Instruction Manual

DIGITAL CONTROLLER COMMUNICATION FUNCTIONS (MODBUS)

TYPE: PXH

Fuji Electric Instruments Co., Ltd.

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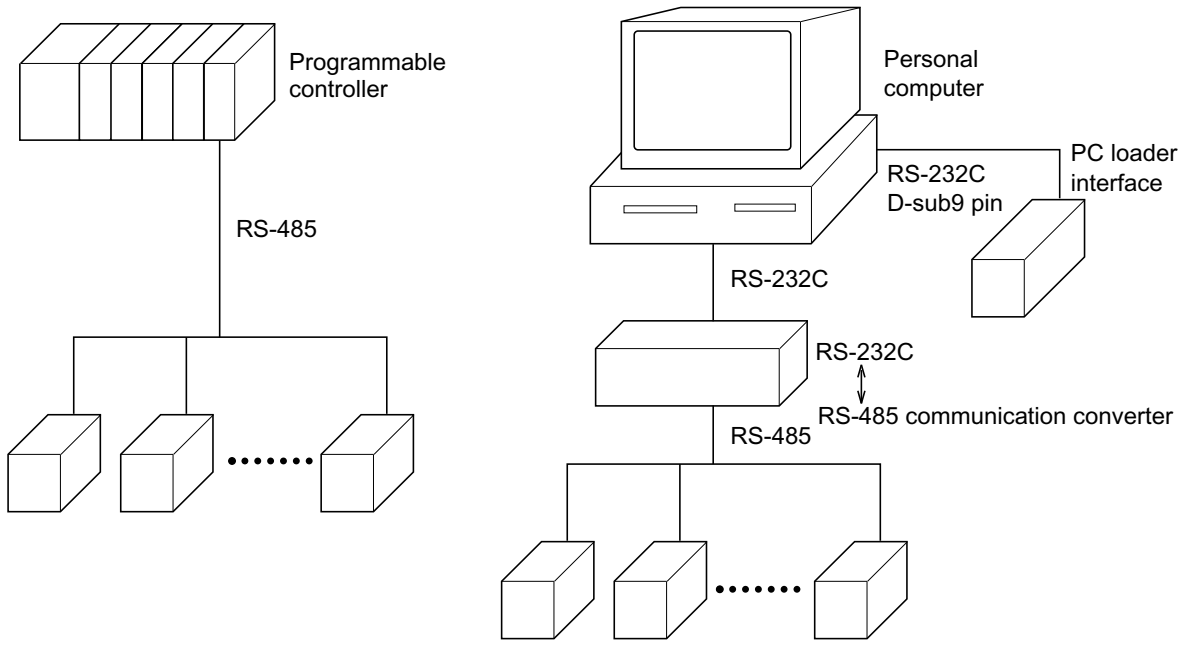
CONTENTS

1. COMMUNICATION FUNCTIONS

1.1 Outline

- Via RS-485 interface and PC loader interface, PXH provides communication functions of transmitting and receiving data to and from host computer, programmable controller, graphic panel, etc.
- The communication system consists of master station and slave stations. For RS-485 communication, up to 31 slave stations (PXHs) can be connected per master station.
  Note that, because the master station can communicate with only one slave station at a time, a party to communicate with must be specified by the "Station No." set at each slave station.
  For loader communication, one slave station (PXH) can be connected per master station.
- In order that the master station and slave station can communicate, the format of the transmit/receive data must coincide. For the PXH, the format of the communication data is determined by the MODBUS protocol.
- Please use an RS-232C ⇔ RS-485 converter in case of designating a personal computer or other devices which have an RS-232C interface as a master station.
  ［RS-232C ⇔ RS-485 converter］ (recommended article)
  Type: RC-77 (isolated type)/ RA SYSTEMS make http://www.ras.co.jp
  Type: K3SC-10 (isolated type)/ OMRON make http://www.omron.co.jp

RS-232C communication with PC is available upon connecting Type: ZZPPXH1*TK4H4563 to PC loader interface where PXH is provided in standard.



Caution:

When using the RS-232C ⇔ RS-485 converter, pay attention to cable connection between the converter and master station. If the cable is not connected correctly, the master station and slave station cannot communicate. In addition, be careful about communication settings such as baud rate and parity set for the converter.

2. SPECIFICATIONS

2.1 Communication Specifications

■ **RS-485**

Item	Specification	
Electrical specification	Based on EIA RS-485	
Transmission method	2-wire, half duplex	
Synchronous system	Start-stop synchronous system	
Connection format	1 : N	
Number connectable units	Up to 31 units	
Transmission distance	500m max. (total extension distance)	
Transmission speed	9600bps, 19200bps, 38400bps	
Data format	Data length	8 bits
	Stop bit	1 bit
	Parity	none, even, odd (selectable)
Transmission code	HEX value (MODBUS RTU mode)	
Error detection	CRC-16	
Isolation	Functional isolation between transmission circuit and others (withstand voltage : 500V AC)	

■ **PC loader interface**

Item	Specification	
Electrical specification	EIA RS232C	
Transmission method	3-wire, half duplex, bit-sereal	
Synchronous system	Start-stop synchronous system	
Connection format	1 : 1	
Transmission speed	9600bps, 19200bps, 38400bps	
Data format	Data length	8 bits
	Stop bit	1 bit
	Parity	none, even, odd (selectable)
Transmission code	HEX value (MODBUS RTU mode)	
Error detection	CRC-16	
Isolation	Non-isolated from internal circuit	

3. CONNECTION

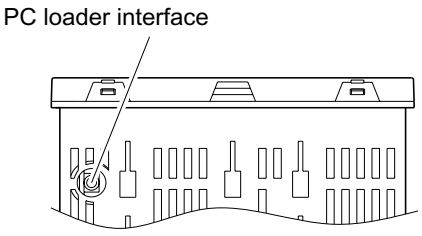
> ⚠ **WARNING**
>
> For avoiding electric shock and malfunctions, do not turn on the power supply until all wiring is completed.

3.1 Communication Terminal Allocation

■ PXH9 (RS-485)

Terminal number	(14)	(15)	(16)
Signal name	RS485 ⊕	SG	RS485 ⊖

■ PXH9 (PC loader interface)

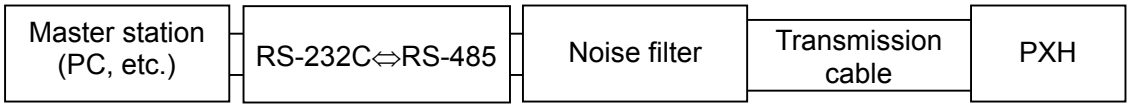


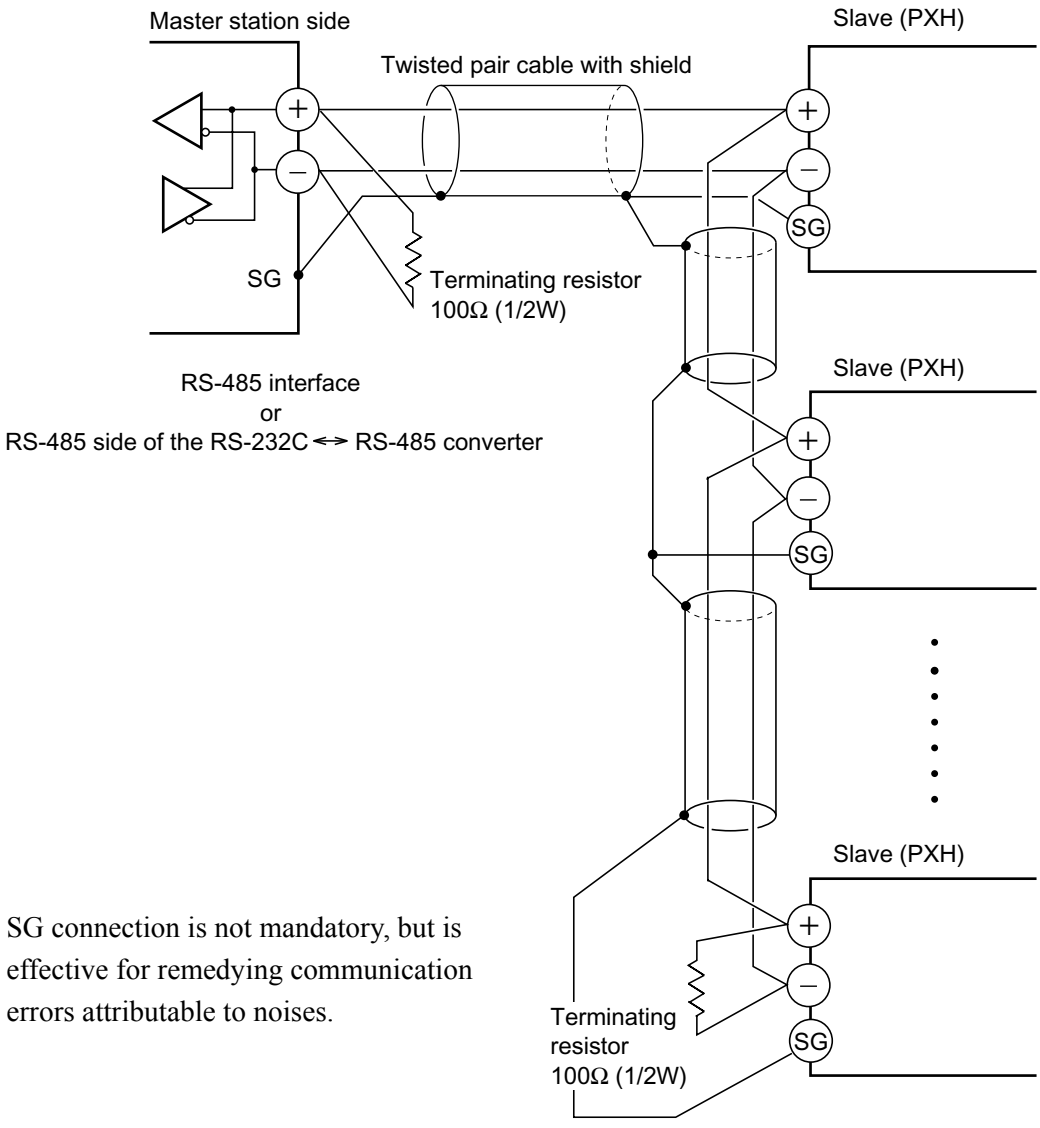
Φ2.5, 3-pole miniature jack

3.2 Wiring

■ **RS-485**

- Use twisted pair cables with shield. Recommended: KPEV-SB (Furukawa Electric make)
- The total extension length of the cable is up to 500 m. A master station and up to 31 units of the PXH can be connected per line.
- Both ends of the cable should be terminated with terminating resistors 100Ω (1/2W or more).
- If the PXH is to be installed where the level of noise applied to the PXH may exceed 1000 V, it is recommended to install a noise filter in the master station side as below.
  Recommended noise filter: ZRAC2203-11 (TDK make)
- If problematic in EMC at communication, loading the communication cable with ferrite can lower the noise level.
  Recommended ferrite core: ZCAT series (TDK make)
  MSFC series (Morimiya Electric make)

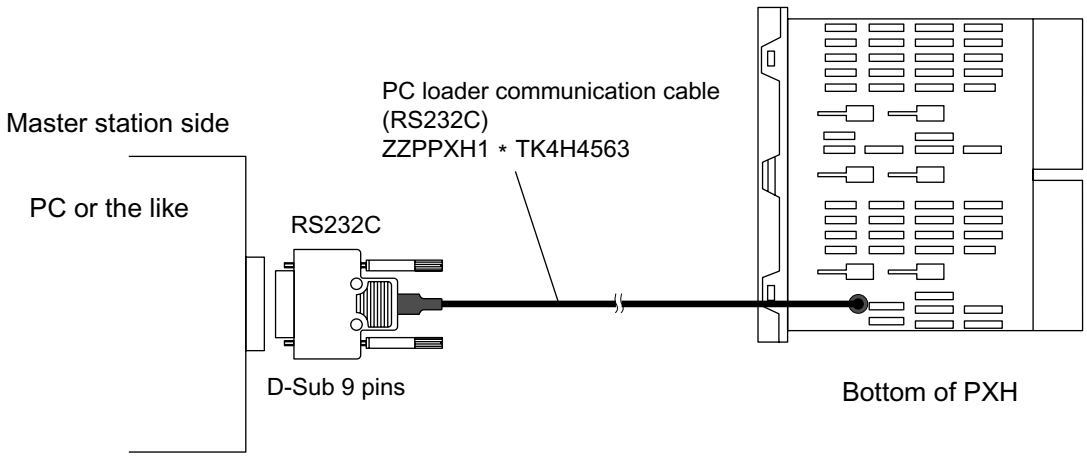




- SG connection is not mandatory, but is effective for remedying communication errors attributable to noises.

