User's Manual

PR201/UZ005 Power Monitor Communication Functions

POWERCERT

IM 77C01C01-11E

YOKOGAWA

Yokogawa Electric Corporation

IM 77C01C01-11E
3rd Edition

Blank Page

Introduction

This user's manual describes the communication functions of the Power Monitor and provides information on how to create communication programs.

The Power Monitor uses the following communication protocols:

1) Communication protocol for YOKOGAWA´s Power Monitor.
2) MODBUS communication protocol
3) PC link communication protocol
4) LON communication protocol

The Power Monitor cannot communicate with a higher-level device that does not use a communication protocol the above.

You are required to understand the communication specifications of higher-level devices, as a background knowledge, in regard to their communication hardware, language used for creating communication programs, and so on.

* Higher-level devices: PCs, PLCs (sequencers), graphic panels, and others

FD No. IM 77C01C01-11E
1st Edition: Feb. 2001 (YG)
3rd Edition: Jun. 2004 (YK)

Documentation Conventions

■ Symbols

The following symbols are used in this manual.

● Symbols used in the main text

NOTE

Draws attention to information that is essential for understanding the operation and/or features of the product.

TIP

Gives additional information to complement the present topic and/or describe terms specific to this document.

See Also

Gives reference locations for further information on the topic.

● Symbols used in figures and tables

[NOTE]

Draws attention to information that is essential for understanding the operation and/or features of the product.

[Tip]

Gives additional information to complement the present topic and/or describe terms specific to this document.

[See Also]

Gives reference locations for further information on the topic.

■ Description of Displays

(1) Some of the representations of product displays shown in this manual may be exaggerated, simplified, or partially omitted for reasons of convenience when explaining them.

(2) Figures and illustrations representing the controller's displays may differ from the real displays in regard to the position and/or indicated characters (upper-case or lower-case, for example), to the extent that they do not impair a correct understanding of the functions and the proper operation and monitoring of the system.

NOTE

In this manual, "PT" is used for the same meaning to Voltage Transformer(VT).

Notices

■ **Regarding This User's Manual**

(1) This manual should be passed on to the end user. Keep this manual in a safe place.
(2) Read this manual carefully to gain a thorough understanding of how to operate this product before you start using it.
(3) This manual is intended to describe the functions of this product. Yokogawa Electric Corporation (hereinafter simply referred to as Yokogawa) does not guarantee that these functions are suited to the particular purpose of the user.
(4) Under absolutely no circumstance may the contents of this manual, in part or in whole, be transcribed or copied without permission.
(5) The contents of this manual are subject to change without prior notice.
(6) Every effort has been made to ensure accuracy in the preparation of this manual. Should any errors or omissions come to your attention however, please contact your nearest Yokogawa representative or our sales office.

■ **Regarding Protection, Safety, and Prohibition Against Unauthorized Modification**

(1) In order to protect the product and the system controlled by it against damage and ensure its safe use, make certain that all of the instructions and precautions relating to safety contained in this document are strictly adhered to. Yokogawa does not guarantee safety if products are not handled according to these instructions.
(2) The following safety symbols are used on the product and/or in this manual.

● Symbols used on the product and in this manual

⚠ **CAUTION**

This symbol on the product indicates that the operator must refer to an explanation in the user's manual in order to avoid the risk of injury or death of personnel or damage to the controller. The manual describes how the operator should exercise special care to avoid electrical shock or other dangers that may result in injury or loss of life.

⏚ **Protective Grounding Terminal**

This symbol indicates that the terminal must be connected to ground for safety use prior to operating the equipment.

⏚ **Functional Grounding Terminal**

This symbol indicates that the terminal must be connected to ground for good function prior to operating the equipment.

● Symbol used in this manual only

WARNING

Indicates that operating the hardware or software in this manner may damage it or lead to system failure.

■ **Force Majeure**

(1) Yokogawa does not make any warranties regarding the product except those mentioned in the WARRANTY that is provided separately.
(2) Yokogawa assumes no liability to any party for any loss or damage, direct or indirect, caused by the use or any unpredictable defect of the product.
(3) Be sure to use the spare parts approved by Yokogawa when replacing parts or consumables.
(4) Modification of the product is strictly prohibited.
(5) Reverse engineering such as the disassembly or decompilation of software is strictly prohibited.
(6) No portion of the product supplied by Yokogawa may be transferred, exchanged, leased or sublet for use by any third party without the prior permission of Yokogawa .

PR201 and UZ005 Power Monitors Communication Functions

IM77C01C01-11E 3rd Edition

Contents

1. Communications Overview

1.1 Overview

The Power Monitor has an RS-485 serial communication interface or LON communication interface, through which data exchange is performed with a device such as a personal computer, PLC (sequencer), and graphic panel.

Table 1.1 Communication Protocols

Communication Standards	Communication Protocol	Descriptions
RS-485 communication	Power Monitor communication	Communication standard used for power monitor
	PC link communication with sum check	With error check
	PC link communication without sum check	Without error check
	MODBUS communication ASCII mode	Communication using ASCII data
	MODBUS communication RTU mode	Communication using Binary data
LON communication	LonTalk protocol	Communication capable with LON supported device

NOTE

Confirm the Model and Specifications.

1.2 Interface Specifications

Table 1.2 Communication Interface Specifications

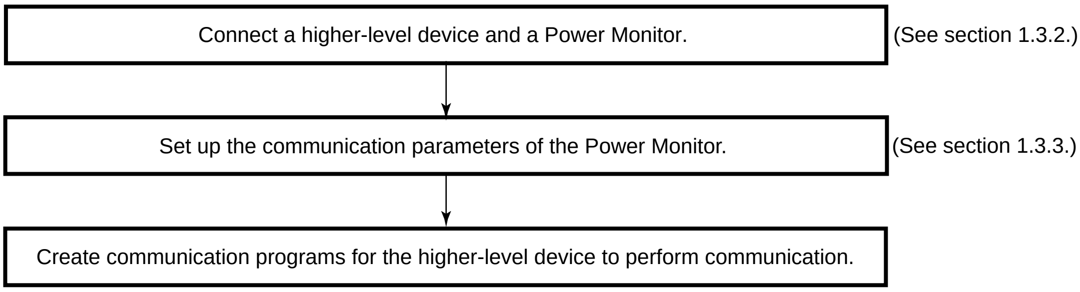
Interface	Communication rate	Communication distance	Descriptions
RS-485 communication	1200, 2400 4800, 9600 bps	Maximum: about 1.2 km	Station number: 1 to 31 Data length: 8 bits Parity: No parity Start bit: 1 Stop bit: 1
LON communication	78 kbps	Total extended length 500 m, Maximum node length 400 m	Node number: 1 to 63, LON standards free topology connection

1.3 Setup of RS-485 communication

This chapter describes the procedure to set up the RS-485 communication functions and also refers to some notes on wiring and communication parameters.

1.3.1 Setup Procedure of RS-485 communication

Set up the communication functions of the Power Monitor as follows:



∗ Create communication programs referring to the documentation of each higher-level device.
∗ In this manual, “higher-level devices” generically denotes PCs, PLCs (sequencers), and graphic panels.

1.3.2 Wiring for RS-485 Communication

Connect the Power Monitor controller and the higher-level device for communication. The wiring procedures and precautionary notes are as follows.

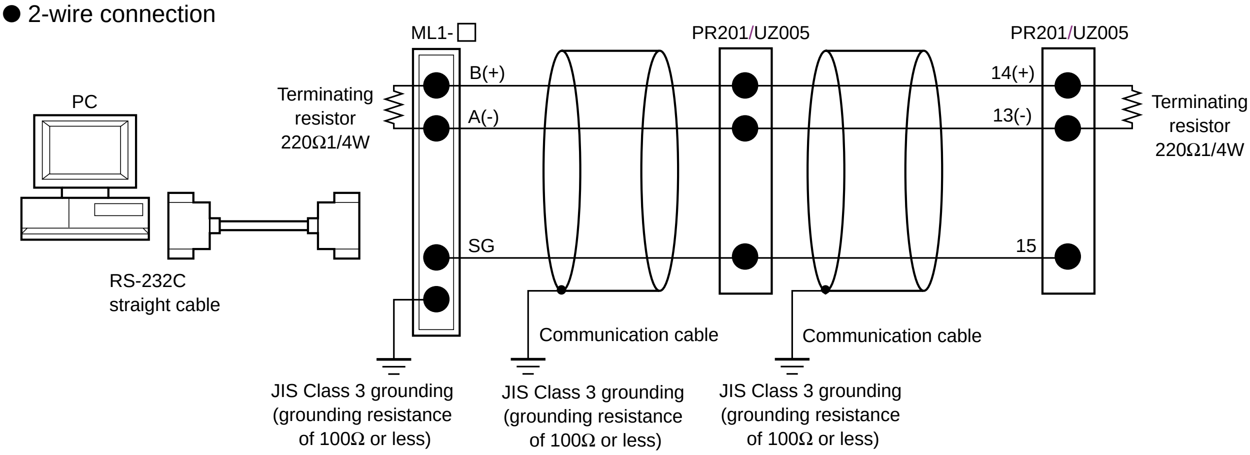
NOTE

To avoid an electrical shock, be sure to turn off the power supply source to the equipment involved before you start wiring.
Use crimp terminals at cable ends.
Before you start wiring, read the user's manual of each device.

(1) Wiring to a Personal Computer

Since general personal computers cannot directly be connected to the RS-485 interface, wiring must be provided via an RS-232C/RS-485 converter. The following figures show the wiring for 2-wire connection.

● 2-wire connection



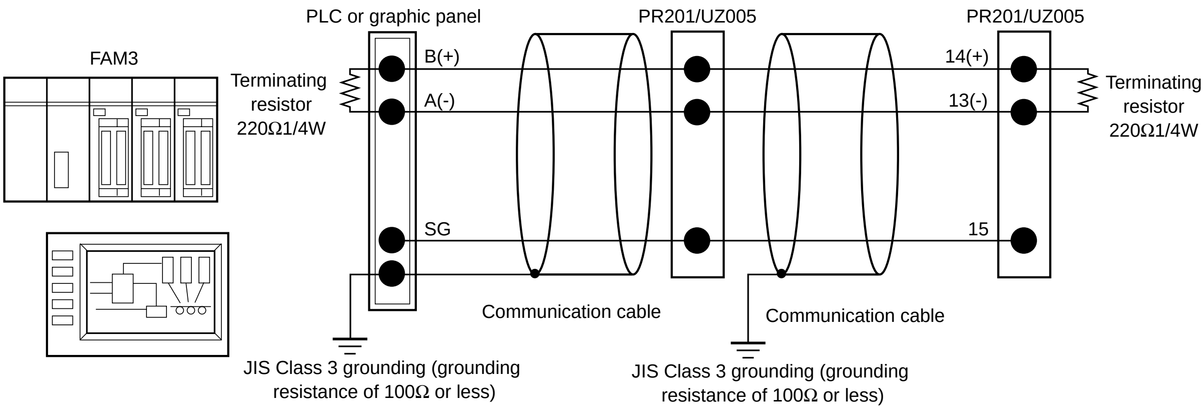
Note: ML1-□ is the converter of Yokogawa Electric Corporation. You can also use other RS-232C/RS-485 converters. Before you use another converter, check its electrical specifications.

NOTE

Do not share the grounding wire with another controller. Doing so may result in a failure of the controller.
Use crimp terminals at the cable ends.

(2)Wiring to a PLC (Sequencer) or Graphic Panel

Since general PLCs (sequencers) and graphic panels have an RS-485 interface, they can be directly connected to a Power Monitor. If your PLC (sequencer) or graphic panel has an RS-232C interface, see subsection (1) .



