User's
Manual

VJ Series
Communication Functions

IM 77J01J11-01E

YOKOGAWA
Yokogawa Electric Corporation

IM 77J01J11-01E
2nd Edition

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Introduction

This instruction manual describes the communication functions of the VJ Series signal conditioners and contains information on how to create communication programs.

Read the manual carefully to understand the communication functions of the VJ Series.

The VJ Series signal conditioners have the following communication protocols.

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

Note that the VJ Series signal conditioner cannot communicate with a higher-level device with a communication protocol other than these.

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

■ Intended Readers

This manual is intended for people familiar with the functions of the VJ Series signal conditioners, control engineers and personnel in charge of maintaining instrumentation and control equipment.

■ Related Documents

The following instruction manuals all relate to the communication functions of the VJ series signal conditioners. Read them as necessary.

- A variety of instruction manuals for VJ Series signal conditioners describing mounting, wiring, and how to calibrate the signal conditioners.

Media No. IM 77J01J11-01E (CD) 2nd Edition : June 2004 (YK)

Documentation Conventions

■ Symbols

This manual uses the following symbols.

● Symbols Used in the Main Text

CAUTION

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.

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) Although, figures and illustrations representing the signal conditioner's displays may differ from the real displays in regard to the position and/or indicated characters (upper-case or lower-case, for example), the extent of difference does not impair a correct understanding of the functions and the proper operations and monitoring of the system.

Notices

■ Regarding This Instruction Manual

(1) This manual should be passed on to the end user. Keep the 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, be certain to strictly adhere to all of the instructions and precautions relating to safety contained in this document. 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 instruction manual in order to avoid the risk of injury or death of personnel or damage to the instrument. The manual describes how the operator should exercise special care to avoid electric 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 prior to operating the equipment.

Functional Grounding Terminal

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

■ 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 software supplied by Yokogawa may be transferred, exchanged, leased, or sublet for use by any third party without the prior permission of Yokogawa.

VJ Series Communication Functions

IM 77J01J11-01E 2nd Edition

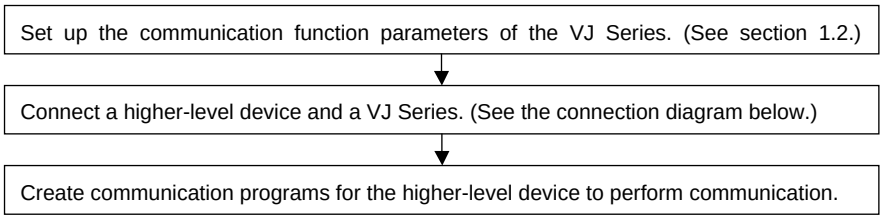
CONTENTS

1. Setup

This chapter describes the setup procedure required to use the communication functions (PC link, Ladder, and MODBUS) and the communication parameters of the VJ Series.

1.1 Setup Procedure

Set up the communication functions on the VJ Series as follows:



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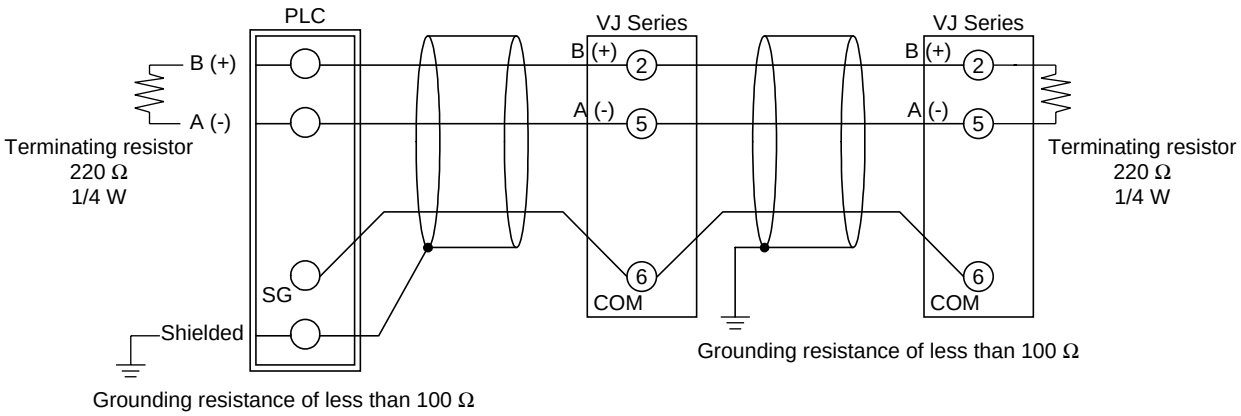
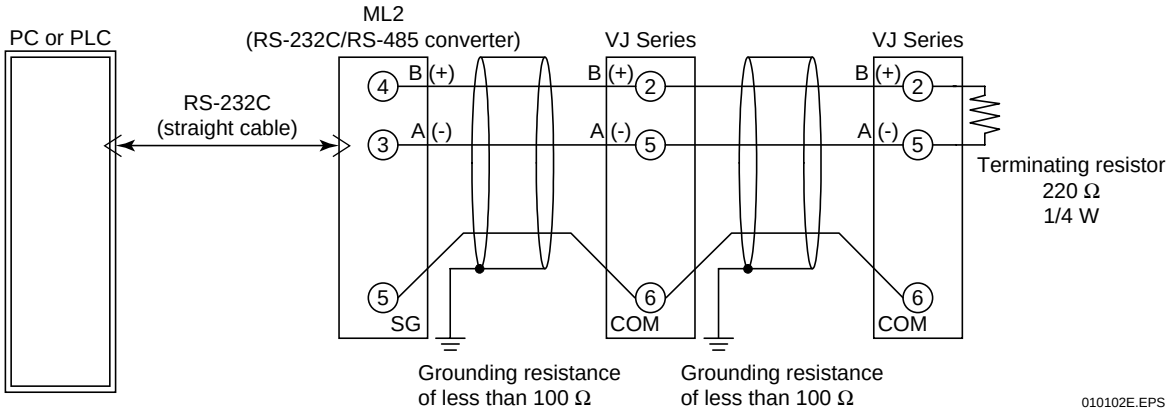
Note: Refer to the documentation of each higher-level device when creating communication programs.

• Connection





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1.2 Notes on Setting Parameters

This section describes the setting parameters for using the communication functions and their setting ranges.

CAUTION

The details of VJ Series communication functions need to be the same as those of the communication functions of the higher-level device to be connected. Check the communication parameters of the higher-level device first, then set up those of the VJ Series using the Handy Terminal or setting tool (VJ77).

Table 1-1 Parameters to be Set for Communication Functions

Parameter Name	Symbol	Setting Range		Default
Protocol selection	PROTOCOL	PC link communication	Without sum check With sum check	PC link communication without sum check
		MODBUS communication	ASCII mode RTU mode	
		Ladder communication	Ladder	
Address	ADDRESS	1 to 99		1
Communication rate	BAUD RATE	1200, 2400, 4800, and 9600		9600
Parity	PARITY	NONE, EVEN, ODD		EVEN
Stop bit	STOP BIT	1, 2		1
Data length	DATA LEN	7, 8 (*1)		8

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*1: When "Ladder" is selected in protocol selection, it is fixed to "8."
When "ASCII mode" is selected for MODBUS communication, it is fixed to "7."
When "RTU mode" is selected, it is fixed to "8."

