE", and stop bit is "1".

Start	1	2	3	4	5	6	7	8	Parity	Stop	
	LSB							MSB			

If parity is "NONE", and stop bit is "2".

Start	1	2	3	4	5	6	7	8	Stop	Stop	
	LSB							MSB			

(3) Transmission timing



You need to set the idling for 3.5 characters or longer before and after each transmission text.

The response is sent within one second of the receipt of query. (for detail, refer the table below)

Each data is sent at 1.5-character or longer interval.

If the transferred data interval becomes longer than 3.5 characters, transmission is finished and received data is discarded. In this case, the data after interval is considered as the beginning address of new query.

<Reference>

Data interval

Transmission speed	3.5 characters		1.5 characters	
	Stop bit: 1 Parity: 1	Stop bit: 1 Parity: NONE	Stop bit: 1 Parity: 1	Stop bit: 1 Parity: NONE
2400 bps	16.04ms	14.58ms	6.88ms	6.25ms
4800 bps	8.02ms	7.29ms	3.44ms	3.13ms
9600 bps	4.01ms	3.65ms	1.72ms	1.56ms
19200 bps	2.00ms	1.82ms	0.86ms	0.78ms
38400 bps	1.00ms	0.91ms	0.43ms	0.39ms

Transmission time (Transmission speed: 38400bps)

Number of batch monitor register (byte)	Query send time	Response time (Mean time from finish of receipt to start of sending: for reference)	Reply send time	Total time
1 register (2 bytes)	2.28ms	2.34ms	2.10ms	6.72ms
10 registers (20 bytes)	2.28ms	4.14ms	7.26ms	13.68ms
40 registers (80bytes)	2.28ms	14.02ms	24.60ms	40.90ms

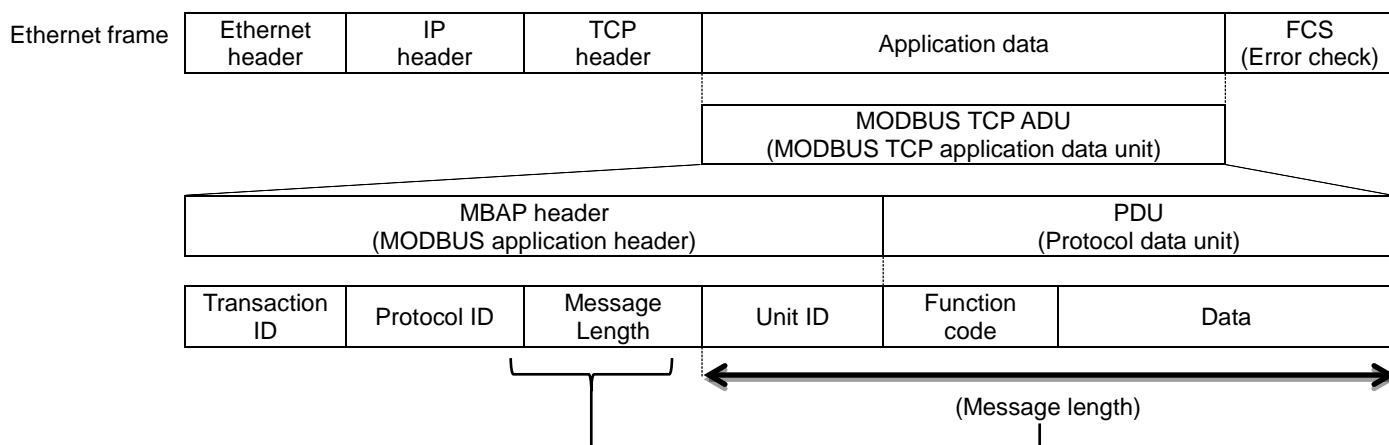
* Stop bit: 1, parity bit: 1, data interval is configured to 0.

The above-mentioned data is a reference value, transmission time is not guaranteed.

4.3 MODBUS TCP

(1) MODBUS TCP frame

The frame specifications of MODBUS TCP are indicated below.



Area Name		Area Size	Description
MBAP header (MODBUS application header)	Transaction ID	2 bytes	Used by the master for matching of the response message from the slave.
	Protocol ID	2 bytes	Indicates the protocol of the PDU (protocol data unit). Stores 0 in the case of MODBUS [®] TCP.
	Message Length	2 bytes	Stores the message size in byte unit. The message length after this field is stored. (See the above figure.)
	Unit ID	1 byte	Stores FFh in the case of EMU4-FD1-MB with the Optional Plug-in Modbule: EMU4-CM-MT
PDU (Protocol data unit)	Function code	1 byte	The master specifies the processing to be performed for the slave. 03H Read Holding Registers (maximum 250 bytes) 10H Write multiple registers (EMU4-FD1-MB does not support the other function codes.)
	Data	1 to 252bytes	[When master sends request message to slave] Stores the requested processing. [When slave sends response message to master] Stores the result of processing execution.

5. Format of query and response

5.1 Register read function (03h)

(1) Query framing

Function Code	Data			
	Head holding register number		Read points	
03h	Hi	Lo	Hi	Lo

•Head holding register number : 2byte

•Read points : 0001h to 007Dh (Maximum 125 points)

(2) Response framing (Maximum 255 bytes)

①When completed normally

Function Code	Data							
	Byte count n x 2	Data1		Data2		...	Data n	
03h		Hi	Lo	Hi	Lo	...	Hi	Lo

•Byte count : Byte count of response data (Maximum 250)

For example, if n=4, the byte count is calculated as 4 x2 =8 bytes.

②When completed with an error

Function Code	Data
	Exception code
83h	Refer to Chapter 6.

(3) Example (ADU frame example)

<Example1> In case of monitoring the phase 2 current value (0301h), and the slave address is 01h in MODBUS[®] RTU.

■Query framing

01h	03h	03h	01h	00h	01h	D5h	8Eh
Slave address	Head holding register number	Read points	CRC(=8ED5h)				

■Response framing

01h	03h	02h	Hi	Lo	Lo	Hi
Slave address	Byte count	phase 2 current value	CRC			

<Example2> In case of monitoring from “the phase 1 current value (0300h)” to “the neutral current value (0303h)”. Slave address is 01h in MODBUS[®] RTU.

■Query framing

01h	03h	03h	00h	00h	04h	44h	4Dh
Slave address	Head holding register number	Read points	CRC(=4D44h)				

■Response framing

01h	03h	08h	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Lo	Hi
Slave address	Byte count	phase 1 current value	phase 2 current value	phase 3 current value	Neutral current value	CRC						

<Example3> In case of monitoring of the active energy (0518h) in MODBUS[®]TCP.

■Query framing

00h	00h	00h	00h	00h	06h	FFh	03h	05h	18h	00h	02h
Transaction ID	Protocol ID	Message Length	Unit ID	Func. Code	Head holding register number	Read points					

■Response framing

00h	00h	00h	00h	00h	07h	FFh	03h	04h	HH	HL	LH	LL
Transaction ID	Protocol ID	Message Length	Unit ID	Func. Code	Byte count	active energy						

5.2 Write Multiple Registers (10h)

(1) Query framing

Function Code	Data											
	Head holding register number		Write points n		Byte count n x 2	Data1		Data2		...	Data n	
10h	Hi	Lo	Hi	Lo		Hi	Lo	Hi	Lo	...	Hi	Lo

- Head holding register number : 2byte
- Write points : 0001h to 007Bh (Maximum 123 points)
- Byte count : Write point x 2 (Maximum 246)
- Data1 to Data n : Write data

(2) Response framing

In MODBUS® RTU, if the slave address is 0 (broadcast), a response is not made.

