Modbus Communication Manual

Supported Modular Models
WLD-PA□□R
WMS-PE2D□
WMB Series

Ver.1.70

Specification number SI-0611-07

watanabe
渡辺電機工業株式会社

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Modbus is a subsidiary of Modicon Inc. (AEG Schneider Automation International S.A.S.) It is a registered trademark.

At first

This specification explains the precautions, information, and settings for using our Modbus-compatible products.

Please be sure to observe the following in order to use the product correctly and safely.

- Please read this specification carefully before use and ensure proper usage.
- When building the system, please carefully read the instruction manual of the Modbus-compatible product or other device you are using and use it correctly.
- After reading it, keep it in a safe place and read it when you need it.

Restrictions on use

● **Please note that the contents of this specification are subject to change without notice.**

Our company shall not be liable under any circumstances for special damages, indirect damages, or consequential damages arising from this specification.

In this specification, hexadecimal data is represented by adding "H" after the number. Nothing is appended to the decimal data.
e.g. hexadecimal: 123H, decimal: 123

1. Summary

This document explains the specifications of Modbus communication applicable to Modbus-compatible products manufactured by Watanabe Electric Industry Co., Ltd.
It is intended for engineers who develop processes to connect to our Modbus-compatible products from a Modbus master and perform settings and data collection.
We assume that the Modbus master will be a PC or a PLC (Programmable Logic Controller). Please prepare the device to be used as the Modbus master in advance.

First, refer to "2. Module Communication Specifications" and set the module (WLD or WMB series) connected to the Modbus master to comply with the communication specifications.
Then, based on "3. Modbus Communication Specifications," refer to "5. Address Map" of the applicable module to perform the necessary settings and readings.

2. Module Communication Specifications

2-1. Supported Modules

The corresponding modules assumed in this specification are as follows.
WLD-PA□□R-2□□□-□A□00 (RS485 model)
WMS-PE2D□
WMB Series [WMB-DI16 (WMB-DI16A), WMB-DIO8R (WMB-DIO8RA), WMB-AI8, WMB-AO4, WMB-MAI6]

※ The WMB-DI16 and WMB-DI16A are expansion modules for the WMB-DI16. Similarly, the WMB-DIO8RA is an expansion module for the WMB-DIO8R. When expanded, the number of channels in the main module can be used in an expanded form.

2-2. Module Communication Specifications

The communication specifications for connecting to each module are shown in the table below.

table 2.1Module Communication Specifications

	WMS-PE2D□	WLD-PA□□R-2□□□-□A□00	WMB Series		
Standard	RS-485 compliant				
Protocol	Modbus (RTU)				
Synchronization method	asynchronous				
Communication Methods	2-wire half-duplex				
Error Detection Method	CRC-16				
Transmission speed	4800bps, 9600bps, 19200bps, 38400bps	9600bps, 19200bps	4800bps, 9600bps, 19200bps, 38400bps		
Data Length	8 (fixed)				
Start Bit	1 (fixed)				
Parity Bits	Even, Odd, None				
Stop Bits	1, 2 (Stop bit 2 can be set only when there is no parity)	1 (fixed)	1, 2 (Stop bit 2 can be set only when there is no parity)		
Signal name	Non-inverting (+), inverting (-)				
Termination Resistor	Approx. 120Ω (Enabled by turning ON the DIP switch on the front of the unit)	Approx. 120Ω (Install the included termination resistor)			
Number of connected devices	31 units (number of slave devices)				
Configurable Addresses	1~99 (0 is not allowed)	1~31 (0 is not allowed)	1~99 (0 is not allowed)		
Transmission distance (total)	Up to 1.2km	Up to 1.2km	500m or less		

2-3. Cabling the Module

2-3-1. Wiring method

Modbus communication wiring is wired in a daisy chain.
If there are multiple branches from the star wire or module, it may not be possible to communicate properly.

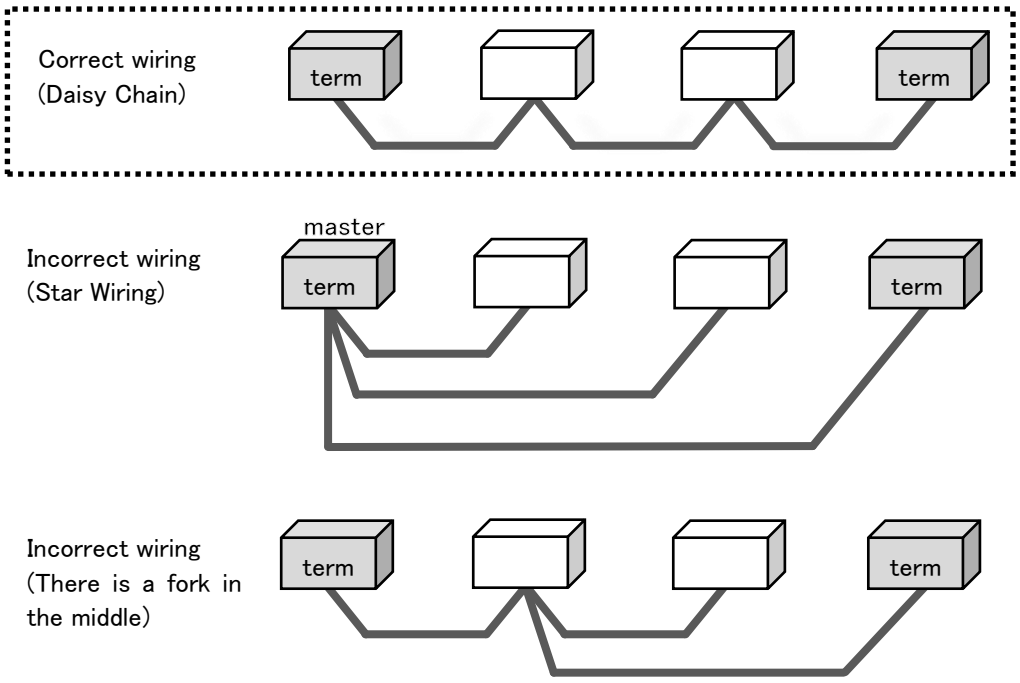


illustration 2.1 Wiring for Modbus communication

2-3-2. Connection Terminals

The Modbus (RS485) connection terminals of each module are described.

1. WLD

The Modbus (RS485) connection terminal of the WLD is shown in the figure below.

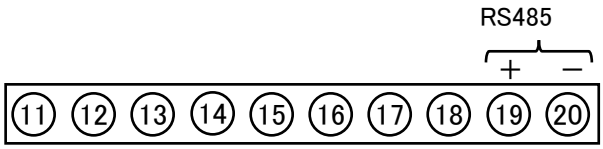


illustration 2.2 WLD Connector

table 2.2WLD Connector Contents

Terminal number	symbol		substance
19	RS485 (※)	+	Communication + Terminals
20		−	Communication- Terminals

※ To set the termination resistor, connect the supplied 120 Ω.

2. WMB Series

The figure below shows the terminal blocks of the WMB series communication wires.

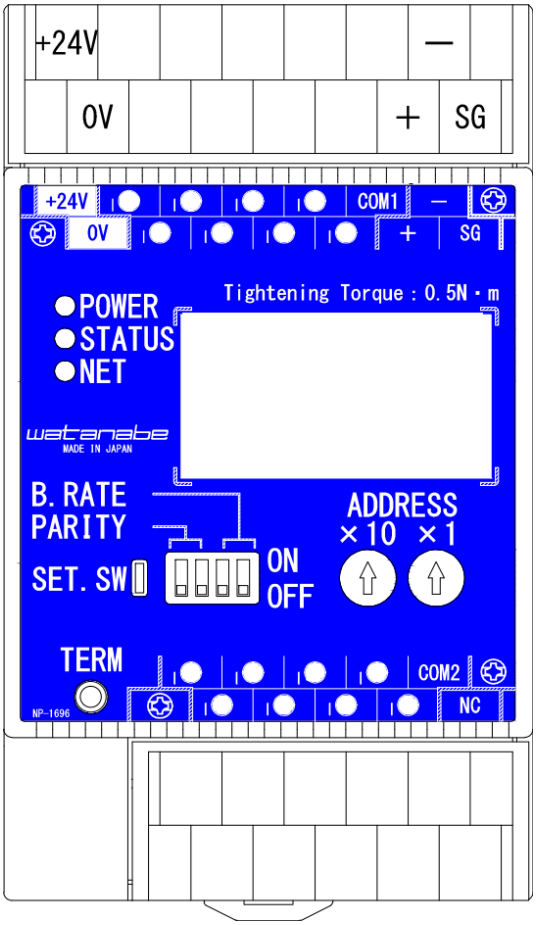


illustration 2.3WMB Series Terminal Blocks

table 2.3WMB Series RS485 terminal block

Terminal number	symbol		Pin Name
+	RS485	+	Communication + Terminals
−		−	Communication- Terminals
SG		SG	Communication SG pin

※ To set the termination resistor, connect the supplied 120 Ω.

3. WMS-PE2D□-00A□01

The Modbus (RS485) connection terminal of the WMS-PE2D□-00A□00 is shown in the figure below.

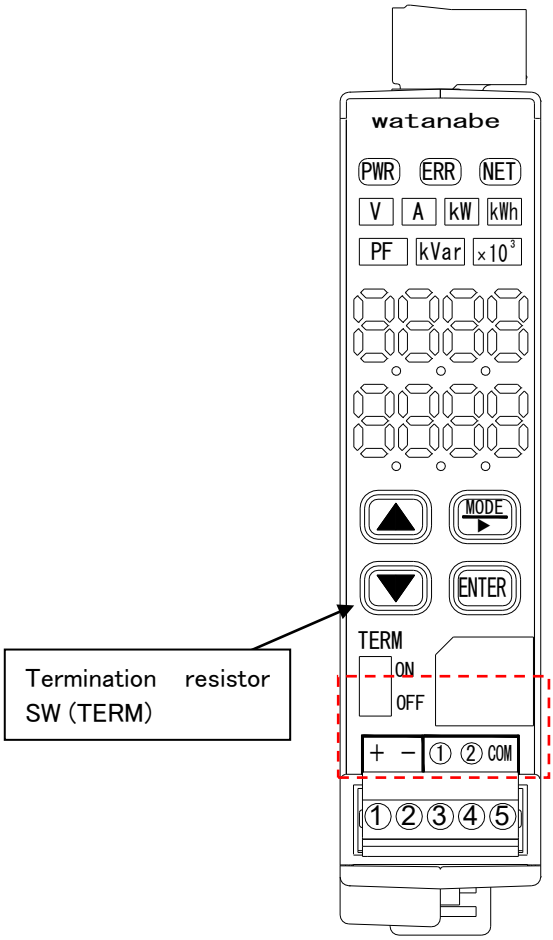


table 2.4WMS-PE2D□-00A□00 RS485 Connector Contents

Terminal number	symbol		Pin Name
1	RS485	+	Communication + Terminals
2		−	Communication- Terminals

* When the termination resistor SW is turned on, the termination resistor (120Ω) is enabled.

2-3-3. Example of configuration diagram

The WLD, WMS-PE2D□ and WMB series configuration examples are shown below.

1. About communication cables

Please use shielded cables that meet the specifications below for WLD, WMS-PE2D□, and WMB series respectively.

table 2.5Communication cable specifications for each product

Product Name	size	Total cable length
WLD	AWG24	1.2km or less
WMS-PE2D□	AWG24~16	1.2km or less
WMB Series	AWG26~16	500m or less

2. About Connecting Termination Resistors

Slaves (modules) can connect up to a maximum of 31 units.
In such cases, the module functioning as the terminal device on the line should be configured with a termination resistor.
Connect the supplied termination resistor (120Ω) to the WLD (between the 19th and 20th terminals).
For WMS-PE2D□, turn ON the termination resistor switch.
For the WMB series, connect the supplied termination resistor (120Ω) between the + terminal and the - terminal.
If this unit is not functioning as the terminal device on the line, do not install the termination resistor.

When using a USB-RS485 converter for Modbus connection, configure the termination resistor for the USB-RS485 converter even if the master is a computer (see diagram below).

Note: Do not construct a configuration where multiple masters are connected to the same slave (module).
This may result in communication errors and prevent data from being retrieved correctly.

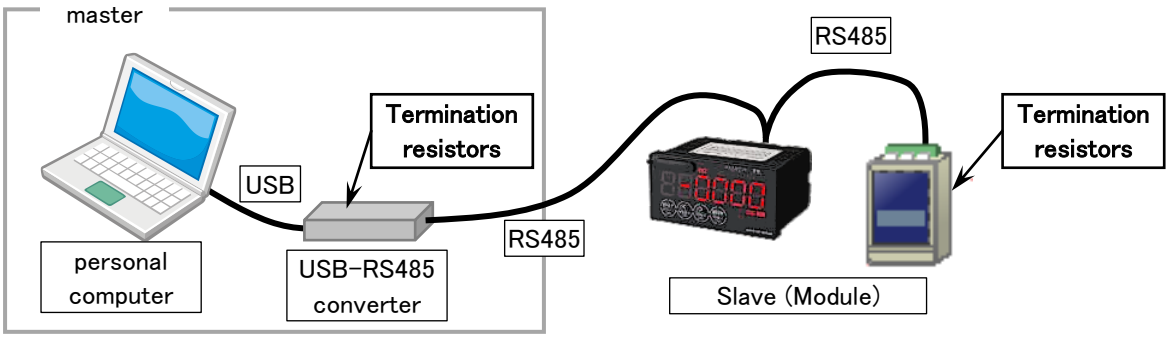


illustration 2.4 Termination resistors when using USB-to-RS485 converters

3. WLD

The Modbus connection of the WLD is shown in the figure below.
The master and final slave (WLD in the figure below) should be set to termination resistors.

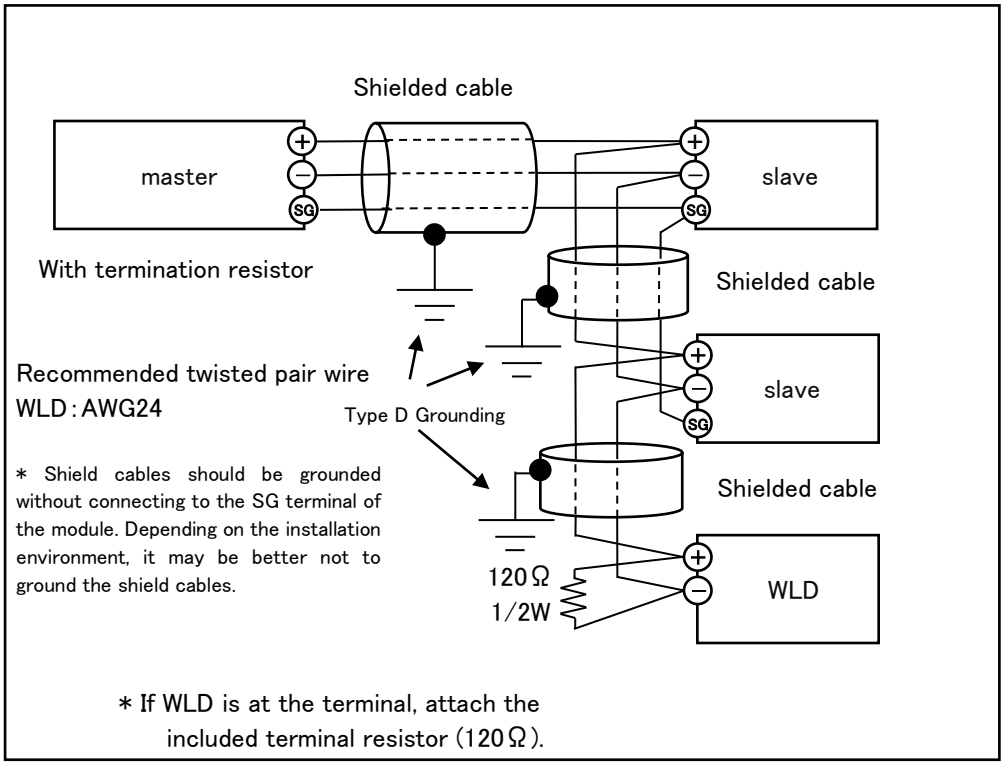


illustration 2.5 Modbus connection for WLD

table 2.6Modbus connection terminal (WLD)

Terminal number	symbol		Pin Name
+	RS485	+	Communication + Terminals
−		−	Communication- Terminals

4. WMB Series

The Modbus connections of the WMB series are as follows:
The master and final slave (WMB series in the figure below) should be set with termination resistors.

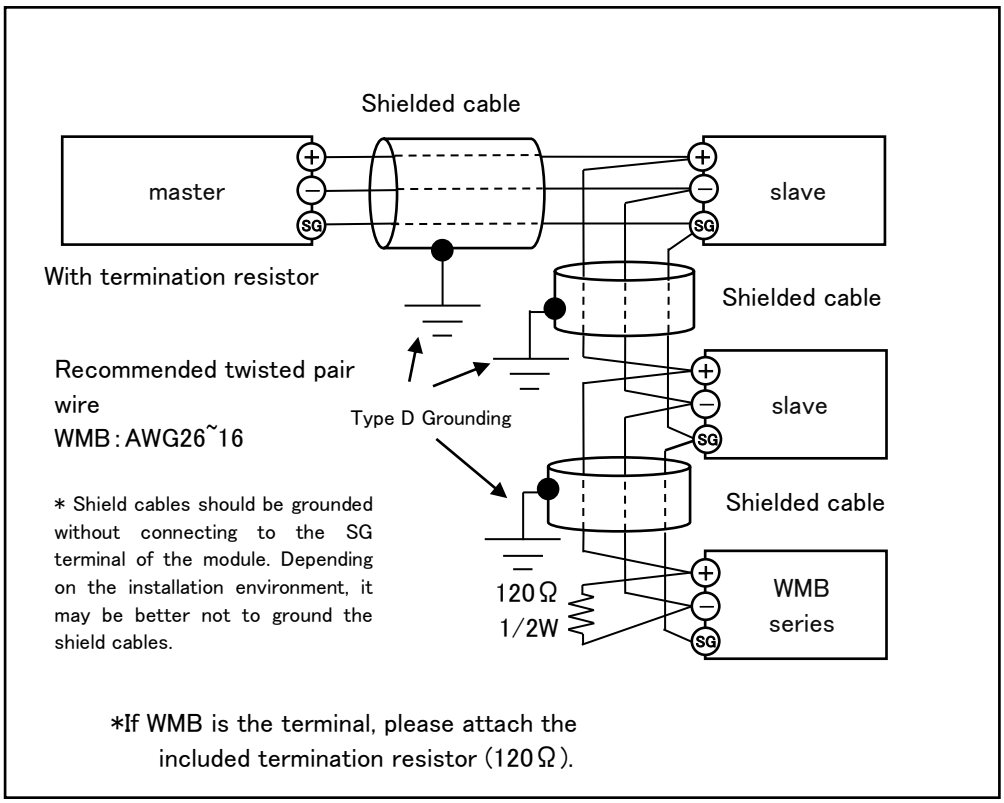


illustration 2.6 Modbus connection for WMB series

table 2.7 Modbus connection terminal (WMB series)

Terminal number	symbol		Pin Name
+	RS485	+	Communication + Terminals
−		−	Communication- Terminals
SG		SG	Communication SG pin

5. WMS-PE2D□

The Modbus connection of the WMS-PE2D□ is shown in the figure below.
Enable the termination resistor by turning on the termination resistor SW of the master and the final slave (WMS-PE2D□ in the figure below).
Please.

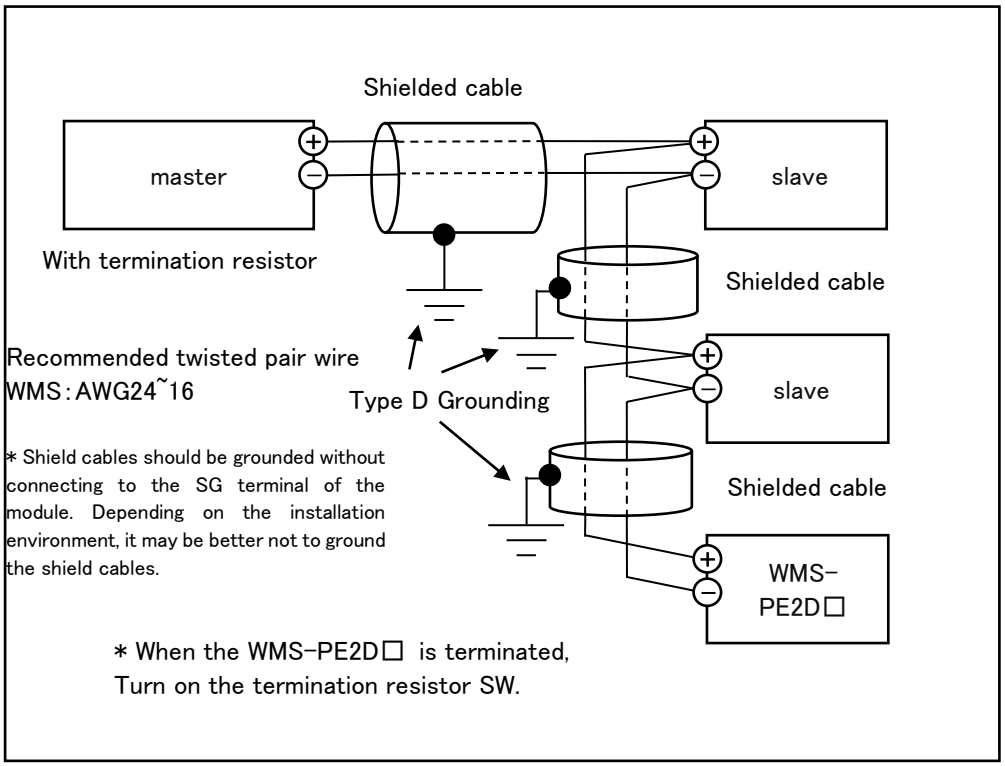


illustration 2.7 Modbus connection of the WMS-PE2D□

table 2.8Modbus connection terminal (WMS-PE2D□)

Terminal number	symbol		Pin Name
1	RS485	+	Communication + Terminals
2		−	Communication- Terminals

* When the termination resistor SW is turned on, the termination resistor (120Ω) is enabled.

3. Modbus Communication Specifications

Modbus is a single-master/multi-slave system.
Messages are sent from one Modbus master to the slaves (modules). The message is sent to the specified slave (module).

3-1. Communication Procedures

When the master sends a command message, the slave (module) sends a reply message in response to the content of the message.
The behavior of master-side and slave-side messages is as follows:

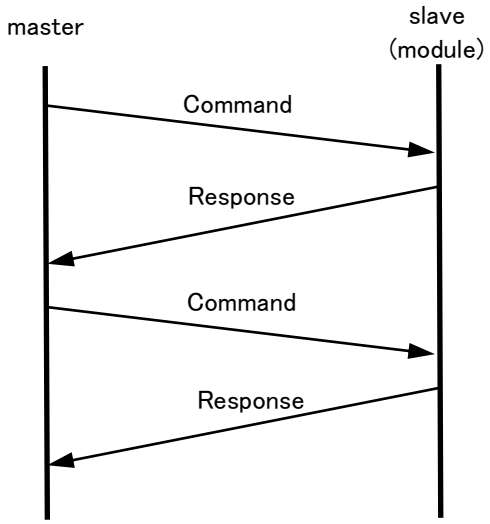
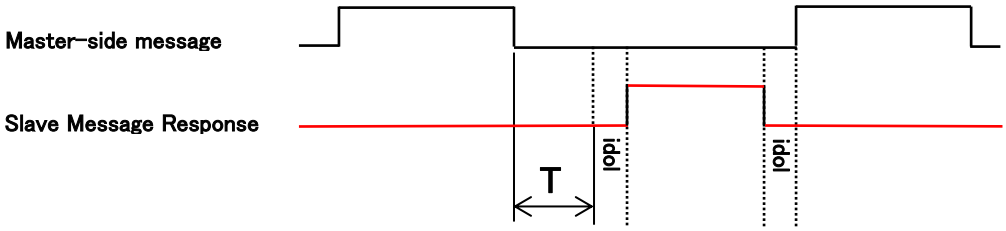


illustration 3.1 Communication Procedures

3-2. Transmission / reception switching time

A 3.5-character idle time is required when switching between transmission and reception in communication between master and slave.