Note: In the case of MELSEC (Mitsubishi Electric Corporation´s sequencer), "B" is for (–), and "A" is for (+). In the case of Graphic panel (Digital Corporation´s), RS232/RS485 converter is needed.

NOTE

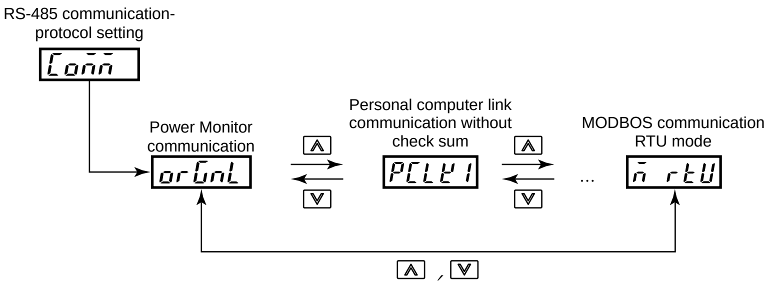
Do not share the grounding wire with another controller. Doing so may result in a failure of the controller.
Use crimp terminals at the cable ends.

1.3.3 Setting Communication Parameters

This section describes the communication parameters and setting ranges necessary to use the communication functions.

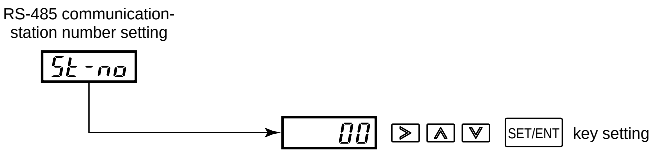
(1) Setting Communication Protocols

On the power monitor, select the RS-485 communication protocol supported by the higher-level device.



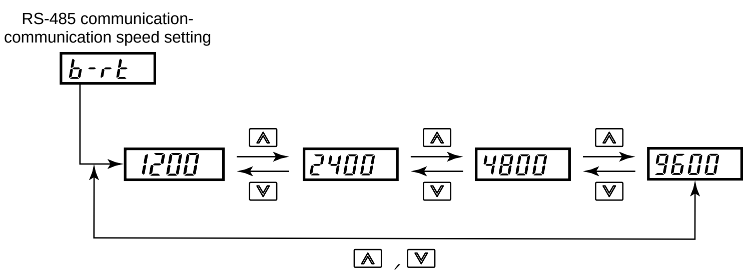
(2)Setting Station Number

On the power monitor, set the station number. When connecting two or more power monitors to an integrated RS-485 communication line, make sure none of the station numbers 1 to 31 is set twice.



(3)Setting Communication Speed

On the power monitor, set the communication speed by selecting the baud rate from among 1200, 2400, 4800 and 9600 bps that agrees with the communication speed set in the higher-level device.



(4)Setting Higher-level Device Communication Parameters

Set the communication parameters of the higher-level device as shown below.

Data length: 8 bits

Parity: None

Number of start bits: 1

Number of stop bits: 1

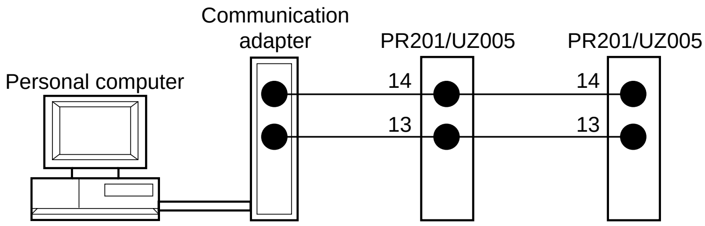
See Also

Section 5.3 of the IM77C01C01-01E user's manual for details on how to operate the power monitor.

1.4 Setup of LON Communication

1.4.1 Wiring to a Personal Computer

•Wiring for LON communication

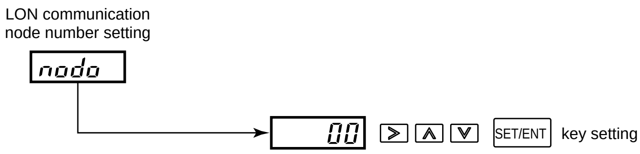


NOTE

LON communication does not require consideration of polarity.

1.4.2 Setting Node Number

The Node Number comes factory-set to "Self-installation." When using the database file provided by Yokogawa, set the node number on the power monitor. When connecting two or more power monitors to an integrated RS-485 communication line, make sure none of the station numbers 1 to 63 is set twice.



1.4.3 Setting up LON Communication Using an individual Network Management Tool

Change the nciconfig_mode option of the network variables to EXTERNAL before setting up LON communication. For details on the setup procedure, see the user's manual of each individual network management tool.

Note that the node number set in section 1.4.2 becomes void when you carry out this setup procedure.

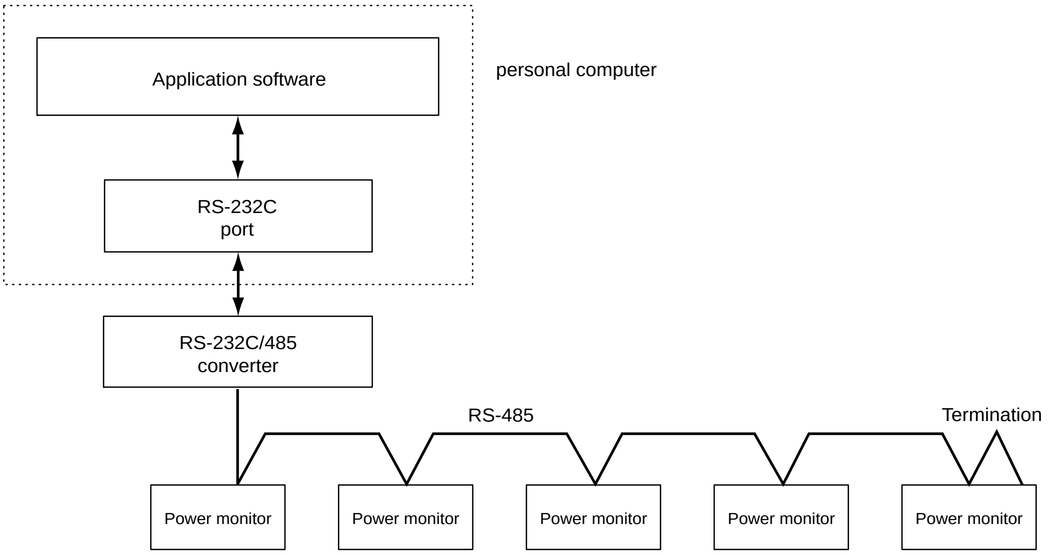
See Also

Section 6.4 of the IM77C01C01-01E user's manual for details on the communication adapter.

2. Power Monitor communication

Using the command/response method, you can read a variety of measured values onto your personal computer. Readout can be achieved in two ways: reading measured values one by one or reading the values at one time (those of measurement data items assigned in the selected parameter).

2.1 System Configuration



Note: It is advisable that for the RS-232C/RS-485 converter, the ML1 from Yokogawa be used in AUTO mode.

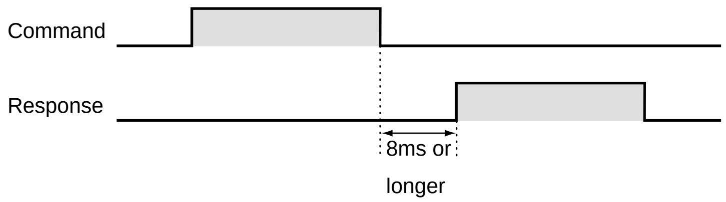
2.2 Communication Specifications

Transmission distance:	Approximately 1.2 km maximum (when 24AWG twisted-pair cable is used)	
Connection:	Multi-drop connection of up to 32 stations, including a higher-level personal computer	
Station number:	1 to 31	
Transmission method:	Half-duplex	
Synchronization:	Start-stop synchronization	
Transmission rate:	9600, 4800, 2400 or 1200 bps	
Data format:	start bi't:	1
	Number of data bits:	8
	Parity:	None
	Number of stop bits:	1
	Xon/Xoff control:	None

Communication error handling:

The power monitor discards a received command and returns no response if the command is invalid (ignores electrical noise and faulty commands). Any time-out process therefore should be run at the higher-level personal computer. Set the time-out option to a value no smaller than one second. The power monitor returns an error response if the parameter or data is erroneous.

Command/response timing diagram:



2.3 Commands and Responses

Command elements:

1 byte	2 bytes	1 byte	2 bytes	Variable-length	2 bytes	1 byte	1 byte
STX	Command	Parameter	Station number	Data	Check sum	ETX	CR

Range of sum check (Command through Data)

STX: Start of Text (hexadecimal: 02)

Command: 2-byte ASCII code (DG or DP)

Parameter: 1-byte ASCII code (0 to X)

Station number: 2-byte ASCII code (01 to 1F)

Data: Not provided at the time of data readout; provided as variable-length ASCII code at the time of setpoint change (byte size depends on the type of parameter)

Check sum: 2-byte ASCII code (00 to FF) representing a value obtained by summing the data within the range of sum check in a hexadecimal way and then converting the least significant two digits to an ASCII code

ETX: End of Text (hexadecimal: 03)

CR: Carriage Return (hexadecimal: 0D)

Response elements:

1 byte	2 bytes	1 byte	2 bytes	Variable-length	2 bytes	1 byte	1 byte
STX	Response	Parameter	Station number	Data	Check sum	ETX	CR

Range of sum check (Response through Data)

STX: Start of Text (hexadecimal: 02)

Response: 2-byte ASCII code (DG or DP)

Parameter: 1-byte ASCII code (0 to Z)

Station number: 2-byte ASCII code (01 to 1F)

Data: Variable-length ASCII code (byte size depends on the type of parameter)

Check sum: 2-byte ASCII code (00 to FF) representing a value obtained by summing the data within the range of sum check in a hexadecimal way and then converting the least significant two digits to an ASCII code

ETX: End of Text (hexadecimal: 03)

CR: Carriage Return (hexadecimal: 0D)

An error code may appear on the power monitor in the case of a communication error. If this occurs, read the error response by sending the parameter Z of the DG command. You can determine details on the communication error from the content of the error response. Concurrently, the error code on the power monitor is cleared.