① When completed normally

Function Code	Data			
	Head holding register number *1		Write points *1	
10h	Hi	Lo	Hi	Lo

*1: The value same as in the request message is stored.

② When completed with an error

Function Code	Data
	Exception code
90h	Refer to Chapter 6.

(3) Example (ADU frame example)

< Example1 > In case of setting a primary current value (0207h).
Slave address is 01h in MODBUS® RTU.

■ Query framing

01h	10h	02h	07h	00h	02h	04h	HH	HL	LH	LL	Lo	Hi
Slave address	Head holding register number		Write points	Byte count	Primary current				CRC			

■ Response framing

01h	10h	02h	07h	00h	02h	Lo	Hi
Slave address	Head holding register number		Write points	CRC			

< Example2 > In case of reset alarm by 16bits set/reset register (020Bh) in MODBUS® TCP.

■ Query framing

00h	00h	00h	00h	00h	09h	FFh	10h	02h	0Bh	00h	01h	02h	00h	01h
Transaction ID	Protocol ID		Message Length	Unit ID	Func. Code	Head holding register number	Write points	Byte count	16bit set/reset register2					

■ Response framing

00h	00h	00h	00h	00h	06h	FFh	10h	02h	0Bh	00h	01h
Transaction ID	Protocol ID		Message Length	Unit ID	Func. Code	Head holding register number	Write points				

5.3 Diagnostics (08h) (Sub function code: 00h)

Diagnostics (08h) is the function dedicated to the MODBUS[®] serial protocol.

(1) Query framing (Sub function code: 00h)

Function Code	Data	
	Sub function Code	Arbitrary data
08h	00h	00h
		Hi Lo

(2) Response framing

① When completed normally

The slave returns the request message received from the master without change.

② When completed with an error

Function Code	Data
	Exception code
88h	*1

*1: Refer to Chapter 6.

(3) Example (ADU frame example)

<Example> In case of the data is 1234h. Slave address is 01h in MODBUS[®] RTU.

■ Query framing

01h	08h	00h	00h	12h	34h	EDh	7Ch
Slave address		Sub function code		Data		CRC(=7CEDh)	

■ Response framing

01h	08h	00h	00h	12h	34h	EDh	7Ch
Slave address		Sub function code		Data		CRC(=7CEDh)	

6. Error handling and response in the event of error.

6.1 MODBUS[®] RTU

Error item	Error content	Handling	Error indication
Framing error	Receive the next data before reading the UART receipt buffer.	Not return error response and transition to waiting data receipt.	Nothing
Overrun error	Not correct one byte data length.		
Parity error	Not correct parity bit.		
CRC check error	Not correct CRC error check code	Response the error code 01.	
Illegal function	Receive function except for '03', '08' or '10'.		
Register address error	Requested register address does not exist.	Response the error code 02.	
Data value error	Data is out of allowable range. The number of word for setting item disagrees with that of word for setting value data.	Response the error code 03.	
Slave busy	While changing setting value	Response the error code 06	

6.2 MODBUS[®] TCP

ERROR	Meaning	Exception code	Display of EMU4-FD1
Protocol ID error	The protocol ID in MBAP header is not 0. Review the data part of the request message.	No response is returned. (TCP connection is cut off.)	☐ in the display blinks until it receives the correct query.
Illegal function	The function code received in the query was except 03h and 10h.	01h	
Illegal data address	The data address received in the query is not an allowable address for the slave.	02h	
Illegal data value	The data value received in the query is not an allowable data value for the slave.	03h	
Slave busy	As the EMU4-FD1 is executing in setting mode, the setting request message processing cannot be executed.	06h	
Gateway unusable	Unit ID is abnormal (Except FFh). EMU4-FD1 is not available for gateway function.	0Ah	
Message length error	The message length in MBAP header is incorrect. . Review The MBAP header length + 6 equals the application data unit length in Ethernet frame	04h or No response is returned. (TCP connection is cut off when next message received.)	

6.3 Example

<Example> In case of monitoring from Σ Reactive power (0322h) to undefined address(0329h).Slave address is 01h in MODBUS[®] RTU.

■ Query framing

01h	03h	03h	22h	00h	08h	Lo	Hi
Slave address	Starting address	Quantity of registers				CRC	

■ Response framing

01h	83h	02h	Lo	Hi
Slave address	Illegal data address		CRC	

7. Data specifications

7.1 Register list

item	substance
R/W	Read and write address
R	Read only

item	substance
○	Support
△	Not used
×	Error

7.1.1 EcoMonitorLight

(1) Setting register

Register address		Number of byte	R/W (*1)	Register name	RANGE	Unit	Support (*2)			
Decimal	Hex						EMU4-FD1-MB			
								1P2W	1P3W 3P3W	3P4W
512	0200h	2	R/W	Phase wire system	1 to 4	-	○	○	○	
513	0201h	4	R/W	Primary voltage (L-L: line voltage)	1 to 6600	V	○	○	○	
515	0203h	4	R/W	Primary voltage (L-N: phase voltage)	10 to 66000	x0.1V	Δ(*3)	Δ(*3)	○(*3)	
517	0205h	4	R/W	Secondary voltage	10 to 2200	x0.1V	○	○	○	
519	0207h	4	R/W	Primary current	10 to 60000	x0.1A	○	○	○	
521	0209h	2	R/W	Electric power demand time	0 to 1800	s	○	○	○	
522	020Ah	2	R/W	Current demand time	0 to 1800	s	○	○	○	
523	020Bh	2	R/W	16 bits Set/Reset register			○	○	○	
524	020Ch	2	R	16 bits monitor			○	○	○	
525	020Dh	2	R/W	N/A	-	-	Δ	Δ	Δ	
526	020Eh	2	R/W	N/A	-	-	Δ	Δ	Δ	
527	020Fh	2	R/W	N/A	-	-	Δ	Δ	Δ	
528	0210h	2	R/W	N/A	-	-	Δ	Δ	Δ	
529	0211h	2	R/W	N/A	-	-	Δ	Δ	Δ	
530	0212h	2	R/W	N/A	-	-	Δ	Δ	Δ	
531	0213h	2	R/W	N/A	-	-	Δ	Δ	Δ	
581	0245h	4	R/W	Secondary current	1: 1A, 5: 5A	A	○	○	○	
753	02F1h	2	R/W	Measuring method of operating time	1: By current, 2: By contact/pulse		○	○	○	
754	02F2h	2	R	Multiplying factor of current	-127 to 127		○	○	○	
755	02F3h	2	R	Multiplying factor of voltage	-127 to 127		○	○	○	
756	02F4h	2	R	Multiplying factor of electric power	-127 to 127		○	○	○	
757	02F5h	2	R	Multiplying factor of electric energy	-127 to 127		○	○	○	
758	02F6h	2	R	Multiplying factor of power factor	-127 to 127		○	○	○	
759	02F7h	2	R	Multiplying factor of frequency	-127 to 127		○	○	○	
760	02F8h	2	R	Multiplying factor of content rate of harmonic current	-127 to 127		○	○	○	
761	02F9h	2	R	Multiplying factor of content rate of harmonic voltage	-127 to 127		○	○	○	
762	02FAh	2	R	Multiplying factor of detail electric energy	-127 to 127		○	○	○	
763	02FBh	2	R	Model code			○	○	○	

*1: R/W: Readable and writable register

In a write operation, if the setting data is 8000h (2-byte data) or 80000000h (4-byte data), the data in address concerned is not changed.

