

**YS80*R
Rack-Mounted Instruments
Communication Functions**

IM 01B04F01-20E

Introduction

This user's manual describes the communication functions of the YS80*R Rack-mounted Instruments and contains information on how to create communication programs.

Read the manual carefully to understand the communication function of the YS80*R Rack-mounted Instruments.

The YS80*R Rack-mounted Instruments have the following communication protocols.

- PC link communication protocol
- MODBUS communication protocol
- Ladder communication protocol

You are required to understand the communication specifications, communication hardware and language used for creating communication programs and the like of host devices as background knowledge.

■ Intended Readers

This manual is intended for people familiar with the functions of the YS80*R Rack-mounted Instruments such as control engineers and personnel in charge of the maintenance of instrumentation and control equipment.

■ Related Documents

The following manual relates to the communication functions. Read them as necessary.

Model SDAU Digital Alarm Unit (IM 01B04K03-02E)

Explains how to mount, wire and operate.

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 topic.

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 features of the product.

TIP

Gives additional information to complement the topic.

See Also

Gives reference locations for further information on the topic.

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- (2) Figures and illustrations 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 the system.

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- (2) The following safety symbols are used on the product and/or in this manual.

● Symbols used on the product and in this manual



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- (5) Reverse engineering such as the disassembly or decompilation of software is strictly prohibited.
- (6) No portion of the software supplied by Yokogawa may be transferred, exchanged, leased or sublet for use by any third party without the prior permission of Yokogawa.

IM 01B04F01-20E

YS80*R

Rack-Mounted Instruments Communication Functions

IM 01B04F01-20E 2nd Edition

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1. Setup

This chapter describes the procedure to set up the communication functions (PC link, Ladder and MODBUS) and the communication parameters.

1.1 Setup Procedure

Set up the communication functions on the YS80*R Rack-mounted Instrument as follows:

Set up the communication function parameters of the YS80*R Rack-mounted Instrument. (See section 1.2.)



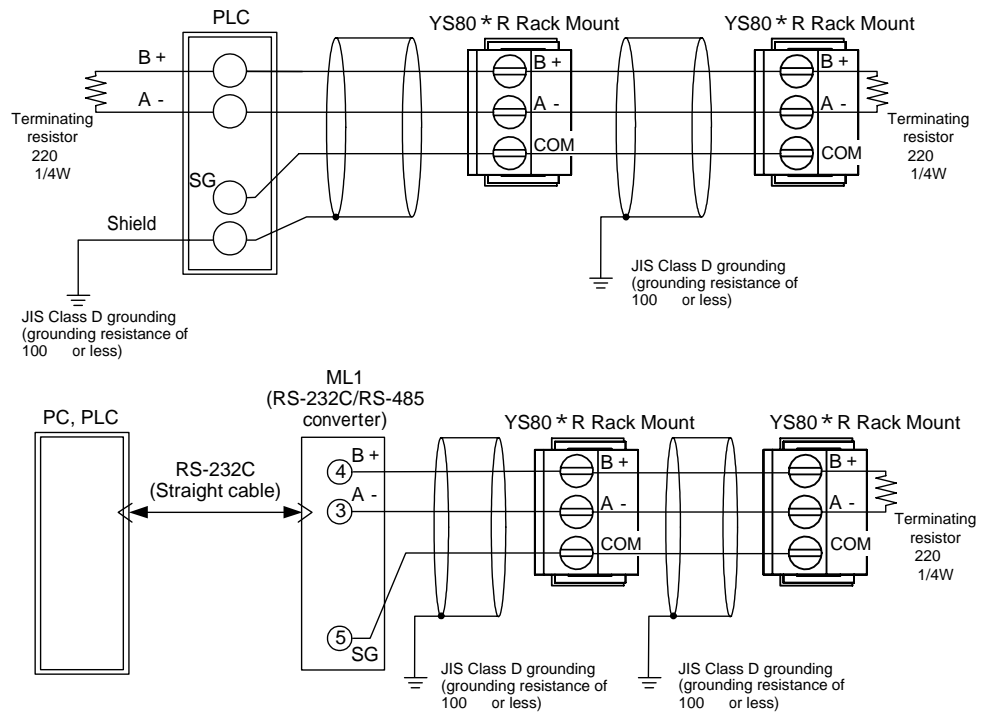
Connect a host device and the YS80*R Rack-mounted Instrument. (See the connection diagram below.)



Create communication programs for the host device to perform communication.

Note: Create communication programs referring to the documentation of each host device. In this manual, "host devices" generically denotes PCs, touch panels and the like.

Connection



NOTE

RS-485 communication is not available when the Handy Terminal is connected to the Hand-held terminal connector on the front panel.

When using the Handy Terminal, connect the Handy Terminal after removing the RS-485 connector so that the Handy Terminal connector can be easily disconnected.

Writing via RS-485 is not available when the parameter write-protect jumper (W.P.) of the SDAU is set to ON, or the communication write-protect parameter (COMMU) is set to 1 (Disable).

RS-485 communication is not available when the Fail indicator lamp (F) on the front panel is lit.

1.2 Notes on Setting Parameters

This section describes the parameters that set up the communication functions and their setting ranges.



NOTE

The communication specifications of both the YS80*R Rack-Mounted Instrument and the host device to connect must be the same. Check the communication parameters of the host device first, then set up the communication parameters of the YS80*R Rack-Mounted Instrument.

Table 1.1 Communication Parameters

Parameter name	Parameter code	Setting range	Default	
Protocol selection	PROTOCOL(PSL)	PC link	PCLINK (0)	PCLINK (0)
		PC link with sum check	PCLINK WITH SUM (1)	
		Ladder	LADDER (2)	
		MODBUS ASCII	MODBUS ASCII (3)	
		MODBUS RTU	MODBUS RTU (4)	
Baud rate	BAUD RATE (BPS)	1200bps	(0)	9600bps (3)
		2400bps	(1)	
		4800bps	(2)	
		9600bps	(3)	
Parity	PARITY (PRI)	None	NONE (0)	EVEN (1)
		Even	EVEN (1)	
		Odd	ODD (2)	
Stop bit	STOP BIT (STP)	1	(1)	1 (1)
		2	(2)	
Data length	DATA LEN (DLN)	7	(7)	8 (8)
		8	(8) Note1	
Address	ADDRESS (ADR)	1 to 99	(1 to 99)	1 (1)

Note 1: Data length is fixed at "8" for LADDER.
Data length is fixed at "7" for MODBUS ASCII, and fixed at "8" for MODBUS RTU.

PROTOCOL (PSL)

Set the same communication protocol as that of the host device to connect.

BAUD RATE (BPS)

Set the same baud rate as that of the host device to connect. Otherwise, proper communication cannot be achieved.

PARITY (PRI)

Set the handling of parity to be carried out when data is sent or received.

Set the same parity state as that of the host device to connect.

STOP BIT (STP)

Set the same stop bit as that of the host device to connect.

DATA LEN (DLN)

Set the same data length as that of the host device to connect.

(The data length is fixed when Ladder or MODBUS communication is selected in protocol selection.)

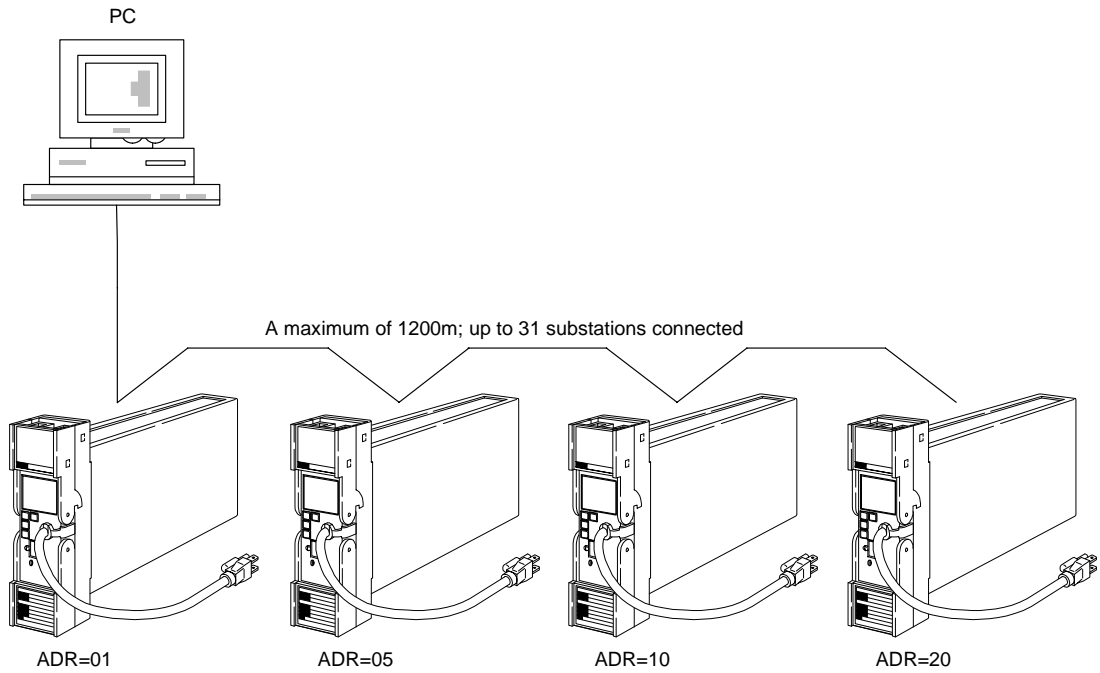
ADDRESS (ADR)

Set the address number of the YS80*R Rack-mounted Instrument.

An address number of 01 to 99 can be assigned in any order. Note that the maximum number of Instruments connectable to a single communication port is 31.

When connecting multiple Instruments to a single communication port, set the address numbers different from each other.

The following is the example of connecting four YS80*R Rack-mounted Instruments with address numbers 01, 05, 10 and 20 to a host device.



2. Communication Specifications

PC link, Ladder and MODBUS communication protocols are prepared for the RS-485 communication interface.