In WLD/WMS-PE2D□, the above-mentioned "T" time can be additionally configured. (The WMB series does not have a setting for this item. It is equivalent to T=0.)
For details on configuring the "T" transmission/reception switching time, please refer to the "Setting Parameters" → "RS485" → "Transmission/Reception Switching Time" section in the WLD instruction manual (for installers).
For WMS-PE2D□, please refer to the transmission wait time section in the Modbus communication settings.

Refer to the table below for the 3.5-character idle time.
In WLD, WMB series, and WMS-PE2D□, the communication speed and parity settings can be modified.

table 3.1Idle time for 3.5 characters (reference value)

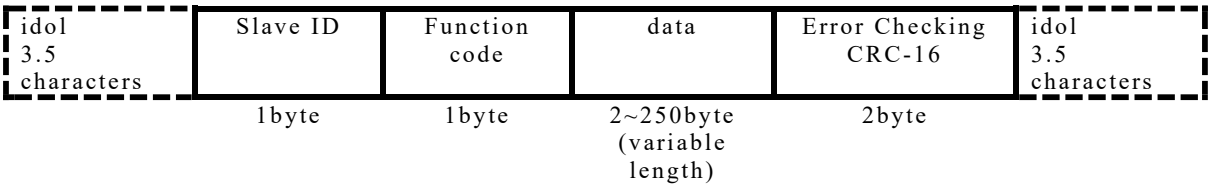
Transmission speed	With parity (even, odd)	No parity
4800bps	8.02ms	7.29ms
9600bps	4.01ms	3.65ms
19200bps	2.01ms	1.82ms
38400bps	1.00ms	0.91ms

The WMB series should be set to this duration or longer.

3-3. Message

3-3-1. Configuring Messages

After ensuring an idle interval of more than 3.5 character transmission times, the communication message is sent and concludes after an idle time exceeding 3.5 character transmission times.



3-3-2. Message content

The following table describes the data and contents that can be set in the structure of the above message.
Publisher indicates which can be the publisher of each item.
In this case, both the master and the slave can be the publisher.

table 3.2Message content

item	Configuration data	Publisher	substance
Slave ID	01~FFH	Master/Slave	Slave ID (maximum number of connected devices is 31)
Function code	01H	Master/Slave	Coil Readout
	02H	Master/Slave	Input Status Readout
	03H	Master/Slave	Hold Register Reads
	04H	Master/Slave	Input Register Readout (Read-only address)
	05H	Master/Slave	Coil Writing
	06H	Master/Slave	Holding Register 1 Word Write
	08H	Master/Slave	diagnosis
	0FH	Master/Slave	Coil Continuous Write
	10H	Master/Slave	Hold Register: Continuous Writes
data	—	Master/Slave	Data (variable length depending on the command)
Error Checking (CRC-16)	Calculate CRC-16 from the last byte of the slave ID ~ data, and append the CRC-16 (2 bytes) of the calculation result to the data in the order of the low-order byte and the high-order byte		

3-3-3. Types of data

There are four types of Modbus data: coils, input status, input registers, and holding registers.

table 3.3Types of data

Types of data	Write	detail
coil	Write	It is used as a switch to acquire the status of the slave and to change the mode. It deals with binary data.
Input Status	Read-only	It is used as the status input of the slave. It deals with binary data.
Input Registers	Read-only	It is used to store information in the slave.
Holding Registers	Write	It is used to store slave configuration information.

3-3-4. Slave ID

A reply message is returned only when the received message matches the ID value set in the module.
If they do not match, no response message is returned.
Please note that the maximum number that can be set varies depending on the module.

3-3-5. Function code

The function code is a code that specifies the action to be performed by the slave and is included in the message sent from the master to the slave. The function codes explained in this specification are as shown in the table below. Since the function codes supported vary depending on the module, please refer to the relevant section of "5. Address Map" for the respective model for details.

table 3.4List of available function codes

Function code	Functional description
01H	Coil Readout
02H	Input Status Readout
03H	Hold Register Reads
04H	Input Register Readout (Read-only address)
05H	Coil Writing
06H	Holding Register 1 Word Write
08H	diagnosis
0FH	Coil Continuous Write
10H	Hold Register: Continuous Writes

3-3-6. Function code data

The functional code is described in detail.

> ⚠ Caution
> Note that the CRC of error checking is appended in the order of low-order byte and then high-order byte.

1. Function Code 01H (Coil Readout)

Reads the status (ON/OFF) of the coil at the specified address.

Transmit and Receive Formats

◎ Transmitted data (master→ slave (module))

table 3.5Transmission format for function code 01H

name		Transmitted data
Slave ID		01 ~ FFH
Function code		01H
address	higher rank	0000 ~ 270FH
	subordinate	
Number of read data	higher rank	0001 ~ 07D0H
	subordinate	
Error Checking (CRC-16)	subordinate	0000 ~ FFFFH
	higher rank	

◎ Received data (slave (module) → master)

table 3.6Reception format for function code 01H

name		Incoming data
Slave ID		01 ~ FFH
Function code		01H
Bytes read (Readout data ÷ 8)		01 ~ FAH
1st data		00 ~ FFH
Second data		00 ~ FFH
≀		≀
Last Data		00 ~ FFH
Error Checking (CRC-16)	subordinate	0000 ~ FFFFH
	higher rank	

Data is packed as one coil as one bit of data.
Therefore, one byte contains 8 coils.

Communication example

In the main module WMB-DIO8R and the expansion module WMB-DIO8RA with slave ID 01H, 10 data (main 8 channels, 2 additional channels) are read from the module address 0000H (output control to DO) of the module.

- Transmission data (master → slave (module))

table 3.7Transmitted data with function code 01H

name		Transmitted data
Slave ID		01H
Function code		01H
address	higher rank	00H
	subordinate	00H
Number of read data	higher rank	00H
	subordinate	0AH
Error Checking (CRC-16)	subordinate	BCH
	higher rank	0DH

- Received data (slave (module) → master)

table 3.8Received data with function code 01H

name		Incoming data
Slave ID		01H
Function code		01H
Bytes read		02H
1st data		89H
Second data		03H
Error Checking (CRC-16)	subordinate	9EH
	higher rank	6DH

The readout data is 89H and 03H.
This indicates that CH1, CH4, and CH8 of the main module and CH1 and CH2 of the expansion module are turned on.
Since the number of readouts is 10, 0 is returned for the channels after the expansion module CH3.

2. Function Code 02H (Input Status Readout)

Reads the input status of the specified address.

Transmit and Receive Formats

◎ Transmitted data (master→slave (module))

table 3.9Transmission format for function code 02H

name		Transmitted data
Slave ID		01 ~ FFH
Function code		02H
address	higher rank	0000 ~ 270FH
	subordinate	
Number of read data	higher rank	0001 ~ 07D0H
	subordinate	
Error Checking (CRC-16)	subordinate	0000 ~ FFFFH
	higher rank	

◎ Received data (slave (module) → master)

table 3.10Reception format with function code 02H

name		Incoming data
Slave ID		01 ~ FFH
Function code		02H
Bytes read (Readout data ÷ 8)		01 ~ FAH
1st data		00 ~ FFH
Second data		00 ~ FFH
≀		≀
Last Data		00 ~ FFH
Error Checking (CRC-16)	subordinate	0000 ~ FFFFH
	higher rank	

The data is packed as a single input status as a single bit of data.
Therefore, one byte contains 8 input statuses.

Communication example

The main module WMB-DIO8R and the expansion module WMB-DIO8RA with slave ID 01H read out 10 data items from address 0080H (raw control state of the DO output channel of DO-CH1~CH128).

- Transmitted data (master→slave (module))

table 3.11Transmitted data with function code 02H

name		Transmitted data
Slave ID		01H
Function code		02H
address	higher rank	00H
	subordinate	80H
Number of read data	higher rank	00H
	subordinate	0AH
Error Checking (CRC-16)	subordinate	F9H
	higher rank	E5H

- Received data (slave (module) → master)

table 3.12Received data with function code 02H

name		Incoming data
Slave ID		01H
Function code		02H
Bytes read		02H
1st data		E5H
Second data		00H
Error Checking (CRC-16)	subordinate	F3H
	higher rank	28H

The read data is E5H and 00H.
This means that CH1, CH3, CH6, CH7, and CH8 of the main module are turned on.
Since the number of readouts is 10, 0 is returned for the channels after the expansion module CH3.

3. Function Code 03H (Hold Register Read)

Reads the parameter value for the specified address.

Transmit and Receive Formats

◎ Transmitted data (master→ slave (module))

table 3.13Transmission format for function code 03H

name		Transmitted data
Slave ID		01 ~ FFH
Function code		03H
address	higher rank	0000 ~ 270FH
	subordinate	
Number of words read (Data length ÷ 2)	higher rank	0001 ~ 007DH
	subordinate	
Error Checking (CRC-16)	subordinate	0000 ~ FFFFH
	higher rank	

* Specify the number of read words in units of data length for each address.

◎ Received data (slave (module) → master)

table 3.14Reception format with function code 03H

name		Incoming data
Slave ID		01 ~ FFH
Function code		03H
Bytes read		2 × Word Read
First Word data	higher rank	0000 ~ FFFFH
	subordinate	
Next Word data	higher rank	0000 ~ FFFFH
	subordinate	
≀	≀	≀
Last Word data	higher rank	0000 ~ FFFFH
	subordinate	
Error Checking (CRC-16)	subordinate	0000 ~ FFFFH
	higher rank	

4. Function code 04H (Input register read [read-only address])

Reads the measurement value of the specified read-only address.

Transmit and Receive Formats

◎ Transmitted data (master→ slave (module))

table 3.15Transmission format with function code 04H

name		Transmitted data
Slave ID		01 ~ FFH
Function code		04H
address	higher rank	0000 ~ 270FH
	subordinate	
Number of words read (Data length ÷ 2)	higher rank	0001 ~ 007DH
	subordinate	
Error Checking (CRC-16)	subordinate	0000 ~ FFFFH
	higher rank	

* Specify the number of read words in units of data length for each address.

◎ Received data (slave (module) → master)

table 3.16Reception format with function code 04H

name		Incoming data
Slave ID		01 ~ FFH
Function code		04H
Bytes read		2 × Word Read
First Word data	higher rank	0000 ~ FFFFH
	subordinate	
Next Word data	higher rank	0000 ~ FFFFH
	subordinate	
≀	≀	≀
Last Word data	higher rank	0000 ~ FFFFH
	subordinate	
Error Checking (CRC-16)	subordinate	0000 ~ FFFFH
	higher rank	

5. Function Code 05H (Coil Writing)

Set the coil state to ON/OFF.

Transmit and Receive Formats

◎ Transmitted data (master→ slave (module))

table 3.17Transmission format for function code 05H

name		Transmitted data
Slave ID		01 ~ FFH
Function code		05H
address	higher rank	0000 ~ 270FH
	subordinate	
Change Data	higher rank	ON:FF00H OFF:0000H
	subordinate	
Error Checking (CRC-16)	subordinate	0000 ~ FFFFH
	higher rank	

◎ Received data (slave (module) → master)

table 3.18Reception format with function code 05H

name		Incoming data
Slave ID		01 ~ FFH
Function code		05H
address	higher rank	0000 ~ 270FH
	subordinate	
writing Word data	higher rank	ON:FF00H OFF:0000H
	subordinate	
Error Checking (CRC-16)	subordinate	0000 ~ FFFFH
	higher rank	

Communication example

Set CH01 of WMB-DIO8R with slave ID 8H to ON.

- Transmission data (master → slave (module))

table 3.19Transmitted data with function code 05H

name		Transmitted data
Slave ID		01H
Function code		05H
address	higher rank	00H
	subordinate	04H
writing Word data	higher rank	FFH
	subordinate	00H
Error Checking (CRC-16)	subordinate	CDH
	higher rank	FBH

- Received data (slave (module) → master)

table 3.20Received data with function code 05H

name		Incoming data
Slave ID		01H
Function code		05H
address	higher rank	00H
	subordinate	04H
writing Word data	higher rank	FFH
	subordinate	00H
Error Checking (CRC-16)	subordinate	CDH
	higher rank	FBH

6. Function Code 06H (Hold Register 1 Word Write)

Writes 1 word (2 bytes) of data to the specified writable address.

Transmit and Receive Formats

◎ Transmitted data (master→ slave (module))

table 3.21Transmission format with function code 06H

name		Transmitted data
Slave ID		01 ~ FFH
Function code		06H
address	higher rank	0000 ~ 270FH
	subordinate	
writing Word data	higher rank	0000 ~ FFFFH
	subordinate	
Error Checking (CRC-16)	subordinate	0000 ~ FFFFH
	higher rank	

◎ Received data (slave (module) → master)

table 3.22Reception format with function code 06H

name		Incoming data
Slave ID		01 ~ FFH
Function code		06H
address	higher rank	0000 ~ 270FH
	subordinate	
writing Word data	higher rank	0000 ~ FFFFH
	subordinate	
Error Checking (CRC-16)	subordinate	0000 ~ FFFFH
	higher rank	

Communication example

Write 0000H to address 01H (maximum, minimum reset) of WLD with slave ID 0028H.

- Transmission data (master → slave (module))

table 3.23Transmitted data with function code 06H

name		Transmitted data
Slave ID		01H
Function code		06H
address	higher rank	10H
	subordinate	28H
writing Word data	higher rank	00H
	subordinate	00H
Error Checking (CRC-16)	subordinate	0DH
	higher rank	02H

- Received data (slave (module) → master)

table 3.24Received data with function code 06H

name		Incoming data
Slave ID		01H
Function code		06H
address	higher rank	10H
	subordinate	28H
writing Word data	higher rank	00H
	subordinate	00H
Error Checking (CRC-16)	subordinate	0DH
	higher rank	02H

7. Function Code 08H (Diagnostic)

This is the communication that diagnoses the communication between the master and the slave, and the communication that diagnoses the module.

Transmit and Receive Formats

◎ Transmitted data (master→ slave (module))

table 3.25Transmission format with function code 08H

name		Transmitted data
Slave ID		01 ~ FFH
Function code		08H
Diagnostic subcodes	higher rank	0000 ~ 0015H
	subordinate	
Data Fields	higher rank	0000 ~ FFFFH
	subordinate	
Error Checking (CRC-16)	subordinate	0000 ~ FFFFH

◎ Received data (slave (module) → master)

table 3.26Reception format with function code 08H

name		Incoming data
Slave ID		01 ~ FFH
Function code		08H
Diagnostic subcodes	higher rank	0000 ~ 0015H
	subordinate	
Data Fields	higher rank	0000 ~ FFFFH
	subordinate	
Error Checking (CRC-16)	subordinate	0000 ~ FFFFH
	higher rank	

Diagnostic subcodes and diagnostic contents

The corresponding diagnostic subcodes are listed in the table below.

table 3.27Corresponding diagnostic subcodes

diagnosis Subcode	Diagnostic Name	Diagnosis details
00H	Return Query Data	Return the data in the submitted data field as it is.
0AH	Clear Counters and Diagnostic Register	Clear all counters and diagnostic registers.
0BH	Return Bus Message Count	Returns the sum of messages detected by the slave.
0CH	Return Bus Communication Error Count	Returns the sum of CRC errors detected by the slave.
0DH	Return Bus Exception Error Count	Returns the sum of the Modbus exception responses returned by the specified slave.
0EH	Return Server Message Count	Returns the total number of messages received by the specified slave.
0FH	Return Server No Response Count	Returns the total number of messages to which the specified slave did not respond.
10H	Return Server NAK Count	Returns the sum of the messages for which the specified slave returned a NAK.
11H	Return Server Busy Count	Returns the number of times the specified slave returned a slave busy exception response.
12H	Return Bus Character Overrun Count	Returns the number of times a character overrun error occurred on the specified slave.

Communication example

Communication is performed with the module with slave ID 01H using diagnostic subcode 00H (Return Query Data).
The following is an example of specifying 55 AAH for the written word data.

- Transmission data (master → slave (module))

table 3.28Transmitted data with function code 08H

name		Transmitted data
Slave ID		01H
Function code		08H
Diagnostic subcodes	higher rank	00H
	subordinate	00H
Data Fields	higher rank	55H
	subordinate	AAH
Error Checking (CRC-16)	subordinate	5FH
	higher rank	24H

- Received data (slave (module) → master)

table 3.29Received data with function code 08H

name		Incoming data
Slave ID		01H
Function code		08H
Diagnostic subcodes	higher rank	00H
	subordinate	00H
Data Fields	higher rank	55H
	subordinate	AAH
Error Checking (CRC-16)	subordinate	5FH
	higher rank	24H

8. Function Code 0FH (Coil Continuous Write)

Set the state of the continuous coil to ON/OFF.

Transmit and Receive Formats

◎ Transmitted data (master→ slave (module))

table 3.30Transmission format with function code 0FH

name		Transmitted data
Slave ID		01 ~ FFH
Function code		0FH
Start address	higher rank	0000 ~ 270FH
	subordinate	
Number of data	higher rank	0001 ~ 07B0H
	subordinate	
Number of bytes		01 ~ F6H
Initial change data		00 ~ FFH
Next Change Data		00 ~ FFH
≀	≀	≀
Last Modified Data		00 ~ FFH
Error Checking (CRC-16)	subordinate	0000 ~ FFFFH
	higher rank	

◎ Received data (slave (module) → master)

table 3.31Reception format with function code 0FH

name		Incoming data
Slave ID		01 ~ FFH
Function code		0FH
Start address	higher rank	0000 ~ 270FH
	subordinate	
Number of data	higher rank	0001 ~ 07B0H
	subordinate	
Error Checking (CRC-16)	subordinate	0000 ~ FFFFH
	higher rank	

Communication example

In WMB-DIO8R with slave ID 01H, output and set the DO of CH5~CH7.

- Transmission data (master → slave (module))

table 3.32Transmitted data with function code 0FH

name		Transmitted data
Slave ID		01H
Function code		0FH
Start address	higher rank	00H
	subordinate	04H
Number of data	higher rank	00H
	subordinate	03H
Number of bytes		01H
Write data		07H
Error Checking (CRC-16)	subordinate	3FH
	higher rank	55H

- Received data (slave (module) → master)

table 3.33Received data with function code 0FH

name		Incoming data
Slave ID		01H
Function code		0FH
address	higher rank	00H
	subordinate	04H
Number of data	higher rank	00H
	subordinate	03H
Error Checking (CRC-16)	subordinate	54H
	higher rank	0BH

9. Function Code 10H (Hold Register Continuous Write)

Writes contiguous data to the specified writable address.

Transmit and Receive Formats

◎ Transmitted data (master→ slave (module))

table 3.34Transmission format with function code 10H

name		Transmitted data
Slave ID		01 ~ FFH
Function code		10H
Start address	higher rank	0000 ~ 270FH
	subordinate	
Number of data	higher rank	0001 ~ 007BH
	subordinate	
Number of bytes		01 ~ F6H
First Writes Word data	higher rank	0000 ~ FFFFH
	subordinate	
Write Next Word data	higher rank	0000 ~ FFFFH
	subordinate	
≀	≀	≀
Last Written Word data	higher rank	0000 ~ FFFFH
	subordinate	
Error Checking (CRC-16)	subordinate	0000 ~ FFFFH
	higher rank	

◎ Received data (slave (module) → master)

table 3.35Reception format with function code 10H

name		Incoming data
Slave ID		01 ~ FFH
Function code		10H
Start address	higher rank	0000 ~ 270FH
	subordinate	
Number of data	higher rank	0001 ~ 007BH
	subordinate	
Error Checking (CRC-16)	subordinate	0000 ~ FFFFH
	higher rank	

Communication example

Write 0000H (0.0000), 9C40H (20.0000), and FFFFH (32.7675) respectively to address 0000H~0002H (CH1~CH3 analog input span adjustment) of WMB-AI8 with slave ID 01H.

- Transmission data (master → slave (module))

table 3.36Transmitted data with function code 10H

name		Transmitted data
Slave ID		01H
Function code		10H
Start address	higher rank	00H
	subordinate	00H
Number of data	higher rank	00H
	subordinate	03H
Number of bytes		06H
writing Word Data 1	higher rank	00H
	subordinate	00H
writing Word Data 2	higher rank	9CH
	subordinate	40H
writing Word Data 3	higher rank	FFH
	subordinate	FFH
Error Checking (CRC-16)	subordinate	C8H
	higher rank	B4H

- Received data (slave (module) → master)

table 3.37Received data with function code 10H

name		Incoming data
Slave ID		01H
Function code		10H
address	higher rank	00H
	subordinate	00H
Number of data	higher rank	00H
	subordinate	03H
Error Checking (CRC-16)	subordinate	80H
	higher rank	08H

10. About communication time

See the example below for how long it takes to communicate.

Example: In WLD, if you measure the time with the following settings, it will go around in about 7 seconds.

- Communication speed set to 19200bps
- Other conditions are default (no parity, transmit/receive switching time 10ms)
- Read 60 byte data from 0980H ~ 099AH
- Use 04H as the function code.

- The number of connected devices is 31 (the weight of issuing commands to the next device is 150ms)

Please note that the time varies depending on the communication environment.

3-4. Error Detection

3-4-1. CRC-16

CRC-16 is 2-byte error checking data. The calculation range is from the slave ID at the beginning of the message to the end of the data section.
The slave (module) calculates the CRC of the received message, and if it does not match the received CRC code, it becomes unresponsive and does not perform any function.

3-4-2. Calculation of CRC-16

The CRC is calculated by dividing the transmitted data by the generated polynomial (X16 + X15 + X2 + X0), and then dividing the remainder by the low-order byte for error checking, Set in order of high-order bytes.

The following is an example of generating command data from the master device.

① Region initialization: Assign FFFFH to [CRC-16].
② Substitute the calculated value of [CRC-16] XOR [first data (here, slave ID data)] into [CRC-16].
③ Assign [CRC-16] to [CRC-16] by shifting [CRC-16] by 1 bit to the right.
④ According to (3) above, when CF (carry flag) = 1, the calculated value of [CRC-16] XOR A001H is substituted into [CRC-16]. (When the least significant bit is 1, shifting 1 bit to the right will cause CF to stand.)
⑤ Repeat (3) and (4) 8 times. After the 8th inning, go to (6).
⑥ If the last data is finished, [CRC-16] is added to the message as the result of the calculation and it is terminated. If not, go to (7).
⑦ Substitute the calculated value of [CRC-16] XOR [next data] into [CRC-16] and go to (3).