■ **PC loader communication**

- Use an optional PC loader communication cable (RS-232C).



4. SETTING OF COMMUNICATION CONDITION

In order that the master station and instrument (PXH) can correctly communicate, following settings are required.

- All communication condition settings of the master station and those of instruments (PXH) are indentical.
- For RS-485 communication, different "station numbers (STN4)" are assigned to all PXHs which are connected to a common line. (Any "Station No." is not shared by more than one instrument.)
- For PC loader communication, the station No. is fixed at "1".
  Both for PC loader communication and RS-485 communication, same station No. "1" may be assigned.

4.1 Setting items

The parameters to be set are shown in the following table. Set them by operating the front panel keys.

■ RS-485

CH B COM Parameter symbol	Item	Value at delivery	Setting range	Remarks
SPD4	Transmission speed	38400bps	96 : 9600bps 192 : 19200bps 384 : 38400bps	Set the same communication condition to the master station and all slave stations.
———	Data length	8 bits	Fixed (can not be changed)	
———	Stop bit	1 bit	Fixed (can not be changed)	
BIT4	Parity setting	odd	8n : none parity 8o : odd parity 8E : even parity	
STN4	Station No.	1	0 to 255 (0: communication function stop)	Set a different number to each station.

■ PC loader communication

CH B COM Parameter symbol	Item	Value at delivery	Setting range	Remarks
SPD2	Transmission speed	38400bps	96 : 9600bps 192 : 19200bps 384 : 38400bps	Set the same conditions as the master station.
———	Data length	8 bits	Fixed (can not be changed)	
———	Stop bit	1 bit	Fixed (can not be changed)	
BIT2	Parity setting	odd	8n : none parity 8o : odd parity 8E : even parity	
———	Station No.	1	Fixed (can not be changed)	

4.2 Setting Operation Method

The following example shows how to set the communication conditions.

Example: For RS-485, set BIT4 parity at even and STN4 at 18.

Key operation	Indication	Description
	200 LP 01 SV 200	Operation status (PV/SV indication) or (PV/MV indication)
SEL	PS1 0000	Press the SEL key to display PS1.
∨	b COM Ch	Press the ∨ key repeatedly until b.COM channel appears. (If past over, press the ∧ key to return.)
SEL	b. STN4 02 1	Press the SEL key to display STN4 parameter.
SEL	b. STN4 02 00001	Press the SEL key. The numeric value on the lower indicator blinks and the setting mode is selected.
>∧∨	b. STN4 02 00018	Press the >, ∧, or ∨ key to change the numeric value to 18.
SEL	b. STN4 02 18	Press the SEL key again. The numeric value stops blinking and the setting is registered.
∨	b. BIT4 04 8o	Press the ∨ key to display the BIT4 parameter.
SEL	b. BIT4 04 8o	Press the SEL key. The numeric value on the lower indicator blinks and the setting mode is selected.
∧∨	b. BIT4 04 8E	Press the ∧ or ∨ key until the numeric value changes to 8E (even parity).
SEL	b. BIT4 04 8E	Press the SEL key again. The numeric value stops blinking and the setting is registered.
DISP	b COM Ch	Press the DISP key to resume b.COM channel indication.
DISP	200 LP 01 SV 200	Press the DISP key to resume the operation status (PV/SV indication).

* Be sure to turn off and on power so that the communication condition settings will affect the control.

5. MODBUS COMMUNICATION PROTOCOL

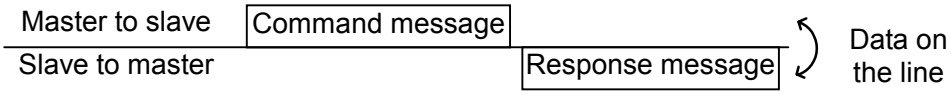
5.1 Outline

The communication system by the MODBUS protocol is that the communication always starts from the master station and a slave station responds to the received message.

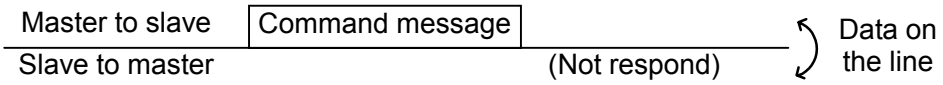
Transmission procedures is as shown below.

1) The master station sends a command message to a slave station.
2) The slave station checks that the station No. in the received message matches with the own station No. or not.
3) If matched, the slave station executes the command and sends back the response message.
4) If mismatched, the slave station leaves the command message and wait for the next command message.

a) In case when the station No. in the received command message matches with the own slave station No.



b) In case when the station No. in the received command message mismatches with the own slave station No.



The master station can individually communicate with any one of slave stations connected on the same line upon setting the station No. in the command message.

5.2 Composition of Message

Command message and response message consist of 4 fields; Station No., Function code, Data and Error check code. And these are sent in the following order.

Station No. (1 byte)
Function code (1 byte)
Data (2 to 69 bytes)
Error check code (CRC-16) (2 bytes)

Fig. 5-1 Composition of message

In the following, each field is explained.

(1) Station No

Station No. is the number specifying a slave station. For RS-485 communication, the command is processed only by the slave station whose station No. matches with the No. set in the parameter "STN4".

For details of setting the parameter "STN4", refer to chapter 4.

For PC loader communication, the station No. is fixed at "1".

(2) Function code

This is a code to designate the function executed at a slave station.

For details, refer to section 5.4.

(3) Data

Data are the data required for executing function codes. The composition of data varies with function codes. For details, refer to chapter 6.

A register number is assigned to each data in the indicating controller. For using the data by communication, designate the register number.

Note that the register number transmitted on message is expressed as its relative address.

The relative address is calculated by the following expression.

$$\boxed{\text{Relateve address}} = \left(\text{The lower 4 digits of the } \boxed{\text{Register number}}\right) - 1$$

For example, when the resister number designated by a function code is 40003,

Relative address = (lower 4 digits of 40003) – 1

= 0002

is used on the message.

(4) Error check code

This is the code to detect message errors (change in bit) in the signal transmission.
On the MODBUS protocol (RTU mode), CRC-16 (Cycric Redundancy Check) is applied.
For CRC calculation method, refer to section 5.5.

5.3 Response of Slave Station

(1) Response for normal command

To a relevant message, the slave station creates and sends back a response message which corresponds to the command message. The composition of message in this case is the same as in section 5.2.

Contents of the data field depend on the function code. For details, refer to Chapter 6.

(2) Response for abnormal command

If contents of a command message have an abnormality (for example, non-actual function code is designated) other than transmission error, the slave station does not execute that command but creates and sends back a response message at error detection.

The composition of response message at error detection is as shown in Fig. 5-2. The value used for function code field is function code of command message plus 80_H.

Table 5-1 gives error codes.

Station No.
Function code + 80_H
Error code
Error check（CRC-16）

Fig. 5-2 Response message at error detection

Table 5-1 Error Code

Error code	Contents	Description
01H	Illegal function code	Non-actual function code is designated. Check for the function code.
02H	Illegal data address	A relative address of resister number to which the designated function code can not be used.
03H	Illegal data value	Because the designation of number is too much, the area where resister numbers do not exist is designated.

(3) No response

Under any of the following items, the slave station takes no action of the command message and sends back no response.

- A station number transmitted in the command message differs from the station number specified to the slave station.
- A error check code is not matched, or a transmission error (parity error, etc.) is detected.
- The time interval between the composition data of the message becomes longer than the time corresponding to 24 bits. (Refer to section 5.6 Transmission Control Procedure.)
- Station No. of a slave station is set as 0.
- A write-in command is sent while executing FIX.

5.4 Function Code

According to MODBUS protocol, register numbers are assigned by function codes.
Each function code acts on specific register number.
This correspondence is shown in Table 5-2, and the message length by function is shown in Table 5-3.

Table 5-2 Correspondence between function codes and objective address

Function code			⟷	Resister No.	
No.	Function	Object		No.	Contents
03_H	Read-out (continuously)	Holding register		4xxxx	Read-out/write-in word data
04_H	Read-out (continuously)	Input register		3xxxx	Read-out word data
06_H	Write-in	Holding register		4xxxx	Read-out/write-in word data
10_H	Write-in (continuously)	Holding register		4xxxx	Read-out/write-in word data

Table 5-3 Function code and message length

[Unit:byte]

	Function code	Contents	Number of designatable data	Command message		Response message	
				Minimum	Maximum	Minimum	Maximum
	03_H	Read-out of word data	32 words	8	8	7	69
	04_H	Read-out of word data (read-out only)	15 words	8	8	7	35
*1	06_H	Write-in of word data	1 word	8	8	8	8
	10_H	Write-in of continuous word data	32 words	11	73	8	8

*1) For PXH, all data is designated by 2 words.
If 06_H (write-in of word data) is used, only 1 lower word can be written in, and only 1 upper word cannot.

5.5 Calculation of Error Check Code (CRC-16)

CRC-16 is the 2-byte (16-bits) error check code. From the top of the message (station No.) to the end of the data field are calculated.

The slave station calculates the CRC of the received message, and does not respond if the calculated CRC is different from the contents of the received CRC code.

Fig. 5-3 shows the flow of the CRC-16 calculation system.