(If you do batch setting, use them for the address which is not set.)

R : Read only register

If you perform a write operation to these registers, the error code 02h is responded.

*2: ○: Supported

Δ: Not in use (Register addresses of these items are defined, but they are not measured.)

For these registers, if they are read, "0" is responded.

The data of negative value is represented by two's complement.

*3: The value is reflected only in three phase 4-wire system. In other system, "0" is responded.

(2)Momentary value monitor register

Register address		Number of byte	R/W (*1)	Register name	RANGE	Unit	Support (*2)		
Decimal	Hex						EMU4-FD1-MB		
							1P2W	1P3W 3P3W	3P4W
768	0300h	2	R	Phase 1 current	0 to 65535	A	○	○	○
769	0301h	2	R	Phase 2 current	0 to 65535	A	△	○	○
770	0302h	2	R	Phase 3 current	0 to 65535	A	△	○	○
771	0303h	2	R	Neutral current	0 to 65535	A	△	△	○
772	0304h	2	R	Average value current	0 to 65535	A	○	○	○
773	0305h	2	R	Phase 1 current demand	0 to 65535	A	○	○	○
774	0306h	2	R	Phase 2 current demand	0 to 65535	A	△	○	○
775	0307h	2	R	Phase 3 current demand	0 to 65535	A	△	○	○
776	0308h	2	R	Neutral current demand	0 to 65535	A	△	△	○
777	0309h	2	R	N/A	-	A	△	△	△
778	030Ah	2	R	Voltage V12	0 to 65535	V	○	○	○
779	030Bh	2	R	Voltage V23	0 to 65535	V	△	○	○
780	030Ch	2	R	Voltage V31	0 to 65535	V	△	○	○
781	030Dh	2	R	Average value voltage (L-L)	0 to 65535	V	○	○	○
782	030Eh	2	R	Voltage V1N	0 to 65535	V	△	△	○
783	030Fh	2	R	Voltage V2N	0 to 65535	V	△	△	○
784	0310h	2	R	Voltage V3N	0 to 65535	V	△	△	○
785	0311h	2	R	N/A	-	-	△	△	△
786	0312h	2	R	N/A	-	-	△	△	△
787	0313h	2	R	N/A	-	-	△	△	△
788	0314h	2	R	N/A	-	-	△	△	△
789	0315h	2	R	ΣPower factor	-500 to +1000 to 500	×0.1%	○	○	○
790	0316h	2	R	Frequency	445 to 999	×0.1Hz	○	○	○
791	0317h	2	R	N/A	-	-	△	△	△
792	0318h	2	R	N/A	-	-	△	△	△
793	0319h	2	R	N/A	-	-	△	△	△
794	031Ah	2	R	ΣActive power	-32768 to 32767	kW	○	○	○
795	031Bh	2	R	N/A	-	-	△	△	△
796	031Ch	2	R	N/A	-	-	△	△	△
797	031Dh	2	R	N/A	-	-	△	△	△
798	031Eh	2	R	ΣActive power demand	-32768 to 32767	kW	○	○	○
799	031Fh	2	R	N/A	-	-	△	△	△
800	0320h	2	R	N/A	-	-	△	△	△
801	0321h	2	R	N/A	-	-	△	△	△
802	0322h	2	R	ΣReactive power	-32768 to 32767	kvar	○	○	○
803	0323h	2	R	N/A	-	-	△	△	△
804	0324h	2	R	N/A	-	-	△	△	△
805	0325h	2	R	N/A	-	-	△	△	△
806	0326h	2	R	ΣApparent power	0 to 32767	kVA	△	△	○

*1: R : Read only register

If you perform a write operation to these registers, the error code 02h is responded.

*2: ○: Supported

△: Not in use (Register addresses of these items are defined, but they are not measured.)

For these registers, if they are read, "0" is responded.

The data of negative value is represented by two's complement.

The data can convert to the measured value by unit in the table and multiplying factor indicated in section 7.3 Multiplying factor of monitor data.

(3)Setting register2

RegisterAddress		Number of byte	R/W (*1)	Register name	RANGE	Unit	Support (*2)		
Decimal	Hex						EMU4-FD1-MB		
							1P2W	1P3W 3P3W	3P4W
1024	0400h	2	R/W	N/A	-	-	△	△	△
1025	0401h	2	R/W	N/A	-	-	△	△	△
1026	0402h	2	R/W	N/A	-	-	△	△	△
1027	0403h	2	R/W	N/A	-	-	△	△	△
1028	0404h	2	R/W	Logging ID	01h to FFh	-	○	○	○
1029	0405h	2	R/W	Logging data clear	0h:no, 1h:yes	-	○	○	○
1030	0406h	2	R/W	Logging unit time (Year,Month)	00 to 99 + 01 to 12	-	○	○	○
1031	0407h	2	R/W	Logging unit time (Day,Hour)	01 to 31 + 00 to 23	-	○	○	○
1032	0408h	2	R/W	Logging unit time (Minute,Second)	00 to 59 + 00 to 59	-	○	○	○
1033	0409h	2	R	N/A	-	-	△	△	△
...	...		R	N/A	-	-	△	△	△
1063	0427h	2	R	N/A	-	-	△	△	△
1066	042Ah	4	R	MAC Address (1,2 octet)	Refer to 7.2.14	-	○	○	○
1068	042Ch	4	R	MAC Address (3 to 6 octet)		-	○	○	○
1070	042Eh	4	R/W	IP Address	Refer to 7.2.15	-	○	○	○
1072	0430h	4	R/W	Subnet mask address		-	○	○	○
1074	0432h	4	R/W	Default gateway address		-	○	○	○