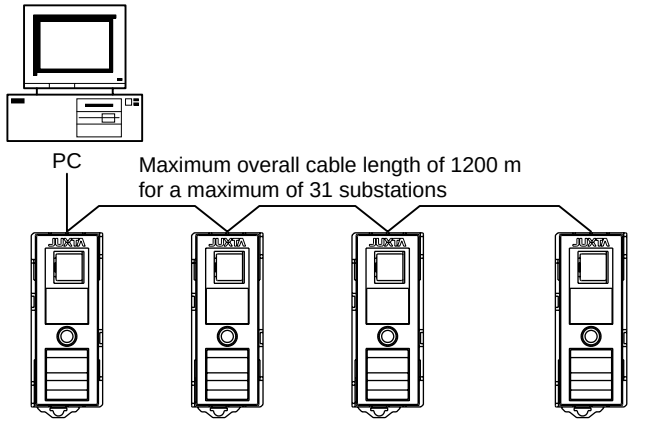
● Protocol selection (PROTOCOL)

Set the communication protocol identical to that of the higher-level device to be connected.

● Address number (ADDRESS)

Set the address number of the VJ Series itself. An address number of 1 to 99 may be assigned in any order. However, there is a limitation - the number of VJ Series to be connected to a single communication port is limited to 31.

Example of connecting four VJ Series signal conditioners to a higher-level device by setting address numbers of 1, 50, 10, and 20



● Communication rate (BAUD RATE)

Set the communication rate identical to that of the higher-level device to be connected. (Otherwise, proper communication cannot be achieved.) The unit of the communication rate is bps (bits per second).

● Parity (PARITY)

Set the handling of parity to be carried out when data is sent or received. Set the parity bit state identical to that of the higher-level device to be connected.

● Stop bit (STOP BIT)

Set the stop bit identical to that of the higher-level device to be connected.

● Data length (DATA LEN)

Set the data length identical to that of the higher-level device to be connected. (When Ladder or MODBUS communication is chosen in protocol selection, the data length is fixed.)

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2. Communication Specifications

The RS-485 communication interface has the PC link communication, Ladder communication, and MODBUS communication protocols.

Table 2-1 VJ Series Communication Specifications

Communication Hardware	2-wire RS-485 communication system
Terminal	Terminal numbers: 2, 5, 6
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 Communication Rate	9600 bps

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Table 2-2 Types of Devices to be Connected

Devices to be Connected	Communication Protocol	Example of Connected Devices
PC	MODBUS communication	General-purpose PC
PC, graphic panels, and PLCs (FA-M3's UT link modules)	PC link communication	General-purpose PC, FA-M3, and GP Series
PLCs (sequencers) and FA-M3 ladder communication module	Ladder communication	General-purpose PLCs (sequencers)

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2.1 RS-485 Communication Specifications

Table 2-3 RS-485 Communication Interface

Item	Specifications
Standard	EIA, RS-485, Compatible
Maximum number of devices to be connected	31
Communication system	2-wire, half duplex
Synchronization	Asynchronous (start-stop)
Communication protocol	No protocol
Maximum communication distance	1200 m
Communication rate	1200, 2400, 4800, 9600

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3. PC Link Communication

3.1 Overview

The use of PC link communication enables the VJ Series to communicate with a device such as a PC, graphic panel, or FA-M3's UT link module. Such a device can be used in communication to read data from D registers or I relays, both of which are internal registers of the VJ Series signal conditioners.

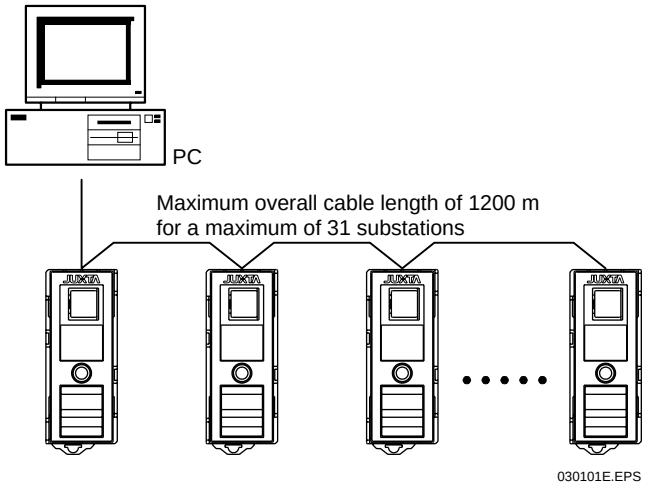

Figure 3-1 Connection of Substations in PC Link Communication

Hereafter, PCs are generally called "higher-level devices."

See Also

Chapters 6 and 7 for information on the D registers and I relays.

In PC link communication, a higher-level device identifies each VJ Series signal conditioner with a communication address of 1 to 99.

3.1.1 Configuration of Command

Commands sent from a higher-level device to VJ Series signal conditioners, consist of the following elements.

Number of Bytes	1	2	2	1	3	Variable length	2	1	1
Element	STX	Address number (ADDRESS)	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)

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(1) STX (Start of Text)

This control code indicates the start of a command. The ASCII code is 02 in hexadecimal.

(2) Address Number (01 to 99)

Address numbers are used by the higher-level device to identify VJ Series signal conditioners at the communication destination. (They are identification numbers specific to the VJ Series signal conditioners.)

(3) CPU number

This number is fixed to “01”.

(4) Time to Wait for Response

This is fixed to “0”.

(5) Command (See subsection 3.2.1, “List of Commands”)

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 pieces, and others.

(7) Checksum

This converts the ASCII codes of texts between the character next to STX and the character immediately before the checksum into hexadecimal values and adds them byte by byte. It then fetches the single lowermost byte of the added results as the checksum.

This column is required only for PC link communication with checksum. PC link communication without checksum does not require this 2-byte space of ASCII code.

(8) ETX (End of Text)

This control code indicates the end of a command string. The ASCII code is “03” in hexadecimal.

(9) CR (Carriage Return)

This control code indicates the end of a command. The ASCII code is “0D” in hexadecimal.

CAUTION

The control codes “STX”, “ETX”, and “CR” are essential for commands when you create a communication program for PC link communication. Omission of any of them or incorrect order of them results in communication failure.

3.1.2 Configuration of Response

Responses from the VJ Series 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) Normal Communication

When communication completes normally, the VJ Series returns a character string "OK" and data corresponding to a command.

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

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2) In the Event of Failure

If communication does not complete normally, the VJ Series returns a character string "ER" and error code (EC1 and EC2). (See subsection 3.1.3, “Response Error Code”.)

- No response is made in case of an error in address number specification or CPU number specification.
- If a VJ Series cannot receive EXT in a command, response may not be made.

* As a countermeasure, provide a timeout process in the communication functions of the higher-level device or in communication programs.

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

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3.1.3 Response Error Codes

See Also

3.1.2, “Configuration of Response”, for the structure of response in the event of error.

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

Table 3-1 List of Error Codes EC1

Error code	Meaning	Cause(s)
02	Command error	• No command exists. • Command not executable
03	Device specification error	• No register number exists. • Invalid specification of bit register (I relay) when it is used on a word basis
04	Out of setpoint range	• Any character other than 0 or 1 is used for bit setting. • A value other than 0000 to FFFF has been specified in word specification. • The position of a start for a data load is out of the address range.
05	Out of data count range	• The specification of the number of bits, words, etc. is out of the range of use. • The number of data specified and that of parameters for registers and others are not consistent.
06	Monitor error	• An attempt was made to execute monitoring without specifying the monitor (BRS or WRS).
08	Parameter error	• An illegal parameter is set.
42	Sum error	• The sum does not match the expected value.
43	Internal buffer overflow	• A data value greater than the specified was received.
44	Character reception timeout	• The end-of-data or end-of-text character has not been received.