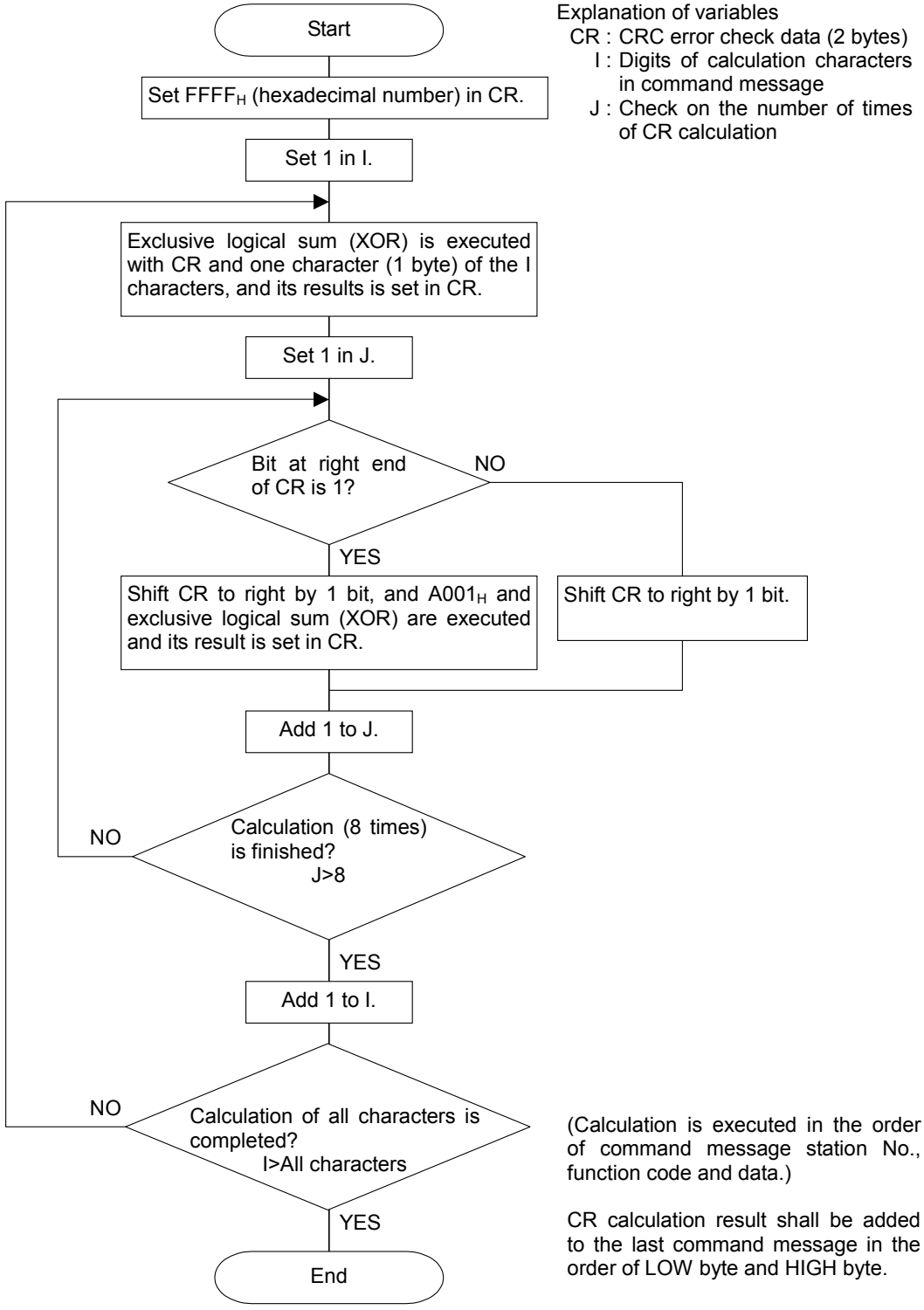


Fig. 5-3 Flow of CRC-16 calculation

5.6 Transmission Control Procedure

(1) Transmission procedure of master station

The master station must proceed to a communication upon conforming to the following items.

(1-1) Before sending a command message, provide 48 bits time or more vacant status.

(1-2) For 1 command message, each field part should be sent below 24 bits time interval.

(1-3) Within 24 bits time after sending a command message, receiving stand-by status starts.

(1-4) Provide 48 bits time or more vacant status between the end of response message reception and beginning of next command message sending [same as in (1-1)].

(1-5) For ensuring the safety, make a confirmation of the response message and make an arrangement so as to provide 3 or more retries in case of no response, error occurrence, etc.

Note) The above definition is minimum requirement. For ensuring the safety, it's recommended the program for the master should be developed with 2 to 3 times margins. Concretely, it is advised to arrange the program for 9600 bps with 10 ms or more for vacant status (1-1), and within 1 ms for byte interval (1-2) and changeover from sending to receiving (1-3).

(2) Description

1) Detection of the message frame

Since the communication system uses the 2-wire RS-485 interface, there may be 2 statuses on a line below. (The same goes with PC loader communication.)

(a) Vacant status (no data on line)

(b) Communication status (data is existing)

Instruments connected on the line are initially at a receiving status and monitoring the line. When 24 bits time or more vacant status has appeared on the line, the end of preceding frame is assumed and, within following 24 bits time, a stand-by status is posted. When data appears on the line, the instruments enter on receiving, and when 24 bits time or more vacant status is detected again, and the end of that frame is assumed. I.e., data which appeared on the line from the first 24 bits time or more vacant status to the next 24 bits time or more vacant status is fetched as one frame.

Therefore, one frame (command message) must be sent upon confirming the following.

(1-1) 48 bits time or more vacant status precedes the command message sending.

(1-2) For 1 command message, each byte should be sent below 24 bits time interval.

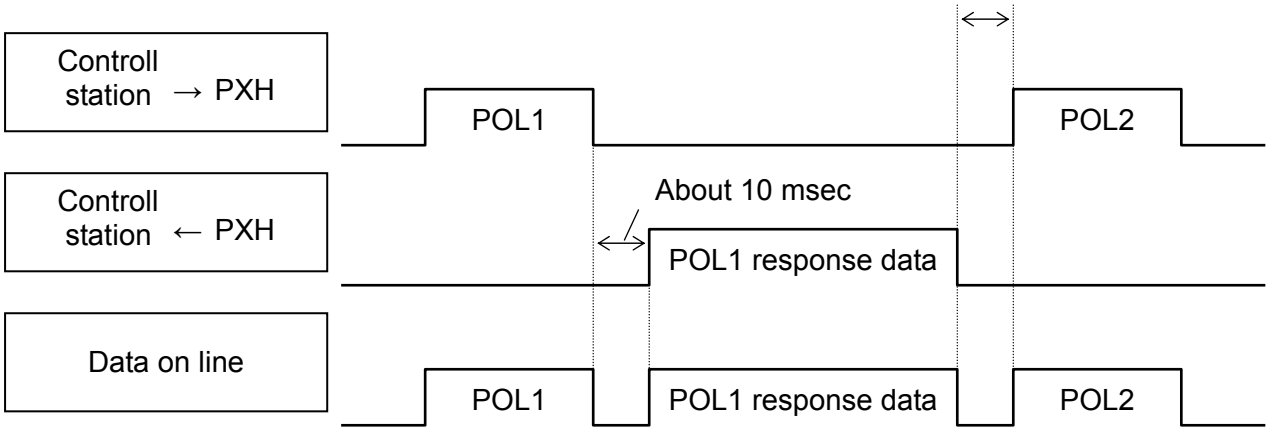
2) Response of this instrument (PXH)

After a frame detection (24 bits time or more vacant status is detected), this instrument carries out processing with that frame as a command message. If the command message is addressed to the own station, a response message is returned. Its processing time is about 10 ms (depends on contents of command message).

After sending a command message, therefore, the master station must observe the following

(1-3) Stand-by status is posted within 24 bits time after sending a command message.

Space of longer than 50msis needed.
(longer than 100ms is recommended.)



5.7 FIX Processing (Cautions in data write)

The instrument is provided inside with a non-volatile memory (EEPROM) for holding the setting parameters. Data written in the non-volatile memory is not lost even if turning off the power.
To hold parameters that were written in the internal memory via communication after turning off the power, the FIX process is effective. It allows parameters to be written in nonvolatile memory.
Fig. 5-4 shows the FIX procedure.

Cautions:

- FIX processing takes approximately 5 seconds to 3 minutes (depending on how many parameters were changed).
- While writing, do not turn off the power of the PXH. Otherwise, the data in the non-volatile memory will be destroyed, whereby the PXH could not be used any longer.
- Don't change parameters on the front panel when performing the FIX procedure, or memory error may result.
- The non-volatile memory (EEPROM) is a device where the number of write-in times is limited. The guaranteed number of write-in times of the non-volatile memory used on the instrument is 100,000 minimum. Therefore, limit the times of FIX processing to bare minimum, like when setting parameters are changed. Refrain from carrying out the FIX processing periodically for example or while such is not absolutely required.

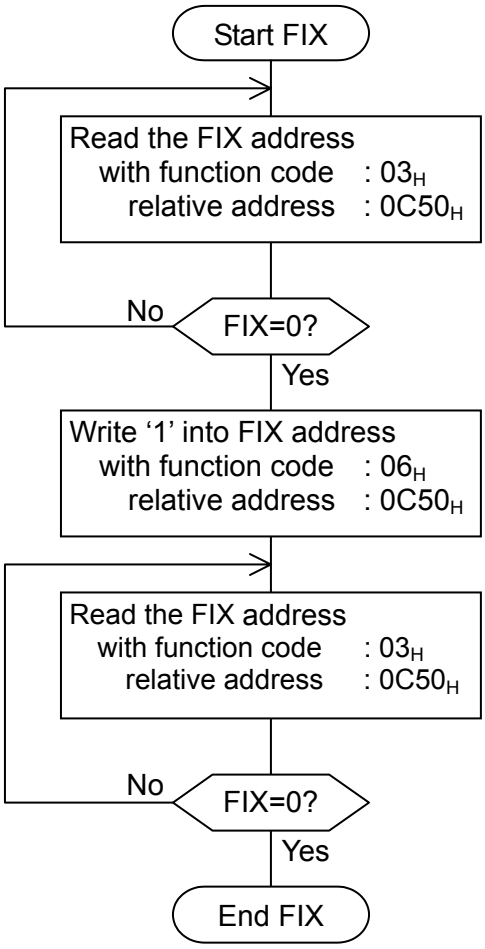


Fig. 5-4 FIX procedure

6. DETAILS OF MESSAGE

6.1 Read-out of Word Data [Function code: 03_H]

Function code	Max. word number read-out in one message	Relative data address	Register No.
03_H	32 words	0000_H – 0E7F	40001-43712

(1) Message composition

Command message composition (byte)

Station No.	
Function code	
Read-out start No. (relative address)	Upper
	Lower
Read-out word number	Upper
	Lower
CRC data	Upper
	Lower

} 1 to 32

Response message composition (byte)

Station No.	
Function code	
Read-out byte number	
State of the first word data	Upper
	Lower
State of the next word data	Upper
	Lower
~	~
State of the last word data	Upper
	Lower
CRC data	Upper
	Lower

Read-out word number × 2

* Arrangement of read-out word data

MSB	LSB
Upper byte of contents of the first word data	
Lower byte of contents of the first word data	
Upper byte of contents of the next word data	
Lower byte of contents of the next word data	
~	~
Upper byte of contents of the last word data	
Lower byte of contents of the last word data	

(2) Function explanation

Words data are read-out, starting from read-out start No. until read-out word number. The slave station transmits the read-out word data in the order of upper and lower bytes.

For PXH for which all data consists of 2 word units, data should be read out by units of 2 words.

Example: Suppose data is 99999 (00 01 86 $9F_H$)

(1) (2) (3) (4)

(3)	86	LH (Low word High byte)
(4)	9F	LL (Low word Low byte)
(1)	00	HH (High word High byte)
(2)	01	HL (High word Low byte)

Suppose data is 1

00	LH
01	LL
00	HH
00	HL

(3) Message transmission

The following shows an example of reading out PV1F (PV1 full scale) from No. 1 station.

Relative address of PV1F (PV1 full scale): 0830_H

Number of data words: 02_H (2 words per data)

Command message composition (byte)

Station No.		01_H
Function code		03_H
Read-out start No. (relative address)	Upper	08_H
	Lower	30_H
Read-out word number	Upper	00_H
	Lower	02_H
CRC data	Upper	$C6_H$
	Lower	64_H

Response message composition (byte)

Station No.		01_H
Function code		03_H
Read-out byte number		04_H
PV1F lower data	Upper	$0F_H$
	Lower	$A0_H$
PV1F upper data	Upper	00_H
	Lower	00_H
CRC data	Upper	$F9_H$
	Lower	05_H

* Meaning of read-out word data

PV1F (PV1 full scale) Upper data (00 00) Lower data (0F $A0_H$) = 4000

6.2 Read-out of Read-out Only Word Data [Function code: 04_H]

Function code	Max. word number read-out in one message	Relative data address	Register No.
04_H	15 words	$0000_H – 0563_H$	30001-31380

(1) Message composition

Command message composition (byte)

Station No.	
Function code	
Read-out start No. (relative address)	Upper
	Lower
Read-out word number	Upper
	Lower
CRC data	Upper
	Lower

} 1 to 15

Response message composition (byte)

Station No.	
Function code	
Read-out byte number	
State of the first word data	Upper
	Lower
State of the next word data	Upper
	Lower
~	~
State of the last word data	Upper
	Lower
CRC data	Upper
	Lower

Read-out word number × 2

* Arrangement of read-out word data

MSB	LSB
Upper byte of contents of the first word data	
Lower byte of contents of the first word data	
Upper byte of contents of the next word data	
Lower byte of contents of the next word data	
~	~
Upper byte of contents of the last word data	
Lower byte of contents of the last word data	

(2) Function explanation

Words data are read-out, starting from read-out start No. until read-out word number. The slave station transmits the read-out word data in the order of upper and lower bytes.

For PXH for which all data consists of 2 word units, data is read out by units of 2 words.