2.4 List of Commands

Table 2.1 Common command for preceding style (PR201S1.0, UZ005S2.0)

Para-meter	Descriptions	Adaptable model	Response data format	Response data range	Response data size
0	Measured value read-out in block	No optional measuring	Data of parameter 1 to 5		40 bytes
		Power factor measuring	Data of parameter 1 to 5 and 6 (Power factor measuring)		46 bytes
		Current 2 measuring	Data of parameter 1 to 5 and 6 (Current 2 measuring)		48 bytes
1	Integrated power read-out		□□□□□	00000 to 99999[kWh]	5 bytes
2	Optional integrated power read-out *1	(preceding value)	□□□□□	00000 to 99999[Wh]	10 bytes
		(present value)	□□□□□	00000 to 99999[Wh]	
3	Instantaneous power value read-out		±□.□□□E+○	±0.001E+2 to ±9.999E+6[W]	9 bytes
4	Voltage 1 value read-out		□.□□□E+○	0.001E+2 to 9.999E+6[V]	8 bytes
5	Current 1 value read-out		□.□□□E+○	0.001E+0 to 9.999E+6[A]	8 bytes
6	Optional instantaneous read-out	No optional measuring	No data		0 byte
		Power factor measuring	△□.□□□	D0.500 to 1.000 to G0.500	6 bytes
		Current 2 measuring	□.□□□E+○	0.001E+0 to 9.999E+6[A]	8 bytes
7	Optional integration start *1		No data		0 byte
8	Optional integration stop *1		No data		0 byte
9	Maximum/minimum values initialization		No data		0 byte
A	Measured Maximum/ minimum values read-out in block	No optional measuring	Data of parameter 1 to 5 and B to D		64 bytes
		Power factor measuring	Data of parameter 1 to 6 and B to D		70 bytes
		Current 2 measuring	Data of parameter 1 to 6 and B to D		72 bytes
B	Voltage 1 maximum value read-out		□.□□□E+○	0.001E+2 to 9.999E+6[V]	8 bytes
C	Voltage 1 minimum value read-out		□.□□□E+○	0.001E+2 to 9.999E+6[V]	8 bytes
D	Current 1 maximum value read-out		□.□□□E+○	0.001E+0 to 9.999E+6[A]	8 bytes
E	Current 2 maximum value read-out	No current 2 measuring	No data		0 byte
		Current 2 measuring	□.□□□E+○		8 bytes

Table 2.2 Command:DG

Para-meter	Descriptions	Adaptable model	Response data format	Response data range	Response data size
2	Instantaneous optional integrated power read-out *1	(preceding value) (present value)	□□□□□ □□□□□	00000 to 99999[Wh] 00000 to 99999[Wh]	10 bytes
3	Power momentary value read-out		±□.□□□E+○	±0.001E+2 to ±9.999E+6[W]	9 bytes
4	Voltage 1 value read-out		□.□□□E+○	0.001E+2 to 9.999E+6[V]	8 bytes
5	Current 1 value read-out		□.□□□E+○	0.001E+0 to 9.999E+6[A]	8 bytes
6	Optional instantaneous value read-out	No optional measuring	No data		0 byte
		Power factor measuring	△□.□□□	D0.500 to 1.000 to G0.500	6 bytes
7	Optional integration start *1		No data		0 byte
8	Optional integration stop *1		No data		0 byte
9	Maximum/minimum values initialization		No data		0 byte
B	Voltage 1 maximum value read-out		□.□□□E+○	0.001E+2 to 9.999E+6[V]	8 bytes
C	Voltage 1 minimum value read-out		□.□□□E+○	0.001E+2 to 9.999E+6[V]	8 bytes
D	Current 1 maximum value read-out		□.□□□E+○	0.001E+0 to 9.999E+6[A]	8 bytes
F	Measured value read-out in block	No optional measuring	Data of parameter G,2,3,4,H,J,5,K and L		75 bytes
		Power factor measuring	Data of parameter G,2,3,4,H,J,5,K,L and 6 (Power factor measuring)		81 bytes
G	Integrated power read-out		□□□□□E+○	00000E+3 to 99999E+6[Wh]	8 bytes
H	Voltage 2 value read-out		□.□□□E+○	0.001E+2 to 9.999E+6[V]	8 bytes
J	Voltage 3 value read-out		□.□□□E+○	0.001E+2 to 9.999E+6[V]	8 bytes
K	Current 2 value read-out		□.□□□E+○	0.001E+0 to 9.999E+6[A]	8 bytes
L	Current 3 value read-out		□.□□□E+○	0.001E+0 to 9.999E+6[A]	8 bytes
M	Measured value Max./min. values read-out in block	No optional measuring	Data of parameter G,2,3,4,H,J,5,K,L and B,C,D and N to T		123 bytes
		Power factor measuring	Data of parameter G,2,3,4,H,J,5,K,L and 6 (Power factor measuring) and B,C,D and N to T		129 bytes
N	Voltage 2 maximum value read-out		□.□□□E+○	0.001E+2 to 9.999E+6[V]	8 bytes
P	Voltage 3 maximum value read-out		□.□□□E+○	0.001E+2 to 9.999E+6[V]	8 bytes
Q	Voltage 2 minimum value read-out		□.□□□E+○	0.001E+2 to 9.999E+6[V]	8 bytes
R	Voltage 3 minimum value read-out		□.□□□E+○	0.001E+2 to 9.999E+6[V]	8 bytes
S	Current 2 maximum value read-out		□.□□□E+○	0.001E+0 to 9.999E+6[A]	8 bytes
T	Current 3 maximum value read-out		□.□□□E+○	0.001E+0 to 9.999E+6[A]	8 bytes
U	---				
V	---				
W	----				
X	Model and specifications read-out		PR201-□□□□□-△△,UZ005-□□□□□-△△		14 bytes
Y	----				
Z	Error response		□□		2 bytes

*1: When start/stop of optional integration is carried out by communication, optional integrated control signal thereafter becomes invalid. Therefore, control of optional integration should be done either by communication or by optional integrated control signal. When power supply is off, control of optional integration control is reset.

Table 2.3 Command:DP

Para-meter	Descriptions	Adaptable model	Command data format	Command data range	Command data size
0	Set value read-out		No data	(Response *2)	0 byte
1	---				
2	---				
3	---				
4	PT ratio setting		□□□□□	00001 to 32000	5 bytes
5	CT ratio setting		□□□□□	00.05 to 32000	5 bytes
6	---				
7	---				
8	---				
9	---				
A	Remote reset		No data		0 byte
B	Integrated low-cut power		□□.□	00.1 to 99.9	4 bytes
C	Integrated pulse unit		□.□□□E−○	6.667E−6 to 1.000E−1	8 bytes
D	ON pulse width of integrated pulse		□□□□	0010 to 1270	4 bytes
E	Input scaling "L" level setting for analog output		△□□□□(△:+or−)	−4800 to +4800	5 bytes
F	Input scaling "H" level setting for analog output		△□□□□(△:+or−)	−4800 to +4800	5 bytes
G	Integration reset		No data (Buffer data is RESET, too.)		0 byte

*2: The response for Set value read-out command is as follows.

PT ratio, CT ratio and Integrated low-cut power 14 bytes (no output option)

PT ratio, CT ratio, Integrated low-cut power, Integrated pulse unit and ON pulse width of integrated pulse 26 bytes (When integrated pulse output is specified)

PT ratio, CT ratio, Integrated low-cut power, Input scaling “L” level setting for analog output and Input scaling “H” level setting for analog output 24 bytes (When analog output is specified)

3. MODBUS Communication

3.1 Overview

A MODBUS communication protocol is one of the protocols used to communicate with devices such as PCs, PLCs (sequencers), and graphic panels. Via this communication protocol, these devices can exchange data with Power Monitor (PR201, UZ005) by reading/writing the internal registers (D registers) of a Power Monitor (PR201, UZ005).

Hereafter, PCs, PLCs (sequencers), and graphic panels are referred to as “higher-level devices.”

See Also

As to configuration of inner registers, refer to "Function and usage of D register and I relay" (Chapter 5).

For the MODBUS communication of the Power Monitor, two transmission modes are supported: ASCII mode (ASCII system) and RTU mode (binary system).

Table 3.1 ASCII and RTU Modes

Item	ASCII mode	RTU mode
Number of data bits	7 bits (ASCII)	8 bits (binary)
Message start mark	: (colon)	Unnecessary
Message end mark	CR + LF	Unnecessary
Message length (Note 1)	2N + 1	N
Data time intervals	1 second or less	24-bit time or less (Note 2)
Error detection	Longitudinal redundancy check: LRC	Cyclic redundancy check: CRC-16

Note 1: When the message length in the RTU mode is assumed to be “N.”
Note 2: When the communication rate is 9600 bps, $1 \div 9600 \times 24$ sec. or less.

In MODBUS communication, a higher-level device identifies each Power Monitor with a communication address, which ranges from 1 to 31.

The next section will discuss the configuration of messages.

3.1.1 Configuration of Messages

Messages sent from a higher-level device to a Power Monitor consist of the following elements.

Mode \ Element	Start of Message Mark	Address Number (ADR)	Function Code	Data	Error Check	End of Message Mark
Number of bytes in ASCII mode	1	1	1	4n	2	2
Number of bytes in RTU mode	None	2	2	2n	2	None
	(1)	(2)	(3)	(4)	(5)	(6)

(1) Start of Message Mark
This mark indicates the start of a message. Note that only ASCII mode requires a colon.

(2) Address Number (1 to 31)
An address number is used by a higher-level device to identify which Power Monitor to communicate with. (ID number of Power Monitor)

(3) Function Code (See subsection 3.2.1, "List of Function Codes")
The function code specifies a command (function code) from the higher-level device.

(4) Data
This element specifies D register numbers, the number of D registers, parameter values, and so on in accordance with the function code.

(5) Error Check
In ASCII mode carried out by the longitudinal redundancy check (LRC) system.

In RTU mode carried out by the cyclic redundancy check (CRC-16) system.

(6) End of Message Mark
This mark indicates the end of a message.

Note that only ASCII mode requires CR.

3.2 Communication with Higher-level Device

When you use a commercially available SCADA or the like or a user-created communication program, you must be careful when specifying D register numbers contained in messages because in both cases, you cannot use the original D register numbers as they are.

● **To specify D registers**

(1) When using a commercially available SCADA or the like, specify D register numbers by changing them into reference numbers. To change them into a reference number, replace the D register number's leading character “D” with “4”. (When using a DDE server or others, specify these reference numbers.)

(2) In a user-created communication program, specify a D register using the hexadecimal number of the value obtained by subtracting “40001” from the D register's reference number. (Specify this hexadecimal number.)

Example: To specify “D0101”

- For a message using commercially available SCADA or the like, specify reference number “40101.”
- For a message in a user-created communication program, specify “0064”, the hexadecimal number of “0100”, which is obtained by subtracting 40001 from the reference number.

3.2.1 List of Function Codes

Function codes are command words used by the higher-level device to obtain the D register information of Power Monitor.

Table 3.2 Function Codes

Code	Function	Description
03	Reads data from multiple D registers.	Capable of reading data from a maximum of 32 successive registers from D0001 to D0150.
06	Writes data into D register.	Capable of writing data to one register from D0001 to D0150.
08	Performs loop back test.	See subsection 5.2.3.
16	Writes data into multiple D registers.	Capable of writing data into a maximum of 32 successive registers from D0001 to D0150.

- The write function codes will not write into read-only or disabled D registers.

3.3 Error Check

MODBUS communication has two modes: ASCII mode which is ASCII-text communication and RTU mode which is binary communication. These two modes use different error check methods.

3.3.1 ASCII Mode

In ASCII mode, an error check is run using the LRC method, i.e., logical redundancy check. This mode calculates the LRC value from the same data as that of the RTU mode. That is, all blocks of a message, from the slave address to the last data item, except the colon (:), carriage return (CR) and line feed (LF), are converted one byte hexadecimal data and summed on a byte-by-byte basis. A two's complement taken from least sigfinicant two bytes of the value thus obtained equals the LRC value. At this point, ignore any carry into the most significant digit occurring during the summing.

Example: Calculating the LRC value when the message is

[:]**303530333030363430303032[LRC][CR][LF]**

[1] Change the underlined ASCII data to one-byte hex data.

→05, 03, 00, 64, 00, 02

[2] Sum up this one-byte hex data on a byte-by-byte basis.

→05 + 03 + 00 + 64 + 00 + 02 = 6E

[3] Take the two's complement of the least significant one byte of the data thus summed up.

→92

3.3.2 RTU Mode

In RTU mode, an error check is run using the CRC-16 method, i.e., cyclic redundancy check. In this method, all blocks of a message, from the slave address to the last data item, are concatenated in series and the value thus obtained is divided by a predetermined 17-bit binary number. The resulting 16-bit remainder then equals the CRC-16 value.

Note that data subjected to computation is only the value given by the 8-bit block of the message and does not include the start bit, stop bit, and parity bit.