Calculation example: Performing CRC calculation for 010405000004.
(This data is a message for retrieving the WLD's effective power consumption (received power).)

table 3.38 Example of calculated data: 010405000004 (6-byte data)

	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	CF	explanation
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	–	FFFFH (Initialize)
01 (1st byte)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	–	
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	–	XOR the top two rows
Right Shift 1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	*0*	
2nd right shift	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	–	XOR the top two rows
3rd right shift	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	*0*	
Fourth Right Shift	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	–	XOR the top two rows
Fifth right shift	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	1	*0*	
6th right shift	0	0	1	0	0	0	0	1	1	1	1	1	1	1	1	1	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	–	XOR the top two rows
7th Right Shift	0	1	0	0	0	0	0	0	1	1	1	1	1	1	1	1	*0*	
Eighth right shift	0	0	1	0	0	0	0	0	0	1	1	1	1	1	1	1	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	–	XOR the top two rows
04 (2nd byte)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	–	
	1	0	0	0	0	0	0	0	0	1	1	1	1	0	1	0	–	XOR the top two rows
Right Shift 1	0	1	0	0	0	0	0	0	0	0	1	1	1	1	0	1	*0*	
2nd right shift	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	0	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	–	XOR the top two rows
3rd right shift	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1	1	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	0	–	XOR the top two rows
Fourth Right Shift	0	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	*0*	
Fifth right shift	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1	1	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	–	XOR the top two rows
6th right shift	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	1	*0*	
7th Right Shift	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	–	XOR the top two rows
Eighth right shift	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	1	1	0	0	0	1	1	0	0	0	0	0	0	0	1	–	XOR the top two rows
05 (3rd byte)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	–	
	1	1	1	0	0	0	1	1	0	0	0	0	0	1	0	0	–	XOR the top two rows
Right Shift 1	0	1	1	1	0	0	0	1	1	0	0	0	0	0	1	0	*0*	
2nd right shift	0	0	1	1	1	0	0	0	1	1	0	0	0	0	0	1	*0*	
3rd right shift	0	0	0	1	1	1	0	0	0	1	1	0	0	0	0	0	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	0	1	1	1	1	0	0	0	1	1	0	0	0	0	1	–	XOR the top two rows
Fourth Right Shift	0	1	0	1	1	1	1	0	0	0	1	1	0	0	0	0	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	1	1	1	1	1	1	0	0	0	1	1	0	0	0	1	–	XOR the top two rows
Fifth right shift	0	1	1	1	1	1	1	1	0	0	0	1	1	0	0	0	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	1	0	1	1	1	1	1	0	0	0	1	1	0	0	1	–	XOR the top two rows
6th right shift	0	1	1	0	1	1	1	1	1	0	0	0	1	1	0	0	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	1	0	0	1	1	1	1	1	0	0	0	1	1	0	1	–	XOR the top two rows
7th Right Shift	0	1	1	0	0	1	1	1	1	1	0	0	0	1	1	0	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	1	0	0	0	1	1	1	1	1	0	0	0	1	1	1	–	XOR the top two rows
Eighth right shift	0	1	1	0	0	0	1	1	1	1	1	0	0	0	1	1	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	1	0	0	0	0	1	1	1	1	1	0	0	0	1	0	–	XOR the top two rows
00 (4th byte)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	–	
	1	1	0	0	0	0	1	1	1	1	1	0	0	0	1	0	–	XOR the top two rows

	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	CF	explanation
Right Shift 1	0	1	1	0	0	0	0	1	1	1	1	1	0	0	0	1	*0*	
2nd right shift	0	0	1	1	0	0	0	0	1	1	1	1	1	0	0	0	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	0	0	1	0	0	0	0	1	1	1	1	1	0	0	1	–	XOR the top two rows
3rd right shift	0	1	0	0	1	0	0	0	0	1	1	1	1	1	0	0	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	1	1	0	1	0	0	0	0	1	1	1	1	1	0	1	–	XOR the top two rows
Fourth Right Shift	0	1	1	1	0	1	0	0	0	0	1	1	1	1	1	0	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	1	0	1	0	1	0	0	0	0	1	1	1	1	1	1	–	XOR the top two rows
Fifth right shift	0	1	1	0	1	0	1	0	0	0	0	1	1	1	1	1	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	1	0	0	1	0	1	0	0	0	0	1	1	1	1	0	–	XOR the top two rows
6th right shift	0	1	1	0	0	1	0	1	0	0	0	0	1	1	1	1	*0*	
7th Right Shift	0	0	1	1	0	0	1	0	1	0	0	0	0	1	1	1	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	0	0	1	0	0	1	0	1	0	0	0	0	1	1	0	–	XOR the top two rows
Eighth right shift	0	1	0	0	1	0	0	1	0	1	0	0	0	0	1	1	*0*	
00 (5th byte)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	–	
	0	1	0	0	1	0	0	1	0	1	0	0	0	0	1	1	–	XOR the top two rows
Right Shift 1	0	0	1	0	0	1	0	0	1	0	1	0	0	0	0	1	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	–	XOR the top two rows
2nd right shift	0	1	0	0	0	0	1	0	0	1	0	1	0	0	0	0	*0*	
3rd right shift	0	0	1	0	0	0	0	1	0	0	1	0	1	0	0	0	*0*	
Fourth Right Shift	0	0	0	1	0	0	0	0	1	0	0	1	0	1	0	0	*0*	
Fifth right shift	0	0	0	0	1	0	0	0	0	1	0	0	1	0	1	0	*0*	
6th right shift	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	1	*0*	
7th Right Shift	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	0	1	0	0	0	1	0	0	0	0	1	0	0	1	1	–	XOR the top two rows
Eighth right shift	0	1	0	1	0	0	0	1	0	0	0	0	1	0	0	1	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	1	1	1	0	0	0	1	0	0	0	0	1	0	0	0	–	
04 (6th byte)	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	–	
	1	1	1	1	0	0	0	1	0	0	0	0	1	1	0	0	*0*	XOR the top two rows
Right Shift 1	0	1	1	1	1	0	0	0	1	0	0	0	0	1	1	0	*0*	
2nd right shift	0	0	1	1	1	1	0	0	0	1	0	0	0	0	1	1	*0*	
3rd right shift	0	0	0	1	1	1	1	0	0	0	1	0	0	0	0	1	***1***	CF stood
	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	–	A001H
	1	0	1	1	1	1	1	0	0	0	1	0	0	0	0	0	–	XOR the top two rows
Fourth Right Shift	0	1	0	1	1	1	1	1	0	0	0	1	0	0	0	0	*0*	
Fifth right shift	0	0	1	0	1	1	1	1	1	0	0	0	1	0	0	0	*0*	
6th right shift	0	0	0	1	0	1	1	1	1	1	0	0	0	1	0	0	*0*	
7th Right Shift	0	0	0	0	1	0	1	1	1	1	1	0	0	0	1	0	*0*	
Eighth right shift	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**1**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**1**	*0*	**05F1H**

The result of this CRC calculation is 0000010111110001. (last line)
When displayed in hexadecimal, it is 05F1H. (When incorporating it into a message, it will be in order of bottom → top)

3-5. Error message

If there is an error in the message sent by the master, the slave (module) returns an error message.
If an error message is returned, check the transmitted data.

table 3.39Contents of the error message (slave (module) → master)

name	
Slave ID	
Received function code +80H	
Error codes (see table below)	
Error Checking (CRC-16)	subordinate
	higher rank

table 3.40Contents of the error code

Error	substance	explanation
01H	Faulty function code	The module received an unsupported function code
02H	Bad address	The module received an unsupported address
03H	Poor data count	the number of data specified is too large
06H	Slave Busy	Module is busy

◎ Example of error

Response when a bad address error occurs with function code 04H from the module with slave ID 04H

table 3.41Example of data received in the event of an error

name		Incoming data
Slave ID		01H
Function code		84H
Error		02H
Error Checking (CRC-16)	subordinate	C2H
	higher rank	C1H

4. Example of system configuration

Examples of system configurations for each module are shown.

4-1. WLD

4-1-1. When acquiring energy data with WLD

The WLD-PA12R-222M-4A000 is used to measure a single-phase, 2-wire 110V 200A circuit.
The following is the case for acquiring energy data with the WLD-PA12R-222M-4A000.
(All setting data is in hexadecimal notation.)

1. Wiring example

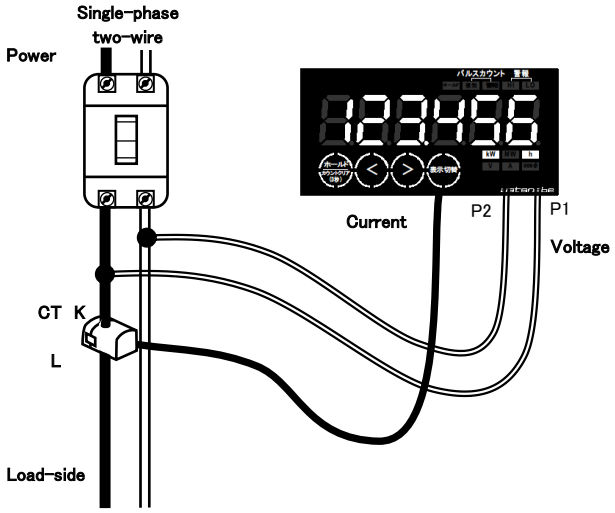
This section describes the case where the WLD-PA12R-222M-4A000 is used.

Wiring of voltage

Connect the first phase to the input voltage terminal P1 of the meter.
Connect the N phase to the input voltage terminal P2 of the meter.

Wiring of electric current

Attach the CT to the one-phase side of the circuit you want to measure and wire it to the input current terminals 1S and 1L of the meter.
CT uses WCTF-200A-N.



2. Parameter Modification

WLD does not require the phase indicator parameter to be set. (It is determined by the model)
RS485 communication settings can be set on the front panel of the module.
The following explanation is when the slave ID of the WLD is set to 01H.

3. Parameter setting communication

You cannot use communication to change phase indicator parameters or communication settings.

4. Data Retrieval

Acquires data on the amount of active energy (power received).
The addresses of the data to be acquired are shown in the table below. (「table 5.3 WLD Data Readout(excerpt)

table 4.1Power Acquisition Address

address	substance	Size (byte)	unit
0500H	Active power (power received)	8	0.001kWh

5. Data Acquisition Communication

Retrieves energy data.
Since it is an acquisition, the function code is 04H (input register read [read-only address]).

Acquisition of active power (power received) data

Acquires data on the amount of active energy (power received).
First, send a message from the master to the slave (module).
The data size is 8 bytes, so the number of read words is 4.

table 4.2Example of Active Energy Data Acquisition [Transmission]

name		Transmitted data
Slave ID		01H
Function code		04H
address	higher rank	05H
	subordinate	00H
Number of words read	higher rank	00H
	subordinate	04H
Error Checking (CRC-16)	subordinate	F1H
	higher rank	05H

After that, the slave (module) sends a response back to the master.
4 words of data will be returned. This is expressed in decimal as 8.870 kWh.

table 4.3Example of Obtaining Active Energy [Received]

name		Incoming data
Slave ID		01H
Function code		04H
Bytes read		08H
The first word, data	higher rank	00H
	subordinate	00H
The second word, data	higher rank	00H
	subordinate	00H
The third word, data	higher rank	00H
	subordinate	00H
The fourth word, data	higher rank	22H
	subordinate	A6H
Error Checking (CRC-16)	subordinate	BCH
	higher rank	D7H

4-2. WMB-DI16(WMB-DI16A)

4-2-1. When acquiring pulse counts with WMB-DI16

The following is the case when acquiring pulse counts with WMB-DI16.
(All setting data is in hexadecimal notation.)

1. Data Acquisition Communication

Get the pulse count.
Since it is an acquisition, the function code is 04H (input register read [read-only address]).

Pulse Count Acquisition

Get the pulse count from CH1 to CH4.
First, send a message from the master to the slave (module).
The data size is 16 bytes, so the number of read words is 8.

table 4.4Pulse Count Acquisition [Transmission]

name		Transmitted data
Slave ID		01H
Function code		04H
address	higher rank	00H
	subordinate	00H
Number of words read	higher rank	00H
	subordinate	08H
Error Checking (CRC-16)	subordinate	F1H
	higher rank	CCH

After that, 8 words of data are returned from the slave (module) to the master.

table 4.5Pulse Count Acquisition [Receive]

name		Incoming data
Slave ID		01H
Function code		04H
Bytes read		10H
The first word, data	higher rank	00H
	subordinate	00H
The second word, data	higher rank	00H
	subordinate	00H
The third word, data	higher rank	00H
	subordinate	08H
The fourth word, data	higher rank	D2H
	subordinate	7EH
The fifth word, data	higher rank	00H
	subordinate	00H
6th word data	higher rank	00H
	subordinate	00H
The seventh word data	higher rank	00H
	subordinate	08H
The eighth word data	higher rank	D1H
	subordinate	89H
Error Checking (CRC-16)	subordinate	EFH
	higher rank	B9H

The acquired data is as follows.

table 4.6Summary of acquired data

channel	Readout value (hexadecimal)	Decimal
CH1	00000000H	0
CH2	0008D27EH	578174
CH3	00000000H	0
CH4	0008D189H	577929

4-3. WMB-DIO8R(WMB-DIO8RA)

4-3-1. When the WMB-DIO8R is used to control the start/stop output to the specified channel

The following is done when outputting to a specified channel with the WMB-DIO8R.
(All setting data is in hexadecimal notation.)

1. Stop/stop output setting communication

Specify the start/stop output settings.
Since it is a write, the function code uses 05H (coil write) or 0FH (coil continuous write).

Communication on start/stop output control

Set the start/stop output of DO to CH1 (start) and CH2 (stop).
First, send a message from the master to the slave (module).
Note that when writing to the coil, write 0xFF00 when setting it to 1 and write 0x0000 when setting it to 0.

table 4.7Stop/stop output setting [Send]

name		Transmitted data
Slave ID		01H
Function code		05H
Start address	higher rank	01H
	subordinate	80H
writing Word data	higher rank	FFH
	subordinate	00H
Error Checking (CRC-16)	subordinate	8CH
	higher rank	2EH

After that, the slave (module) sends a response back to the master.

table 4.8Start/stop output setting [Receive]

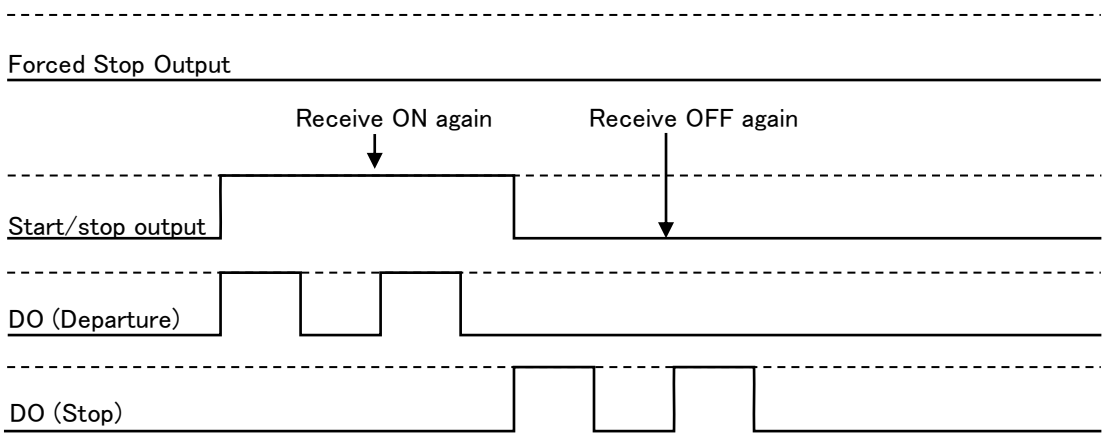
name		Transmitted data
Slave ID		01H
Function code		05H
Start address	higher rank	01H
	subordinate	80H
writing Word data	higher rank	FFH
	subordinate	00H
Error Checking (CRC-16)	subordinate	8CH
	higher rank	2EH

4-3-2. Start/stop output mode

The WMB-DIO8R (WMB-DIO8RA) has a start/stop output mode.
Here's an example:

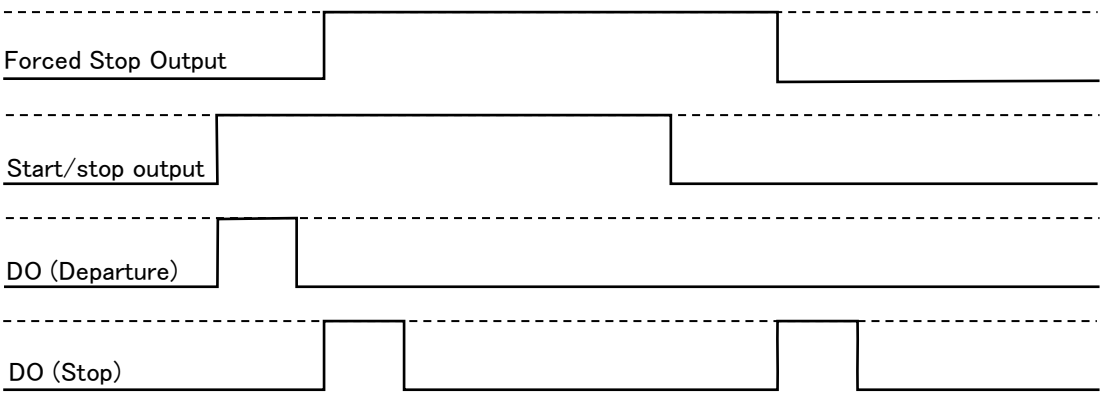
1. Case 1

This indicates the operating status of DO and DO when start/stop output control is performed while the forced stop output control is OFF.



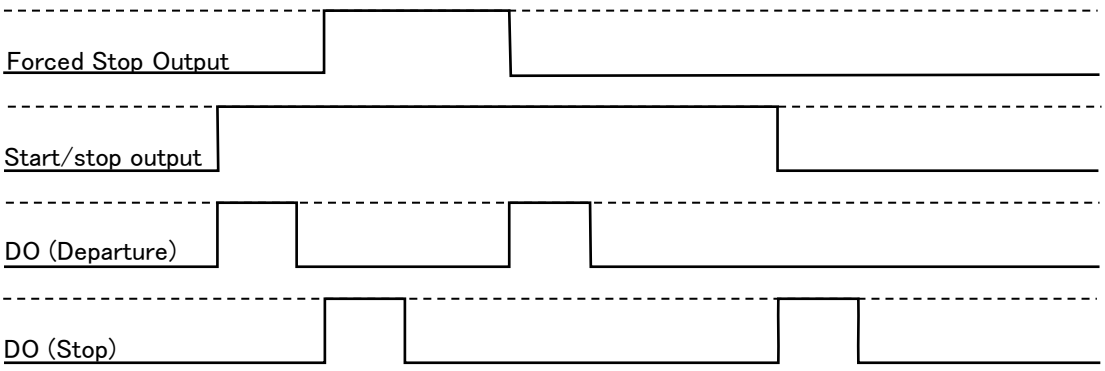
2. Case 2

This shows the operating status of DO and DO when the forced stop output control and the start/stop output control are controlled together.



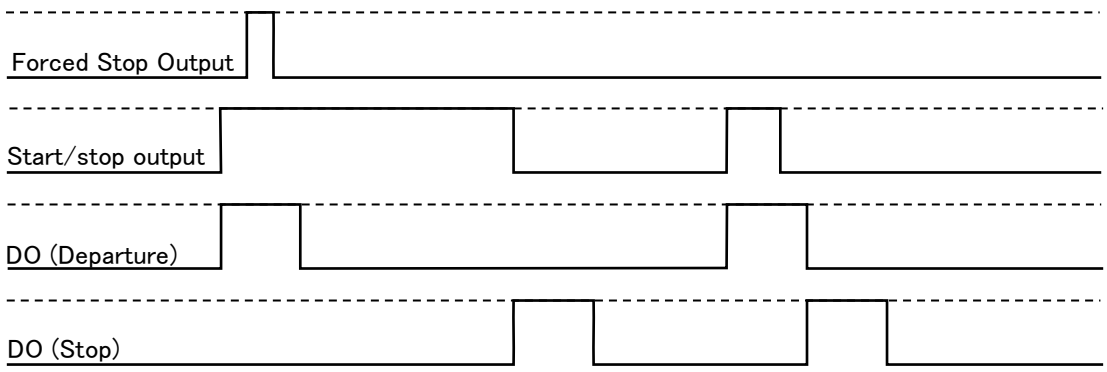
3. Case 3

Indicates the operating status of DO and DO when forced stop output control is performed during start/stop output control.



4. Case 4

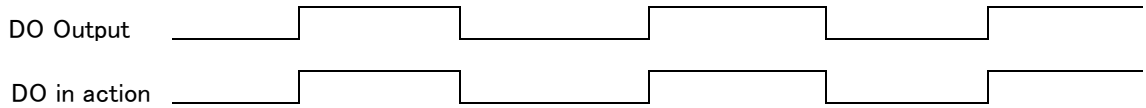
Indicates the operating status of DO and DO when forced stop output control is performed during DO (output) output, and when stop/stop output control is turned off during DO (output) output.



* Ignores the start/stop output control while the forced stop output control is ON.

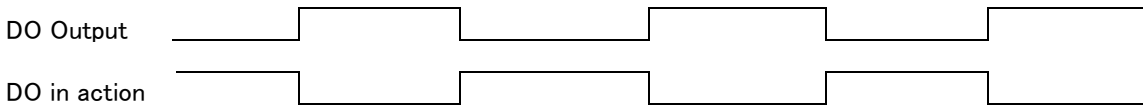
4-3-3. Normal Output

Normal output ensures that the output matches the movement of output control and the actual output.



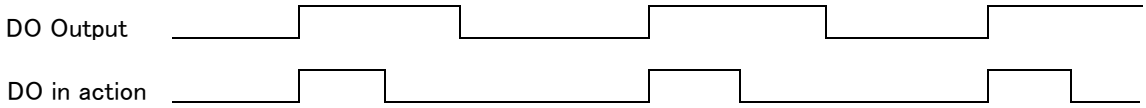
4-3-4. Inverting output

The inverted output delivers output so that the movement of output control and the actual output move in opposite directions.



4-3-5. One-shot output

For one-shot output, the output is turned off after a certain period of time has elapsed since the output control was turned on and the output started.
The time until the output is turned off is "5-3-1. Setting & Control Parameters」「2 Holding Registers」「Digital input/output (DI, DO)」(P.72)It is done with the one-shot pulse width setting.
The one-shot pulse width setting is common to all channels.



4-4. WMB-AI8

4-4-1. Acquiring Analog Input (AI) Measurements from WMB-AI8

The following is the case for acquiring analog input (AI) measurement values with the WMB-AI8.
(All setting data is in hexadecimal notation.)

1. Data Acquisition Communication

Acquires analog input (AI) measurements.
Since it is an acquisition, the function code is 04H (input register read [read-only address]).

Analog Input (AI) Measurements

Acquire analog input (AI) measurements from CH1 to CH8.
First, send a message from the master to the slave (module).
The data size is 2 bytes, so the read word size is 8.

table 4.9Analog Input (AI) Measurements [Transmission]

name		Transmitted data
Slave ID		01H
Function code		04H
Start address	higher rank	00H
	subordinate	00H
Number of words read	higher rank	00H
	subordinate	08H
Error Checking (CRC-16)	subordinate	F1H
	higher rank	CCH

After that, the slave (module) sends a response back to the master.
If the response is 13 88 00 00 27 10 2E E0 00 00 17 A2 F8 30 FB F5H, you can map the data to 13 88H for the first word, the next 00 00H for the second word, and so on.

table 4.10 Analog Inputs(AI) Measured Value [Received]

name		Incoming data
Slave ID		01H
Function code		04H
Bytes read		10H
The first word, data	higher rank	13H
	subordinate	88H
The second word, data	higher rank	00H
	subordinate	00H
The third word, data	higher rank	27H
	subordinate	10H
The fourth word, data	higher rank	2EH
	subordinate	E0H
The fifth word, data	higher rank	00H
	subordinate	00H
6th word data	higher rank	17H
	subordinate	A2H
The seventh word data	higher rank	F8H
	subordinate	30H
The eighth word data	higher rank	FBH
	subordinate	F5H
Error Checking (CRC-16)	subordinate	51H
	higher rank	7EH

The acquired data is as follows.

table 4.11 Analog Inputs(AI) Summary of measured values

channel	Readout value (hexadecimal)	Decimal	Analog Input Measurement (%)
CH1	1388H	5000	50.00
CH2	0000H	0	0.00
CH3	2710H	10000	100.00
CH4	2EE0H	12000	120.00
CH5	0000H	0	0.00
CH6	17A2H	6050	60.50
CH7	F830H	-2000	-20.00
CH8	FBF5H	-1035	-10.35

4-5. WMB-AO4

4-5-1. Setting the WMB-AO4 Analog Output (AO) Output Control Value (%)

The following is how to set the analog output (AO) output control value on the WMB-AO4.
(All setting data is in hexadecimal notation.)

1. Data Acquisition Communication

Sets the analog output (AO) output control value.
Since it is a setting, we will use function code 10H (Hold Register Continuous Write).

Analog output (AO) value setting

Set the output control values from CH1 to CH4.
First, send a message from the master to the slave (module).
The data is set to CH1: 50.00%, CH2: 60.00%, CH3: 70.00%, CH4: 80.00%.
The data size is 2 bytes, so the write byte size is 8.

table 4.12 Analog Output(AO) Get Value [Submit]

name		Transmitted data
Slave ID		01H
Function code		10H
Start address	higher rank	00H
	subordinate	00H
Number of data	higher rank	00H
	subordinate	04H
Number of bytes		08H
The first word, data	higher rank	13H
	subordinate	88H
The second word, data	higher rank	17H
	subordinate	70H
The third word, data	higher rank	1BH
	subordinate	58H
The fourth word, data	higher rank	1FH
	subordinate	40H
Error Checking (CRC-16)	subordinate	33H
	higher rank	70H

After that, the slave (module) sends a response back to the master.

table 4.13 Analog Output(AO) Value Acquisition [Received]

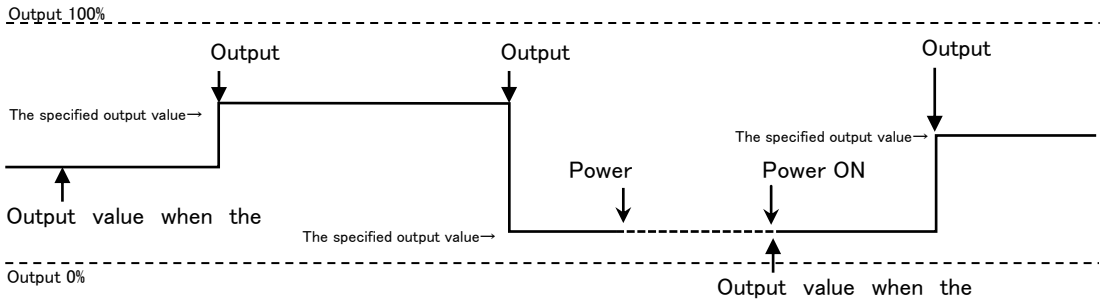
name		Incoming data
Slave ID		01H
Function code		10H
address	higher rank	00H
	subordinate	00H
Number of data	higher rank	00H
	subordinate	04H
Error Checking (CRC-16)	subordinate	C1H
	higher rank	CAH

4-5-2. About Specifying Output Modes

The analog output mode specification, as well as the fixed output value and initial output value, can be set via Modbus communication.
For the Modbus addresses and data used in communication, refer to "5-7-1. Setting and Control Parameters" and "1. Holding Registers".