Table 2.1 Communication Specifications of the YS80*R Rack-mounted Instruments

Communication hardware	2-wire RS-485 communication system
Terminal	Connector on the front: 1, 2, 3
Communication protocol specifications	PC link communication without sum check PC link communication with sum check MODBUS communication (ASCII mode) MODBUS communication (RTU mode) Ladder communication
Maximum baud rate	9600 bps
Maximum communication distance	1200 m
Communication cable	Twist pair cable with shield (wire size: AWG24 or equivalent)

Table 2.2 Example of Communication Protocol and Device to Connect

Communication protocol	Device to connect
MODBUS communication	PC that MODBUS communication driver and SCADA software are installed in.
	PLC for MODBUS
PC link communication	PC that PC link communication driver and SCADA software are installed in.
	Graphic panel (GP series of Digital Electronics Corporation)
	PLC (FA-M3 with UT link module)
Ladder communication	PLC (FA-M3 with ladder communication module)
	PLC (Sequencer with ladder communication function)

2.1 RS-485 Communication Specifications

Table 2.3 RS-485 Communication Interface

Item	Specifications
Standard	Conforming EIA RS-485
Maximum number of devices connectable	31
Communication system	2-wire, half duplex
Synchronization	Start-stop synchronization
Communication protocol	Non-procedural
Maximum communication distance	1200 m
Baud rate	1200bps, 2400bps, 4800bps, 9600bps

3. PC Link Communication

3.1 Overview

PC link communication is used to communicate with a PC, touch panel or FA-M3 with UT link module easily. In this communication, you can use such devices to read/write data from/into D registers or read/write data from/into I relays, both of which are internal registers of the YS80*R Rack-mounted Instruments.

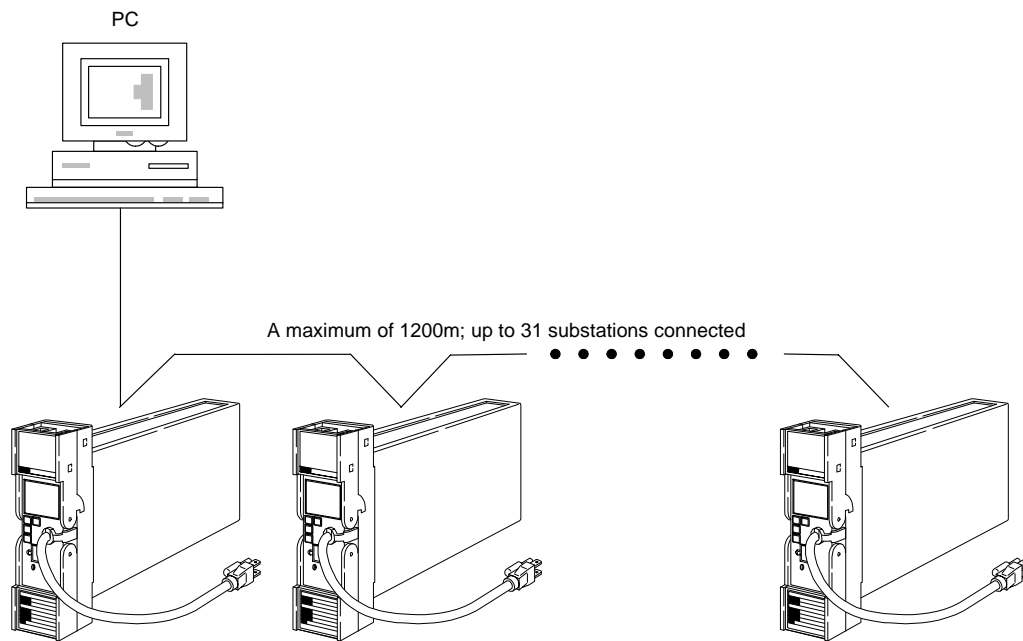


Figure 3.1 Connection for PC Link Communication

Hereinafter, “host devices” generically denotes PCs and the like.

See Also

See chapters 6 and 7 for information on D registers or I relays.

In PC link communication, address numbers 01 to 99 are used by a host device to identify the YS80*R Rack-mounted Instrument to communicate with.

3.1.1 Configuration of Command

Commands sent from a host device to the YS80*R Rack-mounted Instrument consist of the following elements.

Number of bytes	1	2	2	1	3	Number of bytes	2	1	1
Element	STX	Address number (ADR)	CPU number 01	Time to wait for response 0	Command	Data corresponding to command	Checksum	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 ASCII code is 02 (hexadecimal).

(2) Address Number (01 to 99)

Address numbers are used by a host device to identify the YS80*R Rack-mounted Instrument to communicate with. (Identification numbers specific to the YS80*R Rack-mounted Instrument)

(3) CPU Number

CPU number is fixed at 01. The ASCII code is 30, 31 (hexadecimal).

(4) Time to Wait for Response

Time to wait for response is fixed at 0. The ASCII code is 30 (hexadecimal).

(5) Command (See section 3.2, "List of Commands.")

Specify the command from a host device.

(6) Data Corresponding to Command

Specify an internal register (D register or I relay) or number of data items.

(7) Checksum

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 ASCII code is 03 (hexadecimal).

(9) CR (Carriage Return)

This control code indicates the end of a command. The ASCII code is 0D (hexadecimal).



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.

3.1.2 Configuration of Response

Response of the YS80*R Rack-mounted Instrument to a command sent from the host device consists of the following elements, which varies depending on whether the communication succeeded or failed.

(1) When communication succeeded:

If communication succeeded, a character string "OK" is returned with the read-out data.

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

(2) When communication failed:

If communication failed, the character string "ER" is returned with error codes (EC1 and EC2). (See subsection 3.1.3, "Response Error Codes.")

- No response is returned for an address number or CPU number error.
- If ETX in a command cannot be received, a response may not be returned.

Note: As a measure against these situations, provide a timeout processing in the communication functions or communication programs of the host device.

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

3.1.3 Response Error Codes

See Also

For the configuration of response on error occurrence, see subsection 3.1.2, "Configuration of Response."

The following tables show the error codes (EC1) and detailed error codes (EC2) of response.

Table 3.1 EC1 Error Codes

Error code	Meaning	Causes
02	Command error	The command does not exist. Command not executable
03	Register specification error	Specified register number does not exist. In handling bit registers (I relay) on a word-by-word basis, its specification is not correct.
04	Out of setting range	A character other than 0 or 1 was used for bit setting. A value other than hexadecimal values (0 to 9, A to F) was specified in the word specification.
05	Number of data error	Specified number of bits or words is too large. The number of data specified and the number of parameters for registers 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 3.2 EC2 Detailed Error Codes

Error code (EC1)	Meaning	Detailed error codes (EC2)
03	Register specification error	Indicates the parameter number (HEX) where an error occurred. This is the number of a parameter in sequence that first resulted in an error when counted from the leading parameter. Example Register specification error [STX]01010BRR02 I0001.D0001[ETX][CR] Parameter number 1 2 3 [STX]0101ER0303BRR[ETX][CR]
04	Out of setting range	
05	Number of data error	
08	Parameter error	An illegal parameter is set.

For EC1 error codes other than those noted above, EC2 has no meaning.

3.1.4 Broadcast Addressing

Broadcast addressing allows the corresponding multiple YS80*R Rack-mounted Instruments to receive the command.

- (1) In the command, specify “BY” in the address number and execute it.
- (2) Broadcast addressing works independently of the communication address.
- (3) Broadcast addressing is only applicable to write commands.
- (4) No response is returned from the YS80*R Rack-mounted Instruments if this broadcast addressing is specified.

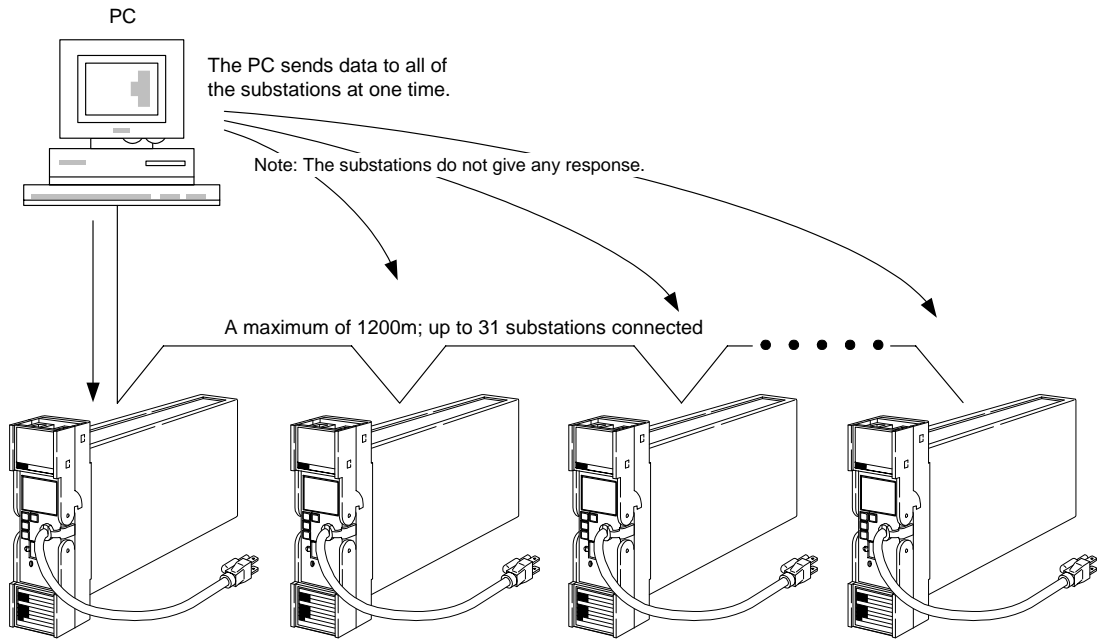


Figure 3.2 Connection for Broadcast

D registers and I relays are used for the communication of YS80*R Rack-mounted Instruments.

3.2 List of Commands

The following lists show the commands usable for PC link communication. The details of them are explained in the description of each command.

(1) Bit-basis Access Commands Dedicated to I Relays

Command	Description	Number of bits handled
BRD	Bit-basis read	1 to 64 bits
BWR	Bit-basis write	1 to 16 bits
BRR	Bit-basis random read	1 to 16 bits
BRW	Bit-basis random write	1 to 16 bits
BRS	Specifies relays to be monitored on a bit-by-bit basis	1 to 16 bits
BRM	Bit-basis monitoring	---

(2) Word-basis Access Commands

Command	Description	Number of Words handled
WRD	Word-basis read	1 to 32 words
WWR	Word-basis write	1 to 32 words
WRR	Word-basis random read	1 to 16 words
WRW	Word-basis random write	1 to 16 words
WRS	Specifies registers/relays to be monitored on a word-by-word basis	1 to 16 words
WRM	Word-basis monitoring	---

(3) Information Command

Command	Description	Number of units handled
INF	Reads model, suffix codes and revision	1

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

● Function

Reads a sequence of contiguous ON/OFF statuses 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 64.
- For the format of response in the event of failure, see subsection 3.1.2.
- 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 number (ADR)	CPU number 01	0	BRD	I relay number	Comma or space	Number of bits (n)	Checksum	ETX	CR

Number of bytes	1	2	2	2	1	1	1	...	1	2	1	1
Response element	STX	Address number (ADR)	CPU number 01	OK	d1	d2	d3	...	dn	Checksum	ETX	CR

Responses "0" and "1" indicate OFF and ON respectively.

$$\left(\begin{array}{l} \text{dn: Read data of the specified number of bits (n=1 to 64)} \\ \text{dn=0 (OFF)} \\ \text{dn=1 (ON)} \end{array} \right)$$

● Example:

Reading the alarm 1 status of the SDAU with address number 01.