3.4 Responses from Slaves

A power monitor receives a command message from the higher-level device. If the received command message is found to be normal and directed at the slave address of the power monitor itself, the power monitor concludes the content of the message to be normal. Thus, the power monitor enters the phase of executing message processing, deciphers the content of the command message, and processes with the message.

The power monitor does not execute message processing, however, if the received command message is found to be abnormal. In that case, the power monitor either ignores the received message or creates a response message telling the received message is erroneous.

After receiving a normal command message and executing a given process, the power monitor creates and sends a response message to which error check data appropriate for the command function code of the higher-level device is added.

3.4.1 Responses to Normal Messages

For a loop back function or a function for writing to a single register, the power monitor returns the received command message as a response message.

For a function for writing to multiple registers, the power monitor returns part of the received command message as the response message.

For a readout function, the power monitor adds the read data to the ends of the address number and function code of the received command message, and returns the message as the response message.

3.4.2 Responses to Abnormal Messages

If there is any failure other than transmission errors, the power monitor returns the following response message without executing any process:

Address number
Function code + 80H
Error code
Error check data

The following table summarizes details on the error codes.

Error code	Description
01	Function code error (nonexistent error code)
02	Abnormal register number
03	Abnormal number of registers

The power monitor does not regard it as an error even if there is any unused register among those with consecutive register numbers specified by a read-out function; rather, the power monitor returns a value of 0 in this case.

The power monitor returns the error code 02 if the first of specified consecutive addresses is made to fall outside the given range by the number of registers specified, even though it was initially within the range.

3.5 Commands

3.5.1 Function Code 03: Readout of D Registers

In the example shown here, the function reads four consecutive registers starting from the register D0043 of the slave with the slave address 17. Take special note of the fact that the Starting D Register Number field is set to “42”.

Table 3.3 Message Sent from Mater

Element	Contents	HEX	Example for ASCII mode (Reference only)	Example for RTU Mode
Start-of-message mark			3Ah (: colon)	(24-bit time)
Address	17	11	31h 31h	0001 0001
03 (=function code)	03	03	30h 33h	0000 0011
Starting D register number (higher-order)	42	00	30h 30h	0000 0000
Starting D register number (lower-order)		2A	32h 41h	0010 1010
Number of D register (higher-order)	4 registers	00	30h 30h	0000 0000
Number of D register (lower-order)		04	30h 34h	0000 0100
Error check data			42h 45h =BEh	0110 0111 0101 0001 =6751h
End-of-message mark			0Dh(=[CR]) 0Ah(=[LF])	None

Table 3.4 Message Sent from Slave

Element		Contents	HEX	Example for ASCII Mode (Reference only)		Example for RTU Mode (Reference only)	
Start-of-message mark				3Ah (: colon)		(24-bit time)	
Address		17	11	31h		0001 0001	
				31h			
03 (= function code)		03	03	30h		0000 0011	
				33h			
Byte count		8 bytes	08	30h		0000 1000	
				38h			
Byte count for D register status (= number of registers32)	Higher -order	3F80	3F	33h		0011 1111	
				46h			
	Lower -order		80	38h		1000 0000	
				30h			
	Higher -order	0000	00	30h		0000 0000	
				30h			
	Lower -order		00	30h		0000 0000	
				30h			
	Higher -order	3F80	3F	33h		0011 1111	
				46h			
	Lower -order		80	38h		1000 0000	
				30h			
	Higher -order	0000	00	30h		0000 0000	
				30h			
	Lower -order		00	30h		0000 0000	
				30h			
Error check data				36h	=66h	0000 1110	=0E77h
				36h		0111 0111	
End-of-message mark				0Dh (=[CR])		None	
				0Ah (=[LF])			

* The D register numbers (addresses) are specified using relative addresses.
* The maximum number of D registers that are read is 32.

3.5.2 Function Code 06: Writing to a Single D Register

Table 3.5 Message Sent from Master

Start-of-message mark
Address
06 (= function code)
D register number (higher-order)
D register number (lower-order)
Data to write (higher-order)
Data to write (lower-order)
Error check data
End-of-message mark

* Data to write: Optional.
* Specify D register numbers (addresses) using relative addresses.

Response from Slave

The slave returns the received command message as a response message.

3.5.3 Function Code 08: Loop-back Test

A loop-back test is used to check signal transmission.

Table 3.6 Message Sent from Higher-level Device

Start-of-message mark
Address
08 (= function code)
Diagnostic code (higher-order) fixed to 00
Diagnostic code (lower-order) fixed to 00
Data (higher-order)
Data (lower-order)
Error check data
End-of-message mark

Table 3.7 Diagnostic Codes

Diagnostic Code	Meaning	Data
00 00	Command message return	Arbitrary

Table 3.8 Message Sent from Power Monitor

Start-of-message mark
Address
08 (= function code)
Diagnostic code (higher-order) fixed to 00
Diagnostic code (lower-order) fixed to 00
Data (higher-order)
Data (lower-order)
Error check data
End-of-message mark

Data: Varies depending on the diagnostic code sent from higher-level device.

3.5.4 Function Code 16: Writing to Multiple Data-retaining D Registers

This function enables you to change the states of D registers with consecutive addresses.

Table 3.9 Message Sent from Higher-level Device

Start-of-message mark
Address
10 (= function code)
Starting D register number (higher-order)
Starting D register number (lower-order)
Number of registers (higher-order)
Number of registers (lower-order)
Byte count
Data (higher-order)
Data (lower-order)
....
Error check data
End-of-message mark

Table 3.10 Message Sent from Power Monitor

Start-of-message mark
Address
10 (=function code)
Starting D register number (higher-order)
Starting D register number (lower-order)
Number of registers (higher-order)
Number of registers (lower-order)
Error check data
End-of-message mark

* The maximum number of D registers to which data are written is 32.

Blank Page

4. PC Link Communication

4.1 Overview

PC link communication protocol is one of the protocols used to communicate with devices such as PCs, PLCs (sequencers), and graphic panels. Via this communication protocol, these devices can exchange data with a Power Monitor (PR201, UZ005) by reading/writing the controller's internal registers (D registers and I relays).

Hereafter, PCs, PLCs (sequencers), and graphic panels shall be referred to as "higher-level devices."

See Also

As to configuration of inner registers, refer to "Function and usage of D register and I relay" (Chapter 5).

In PC link communication, a higher-level device identifies each Power Monitor with a communication address, which ranges from 1 to 31.

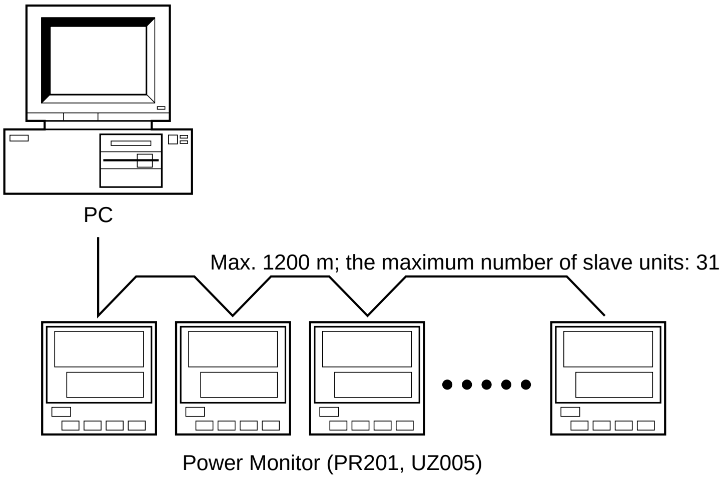


Figure 4.1 Connection of PC Link Communication

The next section will discuss the configuration of commands and responses.

4.1.1 Configuration of Commands

Commands sent from a higher-level device to a Power Monitor consist of the following elements.

Number of bytes	1	2	2	1	3	Variable length	2	1	1
Element	STX	Address number (Station number)	CPU number 01	Time to wait for response 0	Command	Data corresponding to command	Check sum	ETX	CR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

(1) STX (Start of Text)
This control code indicates the start of a command. The character code is CHR$(2).

(2) Address Number (01 to 31)
Address numbers are used by a higher-level device to identify which Power Monitor to communicate with. (ID number of the Power Monitor)

(3) CPU Number
This number is fixed to 01.

(4) Time to Wait for Response
This is fixed to 0.

(5) Command (See subsection 4.4.)
Specify a command to be issued from the higher-level device.

(6) Data Corresponding to Command
Specify an internal register (D register or I relay), number of data items, Power Monitor's parameter values, or others.

(7) Check sum
In PC link communication with sum check, the ASCII codes of the text between STX and the checksum are converted into hexadecimal values and added on a byte basis. Then the lowermost byte of the added results is turned into ASCII code, and its lower byte is used as the checksum.

This 2-byte space is unnecessary for PC link communication without sum check.

(8) ETX (End of Text)
This control code indicates the end of a command string. The character code is CHR$(3).

(9) CR (Carriage Return)
This control code marks the end of a command. The character code is CHR$(13).

NOTE

The control codes STX, ETX, and CR in commands are indispensable. Do not miss any of them when you create a communication program for PC link communication. A communication failure will result if any of them are omitted or if the order is incorrect.

4.1.2 Configuration of Response

Responses from a Power Monitor with respect to a command sent from the higher-level device consist of the elements shown below, which differ depending on the condition of communication – normal or failure.

1) With Normal Communication

When communication is carried out normally, the Power Monitor returns the character string “OK” and, in response to read commands, also returns read-out data.

Number of bytes	1	2	2	2	Variable length	2	1	1
Element	STX	Address number (Station number)	CPU number: 01	OK	Parameter data	Checksum	ETX	CR

2) In the Event of Failure

If communication is carried out abnormally, the Power Monitor returns the character string “ER” and error codes (EC1 and EC2). (See subsection 4.3, Response Error Codes.)

- No response is made in case of an error in address number specification or CPU number specification.
- If a Power Monitor cannot receive an ETX contained in a command, a response may not be made.

* As a measure against these situations, provide a timeout processing in the communication functions or communication programs of the higher-level device.

Number of bytes	1	2	2	2	2	(2)	3	2	1	1
Element	STX	Address number (Station number)	CPU number: 01	ER	EC1	(EC2)	Command	Checksum	ETX	CR

4.2 Communication with Higher-level Device

In PC link communication, when specifying D registers or I relays (internal registers of Power Monitor), you can use the numbers as is. The numbers of these internal registers are in the following format:

- D registers: D**** (****: numeric value)
- I relays: I**** (****: numeric value)

Higher-level devices to be connected to a Power Monitor are those capable of handling the PC link communication protocol.

Communication with FA-M3 with UT-link module

No ladder communication program is required to communicate with FA-M3 with UT-link module (Yokogawa PLC). The UT-link module's function offers 3 modes, in which users can exchange data without paying attention to the communication procedure. (For more information, see the user's manual of UT-link module "IM 34M6H25-01E.")

●Non-user-specifiable mode: .... Always reads the predetermined devices* of the Power Monitor (users cannot specify devices).

- Predetermined devices* of Power Monitor: D0001 to D0022
  (Since these devices* are in the read only area of Power Monitor, they cannot be written to.)

●User-specifiable mode: .... Always reads/writes the user-specified devices* of the Power Monitor.

●Command mode: .... Accesses the devices* of the Power Monitor only when necessary.

*: "Predetermined device" or "device" here denotes the internal registers of the Power Monitor (D registers and I relays).

4.3 Response Error Codes

The error codes (EC1) and detailed error codes (EC2) of response are as follows.

EC2 is no-meaning when error code (EC1) is not included in following table 4.2.