(1) (2) (3) (4)

Example: Suppose data is –2 (FF FF FF FE_H)

(3)	FF	LH
(4)	FE	LL
(1)	FF	HH
(2)	FF	HL

(3) Message transmission

The following shows an example of reading out PV value from No. 1 station.

Relative address of PV value: 0102_H

Data number: 02_H (2 words per data)

Command message composition (byte)

Station No.		01_H
Function code		04_H
Read-out start No. (relative address)	Upper	01_H
	Lower	02_H
Read-out word number	Upper	00_H
	Lower	02_H
CRC data	Upper	$D1_H$
	Lower	$F7_H$

Response message composition (byte)

Station No.		01_H
Function code		04_H
Read-out byte number		04_H
PV1 lower data	Upper	38_H
	Lower	80_H
PV1 upper data	Upper	00_H
	Lower	01_H
CRC data	Upper	36_H
	Lower	CC_H

* Meaning of read-out word data

PV1 measurement data 00 01 38 80_H = 80000

If
decimal point position PV1D = 2
unit PV1U = °C
} 800.00°C

6.3 Write-in of Word Data (1 word) [Function code: 06_H]

Function code	Max. word number write-in in one message	Relative data address	Register No.
06_H	1 word	0000_H－$0E7E_H$	40001－43711

(1) Message composition

Command message composition (byte)

Station No.	
Function code	
Write-in designate No. (relative address)	Upper
	Lower
Write-in word data	Upper
	Lower
CRC data	Upper
	Lower

Response message composition (byte)

Station No.	
Function code	
Write-in designate No. (relative address)	Upper
	Lower
Write-in word data	Upper
	Lower
CRC data	Upper
	Lower

(2) Function explanation

Designated data is written in word data of write-in designate No. Write-in data are transmitted from master station in the order of upper and lower bytes.

For PXH, all data consist of 2 word units. If 06H (write-in of word data) is used, only 1 lower word of 2 word data can be written in, and only 1 upper word of 2 word data cannot.

(3) Message transmission (example)

The following shows an example of setting 100.0 (1000_D=$03E8_H$) to the parameter "P1" of No.1 slave station.

Parameter "P1" Relative address: 0282_H

Command message composition (byte)

Station No.		01_H
Function code		06_H
Write-in designate No. (relative address)	Upper	02_H
	Lower	82_H
State of write-in designation	Upper	03_H
	Lower	$E8_H$
CRC data	Upper	28_H
	Lower	$E4_H$

Response message composition (byte)

Station No.		01_H
Function code		06_H
Write-in designate No. (relative address)	Upper	02_H
	Lower	82_H
State of write-in designation	Upper	03_H
	Lower	$E8_H$
CRC data	Upper	28_H
	Lower	$E4_H$

Note When setting is being locked, response is returned normally, but the command is not executed. Make sure that setting is not locked to send the write-in command.

The setting lock parameter can be written in even if communication setting is invalidated.

If the write-in command message is sent to any slave station during the FIX process, response is not returned from it.

6.4 Write-in of Continuous Word Data [Function code: 10_H]

Function code	Max. word number write-in in one message	Relative data address	Register No.
10_H	32 words	0000_H－$0E7F_H$	40001－43712

(1) Message composition

Command message composition (byte)

Station No.		
Function code		
Write-in start No. (relative address)	Upper	
	Lower	
Write-in word number	Upper	1 to 32
	Lower	
Write-in byte number		Write-in word number × 2
First write-in word data	Upper	
	Lower	
Next write-in word data	Upper	
	Lower	
~		~
Last write-in word data	Upper	
	Lower	
CRC data	Upper	
	Lower	

Response message composition (byte)

Station No.	
Function code	
Write-in start No. (relative address)	Upper
	Lower
Write-in word number	Upper
	Lower
CRC data	Upper
	Lower

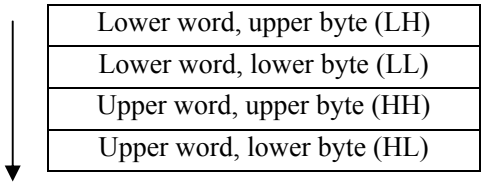
* Arrangement of write-in word data

MSB	LSB
Upper byte of contents of the first word data	
Lower byte of contents of the first word data	
Upper byte of contents of the next word data	
Lower byte of contents of the next word data	
~	~
Upper byte of contents of the last word data	
Lower byte of contents of the last word data	

(2) Function explanation

Words data are written in, starting from write-in start No. until write-in word number. Write-in word data are transmitted from master station in the order of upper and lower bytes.

For PXH for which all data consists of 2 word units, write in data by units of 2 words in the order illustrated below.



(3) Message transmission (example)

The following shows an example of writing-in P1 = 100.0, I1 = 10, and D1 = 5.0 to No. 1 slave station.

$P1 = 03E8_H$ (= 1000_D)

$I1 = 0064_H$ (= 100_D)

$D1 = 0032_H$ (= 50_D)

Parameter "P1" Relative address:0282_H Data number:06_H (2 words per data)

Command message composition (byte)

Station No.		01_H
Function code		10_H
Write-in start No.	Upper	02_H
	Lower	82_H
Write-in word number	Upper	00_H
	Lower	06_H
Write-in byte number		$0C_H$
P1 lower data	Upper	03_H
	Lower	$E8_H$
P1 upper data	Upper	00_H
	Lower	00_H
I1 lower data	Upper	00_H
	Lower	64_H
I1 upper data	Upper	00_H
	Lower	00_H
D1 lower data	Upper	00_H
	Lower	32_H
D1 upper data	Upper	00_H
	Lower	00_H
CRC data	Upper	$B6_H$
	Lower	$D8_H$

Response message composition (byte)

Station No.		01_H
Function code		10_H
Write-in start No.	Upper	02_H
	Lower	82_H
Write-in word number	Upper	00_H
	Lower	06_H
CRC data	Upper	$E1_H$
	Lower	$9B_H$

Point Since the transmission data can not include a decimal point, data of 100.0 is transmitted as "1000".
For transmission format of each data, refer to the address map (Chapter 7).

Caution When setting is being locked, response is returned normally. However, the command is not executed. If the write-in command message is sent to any slave station during the FIX process, response is not returned from it.

7. ADDRESS MAP AND DATA FORMAT

7.1 Data Format

7.1.1 Transmission data format

The MODBUS protocol used in this instrument (PXH) is RTU (Remote Terminal Unit) mode.
Transmitted data is "numeric value" and not "ASCII code".

7.1.2 Engineering unit

This instrument can handle set value data or other data which are affected by input range as follows.
Engineering unit: Subjected to scaling to match the actual value according to input range

[Example] The value of "PV = 150" (input range: 0º to 400ºC)

	Register No.	Data (HEX)	→	Data (decimal)
Engineering unit	0102	00000096_H		150

● How to change the input range setting via communication

The input range setting is for full scale, base scale and decimal point position setting.
In order that the change of input range setting will affect the control, power must be turned off and on, or the reset command must be executed.
Changing the decimal point position automatically changes the full scale and base scale settings.
Example: Changing the input range from 0 to 400, to 0.0 to 400.0

(1) PV1D = 0 → 1 (automatically changes as PV1F = 400 → 400.0, PV1B = 0 → 0.0)
↓
(2) FIX command (see 5.7)
↓
(3) Power OFF-ON or execute reset command (write 1 at relative address 0060H)

● Input range dependent data (see communication address map)

Input range dependent data must be reset after turning off and on power or after transmitting a reset command subsequent to a change of input range.

(1) Input range setting change
↓
(2) FIX command (see 5.7)
↓
(3) Power off and on or execute reset (write 1 at relative address 0060H)
↓
(4) Reset all data depending upon by input range

7.1.3 Handling of decimal point

No decimal point is added to transmission data.

For data given in the following table, carry out an alignment of decimal point. (Decimal point should be removed in transmission, and should be added in receiving data.)

Word data [read-out/write-in]

Digits below decimal point	Kind	Register No.	Digits below decimal point	Kind	Register No.
Designate by UCD1 if TPLT = 10, 11 (0 to 3) Designate by PV1D if TPLT = 13, 14 (0 to 3)	AL1	40257	Designate by PV1D (0 to 3)	PV1F	42097
	A1-L	40257		PV1B	42099
	A1-H	40259		PV1Z	42107
	AL2	40273		PV1S	42109
	A2-L	40273	Designate by PV2D (0 to 3)	PV2F	42129
	A2-H	40275		PV2B	42131
	AL3	40289		PV2Z	42139
	A3-L	40289		PV2S	42141
	A3-H	40291	Designate by AI1D (0 to 3)	AI1F	42193
	AL4	40305		AI1B	42195
	A4-L	40305		AI1Z	42203
	A4-H	40307		AI1S	42205
	AL5	40321	Designate by UCD1 (0 to 3)	UCF1	42081
	A5-L	40321		UCB1	42083
	A5-H	40323	1 digit below decimal point	P1	40643
	AL6	40337		I1	40645
	A6-L	40337		D1	40647
	A6-H	40339		MVH1	40659
	AL7	40353		MVL1	40661
	A7-L	40353		DMV1	40667
	A7-H	40355		BAL1	40677
	AL8	40369		PMV1	40685
	A8-L	40369		ALP1	40833
	A8-H	40371		BET1	40841
	1HYS	40265		P-1	41027
	2HYS	40281		I-1	41029
	3HYS	40297		D-1	41031
	4HYS	40313		BL-1	41045
	5HYS	40329		P-2	41059
	6HYS	40345		I-2	41061
	7HYS	40361		D-2	41063
	8HYS	40377		BL-2	41077
	SV_L1	40641		P-3	41091
	ARH1	40651		I-3	41093
	ARL1	40653		D-3	41095
	SH1	40655		BL-3	41109
	SL1	40657		P-4	41123
	HS1	40671		I-4	41125
	SV1	41025		D-4	41127
	ARH1	41035		BL-4	41141
	ARL1	41037		P-5	41155
	HYS1	41039		I-5	41157
	REF1	41047		D-5	41159
	SV2	41057		BL-5	41173
	ARH2	41067		P-6	41187
	ARL2	41069		I-6	41189
	HYS2	41071		D-6	41191
	REF2	41079		BL-6	41205
	SV3	41089		P-7	41219
	ARH3	41099		I-7	41221
	ARL3	41101		D-7	41223

Digits below decimal point	Kind	Register No.	Digits below decimal point	Kind	Register No.
Designate by UCD1 if TPLT = 10, 11 (0 to 3) Designate by PV1D if TPLT = 13, 14 (0 to 3)	HYS3	41103	1 digit below decimal point	BL-7	41237
	REF3	41111		P1CU	42117
	SV4	41121		P1TF	42119
	ARH4	41131		P2CU	42149
	ARL4	41133		P2TF	42151
	HYS4	41135		A1CU	42211
	REF4	41143		A1TF	42213
	SV5	41153		AO1L	42435
	ARH5	41163		AO1H	42437
	ARL5	41165		A1LL	42439
	HYS5	41167		A1LH	42441
	REF5	41175		AO2L	42451
	SV6	41185		AO2H	42453
	ARH6	41195		A2LL	42455
	ARL6	41197		A2LH	42457
	HYS6	41199		KF1	40849
	REF6	41207		B1F1	40851
	SV7	41217		B2F1	40853
	ARH7	41227			
	ARL7	41229			
	HYS7	41231			
	REF7	41239			

Word data [read-out only]

Digits below decimal point	Kind	Register No.	Digits below decimal point	Kind	Register No.
Designate by UCD1 if TPLT = 10, 11 (0 to 3) Designate by PV1D if TPLT = 13, 14 (0 to 3)	PV1	30259	Designate by PV1D (0 to 3)	PV1	31025
	SV1	30261			
	DV1	30263	Designate by PV2D (0 to 3)	PV2	31027
			Designate by AI1D (0 to 3)	AI1	31031
			Designate by UCD1 (0 to 3)	AIM	31345
			1 digit below decimal point	MV1	30265
				AO1	31105
				AO2	31107
				AMV1	31381
				FFV1	31389
			2 digits below decimal point	RCJ1	31057
				RCJ2	31059

7.1.4 Data when input is abnormal

When "UUUU" or "LLLL" is displayed on the face panel on account of over-range, under-range or input burnout for example, PV read-out value (register No. 30259) is 105% or –5% of input range.