The following command reads the alarm 1 status (I0017) of address number 01.


[Command]

[STX]01010BRDI0017,00198[ETX][CR]

The following response is returned to the above command. (Alarm 1 is set to ON.)

[Response]

[STX]0101OK18D[ETX][CR]


 Alarm has been set to ON since 1 was returned.

■ 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 the specified I relay number.

- 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 3.1.2.
- 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 number (ADR)	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	Checksum	ETX	CR

Write data "0" and "1" indicate OFF and ON respectively.

{ dn: Write data of the specified number of bits (n=1 to 16)
 dn=0 (OFF)
 dn=1 (ON)

Number of bytes	1	2	2	2	2	1	1
Response element	STX	Address number (ADR)	CPU number 01	OK	Checksum	ETX	CR

● Example:

Setting the user-defined flag of the SDAU with address number 01 to "ON".

The following command writes "ON" into the user-defined flag (I0033) of address number 01.

[Command]

[STX]01010BWR I0033,001,106[ETX][CR]

Note: The user-defined flag is a flag the user can read/write without restraint.

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

[Response]

[STX]0101OK5C [ETX][CR]

■ 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 3.1.2.
- 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	2	5	1	5	1
Command element	STX	Address number (ADR)	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	Checksum	ETX	CR

Number of bytes	1	2	2	2	1	1	...	1	2	1	1
Response element	STX	Address number (ADR)	CPU number 01	OK	d1	d2	...	dn	Checksum	ETX	CR

Responses "0" and "1" indicate OFF and ON respectively.

$$\left(\begin{array}{l} \text{dn: Read data of the specified number of bits (n=1 to 16)} \\ \text{dn=0 (OFF)} \\ \text{dn=1 (ON)} \end{array} \right)$$

● Example:

Reading the statuses of alarms 1 and 2 of the SDAU with address number 01.

The following command reads the statuses of alarm 1 (I0017) and alarm 2 (I0018) of address number 01.

[Command]

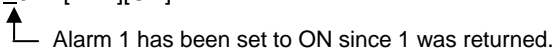
[STX]01010BRR02I0017,I001889[ETX][CR]

The following response is returned to the above command.

Alarm 1: ON; Alarm 2: OFF

[Response]

[STX]0101OK10BD[ETX][CR]



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

● Function

Writes ON/OFF data 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 3.1.2.
- 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	2	5	1	1	1
Command element	STX	Address number (ADR)	CPU number 01	0	BRW	Number of bits (n)	I relay number 1	Comma or space	d1	Comma or space

Command (continued)

5	1	1	1	...	5	1	1	2	1	1
I relay number 2	Comma or space	d2	Comma or space	...	I relay number n	Comma or space	dn	Checksum	ETX	CR

For writing information, responses "0" and "1" indicate OFF and ON respectively.

{

 dn: Register data of the specified number of bits (n=1 to 16)

 dn=0 (OFF)

 dn=1 (ON)
 }

Number of bytes	1	2	2	2	2	1	1
Response element	STX	Address number (ADR)	CPU number 01	OK	Checksum	ETX	CR

● Example:

The following command writes ON, OFF, OFF and ON into the four user-defined flags (I0033, I0034, I0035 and I0036) of the SDAU with address number 05.

[Command]

[STX]05010BRW04I0033,1,I0034,0,I0035,0,I0036,17D[ETX][CR]

Note: The user-defined flag is a flag the user can read/write without restraint.

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

[Response]

[STX]0501OK60[ETX][CR]

■ 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 I relay numbers are specified with this command.

When the volume of data is large and you wish to increase the baud rate, it is effective to use a combination of the BRS and BRM commands rather than the BRR command. If the power supply is turned off, the specified register 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 3.1.2.
- 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	2	5	1	5	1
Command element	STX	Address number (ADR)	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	Checksum	ETX	CR

Number of bytes	1	2	2	2	2	1	1
Response element	STX	Address number (ADR)	CPU number 01	OK	Checksum	ETX	CR

● Example:

Monitoring alarms 1 and 2 of the SDAU with address number 01.

(This command is used for simply specifying registers.)

[Command]

[STX]01010BRS02I0017,I00188A [ETX][CR]

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

[Response]

[STX]0101OK5C[ETX][CR]

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

● Function

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

- Before executing this command, the BRS command must always be executed to specify which I relay is to be monitored. If no relay has been specified, error code 06 is returned.
- For the format of response in the event of failure, see subsection 3.1.2.
- 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	2	1	1
Command element	STX	Address number (ADR)	CPU number 01	0	BRM	Checksum	ETX	CR

Number of bytes	1	2	2	2	1	1	1	...	1	2	1	1
Response element	STX	Address number (ADR)	CPU number 01	OK	d1	d2	d3	...	dn	Checksum	ETX	CR

Responses "0" and "1" indicate OFF and ON respectively.

{

 dn: Register data of the specified number of bits in BRS command (n=1 to 16)

 dn=0 (OFF)

 dn=1 (ON)
 }

● Example:

Monitoring alarms 1 and 2 of the SDAU with address number 01.

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

[Command]

[STX]01010BRMD3[ETX][CR]

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

[Response]

[STX]0101OK00BC[ETX][CR]

↑

 All OFF status

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

● Function

Reads 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 32.
- For the format of response in the event of failure, see subsection 3.1.2.
- The command shown below includes the checksum function. When performing communication without checksum, do not include the 2-byte checksum command 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 number (ADR)	CPU number 01	0	WRD	Register number	Comma or space	Number of words (n)	Checksum	ETX	CR

Number of bytes	1	2	2	2	4	4	...	4	2	1	1
Response element	STX	Address number (ADR)	CPU number 01	OK	dddd1	dddd2	...	ddddn	Checksum	ETX	CR

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

} Read data of the specified number of words
 ddddn=Character string in a hexadecimal pattern
 n=1 to 32

● Example:

Reading high-limit alarm setpoint 1H (1H) of the SDAU with address number 01.
Register number: D0104

[Command]

[STX]01010WRDD0104,0175[ETX][CR]

The high-limit alarm setpoint 1H 500 (01F4 (HEX)) is returned as the response to the above command.

(50.0=500 Decimal point position depends on DPn parameter.)

[Response]

[STX]0101OK01F437[ETX][CR]

↑ 500 in decimal notation (high-limit alarm setpoint 1H=50.0)

■ 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 32.
- For the format of response in the event of failure, see subsection 3.1.2.
- 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	2	1	4
Command element	STX	Address number (ADR)	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	Checksum	ETX	CR

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

(dddd_n: Write data of the specified number of words
 dddd_n=Character string in a hexadecimal pattern
 n=1 to 32)

Number of bytes	1	2	2	2	2	1	1
Response element	STX	Address number (ADR)	CPU number 01	OK	Checksum	ETX	CR

● Example:

Writing 200 (00C8 (HEX)) into the high-limit alarm setpoint 1H (1H) of the SDAU with address number 03.

Register number: D0104

[Command]

[STX]03010WWRD0104,01,00C891[ETX][CR]

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

[Response]

[STX]0301OK5E[ETX][CR]

■ 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 16.
- For the format of response in the event of failure, see subsection 3.1.2.
- 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	2	5	1	5	1
Command element	STX	Address number (ADR)	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	Checksum	ETX	CR

Number of bytes	1	2	2	2	4	4	...	4	2	1	1
Response element	STX	Address number (ADR)	CPU number 01	OK	dddd1	dddd2	...	ddddn	Checksum	ETX	CR

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

(Read data of the specified number of words
 ddddn=Character string in a hexadecimal pattern
 n=1 to 16)

● Example:

Reading the high-limit alarm setpoint 1H (1H) and low-limit alarm setpoint 1L (1L) of the SDAU with address number 01.

Register numbers: 1H=D0104, 1L=D0105

[Command]

[STX]01010WRR02D0104,D01058E[ETX][CR]

The high-limit alarm setpoint 1H 500 (01F4 (HEX)) and low-limit alarm setpoint 1L 500 (01F4 (HEX)) are returned as the response to the above command.

(50.0=500)

[Response]

[STX]0101OK01F401F412[ETX][CR]

↑
 01F4=500 in decimal notation, both alarm setpoints 1H and 1L=50.0

■ WRW Writes data into D registers and I relays on a word-by-word basis in random order by the specified number of words.

● 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 16.
- For the format of response in the event of failure, see subsection 3.1.2.
- 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	2	5	1	4	1
Command element	STX	Address number (ADR)	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	Checksum	ETX	CR

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

{
 dddn: Repetition of register numbers and write information by a specified number of words
 ddddn=Character string in a hexadecimal pattern
 n=1 to 16

Number of bytes	1	2	2	2	2	1	1
Response element	STX	Address number (ADR)	CPU number 01	OK	Checksum	ETX	CR

● Example:

Writing 20.0 (200=00C8 (HEX)) and 15.0 (150=0096 (HEX)) into the high-limit alarm setpoint 1H (1H) and low-limit alarm setpoint 1L (1L) of the SDAU with address number 10 in this order.

Register numbers: 1H=D0104, 1L=D0105

[Command]

[STX]10010WRW02D0104,00C8,D0105,009695[ETX][CR]

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

[Response]

[STX]1001OK5C[ETX][CR]

■ 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 baud rate, it is effective to use a combination of the WRS and WRM commands rather than the 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 16.
- For the format of response in the event of failure, see subsection 3.1.2.
- 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	2	5	1	5	1
Command element	STX	Address number (ADR)	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	Checksum	ETX	CR

Number of bytes	1	2	2	2	2	1	1
Response element	STX	Address number (ADR)	CPU number 01	OK	Checksum	ETX	CR

● Example:

Monitoring high-limit alarm setpoint 1H (1H) and low-limit alarm setpoint 1L (L) of the SDAU with address number 01. (This command is used for simply specifying registers.)