(4) Electric energy / reactive energy monitor register

Register address		Number of byte	R/W (*1)	Register name	RANGE	Unit	Support (*2)			
Decimal	Hex						EMU4-FD1-MB			
								1P2W	1P3W 3P3W	1P2W
1280	0500h	2	R	Integrated electric energy (*4)	import	Less than 1000	kWh	○	○	○
1281	0501h	2	R	Integrated electric energy (*4) (Higher)		1000 or more		○	○	○
1282	0502h	2	R	Integrated electric energy (*4) (Lower)	export	Less than 1000	kWh	○	○	○
1283	0503h	2	R	Integrated electric energy (*4) (Higher)		1000 or more		○	○	○
1284	0504h	2	R	Reactive energy (*4) (Lower)	import LAG	Less than 1000	kvarh	○	○	○
1285	0505h	2	R	Reactive energy (*4) (Higher)		1000 or more		○	○	○
1286	0506h	2	R	N/A	-	-	-	△	△	△
1287	0507h	2	R	N/A	-	-	-	△	△	△
1288	0508h	2	R	N/A	-	-	-	△	△	△
1289	0509h	2	R	N/A	-	-	-	△	△	△
1290	050Ah	2	R	N/A	-	-	-	△	△	△
1291	050Bh	2	R	N/A	-	-	-	△	△	△
1292	050Ch	2	R	N/A	-	-	-	△	△	△
1293	050Dh	2	R	N/A	-	-	-	△	△	△
1294	050Eh	2	R	N/A	-	-	-	△	△	△
1295	050Fh	2	R	N/A	-	-	-	△	△	△
1296	0510h	2	R	N/A	-	-	-	△	△	△
1297	0511h	2	R	N/A	-	-	-	△	△	△
1298	0512h	2	R	N/A	-	-	-	△	△	△
1299	0513h	2	R	N/A	-	-	-	△	△	△
1300	0514h	2	R	N/A	-	-	-	△	△	△
1301	0515h	2	R	N/A	-	-	-	△	△	△
1302	0516h	2	R	N/A	-	-	-	△	△	△
1303	0517h	2	R	N/A	-	-	-	△	△	△
1304	0518h	4	R/W	Integrated electric energy(*3)	import	0 to 999999	kWh	○	○	○
1306	051Ah	4	R/W	Integrated electric energy (*3)	export	0 to 999999	kWh	○	○	○
1308	051Ch	4	R/W	Reactive energy (*3)	import LAG	0 to 999999	kvarh	○	○	○
1310	051Eh	4	R/W	N/A	-	-	-	△	△	△
1312	0520h	4	R/W	N/A	-	-	-	△	△	△
1314	0522h	4	R/W	N/A	-	-	-	△	△	△
1316	0524h	4	R	Extended integrated electric energy (*3)	import	0 to 999999	kWh	○	○	○
1318	0526h	4	R	Extended integrated electric energy (*3)	export	0 to 999999	kWh	○	○	○
1320	0528h	4	R	Expanded reactive energy (*3)	import LAG	0 to 999999	kvarh	○	○	○
1374	055Eh	4	R/W	Periodic electric energy (*3)	import	0 to 999999	kWh	○	○	○
1376	0560h	4	R/W	Pulse count (*3)		0 to 999999		○	○	○
1378	0562h	4	R/W	Operating time (*3)		0 to 999999	h	○	○	○

*1: R/W : Readable and writeable register

In a write operation, if the setting data is 8000h (2-byte data) or 80000000h (4-byte data), the data in address concerned is not changed.

(If you do batch setting, use them for the address which is not set.)

R : Read only register

If you perform a write operation to these registers, the error code 02h is responded.

*2: ○: Supported

△: Not in use (Register addresses of these items are defined, but they are not measured.)

For these registers, if they are read, "0" is responded.

The data of negative value is represented by two's complement.

The data can convert to the measured value by unit in the table and multiplying factor indicated in section 7.3 Multiplying factor of monitor data.

*3: For 4 byte data, only 4, 8, 12, 16, 20 and 24 bytes from even address are accessible.

Address error 02h is responded by the access starting from odd address such as 0519h, 051Bh and so on.

It is also responded by the access to 2nd, 3rd, 5th and 6th byte from the address such as 0518h, 051Ah and so on.

*4: These 6-digit energy values are responded by dividing into upper and lower three digits.

Note: Please replace upper register data and lower register data when acquire 4 bytes data.

(5)Momentary RMS value of harmonic phase voltage monitor register

Register address		Number of byte	R/W (*1)	Register name		RANGE	Unit	Support (*2)		
Decimal	Hex							EMU4-FD1-MB		
								1P2W	1P3W 3P3W	1P2W
1792	0700h	2	R	Harmonics value V1N	Total	0 to 65535	V	△	△	○
1793	0701h	2	R	Harmonics value V2N	Total	0 to 65535	V	△	△	○
1794	0702h	2	R	Harmonics value V3N	Total	0 to 65535	V	△	△	○
1795	0703h	2	R	Harmonics value V1N	1st	0 to 65535	V	△	△	○
1796	0704h	2	R	Harmonics value V2N	1st	0 to 65535	V	△	△	○
1797	0705h	2	R	Harmonics value V3N	1st	0 to 65535	V	△	△	○
1798	0706h	2	R	Harmonics value V1N	3rd	0 to 65535	V	△	△	○
1799	0707h	2	R	Harmonics value V2N	3rd	0 to 65535	V	△	△	○
1800	0708h	2	R	Harmonics value V3N	3rd	0 to 65535	V	△	△	○
1801	0709h	2	R	Harmonics value V1N	5th	0 to 65535	V	△	△	○
1802	070Ah	2	R	Harmonics value V2N	5th	0 to 65535	V	△	△	○
1803	070Bh	2	R	Harmonics value V3N	5th	0 to 65535	V	△	△	○
1804	070Ch	2	R	Harmonics value V1N	7th	0 to 65535	V	△	△	○
1805	070Dh	2	R	Harmonics value V2N	7th	0 to 65535	V	△	△	○
1806	070Eh	2	R	Harmonics value V3N	7th	0 to 65535	V	△	△	○
1807	070Fh	2	R	Harmonics value V1N	9th	0 to 65535	V	△	△	○
1808	0710h	2	R	Harmonics value V2N	9th	0 to 65535	V	△	△	○
1809	0711h	2	R	Harmonics value V3N	9th	0 to 65535	V	△	△	○
1810	0712h	2	R	Harmonics value V1N	11th	0 to 65535	V	△	△	○
1811	0713h	2	R	Harmonics value V2N	11th	0 to 65535	V	△	△	○
1812	0714h	2	R	Harmonics value V3N	11th	0 to 65535	V	△	△	○
1813	0715h	2	R	Harmonics value V1N	13th	0 to 65535	V	△	△	○
1814	0716h	2	R	Harmonics value V2N	13th	0 to 65535	V	△	△	○
1815	0717h	2	R	Harmonics value V3N	13th	0 to 65535	V	△	△	○
1816	0718h	2	R	Harmonics value V1N	15th	0 to 65535	V	△	△	○
1817	0719h	2	R	Harmonics value V2N	15th	0 to 65535	V	△	△	○
1818	071Ah	2	R	Harmonics value V3N	15th	0 to 65535	V	△	△	○

*1: R : Read only register

If you perform a write operation to these registers, the error code 02h is responded.

*2: ○: Supported

△: Not in use (Register addresses of these items are defined, but they are not measured.)

For these registers, if they are read, "0" is responded.

The data of negative value is represented by two's complement.

The data can be converted to the measured value by unit in the table and multiplying factor indicated in section 7.3 Multiplying factor of monitor data.