Presence of any input abnormality via communication can be detected by:

"Register No. 30269: Input abnormal status"

7.1.5 Range of write-in data

When data is written in each parameter, the write-in data should be kept within the setting range. PXH can accept the write-in data beyond the range, however, be careful since the PXH performance will not be guaranteed.

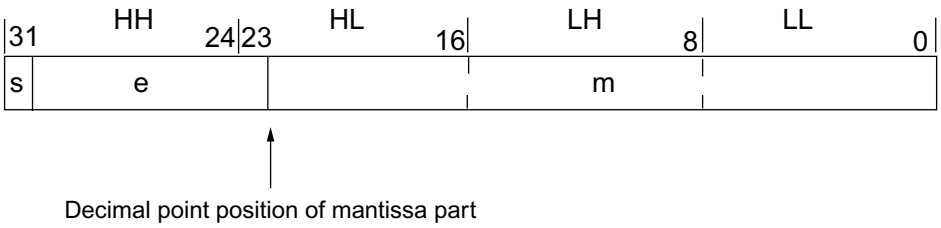
7.1.6 Floating decimal point type

The mathematical calculation constant uses the floating decimal point type at communication.

Type name	Sign	Bits
Floating decimal point type	Yes	32 (2 words)

(1) Floating decimal point type data format

Floating decimal point (float) data of a binary number is expressed by the data format shown in [Fig. 7-1].



s : Sign of mantissa part (1 bit)
e : Exponent part (8 bits)
m : Mantissa part (23 bits)

Fig. 7-1 Floating decimal point type data format

7.2 Communication Address Map

Caution: Never write data into addresses which are not disclosed to users.
Otherwise a failure may be caused.

For detailed contents about individual parameter function or setting range, refer to the user's manual.

Word data [read-out/write-in] : Function code [03_H, 06_H, 10_H]

Relative address	Register No.	Parameter name	Parameter contents	Read-out data	Write-in data setting range	Affected by input range	Remarks or corresponding parameter
0000H	40001	REM1	Remote mode	0: Auto 1: Remote			
0010H	40017	STBY	Standby command	0: OFF 1: ON			
0014H	40021	AT	Auto tuning command	0: AT Not activated 1: AT Activated	0: AT Stop 1: AT Execute		
0020H	40033	LACH	Alarm unlatch command	0: Latched 1: Unlatched	0: No effect 1: Unlatch		
0030H	40049	PLTN	Palette signal selection	0 to 7			
0040H	40065	LOC	Key lock	0 to 5			
0060H	40097	RES	Reset command	0: Operating normally 1: Being reset	0: No effect 1: Execute resetting		
0100H	40257	AL1	Alarm 1 setting	▪ Engineering unit setting		*	
0100H	40257	A1-L	Alarm 1 low limit setting	Absolute value alarm: 0 to 100%FS		*	
0102H	40259	A1-H	Alarm 1 high limit setting	Deviation alarm: –100 to 100%FS		*	
0104H	40261	1 TP	Alarm 1 type	0 to 11, 16 to 32, 35 to 38			
0106H	40263	1 OP	Alarm 1 option	0 to 15 (0000B to 1111B)			
0108H	40265	1HYS	Alarm 1 hysteresis	▪ Engineering unit setting (0 to 50%FS)		*	
010AH	40267	1DLY	Alarm 1 delay time	0 to 9999 (sec or min)			
0110H	40273	AL2	Alarm 2 setting	▪ Engineering unit setting		*	
0110H	40273	A2-L	Alarm 2 low limit setting	Absolute value alarm: 0 to 100%FS		*	
0112H	40275	A2-H	Alarm 2 high limit setting	Deviation alarm: –100 to 100%FS		*	
0114H	40277	2 TP	Alarm 2 type	0 to 11, 16 to 32, 35 to 38			
0116H	40279	2 OP	Alarm 2 option	0 to 15 (0000B to 1111B)			
0118H	40281	2HYS	Alarm 2 hysteresis	▪ Engineering unit setting (0 to 50%FS)		*	
011AH	40283	2DLY	Alarm 2 delay time	0 to 9999 (sec or min)			
0120H	40289	AL3	Alarm 3 setting	▪ Engineering unit setting		*	
0120H	40289	A3-L	Alarm 3 low limit setting	Absolute value alarm: 0 to 100%FS		*	
0122H	40291	A3-H	Alarm 3 high limit setting	Deviation alarm: –100 to 100%FS		*	
0124H	40293	3 TP	Alarm 3 type	0 to 11, 16 to 32, 35 to 38			
0126H	40295	3 OP	Alarm 3 option	0 to 15 (0000B to 1111B)			
0128H	40297	3HYS	Alarm 3 hysteresis	▪ Engineering unit setting (0 to 50%FS)		*	
012AH	40299	3DLY	Alarm 3 delay time	0 to 9999 (sec or min)			
0130H	40305	AL4	Alarm 4 setting	▪ Engineering unit setting		*	
0130H	40305	A4-L	Alarm 4 low limit setting	Absolute value alarm: 0 to 100%FS		*	
0132H	40307	A4-H	Alarm 4 high limit setting	Deviation alarm: –100 to 100%FS		*	
0134H	40309	4 TP	Alarm 4 type	0 to 11, 16 to 32, 35 to 38			
0136H	40311	4 OP	Alarm 4 option	0 to 15 (0000B to 1111B)			
0138H	40313	4HYS	Alarm 4 hysteresis	▪ Engineering unit setting (0 to 50%FS)		*	
013AH	40315	4DLY	Alarm 4 delay time	0 to 9999 (sec or min)			
0140H	40321	AL5	Alarm 5 setting	▪ Engineering unit setting		*	
0140H	40321	A5-L	Alarm 5 low limit setting	Absolute value alarm: 0 to 100%FS		*	
0142H	40323	A5-H	Alarm 5 high limit setting	Deviation alarm: –100 to 100%FS		*	
0144H	40325	5 TP	Alarm 5 type	0 to 11, 16 to 32, 35 to 38			
0146H	40327	5 OP	Alarm 5 option	0 to 15 (0000B to 1111B)			
0148H	40329	5HYS	Alarm 5 hysteresis	▪ Engineering unit setting (0 to 50%FS)		*	
014AH	40331	5DLY	Alarm 5 delay time	0 to 9999 (sec or min)			

Relative address	Register No.	Parameter name	Parameter contents	Read-out data	Write-in data setting range	Affected by input range	Remarks or corresponding parameter
0150H	40337	AL6	Alarm 6 setting	▪ Engineering unit setting		*	
0150H	40337	A6-L	Alarm 6 low limit setting	Absolute value alarm: 0 to 100%FS		*	
0152H	40339	A6-H	Alarm 6 high limit setting	Deviation alarm: –100 to 100%FS		*	
0154H	40341	6 TP	Alarm 6 type	0 to 11, 16 to 32, 35 to 38			
0156H	40343	6 OP	Alarm 6 option	0 to 15 (0000B to 1111B)			
0158H	40345	6HYS	Alarm 6 hysteresis	▪ Engineering unit setting (0 to 50%FS)		*	
015AH	40347	6DLY	Alarm 6 delay time	0 to 9999 (sec or min)			
0160H	40353	AL7	Alarm 7 setting	▪ Engineering unit setting		*	
0160H	40353	A7-L	Alarm 7 low limit setting	Absolute value alarm: 0 to 100%FS		*	
0162H	40355	A7-H	Alarm 7 high limit setting	Deviation alarm: –100 to 100%FS		*	
0164H	40357	7 TP	Alarm 7 type	0 to 11, 16 to 32, 35 to 38			
0166H	40359	7 OP	Alarm 7 option	0 to 15 (0000B to 1111B)			
0168H	40361	7HYS	Alarm 7 hysteresis	▪ Engineering unit setting (0 to 50%FS)		*	
016AH	40363	7DLY	Alarm 7 delay time	0 to 9999 (sec or min)			
0170H	40369	AL8	Alarm 8 setting	▪ Engineering unit setting		*	
0170H	40369	A8-L	Alarm 8 low limit setting	Absolute value alarm: 0 to 100%FS		*	
0172H	40371	A8-H	Alarm 8 high limit setting	Deviation alarm: –100 to 100%FS		*	
0174H	40373	8 TP	Alarm 8 type	0 to 11, 16 to 32, 35 to 38			
0176H	40375	8 OP	Alarm 8 option	0 to 15 (0000B to 1111B)			
0178H	40377	8HYS	Alarm 8 hysteresis	▪ Engineering unit setting (0 to 50%FS)		*	
017AH	40379	8DLY	Alarm 8 delay time	0 to 9999 (sec or min)			
0210H	40529	EXM1	External manipulation variable setting	–250 to 1250 (–25.0 to 125.0%)			
0280H	40641	SV_L1	Local SV	▪ Engineering unit setting (–25 to 125%FS)		*	
0282H	40643	P1	Proportional band	0 to 9999 (0.0 to 999.9%)			
0284H	40645	I1	Integral time	0 to 32000 (0.0 to 3200.0sec)			
0286H	40647	D1	Derivative time	0 to 9999 (0.0 to 999.9sec)			
028AH	40651	ARH1	Anti-reset windup high limit setting	▪ Engineering unit setting (0 to 100%FS)		*	
028CH	40653	ARL1	Anti-reset windup low limit setting			*	
028EH	40655	SH1	SV high limit	▪ Engineering unit setting (–25 to 125%FS)		*	
0290H	40657	SL1	SV low limit			*	
0292H	40659	MVH1	MV high limit setting	–250 to 1250 (–25.0 to 125.0%)			
0294H	40661	MVL1	MV low limit setting				
029AH	40667	DMV1	MV change ratio limit setting	0 to 1500 (0.0 to 150.0%)			
029CH	40669	DT1	Sampling rate	5 to 1000 (50 to 10000msec)			
029EH	40671	HS1	Hysteresis setting	▪ Engineering unit setting (0 to 50%FS)		*	
02A4H	40677	BAL1	Manipulating output convergence value	–1000 to 1000 (–100.0 to 100.0%)			
02A6H	40679	TC1	Control output (MV1) proportional period	1 to 150sec			
02A8H	40681	REV1	Control action setting	0: NRML 1: REV			Turn off and on power
02ACH	40685	PMV1	Manipulating output preset value	–250 to 1250 (–25.0 to 125.0%)			
0340H	40833	ALP1	2 degrees of freedom coefficient α	–3000 to 3000 (–300.0 to 300.0%)			
0348H	40841	BET1	2 degrees of freedom coefficient β	0 to 9999 (0.0 to 999.9%)			
0350H	40849	KF1	Sets Feed Forward Gain and bias 1, bias 2. [FF=KF1 × (Input – B1F) + B2F]	–10000 to 10000			
0352H	40851	B1F1					
0354H	40853	B2F1					
0400H	41025	SV1	Setpoint 1	▪ Engineering unit setting (–25 to 125%FS)		*	
0402H	41027	P-1	Proportional band 1	0 to 9999 (0.0 to 999.9%)			
0404H	41029	I-1	Integral time 1	0 to 32000 (0.0 to 3200.0sec)			
0406H	41031	D-1	Derivative time 1	0 to 9999 (0.0 to 999.9sec)			
040AH	41035	ARH1	Anti-reset windup high limit 1	▪ Engineering unit setting (0 to 100%FS)		*	
040CH	41037	ARL1	Anti-reset windup low limit 1			*	