Register numbers: 1H=D0104, 1L=D0105

[Command]

[STX]01010WRS02D0104,D01058F[ETX][CR]

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

[Response]

[STX]0101OK5C[ETX][CR]

■ WRM Monitors the D registers and I relays on a word-by-word basis.

● Function

Reads register information that has been specified in advance by the WRS command.

- Before executing this command, the WRS command must always be executed to specify which registers are to be monitored. If no register has been specified, error code 06 is returned.
- For the format of response in the event of failure, see subsection 3.1.2.
- 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	2	1	1
Command element	STX	Address number (ADR)	CPU number 01	0	WRM	Checksum	ETX	CR

Number of bytes	1	2	2	2	4	4	...	4	2	1	1
Response element	STX	Address number (ADR)	CPU number 01	OK	dddd1	dddd2	...	ddddn	Checksum	ETX	CR

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

(Read data of the specified number of words in WRS command
 ddddn=character string in a hexadecimal pattern
 n=1 to 16)

● Example:

Monitoring high-limit alarm setpoint 1H (1H) and low-limit alarm setpoint 1L (1L) of the SDAU with address number 01.

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

[Command]

[STX]01010WRME8[ETX][CR]

High-limit alarm setpoint 1H 500 (01F4 (HEX)) and low-limit alarm setpoint 1L (1L) 500 (01F4 (HEX)) is returned as the response to the above command. (50.0=500)

[Response]

[STX]0101OK01F401F412[ETX][CR]

■ INF Reads the model, suffix codes and revisions.

● Function

The model, suffix codes and revisions of the YS80*R Rack-mounted Instrument are returned.

- For the format of response in the event of failure, see subsection 3.1.2.

● Command/Response (for normal operation)

Number of bytes	1	2	2	1	3	1	2	1	1
Command element	STX	Address number (ADR)	CPU number 01	Response time (0)	INF	6	Checksum	ETX	CR

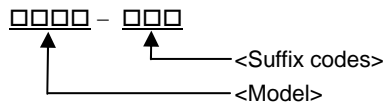
Number of bytes	1	2	2	2	8	8	4	4
Response element	STX	Address number (ADR)	CPU number 01	OK	□□□□□□□□ (Note 1)	Version and revision numbers (Note 2)	Readout start-register for special device *	Number of readout registers for special device *

Command (continued)

4	4	2	1	1
Write start-register for special device *	Number of write registers for special device *	Checksum	ETX	CR

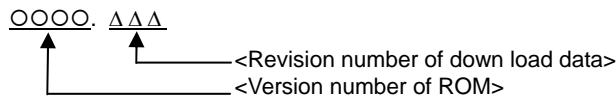
* For FA-M3 with UT link module

Note 1: Model and suffix codes



Example: SDAU-270

Note 2: Version number and revision number



Example: _ _ _ 2.002 (_ indicates a space)

3.3 Communication with Host Device

Host devices to be connected to the YS80*R Rack-mounted Instruments are those capable of handling the PC link communication protocol.

As an example of communication program, subsection 3.3.1 shows an example of BASIC program created using Microsoft Visual BASIC. Also the communication with FA-M3 with UT-link module or touch panel is possible without complicated program. Subsections 3.3.2 and 3.3.3 show the examples.

3.3.1 Example of Visual BASIC Communication Program

This subsection shows an example of a command sending and response receiving program created with Microsoft Visual BASIC 6.0.

Environment where the action was confirmed:

PC/AT (or compatible machines) + Windows NT4.0 (Service Pack 4), Windows 95, Windows2000 (Service Pack 4), Windows98SE

Communicating converter: Model ML1

PC/AT is a product of IBM Corporation.

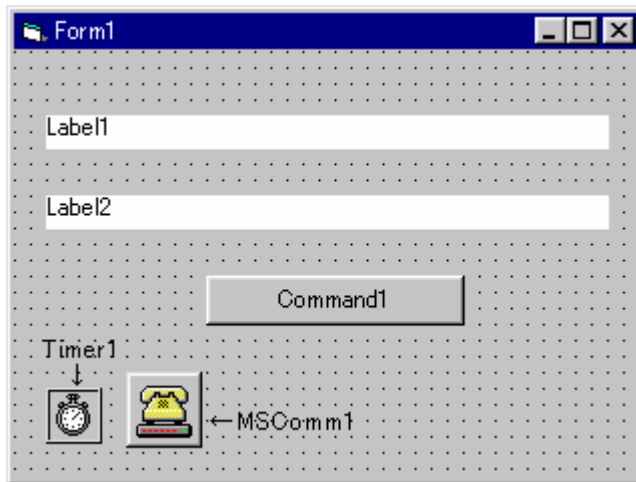
ML1 is a product of Yokogawa.

Microsoft Visual BASIC is a registered trademark of Microsoft Corporation.

See Also

Refer to MSDN or documents on the market for programming of Visual BASIC.

In this example, read the description of D register D0002 via PC-link protocol. Pressing the command button displays the sent command and received response on the form. If the response is not returned, provide a timeout.



```

'=====
' Program name: Sample
'
' RS-485 communication program for SDAU
'
'===== YOKOGAWA Electric Corporation ===
'
'Public                                'Define variable value
Public fSend As Boolean                 'Sending flag
Public strSend As String                 'Sent character string
Public strBuf1 As String                 'Received character (1 byte)
Public strReceive As String              'Received character string
-----

'If command button is pressed
Private Sub Command1_Click()

    strSend = "01010WRDD0002,01" 'Sent character string [stx]01010WRDD0002,01[etx][cr]

```

```

Label1.Caption = "[stx]" & strSend & "[etx][cr]"
Label2.Caption = ""
MSComm1.PortOpen = True           'Open a port
Timer1.Enabled = True             'Start timer for timeout detection
Command1.Enabled = False         'Set command button disabled temporarily
fSend = True                      'Set sending flag

'Send
MSComm1.Output = Chr(&H2) & strSend & Chr(&H3) & Chr(&HD) 'Send with stx, etx, cr added

Do                                'Loop until sending flag is set to False
If DoEvents() = 0 Then           '
End If '
Loop Until fSend = False         '

Timer1.Enabled = False          'Stop timer 1
MSComm1.PortOpen = False        'Close the port

Label2.Caption = strReceive      'Display received character string on Label 2.
Command1.Enabled = True         'Enable command button

End Sub

```

'When starting program

```
Private Sub Form_Load()
```

```

Form1.Caption = "Communication Sample"

'Set timer for timeout detection
Timer1.Enabled = False
Timer1.Interval = 2000
    '2 sec
'Initial setting for control
MSComm1.CommPort = 1           'COM1
MSComm1.InputLen = 1           'Size of received buffer
MSComm1.InputMode = comInputModeText 'Receiving mode
MSComm1.RThreshold = 1         'Start interruption processing MSComm1_OnComm every time receiving 1 byte
MSComm1.Settings = "9600,e,8,1" 'Communication conditions 9600bps, parity even, data length 8bit, stop bit 8bit

'Command button control
Command1.Caption = "Send"

'Initialize label control which displays sent/received character string
Label1.Caption = ""
Label2.Caption = ""

```

```
End Sub
```

'Start this processing every time receiving 1 byte

```
Private Sub MSComm1_OnComm()
```

```

Dim strBuf0 As String

Select Case MSComm1.CommEvent
Case comEvReceive
    strBuf0 = MSComm1.Input '
    Select Case strBuf0     'Select case by received 1 byte
    Case Chr(2)             'If stx
        strBuf1 = "[stx]"
    Case Chr(3)             'If etx
        strBuf1 = strBuf1 & "[etx]"
    Case Chr(13)           'If cr

```

```
strBuf1 = strBuf1 & "[cr]"
'Because sent command may be taken as response by the combination with communication converter,
'it is countermeasure.
If strBuf1 = Label1.Caption Then
    strBuf1 = ""
Else
    strReceive = strBuf1 'Finish received character string
    fSend = False 'Receive end
End If
Case Else 'If not stx, etx, cr
    strBuf1 = strBuf1 & strBuf0
End Select
Case Else
End Select

End Sub
```

```
'Timeout
Private Sub Timer1_Timer()

    strReceive = "Time Out!"
    fSend = False 'Receive end

End Sub
```

3.3.2 Communication with UT-link Module

For communicating with FA-M3, connect the UT-link module via PC link protocol. The communication specifications of both YS80*R Rack-mounted Instrument and UT-link module must be the same.

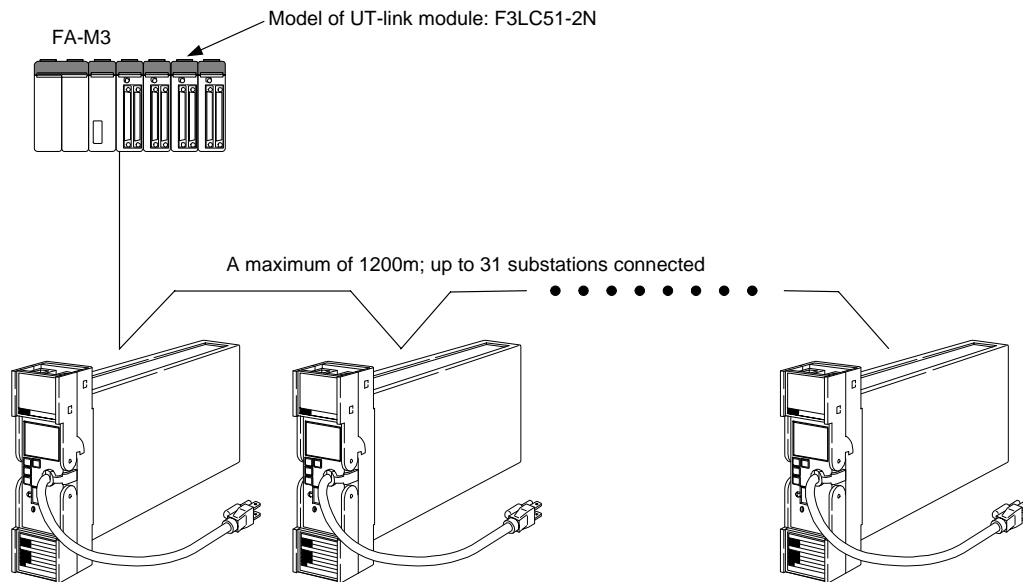


Figure 3.3 Communication with UT-link Module

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 instruction manual of UT-link module "IM 34M6H25-01E."