Table 4.1 Error Codes (EC1)

Error code	Meaning	Causes
02	Command error	• The command does not exist. • Command not executable
03	Internal register specification error	• Specified register number does not exist. • In handling bit registers (I relays) on a word-by-word basis, its specification is not correct.
04	Out of setting range	• A character other than 0 and 1 was used for bit setting. • A value other than 0000 to FFFF was specified in the word specification. • The start address specified for data loading/saving is out of the address range.
05	Data number error	• Specified number of bits or words is too large. • The number of data or registers specified and the number of parameters for them are inconsistent.
06	Monitor error	• An attempt was made to execute monitoring without specifying any device to be monitored (BRS or WRS).
08	Parameter error	• Wrong parameter.
42	Sum error	• The sum does not match.
43	Internal buffer overflow	• Too much data was received.
44	Timeout between received characters	• No terminal character or ETX is received.

Table 4.2 Detailed Error Codes (EC2)

<table>
<tr><th>Error code (EC1)</th><th>Meaning</th><th>Detailed error code (EC2)</th></tr>
<tr><td>03</td><td>Internal register specification error</td><td rowspan="4">Indicates the parameter number where an error occurred (HEX). This is the number of a parameter in sequence that first resulted in an error when counted from the leading parameter.
Example:
Error in internal register specification ↓ (points to parameter 4)
STX 01010WRW <u>02</u> <u>D0043,</u> <u>3F80,</u> <u>A0044,</u> <u>0000</u>
Parameter number 1 2 3 4 5
In this case, EC1 = 03 and EC2 = 04</td></tr>
<tr><td>04</td><td>Out of setting range</td></tr>
<tr><td>05</td><td>Data number error</td></tr>
<tr><td>08</td><td>Parameter error</td></tr>
</table>

4.4 List of Commands

The following are the lists of commands available in PC link communication.

Table 4.3 Bit-basis Access Commands Dedicated to I Relays

Command	Description	Number of bits handled
BRD	Bit-basis read	1 to 48 bits
BWR	Bit-basis write	1 to 32 bits
BRR	Bit-basis, random read	1 to 16 bits
BRW	Bit-basis, random write	1 to 16 bits
BRS	Specifies I relays to be monitored on a bit-by-bit basis.	1 to 16 bits
BRM	Bit-basis monitoring	—

Table 4.4 Word-basis Access Commands

Command	Description	Number of words handled
WRD	Word-basis read	1 to 64 words
WWR	Word-basis write	1 to 64 words
WRR	Word-basis, random read	1 to 32 words
WRW	Word-basis, random write	1 to 32 words
WRS	Specifies internal registers to be monitored on a word-by-word basis.	1 to 24 words
WRM	Word-basis monitoring	—

Table 4.5 Special Commands

Command	Description	Number of controllers handled
INF	Reads model, version, and revision.	—

The device names (-summary name of D register and I relay -) given as to parameter of command have following formats.

• D register: Dxxxx (xxxx is D register number.)

• I relay: Ixxxx (xxxx is I relay number.)

4.4.1 BRD Reads I relays on a bit-by-bit basis.

● **Function**

Reads the ON/OFF statuses of a sequence of contiguous I relays by the specified number of bits, starting at a specified I relay number.

- The number of bits to be read at a time is 1 to 48.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes the checksum function. When performing communication without checksum, do not include the 2-byte checksum element in the command.

● **Command/Response (for normal operation)**

Number of Bytes	1	2	2	1	3	5	1	3	2	1	1
Command element	STX	Address (Station number)	CPU number 01	0	BRD	I relay number	Comma or space	Number of bits (n)	Check sum	ETX	CR

Number of Bytes	1	2	2	2	1	1	1	…	1	2	1	1
Response element	STX	Address (Station number)	CPU number 01	OK	d1	d2	d3	…	dn	Check sum	ETX	CR

The response parameter data is “0” when the status is OFF or “1” when ON.

dn: read data of the specified number of bits (n = 1 to 48)
dn = 0 (OFF)
dn = 1 (ON)

● **Example:** Reading the input overrange against full input scale of the Power Monitor with address number 01.

The following command reads the status of I0001 at address number 01.

[Command] **[STX]01010BRDI0001, 001[ETX][CR]**

The following response is returned with respect to the above command. (When I0001 is ON.)

[Response] **[STX]0101OK1[ETX][CR]**

I0001 has been ON since 1 was returned.

4.4.2 BWR Writes data into I relays on a bit-by-bit basis.

● **Function**

Writes ON/OFF data into a sequence of contiguous I relays by the specified number of bits, starting at a specified I relay number.

- The number of bits to be written at a time is 1 to 32.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes a checksum function. When performing communication without checksum, do not include the 2-byte checksum element in the command.

● **Command/Response (for normal operation)**

Number of Bytes	1	2	2	1	3	5	1	3	1	1	1
Command element	STX	Address (Station number)	CPU number 01	0	BWR	I relay number	Comma or space	Number of bits (n)	Comma or space	d1	d2

Command (continued)

…	1	2	1	1
…	dn	Check sum	ETX	CR

Write information is “0” to set OFF or “1” to set ON.

dn: write data of the specified number of bits (n = 1 to 32)

dn = 0 (OFF)

dn = 1 (ON)

Number of Bytes	1	2	2	2	2	1	1
Response element	STX	Address (Station number)	CPU number 01	OK	Check sum	ETX	CR

● **Example:** Setting the Remote reset (I0010) of the Power Monitor with address number 01 to ON.

[Command] **[STX]01010BWR<u>I0010</u>, 001, <u>1</u>[ETX][CR]**

“<u>OK</u>” is returned in response to the command above.

[Response] **[STX]0101<u>OK</u>[ETX][CR]**

4.4.3 BRR Reads I relays on a bit-by-bit basis in a random order.

● **Function**

Reads the ON/OFF statuses of the individual I relays specified in a random order by the specified number of bits.

- The number of bits to be read at a time is 1 to 16.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes a checksum function. When performing communication without the checksum, do not include the 2-byte checksum element in the command.

● **Command/Response (for normal operation)**

Number of Bytes	1	2	2	1	3	2	5	1	5	1
Command element	STX	Address (Station number)	CPU number 01	0	BRR	Number of bits (n)	I relay number 1	Comma or space	I relay number 2	Comma or space

Command (continued)

…	5	2	1	1
…	I relay number n	Check sum	ETX	CR

Number of Bytes	1	2	2	2	1	1	…	1	2	1	1
Response element	STX	Address (Station number)	CPU number 01	OK	d1	d2	…	dn	Check sum	ETX	CR

The response parameter data is “0” when the status is OFF or “1” when ON.

dn: read data of the specified number of bits (n = 1 to 32)
dn = 0 (OFF)
dn = 1 (ON)

● **Example:** Reading the Input overrange against full input scale (I0001) and the Remote reset (I0010) of the Power Monitor with address number 01.

[Command] **[STX]01010BRR02I0001, I0010 [ETX][CR]**

In response to the command above, the ON and OFF responses are returned for I0001 and I0010 respectively.

[Response] **[STX]0101OK10[ETX][CR]**

↑ I0001 is ON, and I0010 is OFF.

4.4.4 BRW Writes data into I relays on a bit-by-bit basis in a random order.

● **Function**

Writes ON/OFF statuses in the individual I relays specified in a random order by the specified number of bits.

- The number of bits to be written at a time is 1 to 16.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum element in the command.

● **Command/Response (for normal operation)**

Number of Bytes	1	2	2	1	3	2	5	1	1	1	5
Command element	STX	Address (Station number)	CPU number 01	0	BRW	Number of bits (n)	I relay number 1	Comma or space	d1	Comma or space	I relay number 2

Command (continued)

1	1	1	…	5	1	1	2	1	1
Comm a or space	d2	Comma or space	…	I relay number n	Comma or space	dn	Check sum	ETX	CR

Write information is “0” to set OFF or “1” to set ON.

dn: write data of the specified number of bits (n = 1 to 32)
dn = 0 (OFF)
dn = 1 (ON)

Number of Bytes	1	2	2	2	2	1	1
Response element	STX	Address (Station number)	CPU number 01	OK	Check sum	ETX	CR

● **Example:** Setting the Remote reset (I0010) and the Stop of optional power integration (I0014) of the Power Monitor with address number 01 to ON and OFF.

[Command] **[STX]01010BRW02I0010, 1, I0014, 0[ETX][CR]**

“OK” is returned in response to the command above.

[Response] **[STX]0101OK[ETX][CR]**

4.4.5 BRS Specifies I relays to be monitored on a bit-by-bit basis.

● **Function**

Specifies the numbers of I relays to be monitored on a bit-by-bit basis. Note that this command simply specifies I relays. Actual monitoring is performed by the BRM command after the I relay numbers are specified with this command.

When the volume of data is large and you wish to increase the communication rate, it is effective to use a combination of the BRS and BRM commands rather than the BRD or BRR command. If the power supply is turned off, the specified I relay numbers will be erased.

- The number of registers to be specified at a time is 1 to 16.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum element in the command.

● **Command/Response (for normal operation)**

Number of Bytes	1	2	2	1	3	2	5	1	5	1
Command element	STX	Address (Station number)	CPU number 01	0	BRS	Number of bits (n)	I relay number 1	Comma or space	I relay number 2	Comma or space

Command (continued)

…	5	2	1	1
…	I relay number n	Check sum	ETX	CR

Number of Bytes	1	2	2	2	2	1	1
Response element	STX	Address (Station number)	CPU number 01	OK	Check sum	ETX	CR

● **Example:** Monitoring the Input overrange against full input scale (I0001) and the Remote reset (I0010) of the Power Monitor with address number 01.

(This command is used simply for specifying registers.)

[Command] [STX]01010BRS01I0001,I0010[ETX][CR]

"OK" is returned in response to the command above.

[Response] [STX]0101OK[ETX][CR]

4.4.6 BRM Monitors I relays on a bit-by-bit basis.

● **Function**

Reads the ON/OFF statuses of the I relays that have been once specified in advance by the BRS command.

- Before executing this command, the BRS command must always be executed to specify which I relays are to be monitored. If no relay has been specified, error code 06 is returned. This error also occurs if the power supply is turned off.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum element in the command.

● **Command/Response (for normal operation)**

Number of Bytes	1	2	2	1	3	2	1	1
Command element	STX	Address (Station number)	CPU number 01	0	BRM	Check sum	ETX	CR

Number of Bytes	1	2	2	2	1	1	1	…	1	2	1	1
Response element	STX	Address (Station number)	CPU number 01	OK	d1	d2	d3	…	dn	Check sum	ETX	CR

The response parameter data is “0” when the status is OFF and “1” when ON.

dn: read data of the number of bits specified by the BRS command (n = 1 to 16)
dn = 0 (OFF)
dn = 1 (ON)

● **Example:** Monitoring the Input overrange against full input scale (I0001) and the Remote reset (I0010) of the Power Monitor with address number 01.

(This command reads the statuses of the I relays specified by the BRS command.)

[Command] **[STX]01010BRM[ETX][CR]**

The ON/OFF status of the I relay is returned in response to the command above.

[Response] **[STX]0101OK11[ETX][CR]**

↑ The I relay is ON.

4.4.7 WRD Reads D registers and I relays on a word-by-word basis.

● **Function**

Reads a sequence of contiguous register information on a word-by-word basis by the specified number of words, starting at the specified register number.

- The number of words to be read at a time is 1 to 64.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum element in the command.