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Table 3-2 List of Detailed Error Codes EC2

Error Code (EC1)	Meaning	Detailed Error Code (EC2)
03	Device specification error	Parameter number where error occurred (HEX) This is the sequence number of a parameter that first resulted in an error when counted from the leading parameter. e.g.: Device name specification error ↓ [STX]01010BRR02I0001,D0001[ETX][CR] Parameter numbers 1 2 3 [STX]0101ER0303BRR[ETX][CR]
04	Out of setpoint range	
05	Out of data count range	
08	Parameter error	• An illegal parameter is set.

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For error codes other than those noted as EC1, there is no EC2 meaning.

3.2 Commands

3.2.1 List of Commands

The following shows lists of commands available in PC link communication. Their details are explained in the description of each command.

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

Command	Description	Number of Bits to be Handled
BRD	Bit-basis read	1 to 256 bits
BRR	Bit-basis random read	1 to 32 bits
BRS	Specifies I relays to be monitored on a bit basis.	1 to 32 bits
BRM	Bit-basis monitoring	———

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(2) Word-basis Access Commands

Command	Description	Number of Words to be Handled
WRD	Word-basis read	1 to 64 words
WRR	Word-basis random read	1 to 32 words
WRS	Specifies internal registers to be monitored on a word basis.	1 to 32 words
WRM	Word-basis monitoring	———

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(3) Information Command

Command	Description
INF	Reads model, presence/absence of options, and revision.

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3.2.2 BRD Reading 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 256.
- 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 a 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	3	2	1	1
Command Element	STX	Address number (ADDRESS)	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 (ADDRESS)	CPU number 01	OK	d1	d2	d3	• • •	dn	Checksum	ETX	CR

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

dn: reads data of the specified number of bits (n=1 to 256)

dn=0(OFF)

dn=1(ON)

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● Example:

Reading the status of alarm-1 of the VJ Series signal conditioner with communication address-1.

The following command reads the status of alarm-1 (I0009) at communication address-1.

[Command]

[STX]01010BRDI0009,00199[ETX][CR]

The following response is returned with respect to the above command. (Alarm-1 is ON.)

[Response]

[STX]0101OK18D[ETX][CR]

Alarm has been ON since "1" was returned.

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3.2.3 BRR Reading I Relays on a Bit-by-bit Basis in a Random Order

● Function

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

- The number of bits 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 a 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	2	5	1	5	1
Command Element	STX	Address number (ADDRESS)	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 (ADDRESS)	CPU number 01	OK	d1	d2	• • •	dn	Checksum	ETX	CR

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

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

dn=0(OFF)

dn=1(ON)

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● Example:

Reading the statuses of alarms-1 and -2 of the VJ Series signal conditioner with communication address-1

The following command reads the statuses of alarm-1 (I0009) and alarm-2 (I0010) at communication address-1.

[Command]

[STX]01010BRR02I0009,I001082[ETX][CR]

With respect to the above command, the ON and OFF responses are returned for alarms-1 and -2 respectively.

[Response]

[STX]0101OK10BD[ETX][CR]

Alarm-1 has been ON.

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3.2.4 BRS Specifying 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.

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 just the BRR command.

When the power is turned OFF, the register numbers specified will be erased.

- The number of registers to be specified 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 a 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	2	5	1	5	1
Command Element	STX	Address number (ADDRESS)	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 (ADDRESS)	CPU number 01	OK	Checksum	ETX	CR

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● Example:

Specifying that the burnout and alarms-1 and -2 of the VJ Series signal conditioner with communication address-1 are to be monitored

The following command specifies that the statuses of burnout (I0004), alarm-1 (I0009), and alarm-2 (I0010) at communication address-1 are to be monitored.

(This command simply specifies the registers to be monitored.)

[Command]

[STX]01010BRS03I0004,I0009,I0010BD[ETX][CR]

OK is returned in response to the above command.

[Response]

[STX]0101OK5C[ETX][CR]

3.2.5 BRM Monitoring I Relays on a Bit-by-bit Basis

● Function

Reads the 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 relays are to be monitored. If no relay has been specified, error code 06 is generated.
- 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 a 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	2	1	1
Command Element	STX	Address number (ADDRESS)	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 (ADDRESS)	CPU number 01	OK	d1	d2	d3	• • •	dn	Checksum	ETX	CR

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

dn: registers data of the number of bits specified by the BRS command (n=1 to 32)

dn=0(OFF)

dn=1(ON)

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● Example:

When the burnout and alarms-1 and -2 of the VJ Series signal conditioner with communication address-1 have been specified to be monitored:

The following command monitors the statuses of burnout (I0004) and alarm-1 (I0009) and alarm-2 (I0010) at communication address-1.

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

[Command]

[STX]01010BRMA3[ETX][CR]

With respect to the above command, the ON and OFF statuses of the I relays are returned as responses.

[Response]

[STX]0101OK000EC[ETX][CR]

All are in OFF statuses.

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3.2.6 WRD Reading D Registers/I Relays on a Word-by-word Basis

● Function

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

- 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 3.1.2.
- The command shown below includes the checksum function. When performing communication without a 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 (ADDRESS)	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 (ADDRESS)	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.

Reads data of the specified number of words
ddddn is a character string in a hexadecimal pattern.
n=1 to 64

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● Example:

Reading the output value of the VJ Series signal conditioner with communication address-1.

The following command reads the output value (D0008) at communication address-1.

[Command]

[STX]01010WRD0008,0178[ETX][CR]

With respect to the above command, the output value 500 (01F4 (HEX)) is returned as response (50.0% is expressed as 500).

[Response]

[STX]0101OK01F437[ETX][CR]

500 in decimal (output is 50.0%)

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3.2.7 WRR Reading D Registers/I Relays on a Word-by-word Basis in a Random Order

● Function

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

- 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 a 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	2	5	1	5	1
Command Element	STX	Address number (ADDRESS)	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 (ADDRESS)	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.

Reads data of the specified number of words
ddddn is a character string in a hexadecimal pattern.
n=1 to 32

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● Example:

Reading the input and output values of the VJ Series signal conditioner with communication address-1

The following command reads the input value (D0004) and output value (D0008) at communication address-1.

[Command]

[STX]01010WRR02D0004,D00088F[ETX][CR]

With respect to the above command, the input value 500 (01F4 (HEX)) and output value 500 (01F4 (HEX)) are returned as responses (50.0% is expressed as 500).

[Response]

[STX]0101OK01F401F4FC[ETX][CR]

500 in decimal (input is 50.0 %)

500 in decimal (output is 50.0 %)

3.2.8 WRS Specifying D Registers/I Relays to be Monitored on a Word-by-word Basis

● Function

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

When 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 just the WRR command.

When the power is turned OFF, the register numbers specified will be erased.

- The number of words to be specified 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 a 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	2	5	1	5	1
Command Element	STX	Address number (ADDRESS)	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 (ADDRESS)	CPU number 01	OK	Checksum	ETX	CR

030221E.EPS

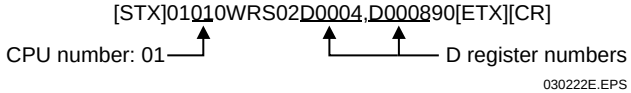
● Example:

Specifying the input value (%) and output value (%) of the VJ Series signal conditioner with communication address-1 are to be monitored

The following command specifies that the input value (D0004) and output value (D0008) at communication address-1 are to be monitored.

(This command simply specifies the registers to be monitored.)

[Command]



030222E.EPS

OK is returned as a response to the above command.

[Response]

[STX]0101OK5C[ETX][CR]

3.2.9 WRM Monitoring D Registers/I Relays on a Word-by-word Basis

● Function

Reads the information of registers that have 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 generated.
- 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 a 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	2	1	1
Command Element	STX	Address number (ADDRESS)	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 (ADDRESS)	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.