1. Non-user-specifiable mode
Always reads/writes the predetermined devices of the instrument (users cannot specify devices).
Predetermined devices are D0001 to D0013 (for read only).

2. User-specifiable mode (Always access)
Always read the user-defined devices of the instrument (user can specify devices).

See Also

"Device" here denotes D registers and I relays.

For the details of D registers and I relays, refer to chapters 6 and 7.

3. Command mode
Accesses the devices only when necessary.

3.3.3 Communication with Touch Panels

For communicating with the touch panel, PC link protocol is used.

The communication specifications of both YS80*R Rack-mounted Instrument and the touch panel must be the same.

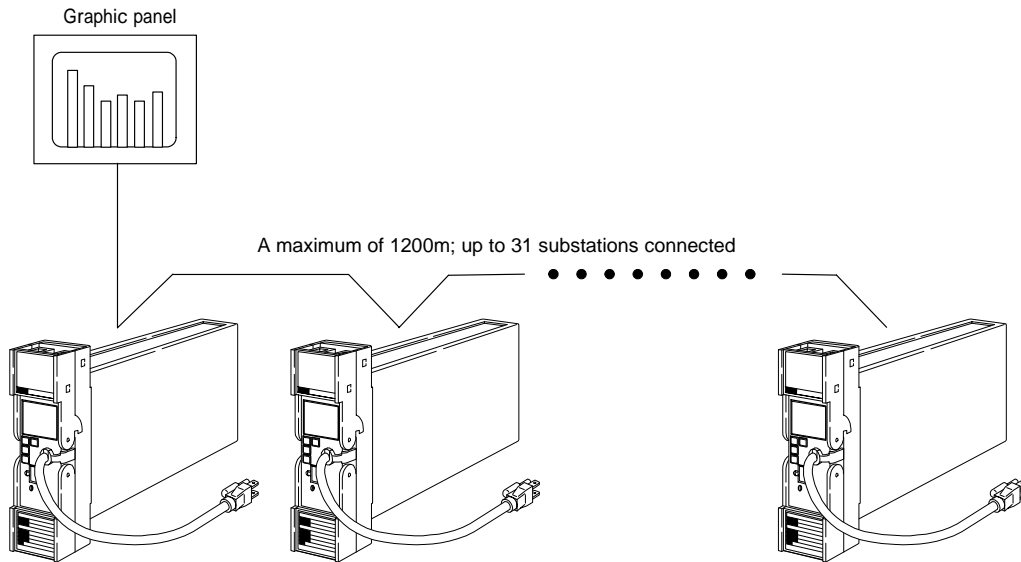


Figure 3.4 Communication with Touch Panel

For more information, refer to the instruction manual of the touch panel to connect.

	Model	Name	Remarks
Pro-face by Digital Electronic Corporation	GP70 series	Graphic control panel	(Note 1)
	GP-J series	High-speed graphic control panel	
	GP-230 series	Medium-size graphic control panel	
	GP-430 series	Advanced, high-speed graphic control panels	
	GP-530 series		

Note 1: The display device differs depending on the model.

Note 2: For more information about Digital's graphic panels, contact Digital Electronics Corporation.

Note 3: Assign "system data area" to D0401.

4. Ladder Communication

4.1 Overview

By using ladder program, you can easily perform communication with a PLC (sequencer).

By specifying the register numbers of the D registers of the YS80*R Rack-mounted instrument as parameters in the ladder program, you can read/write data from/into D registers using BCD codes (0 to 9).

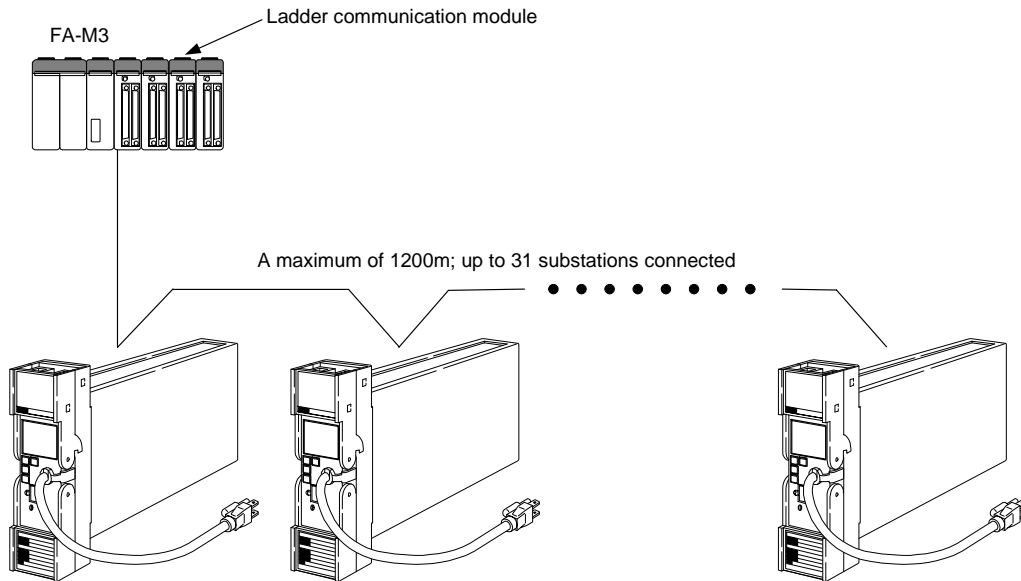


Figure 4.1 Connection for Ladder Communication

- Connecting a PLC of Other Manufacturer
When the YS80*R Rack-mounted Instrument is connected to a PLC manufactured by Mitsubishi (MELSEC-A series), you can use the non-procedural mode of the computer link unit.

4.2 Commands/Responses at the PLC

The PLC sends commands, and receives responses to these commands. The commands/responses that can be used are as follows.

4.2.1 Configuration of Command/Response

Commands sent from the PLC to the YS80*R Rack-mounted Instrument consist of the following elements.

Number of bytes	1	1	2	1		1		2	1	1
Number of BCD digits	2	2	4	1	1	1	1	4	2	2
Command/response element	Address number (ADR)	CPU number 01	Parameter number	0	5th digit	R/W	+ / -	Data	CR (0D)	LF (0A)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	

Can be changed during a read operation.
 A maximum of 32 data items

- (1) Address number (01 to 99)
 Number used to enable the PLC to identify the YS80*R Rack-mounted Instrument with which it communicates (YS80*R Rack-mounted Instrument identification number).
- (2) CPU number
 Fixed at 01.
- (3) Parameter number
 Four-digit BCD data excluding "D" of D register number
 I relay cannot be specified.

See Also

For details on D registers, see chapter 6.

- (4) 0
 This position is fixed at 0.
- (5) 5th digit
 Topmost digit when 5-digit data is displayed.
- (6) R/W
 0: Read
 1: Write
- (7) +/-
 0: Positive data (+)
 1: Negative data (-)
- (8) Data
 Number of data items that are read during a read operation
 Set data during a write operation
- (9) CR, LF
 Control code which indicates the termination of a command. The corresponding control character strings in ASCII code: CR = 0D (HEX), and LF = 0A (HEX)).

4.2.2 Reading Parameters

Parameters from the PLC are read to the YS80*R Rack-mounted Instruments in the following configuration.

Maximum number of read data is 32.

● Command/Response

Number of bytes	1	1	2	1		1		2	1	1
Number of BCD digits	2	2	4	1	1	1	1	4	2	2
Command element	Address number (ADR)	CPU number 01	Parameter number	0	0	0	0	Number of data items that are read (n)	CR (0D)	LF (0A)

Number of bytes	1	1	2	1		1		2	1		1		2
Number of BCD digits	2	2	4	1	1	1	1	4	1	1	1	1	4
Response element	Address number (ADR)	CPU number 01	Parameter number	0	5th digit	0	+ / -	dddd1	0	5th digit	0	+ / -	dddd2

Data of parameter number (a)
Data of parameter number (b)

...	1		1		2		1		1	
...	1	1	1	1	4		2		2	
...	0	5th digit	0	+ / -	ddddn		CR (0D)		LF (0A)	

Data of parameter number (n)

● Example:

Reading PV1 (D register: 0002) of the SDAU with address number 01.

[Command]

01010002000000010D0A

The measured input value 500 (BCD code) is returned as the response to the above command. (50.0°C=500)

[Response]

01010002000005000D0A

4.2.3 Writing Parameters

Parameters from the PLC are written to the YS80*R Rack-mounted Instrument in the following configuration.

● Command/Response

Number of bytes	1	1	2	1		1		2	1	1
Number of BCD digits	2	2	4	1	1	1	1	4	2	2
Command element	Address number (ADR)	CPU number 01	Parameter number	0	5th digit	1	+ / -	dddd	CR	LF

Number of bytes	1	1	2	1		1		2	1	1
Number of BCD digits	2	2	4	1	1	1	1	4	2	2
Response element	Address number (ADR)	CPU number 01	Parameter number	0	5th digit	1	+ / -	dddd	CR	LF

● Example:

Writing 200 into the high-limit alarm setpoint 1H (1H) of the SDAU with address number 01.

Register number: 1H=D0104

[Command]

01010104001002000D0A

The high-limit alarm setpoint 1H (BCD code) is returned as the response to the above command.

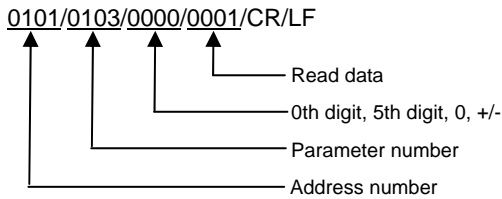
(20.0°C=200)

[Response]

01010104001002000D0A

4.2.4 Response Error Codes

Data that the master station (PLC) may receive on an error occurrence and the descriptions of the corresponding error are shown in the table below.



Note: The "/" in the following send and receive data examples are used for explanatory purposes only, and are not part of the actual data string.