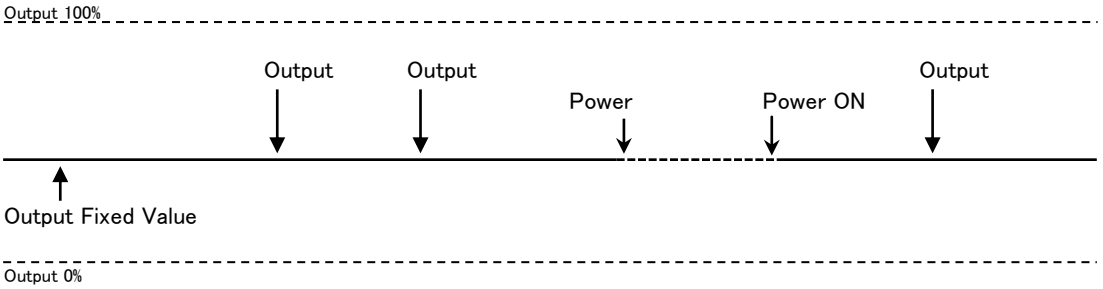
4-5-3. Output Retention

When the module is powered on, the output value from the previous power OFF is output.
When an output indication occurs, the output value is printed.



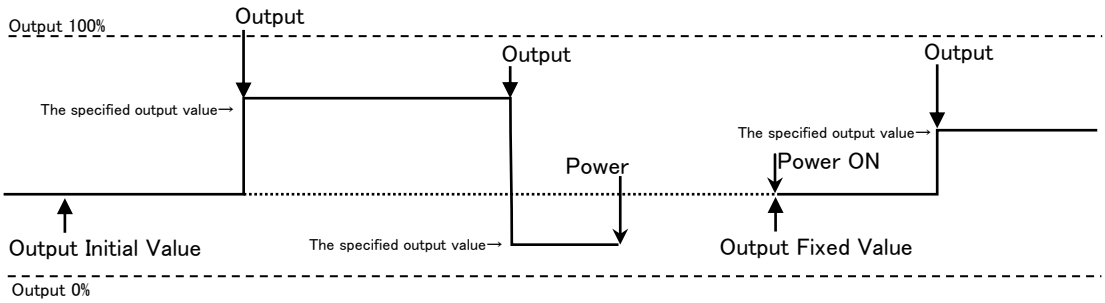
4-5-4. Fixed output

When the module is powered on, the set output fixed value is output.
In this mode, even if the output instruction is given from the outside, the output instruction is ignored and the output fixed value is output.



4-5-5. Initial value specification output

When the module is powered on, the set output initial value is output.
If an output instruction is provided from an external source, the output instruction value is output according to the output instruction.



4-6. WMB-MAI6

4-6-1. Obtaining Resistance Temperature Detector (RI) Measurements from the WMB-MAI6

The following is the case for acquiring resistance temperature detector (RI) measurements with the WMB-MAI6.

(All setting data is in hexadecimal notation.)

1. Data Acquisition Communication

Obtain resistance temperature detector measurements.
Since it is an acquisition, function code 04H (input register read [read-only address]) is used.

Resistance Temperature Detector (RI) Measurements

Obtain resistance temperature detector (RI) measurements from CH1 to CH3.
First, send a message from the master to the slave (module).
The readout word size is 3.

table 4.14Resistance thermometer detector(RI) Measurement [Transmission]

name		Transmitted data
Slave ID		01H
Function code		04H
Start address	higher rank	00H
	subordinate	20H
Number of words read	higher rank	00H
	subordinate	03H
Error Checking (CRC-16)	subordinate	B1H
	higher rank	C1H

After that, the slave (module) sends a response back to the master.
If the response is 13 88 00 00 27 10H, you can map the data to 00 32H for the first word, 00 00H for the second word, and so on.

table 4.15 Resistance thermometer detector(RI) Measurement [Received]

name		Incoming data
Slave ID		01H
Function code		04H
Bytes read		06H
The first word, data	higher rank	13H
	subordinate	88H
The second word, data	higher rank	00H
	subordinate	00H
The third word, data	higher rank	27H
	subordinate	10H
Error Checking (CRC-16)	subordinate	98H
	higher rank	13H

The acquired data is as follows.

table 4.16 Resistance thermometer detector(RI) Summary of measured values

channel	Readout value (hexadecimal)	Temperature (decimal °C)
CH1	1388H	50.00
CH2	0000H	0.00
CH3	2710H	100.00

4-7. WMS-PE2D□

4-7-1. When acquiring energy data with WMS-PE2D □

When measuring a three-phase 3-wire 220V 200A circuit with the WMS-PE2D □ and acquiring energy data for Circuit A and Circuit C, the following is done.
(All setting data is in hexadecimal notation.)

1. Wiring example

This is the case where the wiring is done as shown in the figure below.

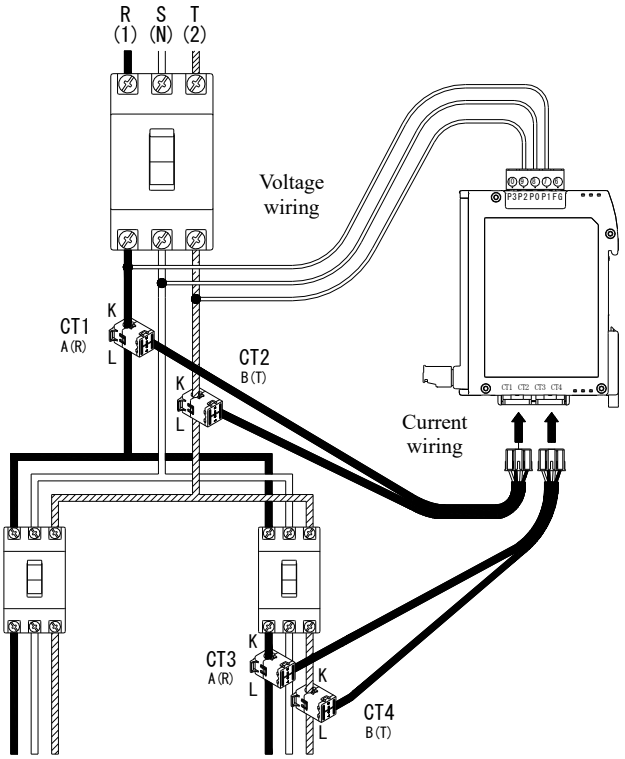


illustration 4.1Wiring example □ WMS-PE2D

2. Parameter Modification

Set the parameters as shown in the table below.
The following explanation is when the slave ID of the WMS-PE2D□ is set to 01H.

table 4.17 WMS-PE2D□ Slave ID Example of parameter change at 01H

address	substance	Size (byte)	data	
			Setting Values	Data Description
1002H	Phase line classification	2	0002H	three-phase3-wire
1003H	Voltage Input Rating	2	0001H	220V
1004H	External VT Rating	4	000000DCH	220V
1006H	Circuit A Enable/Disable	2	0001H	valid
1008H	Circuit C Enable/Disable	2	0001H	valid
100AH	Circuit A Current Input Rating	2	0003H	200A
100CH	Circuit C Current Input Rating	2	0003H	200A
100EH	Circuit A External CT Rating	2	00C8H	200A
1010H	Circuit C External CT Rating	2	00C8H	200A

3. Parameter setting communication

Set the parameters.
Since it is a setting, the function code is 06H (Hold Register Write) or 10H (Hold Register Continuous Write) Use:

Parameter setting permission communication (Address: 1000H)

If you want to change the parameter (address 1002H or later of the holding register), first set the setting permission instruction to
Do.
The function code uses 06H (Hold Register Write).

First, send a message from the master to the slave (module).
The data writes the configuration permission (0001H).

table 4.18 Parameter setting permission instructions[Send]

name		Transmitted data
Slave ID		01H
Function code		06H
address	higher rank	10H
	subordinate	00H
writing Word data	higher rank	00H
	subordinate	01H
Error Checking (CRC-16)	subordinate	4CH
	higher rank	CAH

After that, the slave (module) sends a response back to the master.
If the following response is returned, the slave (module) is allowed to set parameters.
At this time, the display of the 7SEG of the slave (module) is upper row: no display, lower row: "SET".

table 4.19 Parameter setting permission instructions [Receive]

name		Incoming data
Slave ID		01H
Function code		06H
address	higher rank	10H
	subordinate	00H
Number of data	higher rank	00H
	subordinate	01H
Error Checking (CRC-16)	subordinate	4CH
	higher rank	CAH

Phase line classification

Set the phase indicator to three-phase three-wire.
First, send a message from the master to the slave (module).

table 4.20Phase line classification [Transmission]

name		Transmitted data
Slave ID		01H
Function code		06H
address	higher rank	10H
	subordinate	02H
writing Word data	higher rank	00H
	subordinate	02H
Error Checking (CRC-16)	subordinate	ADH
	higher rank	0BH

After that, there will be a response from the slave (module), and we will check if it matches.

table 4.21Phase line classification [Receive]

name		Incoming data
Slave ID		01H
Function code		06H
address	higher rank	10H
	subordinate	02H
writing Word data	higher rank	00H
	subordinate	02H
Error Checking (CRC-16)	subordinate	ADH
	higher rank	0BH

Voltage Input Rating

Set the voltage input rating to 220V.
First, send a message from the master to the slave (module).

table 4.22 Voltage Input Rating[Send]

name		Transmitted data
Slave ID		01H
Function code		06H
address	higher rank	10H
	subordinate	03H
writing Word data	higher rank	00H
	subordinate	01H
Error Checking (CRC-16)	subordinate	BCH
	higher rank	CAH

After that, there will be a response from the slave (module), and we will check if it matches.

table 4.23 Voltage Input Rating[Receive]

name		Incoming data
Slave ID		01H
Function code		06H
address	higher rank	10H
	subordinate	03H
writing Word data	higher rank	00H
	subordinate	01H
Error Checking (CRC-16)	subordinate	BCH
	higher rank	CAH

External VT Rating

Set the external VT rating to 220V.

First, send a message from the master to the slave (module).

table 4.24 External VT Rating[Send]

name		Transmitted data
Slave ID		01H
Function code		10H
Start address	higher rank	10H
	subordinate	04H
Number of data	higher rank	00H
	subordinate	02H
Number of bytes		04H
The first word, data	higher rank	00H
	subordinate	00H
The second word, data	higher rank	00H
	subordinate	DCH
Error Checking (CRC-16)	subordinate	3EH
	higher rank	05H

After that, there will be a response from the slave (module), and we will check if it matches.

table 4.25 External VT Rating[Receive]

name		Incoming data
Slave ID		01H
Function code		10H
address	higher rank	10H
	subordinate	04H
writing Word data	higher rank	00H
	subordinate	02H
Error Checking (CRC-16)	subordinate	04H
	higher rank	C9H

Circuit A Enable/Disable

Circuit A Enables/Disables to Enabled.
First, send a message from the master to the slave (module).

table 4.26 Circuit A Enable/Disable[Send]

name		Transmitted data
Slave ID		01H
Function code		06H
address	higher rank	10H
	subordinate	06H
writing Word data	higher rank	00H
	subordinate	01H
Error Checking (CRC-16)	subordinate	ACH
	higher rank	CBH

After that, there will be a response from the slave (module), and we will check if it matches.

table 4.27 Circuit A Enable/Disable[Receive]

name		Incoming data
Slave ID		01H
Function code		06H
address	higher rank	10H
	subordinate	06H
writing Word data	higher rank	00H
	subordinate	01H
Error Checking (CRC-16)	subordinate	ACH
	higher rank	CBH

Circuit C Enable/Disable

Circuit C Sets Enable/Disable to Enabled.
First, send a message from the master to the slave (module).

table 4.28 Circuit C Enable/Disable[Send]

name		Transmitted data
Slave ID		01H
Function code		06H
address	higher rank	10H
	subordinate	08H
writing Word data	higher rank	00H
	subordinate	01H
Error Checking (CRC-16)	subordinate	CDH
	higher rank	08H

After that, there will be a response from the slave (module), and we will check if it matches.

table 4.29 Circuit C Enable/Disable[Receive]

name		Incoming data
Slave ID		01H
Function code		06H
address	higher rank	10H
	subordinate	08H
writing Word data	higher rank	00H
	subordinate	01H
Error Checking (CRC-16)	subordinate	CDH
	higher rank	08H

Circuit A Current Input Rating

Circuit A sets the current input rating to 200A.
First, send a message from the master to the slave (module).

table 4.30 Circuit A Current Input Rating[Send]

name		Transmitted data
Slave ID		01H
Function code		06H
address	higher rank	10H
	subordinate	0AH
writing Word data	higher rank	00H
	subordinate	03H
Error Checking (CRC-16)	subordinate	EDH
	higher rank	09H

After that, there will be a response from the slave (module), and we will check if it matches.

table 4.31 Circuit A Current Input Rating[Receive]

name		Incoming data
Slave ID		01H
Function code		06H
address	higher rank	10H
	subordinate	0AH
writing Word data	higher rank	00H
	subordinate	03H
Error Checking (CRC-16)	subordinate	EDH
	higher rank	09H

Circuit C Current Input Rating

Circuit C sets the current input rating to 200A.
First, send a message from the master to the slave (module).

table 4.32 Circuit C Current Input Rating[Send]

name		Transmitted data
Slave ID		01H
Function code		06H
address	higher rank	10H
	subordinate	0CH
writing Word data	higher rank	00H
	subordinate	03H
Error Checking (CRC-16)	subordinate	0DH
	higher rank	08H

After that, there will be a response from the slave (module), and we will check if it matches.

table 4.33 Circuit C Current Input Rating[Receive]

name		Incoming data
Slave ID		01H
Function code		06H
address	higher rank	10H
	subordinate	0CH
writing Word data	higher rank	00H
	subordinate	03H
Error Checking (CRC-16)	subordinate	0DH
	higher rank	08H

Circuit A External CT Rating

Circuit A sets the external CT rating to 200A.
First, send a message from the master to the slave (module).

table 4.34 Circuit A External CT Rating[Send]

name		Transmitted data
Slave ID		01H
Function code		06H
address	higher rank	10H
	subordinate	0EH
writing Word data	higher rank	00H
	subordinate	C8H
Error Checking (CRC-16)	subordinate	EDH
	higher rank	5FH

After that, there will be a response from the slave (module), and we will check if it matches.

table 4.35 Circuit A External CT Rating[Receive]

name		Incoming data
Slave ID		01H
Function code		06H
address	higher rank	10H
	subordinate	0EH
writing Word data	higher rank	00H
	subordinate	C8H
Error Checking (CRC-16)	subordinate	EDH
	higher rank	5FH

Circuit C External CT Rating

Circuit C sets the external CT rating to 200A.
First, send a message from the master to the slave (module).

table 4.36 Circuit C External CT Rating[Send]

name		Transmitted data
Slave ID		01H
Function code		06H
address	higher rank	10H
	subordinate	10H
writing Word data	higher rank	00H
	subordinate	C8H
Error Checking (CRC-16)	subordinate	8DH
	higher rank	59H

After that, there will be a response from the slave (module), and we will check if it matches.

table 4.37 Circuit C External CT Rating[Receive]

name		Incoming data
Slave ID		01H
Function code		06H
address	higher rank	10H
	subordinate	10H
writing Word data	higher rank	00H
	subordinate	C8H
Error Checking (CRC-16)	subordinate	8DH
	higher rank	59H

Parameter storage communication (Address: 1000H)

If you want to save the changed parameter, instruct you to save the parameter.
The function code uses 06H (Hold Register Write).

First, a message is sent from the master to the slave (module).
The data writes the save instruction (0000H).

table 4.38 Parameter setting preservation instruction[Send]

name		Transmitted data
Slave ID		01H
Function code		06H
address	higher rank	10H
	subordinate	00H
writing Word data	higher rank	00H
	subordinate	00H
Error Checking (CRC-16)	subordinate	8DH
	higher rank	0AH

After that, the slave (module) sends a response back to the master.
If the following response is returned, the parameter is successfully updated and the slave (module)
The display of the 7SEG will be restored.
In the case of an error response, it is necessary to start again from the parameter setting permission communication.

table 4.39 Parameter setting preservation instruction [Receive]

name		Incoming data
Slave ID		01H
Function code		06H
address	higher rank	10H
	subordinate	00H
Number of data	higher rank	00H
	subordinate	00H
Error Checking (CRC-16)	subordinate	8DH
	higher rank	0AH

4. Data Retrieval

Acquire data for Circuit A active energy (powered) and Circuit C active energy (powered).
The addresses of the data to be acquired are shown in the table below.

table 4.40Example of data acquisition of active power (power received)

address	substance	Size (byte)	unit
0110H	Circuit A Active Power (Power Received)	8	Wh
0140H	Circuit C Active energy (power received)	8	Wh

① Refer to the row for "Active Energy (Import/Export)" in Table 5.82: Data Size and Response Data for Each Measurement Element.
② Since the "Address" column says "See Table 5.87," refer to Table 5.87: Energy Data Address List (8 bytes).
③ Looking at "Circuit A - Active Energy (Import)," you can see that the address is 0110H.
Similarly, by checking the table, you will find that the address for "Circuit C - Active Energy (Import)" is 0140H.

5. Data Acquisition Communication

Obtain the energy data for each circuit.
Since it is an acquisition, the function code is 04H (input register read [read-only address]).

Circuit A: Active energy (power received) data acquisition

Circuit A acquires data on the amount of active energy (power received).
First, send a message from the master to the slave (module).
The data size is 8 bytes, so the number of read words is 4.

table 4.41 Circuit A Active Energy(Power Received) Data Acquisition [Transmission]

name		Transmitted data
Slave ID		01H
Function code		04H
address	higher rank	01H
	subordinate	10H
Number of words read	higher rank	00H
	subordinate	04H
Error Checking (CRC-16)	subordinate	F1H
	higher rank	F0H

After that, the slave (module) sends a response back to the master.
4 words of data will be returned. This is expressed in decimal terms, which is 8,870 Wh.

table 4.42 Circuit A Active Energy(Power receiving) data acquisition [Receiving]

name		Incoming data
Slave ID		01H
Function code		04H
Bytes read		08H
The first word, data	higher rank	00H
	subordinate	00H
The second word, data	higher rank	00H
	subordinate	00H
The third word, data	higher rank	00H
	subordinate	00H
The fourth word, data	higher rank	22H
	subordinate	A6H
Error Checking (CRC-16)	subordinate	BCH
	higher rank	D7H

Circuit C: Active energy (power received) data acquisition

Circuits Acquires data on the amount of active energy (power received).
First, send a message from the master to the slave (module).
The data size is 8 bytes, so the number of read words is 4.

table 4.43 Circuit C Active energy(Power Received) Data Acquisition [Transmission]

name		Transmitted data
Slave ID		01H
Function code		04H
address	higher rank	01H
	subordinate	40H
Number of words read	higher rank	00H
	subordinate	04H
Error Checking (CRC-16)	subordinate	F1H
	higher rank	E1H

After that, the slave (module) sends a response back to the master.
4 words of data will be returned. This is expressed in decimal as 3,860 Wh.

table 4.44 Circuit C Active energy(Power receiving) data acquisition [Receiving]

name		Incoming data
Slave ID		01H
Function code		04H
Bytes read		08H
The first word, data	higher rank	00H
	subordinate	00H
The second word, data	higher rank	00H
	subordinate	00H
The third word, data	higher rank	00H
	subordinate	00H
The fourth word, data	higher rank	0FH
	subordinate	14H
Error Checking (CRC-16)	subordinate	21H
	higher rank	F2H

4-7-2. When controlling the start/stop output with WMS-PE2DO

The output is as follows when output is performed by WMS-PE2DO.
(All setting data is in hexadecimal notation.)

1. Stop/stop output setting communication

Specify the start/stop output settings.
Since it is a write, the function code uses 05H (coil write) or 0FH (coil continuous write).

Communication on start/stop output control

Sets the DO stop output to DO1 (start) and DO2 (stop).
First, send a message from the master to the slave (module).
Note that when writing to the coil, write 0xFF00 when setting it to 1 and write 0x0000 when setting it to 0.

table 4.45Stop/stop output setting [Send]

name		Transmitted data
Slave ID		01H
Function code		05H
Start address	higher rank	01H
	subordinate	E0H
writing Word data	higher rank	FFH
	subordinate	00H
Error Checking (CRC-16)	subordinate	8CH
	higher rank	30H

After that, the slave (module) sends a response back to the master.

table 4.46Start/stop output setting [Receive]

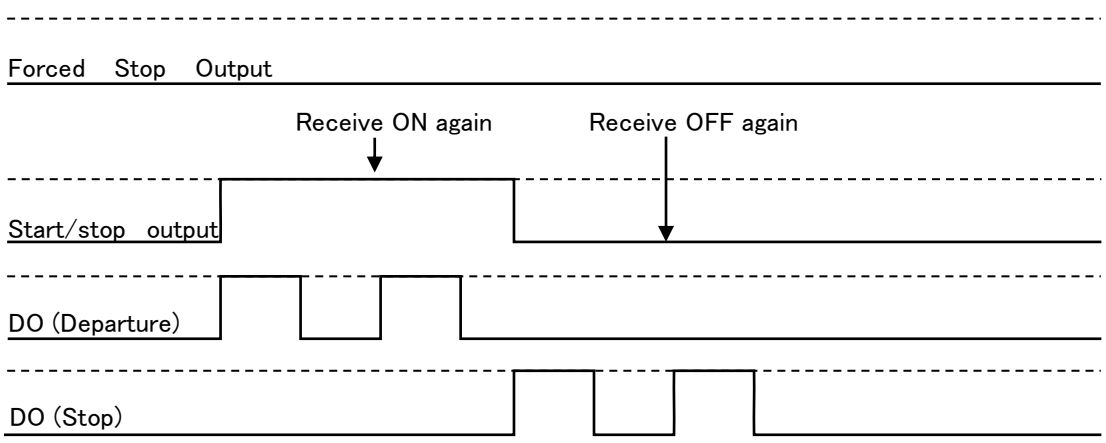
name		Transmitted data
Slave ID		01H
Function code		05H
Start address	higher rank	01H
	subordinate	E0H
writing Word data	higher rank	FFH
	subordinate	00H
Error Checking (CRC-16)	subordinate	8CH
	higher rank	30H

4-7-3. Start/stop output mode

The WMS-PE2DO has a start/stop output mode.
Output instruction is available only when both DO1 and DO2 pulse output settings are set to OFF.
Here's an example:

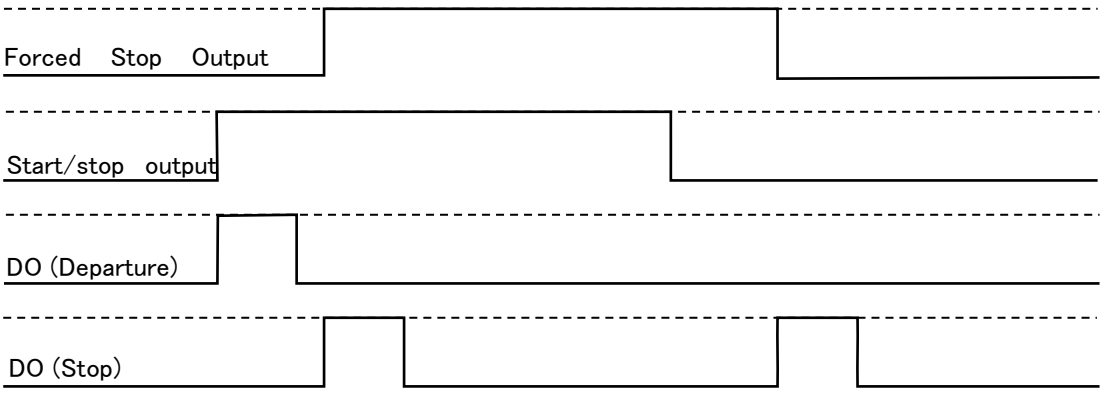
1. Case 1

This indicates the operating status of DO and DO when start/stop output control is performed while the forced stop output control is OFF.