● **Command/Response (for normal operation)**

Number of Bytes	1	2	2	1	3	5	1	2	2	1	1
Command element	STX	Address (Station number)	CPU number 01	0	WRD	Register number	Comma or space	Number of words (n)	Check sum	ETX	CR

Number of Bytes	1	2	2	2	4	4	…	4	2	1	1
Response element	STX	Address (Station number)	CPU number 01	OK	dddd1	dddd2	…	ddddn	Check sum	ETX	CR

The response is returned in a 4-digit character string (0000 to FFFF) in a hexadecimal pattern.

ddddn: Read data of the specified number of words
ddddn = character string in a hexadecimal pattern
n = 1 to 64

● **Example:** Reading the Integrated power (uint32; lower-order 2 bytes) (D0001) and the Integrated power (uint32; higher-order 2 bytes) (D0002) of the Power Monitor with address number 01.

[Command] [STX]01010WRDD0001, 02[ETX][CR]

The Integrated power (uint32; lower-order 2 bytes) (D0001) value (03E8(HEX)) and the Integrated power (uint32; higher-order 2 bytes) (D0002) value (00C8 (HEX)) is returned in response to the command above.

[Response] [STX]0101OK03E800C8[ETX][CR]

4.4.8 WWR Writes data into D registers and I relays on a word-by-word basis.

● **Function**

Writes information into a sequence of contiguous registers on a word-by-word basis by the specified number of words, starting at the specified register number.

- The number of words to be written at a time is 1 to 64.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum element in the command.

● **Command/Response (for normal operation)**

Number of Bytes	1	2	2	1	3	5	1	2	1	4
Command element	STX	Address (Station number)	CPU number 01	0	WWR	Register number	Comma or space	Number of words (n)	Comma or space	dddd1

Command (continued)

4	…	4	2	1	1
dddd2	…	ddddn	Check sum	ETX	CR

Write information is specified in a 4-digit character string (0000 to FFFF) in a hexadecimal pattern.

(ddddn: Write data of the specified number of words
ddddn = character string in a hexadecimal pattern
n = 1 to 64)

Number of Bytes	1	2	2	2	2	1	1
Response element	STX	Address (Station number)	CPU number 01	OK	Check sum	ETX	CR

● **Example:** Writing 0380(HEX) into the PT ratio (float upper 2 bytes) (D0044) and 0000(HEX) into the PT ratio (float lower 2 bytes) (D0043) of the Power Monitor with address number 01.

[Command] **[STX]01010WWRD0043, 02, 03800000[ETX][CR]**

"OK" is returned in response to the command above.

[Response] **[STX]0101OK[ETX][CR]**

4.4.9 WRR Reads D registers and I relays on a word-by-word basis in random order.

● **Function**

Reads the statuses of the individual registers, on a word-by-word basis, specified in a random order by the specified number of words.

- The number of words to be read at a time is 1 to 32.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum element in the command.

● **Command/Response (for normal operation)**

Number of Bytes	1	2	2	1	3	2	5	1	5	1
Command element	STX	Address (Station number)	CPU number 01	0	WRR	Number of words (n)	Register number 1	Comma or space	Register number 2	Comma or space

Command (continued)

…	5	2	1	1
…	Register number (n)	Check sum	ETX	CR

Number of Bytes	1	2	2	2	4	4	…	4	2	1	1
Response element	STX	Address (Station number)	CPU number 01	OK	dddd1	dddd2	…	ddddn	Check sum	ETX	CR

The response is returned in a 4-digit character string (0000 to FFFF) in a hexadecimal pattern.

ddddn = character string in a hexadecimal pattern (n = 1 to 32)

● **Example:** Reading the Integrated pulse Characteristic (int 16 bits) (D0051) and the area for user (D0104) of the Power Monitor with address number 01.

[Command] [STX]01010WRR02D0051,D104[ETX][CR]

The Intergrated pulse Characteristic (int 16 bits) (D0051) value 00C8 (HEX) and the area for user (D0104) value 0032 (HEX) are returned as the response to the above command.

[Response] [STX]01010OK00C80032[ETX][CR]

4.4.10 WRW Writes data into D registers and I relays on a word-by-word basis in random order.

● **Function**

Writes register information specified for each register into the registers specified in a random order by the specified number of words.

- The number of words to be written at a time is 1 to 32.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum element in the command.

● **Command/Response (for normal operation)**

Number of Bytes	1	2	2	1	3	2	5	1	4	1
Command element	STX	Address (Station number)	CPU number 01	0	WRW	Number of words (n)	Register number 1	Comma or space	dddd1	Comma or space

Command (continued)

5	1	4	…	5	1	4	2	1	1
Register number 2	Comma or space	dddd2	…	Register number n	Comma or space	ddddn	Check sum	ETX	CR

Write information is specified in a 4-digit character string (0000 to FFFF) in a hexadecimal pattern.

ddddn: Repetition of register data and write information of the specified number of words
ddddn = character string in a hexadecimal pattern
n = 1 to 32

Number of Bytes	1	2	2	2	2	1	1
Response element	STX	Address (Station number)	CPU number 01	OK	Check sum	ETX	CR

● Example: Writing 0014(HEX) into the area for user (D0104) and 0005(HEX) into the area for user (D0105) of the Power Monitor with address number 01.

[Command] **[STX]01010WRW02D0104, 0014, D0105, 0005[ETX][CR]**

"OK" is returned in response to the command above.

[Response] **[STX]0101OK[ETX][CR]**

4.4.11 WRS Specifies the D registers and I relays to be monitored on a word-by-word basis.

● **Function**

Specifies the numbers of the registers to be monitored on a word-by-word basis. Note that this command simply specifies the registers. Actual monitoring is performed by the WRM command after the register numbers are specified by this command.

If the volume of data is large and you wish to increase the communication rate, it is effective to use a combination of the WRS and WRM commands rather than the WRD or WRR command. If the power supply is turned off, the register numbers specified will be erased.

- The number of words to be specified at a time is 1 to 24.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum element in the command.

● **Command/Response (for normal operation)**

Number of Bytes	1	2	2	1	3	2	5	1	5	1
Command element	STX	Address (Station number)	CPU number 01	0	WRS	Number of words (n)	Register number 1	Comma or space	Register number 2	Comma or space

Command (continued)

…	5	2	1	1
…	Register number n	Check sum	ETX	CR

Number of Bytes	1	2	2	2	2	1	1
Response element	STX	Address (Station number)	CPU number 01	OK	Check sum	ETX	CR

● **Example:** Monitoring the integrated power (uint32; lower-order 2 bytes) (D0001) and the integrated power (uint32; higher-order 2 bytes) (D0002) of the Power Monitor with address number 01.

(This command simply specifies the registers.)

[Command] **[STX]01010WRS02D0001,D0002[ETX][CR]**

"OK" is returned in response to the command above.

[Response] **[STX]0101OK[ETX][CR]**

4.4.12 WRM Monitors the D register and I relays on a word-by-word basis.

● **Function**

Reads the information of the registers that have been specified in advance by the WRS command.

- Before executing this command, the WRS command must once be executed to specify which registers are to be monitored. If no register has been specified, error code 06 is returned. This error also occurs if the power supply is turned off.
- For the format of response in the event of failure, see subsection 4.1.2.
- The command shown below includes the checksum function. When performing communication without the checksum, do not include the 2-byte checksum element in the command.

● **Command/Response (for normal operation)**

Number of Bytes	1	2	2	1	3	2	1	1
Command element	STX	Address (Station number)	CPU number 01	0	WRM	Check sum	ETX	CR

Number of Bytes	1	2	2	2	4	4	…	4	2	1	1
Response element	STX	Address (Station number)	CPU number 01	OK	dddd1	dddd2	…	ddddn	Check sum	ETX	CR

The response is returned in a 4-digit character string (0000 to FFFF) in a hexadecimal pattern.

ddddn: Read data of the number of words specified by the WRS command
ddddn = character string in a hexadecimal pattern
n = 1 to 24

● **Example:** Monitoring the integrated power (uint32; lower-order 2 bytes) (D0001) and the integrated power (uint32; higher-order 2 bytes) (D0002) of a Power Monitor with address number 01.

(This command reads the status of the register specified by the WRS command.)

[Command] [STX]01<u>01</u>0WRM[ETX][CR]

The integrated power (uint32; lower-order 2 bytes) (D0001) value 0001 (HEX) and the integrated power (uint32; higher-order 2 bytes) (D0002) value E02F(HEX) are returned in response to the command above.

[Response] [STX]0101OK0001E02F[ETX][CR]

4.4.13 INF Reads the model, version, and revision information.

● **Function**

Reads the model code, version number, and revision number of the Power Monitor.

• For the format of response in the event of failure, see subsection 4.1.2.

● **Command/Response (for normal operation)**

Number of Bytes	1	2	2	1	3	1	2	1	1
Command element	STX	Address (Station number)	CPU number 01	Response time: 0	INF	6	Check sum	ETX	CR

Number of Bytes	1	2	2	2	8	8	4	4
Response element	STX	Address (Station number)	CPU number 01	OK	Model and Option (Note 1)	Version and revision numbers (Note 2)	0001 (Note 3)	0022 (Note 3)

Response (continued)

4	4	2	1	1
0001 (Note 3)	0000 (Note 3)	Check sum	ETX	CR

Note 1: [Model • Option]

When PR201: PR201□□□

When UZ005: UZ005□□□

Contents of □□□:

First column Phase and wiring system 1; single phase 2 wire, 2; single phase 3 wire, 3; three phase 3 wire and 4; three phase 4 wire

Second column (Reserved) no meaning

Third column Option 0; none, 1; power factor and 2; current 2

Note 2: [Version • Revision] _V**.R**

First column character (i.e. "_" in sample) indicates space.

Note 3: These are manufacture's matter, so ignore those items.

Blank Page

5. Functions and Usage of D Registers and I Relays

5.1 Functions and Usage of D Registers

Various types of data are allocated to the D registers of a power monitor. A higher-level device can acquire data from the power monitor or control the power monitor by accessing these D registers through MODBUS personal computer link communication.

Table 5.1 D Register Configuration

Register Number	Classification	Description
D0001-D0040	Process data	Measured values, e.g, integrated power
D0043-D0058	Parameter data	Setting condition, e.g, PT and CT ratios
D0059	Setpoint change status	Data serving as a trigger for setpoint change
D0059-D0063	Control data	Control of operations, e.g., remote reset
D0072	Setpoint change status	Switch serving as a trigger for setpoint change
D0073	Integrated value write status	Switch serving as a trigger for writting an integrated value
D0101-D0150	User area	Can be used freely by the user.
Others	Prohibited area	Can not be used. Reading from/writing to this area is not guaranteed.