Table4.1 Error Code List

Description of error	Example of data sent from PLC	Example of data PLC receives
A non-existent parameter was set.	0101/0451/0000/0001/CR/LF	0101/0451/0000/FFFF/CR/LF FFFF is returned.
Characters other than a BCD code (0 to 9) were used other than in an address. * This excludes LF (0A).	0101/0420/0000/000B/CR/LF 0101/0420/000 <u>B</u> /0000/CR/LF 0101/0420/0 <u>B</u> 00/0000/CR/LF 0101/042 <u>B</u> /0000/0000/CR/LF	0101/FFFF/FFFF/FFFF/CR/LF
An LF code (0A) was used other than in an address.	0101/0420/0000/000A/CR/LF 0101/0420/000 <u>A</u> /0000/CR/LF 0101/0420/0 <u>A</u> 00/0000/CR/LF 0101/040 <u>A</u> /0000/0000/CR/LF	No response
An address is different from that of the YS80*R Rack-mounted Instrument. * In the example at right, none of the addresses exist	010 <u>3</u> /0420/0000/0000/CR/LF 0001/0420/0000/0000/CR/LF <u>33</u> 01/0420/0000/0000/CR/LF	No response
The command length (length of the send data) is incorrect. * The command length, including CR and LF, must be 10 bytes.	0101/0420/0000/00/CR/LF 0101/0420/0/CR/LF 0101/0/CR/LF	No response
A timeout occurred during communication. * Timeout is 2 seconds.	0101/012	No response
The buffer overflowed. * This error occurs when the buffer overflow exceeds 199 bytes.		No response
A framing error or a parity error is occurred.		No response



NOTE

If a parameter that is not in the D register table is read, an error does not occur. In this case, 0 will be returned instead.

5. MODBUS Communication

5.1 Overview

Use of the MODBUS communication enables the YS80*R Rack-mounted Instrument to communicate with PCs. In this communication, you use such device to read/write data from/into D registers, (internal registers) of the YS80*R Rack-mounted Instrument.

Hereinafter, "host devices" generically denotes PCs.

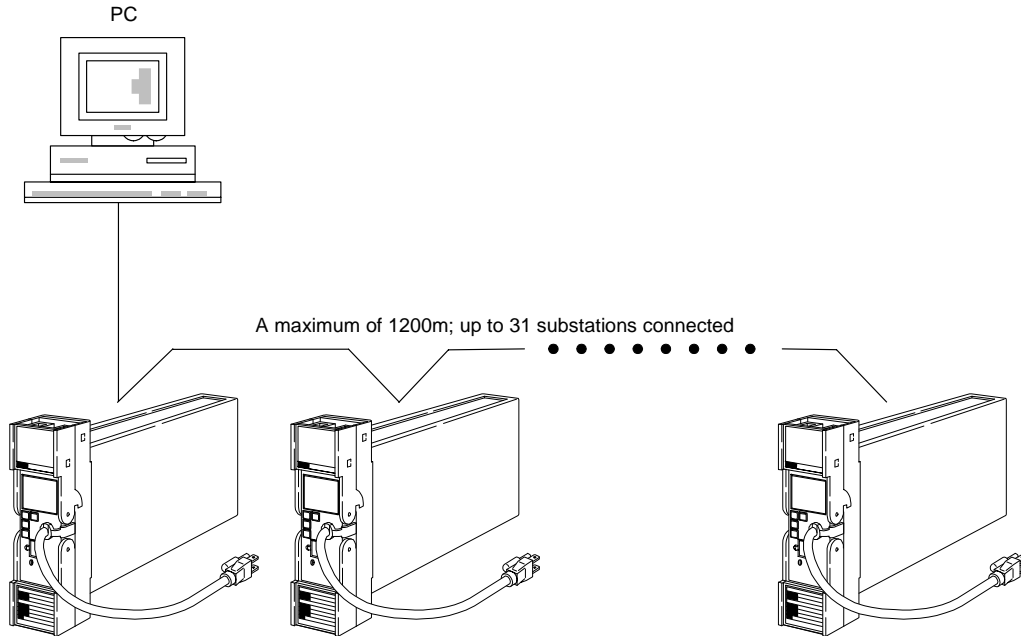


Figure 5.1 Connection for MODBUS Communication

See Also

For details on D registers, see chapter 6.

For the MODBUS communication of the YS80*R Rack-mounted Instrument, we provide the ASCII mode (ASCII system) and RTU mode (binary system) for retransmission mode.

Table 5.1 ASCII and RTU Modes

Item	ASCII mode	RTU mode
Number of data bits	7 bits (ASCII)	8 bits (binary)
Message start mark	: (colon)	Not necessary
Message end mark	CR+LF	Not necessary
Length of message (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	Cycle redundancy check: CRC-16

Note 1: When the message length in the RTU mode is assumed to be "N."

Note 2: When the baud rate is 9600 bps, 1 ÷ 9600 x 24 sec or less.

In the MODBUS communication, a host device identifies each YS80*R Rack-mounted Instrument with a communication address of 01 to 99.

5.1.1 Configuration of Message

Messages sent from a host device to the YS80*R Rack-mounted Instrument consist of the following elements.

Element	Start of message mark	Address number	Function code	Data	Error check	End of message mark
Number of bytes in RTU mode	None	1	1	2n	2	None
Number of bytes in ASCII mode	1	2	2	4n	2	2

(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 the colon.

(2) Address number (01 to 99)

Address numbers are used by host devices to identify the YS80*R Rack-mounted Instrument to communicate with. (Identification numbers specific to individual YS80*R Rack-mounted Instrument: Hexadecimal pattern in a message)

(3) Function Code (See subsection 5.2.1, "List of Function Codes.")

The function code specifies a command (function code) from the host 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. (Hexadecimal in a message)

(5) Error Check

In RTU mode: Carried out by the cyclic redundancy check (CRC-16) system.
In ASCII mode: Carried out by the longitudinal redundancy check (LRC) system.

(6) End of Message Mark

This mark indicates the end of a message.
Note that only ASCII mode requires CR + LF.

5.1.2 Specifying D Registers

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

- (1) When using a commercially available SCADA or the like, specify reference number. To change D register number into a reference number, replace the D register number's leading character "D" with "4."
- (2) When using a user-created communication program, specify the hexadecimal number of value obtained by subtracting "40001" from the D register reference number.

Example: Specifying a setpoint (high-limit alarm setpoint 1H (D0104))

1. For a message using commercially available SCADA or the like, specify reference number "40104."
2. For a message in a user-created communication program, specify "0067", the hexadecimal pattern of 103, which is obtained by subtracting 40001 from the reference number.

5.2 Function Codes

5.2.1 List of Function Codes

Function codes are command words used by the host device to obtain the D register information of the YS80*R Rack-mounted Instrument.

Table 5.2 List of Function Codes

Code number	Function	Description
03	Reads data from multiple D registers.	Capable of reading data from a maximum of 32 successive D registers.
06	Writes data into D register.	Capable of writing data to one D register.
08	Performs loop back test.	Used for checking communication connection.
16	Writes data into multiple D registers.	Capable of writing data into a maximum of 16 successive D registers.

- The write function codes will not write into read-only or disabled D registers.
- Broadcast addressing is possible with function codes “06” and “16” only. (Also in this case, read-only or disabled D registers will not be written.)

03 Reads data from multiple D registers.

● Function

This function code reads the contents of successive D registers by the specified number of D registers starting at a specified D register number.

- The maximum number of D registers to be read at a time is 32.
- For the format of responses in the event of failure, see subsection 5.2.2.

● Message (for normal operation)

Element	Start of message mark (:)	Address number (ADR)	Function code (03)	D-register start number	Number of D registers
Number of bytes in RTU mode	None	1	1	2	2
Number of bytes in ASCII mode	1	2	2	4	4

Message (continued)

Error check	End of message mark (CR+LF)
2	None
2	2

● Response (for normal operation)

Element	Start of message mark (:)	Address number (ADR)	Function code (03)	Byte count	Contents of D register	...
Number of bytes in RTU mode	None	1	1	1	2	...
Number of bytes in ASCII mode	1	2	2	2	4	...

Response (continued)

Contents of D-registers	Error check	End of message mark (CR+LF)
2	2	None
4	2	2

● Example:

Reading the statuses of high-limit alarm setpoint 1H and low-limit alarm setpoint 1L of the SDAU with address number 01.

The following message reads two successive D registers starting at high-limit alarm setpoint 1H (D0104) in the ASCII mode.

[Message]

:01030067000293[CR][LF]

“01”: address number 01, “03”: function code 03, “0067”: D register address 0104, “0002”: number of D registers 2, and “93”: error check

*Numbers in quotation marks are hexadecimal.

[Response]

:01030400010000F7[CR][LF]

High-limit Alarm setpoint 1H is “1”, and low-limit alarm setpoint 1L is “0.”

06 Writes data into D register.

● Function

This function code writes data into a specified D register number.

- The maximum number of D registers into which data is written at a time is 1.
- For the format of response in the event of failure, see subsection 5.2.2.
- Broadcast addressing is possible by setting “00” to the address number.

● Message (for normal operation)

Element	Start of message mark (:)	Address number (ADR)	Function code (06)	D register number (upper digit)	D register number (lower digit)
Number of bytes in RTU mode	None	1	1	1	1
Number of bytes in ASCII mode	1	2	2	2	2

Message (continued)

Write data (upper digit)	Write data (lower digit)	Error check	End of message mark (CR+LF)
1	1	2	None
2	2	2	2

● Response (for normal operation)

Element	Start of message mark (:)	Address number (ADR)	Function code (06)	D register number (upper digit)	D register number (lower digit)
Number of bytes in RTU mode	None	1	1	1	1
Number of bytes in ASCII mode	1	2	2	2	2

Message (continued)

Write data (upper digit)	Write data (lower digit)	Error check	End of message mark (CR+LF)
1	1	2	None
2	2	2	2

● Example:

Setting 70.00 to the high-limit alarm setpoint 1H of the SDAU with address number 01.

The following message writes “7000” in the ASCII mode to the high-limit alarm setpoint 1H (D0104) of address number 01.

[Message]

:010600671B581F[CR][LF]

“01”: address number 01, “06”: function code 06, “0067”: D register address 0104, “1B58”: data 7000, and “1F”: error check

* Numbers in quotation marks are hexadecimal.

The following response is returned with respect to the above message.

[Response]

:010600671B581F[CR][LF]

08 Performs a loop back test.

● Function

This function code is used to check the connection for communication.

- For the format of response in the event of failure, see subsection 5.2.2.
- The “00” shown below (marked with an asterisk*) is fixed.
- Any value can be selected for send data.

● Message (for normal operation)

Element	Start of message mark (:)	Address number (ADR)	Function code (08)	00* 0000	Send data (any value)
Number of bytes in RTU mode	None	1	1	2	2
Number of bytes in ASCII mode	1	2	2	4	4

Message (continued)

Error check	End of message mark (CR+LF)
2	None
2	2

● Response (for normal operation)

Element	Start of message mark (:)	Address number (ADR)	Function code (08)	00 0000	Same as sent data
Number of bytes in RTU mode	None	1	1	2	2
Number of bytes in ASCII mode	1	2	2	4	4

Response (continued)

Error check	End of message mark (CR+LF)
2	None
2	2

● Example:

Sending data 1234h to the SDAU with address number 01 to check the connection for communication.