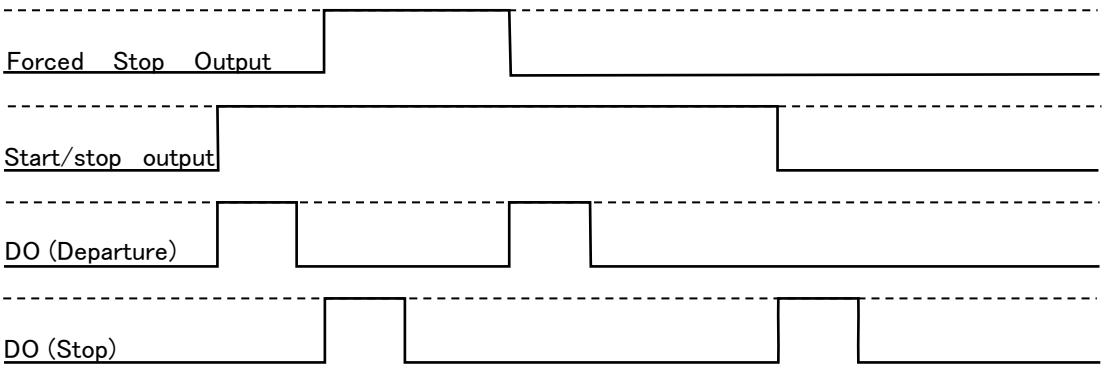
2. Case 2

This shows the operating status of DO and DO when the forced stop output control and the start/stop output control are controlled together.



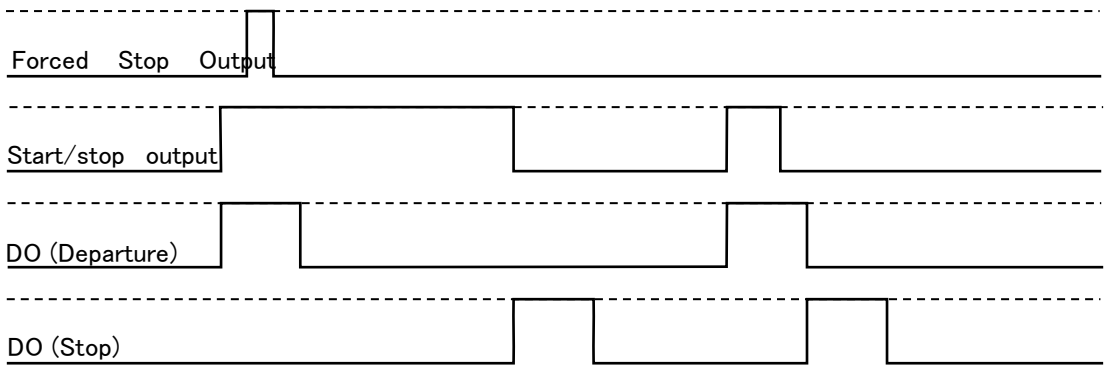
3. Case 3

Indicates the operating status of DO and DO when forced stop output control is performed during start/stop output control.



4. Case 4

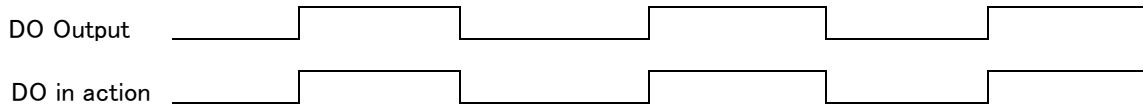
Indicates the operating status of DO and DO when forced stop output control is performed during DO (output) output, and when stop/stop output control is turned off during DO (output) output.



* Ignores the start/stop output control while the forced stop output control is ON.

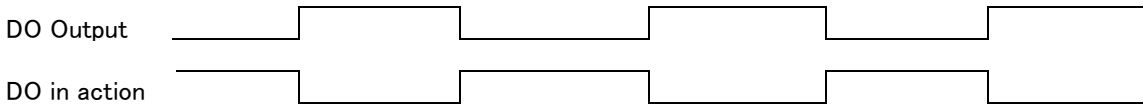
4-7-4. Normal Output

Normal output ensures that the movement of output control matches the actual output.
Output control is only possible for DO channels where the pulse output setting operation is set to OFF.



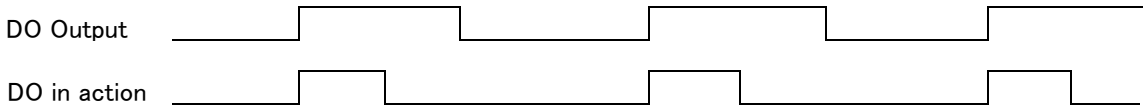
4-7-5. Inverting output

Reverse output is designed to make the actual output move in the opposite direction of the output control movement.
Output instructions are only possible for DO channels where the pulse output setting is set to OFF.



4-7-6. One-shot output

One-shot output turns OFF the output after a certain amount of time has elapsed since the output control was turned ON and the output started.
Only DO channels with the pulse output operation set to OFF can receive output commands.
The one-shot pulse width, which determines how long the output remains OFF, is configured in the one-shot time settings under other settings.
The one-shot pulse width settings are common to all DO channels.



5. Address Map

Describe the address map for each model.

5-1. WLD

This section describes the WLD address map.

5-1-1. Reset maximum and minimum values

The function code used to reset the maximum and minimum values is 06H.

table 5.1Reset maximum and minimum values

address	Size (byte)	substance	data
1028H	2	Reset maximum, minimum	0000H

Performing a maximum and minimum value reset resets the maximum and minimum values of current, voltage, active power, reactive power, power factor, and frequency.

5-1-2. Data Readout

The function code used to read the WLD data is 04H.
The data to be read is binary data. (not an ASCII string)

table 5.2command

Load Commands	04H
Write Commands	-
Continuous Write Commands	-
Absolute address	30000 (decimal)

table 5.3 WLD Data Readout

address	substance	Size (byte)	R/W	data (Decimal/invalid data in hexadecimal notation)	unit
0000H	R(1) phase current (instantaneous)	4	R	0~1080000 (Invalid data: 80000000H)	0.01A
0002H	T(2) phase current (instantaneous)	4	R		
0004H	S-phase current (instantaneous)	4	R		
0006H	N-phase current (instantaneous)	4	R		
0008H	R(1) phase current (minimum value)	4	R		
000AH	T(2) phase current (minimum)	4	R		
000CH	S phase current (minimum value)	4	R		
000EH	N-phase current (minimum)	4	R		
0010H	R(1) phase current (maximum)	4	R		
0012H	T(2) phase current (maximum)	4	R		
0014H	S phase current (maximum)	4	R		
0016H	N-phase current (maximum)	4	R		
0186H	Voltage R-S(1-N) (instantaneous)	4	R	0~18480000 (Invalid data: 80000000H)	0.01V

address	substance	Size (byte)	R/W	data (Decimal/invalid data in hexadecimal notation)	unit
0188H	Voltage S-T (2-N) (instantaneous)	4	R		
018AH	Voltage T-R(1-2) (instantaneous)	4	R		
0192H	Voltage R-S(1-N) (min)	4	R		
0194H	Voltage S-T (2-N) (minimum value)	4	R		
0196H	Voltage T-R(1-2) (minimum value)	4	R		
019EH	Voltage R-S(1-N) (maximum)	4	R		
01A0H	Voltage S-T (2-N) (maximum)	4	R		
01A2H	Voltage T-R(1-2) (maximum value)	4	R		
0380H	Active power (instantaneous value)	8	R	-199584000000~199584000000 (Invalid data: 8000000000000000H)	0.01W
0384H	Reactive power (instantaneous value)	8	R	-199584000000~199584000000 (Invalid data: 8000000000000000H)	0.01Var
0388H	Power factor (instantaneous value)	2	R	-1000~0~1000 (Invalid data: 8000H)	×0.001
0389H	Active power (minimum)	8	R	-199584000000~199584000000 (Invalid data: 8000000000000000H)	0.01W
038DH	Reactive power (minimum)	8	R	-199584000000~199584000000 (Invalid data: 8000000000000000H)	0.01Var
0391H	Power factor (minimum)	2	R	-1000~0~1000 (Invalid data: 8000H)	×0.001
0392H	Active power (maximum)	8	R	-199584000000~199584000000 (Invalid data: 8000000000000000H)	0.01W
0396H	Reactive power (maximum)	8	R	-199584000000~199584000000 (Invalid data: 8000000000000000H)	0.01Var
039AH	Power factor (maximum)	2	R	-1000~0~1000 (Invalid data: 8000H)	×0.001
0500H	Active power (power received)	8	R	0~999999999999 (Invalid data: 8000000000000000H)	0.001kWh
0504H	Active Electricity (Power Transmission)	8	R		
0508H	Amount of reactive energy (delayed power reception)	8	R	0~999999999999 (Invalid data: 8000000000000000H)	0.001kVarh
050CH	Amount of reactive energy (power received)	8	R		
0510H	Reactive power (transmission delay)	8	R		
0514H	Amount of reactive energy (power transmission progress)	8	R		
0780H	Frequency (instantaneous value)	4	R	4420~6580 (Invalid data: 80000000H)	0.01Hz
0782H	Frequency (minimum)	4	R		
0784H	Frequency (maximum)	4	R		

5-1-3. Data Readout (Continuous)

Since the addresses in the table below are contiguous, the function code can be obtained at once from the active power (instantaneous value) to the pulse input count ON time integrated value [cumulative] using 04H. You can retrieve all the data in the table below, or you can retrieve data between any addresses.
The data to be read is binary data. (not an ASCII string)

table 5.4WLD Data Readout (Continuous)

address	substance	Size (byte)	R/W	data (Decimal/invalid data in hexadecimal notation)	unit
0980H	Active power (instantaneous value) continuous	8	R	-199584000000~199584000000 (Invalid data: 8000000000000000H)	0.01W
0984H	Active power (minimum) continuous	8	R		
0988H	Active power (maximum) continuous	8	R		
098CH	Active power (power received) continuous	8	R	0~999999999999 (Invalid data: 8000000000000000H)	0.001kWh
0990H	Active power (power transmission) continuous	8	R		
0994H	Pulse Input Count Integration [Display] Continuous	4	R	0~999999999	0.001
0996H	Pulse Input Count Accumulated [Cumulative] Continuous	8	R	0~999999999999	—
099AH	Pulse Input Count ON Time Accumulated Value [Display] Continuous	4	R	0~999999	—
099CH	Pulse Input Count ON Time Cumulative Value [Cumulative] Continuous	4	R	0~999999	—

5-1-4. Other data readout

The function code used for reading other data is 04H.
The data read out by the format read is an ASCII string.

table 5.5Other data readout

address	substance	Size (byte)	R/W	data
07D0H	Format Readout	20	R	Connection Module Format String

5-2. WMB-DI16 (WMB-DI16A)

This section describes the address map of the WMB-DI16 (DI16A).

5-2-1. Setting & Control Parameters

1. Holding Registers

The hold register commands are described in the table below.

table 5.6Hold Register Commands

Load Commands	03H
Write Commands	06H
Continuous Write Commands	10H
Absolute address	40000 (decimal)

Digital Input (DI)

The digital inputs (DIs) are as follows:

table 5.7Digital Input (DI)

communication address	CH	substance	size (byte)	R/W	data (decimal)	unit
0000H	CH1	Pulse count upper limit (DI16)	4	R/W	Data range: 1~99,999,999 integers Coefficient: 1 (Factory:99,999,999)	count
0002H	CH2		4	R/W		
0004H	CH3		4	R/W		
0006H	CH4		4	R/W		
0008H	CH5		4	R/W		
000AH	CH6		4	R/W		
000CH	CH7		4	R/W		
000EH	CH8		4	R/W		
0010H	CH9		4	R/W		
0012H	CH10		4	R/W		
0014H	CH11		4	R/W		
0016H	CH12		4	R/W		
0018H	CH13		4	R/W		
001AH	CH14		4	R/W		
001CH	CH15		4	R/W		
001EH	CH16		4	R/W		
0020H	CH1	Pulse count upper limit (DI16A)	4	R/W		
0022H	CH2		4	R/W		
0024H	CH3		4	R/W		
0026H	CH4		4	R/W		
0028H	CH5		4	R/W		
002AH	CH6		4	R/W		
002CH	CH7		4	R/W		
002EH	CH8		4	R/W		
0030H	CH9		4	R/W		
0032H	CH10		4	R/W		
0034H	CH11		4	R/W		
0036H	CH12		4	R/W		
0038H	CH13		4	R/W		
003AH	CH14		4	R/W		
003CH	CH15		4	R/W		
003EH	CH16		4	R/W		

communication address	CH	substance	size (byte)	R/W	data (decimal)	unit
0040H ~ 0060H	~	reserve	~	~		
0061H	CH1	Pulse Count Reset (DI16)	4	R/W	Data range: integer from 0~99,999,999 Coefficient: 1	count
0063H	CH2		4	R/W		
0065H	CH3		4	R/W		
0067H	CH4		4	R/W		
0069H	CH5		4	R/W		
006BH	CH6		4	R/W		
006DH	CH7		4	R/W		
006FH	CH8		4	R/W		
0071H	CH9		4	R/W		
0073H	CH10		4	R/W		
0075H	CH11		4	R/W		
0077H	CH12		4	R/W		
0079H	CH13		4	R/W		
007BH	CH14		4	R/W		
007DH	CH15		4	R/W		
007FH	CH16		4	R/W		
0081H	CH1	Pulse Count Reset (DI16A)	4	R/W		
0083H	CH2		4	R/W		
0085H	CH3		4	R/W		
0087H	CH4		4	R/W		
0089H	CH5		4	R/W		
008BH	CH6		4	R/W		
008DH	CH7		4	R/W		
008FH	CH8		4	R/W		
0091H	CH9		4	R/W		
0093H	CH10		4	R/W		
0095H	CH11		4	R/W		
0097H	CH12		4	R/W		
0099H	CH13		4	R/W		
009BH	CH14		4	R/W		
009DH	CH15		4	R/W		
009FH	CH16		4	R/W		

address	CH	substance	size (byte)	R/W	data	unit
00A1H	CH1	ON Time Accumulation Reset (DI16)	4	R/W	Data range: 0~5,999,999 integers Coefficient: 1	minute
00A3H	CH2		4	R/W		
00A5H	CH3		4	R/W		
00A7H	CH4		4	R/W		
00A9H	CH5		4	R/W		
00ABH	CH6		4	R/W		
00ADH	CH7		4	R/W		
00AFH	CH8		4	R/W		
00B1H	CH9		4	R/W		
00B3H	CH10		4	R/W		
00B5H	CH11		4	R/W		
00B7H	CH12		4	R/W		
00B9H	CH13		4	R/W		
00BBH	CH14		4	R/W		
00BDH	CH15		4	R/W		
00BFH	CH16		4	R/W		
00C1H	CH1	ON Time Accumulation Reset (DI16A)	4	R/W		
00C3H	CH2		4	R/W		
00C5H	CH3		4	R/W		
00C7H	CH4		4	R/W		
00C9H	CH5		4	R/W		
00CBH	CH6		4	R/W		
00CDH	CH7		4	R/W		
00CFH	CH8		4	R/W		
00D1H	CH9		4	R/W		
00D3H	CH10		4	R/W		
00D5H	CH11		4	R/W		
00D7H	CH12		4	R/W		
00D9H	CH13		4	R/W		
00DBH	CH14		4	R/W		
00DDH	CH15		4	R/W		
00DFH	CH16		4	R/W		

* The upper limit of the pulse count is stored in the non-volatile memory, so it is retained even when the power is turned off.

common

The common item is starting at 47000 (7000 = 0x1B58).

table 5.8Common Items

address	CH	substance	size (byte)	R/W	data	unit
1B58H	-	Module Name	32	R/W	Arbitrary Character Data (Shift-JIS)	-
1B68H	-	Wink Start Designation	2	R/W	0: Stop 1~FFFEH: Flashing time FFFFH: Infinite	second
1B69H	-	Specify the start of soft reset	2	R/W	0x6141: Start	-
1B6AH	-	Response Delay	2	R/W	0~100	10ms

* The module name and response delay are stored in the non-volatile memory, so they are retained even when the power is turned off.

5-2-2. Measurement data

1. Input Status

The input status commands are described in the table below.
The input status is read-only, not writable.

table 5.9Input Status Commands

Load Commands	02H
Write Commands	-
Continuous Write Commands	-
Absolute address	10000 (decimal)

The response is 1 status = 1 bit, but 1 byte represents 8 statuses.
If there are less than 8 pieces, the end will be packed with 0 and responded.

Digital Input (DI)

table 5.10Digital Input (DI)

address	CH	substance	Size (bit)	R/W	data
0000H	CH1	DI Input Measurement Status (DI16)	1	R	0:OFF, 1:ON
0001H	CH2		1	R	
0002H	CH3		1	R	
0003H	CH4		1	R	
0004H	CH5		1	R	
0005H	CH6		1	R	
0006H	CH7		1	R	
0007H	CH8		1	R	
0008H	CH9		1	R	
0009H	CH10		1	R	
000AH	CH11		1	R	
000BH	CH12		1	R	
000CH	CH13		1	R	
000DH	CH14		1	R	
000EH	CH15		1	R	
000FH	CH16		1	R	
0010H	CH1	DI Input Measurement Status (DI16A)	1	R	0:OFF, 1:ON
0011H	CH2		1	R	
0012H	CH3		1	R	
0013H	CH4		1	R	
0014H	CH5		1	R	
0015H	CH6		1	R	
0016H	CH7		1	R	
0017H	CH8		1	R	
0018H	CH9		1	R	
0019H	CH10		1	R	
001AH	CH11		1	R	
001BH	CH12		1	R	
001CH	CH13		1	R	
001DH	CH14		1	R	
001EH	CH15		1	R	
001FH	CH16		1	R	

2. Input Registers

The input register commands are shown in the table below.
Input registers can only be read and not written.

table 5.11Input Register Commands

Load Commands	04H
Write Commands	-
Continuous Write Commands	-
Absolute address	30000 (decimal)

Digital Input (DI)

The DI data is shown in the table below.

table 5.12Digital Input (DI)

address	CH	substance	size (byte)	R/W	data (Decimal notation)	unit
0000H	CH1	Pulse Count (DI16)	4	R	Data Range: 0 ~ Integer of the upper limit of the pulse count (up to 99,999,999) Coefficient: 1	count
0002H	CH2		4	R		
0004H	CH3		4	R		
0006H	CH4		4	R		
0008H	CH5		4	R		
000AH	CH6		4	R		
000CH	CH7		4	R		
000EH	CH8		4	R		
0010H	CH9		4	R		
0012H	CH10		4	R		
0014H	CH11		4	R		
0016H	CH12		4	R		
0018H	CH13		4	R		
001AH	CH14		4	R		
001CH	CH15		4	R		
001EH	CH16		4	R		
0020H	CH1	Pulse Count (DI16A)	4	R		
0022H	CH2		4	R		
0024H	CH3		4	R		
0026H	CH4		4	R		
0028H	CH5		4	R		
002AH	CH6		4	R		
002CH	CH7		4	R		
002EH	CH8		4	R		
0030H	CH9		4	R		
0032H	CH10		4	R		
0034H	CH11		4	R		
0036H	CH12		4	R		
0038H	CH13		4	R		
003AH	CH14		4	R		
003CH	CH15		4	R		
003EH	CH16		4	R		
0040H	CH1	ON Time Totalization (DI16)	4	R	Data range: 0~5,999,999 integers Coefficient: 1	minute
0042H	CH2		4	R		

address	CH	substance	size (byte)	R/W	data (Decimal notation)	unit
0044H	CH3		4	R		
0046H	CH4		4	R		
0048H	CH5		4	R		
004AH	CH6		4	R		
004CH	CH7		4	R		
004EH	CH8		4	R		
0050H	CH9		4	R		
0052H	CH10		4	R		
0054H	CH11		4	R		
0056H	CH12		4	R		
0058H	CH13		4	R		
005AH	CH14		4	R		
005CH	CH15		4	R		
005EH	CH16		4	R		
0060H	CH1	ON time integration (DI16A)	4	R		
0062H	CH2		4	R		
0064H	CH3		4	R		
0066H	CH4		4	R		
0068H	CH5		4	R		
006AH	CH6		4	R		
006CH	CH7		4	R		
006EH	CH8		4	R		
0070H	CH9		4	R		
0072H	CH10		4	R		
0074H	CH11		4	R		
0076H	CH12		4	R		
0078H	CH13		4	R		
007AH	CH14		4	R		
007CH	CH15		4	R		
007EH	CH16		4	R		

* Pulse counting and ON time integration are stored in a non-volatile memory, so they are retained even when the power is turned off.

Common Properties

The common properties are shown in the table below.

table 5.13Common Properties

address	CH	substance	size (byte)	R/W	data	unit
2328H	-	Module Status	8	R		-
232CH	-	Vendor Name (Watanabe Electric Industry)	32	R	String "Watanabe Electric Industry" fixed	-
233CH	-	Product type	32	R	string	-
234CH	-	Firmware version	8	R	string	-
2350H	-	Hardware Version	8	R	string	-
2354H	-	Modbus table version	8	R	string	-
2358H	-	Serial number	32	R	string	-

5-3. WMB-DIO8R (WMB-DIO8RA)

This section describes the address map of WMB-DIO8R (WMB-DIO8RA).

5-3-1. Setting & Control Parameters

1. Coil

The coil commands are described in the table below.

table 5.14Coil Commands

Load Commands	01H
Write Commands	05H
Continuous Write Commands	0FH
Absolute address	00000 (decimal)

Note that when writing to the coil, write 0xFF00 when setting it to 1 and 0x0000 when setting it to 0.