(6)Momentary RMS value of harmonic line voltage monitor register

Register address		Number of byte	R/W (*1)	Register name	RANGE	Unit	Support (*2)			
Decimal	Hex						EMU4-FD1-MB			
							1P2W	1P3W 3P3W	1P2W	
2048	0800h	2	R	Harmonics value V12	Total	0 to 65535	V	○	○	△
2049	0801h	2	R	Harmonics value V23	Total	0 to 65535	V	△	○	△
2050	0802h	2	R	N/A	-	-	-	△	△	△
2051	0803h	2	R	Harmonics value V12	1st	0 to 65535	V	○	○	△
2052	0804h	2	R	Harmonics value V23	1st	0 to 65535	V	△	○	△
2053	0805h	2	R	N/A	-	-	-	△	△	△
2054	0806h	2	R	Harmonics value V12	3rd	0 to 65535	V	○	○	△
2055	0807h	2	R	Harmonics value V23	3rd	0 to 65535	V	△	○	△
2056	0808h	2	R	N/A	-	-	-	△	△	△
2057	0809h	2	R	Harmonics value V12	5th	0 to 65535	V	○	○	△
2058	080Ah	2	R	Harmonics value V23	5th	0 to 65535	V	△	○	△
2059	080Bh	2	R	N/A	-	-	-	△	△	△
2060	080Ch	2	R	Harmonics value V12	7th	0 to 65535	V	○	○	△
2061	080Dh	2	R	Harmonics value V23	7th	0 to 65535	V	△	○	△
2062	080Eh	2	R	N/A	-	-	-	△	△	△
2063	080Fh	2	R	Harmonics value V12	9th	0 to 65535	V	○	○	△
2064	0810h	2	R	Harmonics value V23	9th	0 to 65535	V	△	○	△
2065	0811h	2	R	N/A	-	-	-	△	△	△
2066	0812h	2	R	Harmonics value V12	11th	0 to 65535	V	○	○	△
2067	0813h	2	R	Harmonics value V23	11th	0 to 65535	V	△	○	△
2068	0814h	2	R	N/A	-	-	-	△	△	△
2069	0815h	2	R	Harmonics value V12	13th	0 to 65535	V	○	○	△
2070	0816h	2	R	Harmonics value V23	13th	0 to 65535	V	△	○	△
2071	0817h	2	R	N/A	-	-	-	△	△	△
2072	0818h	2	R	Harmonics value V12	15th	0 to 65535	V	○	○	△
2073	0819h	2	R	Harmonics value V23	15th	0 to 65535	V	△	○	△
2074	081Ah	2	R	N/A	-	-	-	△	△	△

*1: R : Read only register

If you perform a write operation to these registers, the error code 02h is responded.

*2: ○: Supported

△: Not in use (Register addresses of these items are defined, but they are not measured.)

For these registers, if they are read, "0" is responded.

The data of negative value is represented by two's complement.

The data can convert to the measured value by unit in the table and multiplying factor indicated in section 7.3 Multiplying factor of monitor data.

(7)Momentary RMS value of harmonic current monitor register

Register address		Number of byte	R/W (*1)	Register name		RANGE	Unit	Support (*2)		
Decimal	Hex							EMU4-FD1-MB		
								1P2W	1P3W 3P3W	1P2W
2304	0900h	2	R	Harmonics value I1	Total	0 to 65535	A	○	○	○
2305	0901h	2	R	Harmonics value I2	Total	0 to 65535	A	△	△	○
2306	0902h	2	R	Harmonics value I3	Total	0 to 65535	A	△	○	○
2307	0903h	2	R	Harmonics value IN	Total	0 to 65535	A	△	△	○
2308	0904h	2	R	Harmonics value I1	1st	0 to 65535	A	○	○	○
2309	0905h	2	R	Harmonics value I2	1st	0 to 65535	A	△	△	○
2310	0906h	2	R	Harmonics value I3	1st	0 to 65535	A	△	○	○
2311	0907h	2	R	Harmonics value IN	1st	0 to 65535	A	△	△	○
2312	0908h	2	R	Harmonics value I1	3rd	0 to 65535	A	○	○	○
2313	0909h	2	R	Harmonics value I2	3rd	0 to 65535	A	△	△	○
2314	090Ah	2	R	Harmonics value I3	3rd	0 to 65535	A	△	○	○
2315	090Bh	2	R	Harmonics value IN	3rd	0 to 65535	A	△	△	○
2316	090Ch	2	R	Harmonics value I1	5th	0 to 65535	A	○	○	○
2317	090Dh	2	R	Harmonics value I2	5th	0 to 65535	A	△	△	○
2318	090Eh	2	R	Harmonics value I3	5th	0 to 65535	A	△	○	○
2319	090Fh	2	R	Harmonics value IN	5th	0 to 65535	A	△	△	○
2320	0910h	2	R	Harmonics value I1	7th	0 to 65535	A	○	○	○
2321	0911h	2	R	Harmonics value I2	7th	0 to 65535	A	△	△	○
2322	0912h	2	R	Harmonics value I3	7th	0 to 65535	A	△	○	○
2323	0913h	2	R	Harmonics value IN	7th	0 to 65535	A	△	△	○
2324	0914h	2	R	Harmonics value I1	9th	0 to 65535	A	○	○	○
2325	0915h	2	R	Harmonics value I2	9th	0 to 65535	A	△	△	○
2326	0916h	2	R	Harmonics value I3	9th	0 to 65535	A	△	○	○
2327	0917h	2	R	Harmonics value IN	9th	0 to 65535	A	△	△	○
2328	0918h	2	R	Harmonics value I1	11th	0 to 65535	A	○	○	○
2329	0919h	2	R	Harmonics value I2	11th	0 to 65535	A	△	△	○
2330	091Ah	2	R	Harmonics value I3	11th	0 to 65535	A	△	○	○
2331	091Bh	2	R	Harmonics value IN	11th	0 to 65535	A	△	△	○
2332	091Ch	2	R	Harmonics value I1	13th	0 to 65535	A	○	○	○
2333	091Dh	2	R	Harmonics value I2	13th	0 to 65535	A	△	△	○
2334	091Eh	2	R	Harmonics value I3	13th	0 to 65535	A	△	○	○
2335	091Fh	2	R	Harmonics value IN	13th	0 to 65535	A	△	△	○
2336	0920h	2	R	Harmonics value I1	15th	0 to 65535	A	○	○	○
2337	0921h	2	R	Harmonics value I2	15th	0 to 65535	A	△	△	○
2338	0922h	2	R	Harmonics value I3	15th	0 to 65535	A	△	○	○
2339	0923h	2	R	Harmonics value IN	15th	0 to 65535	A	△	△	○

*1: R : Read only register

If you perform a write operation to these registers, the error code 02h is responded.

*2: ○: Supported

△: Not in use (Register addresses of these items are defined, but they are not measured.)

For these registers, if they are read, "0" is responded.

The data of negative value is represented by two's complement.

The data can be converted to the measured value by unit in the table and multiplying factor indicated in section 7.3 Multiplying factor of monitor data.