Reads data of the number of words specified by the WRS command

ddddn is a character string in a hexadecimal pattern.

n=1 to 32

030223E.EPS

● Example:

When the input value (%) and output value (%) of the VJ Series signal conditioner with communication address-1 have been specified to be monitored:

The following command monitors the input value (D0004) and output value (D0008) at communication address-1.

(This command reads the registers specified by the WRS command.)

[Command]

[STX]01010WRME8[ETX][CR]

↑ CPU number: 01

With respect to the above command, the input value 500 (01F4 (HEX)) and output value 500 (01F4 (HEX)) are returned as responses (50.0% is expressed as 500).

[Response]

[STX]0101OK01F401F412[ETX][CR]

3.2.10 INF Reading the Model, Presence/Absence of Options, and Revision

● Function

Returns the model number of a VJ Series signal conditioner, whether any options are included, and the version and revision numbers.

- 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 (ADDRESS)	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 (ADDRESS)	CPU number 01	OK	□□□□□□□□ (Note 1)	Version Revision (Note 2)	Start register specified for readout refreshing *	Number of registers specified for readout refreshing *

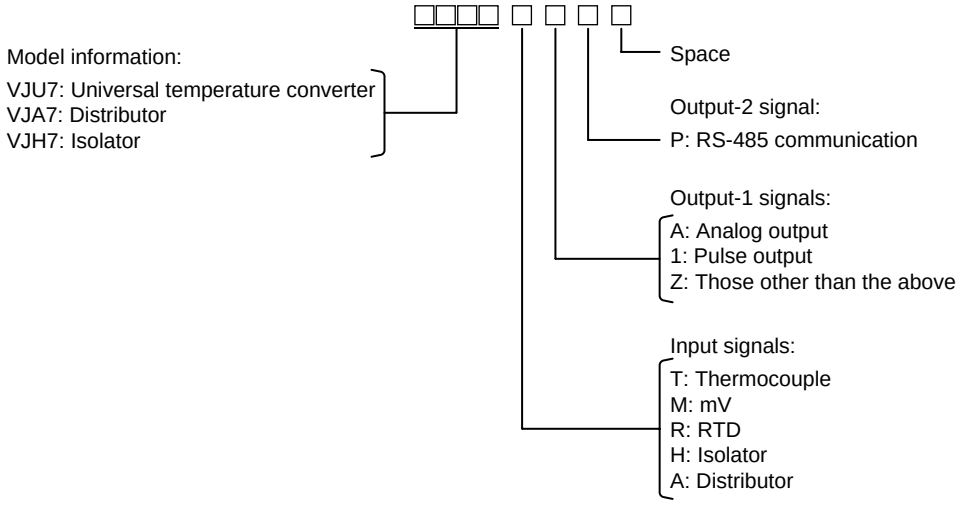
Response (continued)

4	4	2	1	1
Start register specified for readout refreshing *	Number of registers specified for readout refreshing *	Checksum	ETX	CR

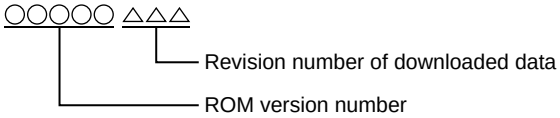
The * mark indicates fields the FA-M3 UT link module refers to.

030226E.EPS

Note 1: Model and input and output information of the VJ Series



Note 2: Version number and revision number



3.3 Communication with Higher-level Devices

Higher-level devices are those capable of using the PC link communication protocol. As an example of a communication program, the Basic program created using Microsoft Visual Basic is given in subsection 3.3.1. Further, communications with an FA-M3's UT link module or graphic panel can be achieved without creating a complex program. Examples of communication with them are given in subsections 3.3.2 and 3.3.3.

3.3.1 Example of Communication Program Created Using Visual Basic

This subsection shows a sample program created using Microsoft Visual Basic 6.0.

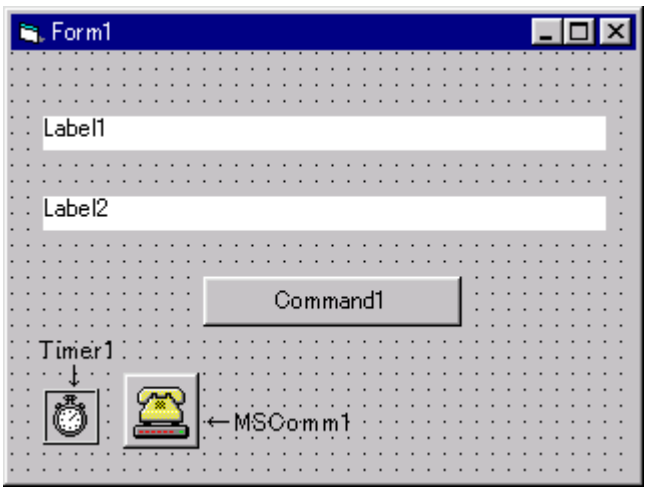
Operation verification environment: PC/AT compatible machine + Windows NT 4.0 (SP4), Windows 95

PC/AT is a product of International Business Machine Corp.
Visual Basic is a registered trademark of Microsoft Corporation.

See Also

MSDN and commercially available documentation for information on Visual Basic programming.

The sample program reads the contents of D register D0002 using the PC link communication protocol. When you press the Command button, the commands sent and responses received will be displayed in a form. If no response is received, a timeout will occur.



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```
'=======================================================
' Program name: Sample
'
' RS-485 communication program for VJ series
'
'============================== YOKOGAWA Electric Corporation ===
'
'Definition of public variables
Public fSend As Boolean           'Sending flag
Public strSend As String          'Character string sent
Public strBuf1 As String          'Character (1 byte) received
Public strReceive As String       'Character string received

'When the Command button is pressed,
Private Sub Command1_Click()

  strSend = "01010WRDD0002,01"    'Character string to be sent
                                  '[stx]01010WRDD0003,01[etx][cr]
```

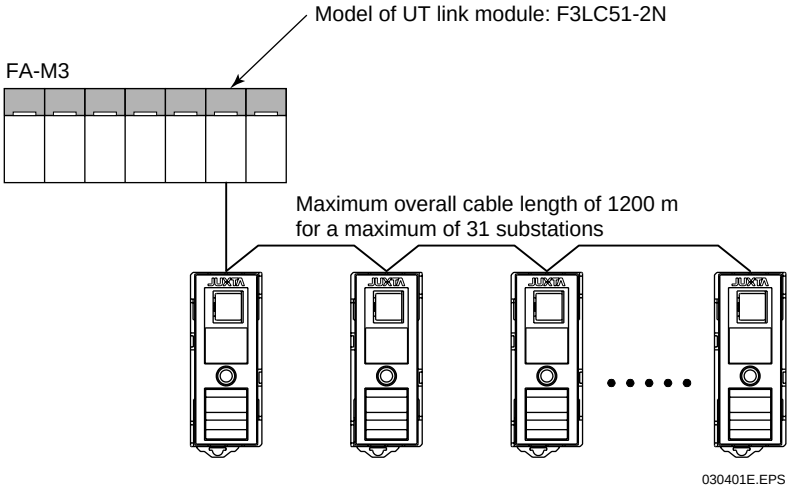
```
  Label1.Caption = "[stx]" + strSend + "[etx][cr]"
  Label2.Caption = ""

  MSComm1.PortOpen = True         'Open port
  Timer1.Enabled = True           'Start timer for detecting timeout
  Command1.Enabled = False        'Disable the Command button temporarily
  fSend = True                    'Set sending flag