Table 5.2 D Register Map (1/2)

D-Reg No.	Ref No.	H No.	Register Name	Read/Write
D0001	40001	0000	Integrated power (uint32; lower-order 2bytes)	Read
D0002	40002	0001	Integrated power (uint32; higher-order 2bytes)	Read
D0003	40003	0002	Optional integrated power-present send value (uint32; lower-order 2bytes)	Read
D0004	40004	0003	Optional integrated power-present send value (uint32; higher-order 2bytes)	Read
D0005	40005	0004	Optional integrated power-previous sent value (uint32; lower-order 2bytes)	Read
D0006	40006	0005	Optional integrated power-previous sent value (uint32; higher-order 2bytes)	Read
D0007	40007	0006	Instantaneous value of power (float; lower-order 2bytes)	Read
D0008	40008	0007	Instantaneous value of power (float; higher-order 2bytes)	Read
D0009	40009	0008	Voltage 1 instantaneous value (float; lower-order 2bytes)	Read
D0010	40010	0009	Voltage 1 instantaneous value (float; higher-order 2bytes)	Read
D0011	40011	0010	Voltage 2 instantaneous value (float; lower-order 2bytes)	Read
D0012	40012	0011	Voltage 2 instantaneous value (float; higher-order 2bytes)	Read
D0013	40013	0012	Voltage 3 instantaneous value (float; lower-order 2bytes)	Read
D0014	40014	0013	Voltage 3 instantaneous value (float; higher-order 2bytes)	Read
D0015	40015	0014	Current 1 instantaneous value (float; lower-order 2bytes)	Read
D0016	40016	0015	Current 1 instantaneous value (float; higher-order 2bytes)	Read
D0017	40017	0016	Current 2 instantaneous value (float; lower-order 2bytes)	Read
D0018	40018	0017	Current 2 instantaneous value (float; higher-order 2bytes)	Read
D0019	40019	0018	Current 3 instantaneous value (float; lower-order 2bytes)	Read
D0020	40020	0019	Current 3 instantaneous value (float; higher-order 2bytes)	Read
D0021	40021	0020	Instantaneous value of power factor (float; lower-order 2bytes)	Read
D0022	40022	0021	Instantaneous value of power factor (float; higher-order 2bytes)	Read
D0023	40023	0022	Voltage 1 maximum value (float; lower-order 2bytes)	Read
D0024	40024	0023	Voltage 1 maximum value (float; higher-order 2bytes)	Read
D0025	40025	0024	Voltage 1 minimum value (float; lower-order 2bytes)	Read
D0026	40026	0025	Voltage 1 minimum value (float; higher-order 2bytes)	Read

Table 5.2 D register map(2/2)

D-Reg No.	Ref No.	H No.	Register Name	Read/Write
D0027	40027	0026	Voltage 2 maximum value (float lower 2 bytes)	Read
D0028	40028	0027	Voltage 2 maximum value (float upper 2 bytes)	Read
D0029	40029	0028	Voltage 2 minimum value (float lower 2 bytes)	Read
D0030	40030	0029	Voltage 2 minimum value (float upper 2 bytes)	Read
D0031	40031	0030	Voltage 3 maximum value (float lower 2 bytes)	Read
D0032	40032	0031	Voltage 3 maximum value (float upper 2 bytes)	Read
D0033	40033	0032	Voltage 3 minimum value (float lower 2 bytes)	Read
D0034	40034	0033	Voltage 3 minimum value (float upper 2 bytes)	Read
D0035	40035	0034	Current 1 maximum value (float lower 2 bytes)	Read
D0036	40036	0035	Current 1 maximum value (float upper 2 bytes)	Read
D0037	40037	0036	Current 2 maximum value (float lower 2 bytes)	Read
D0038	40038	0037	Current 2 maximum value (float upper 2 bytes)	Read
D0039	40039	0038	Current 3 maximum value (float lower 2 bytes)	Read
D0040	40040	0039	Current 3 maximum value (float upper 2 bytes)	Read
D0041	40041	0040		
D0042	40042	0041		
D0043	40043	0042	PT ratio (float lower 2 bytes)	Read/Write
D0044	40044	0043	PT ratio (float upper 2 bytes)	Read/Write
D0045	40045	0044	CT ratio (float lower 2 bytes)	Read/Write
D0046	40046	0045	CT ratio (float upper 2 bytes)	Read/Write
D0047	40047	0046	Integrated low-cut power (float lower 2 bytes)	Read/Write
D0048	40048	0047	Integrated low-cut power (float upper 2 bytes)	Read/Write
D0049	40049	0048	Integrated pulse unit Mantissa (float lower 2 bytes)	Read/Write
D0050	40050	0049	Integrated pulse unit Mantissa (float upper 2 bytes)	Read/Write
D0051	40051	0050	Integrated pulse unit Characteristic (int 16 bits)	Read/Write
D0052	40052	0051	Integrated pulse ON pulse width (uint 16 bits)	Read/Write
D0053	40053	0052	Input scaling "L" level for analog output (float lower 2 bytes)	Read/Write
D0054	40054	0053	Input scaling "L" level for analog output (float upper 2 bytes)	Read/Write
D0055	40055	0054	Input scaling "H" level for analog output (float lower 2 bytes)	Read/Write
D0056	40056	0055	Input scaling "H" level for analog output (float upper 2 bytes)	Read/Write
D0057	40057	0056	Integrated power setting (uint 32 lower 2 bytes)	Write
D0058	40058	0057	Integrated power setting (uint 32 upper 2 bytes)	Write
D0059	40059	0058	Remote reset	Write
D0060	40060	0059	Integrated power reset	Write
D0061	40061	0060	Maximum/Minimum value reset	Write
D0062	40062	0061	Start of optional integrated power	Write
D0063	40063	0062	Stop of optional integrated power	Write
D0065	40065	0064		
D0072	40072	0071	Status of setting change	Write
D0073	40073	0072	Status of write-in integrated power	Write
D0074	40074	0073		
D0075	40075	0074		
D0101	40101	0100	Area for user	Read/Write
⋮	⋮	⋮	⋮	
D0150	40150	0149	Area for user	Read/Write

Note:

Ref No.: For SCADA program
H No.: For user created program
float : single precision floating decimal point
uint : without sign integer
int : with sign integer

Table 5.3 Parameters of D Registers

Parameter Name	Range and Unit	Type
Integrated power	0-99999999kWh	uint32
Optional integrated power-present send value	0-99999Wh	uint32
Optional integrated power-previous sent value	0-99999Wh	uint32
Instantaneous value of power	0 to 69999MW	float
Voltages 1-3 instantaneous values	0-9999kV	float
Currents 1-3 instantaneous values	0-9999kA	float
Instantaneous value of power factor	-0.5 to +0.5	float
Voltages 1-3 maximum values	0-9999kV	float
Voltages 1-3 minimum values	0-9999kV	float
Currents 1-3 maximum values	0-9999kA	float
PT ratio	1-32000	float
CT ratio	0.05-32000	float
Integrated low-cut power	0.1-99.9	float
Integrated pulse unit	6.667310^{-6} to 1.000310^{-1}	float
Integrated pulse unit mantissa	1.000 to 9.999. Assuming the mantissa and characteristic of an integrated pulse unit are a and b respectively, then the parameter value must fall within the range of the integrated pulse unit, i.e., $6.667310^{-6} \leqq a \times 10^{b} \leqq 1.000310^{-1}$.	float
Integrated pulse unit characteristic	-6 to -1. Assuming the mantissa and characteristic of an integrated pulse unit are a and b respectively, then the parameter value must fall within the range of the integrated pulse unit, i.e., $6.667310^{-6} \leqq a \times 10^{b} \leqq 1.000310^{-1}$.	int16
Integrated pulse ON pulse width	1 to 127. This range is equivalent to 10 to 1270 ms since 1 count equals 10 ms.	int16
Input scaling L for analog output	-4800 to +4800	float
Input scaling H for analog output	-4800 to +4800	float
Remote reset	Value other than 1: Does nothing. 1: Resets the power monitor.	int16
Integrated power reset	Value other than 1: Does nothing. 1: Resets the integrated power.	int16
Maximum/minimum value reset	Value other than 1: Does nothing. 1: Resets the maximum/minimum value.	int16
Start of optional power integration	Value other than 1: Does nothing. 1: Starts optional power integration.	int16
Stop of optional power integration	Value other than 1: Does nothing. 1: Stops optional power integration.	int16
Integrated power setting	0-99999999999 kWh	int32
Status of setting change	Value other than 1: Does nothing. 1: Initializes the D register to reflect the setpoint change.	int16
Status of write-in integrated power	Value other than 1: Does nothing. 1: Writes the values of the registers D0057 and D0058 as the integrated power.	int16

Table 5.4 Change in D Registers

(This table describes the behavior of each D register when any change is made to the parameter of the register.)

Changed Parameter	Behavior When Parameter Is Changed
PT ratio	This change only results in the saving of the setpoint in the buffer memory of the power monitor; no change is made to the PT ratio until the status of setting change switches to
CT ratio	This change only results in the saving of the setpoint in the buffer memory of the power monitor; no change is made to the CT ratio until the status of setting change switches to
Integrated low-cut power	This change only results in the saving of the setpoint in the buffer memory of the power monitor; no change is made to the integrated low-cut power until the status of setting change switches to 1.
Integrated pulse unit	This change only results in the saving of the setpoint in the buffer memory of the power monitor; no change is made to the integrated pulse unit until the status of setting change switches to 1.
Integrated pulse ON pulse width	This change only results in the saving of the setpoint in the buffer memory of the power monitor; no change is made to the integrated pulse ON pulse width until the status of setting change switches to 1.
Input scaling L for analog output	This change only results in the saving of the setpoint in the buffer memory of the power monitor; no change is made to the analog output scaling L until the status of setting change switches to 1.
Input scaling H for analog output	This change only results in the saving of the setpoint in the buffer memory of the power monitor; no change is made to the analog output scaling H until the status of setting change switches to 1.
Status of setting change	This change initializes operating conditions with setpoints saved in the storage buffers of the power monitor when the parameter is set to 1, so that these setpoints are incorporated into power monitor operation.
Remote reset	This change causes the power monitor to reset itself for restart immediately after returning a response message when it receives 1 as the setpoint.
Integrated power reset	This change causes the power monitor to reset the integrated power immediately after returning a response message when it receives 1 as the setpoint.
Maximum/minimum value reset	This change causes the power monitor to reset the maximum/minimum value immediately after returning a response message when it receives 1 as the setpoint.
Start of optional power integration	This change causes the power monitor to start optional power integration immediately after returning a response message when it receives 1 as the setpoint. This setting change is ignored if integration has already started.
Stop of optional power integration	This change causes the power monitor to stop optional power integration immediately after returning a response message when it receives 1 as the setpoint. This setting change is ignored if integration has already stopped.
Integrated power setting	This change only results in the saving of the setpoint in the buffer memory of the power monitor; no change is made to the integrated power setting until the status of write-in integrated power switches to 1. No change is made to the integrated power even if the status of setting change switched to 1, however, in the case where this parameter is set to 0xFFFFFFFF.

5.2 Functions and Usage of I Relays

Overview of I Relays

Various types of information and control functions are allocated to the I relays of a power monitor. A higher-level device can acquire data from the power monitor or control the power monitor by accessing these I relays through MODBUS personal computer link communication.

Table 5.5 I Relay Configuration

I Relay Number	Classification	Description
1, 2	Error information	Error related to input overranges
10-14	Control data	Control of operations, e.g., remote reset
101-164	User area	Can be used freely by the user.
Others	Prohibited area	Cannot be used. Reading from/writing to this area is not guaranteed.

Table 5.6 I Relay Map

Relay No.	Relay Name	Read/Write
1	Input overrange against full input scale	Read
2	Input overrange against analog output scaling	Read
3		
4		
5		
6		
7		
8		
9		
10	Remote reset	Write
11	Integrated power reset	Write
12	Maximum/minimum value reset	Write
13	Start of optional power integration	Write
14	Stop of optional power integration	Write
15		
101	User area	Read/Write
⋮	⋮	⋮
164	User area	Read/Write

Table 5.7 Change in I Relays

(This table describes the behavior of each I relay when any change is made to the parameter of the relay.)

Changed Parameter	Behavior When Parameter Is Changed
Remote reset	This change causes the power monitor to reset itself for restart immediately after returning a response message when it receives 1 as the setpoint.
Integrated power reset	This change causes the power monitor to reset the integrated power immediately after returning a response message when it receives 1 as the setpoint.
Maximum/minimum value reset	This change causes the power monitor to reset the maximum/minimum value immediately after returning a response message when it receives 1 as the setpoint.
Start of optional power integration	This change causes the power monitor to start optional power integration immediately after returning a response message when it receives 1 as the setpoint. This setting change is ignored if the integration has already started.
Stop of optional power integration	This change causes the power monitor to stop optional power integration immediately after returning a response message when it receives 1 as the setpoint. This setting change is ignored if integration has already stopped.