(8) Momentary distortion rate of harmonic phase voltage monitor register

Register address		Number of byte	R/W (*1)	Register name		RANGE	Unit	Support (*2)		
Decimal	Hex							EMU4-FD1-MB		
								1P2W	1P3W 3P3W	1P2W
2560	0A00h	2	R	THD V1N	Total	0 to 1000	×0.1%	△	△	○
2561	0A01h	2	R	THD V2N	Total	0 to 1000	×0.1%	△	△	○
2562	0A02h	2	R	THD V3N	Total	0 to 1000	×0.1%	△	△	○
2563	0A03h	2	R	Harmonics ratio V1N	3rd	0 to 1000	×0.1%	△	△	○
2564	0A04h	2	R	Harmonics ratio V2N	3rd	0 to 1000	×0.1%	△	△	○
2565	0A05h	2	R	Harmonics ratio V3N	3rd	0 to 1000	×0.1%	△	△	○
2566	0A06h	2	R	Harmonics ratio V1N	5th	0 to 1000	×0.1%	△	△	○
2567	0A07h	2	R	Harmonics ratio V2N	5th	0 to 1000	×0.1%	△	△	○
2568	0A08h	2	R	Harmonics ratio V3N	5th	0 to 1000	×0.1%	△	△	○
2569	0A09h	2	R	Harmonics ratio V1N	7th	0 to 1000	×0.1%	△	△	○
2570	0A0Ah	2	R	Harmonics ratio V2N	7th	0 to 1000	×0.1%	△	△	○
2571	0A0Bh	2	R	Harmonics ratio V3N	7th	0 to 1000	×0.1%	△	△	○
2572	0A0Ch	2	R	Harmonics ratio V1N	9th	0 to 1000	×0.1%	△	△	○
2573	0A0Dh	2	R	Harmonics ratio V2N	9th	0 to 1000	×0.1%	△	△	○
2574	0A0Eh	2	R	Harmonics ratio V3N	9th	0 to 1000	×0.1%	△	△	○
2575	0A0Fh	2	R	Harmonics ratio V1N	11th	0 to 1000	×0.1%	△	△	○
2576	0A10h	2	R	Harmonics ratio V2N	11th	0 to 1000	×0.1%	△	△	○
2577	0A11h	2	R	Harmonics ratio V3N	11th	0 to 1000	×0.1%	△	△	○
2578	0A12h	2	R	Harmonics ratio V1N	13th	0 to 1000	×0.1%	△	△	○
2579	0A13h	2	R	Harmonics ratio V2N	13th	0 to 1000	×0.1%	△	△	○
2580	0A14h	2	R	Harmonics ratio V3N	13th	0 to 1000	×0.1%	△	△	○
2581	0A15h	2	R	Harmonics ratio V1N	15th	0 to 1000	×0.1%	△	△	○
2582	0A16h	2	R	Harmonics ratio V2N	15th	0 to 1000	×0.1%	△	△	○
2583	0A17h	2	R	Harmonics ratio V3N	15th	0 to 1000	×0.1%	△	△	○

*1: R : Read only register

If you perform a write operation to these registers, the error code 02h is responded.

*2: ○: Supported

△: Not in use (Register addresses of these items are defined, but they are not measured.)

For these registers, if they are read, "0" is responded.

The data of negative value is represented by two's complement.

The data can be converted to the measured value by unit in the table and multiplying factor indicated in section 7.3 Multiplying factor of monitor data.

(9) Momentary distortion rate of harmonic line voltage monitor register

Register address		Number of byte	R/W (*1)	Register name	RANGE	Unit	Support (*2)			
Decimal	Hex						EMU4-FD1-MB			
							1P2W	1P3W 3P3W	1P2W	
2816	0B00h	2	R	THD V12	Total	0 to 1000	×0.1%	○	○	△
2817	0B01h	2	R	THD V23	Total	0 to 1000	×0.1%	△	○	△
2818	0B02h	2	R	N/A	-	-	-	△	△	△
2819	0B03h	2	R	Harmonics ratio V12	3rd	0 to 1000	×0.1%	○	○	△
2820	0B04h	2	R	Harmonics ratio V23	3rd	0 to 1000	×0.1%	△	○	△
2821	0B05h	2	R	N/A	-	-	-	△	△	△
2822	0B06h	2	R	Harmonics ratio V12	5th	0 to 1000	×0.1%	○	○	△
2823	0B07h	2	R	Harmonics ratio V23	5th	0 to 1000	×0.1%	△	○	△
2824	0B08h	2	R	N/A	-	-	-	△	△	△
2825	0B09h	2	R	Harmonics ratio V12	7th	0 to 1000	×0.1%	○	○	△
2826	0B0Ah	2	R	Harmonics ratio V23	7th	0 to 1000	×0.1%	△	○	△
2827	0B0Bh	2	R	N/A	-	-	-	△	△	△
2828	0B0Ch	2	R	Harmonics ratio V12	9th	0 to 1000	×0.1%	○	○	△
2829	0B0Dh	2	R	Harmonics ratio V23	9th	0 to 1000	×0.1%	△	○	△
2830	0B0Eh	2	R	N/A	-	-	-	△	△	△
2831	0B0Fh	2	R	Harmonics ratio V12	11th	0 to 1000	×0.1%	○	○	△
2832	0B10h	2	R	Harmonics ratio V23	11th	0 to 1000	×0.1%	△	○	△
2833	0B11h	2	R	N/A	-	-	-	△	△	△
2834	0B12h	2	R	Harmonics ratio V12	13th	0 to 1000	×0.1%	○	○	△
2835	0B13h	2	R	Harmonics ratio V23	13th	0 to 1000	×0.1%	△	○	△
2836	0B14h	2	R	N/A	-	-	-	△	△	△
2837	0B15h	2	R	Harmonics ratio V12	15th	0 to 1000	×0.1%	○	○	△
2838	0B16h	2	R	Harmonics ratio V23	15th	0 to 1000	×0.1%	△	○	△
2839	0B17h	2	R	N/A	-	-	-	△	△	△

*1: R : Read only register

If you perform a write operation to these registers, the error code 02h is responded.

*2: ○: Supported

△: Not in use (Register addresses of these items are defined, but they are not measured.)

For these registers, if they are read, "0" is responded.

The data of negative value is represented by two's complement.

The data can be converted to the measured value by unit in the table and multiplying factor indicated in section 7.3 Multiplying factor of monitor data.