The following message sends “1234” (hexadecimal) in the ASCII mode to the SDAU with address number 01.

[Message]

:010800001234B1[CR][LF]

When the connection is normal, the following response is returned with respect to the above message.

[Response]

:010800001234B1[CR][LF]

16 Writes data into multiple D registers.

● Function

This function code writes data into successive D registers by the number of specified D registers starting from the specified D register number.

- The maximum number of D registers into which data is written at a time is 16.
- For the format of response in the event of failure, see subsection 5.2.2.
- Broadcast addressing is possible (by setting “00” to the address number).

● Message (for normal operation)

Element	Start of message mark (:)	Address number (ADR)	Function code (10)	D register start number (upper digit)	D register start number (lower digit)
Number of bytes in RTU mode	None	1	1	1	1
Number of bytes in ASCII mode	1	2	2	2	2

Message (continued)

Number of D registers (upper digit)	Number of D registers (lower digit)	Byte count	Data (upper digit)	Data (lower digit)	...	Error check	End of message mark (CR+LF)
1	1	1	1	1	...	2	None
2	2	2	2	2	...	2	2

● Response (for normal operation)

Element	Start of message mark (:)	Address number (ADR)	Function code (10)	D register start number (upper digit)	D register start number (lower digit)
Number of bytes in RTU mode	None	1	1	1	1
Number of bytes in ASCII mode	1	2	2	2	2

Response (continued)

Number of D registers (upper digit)	Number of D registers (lower digit)	Error check	End of message mark (CR+LF)
1	1	2	None
2	2	2	2

● Example:

Setting 200 to high-limit alarm setpoint 1H, and 10 to low-limit alarm setpoint 1L of the SDAU with address number 02.

The following message writes values “200” and “10” in this order in the ASCII mode, starting at the high-limit alarm setpoint 1H (D0104) of address number 02.

[Message]

:0210006700020400C8000AAF[CR][LF]

“02”: address number 02, “10”: function code 16, “0067”: D register address 0104, “0002”: number of D registers 2, “04”: byte count, “00C8”: high-limit alarm setpoint 1H 200, “000A”: low-limit alarm setpoint 1L 10, “AF”: error check

* Numbers in quotation marks are hexadecimal.

The following response is returned with respect to the above message.

[Response]

:02100067000285[CR][LF]

↑
Number of registers: 2

5.2.2 Response Error Codes

● Message Format in the Event of Error

If there is any inconsistency other than communication errors in a message, the YS80*R Rack-mounted Instrument does nothing, but returns the following message.

Element	Start of message mark (:)	Address number (ADR)	Function code (Note 1)	Error code	Error check	[CR] [LF]
Number of bytes in RTU mode	None	1	1	1	2	None
Number of bytes in ASCII mode	1	2	2	2	2	2

Note 1: In this space, a value of [function code (hexadecimal) + 80 (hexadecimal)] is set.

● Error Codes in Response

Table 5.3 List of Error Codes

Error code	Meaning	Cause
01	Function code error	No such function code exists.
02	D register number error	The address number outside the range is specified.
03	Number of D registers error	The number of the register outside the range is specified.

● Even when a Message is Sent, No Response Returns if:

- Retransmission error (overrun, framing, parity, LRC, or CRC-16 error) was detected.
- Address in a command message is incorrect.
- Interval between data composing a message was 2 seconds or more.
- CRC-16 value or LRC value is incorrect.
- Broadcast is specified (address number: 00).

* As a measure against those, provide a timeout processing in the communication functions or communication programs of the host device.

5.2.3 Broadcast Addressing

Broadcast addressing allows the corresponding multiple YS80*R Rack-mounted Instruments to receive the command.

- (1) In the command, specify the broadcast address "00" and execute it.
- (2) Broadcast addressing works independently of the communication address.
- (3) Broadcast addressing is only applicable to write commands.
- (4) No response is returned from the YS80*R Rack-mounted Instruments if this broadcast address is specified.

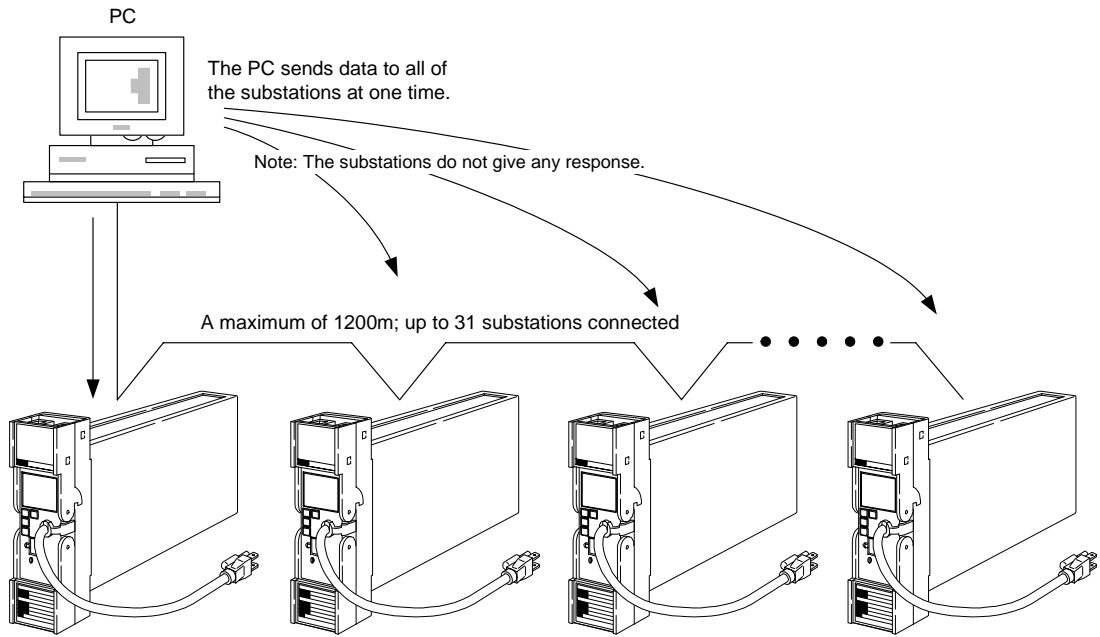


Figure 5.2 Broadcast Addressing

D registers are used for the communication of YS80*R Rack-mounted Instruments.

6. Functions and Usage of D Registers

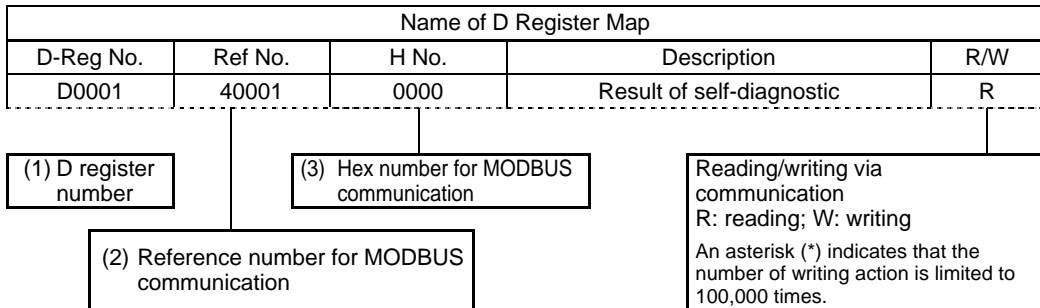
6.1 Overview of D Registers

This section describes the functions and usage of D registers.

The D registers store the input value, status and the like of the YS80*R Rack-mounted Instrument. These data can be used via PC link communication, ladder communication or MODBUS communication.

6.2 Method of Reading the D Register Map Table

This section describes how to read the “D Register Map Table.” In the example shown below, the number in the leftmost column denotes (1) D register number. The five-digit number on the immediate right of the leftmost column is (2) Reference number for MODBUS communication. The number in the column third from left is (3) Register number (hexadecimal) for MODBUS communication program.



6.3 D Register Map Table of SDAU

For the details of the parameters, see Section 6.3, “Display on Front Panel : List of Parameters” and Section 6.4, “JHT200 Handy Terminal : List of Parameters” of the User’s Manual for the SDAU (IM 01B04K03-02E).

D-Reg No.	Ref No.	H No.	Register name	Description	R/W
D0001	40001	0000	FLAG	Result of self-diagnostic	R
D0002	40002	0001	PV1	PV1	R
D0003	40003	0002	PV2	PV2	R
D0004	40004	0003	DV	Input deviation	R
D0005	40005	0004	PV1.VL	PV1 rate of change	R
D0006	40006	0005	PV2.VL	PV2 rate of change	R
D0007	40007	0006	ALM1	Alarm 1 status	R
D0008	40008	0007	ALM2	Alarm 2 status	R
D0009	40009	0008	ALM3	Alarm 3 status	R
D0010	40010	0009	ALM4	Alarm 4 status	R
D0013	40013	000C	OUT	Output value (%) Note 1	R
D0014	40014	000D	WRT PROTECT	Parameter write protect	R
D0022	40022	0015	FAIL	FAIL contact output status	R
D0103	40103	0066	MOD1	Input mode 1	R/W
D0104	40104	0067	1H	Alarm setpoint 1H	R/W
D0105	40105	0068	1L	Alarm setpoint 1L	R/W
D0106	40106	0069	HYSTERESIS1	Hysteresis 1	R/W
D0107	40107	006A	VL1 TIMER	Rate-of-change alarm 1 sample time	R/W
D0113	40113	0070	MOD2	Input mode 2	R/W
D0114	40114	0071	2H	Alarm setpoint 2H	R/W
D0115	40115	0072	2L	Alarm setpoint 2L	R/W
D0116	40116	0073	HYSTERESIS2	Hysteresis 2	R/W
D0117	40117	0074	VL2 TIMER	Rate-of-change alarm 2 sample time	R/W
D0123	40123	007A	MOD3	Input mode 3	R/W
D0124	40124	007B	3H	Alarm setpoint 3H	R/W
D0125	40125	007C	3L	Alarm setpoint 3L	R/W
D0126	40126	007D	HYSTERESIS3	Hysteresis 3	R/W
D0127	40127	007E	VL3 TIMER	Rate-of-change alarm 3 sample time	R/W
D0141	40141	008C	TIMER MODE	Alarm timer mode	R/W
D0142	40142	008D	AL1_H	Alarm 1 high limit alarm connection	R/W
D0143	40143	008E	AL1_L	Alarm 1 low limit alarm connection	R/W
D0144	40144	008F	AND.OR.1	Alarm 1 AND/OR specification	R/W
D0145	40145	0090	RLY1 ACTION	Alarm 1 relay action direction	R/W
D0146	40146	0091	DELAY TIM1	Alarm 1 output timer	R/W
D0147	40147	0092	ON DELAY1	Alarm 1 ON delay timer	R/W
D0148	40148	0093	OFF DELAY1	Alarm 1 OFF delay timer	R/W

Note 1: “100.0%” is indicated as “1000(03E8(HEX)).”