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

  Do                              'Loop until sending flag becomes false
    If DoEvents() = 0 Then        '
    End If                        '
  Loop Until fSend = False        '

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

  Label2.Caption = strReceive     'Display received character string in Label 2
  Command1.Enabled = True         'Enable the Command button

End Sub

--------------------------------------------------------------------------------

'At start of program
Private Sub Form_Load()

  Form1.Caption = "Communication Sample"

  'Set up timer for detecting timeout
  Timer1.Enabled = False
  Timer1.Interval = 2000
                                  'Regard as being 2 seconds
  'Initialize MSComm control
  MSComm1.CommPort = 1            'COM1
  MSComm1.InputLen = 1            'Size of receiving buffer
  MSComm1.InputMode = comInputModeText       'Receiving mode
  MSComm1.RThreshold = 1          'MSComm1_OnComm interrupt processing starts
                                  'each time 1 byte is received
  MSComm1.Settings = "9600,e,8,1" 'Communication conditions: 9600 bps; Parity,
                                  'even; Data length, 8 bits; Stop bit, 1 bit

  'Command button control
  Command1.Caption = "Send"
```

```
  'Initialize label control that displays character strings sent and received
  Label1.Caption = ""
  Label2.Caption = ""

End Sub

--------------------------------------------------------------------------------

'This processing starts each time 1 byte is received
Private Sub MSComm1_OnComm()
Dim strBuf0 As String

  Select Case MSComm1.CommEvent
    Case comEvReceive
      strBuf0 = MSComm1.Input     '
      Select Case strBuf0         'Case classification based on 1 byte received
      Case Chr(2)                 'When it is stx
        strBuf1 = "[stx]"
      Case Chr(3)                 'When it is etx
        strBuf1 = strBuf1 & "[etx]"
      Case Chr(13)                'When it is cr
        strBuf1 = strBuf1 & "[cr]"
        'This is provided as a measure against the fact that a command sent may
        'be seen as response depending on a combination with communication
        'converter.

        If strBuf1 = Label1.Caption Then
          strBuf1 = ""
        Else
          strReceive = strBuf1    'Completion of character string received
          fSend = False           'When it is not stx, etx, or cr
        End If
      Case Else                   'stx,etx,crÇ≈Ç»Ç¢ÇΔÇ´
        strBuf1 = strBuf1 & strBuf0
      End Select
  Case Else
  End Select

End Sub

--------------------------------------------------------------------------------

'Timeout
Private Sub Timer1_Timer()
```

```
    strReceive = "Time Out!"
    fSend = False                    'Receiving is regarded as being ended