Output control to digital output (DO)

The response is 1 coil = 1 bit, but 1 byte represents the status of 8 coils.
If there are less than 8 pieces, the end will be packed with 0 and responded.

table 5.15Output control to digital output (DO)

communication address	CH	substance	Size (bit)	R/W	data
0000H	CH1	Output control to DO (Normal output) (DIO8R)	1	R/W	0:OFF, 1:ON
0001H	CH2		1	R/W	
0002H	CH3		1	R/W	
0003H	CH4		1	R/W	
0004H	CH5		1	R/W	
0005H	CH6		1	R/W	
0006H	CH7		1	R/W	
0007H	CH8		1	R/W	
0008H	CH1	Output control to DO (Normal output) (DIO8RA)	1	R/W	
0009H	CH2		1	R/W	
000AH	CH3		1	R/W	
000BH	CH4		1	R/W	
000CH	CH5		1	R/W	
000DH	CH6		1	R/W	
000EH	CH7		1	R/W	
000FH	CH8		1	R/W	
0010H ~ 007FH	~	reserve	~	~	
0080H	CH1	Output control to DO (Inverting output) (DIO8R)	1	R/W	0:ON, 1:OFF (Note that ON/OFF is the opposite of the above)
0081H	CH2		1	R/W	
0082H	CH3		1	R/W	
0083H	CH4		1	R/W	
0084H	CH5		1	R/W	
0085H	CH6		1	R/W	
0086H	CH7		1	R/W	
0087H	CH8		1	R/W	
0088H	CH1	Output control to DO	1	R/W	0:ON, 1:OFF

communication address	CH	substance	Size (bit)	R/W	data
0089H	CH2	(Inverting output) (DIO8RA)	1	R/W	(Note that ON/OFF is the opposite of the above)
008AH	CH3		1	R/W	
008BH	CH4		1	R/W	
008CH	CH5		1	R/W	
008DH	CH6		1	R/W	
008EH	CH7		1	R/W	
008FH	CH8		1	R/W	
0090H ~ 009FH	~	reserve	~	~	
0100H	CH1	One-shot output (DIO8R)	1	R/W	0: Nothing happens 1: One-shot output
0101H	CH2		1	R/W	
0102H	CH3		1	R/W	
0103H	CH4		1	R/W	
0104H	CH5		1	R/W	
0105H	CH6		1	R/W	
0106H	CH7		1	R/W	
0107H	CH8		1	R/W	
0108H	CH1	One-shot output (DIO8RA)	1	R/W	0: Nothing happens 1: One-shot output
0109H	CH2		1	R/W	
010AH	CH3		1	R/W	
010BH	CH4		1	R/W	
010CH	CH5		1	R/W	
010DH	CH6		1	R/W	
010EH	CH7		1	R/W	
010FH	CH8		1	R/W	
0110H~ 017FH	~	reserve	~	~	
0180H	-	Stop/stop output control for DO1 (start) and DO2 (stop) (DIO8R)	1	R/W	0: Stop, 1: Departure
0181H	-	Stop/stop output control to DO3 (start) and DO4 (stop) (DIO8R)	1	R/W	
0182H	-	Stop/stop output control to DO5 (start) and DO6 (stop) (DIO8R)	1	R/W	
0183H	-	Stop/stop output control to DO7 (start) and DO8 (stop) (DIO8R)	1	R/W	
0184H	-	Stop/stop output control for DO1 (start) and DO2 (stop) (DIO8RA)	1	R/W	
0185H	-	Stop/stop output control to DO3 (start) and DO4 (stop) (DIO8RA)	1	R/W	
0186H	-	Stop/stop output control to DO5 (start) and DO6 (stop) (DIO8RA)	1	R/W	
0187H	-	Stop/stop output control to DO7 (start) and DO8 (stop) (DIO8RA)	1	R/W	

communication address	CH	substance	Size (bit)	R/W	data
0188H	-	Forced stop output control for DO1 (start) and DO2 (stop) (DIO8R)	1	R/W	0: Forced stop release, 1: Forced stop
0189H	-	Forced stop output control to DO3 (start) and DO4 (stop) (DIO8R)	1	R/W	
018AH	-	Forced stop output control to DO5 (start) and DO6 (stop) (DIO8R)	1	R/W	0: Forced stop release, 1: Forced stop
018BH	-	Forced stop output control to DO7 (start) and DO8 (stop) (DIO8R)	1	R/W	
018CH	-	Forced stop output control to DO1 (start) and DO2 (stop) (DIO8RA)	1	R/W	
018DH	-	Forced stop output control to DO3 (start) and DO4 (stop) (DIO8RA)	1	R/W	
018EH	-	Forced stop output control to DO5 (start) and DO6 (stop) (DIO8RA)	1	R/W	
018FH	-	Forced stop output control to DO7 (start) and DO8 (stop) (DIO8RA)	1	R/W	

* The digital output (DO) of the WMB-DIO8R (DIO8RA) is a relay (a-contact) output.
When the power is turned off and the initial state after the power is turned on, the contacts are in the open state.
The output state returns to the initial state when the power is turned off (the output is not retained)

2. Holding Registers

The hold register commands are described in the table below.

table 5.16Hold Register Commands

Load Commands	03H
Write Commands	06H
Continuous Write Commands	10H
Absolute address	40000 (decimal)

Digital input/output (DI, DO)

The digital inputs and outputs (DI, DO) are as follows.

table 5.17 Digital Inputs(DI, DO)

communication address	CH	substance	size (byte)	R/W	data (decimal)	unit
0000H	CH1	Pulse count upper limit (DIO8R)	4	R/W	Data range: 1~99,999,999 integers Coefficient: 1 (Factory:99,999,999)	count
0002H	CH2		4	R/W		
0004H	CH3		4	R/W		
0006H	CH4		4	R/W		
0008H	CH5		4	R/W		
000AH	CH6		4	R/W		
000CH	CH7		4	R/W		
000EH	CH8		4	R/W		
0010H	CH1	Pulse count upper limit (DIO8RA)	4	R/W		
0012H	CH2		4	R/W		
0014H	CH3		4	R/W		
0016H	CH4		4	R/W		
0018H	CH5		4	R/W		
001AH	CH6		4	R/W		
001CH	CH7		4	R/W		
001EH	CH8		4	R/W		
0020H~ 005FH	~	reserve	~	~		
0060H	common	One-Shot Pulse Width	2	R/W	1~10 (Factory:1)	second
0061H	CH1	Pulse Count Reset (DIO8R)	4	R/W	Data range: integer from 0~99,999,999 Coefficient: 1	count
0063H	CH2		4	R/W		
0065H	CH3		4	R/W		
0067H	CH4		4	R/W		
0069H	CH5		4	R/W		
006BH	CH6		4	R/W		
006DH	CH7		4	R/W		
006FH	CH8		4	R/W		
0071H	CH1	Pulse Count Reset (DIO8RA)	4	R/W		
0073H	CH2		4	R/W		
0075H	CH3		4	R/W		
0077H	CH4		4	R/W		
0079H	CH5		4	R/W		
007BH	CH6		4	R/W		
007DH	CH7		4	R/W		
007FH	CH8		4	R/W		
0081H~ 00A0H	~	reserve	~	~		
00A1H	CH1	ON Time Accumulation Reset	4	R/W	Data range: 0~5,999,999 integers Coefficient: 1	minute
00A3H	CH2		4	R/W		

communication address	CH	substance	size (byte)	R/W	data (decimal)	unit
00A5H	CH3	(DIO8R)	4	R/W		
00A7H	CH4		4	R/W		
00A9H	CH5		4	R/W		
00ABH	CH6		4	R/W		
00ADH	CH7		4	R/W		
00AFH	CH8		4	R/W		
00B1H	CH1	ON Time Accumulation Reset (DIO8RA)	4	R/W		
00B3H	CH2		4	R/W		
00B5H	CH3		4	R/W		
00B7H	CH4		4	R/W		
00B9H	CH5		4	R/W		
00BBH	CH6		4	R/W		
00BDH	CH7		4	R/W		
00BFH	CH8		4	R/W		

* The upper limit of the pulse count and the one-shot pulse width are stored in the non-volatile memory, so they are retained even when the power is turned off.

common

The common item is starting at 47000 (7000 = 0x1B58).

table 5.18Common Items

address	CH	substance	size (byte)	R/W	data	unit
1B58H	-	Module Name	32	R/W	Arbitrary Character Data (Shift-JIS)	-
1B68H	-	Wink Start Designation	2	R/W	0: Stop 1~FFFEH: Flashing time FFFFH: Infinite	second
1B69H	-	Specify the start of soft reset	2	R/W	0x6141: Start	-
1B6AH	-	Response Delay	2	R/W	0~100	10ms

* The module name and response delay are stored in the non-volatile memory, so they are retained even when the power is turned off.

5-3-2. Measurement data

1. Input Status

The input status commands are described in the table below.
The input status is read-only, not writable.

table 5.19 Input Status Commands

Load Commands	02H
Write Commands	-
Continuous Write Commands	-
Absolute address	10000 (decimal)

The response is 1 status = 1 bit, but 1 byte represents 8 statuses.
If there are less than 8 pieces, the end will be packed with 0 and responded.

Digital input/output (DI, DO)

table 5.20Digital input/output (DI, DO)

address	CH	substance	Size (bit)	R/W	data
0000H	CH1	DI Input Measurement Status (DIO8R)	1	R	0:OFF, 1:ON
0001H	CH2		1	R	
0002H	CH3		1	R	
0003H	CH4		1	R	
0004H	CH5		1	R	
0005H	CH6		1	R	
0006H	CH7		1	R	
0007H	CH8		1	R	
0008H	CH1	DI Input Measurement Status (DIO8RA)	1	R	
0009H	CH2		1	R	
000AH	CH3		1	R	
000BH	CH4		1	R	
000CH	CH5		1	R	
000DH	CH6		1	R	
000EH	CH7		1	R	
000FH	CH8		1	R	
0010H ~ 007FH	~	reserve	~	~	
0080H	CH1	DO Output Control State (DIO8R)	1	R	0:OFF, 1:ON
0081H	CH2		1	R	
0082H	CH3		1	R	
0083H	CH4		1	R	
0084H	CH5		1	R	
0085H	CH6		1	R	
0086H	CH7		1	R	
0087H	CH8		1	R	
0088H	CH1	DO Output Control State (DIO8RA)	1	R	
0089H	CH2		1	R	
008AH	CH3		1	R	
008BH	CH4		1	R	
008CH	CH5		1	R	
008DH	CH6		1	R	
008EH	CH7		1	R	
008FH	CH8		1	R	

2. Input Registers

The input register commands are shown in the table below.
Input registers can only be read and not written.

table 5.21Input Register Commands

Load Commands	04H
Write Commands	-
Continuous Write Commands	-
Absolute address	30000 (decimal)

Digital Input (DI)

The DI data is shown in the table below.

table 5.22Digital Input (DI)

address	CH	substance	size (byte)	R/W	data (Decimal notation)	unit
0000H	CH1	Pulse Count (DIO8R)	4	R	Data range: 0 ~ integer of pulse count upper limit (up to 99,999,999) Coefficient: 1	count
0002H	CH2		4	R		
0004H	CH3		4	R		
0006H	CH4		4	R		
0008H	CH5		4	R		
000AH	CH6		4	R		
000CH	CH7		4	R		
000EH	CH8		4	R		
0010H	CH1	Pulse Count (DIO8RA)	4	R		
0012H	CH2		4	R		
0014H	CH3		4	R		
0016H	CH4		4	R		
0018H	CH5		4	R		
001AH	CH6		4	R		
001CH	CH7		4	R		
001EH	CH8		4	R		
0020H ~ 003FH	~	reserve	~	~		

address	CH	substance	size (byte)	R/W	data (Decimal notation)	unit
0040H	CH1	ON time accumulation (DIO8R)	4	R	Data range: 0~5,999,999 integers Coefficient: 1	minute
0042H	CH2		4	R		
0044H	CH3		4	R		
0046H	CH4		4	R		
0048H	CH5		4	R		
004AH	CH6		4	R		
004CH	CH7		4	R		
004EH	CH8		4	R		
0050H	CH1	ON time accumulation (DIO8RA)	4	R		
0052H	CH2		4	R		
0054H	CH3		4	R		
0056H	CH4		4	R		
0058H	CH5		4	R		
005AH	CH6		4	R		
005CH	CH7		4	R		
005EH	CH8		4	R		

* Pulse counting and ON time integration are stored in a non-volatile memory, so they are retained even when the power is turned off.

Common Properties

The common properties are shown in the table below.

table 5.23Common Properties

address	CH	substance	size (byte)	R/W	data	unit
2328H	-	Module Status	8	R		-
232CH	-	Vendor Name (Watanabe Electric Industry)	32	R	String "Watanabe Electric Industry" fixed	-
233CH	-	Product type	32	R	string	-
234CH	-	Firmware version	8	R	string	-
2350H	-	Hardware Version	8	R	string	-
2354H	-	Modbus table version	8	R	string	-
2358H	-	Serial number	32	R	string	-

5-4. WMB-AI8

This section describes the address map of WMB-AI8.

5-4-1. Setting & Control Parameters

1. Holding Registers

The hold register commands are described in the table below.

table 5.24Hold Register Commands

Load Commands	03H
Write Commands	06H
Continuous Write Commands	10H
Absolute address	40000 (decimal)

Analog Input (AI)

The analog inputs (AI) are as follows.

table 5.25Analog Input (AI)

communication address	CH	substance	Size (byte)	R/W	data (Decimal/invalid data in hexadecimal notation)	unit
0000H	CH1	Analog Input (AI) Span Adjustment	2	R/W	Data range: 0~65535 Coefficient: 0.0005 (Factory: 2,000 [1x])	without
0001H	CH2		2	R/W		
0002H	CH3		2	R/W		
0003H	CH4		2	R/W		
0004H	CH5		2	R/W		
0005H	CH6		2	R/W		
0006H	CH7		2	R/W		
0007H	CH8		2	R/W		
0008H ~ 000FH	~	reserve	~	~		
0010H	CH1	Analog Input (AI) Zero Adjustment	2	R/W	Data range: -10000~10000 Coefficient: 0.01 (Factory: 0)	%
0011H	CH2		2	R/W		
0012H	CH3		2	R/W		
0013H	CH4		2	R/W		
0014H	CH5		2	R/W		
0015H	CH6		2	R/W		
0016H	CH7		2	R/W		
0017H	CH8		2	R/W		
0018H~ 001FH	~	reserve	~	~		
0020H	CH1	Analog Input (AI) Low	2	R/W	Data range: 0~12000 Coefficient: 0.01 (FFFFH: Low cut disabled) (Factory: FFFFH [Disabled])	%
0021H	CH2		2	R/W		
0022H	CH3		2	R/W		
0023H	CH4		2	R/W		
0024H	CH5		2	R/W		
0025H	CH6		2	R/W		
0026H	CH7		2	R/W		
0027H	CH8		2	R/W		

* Span adjustment, zero adjustment, and low cut are stored in a non-volatile memory, so they are retained even when the power is turned off.

Common

The common item is starting at 47000 (7000 = 0x1B58).

table 5.26 Common Items

address	CH	substance	size (byte)	R/W	data	unit
1B58H	-	Module Name	32	R/W	Arbitrary Character Data (Shift-JIS)	-
1B68H	-	Wink Start Designation	2	R/W	0: Stop 1~FFFEH: Flashing time FFFFH: Infinite	second
1B69H	-	Specify the start of soft reset	2	R/W	0x6141: Start	-
1B6AH	-	Response Delay	2	R/W	0~100	10ms

* The module name and response delay are stored in the non-volatile memory, so they are retained even when the power is turned off.

5-4-2. Measurement data

1. Input Registers

The input register commands are shown in the table below.

Input registers can only be read and not written.

table 5.27Input Register Commands

Load Commands	04H
Write Commands	-
Continuous Write Commands	-
Absolute address	30000 (decimal)

Analog Input (AI) Measurements

The analog input (AI) data is as follows:

table 5.28Analog Input (AI) Measurements

address	CH	substance	size (byte)	R/W	data (Decimal notation)	unit
0000H	CH1	Analog Input (AI) Measured value (%)	2	R	Data range: -2000~12000 Coefficient: 0.01	%
0001H	CH2		2	R		
0002H	CH3		2	R		
0003H	CH4		2	R		
0004H	CH5		2	R		
0005H	CH6		2	R		
0006H	CH7		2	R		
0007H	CH8		2	R		

※ Analog Input Measurement = (Measured Value + Zero Adjustment Value) × Span Adjustment Value

The measured percentage is a percentage of the full-scale rating of the input specification.
Example: WMB-AI8-36D□00 (input specification DC4-20mA):
4 mA is 0% and 20 mA is 100%

Common Properties

The common properties are shown in the table below.

table 5.29Common Properties

address	CH	substance	size (byte)	R/W	data	unit
2328H	-	Module Status	8	R		-
232CH	-	Vendor Name (Watanabe Electric Industry)	32	R	String "Watanabe Electric Industry" fixed	-
233CH	-	Product type	32	R	string	-
234CH	-	Firmware version	8	R	string	-
2350H	-	Hardware Version	8	R	string	-
2354H	-	Modbus table version	8	R	string	-
2358H	-	Serial number	32	R	string	-

5-5. WMB-MAI6

This section describes the WMB-MAI6 address map.

5-5-1. Setting & Control Parameters

1. Holding Registers

The hold register commands are described in the table below.

table 5.30Holding Registers

Load Commands	03H
Write Commands	06H
Continuous Write Commands	10H
Absolute address	40000 (decimal)

Analog Input (AI)

The analog inputs (AI) are as follows.

table 5.31Analog Input (AI)

communication address	CH	substance	Size (byte)	R/W	data (Decimal/invalid data in hexadecimal notation)	unit
0000H	CH1	Analog Input (AI) Span Adjustment	2	R/W	Data range: 0~65535 Coefficient: 0.0005 (Factory: 2,000 [1x])	without
0001H	CH2		2	R/W		
0002H	CH3		2	R/W		
0003H ~ 000FH	~	reserve	~	~		
0010H	CH1	Analog Input (AI) Zero Adjustment	2	R/W	Data range: -10000~10000 Coefficient: 0.01 (Factory: 0)	%
0011H	CH2		2	R/W		
0012H	CH3		2	R/W		
0013H~ 001FH	~	reserve	~	~		
0020H	CH1	Analog Input (AI) Low	2	R/W	Data range: 0~12000 Coefficient: 0.01 (FFFFH: Low cut disabled) (Factory: FFFFH [Disabled])	%
0021H	CH2		2	R/W		
0022H	CH3		2	R/W		

* Span adjustment, zero adjustment, and low cut are stored in a non-volatile memory, so they are retained even when the power is turned off.

Resistance Temperature Detector Input (RI)

The resistance temperature detector inputs (RIs) are as follows.

table 5.32Resistance Temperature Detector (RI)

communication address	CH	substance	Size (byte)	R/W	data (decimal)	unit
0030H	CH1	Resistance Temperature Detector (RI) Span Adjustment	2	R/W	Data range: 0~65535 Coefficient: 0.0005 (Factory: 2,000 [1x])	without
0031H	CH2		2	R/W		
0032H	CH3		2	R/W		
0033H ~ 003FH	~	reserve	~	~		
0040H	CH1	Resistance Temperature Detector (RI) Zero Adjustment	2	R/W	Data range: -25000~25000 Coefficient: 0.01 (Factory: 0)	℃
0041H	CH2		2	R/W		
0042H	CH3		2	R/W		

* Span adjustment and zero adjustment are stored in the non-volatile memory, so they are retained even when the power is turned off.

common

The common item is starting at 47000 (7000 = 0x1B58).

table 5.33Common Items

address	CH	substance	size (byte)	R/W	data	unit
1B58H	-	Module Name	32	R/W	Arbitrary Character Data (Shift-JIS)	-
1B68H	-	Wink Start Designation	2	R/W	0: Stop 1~FFFEH: Flashing time FFFFH: Infinite	second
1B69H	-	Specify the start of soft reset	2	R/W	0x6141: Start	-
1B6AH	-	Response Delay	2	R/W	0~100	10ms

* The module name and response delay are stored in the non-volatile memory, so they are retained even when the power is turned off.

5-5-2. Measurement data

1. Input Registers

The input register commands are shown in the table below.

Input registers can only be read and not written.

table 5.34 Input Register Commands

Load Commands	04H
Write Commands	-
Continuous Write Commands	-
Absolute address	30000 (decimal)

Analog Input (AI) Measurements

The analog input (AI) data is as follows:

table 5.35 Analog Inputs(AI) Measurements

Address	CH	Substance	Size (byte)	R/W	Data (Decimal notation)	Unit
0000H	CH1	Analog Input (AI) Measured value (%)	2	R	Data range: -2000~12000 Coefficient: 0.01	%
0001H	CH2		2	R		
0002H	CH3		2	R		

※ Analog Input Measurement = (Measured Value + Zero Adjustment Value) × Span Adjustment Value

The measured percentage of the analog input is a percentage of the full-scale rating of the input specification.
Example: WMB-MAI6-36FD□00 (input specification DC4-20mA):
4 mA is 0% and 20 mA is 100%

Resistance Temperature Detector Input (RI) Measurements

The resistance temperature detector input (RI) data is as follows:

table 5.36 RTD Input(RI) Measurements

Address	CH	Substance	Size (byte)	R/W	Data (Decimal notation)	Unit
0010H	CH1	Resistance Temperature Detector (RI) Measured value (%)	2	R	Data range: -2000~12000 Coefficient: 0.01	%
0011H	CH2		2	R		
0012H	CH3		2	R		
0013H ~ 001FH	~	reserve	~	~		
0020H	CH1	Resistance Temperature Detector (RI) Measured value (°C)	2	R	Data range: -10000~25000 Coefficient: 0.01	°C
0021H	CH2		2	R		
0022H	CH3		2	R		

※ Resistance thermometer measurement (°C) = (measured value + zero adjustment value) × span adjustment value The resistance thermometer measurement value (%) is calculated by scaling from the resistance thermometer measurement value (°C).
Measured value (%) = 100 × (measured value (°C) + 50) / 250

The measured value (%) of the resistance thermometer detector is 0% at -50°C and 100% at 200°C
(Percentage of full scale of the temperature range of the input specification)

Common Properties

The common properties are shown in the table below.

table 5.37Common Properties

Address	CH	Substance	Size (byte)	R/W	Data	Unit
2328H	-	Module Status	8	R		-
232CH	-	Vendor Name (Watanabe Electric Industry)	32	R	String "Watanabe Electric Industry" fixed	-
233CH	-	Product type	32	R	string	-
234CH	-	Firmware version	8	R	string	-
2350H	-	Hardware Version	8	R	string	-
2354H	-	Modbus table version	8	R	string	-
2358H	-	Serial number	32	R	string	-

5-6. WMB-AO4

This section describes the address map of WMB-AO4.

5-6-1. Setting & Control Parameters

1. Holding Registers

The hold register commands are described in the table below.

table 5.38Hold Register Commands

Load Commands	03H
Write Commands	06H
Continuous Write Commands	10H
Absolute address	40000 (decimal)

Analog Output (AO)

The analog output (AO) is as follows.

table 5.39 Analog Output(AO)

Communication address	CH	Substance	Size (byte)	R/W	Data (decimal)	Uunit
0000H	CH1	Analog Output (AO) Output Control Value (%)	2	R/W	Data range: -2000~12000 Coefficient: 0.01 (Factory: 0)	%
0001H	CH2		2	R/W		
0002H	CH3		2	R/W		
0003H	CH4		2	R/W		
0004H ~ 000FH	~	reserve	~	~		
0010H	CH1	Analog Output (AO) Span Adjustment	2	R/W	Data range: 0~65535 Coefficient: 0.0005 (Factory: 2,000 [1x])	without
0011H	CH2		2	R/W		
0012H	CH3		2	R/W		
0013H	CH4		2	R/W		
0014H ~ 001FH	~	reserve	~	~		
0020H	CH1	Analog Output (AO) Zero Adjustment	2	R/W	Data range: -10000~10000 Coefficient: 0.01 (Factory: 0)	%
0021H	CH2		2	R/W		
0022H	CH3		2	R/W		
0023H	CH4		2	R/W		
0024H ~ 002FH	~	reserve	~	~		
0030H	CH1	Analog Output (AO) Output Mode	2	R/W	0: Initial value specified output 1: Output Hold 2: Fixed output (Factory: 0 [Initial value specified output])	without
0031H	CH2		2	R/W		
0032H	CH3		2	R/W		
0033H	CH4		2	R/W		
0034H ~ 003FH	~	reserve	~	~		
0040H	CH1	Analog Output (AO) Output Fixed Value (%)	2	R/W	Data range: -2000~12000 Coefficient: 0.01 (Factory: 0)	%
0041H	CH2		2	R/W		
0042H	CH3		2	R/W		
0043H	CH4		2	R/W		
0044H ~ 004FH	~	reserve	~	~		
0050H	CH1	Analog Output (AO)	2	R/W	Data range: -2000~12000	%

Communication address	CH	Substance	Size (byte)	R/W	Data (decimal)	Uunit
0051H	CH2	Initial value specified output value (%)	2	R/W	Coefficient: 0.01 (Factory: 0)	
0052H	CH3		2	R/W		
0053H	CH4		2	R/W		

* Output control value, span adjustment, zero adjustment, output mode, output fixed value, and initial value specified output value are stored in non-volatile memory.
It is also held when the power is turned off

The output value (%) is a percentage of the full-scale rating of the output specification.
Example: WMB-AO4-AD□00 (output specification DC4-20mA):
4 mA is 0% and 20 mA is 100%

common

The common item is starting at 47000 (7000 = 0x1B58).

table 5.40Common Items

Address	CH	Substance	Size (byte)	R/W	Data	Unit
1B58H	-	Module Name	32	R/W	Arbitrary Character Data (Shift-JIS)	-
1B68H	-	Wink Start Designation	2	R/W	0: Stop 1~FFFEH: Flashing time FFFFH: Infinite	second
1B69H	-	Specify the start of soft reset	2	R/W	0x6141: Start	-
1B6AH	-	Response Delay	2	R/W	0~100	10ms

* The module name and response delay are stored in the non-volatile memory, so they are retained even when the power is turned off.

5-6-2. Measurement data

1. Input Registers

The input register commands are shown in the table below.