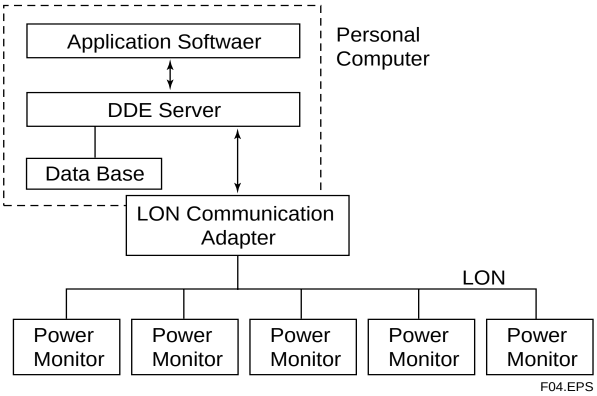
Blank Page

6. LON communication

The read out of various setting data can be easily done without notice of communication,by using LON communication adapter and DDE server. Also the control of optional integrated power and the reset of maximum and minimum values can be done by personal computer. When you connect another device except PR201 or UZ005, Network management tool ("Lon Maker for Windows" of Echelon and so on) is needed. In this ocasion, press [∧]+[∨] keys within three seconds. Then monitor lights on COMM LED in red,and sends service message.

6.1 Figure of system configuration

(In case of system configuration with PR201 only)



Instruments recommended to use for system construction:

(1) Personal Computer

PC/AT compatible instrument

CPU Pentium more than 100MHz

Memory more than 16MB 3.5 inch 1.44MB FDD

HDD empty capacity more than 6MB

Windows Version 95/98

Can equip with either one of <1> <2> <3> of Item (2)

(2) Communication port, slot and communication adapter (<4> and either one of <1> <2> <3> are required)

<1> PCI Slot to store extension board

Echelon Type

74401 PCLTA-20/FT-10 PCI Interface

<2> RS-232C port

Echelon type

73351 SLTA-10 Serial LonTalk Adapter

<3> PCMICA Slot

Echelo Type

73200 PCC-10 PC Card Network Adaptor

78302-2 Conductor Cable Assembly

<4> Driver Soft for above <1> to <3>

Echelon Type

58030-01 Connectivity Starter Kit

(3) Application Software

Software for Microsoft Windows with DDE function (Microsoft Type Microsoft Excel, Visual Basic or various SCADA softwares.), Echelon Type LonMaker for windows and others.

6.2 Communication Specs.

Transmit distance: Total extension 500 m, Between node max. 400 m

(When use of 22AWG twist pair cable)

Connecting mode:

• LON standrd Freetopology connection

Max. 64 node (including upper computer)

• Terminating resistor: 51 Ω (one end)

• Transformer insulation (FTT-10A)

Connecting Terminal:

3 terminals back face

A,B: Balanced type twist paircable

C: Shield

Node No.: 1 to 63

Transmit mode: Half duplex communication

Transmit speed: 78 kbps

Data format: LonTalk protocol standard

Error detect: CRC check

6.3 Network Variable

Actual communication is carried out by DDE server. By means of accessing to the Network variable from Microsoft Windows software with DDE function, read-out of various setting values and reset of optional integrated power and maximum/minimum values can be done from personal computer.

Variables meaning	Type declaration	Variable names	Range
Integrated power output	network output SVNT_elec_whr_f	nvoe1	00000 to 99999[kWh]
Optional integrated power present send value output	network output SVNT_elec_whr_f	nvoe2	00000 to 99999[Wh]
Optional integrated power previous sent value output	network output SVNT_elec_whr_f	nvoe3	00000 to 99999[Wh]
Integrated power value output	network output SVNT_elec_whr_f	nvoe4	00000 to 99999999000[Wh]
Instantaneous power output	network output SVNT_power_f	nvop	±0.001E+2 to ±9.999E+6[W]
Voltage 1 value output	network output SVNT_volt_f	nvov1	0.001E+2 to 9.999E+6[V]
Voltage 2 value output	network output SVNT_volt_f	nvov2	0.001E+2 to 9.999E+6[V]
Voltage 3 value output	network output SVNT_volt_f	nvov3	0.001E+2 to 9.999E+6[V]
Current 1 value output	network output SVNT_amp_f	nvoi1	0.001E+0 to 9.999E+3[A]
Current 2 value output	network output SVNT_amp_f	nvoi2	0.001E+0 to 9.999E+3[A]
Current 3 value output	network output SVNT_amp_f	nvoi3	0.001E+0 to 9.999E+3[A]
Instantaneous power factor output	network output SVNT_pwr_fact_f	nvopf	–0.500 to 1.000 to +0.500[cos ø]
Voltage 1 maximum value output	network output SVNT_volt_f	nvomaxv1	0.001E+2 to 9.999E+6[V]
Voltage 2 maximum value output	network output SVNT_volt_f	nvomaxv2	0.001E+2 to 9.999E+6[V]
Voltage 3 maximum value output	network output SVNT_volt_f	nvomaxv3	0.001E+2 to 9.999E+6[V]
Voltage 1 minimum value output	network output SVNT_volt_f	nvominv1	0.001E+2 to 9.999E+6[V]
Voltage 2 minimum value output	network output SVNT_volt_f	nvominv2	0.001E+2 to 9.999E+6[V]
Voltage 3 minimum value output	network output SVNT_volt_f	nvominv3	0.001E+2 to 9.999E+6[V]
Current 1 maximum value output	network output SVNT_amp_f	nvomaxi1	0.001E+0 to 9.999E+3[A]
Current 2 maximum value output	network output SVNT_amp_f	nvomaxi2	0.001E+0 to 9.999E+3[A]
Current 3 maximum value output	network output SVNT_amp_f	nvomaxi3	0.001E+0 to 9.999E+3[A]
Integrated power send period input	network input SVNT_elapsed_tm	nciinterval1	0 to 59[min] 0 to 59[sec]
Instantaneous value send period input	network input SVNT_elapsed_tm	nciinterval2	0 to 59[min] 0 to 59[sec]
Maximum & minimum value send periodical input	network input SVNT_elapsed_tm	nciinterval3	0 to 59[min] 0 to 59[sec]
Integrated power reset input	network input SVNT_count	nviereset	1: reset of integrated value (reset holding data too)
Optional integrated power control input	network input SVNT_count	nvicontrole2	0: Option integration stop 1: Optional integration start
Maximum & minimum value reset input	network input SVNT_count	nviresetmax	1: Maximum/Minimum value reset
Integrated power send request input	network input SVNT_count	nvireqe1	1: Integrated power send request
Optional integrated power present value send request input	network input SVNT_count	nvireqe2	1: Optional integrated power present value send request
Optional integrated power previous value sent request input	network input SVNT_count	nvireqe3	1: Optional integrated power preceding value send request
Instantaneous power send request input	network input SVNT_count	nvireqp	1: Instantaneous power send request
Voltage 1 send request input	network input SVNT_count	nvireqv1	1: Voltage 1 send request
Voltage 2 send request input	network input SVNT_count	nvireqv2	1: Voltage 2 send request
Voltage 3 send request input	network input SVNT_count	nvireqv3	1: Voltage 3 send request
Current 1 send request input	network input SVNT_count	nvireqi1	1: Current 1 send request
Current 2 send request input	network input SVNT_count	nvireqi2	1: Current 2 send request
Current 3 send request input	network input SVNT_count	nvireqi3	1: Current 3 send request
Instantaneous power factor send request input	network input SVNT_count	nvireqpf	1: Instantaneous power factor send request
Voltage 1 maximum value send request input	network input SVNT_count	nvireqmaxv1	1: Voltage 1 maximum value send request
Voltage 2 maximum value send request input	network input SVNT_count	nvireqmaxv2	1: Voltage 2 maximum value send request
Voltage 3 maximum value send request input	network input SVNT_count	nvireqmaxv3	1: Voltage 3 maximum value send request
Voltage 1 minimum value send request input	network input SVNT_count	nvireqminv1	1: Voltage 1 minimum value send request
Voltage 2 minimum value send request input	network input SVNT_count	nvireqminv2	1: Voltage 2 minimum value send request
Voltage 3 minimum value send request input	network input SVNT_count	nvireqminv3	1: Voltage 3 minimum value send request
Current 1 maximum value send request input	network input SVNT_count	nvireqmaxi1	1: Current 1 maximum value send request
Current 2 maximum value send request input	network input SVNT_count	nvireqmaxi2	1: Current 2 maximum value send request
Current 3 maximum value send request input	network input SVNT_count	nvireqmaxi3	1:Current 3 maximum value send request

Buffer type

Buffer Type	Default Count	Default Size
Application input buffers	15	22
Application output buffers	3	20
Application priority output buffers	2	20
Network input buffers	11	66
Network output buffers	5	42
Network priority output buffers	2	42
Receive transaction buffers	16	13
Transmit transaction buffers	2	28
TOTAL USED	56	253

YOKOGAWA

Yokogawa Electric Corporation

YOKOGAWA ELECTRIC CORPORATION

Network Solutions Business Division
2-9-32, Nakacho, Musashino-shi, Tokyo, 180-8750 JAPAN
Phone: +81-422-52-7179 Facsimile: +81-422-52-6793
Sales Branch Offices
Tokyo, Nagoya, Osaka, Hiroshima, Fukuoka

YOKOGAWA CORPORATION OF AMERICA

Headquaters
2 Dart Road, Newnan, GA. 30265-1094 U.S.A.
Phone: +1-770-253-7000 Facsimile: +1-770-251-0928
Sales Branch Offices / Texas, Chicago, Detroit, San Jose

YOKOGAWA EUROPE B. V.

Headquaters
Databankweg 20, 3821 AL Amersfoort THE NETHERLANDS
Phone: +31-334-64-1611 Facsimile: +31-334-64-1610
Sales Branch Offices / Houten (The Netherlands), Wien (Austria), Zaventem (Belgium), Ratingen (Germany), Madrid (Spain), Bratislava (Slovakia), Runcorn (United Kingdom), Milano (Italy), Velizy villacoublay(France), Johannesburg(Republic of South Africa)

YOKOGAWA AMERICA DO SUL S.A.

Headquarters & Plant
Praca Acapulco, 31-Santo Amaro, Sao Paulo/SP, BRAZIL CEP-04675-190
Phone: +55-11-5681-2400 Facsimile: +55-11-5681-4434

YOKOGAWA ENGINEERING ASIA PTE. LTD.

Head office
5 Bedok South Road, Singapore 469270 SINGAPORE
Phone: +65-6241-9933 Facsimile: +65-6241-2606

YOKOGAWA ELECTRIC KOREA CO., LTD.

Seoul Sales office
395-70, Shindaebang-dong, Dongjak-gu, Seoul,156-010, KOREA
Phone: +82-2-3284-3000 Facsimile: +82-2-3284-3019

YOKOGAWA TAIWAN CORPORATION

Head office
17F, No.39, Sec. 1, Chung Hwa Road Taipei, 100 TAIWAN
Phone: +886-2-2314-9166 Facsimile: +886-2-2314-9918

YOKOGAWA AUSTRALIA PTY. LTD.

Head office
Centrecourt D1, 25-27 Paul Street North, North Ryde, N. S. W. 2113, AUSTRALIA
Phone: +61-2-9805-0699 Facsimile: +61-2-9888-1844

YOKOGAWA INDIA LTD.

Head office
40/4 Lavelle Road, Bangalore, 560 001, INDIA
Phone: +91-80-227-1513 Facsimile: +91-80-227-4270

LTD. YOKOGAWA ELECTRIC

Grokholskiy per. 13, Build. 2, 4th Floor, 129010, Moscow, RUSSIA FEDERATION
Phone: +7-095-737-7868 Facsimile: +7-095-737-7869