Relative address	Register No.	Parameter name	Parameter contents	Read-out data	Write-in data setting range	Affected by input range	Remarks or corresponding parameter
040EH	41039	HYS1	Hysteresis setting 1	▪ Engineering unit setting (0 to 50%FS)		*	
0414H	41045	BL-1	Output convergence value 1	–1000 to 1000 (–100.0 to 100.0%)			
0416H	41047	REF1	PID change point 1	▪ Engineering unit setting (–25 to 125%FS)		*	
0420H	41057	SV2	Setpoint 2	▪ Engineering unit setting (–25 to 125%FS)		*	
0422H	41059	P-2	Proportional band 2	0 to 9999 (0.0 to 999.9%)			
0424H	41061	I-2	Integral time 2	0 to 32000 (0.0 to 3200.0sec)			
0426H	41063	D-2	Derivative time 2	0 to 9999 (0.0 to 999.9sec)			
042AH	41067	ARH2	Anti-reset windup high limit 2	▪ Engineering unit setting (0 to 100%FS)		*	
042CH	41069	ARL2	Anti-reset windup low limit 2			*	
042EH	41071	HYS2	Hysteresis setting 2	▪ Engineering unit setting (0 to 50%FS)		*	
0434H	41077	BL-2	Output convergence value 2	–1000 to 1000 (–100.0 to 100.0%)			
0436H	41079	REF2	PID change point 2	▪ Engineering unit setting (–25 to 125%FS)		*	
0440H	41089	SV3	Setpoint 3	▪ Engineering unit setting (–25 to 125%FS)		*	
0442H	41091	P-3	Proportional band 3	0 to 9999 (0.0 to 999.9%)			
0444H	41093	I-3	Integral time 3	0 to 32000 (0.0 to 3200.0sec)			
0446H	41095	D-3	Derivative time 3	0 to 9999 (0.0 to 999.9sec)			
044AH	41099	ARH3	Anti-reset windup high limit 3	▪ Engineering unit setting (0 to 100%FS)		*	
044CH	41101	ARL3	Anti-reset windup low limit 3			*	
044EH	41103	HYS3	Hysteresis setting 3	▪ Engineering unit setting (0 to 50%FS)		*	
0454H	41109	BL-3	Output convergence value 3	–1000 to 1000 (–100.0 to 100.0%)			
0456H	41111	REF3	PID change point 3	▪ Engineering unit setting (–25 to 125%FS)		*	
0460H	41121	SV4	Setpoint 4	▪ Engineering unit setting (–25 to 125%FS)		*	
0462H	41123	P-4	Proportional band 4	0 to 9999 (0.0 to 999.9%)			
0464H	41125	I-4	Integral time 4	0 to 32000 (0.0 to 3200.0sec)			
0466H	41127	D-4	Derivative time 4	0 to 9999 (0.0 to 999.9sec)			
046AH	41131	ARH4	Anti-reset windup high limit 4	▪ Engineering unit setting (0 to 100%FS)		*	
046CH	41133	ARL4	Anti-reset windup low limit 4			*	
046EH	41135	HYS4	Hysteresis setting 4	▪ Engineering unit setting (0 to 50%FS)		*	
0474H	41141	BL-4	Output convergence value 4	–1000 to 1000 (–100.0 to 100.0%)			
0476H	41143	REF4	PID change point 4	▪ Engineering unit setting (–25 to 125%FS)		*	
0480H	41153	SV5	Setpoint 5	▪ Engineering unit setting (–25 to 125%FS)		*	
0482H	41155	P-5	Proportional band 5	0 to 9999 (0.0 to 999.9%)			
0484H	41157	I-5	Integral time 5	0 to 32000 (0.0 to 3200.0sec)			
0486H	41159	D-5	Derivative time 5	0 to 9999 (0.0 to 999.9sec)			
048AH	41163	ARH5	Anti-reset windup high limit 5	▪ Engineering unit setting (0 to 100%FS)		*	
048CH	41165	ARL5	Anti-reset windup low limit 5			*	
048EH	41167	HYS5	Hysteresis setting 5	▪ Engineering unit setting (0 to 50%FS)		*	
0494H	41173	BL-5	Output convergence value 5	–1000 to 1000 (–100.0 to 100.0%)			
0496H	41175	REF5	PID change point 5	▪ Engineering unit setting (–25 to 125%FS)		*	
04A0H	41185	SV6	Setpoint 6	▪ Engineering unit setting (–25 to 125%FS)		*	
04A2H	41187	P-6	Proportional band 6	0 to 9999 (0.0 to 999.9%)			
04A4H	41189	I-6	Integral time 6	0 to 32000 (0.0 to 3200.0sec)			
04A6H	41191	D-6	Derivative time 6	0 to 9999 (0.0 to 999.9sec)			
04AAH	41195	ARH6	Anti-reset windup high limit 6	▪ Engineering unit setting (0 to 100%FS)		*	
04ACH	41197	ARL6	Anti-reset windup low limit 6			*	
04AEH	41199	HYS6	Hysteresis setting 6	▪ Engineering unit setting (0 to 50%FS)		*	
04B4H	41205	BL-6	Output convergence value 6	–1000 to 1000 (–100.0 to 100.0%)			
04B6H	41207	REF6	PID change point 6	▪ Engineering unit setting (–25 to 125%FS)		*	
04C0H	41217	SV7	Setpoint 7	▪ Engineering unit setting (–25 to 125%FS)		*	
04C2H	41219	P-7	Proportional band 7	0 to 9999 (0.0 to 999.9%)			
04C4H	41221	I-7	Integral time 7	0 to 32000 (0.0 to 3200.0sec)			
04C6H	41223	D-7	Derivative time 7	0 to 9999 (0.0 to 999.9sec)			
04CAH	41227	ARH7	Anti-reset windup high limit 7	▪ Engineering unit setting (0 to 100%FS)		*	
04CCH	41229	ARL7	Anti-reset windup low limit 7			*	

Relative address	Register No.	Parameter name	Parameter contents	Read-out data	Write-in data setting range	Affected by input range	Remarks or corresponding parameter
04CEH	41231	HYS7	Hysteresis setting 7	▪ Engineering unit setting (0 to 50%FS)		*	
04D4H	41237	BL-7	Output convergence value 7	–1000 to 1000 (–100.0 to 100.0%)			
04D6H	41239	REF7	PID change point 7	▪ Engineering unit setting (–25 to 125%FS)		*	
0820H	42081	UCF1	Mathematical calculation full scale	–19999 to 99999			Turn off and on power
0822H	42083	UCB1	Mathematical calculation base scale				
0824H	42085	UCD1	Mathematical calculation decimal point position	0 to 3			
0830H	42097	PV1F	PV1 full scale	–19999 to 99999			Turn off and on power
0832H	42099	PV1B	PV1 base scale				
0834H	42101	PV1D	PV1 decimal point position	0 to 3			
0836H	42103	PV1T	PV1 input type	0 to 9, 12 to 14, 16 to 20, 26, 27			
0838H	42105	PV1U	PV1 input unit	0: °C 1: °F 2: non			
083AH	42107	PV1Z	PV1 zero adjustment	▪ Engineering unit setting (–50 to 50%FS)		*	
083CH	42109	PV1S	PV1 span adjustment			*	
0844H	42117	P1CU	PV1 input router cut point	–1 to 1250 (–0.1 to 125.0%) (–1: OFF)			
0846H	42119	P1TF	PV1 input filter time constant	0 to 9000 (0.0 to 900.0sec)			
0850H	42129	PV2F	PV2 full scale	–19999 to 99999			Turn off and on power
0852H	42131	PV2B	PV2 base scale				
0854H	42133	PV2D	PV2 decimal point position	0 to 3			
0856H	42135	PV2T	PV2 input type	0 to 9, 12 to 14, 16 to 20, 26, 27			
0858H	42137	PV2U	PV2 input unit	0: °C 1: °F 2: non			
085AH	42139	PV2Z	PV2 zero adjustment	▪ Engineering unit setting (–50 to 50%FS)		*	
085CH	42141	PV2S	PV2 span adjustment			*	
0864H	42149	P2CU	PV2 input router cut point	–1 to 1250 (–0.1 to 125.0%) (–1: OFF)			
0866H	42151	P2TF	PV2 input filter time constant	0 to 9000 (0.0 to 900.0sec)			
0890H	42193	AI1F	AI1 full scale	–19999 to 99999			Turn off and on power
0892H	42195	AI1B	AI1 base scale				
0894H	42197	AI1D	AI1 decimal point position	0 to 3			
0896H	42199	AI1T	AI1 input unit	16 to 18			
089AH	42203	AI1Z	AI1 zero adjustment	▪ Engineering unit setting (–50 to 50%FS)		*	
089CH	42205	AI1S	AI1 span adjustment			*	
08A2H	42211	A1CU	AI1 input router cut point	–1 to 1250 (–0.1 to 125.0%) (–1: OFF)			
08A4H	42213	A1TF	AI1 input filter time constant	0 to 9000 (0.0 to 900.0sec)			
0970H	42417	AO1T	AO1 output type	1: PV 5: AiM 2: SV 6: S1 3: MV 7: S2 4: DV 8: S3			
0972H	42419	AO2T	AO2 output type				
0982H	42435	AO1L	AO1 output base scale	–1300 to 1300 (–130.0 to 130.0%)			
0984H	42437	AO1H	AO1 output full scale				
0986H	42439	A1LL	AO1 output low limit	–250 to 1050 (–25.0 to 105.0%)			
0988H	42441	A1LH	AO1 output high limit				
0992H	42451	AO2L	AO2 output base scale	–1300 to 1300 (–130.0 to 130.0%)			
0994H	42453	AO2H	AO2 output full scale				
0996H	42455	A2LL	AO2 output low limit	–250 to 1050 (–25.0 to 105.0%)			
0998H	42457	A2LH	AO2 output high limit				

Relative address	Register No.	Parameter name	Parameter contents	Read-out data	Write-in data setting range	Affected by input range	Remarks or corresponding parameter
0A00H	42561	CALC	Calculation	0 to 11			
0A02H	42563	TPLT	Template number	10, 11, 13, 14, 16			Turn off and on power
0A04H	42565	OTYP	Output type number	10 to 13			
0A30H	42609	RIH1	Remote setting inhibition	0: OFF 1: ON			
0A40H	42625	RAC1	Whether to use R-ACK or not	0: inhibit 1: enable			
0A50H	42641	A-M1	A/M mode	0: A–M 1: A			
0A60H	42657	CND1	Power-ON starting mode setting	0: Auto 1: Remote 2: Manual			
0A74H	42677	STBO	Standby action setting	0, 1			
0A80H	42689	TRK1	Whether to select tracking or not	0: OFF 1: ON			
0A90H	42705	PLTS	Palette change method selection	0: PLTn 1: SV 2: PV			
0A92H	42707	F1	User assign key 1 (F1)	0 to 27			
0A94H	42709	F2	User assign key 2 (F2)				
0A96H	42711	F3	User assign key 3 (F3)				
0AA0H	42721	BRD1	Burnout direction designation (MV1)	0: HOLD 1: LO 2: UP 3: EXMV			
0AE0H	42785	DI01	DI1 function selection	0 to 255			
0AE2H	42787	DI02	DI2 function selection				
0AE4H	42789	DI03	DI3 function selection				
0AE6H	42791	DI04	DI4 function selection				
0AE8H	42793	DI11	DI11 function selection				
0AEAH	42795	DI12	DI12 function selection				
0AECH	42797	DI13	DI13 function selection				
0AEEH	42799	DI14	DI14 function selection				
0AF0H	42801	DI15	DI15 function selection				
0B50H	42897	DS00	Parameter mask 00	0 to 65535 (0000H to FFFFH)			
0B52H	42899	DS01	Parameter mask 01				
0B54H	42901	DS02	Parameter mask 02				
0B56H	42903	DS03	Parameter mask 03				
0B58H	42905	DS04	Parameter mask 04				
0B5AH	42907	DS05	Parameter mask 05				
0B5CH	42909	DS06	Parameter mask 06				
0B5EH	42911	DS07	Parameter mask 07				
0B60H	42913	DS08	Parameter mask 08				
0B62H	42915	DS09	Parameter mask 09				
0B64H	42917	DS10	Parameter mask 10				
0B66H	42919	DS11	Parameter mask 11				
0B68H	42921	DS12	Parameter mask 12				
0B6AH	42923	DS13	Parameter mask 13				
0B6CH	42925	DS14	Parameter mask 14				
0B6EH	42927	DS15	Parameter mask 15				
0B70H	42929	DS16	Parameter mask 16				
0B72H	42931	DS17	Parameter mask 17				
0B74H	42933	DS18	Parameter mask 18				
0B76H	42935	DS19	Parameter mask 19				
0B78H	42937	DS20	Parameter mask 20				
0B7AH	42939	DS21	Parameter mask 21				
0B7CH	42941	DS22	Parameter mask 22				
0B7EH	42943	DS23	Parameter mask 23				