End Sub
```

3.3.2 Communication with UT Link Module

Communication with FA-M3 is achieved by simply connecting the VJ Series to a UT link module using the PC link communication protocol. Set the communication conditions of the VJ Series signal conditioners identical to those of the UT link module.



The UT link module function has the following three modes, which allow you to communicate with FA-M3 without being aware of it. For more information, see the optionally available "UT Link Module Instruction Manual (IM 34M6H25-01E)."

1. Automatic mode

   This mode enables the instruments' fixed devices (those that cannot be specified by the user) to be constantly refreshed by reading from and/or writing to them. The fixed devices are D0001 to D0015, and the read areas cannot be written to.

2. Customize mode (constant access)

   This mode reads and refreshes the instrument's devices (those that can be specified by the user).

See Also

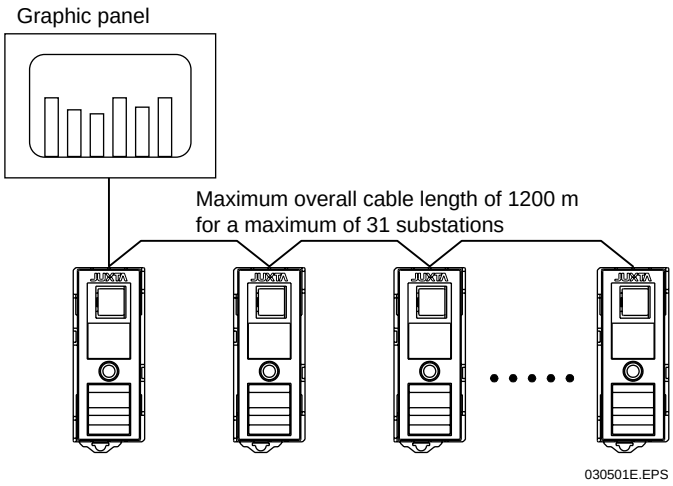
The devices mentioned here are D registers and I relays. For more information on D registers and I relays, see Chapters 6 and 7.

3. Command Action

   This mode allows access to be made as necessary.

3.3.3 Communication with Graphic Panel

Communication with a graphic panel is achieved using the PC link communication protocol. Set the communication conditions of the VJ Series signal conditioners identical to those of the graphic panel.



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For more information, refer to the instruction manual of the graphic panel to be connected.

	Model	Name	Remarks
Yokogawa Electric	TOP75T	Touch operation panel (large)	10-inch TFT color LCD
	TOP72S	Touch operation panel (medium)	5-inch STN color LCD
Digital's Pro-face	GP-70 Series	Graphic operation panel	(*1)
	GP-J Series	High-speed graphic operation panel	
	GP-230 Series	Medium-size graphic operation panel	
	GP-430 Series	High-speed, advanced graphic operation panels	
	GP-530 Series		

030502E.EPS

Note 1: For Digital's graphic panels, contact Digital Corp. directly.
Note 2: The system data area should be assigned to D0065.
*1: Display devices differ depending on the model.

Blank Page

4. Ladder Communication

4.1 Overview

Communication with a sequencer (PLC) is achieved using a ladder program. Specifying the register numbers of D registers of the VJ Series signal conditioners in the ladder program allows the registers to be read using the BCD codes (0 to 9).

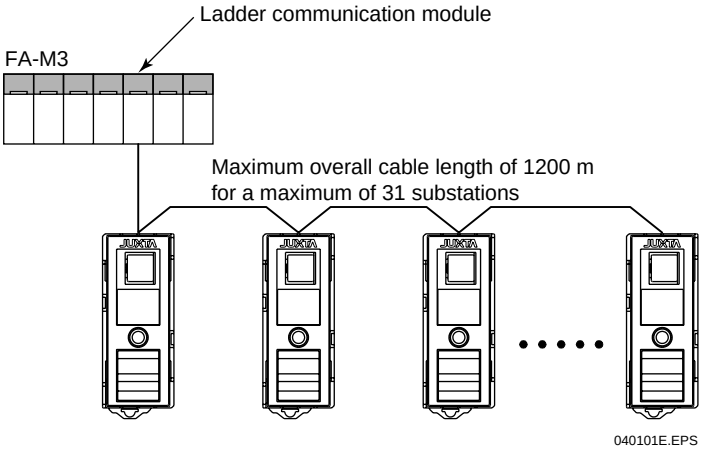

Figure 4-1 Example of Connection for Ladder Communication

● Connecting the VJ Series to a PLC of another company

When the VJ Series signal conditioners are connected to a PLC manufactured by Mitsubishi Electric (MELSEC-A series), you can use the no-handshaking mode of the computer link unit.

4.2 Commands/Responses at the PLC

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

4.2.1 Command/Response Component Elements

Commands sent from the PLC to the VJ Series signal conditioners are configured as shown below.

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 (ADDRESS)	CPU number 01	Parameter number	0	5th digit	0	+/-	Data	CR (0D)	LF (0A)

Variable only for responses.
A maximum of 64 data items

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(1) Address number (01 to 99)

Numbers used by the PLC to identify the VJ Series signal conditioners at the communication destination. (They are identification number specific to individual VJ Series signal conditioners.)

(2) CPU number

This number is fixed to “01”.

(3) Parameter number

This is 4-digit BCD data of a D register number, not including "D." No I-relays can be specified.

See Also

Chapter 6 for more information on D registers.

(4) 0

This is fixed to "0."

(5) 0

This is fixed to "0" for commands, while it is 5th digit of read data for responses.

(6) 0

This is fixed to "0."

(7) +/-

This is fixed to "0" for commands, while it is 0: positive data (+) or 1: negative data (-) for responses.

(8) Data

This is data to be read for commands, while it is the number of read data for responses.

(9) CR and LF

These are the control codes indicating the end of a command. The corresponding control character strings are CR, which is 0D in hexadecimal in ASCII code, and LF, which is 0A in hexadecimal in ASCII code.

4.2.2 Reading Parameters

Parameters from the PLC are read in the VJ Series signal conditioners in the following configuration. (The maximum number of data items to be read is 64.)

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 (ADDRESS)	CPU number 01	Parameter number	0	0	0	0	Number of read data (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 (ADDRESS)	CPU number 01	Parameter number	0	5th digit	0	+/-	dddd1	0	5th digit	0	+/-	dddd2

Data of parameter no. (a) Data of parameter no. (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 no. (n)

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● Example of reading the output value (D register 0008) of the VJ Series signal conditioner with communication address-1

[Command]

0101<u>0008</u>000000010D0A

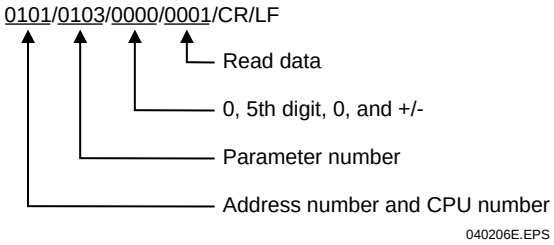
The output value 500 (BCD code) is returned as a response to the above command (50.0% is expressed as 500).

[Response]

0101000800000<u>0500</u>0D0A

4.2.3 Response Error Codes

Data that the master station (PLC) will receive in the event of an error and the description of errors are given in the table below.



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

Table 4-2 List of Error Codes

Description of error	Example of data sent by master station	Data received by master station
A non-existing parameter was set.	0101/0129/0000/0001/CR/LF	0101/0103/0000/FFFF/CR/LF ↑ FFFF is returned.
A character other than a BCD code (0 to 9) was used in item other than address. * Note that this excludes LF (0A).	0101/0123/0000/000B/CR/LF 0101/0123/000B/0000/CR/LF 0101/0123/0B00/0000/CR/LF 0101/012B/0000/0000/CR/LF	0101/FFFF/FFFF/FFFF/CR/LF
LF code (0A) is used in an item other than address.	0101/0123/0000/000A/CR/LF 0101/0123/000A/0000/CR/LF 0101/0123/0A00/0000/CR/LF 0101/010A/0000/0000/CR/LF	No response
Address was different from that of a VJ Series signal conditioner. * Examples at the right show addresses not existing.	0103/0123/0000/0000/CR/LF 0001/0123/0000/0000/CR/LF 3301/0123/0000/0000/CR/LF	No response
Command length (length of send data) is incorrect. * Command length is 10 bytes including CR and LF.	0101/0123/0000/00/CR/LF 0101/0123/0/CR/LF 0101/0/CR/LF	No response
A timeout occurred during communication. * Timeout is 2 seconds.	0101/012	No response
Buffer overflowed * Buffer overflow occurs if data exceeds 367 bytes.	–	No response
Framing error or parity error occurred.	–	No response

040207E.EPS

CAUTION

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

5. MODBUS Communication

5.1 Overview

The use of MODBUS communication allows the VJ Series signal conditioners to communicate with a PC. In this communication, a PC reads data from D registers, internal registers of the VJ Series.

Hereafter, PCs are generally called "higher-level devices."

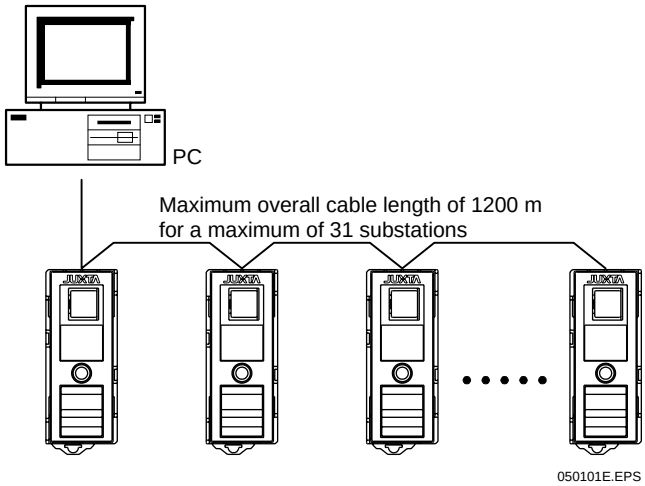

Figure 5-1 Example of Connection for MODBUS Communication

See Also

Chapter 6 for information on the D registers.

For MODBUS communication with the VJ Series, we provide the ASCII mode and RTU mode (binary system) for the transmission 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
Message length (*1)	2N+1	N
Data time intervals	1 second or less	24 bit time or less (*2)