(10) Harmonics current content rate monitor register

Register address		Number of byte	R/W (*1)	Register name		RANGE	Unit	Support (*2)		
Decimal	Hex							EMU4-FD1-MB		
								1P2W	1P3W 3P3W	1P2W
3072	0C00h	2	R	THD I1	Total	0 to 1000	x0.1%	○	○	○
3073	0C01h	2	R	THD I2	Total	0 to 1000	x0.1%	△	△	○
3074	0C02h	2	R	THD I3	Total	0 to 1000	x0.1%	△	○	○
3075	0C03h	2	R	THD IN	Total	0 to 1000	x0.1%	△	△	○
3076	0C04h	2	R	Harmonics ratio I1	3rd	0 to 1000	x0.1%	○	○	○
3077	0C05h	2	R	Harmonics ratio I2	3rd	0 to 1000	x0.1%	△	△	○
3078	0C06h	2	R	Harmonics ratio I3	3rd	0 to 1000	x0.1%	△	○	○
3079	0C07h	2	R	Harmonics ratio IN	3rd	0 to 1000	x0.1%	△	△	○
3080	0C08h	2	R	Harmonics ratio I1	5th	0 to 1000	x0.1%	○	○	○
3081	0C09h	2	R	Harmonics ratio I2	5th	0 to 1000	x0.1%	△	△	○
3082	0C0Ah	2	R	Harmonics ratio I3	5th	0 to 1000	x0.1%	△	○	○
3083	0C0Bh	2	R	Harmonics ratio IN	5th	0 to 1000	x0.1%	△	△	○
3084	0C0Ch	2	R	Harmonics ratio I1	7th	0 to 1000	x0.1%	○	○	○
3085	0C0Dh	2	R	Harmonics ratio I2	7th	0 to 1000	x0.1%	△	△	○
3086	0C0Eh	2	R	Harmonics ratio I3	7th	0 to 1000	x0.1%	△	○	○
3087	0C0Fh	2	R	Harmonics ratio IN	7th	0 to 1000	x0.1%	△	△	○
3088	0C10h	2	R	Harmonics ratio I1	9th	0 to 1000	x0.1%	○	○	○
3089	0C11h	2	R	Harmonics ratio I2	9th	0 to 1000	x0.1%	△	△	○
3090	0C12h	2	R	Harmonics ratio I3	9th	0 to 1000	x0.1%	△	○	○
3091	0C13h	2	R	Harmonics ratio IN	9th	0 to 1000	x0.1%	△	△	○
3092	0C14h	2	R	Harmonics ratio I1	11th	0 to 1000	x0.1%	○	○	○
3093	0C15h	2	R	Harmonics ratio I2	11th	0 to 1000	x0.1%	△	△	○
3094	0C16h	2	R	Harmonics ratio I3	11th	0 to 1000	x0.1%	△	○	○
3095	0C17h	2	R	Harmonics ratio IN	11th	0 to 1000	x0.1%	△	△	○
3096	0C18h	2	R	Harmonics ratio I1	13th	0 to 1000	x0.1%	○	○	○
3097	0C19h	2	R	Harmonics ratio I2	13th	0 to 1000	x0.1%	△	△	○
3098	0C1Ah	2	R	Harmonics ratio I3	13th	0 to 1000	x0.1%	△	○	○
3099	0C1Bh	2	R	Harmonics ratio IN	13th	0 to 1000	x0.1%	△	△	○
3100	0C1Ch	2	R	Harmonics ratio I1	15th	0 to 1000	x0.1%	○	○	○
3101	0C1Dh	2	R	Harmonics ratio I2	15th	0 to 1000	x0.1%	△	△	○
3102	0C1Eh	2	R	Harmonics ratio I3	15th	0 to 1000	x0.1%	△	○	○
3103	0C1Fh	2	R	Harmonics ratio IN	15th	0 to 1000	x0.1%	△	△	○

*1: R : Read only register

If you perform a write operation to these registers, the error code 02h is responded.

*2: ○: Supported

△: Not in use (Register addresses of these items are defined, but they are not measured.)

For these registers, if they are read, "0" is responded.

The data of negative value is represented by two's complement.

The data can be converted to the measured value by unit in the table and multiplying factor indicated in section 7.3 Multiplying factor of monitor data.

7.2 Specifications of Register Data

- * If the setting data is 8000h (2-byte data) or 80000000h (4-byte data), the data in address concerned is not changed.
- * Please take interval more than 5 seconds after change setting when monitoring (resetup) setup value. If you setup or monitor (resetup) during this time, this unit response error or can't monitor correct values.

7.2.1 Specifications of Register Data

Phase wire system	Setting value	Applicable model
1P2W	0001h	EMU4-FD1-MB
1P3W	0002h	
3P3W	0003h	
3P4W	0004h	

7.2.2 Setting data for primary voltage (line voltage)

The setting value is 4-byte data which the voltage value is converted into. (For example, "6600V" is converted into "6600(000019C8h)".)

(1) EcoMonitorLight(EMU4-FD1-MB)

If the setting for phase wire system is 3P3W or 1P2W:

- For the setting range, refer to the users' manual.
- If the setting value is 110V, 220V or 440V for EMU4-FD1-MB:
 - The setting becomes "Direct (Without VT)", and received value of voltage is considered as the value of direct voltage.
- If the setting voltage is the value other than those above:
 - The setting becomes "With VT", and received primary voltage is set. In this case, the setting of secondary voltage is also necessary.
 - The upper three digits of primary voltage are configurable, and otherwise are rounded down. (If the primary voltage is lower than 100V, the upper two digits of it are configurable.)
- On the setting of 1P3W, 110V is only available.

If the setting for phase wire system is 1P3W:

- Only setup 110V.

If the setting for phase wire system is 3P4W:

- For the setting range, refer to the users' manual.
- If the setting value is 110V, 173V, 182V, 190V, 199V, 208V, 220V, 346V, 380V, 400V, 415V, 420V, 430V, 440V, 460V, 480V.
 - The setting becomes "Direct (Without VT)", and received value of voltage is considered as the value of direct voltage.
- If the setting voltage is the value other than those above:
 - The setting becomes "With VT", and received primary voltage is set. In this case, the setting of secondary voltage is also necessary.
 - The upper three digits of primary voltage are configurable, and otherwise are rounded down. (If the primary voltage is lower than 100V, the upper two digits of it are configurable.)

7.2.3 Setting data for primary voltage (phase voltage)

The setting value is 4-byte data which the tenfold voltage value is converted into. (For example, “63.5V” is converted into “635(0000027Bh)”.)

(1) EcoMonitorLight(EMU4-FD1-MB)

If the setting for phase wire system is 3P3W, 1P3W or 1P2W:

- The exception code of illegal data address is replied. Use the 7.2.2 Setting data for primary voltage (line voltage).

If the setting for phase wire system is 3P4W:

- For the setting range, refer to the users' manual.
- If the setting value is 63.5V, 100V, 105V, 110V, 115V, 120V, 127V, 220V, 230V, 240V, 242V, 250V, 254V, 265V, 277V.
 - The setting becomes “Direct (Without VT)”, and received value of voltage is considered as the value of direct voltage.
- If the setting voltage is the value other than those above:
 - The setting becomes “With VT”, and received primary voltage is set. In this case, the setting of secondary voltage is also necessary.
 - The upper three digits of primary voltage are configurable, and otherwise are rounded down. (If the primary voltage is lower than 100V, the upper two digits of it are configurable.)

7.2.4 Setting data for secondary voltage

The setting value is 4-byte data which the tenfold voltage value is converted into. (For example, “63.5V” is converted into “635(0000027Bh)”.)

- If the setting for phase wire system is 3P3W, 1P3W or 1P2W:
 - For the setting range, refer to the users' manual.(Setup the line voltage)
 - If the primary voltage setting of the device is set to “Direct (Without VT)”, secondary voltage can be set. But the device operates in the setting of direct voltage (primary voltage).
- If the setting for phase wire system is 3P4W
 - For the setting range, refer to the users' manual. (Setup the phase voltage)
 - If the primary voltage setting of the device is set to “Direct (Without VT)”, secondary voltage can be set. But the device operates in the setting of direct voltage (primary voltage).

7.2.5 Setting data for primary current

The setting value is 4-byte data which the tenfold current value is converted into. (For example, “7.5A” is converted into “75(0000004Bh)”.)

For the setting range, refer to the users' manual.