Relative address	Register No.	Parameter name	Parameter contents	Read-out data	Write-in data setting range	Affected by input range	Remarks or corresponding parameter
0B80H	42945	DS24	Parameter mask 24	0 to 65535 (0000H to FFFFH)			
0B82H	42947	DS25	Parameter mask 25				
0B84H	42949	DS26	Parameter mask 26				
0B86H	42951	DS27	Parameter mask 27				
0B88H	42953	DS28	Parameter mask 28				
0B8AH	42955	DS29	Parameter mask 29				
0B8CH	42957	DS30	Parameter mask 30				
0B8EH	42959	DS31	Parameter mask 31				
0B90H	42961	DS32	Parameter mask 32				
0B92H	42963	DS33	Parameter mask 33				
0B94H	42965	DS34	Parameter mask 34				
0B96H	42967	DS35	Parameter mask 35				
0B98H	42969	DS36	Parameter mask 36				
0B9AH	42971	DS37	Parameter mask 37				
0B9CH	42973	DS38	Parameter mask 38				
0B9EH	42975	DS39	Parameter mask 39				
0BA0H	42977	DS40	Parameter mask 40				
0BA2H	42979	DS41	Parameter mask 41				
0BA4H	42981	DS42	Parameter mask 42				
0BA6H	42983	DS43	Parameter mask 43				
0C00H	43073	PAS1	Security setting 1	0 to 65535 (0000H to FFFFH)			
0C02H	43075	PAS2	Security setting 2				
0C04H	43077	PAS3	Security setting 3				
0C22H	43107	STN4	RS-485 station No.	0 to 255			Turn off and on power
0C24H	43109	SPD4	RS-485 communication speed	0: 9.6k 1: 19.2k 2: 38.4k			
0C26H	43111	BIT4	RS-485 bit format	0: 8N 1: 8O 2: 8E			
0C30H	43121	SPD2	RS-232C communication speed	0: 9.6k 1: 19.2k 2: 38.4k			
0C32H	43123	BIT2	RS-232C bit format	0: 8N 1: 8O 2: 8E			
0C50H	43153	-	FIX command	0: Not writing in 1: Now writing in memory	0: No effect 1: Write-in request		
0DC0H	43521	K01	Mathematical calculation constant 1	▪ Floating decimal point type 99999 to 0.0000 –0.001 to –9999			
0DC2H	43523	K02	Mathematical calculation constant 2				
0DC4H	43525	K03	Mathematical calculation constant 3				
0DC6H	43527	K04	Mathematical calculation constant 4				
0DC8H	43529	K05	Mathematical calculation constant 5				
0DCAH	43531	K06	Mathematical calculation constant 6				
0DCCH	43533	K07	Mathematical calculation constant 7				
0DCEH	43535	K08	Mathematical calculation constant 8				
0DD0H	43537	K09	Mathematical calculation constant 9				
0DD2H	43539	K10	Mathematical calculation constant 10				
0DD4H	43541	K11	Mathematical calculation constant 11				
0DD6H	43543	K12	Mathematical calculation constant 12				

Relative address	Register No.	Parameter name	Parameter contents	Read-out data	Write-in data setting range	Affected by input range	Remarks or corresponding parameter
0DD8H	43545	K13	Mathematical calculation constant 13	▪ Floating decimal point type 99999 to 0.0000 –0.001 to –9999			
0DDAH	43547	K14	Mathematical calculation constant 14				
0DDCH	43549	K15	Mathematical calculation constant 15				
0DDEH	43551	K16	Mathematical calculation constant 16				
0E00H	43585	ATP1	Auto tuning type	0: NRML 1: LPV			
0E20H	43617	DO1	DO1 output designation	0 to 255			Turn off and on power
0E22H	43619	DO2	DO2 output designation				
0E24H	43621	DO3	DO3 output designation				
0E26H	43623	DO4	DO4 output designation				
0E30H	43633	DO11	DO11 output designation				
0E32H	43635	DO12	DO12 output designation				
0E34H	43637	DO13	DO13 output designation				
0E36H	43639	DO14	DO14 output designation				
0E38H	43641	DO15	DO15 output designation				
0E70H	43697	C1	LED C1 assign	0 to 255			Turn off and on power
0E72H	43699	C2	LED C2 assign				
0E74H	43701	LDO1	LED DO1 assign				
0E76H	43703	LDO2	LED DO2 assign				
0E78H	43705	LDO3	LED DO3 assign				
0E7AH	43707	LDO4	LED DO4 assign				
0E7CH	43709	LDO5	LED DO5 assign				
0E7EH	43711	LALM	LED ALM assign				
0EA0H	43745	CN01	Constant 1 used for template	–19999 to 99999			
0EA2H	43747	CN02	Constant 2 used for template				
0EA4H	43749	CN03	Constant 3 used for template				
0EA6H	43751	CN04	Constant 4 used for template				
0EA8H	43753	CN05	Constant 5 used for template				
0EAAH	43755	CN06	Constant 6 used for template				
0EACH	43757	CN07	Constant 7 used for template				
0EAEH	43759	CN08	Constant 8 used for template				
0EB0H	43761	CN09	Constant 9 used for template				
0EB2H	43763	CN10	Constant 10 used for template				
0EB4H	43765	CN11	Constant 11 used for template				
0EB6H	43767	CN12	Constant 12 used for template				
0EB8H	43769	CN13	Constant 13 used for template				
0EBAH	43771	CN14	Constant 14 used for template				
0EBCH	43773	CN15	Constant 15 used for template				
0EBEH	43775	CN16	Constant 16 used for template				

Word data [read-out only] : Function code [04_H]

Relative address	Register No.	Parameter name	Parameter contents	Read-out data	Affected by input range	Remarks or corresponding parameter
0100H	30257	PID MODE1	Current control mode	0001H: Fault status 0002H: Standby status 0004H: Remote Ack 0008H: Other than auto mode 0010H: Auto mode request 0020H: Remote mode request 0040H: Auto tuning status 0080H: Normal operation status 0100H: PV tracking status 0200H: Local SV status 0400H: Remote SV status 0800H: Local + PV tracking status 1000H: Forced manual mode status 2000H: EX-MV mode status 4000H: Manual mode status		Correspond-ing bit to relevant status is "1".
0102H	30259	PV1	Process variable (PV) used for control currently	–25999 to 105999 (Input scale: –5 to 105% FS)	*	
0104H	30261	SV1	Currently used setpoint (SV)	–19999 to 99999 (within settable range)	*	
0106H	30263	DV1	Currently used deviation (DV)	–125998 to 125998 (Input scale: –105 to 105% FS)	*	
0108H	30265	MV1	Currently used manipulating value (MV)	–250 to 1250 (–25.0 to 125.0%)		
010CH	30269	FAULT1	Currently used input error status information	Normal: 0 Over: 1 Under: 2		
0310H	30785	ALM1 (RELAY)	Alarm 1 status (relay status)	Excitation: 1, Non-excitation: 0		
0312H	30787	ALM2 (RELAY)	Alarm 2 status (relay status)			
0314H	30789	ALM3 (RELAY)	Alarm 3 status (relay status)			
0316H	30791	ALM4 (RELAY)	Alarm 4 status (relay status)	Excitation: 1, Non-excitation: 0		
0318H	30793	ALM5 (RELAY)	Alarm 5 status (relay status)			
031AH	30795	ALM6 (RELAY)	Alarm 6 status (relay status)			
031CH	30797	ALM7 (RELAY)	Alarm 7 status (relay status)			
031EH	30799	ALM8 (RELAY)	Alarm 8 status (relay status)			
0340H	30833	ALM1	Alarm 1 status	ON: 1, OFF: 0		
0342H	30835	ALM2	Alarm 2 status			
0344H	30837	ALM3	Alarm 3 status			
0346H	30839	ALM4	Alarm 4 status			
0348H	30841	ALM5	Alarm 5 status			
034AH	30843	ALM6	Alarm 6 status			
034CH	30845	ALM7	Alarm 7 status			
034EH	30847	ALM8	Alarm 8 status			
0400H	31025	PV1	PV1 measurement value	–214783647 to 214783648	*	
0402H	31027	PV2	PV2 measurement value		*	
0406H	31031	AI1	Ai1 measurement value		*	
0420H	31057	RCJ1	PV1 RCJ measurement value			
0422H	31059	RCJ2	PV2 RCJ measurement value			
0450H	31105	AO1	AO1 output value	–250 to 1250 (–25.0 to 125.0%)		
0452H	31107	AO2	AO2 output value			

Relative address	Register No.	Parameter name	Parameter contents	Read-out data	Affected by input range	Remarks or corresponding parameter
0470H	31137	DI01	DI1 to 4 input status	DI1: 8000H DI2: 4000H DI3: 2000H DI4: 1000H		Corresponding bit to ON is "1".
0472H	31139	DI11	DI11 to 15 input status	DI11: 8000H DI12: 4000H DI13: 2000H DI14: 1000H DI15: 0800H		Corresponding bit to ON is "1".
04D0H	31233	DO01	DO1 to 4 output status	DO1: 1 DO2: 2 DO3: 4 DO4: 8		Corresponding bit to ON is "1".
04D2H	31235	DO11	DO11 to 15 output status	DO11: 1 DO12: 2 DO13: 4 DO14: 8 DO15: 16		Corresponding bit to ON is "1".
0540H	31345	AIM	Mathematical calculation result	–214783647 to 214783648	*	Mathematical calculation scale
0550H	31361	ALM DLY 1	Alarm 1 delay timer remaining time monitor	0 to 9999		
0552H	31363	ALM DLY 2	Alarm 2 delay timer remaining time monitor			
0554H	31365	ALM DLY 3	Alarm 3 delay timer remaining time monitor			
0556H	31367	ALM DLY 4	Alarm 4 delay timer remaining time monitor			
0558H	31369	ALM DLY 5	Alarm 5 delay timer remaining time monitor			
055AH	31371	ALM DLY 6	Alarm 6 delay timer remaining time monitor			
055CH	31373	ALM DLY 7	Alarm 7 delay timer remaining time monitor			
055EH	31375	ALM DLY 8	Alarm 8 delay timer remaining time monitor			
0564H	31381	AMV1	EXMV value (External analog value)	–214783647 to 214783648		
056CH	31389	FFV1	Feed Forward value	–214783647 to 214783648		

8. SAMPLE PROGRAM

This section concerns data read-out/write-in sample program by Microsoft Visual Basic 6.0 (SP6) (enclosed to CD-ROM).

Note that the program shown here is for reference for you to create a program and not for guaranteeing all actions.

Before executing the program, make sure of the communication conditions in the following procedure.

- Parity, communication speed: Must be set in this program to match the instrument.

Precautions for some RS-232C ⇔ RS-485 converter

The transmission data itself may precede the answer data from the slave station. In such a case, discard as many data as transmission bytes found there, and then process it as answer data.

Applicable OS

Windows 2000 Professional

Windows XP Professional Edition

Fuji Electric Systems Co., Ltd. and Fuji Electric Instruments Co., Ltd. will not be responsible for damages attributable to use of the sample program nor infringement of rights owned by third parties.

Use the program upon admitting the above.

(a) Example of data read-out

Operation: 2 word data of a designated address is read-out and displayed at a time.