Error detection	Longitudinal redundancy check: LRC	Cyclic redundancy check: CRC-16

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*1: When message length in the RTU mode is assumed to be "N"
*2: For a communication rate of 9600 bps, 1÷9600×24 seconds or less applies.

In MODBUS communication, a higher-level device identifies each VJ Series signal conditioner with a communication address of 1 to 99.

5.1.1 Configuration of Message

Messages sent from the higher-level device to the VJ Series consist of the following elements.

Element	Start of Message Mark	Address Number (ADDRESS)	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)

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(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 99)

Address numbers are used by the higher-level device to identify the VJ Series signal conditioners at the communication destination. (These numbers are identification numbers specific to individual VJ Series, which are expressed in a hexadecimal in the message.)

(3) Function Code (See subsection 5.2.1, “List of Function Codes”)

This element 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, or others in accordance with the function code. (It is expressed in a hexadecimal in the 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

Specification of D registers using commercially available SCADA or other software and specification of D registers for messages used in a customer-created communication program are different. Take note of this.

1) When using commercially available SCADA or other software, specify a "reference number" in which "D," the first character of a D register number, is replaced by "4."
2) For a customer-created communication program, specify a value in hexadecimal that is obtained by subtracting 40001 from a reference number.

Example: Specifying a value (alarm 1 (D0014))

1) For messages when using commercially available SCADA or other software, specify the reference number "40014."
2) For messages in the customer-created communication program, specify "000D," the hexadecimal number of value 13 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 higher-level device to obtain the D register information of the VJ Series signal conditioners.

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 64 successive D registers between D0001 and D0128.
08	Performs a loop back test.	See subsection 5.2.2, “Function Codes”.

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03 Reads data from multiple D registers.

● Function

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

- The maximum number of D registers to be read at a time is 64.
- 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 (ADDRESS)	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

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● Response (for normal operation)

Element	Start of Message Mark (:)	Address Number (ADDRESS)	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-Register	Error Check	End of Message Mark (CR+LF)
2	2	None
4	2	2

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● Example:

Reading the statuses of alarms-1 and -2 from the VJ Series signal conditioner with communication address 1.

The following message reads two successive D registers starting at alarm-1 (D0014) and communication address 1 in the ASCII mode.

[Message]

: 0103000D0002ED[CR][LF]

Start of message mark

"01": communication address 1, "03": function code 03, "000D": D-register address 0014, "0002": number of D registers 2, and "ED": error check

Note: Numbers in quotation marks are hexadecimal.

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

[Response]

: 010304<u>0001</u><u>0000</u>F7[CR][LF]

Alarm-1 is ON. Alarm-2 is OFF.

08 Performs a loop back test.

● Function

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

- For the format of responses in the event of failure, see subsection 5.2.2.
- The element marked with * is "00" (fixed).
- Any value can be selected to send data.

● Message (for normal operation)

Element	Start of Message Mark (:)	Address Number (ADDRESS)	Function Code (08)	00* 0000	Send Data (any)
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

050216E.EPS

● Response (for normal operation)

Element	Start of Message Mark (:)	Address Number (ADDRESS)	Function Code (08)	00 0000	Same as send 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

050217E.EPS

● Example:

Sending data "1234h" in hexadecimal to the VJ Series signal conditioner with communication address 1 to check connection for communication.

The following message sends "1234" (hexadecimal) to communication address 1 in the ASCII mode.

[Message]

: 010800001234B1[CR][LF]

Start of message mark

When connection for communication is normal, the response whose configuration is the same as that of the message is returned with respect to the above message.

[Response]

: 010800001234B1[CR][LF]

5.2.2 Response Error Code[Response]

● Message Format in the Event of Error

If there are any inconsistencies other than communication errors in a message, a VJ Series signal conditioner does nothing, but returns the following message.

Element	Address Number (ADDRESS)	Function Code (*1)	Error Code	Error Check	[CR] [LF]
Number of bytes in RTU mode	1	1	1	2	None
Number of bytes in ASCII mode	2	2	2	2	2

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*1: The function code contains a function code (hexadecimal number) + number 80 (hexadecimal number).

● Response Error Codes

Table 5-3 List of Error Codes

Error Code	Meaning	Description
01	Function code error	No function code exists.
02	D-register number error	D-register number out of the range has been specified.
03	D-register count error	Number of D registers has been specified, being out of the range.

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● Even when a message is sent, no response returns if:

- Retransmission error (overrun, framing, parity, LRC, or CRC-16 error) was detected.
- Address in an instructed message is incorrect.
- Interval between data composing a message was 2 seconds or more.
- CRC-16 or LRC values are incorrect.

Note: As a countermeasure, provide a timeout process in the communication functions of a higher-level device or in the communication program.

5.3 Example of Setting up Commercially Available SCADA Software

The MODBUS protocol is widely supported by commercially available SCADA and other software. This section shows examples of settings when using WonderWare's SCADA software, or "InTouch", and MODBUS DDE Server.

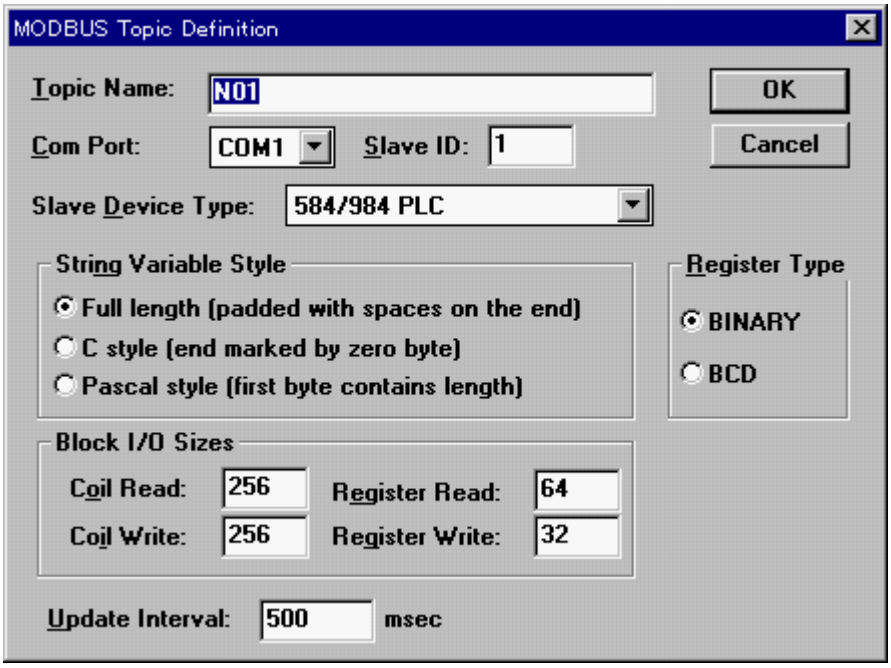
See Also

The documentation of each software for more information on DDE and SCADA software.

The following setting shows an example of providing a DDE integer-type tag variable called "INPUT1" and reading data from D0002 of VJU7 (TC, type K).

● Example of MODBUS DDE setting

This setting uses "N01" as the topic name.



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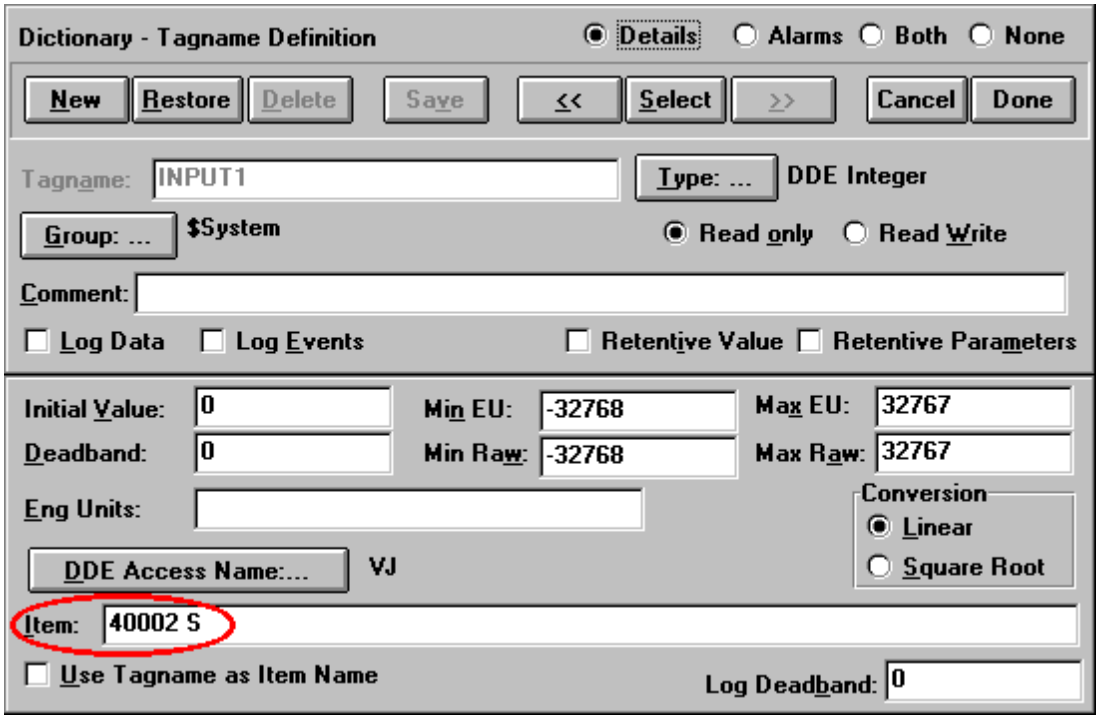
● Example of setting the tag variable of InTouch

In setting "DDE Access Name (D)..." for definition of the tag variable, define the DDE application/server name to be used and the DDE topic name. For the topic name, enter "N01" which was defined in the MODBUS DDE.

For the item name, enter value "40002," obtained by replacing D-register number "D0002" with the MODBUS reference number. "S" indicates that read data is handled with a sign assigned to it.