Input registers can only be read and not written.

table 5.41Input Register Commands

Load Commands	04H
Write Commands	-
Continuous Write Commands	-
Absolute address	30000 (decimal)

Analog Output (AO) Output Value

The analog output (AO) data is as follows:

table 5.42 Analog Output(AO) Output value

Address	CH	Substance	Size (byte)	R/W	Data (Decimal notation)	Unit
0000H	CH1	Analog Output (AO) (%)	2	R	Data range: -2000~12000 Coefficient: 0.01	%
0001H	CH2		2	R		
0002H	CH3		2	R		
0003H	CH4		2	R		

※ Analog output value = (measured value + zero adjustment value) × span adjustment value

Common Properties

The common properties are shown in the table below.

table 5.43Common Properties

Address	CH	Substance	Size (byte)	R/W	Data	Unit
2328H	-	Module Status	8	R		-
232CH	-	Vendor Name (Watanabe Electric Industry)	32	R	String "Watanabe Electric Industry" fixed	-
233CH	-	Product type	32	R	string	-
234CH	-	Firmware version	8	R	string	-
2350H	-	Hardware Version	8	R	string	-
2354H	-	Modbus table version	8	R	string	-
2358H	-	Serial number	32	R	string	-

5-7. WMS-PE2D□

5-7-1. Configuration Parameters

1. How to set configuration parameters

If you want to change the parameters (address 1002H or later of the holding register), there is a configuration procedure.

table 5.44Order of setting configuration parameters

order	item	operation
1	Configuration: Permission Communication	Holding register address: Write data 0001H to 1000H
2	Parameter Modification	Write change data to each address
3	Configuration, saving, and communication	Holding register address: write data 0000H to 1000H

※If an exception response occurs during the process, you must start over from Step 1.
※At Step 2, even if you read the contents of the holding registers, the write values are not yet reflected.
The changes made in Step 2 will only be reflected in the holding registers after successful communication for saving settings in Step 3.

For detailed configuration procedures, please refer to "Parameter Setting Communication."

The function codes used for reading and setting parameters are 03H (read), 06H (write), and 10H (write multiple).
The data to be set and the data to be read are binary data (not ASCII characters).

table 5.45command

Load Commands	03H
Write Commands	06H
Continuous Write Commands	10H
Absolute address	40000 (decimal)

table 5.46 Configuration Parameters

Address	Substance	Size (byte)	R/W	Data
1000H	Setting Permissions/Saving Instructions	2	W	0000H: Save settings 0001H: Configuration permission
1001H	Configuration Error Codes	2	R	0000H: No error Except 0000H: With error * For details of the error contents, table 5.47reference

Set Era-Code

When saving the settings, the following range checks are performed.
If an error exists, itstores the error code at the communication address 100 1 H and the changes are not saved.
Error codes are prioritized in ascending order in the table below.

table 5.47 Error

Target setting value	Error Determination	Error
Each circuit is enabled/disabled	All measurable circuits are invalid according to the phase line classification. ・ Single-phase 2 wire: Circuit A ~ D all disabled Single-phase 3-wire: Circuit A and Circuit C are invalid Three-phase 3-wire: Circuit A and Circuit C are invalid Three-phase 4-wire: Circuit A is invalid ・ Single-phase 2 wires branched from single-phase 3 wires: Circuit A ~ D all invalid Single-phase 3-wire + single-phase 2-wire: Circuit A, Circuit C, Circuit D are invalid	0001H
Voltage Rating/External VT Rating	Voltage Rating > External VT Rating	0002H
Circuit A Current Rating/External CT Rating	Current rating: Other than 5A and Current rating and external CT rating are not equal	0003H
Circuit B Current Rating/External CT Rating	ditto	0004H
Circuit C Current Rating/External CT Rating	ditto	0005H
Circuit D Current Rating/External CT Rating	ditto	0006H
DO1 alarm kW/A	・Current phase 2~4 is set when single-phase 2-wire is used. ・ When branching from single-phase 3 wires to single-phase 2 wires Set current phase 2~4 ・ Alarm circuit assignment when single-phase 3-wire + single-phase 2-wire Circuit C or D sets current phase 2~4 ・ Set current phase 4 other than 3-phase 4 wire	0007H
DO2 alarm kW/A	ditto	0008H
Voltage Rating	single-phase3-wire or Single-phase two-wire branched from single-phase three-wire or When single-phase 3-wire + single-phase 2-wire Set to 220V	0009H
Stop Bits	Modbus communication with even parity or Set the stop bit to 2 at odd numbers	000AH
DO1 Alarm Circuit Assignment	・Circuit B is set when single-phase 3-wire / three-phase 3-wire / three-phase 4-wire / single-phase 3-wire + single-phase 2-wire ・Circuit C is set when 3-phase 4-wire - Set circuit D when single-phase 3-wire, three-phase 3-wire, or three-phase 4-wire	000BH
DO2 Alarm Circuit Assignment	ditto	000CH

2. Common circuit settings

The common circuit settings are as follows.

table 5.48 Common circuit settings

address	substance	data size (byte)	R/W	data
1002H	Phase line classification	2	R/W	0000H: Single-phase 2-wire 0001H: Single-phase 3-wire 0002H: Three-phase three-wire 0003H: Three-phase four-wire 0004H: Single-phase 2-wire branched from single-phase 3-wire 0005H: Single-phase 3-wire + Single-phase 2-wire * When the phase line classification is changed, the following settings are initialized. ・Circuit A Enabled/Disable: Enabled ・Circuit B~D Enable/Disable: Disabled ・DO1/2 Output Operation Selection: OFF ・DO1/2 Alarm Circuit Assignment: Circuit A ・DO1/2 Alarm kW/A: Active power alarm (unit: kW) In addition to the above Single-phase 3 wires / Single-phase 2 wires branched from single-phase 3 wires / When changing to single-phase 3-wire + single-phase 2, if the voltage input rating is 220V, the voltage input rating and the external VT rating will be 110V.
1003H	Voltage Input Rating	2	R/W	0000H：110V 0001H：220V * If the phase line classification is single-phase 2 wires/single-phase 3 wires + single-phase 2 wires/branched from single-phase 3 wires/single-phase 3 wires, set it to 110V. * When the voltage input rating is changed, the external VT rating becomes the same value as the voltage input rating. Example: When the voltage input rating is changed to 0000H:110V The external VT rating will also be 6EH:110V.
1004H	External VT Rating	4	R/W	6E~12CC8H(=110~77,000：110~77,000V) * Set the voltage input to or higher than the rated value.

3. Individual circuit setting

The individual circuit settings are as follows.

table 5.49 Individual circuit setting

address	substance	data size (byte)	R/W	data
1006H	Circuit A Enable/Disable	2	R/W	0000H: Disabled 0001H: Enabled
1007H	Circuit B Enable/Disable	2	R/W	
1008H	Circuit C Enable/Disable	2	R/W	
1009H	Circuit D Enable/Disable	2	R/W	
100AH	Circuit A Current Input Rating	2	R/W	0000H : 5A 0001H : 50A 0002H : 100A 0003H : 200A 0004H : 400A 0005H : 600A * When the current input rating is changed, the external CT rating becomes the same value as the current input rating. Example) When the current input rating is changed to 0005H:600A The external CT rating will also be 258H:600A.
100BH	Circuit B Current Input Rating	2	R/W	
100CH	Circuit C Current Input Rating	2	R/W	
100DH	Circuit D Current Input Rating	2	R/W	
100EH	Circuit A External CT Rating	2	R/W	5 ~ 270H (= 5 ~ 9,999: 5 ~ 9,999 A) * When the current input rating is 5 A, all of the above ranges are valid. * When other than 5A, only the current input rating = external CT rating is valid.
100FH	Circuit B External CT Rating	2	R/W	
1010H	Circuit C External CT Rating	2	R/W	
1011H	Circuit D External CT Rating	2	R/W	
1012H	Circuit A Pulse Port Assignment	2	R/W	0000H : OFF 0001H : OUT1 0002H : OUT2 * Only WMS-PE2DO works.
1013H	Circuit B Pulse Port Assignment	2	R/W	
1014H	Circuit C Pulse Port Assignment	2	R/W	
1015H	Circuit D Pulse Port Assignment	2	R/W	
1016H	Circuit A Current Low Cut	2	R/W	0~63H(=0~99:0.0%~9.9%[0.1% unit])
1017H	Circuit B Current Low Cut	2	R/W	
1018H	Circuit C Current Low Cut	2	R/W	
1019H	Circuit D Current Low Cut	2	R/W	
101AH	Circuit A Measured voltage	2	R/W	0000H: Voltage between 1-N 0001H: Voltage between 2-N 0002H: Voltage between 1-2 * It works only when the phase line classification is "single-phase 2 wires branched from single-phase 3 wires" or "single-phase 3 wires + single-phase 2 wires". * In the case of "single-phase 2 wires branched from single-phase 3 wires", the set value of the measured voltage of all circuits is operated. * In the case of "single-phase 3-wire + single-phase 2-wire", the set value of the measured voltage of circuit C and circuit D operates.
101BH	Circuit B: Measured voltage	2	R/W	
101CH	Circuit C Measured voltage	2	R/W	
101DH	Circuit D Measured voltage	2	R/W	
101EH	Circuit A Voltageless Measurement ON/OFF	2	R/W	0000H : OFF 0001H : ON
101FH	Circuit B Voltage-less measurement ON/OFF	2	R/W	
1020H	Circuit C Voltage-less measurement ON/OFF	2	R/W	
1021H	Circuit D Voltageless Measurement ON/OFF	2	R/W	

address	substance	data size (byte)	R/W	data
1022H	Circuit A Virtual Power Factor	2	R/W	0~3E8H(＝0~1,000：0.0~100.0% [in 0.1% increments])
1023H	Circuit B Virtual Power Factor	2	R/W	
1024H	Circuit C Virtual Power Factor	2	R/W	
1025H	Circuit D Virtual Power Factor	2	R/W	
1026H	Circuit A conversion factor	2	R/W	0~270FH(=0~9,999:0.000~9.999[0.001 unit])
1027H	Circuit B conversion factor	2	R/W	
1028H	Circuit C conversion factor	2	R/W	
1029H	Circuit D conversion factor	2	R/W	

4. Modbus communication settings

The Modbus communication settings are as follows.

table 5.50 Modbus communication settings

address	substance	data size (byte)	R/W	data
108FH	Transmission speed	2	R/W	0000H：4800bps 0001H：9600bps 0002H：19200bps 0003H：38400bps
1090H	Stop Bits	2	R/W	0000H：1bit 0001H：2bit * 2bit can only be set when there is no parity.
1091H	parity	2	R/W	0000H: None 0001H: Odd 0002H: Even number * If the parity is changed to an odd or even number, the stop bit will be 0000H:1bit.
1092H	Transmission latency	2	R/W	0~63H(=0~99:0~99ms[1ms increments])

5. Pulse output setting

The pulse output settings are as follows. Only WMS-PE2DO works.

table 5.51 Pulse output setting

address	substance	data size (byte)	R/W	data
10C0H	DO1 Output Operation Selection	2	R/W	0000H：OFF 0001H: Pulse output 0002H: Alarm output
10C1H	DO1 Unit Pulse Weights	2	R/W	0000H: 0.001 kWh/1 pulse 0001H: 0.01 kWh/1 pulse 0002H: 0.1 kWh/1 pulse 0003H: 0.5 kWh/1 pulse 0004H: 1 kWh/1 pulse 0005H: 10 kWh/1 pulse 0006H: 100 kWh/1 pulse * Operates only when the DO1 output operation selection is pulse output.
10C2H	DO1 Pulse Output Width	2	R/W	0000H：100 ms 0001H：250 ms 0002H：500 ms 0003H：1000 ms * Operates only when the DO1 output operation selection is pulse output.
10C3H	DO1 Alarm Circuit Assignment	2	R/W	0000H: Circuit A 0001H: Circuit B 0002H: Circuit C 0003H: Circuit D * Operates only when the DO1 output operation selection is alarm output.
10C4H	DO1 Alarm HI/LO	2	R/W	0000H：HI 0001H：LO * Operates only when the DO1 output operation selection is alarm output.

address	substance	data size (byte)	R/W	data
10C5H	DO1 alarm kW/A	2	R/W	0000H: Active power alarm (unit: kW) 0001H: Current Alarm - Phase 1 (Unit: A) 0002H: Current Alarm - Phase 2 (Unit: A) 0003H: Current Alarm - Phase 3 (Unit: A) 0004H: Current Alarm - Phase 4 (Unit: A) * Operates only when the DO1 output operation selection is alarm output.
10C6H	DO1 Alarm HI Judgment Value (Active power designation) single-phase2-wire	4	R/W	FF676981H~98967FH (＝±9,999,999： The setting range varies depending on the power rating of the circuit set in the alarm circuit assignment.) Power Rating ・Less than 6MW: ±9999.999kW ・6MW or more ~ less than 60MW: ±99999.99kW ・60MW or more ~ less than 600MW: ±999999.9kW ・600MW or more: ±9999999kW * Operates only when the DO1 output operation selection is alarm output.
10C8H	DO1 Alarm HI Judgment Value (Active power designation) single-phase3-wire	4	R/W	
10CAH	DO1 Alarm HI Judgment Value (Active power designation) three-phase3-wire	4	R/W	
10CCH	DO1 Alarm HI Judgment Value (Active power designation) three-phase4-wire	4	R/W	
10CEH	DO1 Alarm HI Judgment Value (Active power designation) Single-phase two-wire branched from single-phase three-wire	4	R/W	
10D0H	DO1 Alarm HI Judgment Value (Active power designation) Single-phase 3-wire + single-phase 2-wire	4	R/W	
10D2H	DO1 Alarm HI Judgment Value (Phase current specification) single-phase2-wire	2	R/W	0~270FH(＝0~9,999： The setting range differs depending on the current rating of the circuit set in the alarm circuit assignment.) Current Rating ・Rated 80A or less: 0.00 ~ 99.99A ・Rated 800A or less: 0.0 ~ 999.9A ・Rated 8000A or less: 0~9999A * Operates only when the DO1 output operation selection is alarm output.
10D3H	DO1 Alarm HI Judgment Value (Phase current specification) single-phase3-wire	2	R/W	
10D4H	DO1 Alarm HI Judgment Value (Phase current specification) three-phase3-wire	2	R/W	
10D5H	DO1 Alarm HI Judgment Value (Phase current specification) three-phase4-wire	2	R/W	
10D6H	DO1 Alarm HI Judgment Value (Phase current specification) Single-phase two-wire branched from single-phase three-wire	2	R/W	
10D7H	DO1 Alarm HI Judgment Value (Phase current specification) Single-phase 3-wire + single-phase 2-wire	2	R/W	

address	substance	data size (byte)	R/W	data
10D8H	DO1 Alarm LO Judgment Value (Active power designation) single-phase2-wire	4	R/W	FF676981H~98967FH (＝±9,999,999： The setting range varies depending on the power rating of the circuit set in the alarm circuit assignment.) Power Rating ・Less than 6MW: ±9999.999kW ・6MW or more ~ less than 60MW: ±99999.99kW ・60MW or more ~ less than 600MW: ±999999.9kW ・600MW or more: ±9999999kW * Operates only when the DO1 output operation selection is alarm output.
10DAH	DO1 Alarm LO Judgment Value (Active power designation) single-phase3-wire	4	R/W	
10DCH	DO1 Alarm LO Judgment Value (Active power designation) three-phase3-wire	4	R/W	
10DEH	DO1 Alarm LO Judgment Value (Active power designation) three-phase4-wire	4	R/W	
10E0H	DO1 Alarm LO Judgment Value (Active power designation) Single-phase two-wire branched from single-phase three-wire	4	R/W	
10E2H	DO1 Alarm LO Judgment Value (Active power designation) Single-phase 3-wire + single-phase 2-wire	4	R/W	
10E4H	DO1 Alarm LO Judgment Value (Phase current specification) single-phase2-wire	2	R/W	0~270FH(＝0~9,999： The setting range differs depending on the current rating of the circuit set in the alarm circuit assignment.) Current Rating ・Rated 80A or less: 0.00 ~ 99.99A ・Rated 800A or less: 0.0 ~ 999.9A ・Rated 8000A or less: 0~9999A * Operates only when the DO1 output operation selection is alarm output.
10E5H	DO1 Alarm LO Judgment Value (Phase current specification) single-phase3-wire	2	R/W	
10E6H	DO1 Alarm LO Judgment Value (Phase current specification) three-phase3-wire	2	R/W	
10E7H	DO1 Alarm LO Judgment Value (Phase current specification) three-phase4-wire	2	R/W	
10E8H	DO1 Alarm LO Judgment Value (Phase current specification) Single-phase two-wire branched from single-phase three-wire	2	R/W	
10E9H	DO1 Alarm LO Judgment Value (Phase current specification) Single-phase 3-wire + single-phase 2-wire	2	R/W	

address	substance	data size (byte)	R/W	data
10EAH	DO1 Hysteresis Width (Active power designation) single-phase2-wire	4	R/W	0~98967FH (＝0~9,999,999： The setting range varies depending on the power rating of the circuit set in the alarm circuit assignment.) Power Rating ・Less than 6MW: 0.000~9999.999kW ・6MW or more ~ less than 60MW: 0.00~99999.99kW ・60MW or more ~ less than 600MW: 0.0~999999.9kW ・600MW or more: 0~9999999kW * Operates only when the DO1 output operation selection is alarm output.
10ECH	DO1 Hysteresis Width (Active power designation) single-phase3-wire	4	R/W	
10FEH	DO1 Hysteresis Width (Active power designation) three-phase3-wire	4	R/W	
10F0H	DO1 Hysteresis Width (Active power designation) three-phase4-wire	4	R/W	
10F2H	DO1 Hysteresis Width (Active power designation) Single-phase two-wire branched from single-phase three-wire	4	R/W	
10F4H	DO1 Hysteresis Width (Active power designation) Single-phase 3-wire + single-phase 2-wire	4	R/W	
10F6H	DO1 Hysteresis Width (Phase current specification) single-phase2-wire	2	R/W	0~270FH(＝0~9,999： The setting range differs depending on the current rating of the circuit set in the alarm circuit assignment.) Current Rating ・Rated 80A or less: 0.00 ~ 99.99A ・Rated 800A or less: 0.0 ~ 999.9A ・Rated 8000A or less: 0~9999A * Operates only when the DO1 output operation selection is alarm output.
10F7H	DO1 Hysteresis Width (Phase current specification) single-phase3-wire	2	R/W	
10F8H	DO1 Hysteresis Width (Phase current specification) three-phase3-wire	2	R/W	
10F9H	DO1 Hysteresis Width (Phase current specification) three-phase4-wire	2	R/W	
10FAH	DO1 Hysteresis Width (Phase current specification) Single-phase two-wire branched from single-phase three-wire	2	R/W	
10FBH	DO1 Hysteresis Width (Phase current specification) Single-phase 3-wire + single-phase 2-wire	2	R/W	
10FCH	DO1 Output OFF Delay	2	R/W	0~3E7H(=0~999:0~99.9 sec [0.1 sec increments]) * Operates only when the DO1 output operation selection is set to alarm output.

DO2: The communication address is +61 (3DH) for each address in the above table, and the data content is the same as DO1.

6. Pulse Input Settings

The pulse input settings are as follows. Only WMS-PE2DI works.

table 5.52 Pulse Input Settings

address	substance	data size (byte)	R/W	data
116CH	DI1 Pulse Accumulation Factor	4	R/W	1~186A0H (=1~100,000:0.001~100.000[0.001 unit])
116EH	DI1 Pulse Accumulation Maximum	4	R/W	1~5F5E0FFH(＝1~99,999,999)
1170H	DI2 Pulse Accumulation Factor	4	R/W	1~186A0H (=1~100,000:0.001~100.000[0.001 unit])
1172H	DI2 Pulse Accumulation Maximum	4	R/W	1~5F5E0FFH(＝1~99,999,999)

7. Other settings

Other settings are as follows.

table 5.53 Other settings

address	substance	data size (byte)	R/W	data
11A6H	Auto-off	2	R/W	0000H：OFF 0001H: 1 minute 0002H: 5 minutes 0003H: 10 minutes
11A7H	Configuration Protect	2	R/W	0000H：OFF 0001H：ON * When ON, setting changes by module UI operation are restricted.
11A8H	Brightness adjustment	2	R/W	0000H：TYP 0001H：MAX 0002H：MIN
11A9H	One-shot time	2	R/W	1~AH(=1~10 seconds [1 second unit]) * The initial value is 1 second. * One-shot time when controlling DO from communication
11AAH	Module Name	32	R/W	Arbitrary Character Data (Shift-JIS) * Initial value 32 Byte All NULL

5-7-2. Control Parameters

1. Coil

The function codes used for coil reading and writing are 01H (read), 05H (write), 0FH (continuous write).
The data that is written and read is binary data. (not ASCII characters)

table 5.54Coil Commands

Load Commands	01H
Write Commands	05H
Continuous Write Commands	0FH
Absolute address	00000 (decimal)

Note that when writing to the coil, write 0xFF00 when setting it to 1 and 0x0000 when setting it to 0.

The response is 1 coil = 1 bit, but 1 byte represents the status of 8 coils.
If there are less than 8 pieces, it will be responded with the end stuffed with 0.
* WMS-PE2DO has a maximum of 2 coils.

Output control to digital output (DO)

Only WMS-PE2DO works.
Writing to the address is valid only for DO when the output operation selection of the pulse output setting is turned off.
For start/stop output control, the output operation selection of DO1 and DO2 must be turned off.

table 5.55Output control to digital output (DO)

communication address	CH	substance	Size (bit)	R/W	data
0000H	DO1	Output control to DO (Normal output)	1	R/W	0:OFF, 1:ON
0001H	DO2		1	R/W	
0002H ~ 009FH	~	reserve	~	~	-
00A0H	DO1	Output control to DO (Inverting output)	1	R/W	0:ON, 1:OFF * Since ON / OFF is the opposite of the above normal output Please be careful.
00A1H	DO2		1	R/W	
00A2H ~ 011FH	~	reserve	~	~	
0120H	CH1	One-shot output	1	R/W	0: Nothing happens 1: One-shot output
0121H	CH2		1	R/W	
0122H~ 017FH	~	reserve	~	~	-
01E0H	-	Stop/stop output control to DO1 (start) and DO2 (stop)	1	R/W	0: Stop, 1: Departure
01E1H	-	Forced stop output control for DO1 (start) and DO2 (stop)	1	R/W	0: Forced stop release, 1: Forced stop

* The output state will return to the initial state when the power is turned off. (Output is not preserved)
* If the output operation selection of the pulse output setting is set to something other than OFF during output control, the output will be canceled and the output operation selection will be
Follows the behavior of the selected setting.

2. Holding Registers

The function codes used for reading and writing the holding register are 03H (read), 06H (write), 10H (Continuous Write). The commands are described in the table below.

table 5.56 Hold Register Commands

Load Commands	03H
Write Commands	06H
Continuous Write Commands	10H
Absolute address	40000 (decimal)

Clearing Measurement Data and Resetting Energy

The data to be set is binary data. (not an ASCII string)

table 5.57 Clearing Measurement Data and Resetting Energy

address	substance	data size (byte)	R/W	data
0080H	Circuit A Active/Reactive Energy 0 Reset	2	W	0000H: Reset
0081H	Circuit B: Active/Reactive Power 0 Reset	2	W	
0082H	Circuit C Active/Reactive Power 0 Reset	2	W	
0083H	Circuit D Active/Reactive Energy 0 Reset	2	W	
0084H	All circuits: Active/reactive energy 0 reset	2	W	
0085H	Circuit A Maximum and Minimum Value Reset	2	W	
0086H	Circuit B: Maximum, Minimum Reset	2	W	
0087H	Circuit C Maximum, Minimum Value Reset	2	W	
0088H	Circuit D Maximum, Minimum Value Reset	2	W	
0089H	All circuits: Reset maximum and minimum values	2	W	
table 5.58 reference	Energy Preset (Function Code: 10H)	8	W	0~999,999,999,999[Wh] * Writable only in measurement mode
table 5.59 reference	Energy Preset (Function Code: 10H)	4	W	Rated power less than 964.506 kW: 0~9,999,999 .99[kWh] Rated power 964.506 kW or more: 0~999,999,999[kWh] (Reactive energy [kVar]) * Writable only in measurement mode
0135H	Wink (ERR LED flashing)	2	W	0000H: Stop flashing 0001H~FFFEH: Start flashing (until flashing time [seconds]) FFFFH: Start flashing

※ When the maximum and minimum values are reset, all measurement elements (current, voltage, active power, reactive power,
Power factor, frequency) maximum and minimum values are reset.
After the maximum and minimum values are reset, it takes up to 0.5 seconds for the maximum and minimum values to be updated.

table 5.58 Energy Preset Address List (8 Bytes of Data)

circuit	Active energy		Amount of reactive energy			
	(Power received)	(Power Transmission)	(Delay in receiving power)	(Incoming power)	(Transmission delay)	(Transmission proceeds)
	8 bytes	8 bytes	8 bytes	8 bytes	8 bytes	8 bytes
Circuit A	008AH	008EH	0092H	0096H	009AH	009EH
Circuit B	00A2H	00A6H	00AAH	00AEH	00B2H	00B6H
Circuit C	00BAH	00BEH	00C2H	00C6H	00CAH	00CEH
Circuit D	00D2H	00D6H	00DAH	00DEH	00E2H	00E6H

※ The function code used for the energy preset is 10H.

table 5.59Energy Preset Address List (4 Bytes Data)

circuit	Active energy		Amount of reactive energy			
	(Power received)	(Power Transmission)	(Delay in receiving power)	(Incoming power)	(Transmission delay)	(Transmission proceeds)
	4 bytes	4 bytes	4 bytes	4 bytes	4 bytes	4 bytes
Circuit A	00EAH	00ECH	00EEH	00F0H	00F2H	00F4H
Circuit B	00F6H	00F8H	00FAH	00FCH	00FEH	0100H
Circuit C	0102H	0104H	0106H	0108H	010AH	010CH
Circuit D	010EH	0110H	0112H	0114H	0116H	0118H

※ The function code used for the energy preset is 10H.