7.2.6 Setting data for secondary current

The setting value is 4-byte data which the tenfold current value is converted into. (For example, “5A” is converted into “5(00000005h)”.)

For the setting range, refer to the users' manual.

7.2.7 Setting data for time constant for demand current and electric power demand

The setting value is 2-byte data which the value is converted into in seconds unit. (For example, “2 min.” is converted into “120(0078h)”.)

For the setting range, refer to the users' manual.

7.2.8 16bit set / reset register

	Bit	Content	Value is "1"	Value is "0"	EMU4-FD1-MB	Note	
Set data	Data L	b0	Reset alarm	Clear it	Do not clear	○	
		b1	Clear integrated data	Clear it	Do not clear	○	Note1
		b2	Not in use	—	—	—	
		b3	Not in use	—	—	—	
		b4	Not in use	—	—	—	
		b5	Not in use	—	—	—	
		b6	Not in use	—	—	—	
	Data H	b7	Not in use	—	—	—	
		b8	Clear contact input latch	Clear it	Do not clear	○	
		b9	Clear external input data	Clear it	Do not clear	○	Note2
		b10	Not in use	—	—	—	
		b11	Not in use	—	—	—	
		b12	Not in use	—	—	—	
		b13	Not in use	—	—	—	
		b14	Clear electric energy data	Clear it	Do not clear	○	
b15	Not in use	—	—	—			

Note1: The integrated value is showed in below differed by the models.

EMU4-FD1-MB: Electric Energy, Reactive energy, Pulse count, Operating time, Periodic electric energy, CO₂ converted value

Note2: The items reset is showed in below differed by the models.

EMU4-FD1-MB: Pulse count, Operating time, Periodic electric energy, CO₂ converted value

7.2.9 16bit monitor

(1) EcoMonitorLight(EMU4-FD1-MB)

	Bit	Content	Value is "1"	Value is "0"	EMU4-FD1-MB	
Monitor data	Data L	b0	Upper limit alarm of pulse count (*1)	Alarm action	No alarm	○
		b1	Not in use	—	—	-
		b2	Upper / lower limit alarm of current demand	Alarm action	No alarm	○
		b3	Upper / lower limit alarm of electric power demand	Alarm action	No alarm	○
		b4	DI	ON	OFF	○
		b5	Upper / lower limit batch alarm	Alarm action	No alarm	○
		b6	Not in use	—	—	-
	Data H	b7	Not in use	—	—	-
		b8	Upper / lower limit alarm of voltage	Alarm action	No alarm	○
		b9	Not in use	—	—	-
		b10	Not in use	—	—	-
		b11	Not in use	—	—	-
		b12	Not in use	—	—	-
		b13	Upper / lower limit alarm of power factor	Alarm action	No alarm	○
		b14	Not in use	—	—	-
b15	Not in use	—	—	-		

*1: b0(Upper limit alarm of pulse count) is only available when external input is setup "Pulse input" in setup of EMU4-FD1-MB.

*2: b4(DI) is only available when external input is setup "Contact input" in setup of EMU4-FD1-MB.

7.2.10 Setting data for measuring method of operating time

Measuring method of operating time	Setting value
By current	0001h
By contact / pulse	0002h

7.2.11 Setting data for multiplying factor

This data indicates multiplying factor of current, voltage, electric power, electric energy, power factor, frequency, content rate of harmonic current, content rate of harmonic voltage, and detail electric energy (register address: 02F2h to 02FAh).

The value of the data is 2-byte value which the exponent of 10^n (i.e., "n") is converted into.

The data of negative value is represented by two's complement.

The true value is obtained by multiplying monitored data by " 10^n ".

7.2.12 Model code data

Model code	Data
EMU4-FD1-MB	000Bh

7.2.13 Logging unit present time

When setting Logging unit present time, specify that the register address is 1030(0406h) and the write points is 3. When a data of Logging unit time in the write multiple registers (10h) is 80000000h, the setting is not skipped.

Ex) When Logging unit time of EMU4-LM is "October 23, 2016 02:34:56, the monitor data are follows.

Register Address		Byte Count	R/W	Register Name	Data(Hex) *1
Dec.	Hex.				
1030	0406h	2	R/W	Logging unit time (Year,Month)	16 10
1031	0407h	2	R/W	Logging unit time (Day,Hour)	23 02
1032	0408h	2	R/W	Logging unit time (Minute,Second)	34 56

*1 Data of logging unit present time are BCD code.

7.2.14 MAC Address

When monitoring MAC Address, specify that the register address is 1066(042Ah) and the read points is 4.

Ex) When MAC Address of EMU4-CM-MT is 00:26:92:FF:6F:A9, the monitor data are follows.

Register Address		Byte Count	R/W	Register Name	Data(Hex)
Dec.	Hex.				
1066	042Ah	4	R	MAC Address (1,2 octet)	00 00 00 26
1068	042Ch	4	R	MAC Address (3 to 6 octet)	92 FF 6F A9

7.2.15 IP Address/Subnet mask/Default gateway

When a data of IP Address/Subnet mask/Default gateway in the write multiple registers (10h) is 80000000h, the setting is not skipped.

Ex) When IP Address of EMU4-CM-MT is 192.168.3.10, the monitor/setting data are follows.

Register Address		Byte Count	R/W	Register Name	Data(Hex)
Dec.	Hex.				
1070	042Eh	4	R/W	IP Address	C0 A8 03 0A

7.3 Multiplying factor of monitor data

True value is converted to the true value by multiplying multiplying factor by below table to the monitored data.

Data	Judgement data	Punctuation	Multiplying factor
Voltage Harmonic voltage RMS	Primary voltage (*1)	Less than 300V	×0.1
		300V or more	×1
Current Current demand Harmonic current RMS	Primary current	Less than 40A	×0.001
		40A or more and less than 400A	×0.01
		400A or more and less than 4000A	×0.1
		4000A or more	×1
Electric power Electric power demand Reactive power	Full load power	Less than 12kW	×0.001
		12kW or more and less than 120kW	×0.01
		120kW or more and less than 1200kW	×0.1
		1200kW or more and less than 12000kW	×1
		12000kW or more	×10
Electric energy Reactive energy	Full load power	Less than 12kW	×0.01
		12kW or more and less than 120kW	×0.1
		120kW or more and less than 1200kW	×1
		1200kW or more and less than 12000kW	×10
		12000kW or more	×100
Electric energy (expansion) Reactive energy (expansion)	Full load power	Less than 12kW	×0.00001
		12kW or more and less than 120kW	×0.0001
		120kW or more and less than 1200kW	×0.001
		1200kW or more and less than 12000kW	×0.01
		12000kW or more	×0.1
Power factor Frequency Content rate	—	—	×0.1(Hold)

*1 Primary voltage is primary voltage (phase voltage) when wire phase system is 3P4W.

*2 Total electric power is calculated in below.

$$\text{Total electric power [kW]} = \frac{\alpha \times (\text{Primary voltage}) \times (\text{Primary current})}{1000}$$

α value is showed in below table.

Wire phase system	α value	Note
1P2W	α=1	
1P3W	α=2	Please setup the primary voltage is 110V(in 110/220V system)
3P3W	α=1.732	
3P4W	α=3	Primary voltage is setup value of phase voltage