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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 and output values, statuses, and others that are handled by the VJ Series signal conditioners. By connecting VJ Series signal conditioners to higher-level equipment capable of PC link communication, Ladder communication, or MODBUS communication, you can readily use these internal data items by reading from or writing to the D registers.

6.2 Interpretation of D Register Map Table

This section explains how to interpret the "D Register Map" table. In the example shown below, the number in the leftmost column denotes the register number "1." The five-digit number in the column on the immediate right of the leftmost column represents the reference number for MODBUS communication "2." The number in the column third from left is the register number (hexadecimal) for the MODBUS communication program "3."

Name of D Register Map			
D-Reg No.	**Ref No.**	**H No.**	**Description**
D0001	40001	0000	Status

(1) D register number
(2) Reference number (for MODBUS communication)
(3) Hex number (for MODBUS communication)

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6.3 D Register Map Table

D-Register Data Area			
D-Reg No.	**Ref No.**	**H No.**	**Description**
D0001	40001	0000	Status
D0002	40002	0001	Input value (engineering unit)
D0003	40003	0002	Input value (engineering unit), number of digits below decimal point
D0004	40004	0003	Input value (ratio of input to span, %)
D0008	40008	0007	Output value (%)
D0014	40014	000D	Alarm-1 status
D0015	40015	000E	Alarm-2 status
D0041 to D0044	40041 to 40044	0028 to 002B	Revision
D0045 to D0048	40045 to 40048	002C to 002F	Revision of menu table
D0049 to D0052	40049 to 40052	0030 to 0033	Tag No. 1
D0053 to D0056	40053 to 40056	0034 to 0037	Tag No. 2
D0057 to D0060	40057 to 40060	0038 to 003B	Comment 1
D0061 to D0064	40061 to 40064	003C to 003F	Comment 2
D0065 to D0128	40065 to 40128	0040 to 007F	User area (*1)

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*1: The user area applies when a graphic panel manufactured by Digital Corp. is used. The system data area must be assigned to D0065.

6.3.1 Contents of D Registers

● D0001: Bit configuration of status

The D0001 register represents errors and parameter data by a combination of bits in the register.

In the table below, if any of the events shown occurs, the corresponding bit is set to "1." The bit remains set to "0" if the event has not occurred yet. Note that blank fields indicate bits not used, which are in "0."

Bit	Event
0	EEP error
1	EEP sum error
2	Low-cut status
3	AD off-scale (burnout)
4	Communication error
5	
6	History of power failures
7	RJC error
8	"1" if alarm 1 is on, or "0" if off
9	"1" if alarm 2 is on, or "0" if off
10	Status of contact input
11	Status of contact output
12	Overflow of computation cycle
13	Computation overflow
14	
15	

● D0002, D0003: INPUT1_L, INPUT1_H (input value: engineering unit)

D0002 shows a numeric value and D0003 shows the number of digits below the decimal point.

Input Units	Number of digits belowdecimal point
mA, mV, V	2
°C, K	1

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● D0004: input value (ratio of input value to input span is indicated as a percentage)

● D0008: output value (percentage indication)

Example 1: When the input value (engineering unit) is 680.0 °C for VJU7 (universal temperature converter), thermocouple input, and type K (input range: 0 to 1000°C):

	Contents of D registers	Internal value
D0002: input value (engineering unit)	1A90 (=6800)	680.0 (°C)
D0003: input value (engineering unit), number of digits below decimal point	0001 (=1)	
D0004: input value (%)	02A8 (=680)	68.0 (%)
D0008: output value (%)	02A8 (=680)	68.0 (%)

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Example 2: Representation of negative values

When the input value (engineering unit) is -10.5 °C in the same conditions as above:

	Contents of D registers	Internal value
D0002: input value (engineering unit)	FF97 (= -105)	-10.5 (°C)
D0003: input value (engineering unit), number of digits below decimal point	0001 (=1)	
D0004: input value (%)	FFF5 (= -11)	-1.1 (%)
D0008: output value (%)	FFF5 (= -11)	-1.1 (%)

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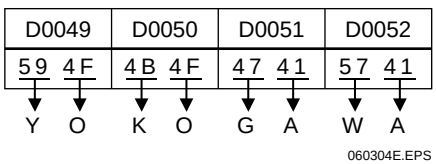
● D0014, D0015: Alarms 1 and 2 ("1" when on or "0" when off)

● D0041 to D0064: Revision, revision of menu table, tag number 1, tag number 2, comment 1, and comment 2

One D register indicates two letters in the ASCII code.

For example, if D0049 to D0052 contain a tag called "YOKOGAWA," each D register shows two letters as follows:



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7. Functions and Usage of I Relays

This chapter describes the functions and usage of the I relays.

The I relays contain information on errors, alarm statuses, and others of the VJ Series signal conditioners. The higher-level device can read data from I relays using PC link communication.

7.1 Status

The following table shows how the I relays are classified.

I Relay Number	Type of Status	Description
1 to 16	On-off	Error information (same contents as those of D0001)
17 to 256		User area (that is used in some devices such as graphic panels)

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CAUTION

- The I relays numbered 1 to 16 store on-off status information. Generally, this area can be accessed to read the on-off status.
- When specifying an I relay number via communication, begin the number with an upper-case letter I. For example, type "I0009" to specify the alarm-1 status (I relay number: 9).
- No data may be written to or read from data storage areas with blank fields in the table below. If you attempt to do so, the VJ Series signal conditioner may fail to operate normally.

I Relay Area	
I Relay Number	**Description**
1	EEP error
2	EEP sum error
3	Low-cut status
4	AD off-scale (burnout)
5	Communication error
6	
7	History of power failures
8	RJC error
9	Alarm 1 status
10	Alarm 2 status
11	Status of contact input
12	Status of contact output
13	Overflow of calculation cycle
14	Calculation overflow
15	
16	
17 to 256	User area

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Appendix Table of ASCII Codes (Alphanumeric Codes)

In order to implement PC link communication, create a transmission/receiving program by referring to the Table of ASCII Codes below.

b8	b7	b6	b5	b4	b3	b2	b1		0 (000)	1 (001)	2 (010)	3 (011)	4 (100)	5 (101)	6 (110)	7 (111)
				0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
				0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
				0	0	1	0	2	STX	DC2	“	2	B	R	b	r
				0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
				0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
				0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
				0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
				0	1	1	1	7	BEL	ETB	‘	7	G	W	g	w
				1	0	0	0	8	BS	CAN	(	8	H	X	h	x
				1	0	0	1	9	HT	EM	)	9	I	Y	i	y
				1	0	1	0	A	LF	SUB	*	:	J	Z	j	z
				1	0	1	1	B	VT	ESC	+	;	K	[	k	{
				1	1	0	0	C	FF	FS	,	<	L	\	l	|
				1	1	0	1	D	CR	GS	-	=	M	]	m	}
				1	1	1	0	E	SO	RS	.	>	N	•	n	~
				1	1	1	1	F	SI	US	/	?	O	_	o	DEL

Control code — Character code

APP01E.EPS

Note: SP($20): space
DEL($7F): control code

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Revision Information

- Title : VJ Series Communication Functions
- Manual No. : IM77J01J11-01E

Aug. 1999/1st Edition
Newly published
June 2004/2nd Edition
Change of the company name.

Written by Yokogawa Electric Corporation

Published by Yokogawa Electric Corporation
2-9-32 Nakacho, Musashino-shi, Tokyo 180-8750, JAPAN

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