D-Reg No.	Ref No.	H No.	Register name	Description	R/W
D0152	40152	0097	AL2_H	Alarm 2 high limit alarm connection	R/W
D0153	40153	0098	AL2_L	Alarm 2 low limit alarm connection	R/W
D0154	40154	0099	AND.OR.2	Alarm 2 AND/OR specification	R/W
D0155	40155	009A	RLY2 ACTION	Alarm 2 relay action direction	R/W
D0156	40156	009B	DELAY TIM2	Alarm 2 output timer	R/W
D0157	40157	009C	ON DELAY2	Alarm 2 ON delay timer	R/W
D0158	40158	009D	OFF DELAY2	Alarm 2 OFF delay timer	R/W
D0162	40162	00A1	AL3_H	Alarm 3 high limit alarm connection	R/W
D0163	40163	00A2	AL3_L	Alarm 3 low limit alarm connection	R/W
D0164	40164	00A3	AND.OR.3	Alarm 3 AND/OR specification	R/W
D0165	40165	00A4	RLY3 ACTION	Alarm 3 relay action direction	R/W
D0166	40166	00A5	DELAY TIM3	Alarm 3 output timer	R/W
D0167	40167	00A6	ON DELAY3	Alarm 3 ON delay timer	R/W
D0168	40168	00A7	OFF DELAY3	Alarm 3 OFF delay timer	R/W
D0172	40172	00AB	AL4_H	Alarm 4 high limit alarm connection	R/W
D0173	40173	00AC	AL4_L	Alarm 4 low limit alarm connection	R/W
D0174	40174	00AD	AND.OR.4	Alarm 4 AND/OR specification	R/W
D0175	40175	00AE	RLY4 ACTION	Alarm 4 relay action direction	R/W
D0176	40176	00AF	DELAY TIM4	Alarm 4 output timer	R/W
D0177	40177	00B0	ON DELAY4	Alarm 4 ON delay timer	R/W
D0178	40178	00B1	OFF DELAY4	Alarm 4 OFF delay timer	R/W
D0201	40201	00C8	FILTER 1	Input 1 filter	R/W
D0202	40202	00C9	SENSOR TYPE1	Sensor type 1	R/W
D0203	40203	00CA	SQR1	Input 1 square root extraction	R/W
D0204	40204	00CB	LOW CUT1	Low cut point 1	R/W
D0205	40205	00CC	TC TYPE1	Thermocouple type 1	R/W
D0206	40206	00CD	RTD TYPE1	RTD type 1	R/W
D0211	40211	00D2	UNIT1	Unit 1	R/W
D0212	40212	00D3	RH1	Input 1 range high limit	R/W
D0213	40213	00D4	RL1	Input 1 range low limit	R/W
D0214	40214	00D5	DP1	Input 1 decimal point position	R/W
D0215	40215	00D6	SCH1	Input 1 scale H	R/W
D0216	40216	00D7	SCL1	Input 1 scale L	R/W
D0217	40217	00D8	BIAS1	Input 1 bias	R/W
D0221	40221	00DC	RJC	Presence/absence of input reference junction compensation	R/W
D0222	40222	00DD	RJC CONST	RJC fixed value	R/W
D0223	40223	00DE	BURN OUT1	Burnout 1	R/W
D0241	40241	00F0	FILTER2	Input 2 filter	R/W
D0242	40242	00F1	SENSOR TYPE2	Sensor type 2	R/W
D0243	40243	00F2	SQR2	Input 2 square root extraction	R/W
D0244	40244	00F3	LOW CUT2	Low cut point 2	R/W
D0245	40245	00F4	TC TYPE2	Thermocouple type 2	R/W
D0246	40246	00F5	RTD TYPE2	RTD type 2	R/W

D-Reg No.	Ref No.	H No.	Register name	Description	R/W
D0251	40251	00FA	UNIT2	Unit 2	R/W
D0252	40252	00FB	RH2	Input 2 range high limit	R/W
D0253	40253	00FC	RL2	Input 2 range low limit	R/W
D0254	40254	00FD	DP2	Input 2 decimal point position	R/W
D0255	40255	00FE	SCH2	Input 2 scale H	R/W
D0256	40256	00FF	SCL2	Input 2 scale L	R/W
D0257	40257	0100	BIAS2	Input 2 bias	R/W
D0263	40263	0106	BURN OUT2	Burn out 2 action	R/W
D0302	40302	012D	H/C	HOT/COLD start	R/W
D0303	40303	012E	DSP MODE	Display mode	R/W
D0304	40304	012F	SKIP	Parameter non-display setting	R/W
D0305	40305	0130	FAIL MODE	Fail output action at an error	R/W
D0311	40311	0136	RET	Retransmission output type selection	R/W
D0312	40312	0137	RTH	Maximum value of retransmission output scale	R/W
D0313	40313	0138	RTL	Minimum value of retransmission output scale	R/W
D0321	40321	0140	PROTOCOL	Protocol selection	R/W
D0322	40322	0141	BAUD RATE	Baud rate	R/W
D0323	40323	0142	PARITY	Parity	R/W
D0324	40324	0143	STOP BIT	Stop bit	R/W
D0325	40325	0144	DATA LEN	Data length	R/W
D0326	40326	0145	ADDRESS	Instrument address	R/W
D0327	40327	0146	COMMU	Communication writing forbidden specification (Note 1)	R/W
D0401 to D0420	40401 to 40420	0190 to 01A3		User-defined area (Note 2)	R/W

Note 1: Writing via RS-485 is not available when COMMU is set to 1.

Note 2: User-defined areas are used when using a graphic panel of Digital Electronic Corporation.

6.3.1 D Register Contents of SDAU

- **D0001: Bit Configuration of Self-diagnostics Result**

D0001 register indicates the status of error using combinations of bits within the register. If any of the events shown in the following table occurs, the corresponding bit is set to 1. The bit remains set to 0 if the event has not occurred yet. Note that bits in blank fields are not in use, and 0.

Bit	Event
0	Input 1 range over
1	Input 2 range over
2	
3	
4	
5	
6	HOT start error
7	
8	
9	
10	
11	Input 1 burn out
12	Input 2 burn out
13	
14	
15	

● **D0022: Status of FAIL contact output**

D0022 register indicates the status of FAIL contact output.

0: Energized

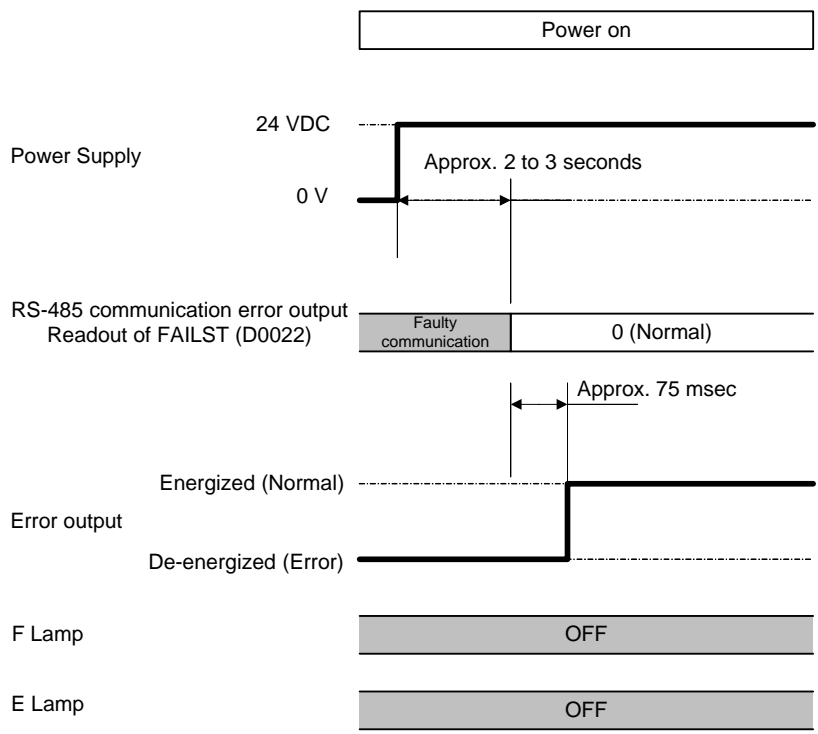
1: De-energized

The figure below shows the communication status and error output action at power on.

Note: The action shown below indicates the example when an error is not occurring.

(1) Starts the communication action about a few seconds after power on.

(2) Then an error output will become the energized (normal) condition in about 75 msec.



7. Functions and Usage of I Relays

This chapter describes the functions and usage of I relays.

I relays store the information on errors and the alarm statuses of the YS80*R Rack-mounted Instrument.

By connecting the YS80*R Rack-mounted Instrument to host device (via PC link communication), you can read/write I relays.

7.1 I Relay Map Table of SDAU

I relay number	Status type	Description
I0001 to I0016	On/off statuses	Error information (same as data in D0001 register)
I0017 to I0020		Alarm status
I0033 to I0064		User area (Used for special device such as a graphic panel.)



NOTE

I relays numbered 1 to 20 store on-off status information. In normal operation, this area can be accessed to read the on-off status.

When specifying I relay number via communication, begin the number with an uppercase "I".

For example, type "I0017" to specify the alarm 1 status (I relay number: 17).

No data may be written to or read from data storage areas with blank fields in the following table. If you attempt to do so, the YS80*R Rack-mounted Instrument may fail to operate correctly.

I relay number	Description
I0001	Input 1 range over
I0002	Input 2 range over
I0003	
I0004	
I0005	
I0006	
I0007	HOT start error
I0008	
I0009	
I0010	
I0011	
I0012	Input 1 burn out
I0013	Input 2 burn out
I0014	
I0015	
I0016	
I0017	ALM 1 status
I0018	ALM 2 status
I0019	ALM 3 status
I0020	ALM 4 status
I0021 ~ I0032	
I0033 ~ I0064	User area

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