Simulated Output

Simulated output works only with WMS-PE2DO.
The data to be set is binary data. (not an ASCII string)

table 5.60 Simulated Output Address List

address	substance	data size (byte)	R/W	data
011FH	Simulated Output Enabled/Disabled	2	R/W	bit15-2：Reserved bit1:DO2 (0: disabled, 1: enabled) bit0:DO1 (0: disabled, 1: enabled)
0120H	Simulated Output Output Values	2	R/W	bit15-2：Reserved bit1：DO2（0：OFF, 1：ON） bit0：DO1（0：OFF, 1：ON） * Works only when simulated output is enabled.
0121H	Simulated output one-shot instruction	2	R/W	bit15-2：Reserved bit1: DO2 (0: no operation, 1: One-shot instruction) bit0:DO1(0:No action, 1: One-shot instruction) * Works only when simulated output is enabled.

※ When simulated output is enabled, pulse output/alarm output/output control is ignored. The output value or one-shot instruction of the simulated output takes precedence.

DI Totalization Reset and Simulated Input

DI integrated value reset and simulated input only work with WMS-PE2DI.
The data to be set is binary data. (not an ASCII string)

table 5.61 DI Totalization Reset and Simulated Input Address List

address	substance	data size (byte)	R/W	data
0123H	DI1 Pulse Totalization 0 Reset	2	W	0000H: Reset
0124H	DI1 ON time accumulation value 0 reset	2	W	
0125H	DI2 Pulse Totalization 0 Reset	2	W	
0126H	DI2 ON time accumulation value 0 reset	2	W	
0127H	DI1 Pulse Accumulation Preset (Function Code: 10H)	4	W	0~99,999,999 * Writable only in measurement mode
0129H	DI1 ON Time Integration Preset (Function Code: 10H)	4	W	0~5,999,999[min] * Writable only in measurement mode
012BH	DI2 Pulse Integrator Preset (Function Code: 10H)	4	W	0~99,999,999 * Writable only in measurement mode
012DH	DI2 ON Time Integration Preset (Function Code: 10H)	4	W	0~5,999,999[min] * Writable only in measurement mode
012FH	Simulated Input Enabled/Disabled	2	R/W	bit15-2：Reserved bit1:DI2 (0: disabled, 1: enabled) bit0:DI1 (0: disabled, 1: enabled)
0130H	Simulated Input Input Values	2	R/W	bit15-2：Reserved bit1：DI2（0：OFF, 1：ON） bit0：DI1（0：OFF, 1：ON） * Works only when Simulated input is enabled.

※ If the simulated input is enabled, the DI estimation operation stops.
※ Please note that the DI LED on the front of the product does not light up in conjunction with the input value of the simulated input.

5-7-3. Measurement data readout

The function code used for data readout is 04H.
The data to be read is binary data. (not an ASCII string)

table 5.62command

Load Commands	04H
Absolute address	30000 (decimal)

table 5.63 Data size and response data for each measurement element

address	substance	Size (byte)	R/W	data (Decimal/invalid data in hexadecimal notation)	unit
table 5.65 reference	Current value (instantaneous value/minimum value/maximum value)	4	R	0~1080000 (Invalid data: 80000000H)	0.01A
table 5.66 reference	Voltage value (instantaneous value/minimum value/maximum value)	4	R	0~18480000 (Invalid data: 80000000H)	0.01V
table 5.67 reference	Active power (instantaneous/minimum/maximum)	8	R	-199584000000~199584000000 (Invalid data: 8000000000000000H)	0.01W
	Reactive power (instantaneous/minimum/maximum)	8	R	-199584000000~199584000000 (Invalid data: 8000000000000000H)	0.01Var
	Power Factor (Instantaneous Value/Minimum/Maximum)	2	R	-1000~1000 (Invalid data: 8000H)	0.1%
table 5.68 reference	Active Electricity (Power Receiving/Transmitting)	8	R	0~999999999999 (Invalid data: 8000000000000000H)	Wh
	Amount of reactive power (delay in receiving power / progress in receiving power / delay in transmission / progress in power transmission)	8	R	0~999999999999 (Invalid data: 8000000000000000H)	Varh
table 5.69 reference	Conversion Values	8	R	0~999999999999 (Invalid data: 8000000000000000H)	0.01
table 5.70 reference	Frequency (instantaneous value/minimum/maximum value)	4	R	4420~6580 (Invalid data: 80000000H)	0.01Hz
table 5.71reference	Active power (instantaneous/minimum/maximum)	4	R	Rated power less than 964.506 kW: -96450600~96450600 (Invalid data: 80000000H)	0.01W
				Rated power 964.506 kW or more: -199584000~199584000 (Invalid data: 80000000H)	0.01kW
	Reactive power (instantaneous/minimum/maximum)	4	R	Rated power less than 964.506 kW: -96450600~96450600 (Invalid data: 80000000H)	0.01Var
				Rated power 964.506 kW or more: -199584000~199584000 (Invalid data: 80000000H)	0.01kVar
table 5.72 reference	Active Electricity (Power Receiving/Transmitting)	4	R	Rated power less than 964.506 kW: 0~999999999	0.01kWh
				Rated power 964.506 kW or more: 0~999999999	kWh
	Amount of reactive power (delay in receiving power / progress in	4	R	Rated power less than 964.506 kW:	0.01kVarh

address	substance	Size (byte)	R/W	data (Decimal/invalid data in hexadecimal notation)	unit
	receiving power / delay in transmission / progress in power transmission)			0~999999999	
				Rated power 964.506 kW or more: 0~999999999	kVarh
table 5.73 reference	Conversion Values	4	R	Conversion less than 9999999.99 0~999999999999	0.01
				Conversion value: 9999999.99 or more 0~999999999999	10

* The maximum and minimum values are reset when the power is turned on.
* The amount of power will return to 0 when overflowing.
* Since the amount of power is stored in the non-volatile memory, it is retained even when the power is turned off.
* About the Modbus output value of measurement data
  Depending on the condition of the product, you may receive an "invalid data response" or "no response".

1. About Invalid Data

Definition of Invalid Data

· A group of data for which power calculation has stopped, but a valid value can be returned by changing the setting or input.

Conditions for Invalid Data

· Instantaneous, maximum, minimum, and integrated values of unused (disabled) circuits arbitrarily specified by the user
· Readout of instantaneous, maximum, and minimum values of unused phases (e.g., two-phase current in single-phase two-wire setup)

Invalid data

Depending on the data size, invalid data is represented as shown in the table below.

table 5.64Invalid data

Size of the data	Invalid data
2byte	8000H
4byte	8000 0000H
8byte	8000 0000 0000 0000H

Conditions for no response

・ Readout of various measurement data when calculation is not possible due to hardware failure

table 5.65 Current Value Address List

substance		data size (byte)	Circuit A	Circuit B	Circuit C	Circuit D
single-phase2-wire						
Instantaneous value	1-phase current	4	0000H	0018H	001EH	0030H
minimum value	1-phase current	4	0008H	001AH	0024H	0032H
Maximum Value	1-phase current	4	0010H	001CH	002AH	0034H
single-phase3-wire						
Instantaneous value	1-phase current	4	0000H	-	001EH	-
	2-phase current	4	0002H	-	0020H	-
	N-phase current	4	0004H	-	0022H	-
minimum value	1-phase current	4	0008H	-	0024H	-
	2-phase current	4	000AH	-	0026H	-
	N-phase current	4	000CH	-	0028H	-
Maximum Value	1-phase current	4	0010H	-	002AH	-
	2-phase current	4	0012H	-	002CH	-
	N-phase current	4	0014H	-	002EH	-
three-phase3-wire						
Instantaneous value	R-phase current	4	0000H	-	001EH	-
	T phase current	4	0002H	-	0020H	-
	S-phase current	4	0004H	-	0022H	-
minimum value	R-phase current	4	0008H	-	0024H	-
	T phase current	4	000AH	-	0026H	-
	S-phase current	4	000CH	-	0028H	-
Maximum Value	R-phase current	4	0010H	-	002AH	-
	T phase current	4	0012H	-	002CH	-
	S-phase current	4	0014H	-	002EH	-
three-phase4-wire						
Instantaneous value	R-phase current	4	0000H	-	-	-
	T phase current	4	0002H	-	-	-
	S-phase current	4	0004H	-	-	-
	N-phase current	4	0006H	-	-	-
minimum value	R-phase current	4	0008H	-	-	-

	T phase current	4	000AH	-	-	-
	S-phase current	4	000CH	-	-	-
	N-phase current	4	000EH	-	-	-
Maximum Value	R-phase current	4	0010H	-	-	-
	T phase current	4	0012H	-	-	-
	S-phase current	4	0014H	-	-	-
	N-phase current	4	0016H	-	-	-
Single-phase two-wire branched from single-phase three-wire						
Instantaneous value	1-phase current	4	0000H	0018H	001EH	0030H
minimum value	1-phase current	4	0008H	001AH	0024H	0032H
Maximum Value	1-phase current	4	0010H	001CH	002AH	0034H

last

substance		data size (byte)	Circuit A	Circuit B	Circuit C	Circuit D
Single-phase 3-wire + single-phase 2-wire						
Instantaneous value	1-phase current	4	0000H	-	001EH	0030H
	2-phase current	4	0002H	-	-	-
	N-phase current	4	0004H	-	-	-
minimum value	1-phase current	4	0008H	-	0024H	0032H
	2-phase current	4	000AH	-	-	-
	N-phase current	4	000CH	-	-	-
Maximum Value	1-phase current	4	0010H	-	002AH	0034H
	2-phase current	4	0012H	-	-	-
	N-phase current	4	0014H	-	-	-

※ The circuits that can be measured are determined for each phase line classification.
The address of the hyphen is an invalid circuit that is measured in each phase line classification. Respond with invalid data.

※ Circuits that are disabled in the individual circuit settings will respond with invalid data.

table 5.66 Voltage value address list

substance		data size (byte)	Circuit A	Circuit B	Circuit C	Circuit D
single-phase2-wire						
Instantaneous value	1-N voltage	4	0040H	0064H	0076H	0088H
minimum value	1-N voltage	4	004CH	006AH	007CH	008EH
Maximum Value	1-N voltage	4	0058H	0070H	0082H	0094H
single-phase3-wire						
Instantaneous value	1-N voltage	4	0040H	-	0076H	-
	2-N voltage	4	0042H	-	0078H	-
	Voltage betwee n 1-2	4	0044H	-	007AH	-
minimum value	1-N voltage	4	004CH	-	007CH	-
	2-N voltage	4	004EH	-	007EH	-
	Voltage betwee n 1-2	4	0050H	-	0080H	-
Maximum Value	1-N voltage	4	0058H	-	0082H	-
	2-N voltage	4	005AH	-	0084H	-
	Voltage betwee n 1-2	4	005CH	-	0086H	-
three-phase3-wire						
Instantaneous value	R-to-S voltage	4	0040H	-	0076H	-
	S-to-T voltage	4	0042H	-	0078H	-
	T-R voltage	4	0044H	-	007AH	-
minimum value	R-to-S voltage	4	004CH	-	007CH	-
	S-to-T voltage	4	004EH	-	007EH	-
	T-R voltage	4	0050H	-	0080H	-
Maximum Value	R-to-S voltage	4	0058H	-	0082H	-
	S-to-T voltage	4	005AH	-	0084H	-
	T-R voltage	4	005CH	-	0086H	-

last

substance		data size (byte)	Circuit A	Circuit B	Circuit C	Circuit D
three-phase4-wire						
Instantaneous value	R-to-S voltage	4	0040H	-	-	-
	S-to-T voltage	4	0042H	-	-	-
	T-R voltage	4	0044H	-	-	-
	R-N voltage	4	0046H	-	-	-
	S-N voltage	4	0048H	-	-	-
	T-N voltage	4	004AH	-	-	-
minimum value	R-to-S voltage	4	004CH	-	-	-
	S-to-T voltage	4	004EH	-	-	-
	T-R voltage	4	0050H	-	-	-
	R-N voltage	4	0052H	-	-	-
	S-N voltage	4	0054H	-	-	-
	T-N voltage	4	0056H	-	-	-
Maximum Value	R-to-S voltage	4	0058H	-	-	-
	S-to-T voltage	4	005AH	-	-	-
	T-R voltage	4	005CH	-	-	-
	R-N voltage	4	005EH	-	-	-
	S-N voltage	4	0060H	-	-	-
	T-N voltage	4	0062H	-	-	-
Single-phase two-wire branched from single-phase three-wire						
Instantaneous value	1-N voltage	4	0040H	0064H	0076H	0088G
	2-N voltage	4	0042H	0066H	0078H	008AH
	Voltage between 1-2	4	0044H	0068H	007AH	008CH
minimum value	1-N voltage	4	004CH	006AH	007CH	008EH
	2-N voltage	4	004EH	006CH	007EH	0090H
	Voltage between 1-2	4	0050H	006EH	0080H	0092H
Maximum Value	1-N voltage	4	0058H	0070H	0082H	0094H
	2-N voltage	4	005AH	0072H	0084H	0096H
	Voltage between 1-2	4	005CH	0074H	0086H	0098H
Single-phase 3-wire + single-phase 2-wire						
Instantaneous value	1-N voltage	4	0040H	-	0076H	0088G
	2-N voltage	4	0042H	-	0078H	008AH
	Voltage between 1-2	4	0044H	-	007AH	008CH
minimum value	1-N voltage	4	004CH	-	007CH	008EH
	2-N voltage	4	004EH	-	007EH	0090H
	Voltage between 1-2	4	0050H	-	0080H	0092H
Maximum Value	1-N voltage	4	0058H	-	0082H	0094H
	2-N voltage	4	005AH	-	0084H	0096H
	Voltage between 1-2	4	005CH	-	0086H	0098H

※ The circuits that can be measured are determined for each phase line classification.
The address of the hyphen is an invalid circuit that is measured in each phase line classification. Respond with invalid data.

※ Circuits that are disabled in the individual circuit settings will respond with invalid data.

※ In the case of single-phase 2 wires branched from single-phase 3 wires, the line voltage set by the measurement voltage set by the circuit individually set is
Respond.

※ In the case of single-phase 3-wire + single-phase 2-wire, the line voltage set by the measured voltage set by the circuit is set individually.

table 5.67 Power (8 bytes), Power factor (2 bytes) address list

substance		data size (byte)	Circuit A	Circuit B	Circuit C	Circuit D
Instantaneous value	Active power	8	00A0H	00BBH	00D6H	00F1H
	Reactive power	8	00A4H	00BFH	00DAH	00F5H
	Power Factor	2	00A8H	00C3H	00DEH	00F9H
minimum value	Active power	8	00A9H	00C4H	00DFH	00FAH
	Reactive power	8	00ADH	00C8H	00E3H	00FEH
	Power Factor	2	00B1H	00CCH	00E7H	0102H
Maximum Value	Active power	8	00B2H	00CDH	00E8H	0103H
	Reactive power	8	00B6H	00D1H	00ECH	0107H
	Power Factor	2	00BAH	00D5H	00F0H	010BH

※ The circuits that can be measured are determined for each phase line classification.
Measured at each phase line segment, an invalid circuit responds with invalid data.
※ Circuits that are disabled in the individual circuit settings will respond with invalid data.

table 5.68 Electricity address list (8 bytes)

substance	data size (byte)	Circuit A	Circuit B	Circuit C	Circuit D
Active power (power received)	8	0110H	0128H	0140H	0158H
Active Electricity (Power Transmission)	8	0114H	012CH	0144H	015CH
Amount of reactive energy (delayed power reception)	8	0118H	0130H	0148H	0160H
Amount of reactive energy (power received)	8	011CH	0134H	014CH	0164H
Reactive power (transmission delay)	8	0120H	0138H	0150H	0168H
Amount of reactive energy (power transmission progress)	8	0124H	013CH	0154H	016CH

※ The circuits that can be measured are determined for each phase line classification.
Measured at each phase line segment, an invalid circuit responds with invalid data.
※ Circuits that are disabled in the individual circuit settings will respond with invalid data.

table 5.69 Conversion address list (8 bytes)

substance	data size (byte)	Circuit A	Circuit B	Circuit C	Circuit D
Conversion Values	8	01F0H	01F4H	01F8H	01FCH

※ The circuits that can be measured are determined for each phase line classification.
Measured at each phase line segment, an invalid circuit responds with invalid data.
※ Circuits that are disabled in the individual circuit settings will respond with invalid data.

table 5.70 Frequency Address List

substance	data size (byte)	address
Instantaneous value	4	0180H
minimum value	4	0182H
Maximum Value	4	0184H

※ Frequency is common data for all circuits.

table 5.71 Power (4 bytes) address list

substance		data size (byte)	Circuit A	Circuit B	Circuit C	Circuit D
Instantaneous value	Active power	4	0190H	019CH	01A8H	01B4H
	Reactive power	4	0192H	019EH	01AAH	01B6H
minimum value	Active power	4	0194H	01A0H	01ACH	01B8H
	Reactive power	4	0196H	01A2H	01AEH	01BAH
Maximum Value	Active power	4	0198H	01A4H	01B0H	01BCH
	Reactive power	4	019AH	01A6H	01B2H	01BEH

※ The circuits that can be measured are determined for each phase line classification.
Measured at each phase line segment, an invalid circuit responds with invalid data.

※ Circuits that are disabled in the individual circuit settings will respond with invalid data.

table 5.72 Electricity address list (4 bytes)

substance	data size (byte)	Circuit A	Circuit B	Circuit C	Circuit D
Active power (power received)	4	01C0H	01CCH	01D8H	01E4H
Active Electricity (Power Transmission)	4	01C2H	01CEH	01DAH	01E6H
Amount of reactive energy (delayed power reception)	4	01C4H	01D0H	01DCH	01E8H
Amount of reactive energy (power received)	4	01C6H	01D2H	01DEH	01EAH
Reactive power (transmission delay)	4	01C8H	01D4H	01E0H	01ECH
Amount of reactive energy (power transmission progress)	4	01CAH	01D6H	01E2H	01EEH

※ The circuits that can be measured are determined for each phase line classification.
Measured at each phase line segment, an invalid circuit responds with invalid data.

※ Circuits that are disabled in the individual circuit settings will respond with invalid data.

table 5.73 Conversion address list (4 bytes)

substance	data size (byte)	Circuit A	Circuit B	time Road C	Circuit D
Conversion Values	8	0200H	0202H	0204H	0206H

※ The circuits that can be measured are determined for each phase line classification.
Measured at each phase line segment, an invalid circuit responds with invalid data.

※ Circuits that are disabled in the individual circuit settings will respond with invalid data.

5-7-4. DI integrated value and digital input/output data readout

The function code used for data readout is 04H.

The data to be read is binary data. (not an ASCII string)

table 5.74command

Load Commands	04H
Absolute address	30000 (decimal)

table 5.75 DI Totaled Address List

address	substance	Size (byte)	R/W	data (Decimal/invalid data in hexadecimal notation)	unit
0208H	DI1 ON time integration	4	R	0~5,999,999 (Invalid data: 80000000H)	minute
020AH	DI2 ON time integration	4	R		
020CH	DI1 Pulse Accumulation	4	R	0~99,999,999 (Invalid data: 80000000H)	count
020EH	DI2 Pulse Accumulation	4	R		

table 5.76 Digital I/O Address List

address	substance	Size (byte)	R/W	data (Decimal/invalid data in hexadecimal notation)
0210H	DO Output State	2	R	bit15-2：Reserved bit1：DO2（0=OFF, 1=ON） bit0：DO1（0=OFF, 1=ON）
0211H	DI Input State	2	R	bit15-2：Reserved bit1：DI2（0=OFF, 1=ON） bit0：DI1（0=OFF, 1=ON）

5-7-5. Other data readout

The function code used for reading other data is 04H.
The data read out by the format read is an ASCII string.
All other data is binary data. (not an ASCII string)

table 5.77Other data readout

address	substance	Size (byte)	R/W	data
0224H	Incorrect wiring information	2	R	Presence or absence of simple miswiring (Each of the following bits: 0 = normal, 1 = possibility of incorrect wiring) bit15~bit4：Reserved（0） bit3: Circuit D bit2: Circuit C bit1: Circuit B bit0: Circuit A
0225H	Circuit A Miswiring Information Details	2	R	Simplified miswiring information (Each of the following bits: 0 = not occurring, 1 = occurring) bit15~bit10：Reserved（0） bit12: (1) Voltage input between R-S (1-N) is less than 10% bit11: (2) Voltage input between S-T (2-N) is less than 10% bit10: (3) Voltage input between T-R and less than 10% bit9: (4) Voltage input between R-S (1-N) less than 80% bit8: (5) Voltage input between S-T (2-N) and less than 80% bit7: (6) Voltage input between T-R and less than 80% bit6: (7) R(1) phase current less than 3% bit5: (8) T (2) phase current less than 3% bit4: (9) S phase current less than 3% bit3: (10) Power < 0 (power transmission) bit2: (11) power = 0 (no load) bit1: (12) Less than 20% of the apparent power calculated from the power < current and voltage bit0: (13) Power > 0 (power received) * When (1) occurs, (4) does not occur at the same time. * When (2) occurs, (5) does not occur at the same time. * When (3) occurs, (6) does not occur at the same time. * (10) ~ (13) must occur at least one of them.
0226H	Circuit B Miswiring Information Details	2	R	
0227H	Circuit C Miswiring Information Details	2	R	
0228H	Circuit D Miswiring Information Detail	2	R	
0229H ~ 0233H	reserve	~	~	-
0234H	Module Status	8	R	0000H: No error Other than 0000H: There is an error
0238H	Vendor Name	32	R	String "Watanabe Electric Industry" fixed
0248H	Product type	32	R	string
0258H	Firmware version	8	R	string
025CH	Hardware Version	8	R	string
0260H	Modbus table version	8	R	string
0264H	Serial number	32	R	string

* For addresses that handle the character strings in this table, it will be 1 character in 1 byte.
If the data size is less than the size, the space (20H) will be filled.

6. Troubleshooting

6-1. About communication

6-1-1. Unable to communicate

If communication is not possible, please check the following items.

- Is the power turned on for all devices related to communication?
- Is the wiring correct?
- Are the number of connected devices and the connection distance within the specified range?
- Are the communication condition settings consistent between the master and the slave (module)? (Communication speed, data length, stop bit, parity)
- Does the timing of the send/receive signal satisfy "3-2. Send/Receive Switching Time"?
- Does the Slave ID specified as the transmission destination by the master match the Slave ID setting of the connected slave (module)?
- Are there no duplicate Slave IDs set on modules connected to the same transmission line?
- Is a termination resistor attached to the transmission line?

6-1-2. The acquired data is strange

If you can get the data but the value is incorrect, please check the following items.

- Is the function code incorrect?
- Is the address of the data you are trying to retrieve?
- Do you use unit conversion?
  For example, in the case of WLD active power (instantaneous value), the actual value is the obtained data multiplied by 0.01 W.

7. Revision History

version	Revision Date	Summary of revisions
1.00	September 2014	New release.
1.10	September 2015	Added WMB series (DI16, DIO8R).
1.70	March 2025	Added WMS-PE2D □.

Please note that the contents of this specification are subject to change without notice due to product improvement.

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