Used function code: 03_H , 04_H

Read-out word number: 2

```
' Variable declaration ************************************************************************************************************
    Dim idx As Integer
    Dim Ansdat() As Byte                    ' For storing answer data
    Dim Rxbuff As Variant                   ' Receive data buffer
    Dim PauseTime                           ' Sets the communication wait time
                                            ' Required wait time depends on transmission speed and transmission frame length
    Dim Stno As Byte                        ' Communication station number

Private Sub Form_Load()

' Initializing the variable ********************************************************************************************************
    Stno = 1
    Main.Visible = True

End Sub

'-------------------------------------------
'Read continuous words sample program
'Function code : 03H, 04H
'Number of words : 2
'-------------------------------------------

Private Sub TX1_Click()

    TX1.Enabled = False

' Communication port setting *******************************************************************************************************
    If Com5.Value = True Then
        Comm_port = 5                       ' COM5
    ElseIf Com4.Value = True Then
        Comm_port = 4                       ' COM4
    ElseIf Com3.Value = True Then
        Comm_port = 3                       ' COM3
    ElseIf Com2.Value = True Then
        Comm_port = 2                       ' COM2
    Else
        Comm_port = 1                       ' COM1
    End If

    If SPD192.Value = True Then
        Comm_speed = "19200,"               ' 19200bps
    ElseIf SPD96.Value = True Then
        Comm_speed = "9600,"                ' 9600bps
    Else
        Comm_speed = "38400,"               ' 38400bps
    End If

    If Even1.Value = True Then
        Comm_parity = "E,"                  ' Even parity
    ElseIf Odd1.Value = True Then
        Comm_parity = "O,"                  ' Odd parity
    Else
        Comm_parity = "N,"                  ' No parity
    End If

    PauseTime = 0.2                         ' Sets the wait time (0.2 sec)

    idx = 0

' Opening the communication port ***************************************************************************************************
    MSComm1.CommPort = Comm_port            ' COM port setting
    MSComm1.Settings = Comm_speed & Comm_parity & "8,1"     ' Speed / Party / 8bit_Data / Stop_1bit
    MSComm1.PortOpen = True                 ' Opens a port

' Setting the opposite station number for communication ****************************************************************************
    St = Val(Stno1(idx).Text)
    Stno = St Mod 256
    Stno1(idx).Text = Str(Stno)

' Address processing ***************************************************************************************************************
    AD$ = Str(Val(Address(idx).Text) - 1)
    AD$ = Right$(("00000" & AD$), 5)
    Area = Val(Left$(AD$, 1))
    Adrsh = Int(Val(Right$(AD$, 4)) / 256)
    Adrsl = Val(Right$(AD$, 4)) Mod 256
```

```
' Transmission command generation ***********************************************************************************************
    Select Case Area
    Case 3
        ReDim Txdat(7) As Byte                  ' Secures 8 byte array
        Txdat(0) = Stno                         ' Station No.
        Txdat(1) = &H4                          ' Command
        Txdat(2) = Adrsh                        ' High address
        Txdat(3) = Adrsl                        ' Low address
        Txdat(4) = &H0                          ' Number of read-in words (High)
        Txdat(5) = &H2                          ' Number of read-in words (Low)
        Txsu = 5                                ' Number of transmission data

    Case 4
        ReDim Txdat(7) As Byte                  ' Secures 8 byte array
        Txdat(0) = Stno                         ' Station No.
        Txdat(1) = &H3                          ' Command
        Txdat(2) = Adrsh                        ' High address
        Txdat(3) = Adrsl                        ' Low address
        Txdat(4) = &H0                          ' Number of read-in words (High)
        Txdat(5) = &H2                          ' Number of read-in words (Lo)
        Txsu = 5                                ' Number of transmission data

    Case Else                                   ' For other value
        MSComm1.PortOpen = False                ' Closes COM port
        TX1.Enabled = True
        Exit Sub
    End Select

' Transmitting a command **********************************************************************************************************

' Generation of CRC for transmission data
        GoSub 10000                             ' CRC calculation
        Txdat(Txsu + 1) = CRC1                  '
        Txdat(Txsu + 2) = CRC2                  '

' Transmitting a generated command
        MSComm1.Output = Txdat                  ' Transmits 1 byte

' Waiting until all answer data is received
    Start = Timer                               ' Saves the waiting start time
    Do While Timer < Start + PauseTime          ' Whether time setting elapsed
        DoEvents                                ' Transfers the control to another process
        If ((Start + PauseTime) - Timer) > PauseTime Then
           Start = Timer
        End If
    Loop

' Fetching the answer data into byte array
    MSComm1.InputMode = comInputModeBinary      ' Designates binary mode
    length = MSComm1.InBufferCount              ' Acquires required number of receive data bytes
    MSComm1.InputLen = 0                        ' Designates acquisition of all data
    Rxbuff = MSComm1.Input                      ' Fetches receive data into receive buffer
    Ansdat = Rxbuff                             ' Assigns byte array to receive data

' CRC calculation for receive data
    Ansu = length – 3                           ' Receive data length
    GoSub 20000                                 ' CRC calculation

' Error check
    If (length = 0) Then                                                    ' No anser
        Noans = Noans + 1: Rx_data.Caption = "Noans": GoTo 150
    ElseIf ((Ansdat(length - 2) <> CRC1) + (Ansdat(length - 1) <> CRC2)) Then   ' CRC error
        CRCErr = CRCErr + 1: Rx_data.Caption = "CRCErr": GoTo 150
    ElseIf Ansdat(1) >= &H80 Then                                           ' Command error
        CMDErr = CMDErr + 1: Rx_data.Caption = "CMDErr": GoTo 150
    End If

' Processing of normal receive data
        wrk1 = Ansdat(3)
        wrk2 = Ansdat(4)
        wrk3 = Ansdat(5)
        wrk4 = Ansdat(6)
    If Ansdat(5) > 128 Then                     ' If receive data is negative
        Rx_data.Caption = Str(((wrk3 * (2 ^ 24)) + (wrk4 * (2 ^ 16)) + (wrk1 * (2 ^ 8)) + wrk2) - (2 ^ 32))
    Else
        Rx_data.Caption = Str(((wrk3 * (2 ^ 24)) + (wrk4 * (2 ^ 16)) + (wrk1 * (2 ^ 8)) + wrk2))
    End If
150
    MSComm1.PortOpen = False                    ' Closes COM port

    TX1.Enabled = True

    Exit Sub
```

```
' ************************************************************************************************************************

10000       ' CRC calculation subroutine IN:Txdat(Txsu) / OUT CRC1,CRC2   ************************************************************
      CRC = &HFFFF
      For i = 0 To Txsu Step 1
            CRC = CRC Xor Txdat(i)
            For J = 1 To 8 Step 1
                  CT = CRC And &H1
                  If CRC < 0 Then CH = 1 Else: CH = 0: GoTo 11000
                  CRC = CRC And &H7FFF
11000             CRC = Int(CRC / 2)
                  If CH = 1 Then CRC = CRC Or &H4000
                  If CT = 1 Then CRC = CRC Xor &HA001
            Next J
      Next i
      CRC1 = CRC And &HFF
      CRC2 = ((CRC And &HFF00) / 256 And &HFF)
      Return


20000       ' CRC calculation subroutine IN:Ansdat(Ansu) / OUT CRC1,CRC2   ************************************************************
      CRC = &HFFFF
      For i = 0 To Ansu Step 1
            CRC = CRC Xor Ansdat(i)
            For J = 1 To 8 Step 1
                  CT = CRC And &H1
                  If CRC < 0 Then CH = 1 Else: CH = 0: GoTo 21000
                  CRC = CRC And &H7FFF
21000             CRC = Int(CRC / 2)
                  If CH = 1 Then CRC = CRC Or &H4000
                  If CT = 1 Then CRC = CRC Xor &HA001
            Next J
      Next i
      CRC1 = CRC And &HFF
      CRC2 = ((CRC And &HFF00) / 256 And &HFF)
      Return

End Sub
```

(b) Example of data write-in

Operation: Writes 2 word data into a designated address

Used function code: 10_H

Number of write-in words: 2

```
'-------------------------------------
'Write 2 words sample program
'Function code : 10H
'Number of words : 2
'-------------------------------------

Private Sub Write_command_Click()
    Write_command.Enabled = False

    ' Communication port setting ***********************************************************************************************
    If Com5.Value = True Then
        Comm_port = 5                           ' COM5
    ElseIf Com4.Value = True Then
        Comm_port = 4                           ' COM4
    ElseIf Com3.Value = True Then
        Comm_port = 3                           ' COM3
    ElseIf Com2.Value = True Then
        Comm_port = 2                           ' COM2
    Else
        Comm_port = 1                           ' COM1
    End If

    If SPD192.Value = True Then
        Comm_speed = "19200,"                   ' 19200bps
    ElseIf SPD96.Value = True Then
        Comm_speed = "9600,"                    ' 9600bps
    Else
        Comm_speed = "38400,"                   ' 38400bps
    End If

    If Even1.Value = True Then
        Comm_parity = "E,"                      ' Even parity
    ElseIf Odd1.Value = True Then
        Comm_parity = "O,"                      ' Odd parity
    Else
        Comm_parity = "N,"                      ' No parity
    End If

    PauseTime = 0.2                             ' Sets the wait time (0.2 sec)
    idx = 1

    ' Opening the communication port *******************************************************************************************
    MSComm1.CommPort = Comm_port                ' Com port
    MSComm1.Settings = Comm_speed & Comm_parity & "8,1"     ' Speed / Party / 8bit_Data / Stop_1bit
    MSComm1.PortOpen = True                     ' Open com port

    ' Setting the opposite station number for communication ********************************************************************
    St = Val(Stno1(idx).Text)
    Stno = St Mod 256
    Stno1(idx).Text = Str(Stno)

    ' Address processing *******************************************************************************************************
    AD$ = Str(Val(Address(idx).Text) - 1)
    AD$ = Right$(("00000" & AD$), 5)
    Area = Val(Left$(AD$, 1))
    Adrsh = Int(Val(Right$(AD$, 4)) / 256)
    Adrsl = Val(Right$(AD$, 4)) Mod 256

    ' Transmission command generation ******************************************************************************************

    Select Case Area
    Case 4

    'Normal sending data is processed.
        Dim byteData(3) As Byte
        Dim sHex    As String

        sHex = Right("00000000" & Hex(Val(Write_data.Text)), 8) ' Decimal → hexadecimal
        byteData(0) = CByte("&H" & Mid(sHex, 1, 2))             'hh byte
        byteData(1) = CByte("&H" & Mid(sHex, 3, 2))             'hl byte
        byteData(2) = CByte("&H" & Mid(sHex, 5, 2))             'lh byte
        byteData(3) = CByte("&H" & Mid(sHex, 7, 2))             'll byte
```

```
            ReDim Txdat(12) As Byte                 ' 13 bytes
                Txdat(0) = Stno                     ' Station No.
                Txdat(1) = &H10                     ' Command
                Txdat(2) = Adrsh                    ' High address
                Txdat(3) = Adrsl                    ' Low address
                Txdat(4) = &H0                      ' Number of write-in words (High)
                Txdat(5) = &H2                      ' Number of write -in words (Lo)
                Txdat(6) = &H4                      ' Number of write -in bytes
                Txdat(7) = byteData(2)              ' Write-in data (Lo high)
                Txdat(8) = byteData(3)              ' Write-in data (Lo lo)
                Txdat(9) = byteData(0)              ' Write-in data (High high)
                Txdat(10) = byteData(1)             ' Write-in data (HIgh lo)
                Txsu = 10                           ' Number of transmission data

        Case Else                                   ' For other
                MSComm1.PortOpen = False            ' Closes COM port
                Write_command.Enabled = True
                Exit Sub
        End Select

        ' Transmitting a command ********************************************************************************************************

        ' Generation of CRC for transmission data
        GoSub 10000                                 ' CRC calculation
        Txdat(Txsu + 1) = CRC1                      '
        Txdat(Txsu + 2) = CRC2                      '

        ' Transmitting a generated command
        MSComm1.Output = Txdat                      ' Transmits 1 byte

        ' Waiting until all answer data is received
        Start = Timer                               ' Saves the waiting start time
        Do While Timer < Start + PauseTime          ' Whether time setting elapsed
            DoEvents                                ' Transfers the control to another process
            If ((Start + PauseTime) - Timer) > PauseTime Then
                Start = Timer
            End If
        Loop

        MSComm1.PortOpen = False                     ' Closes COM port

        Write_command.Enabled = True

        Exit Sub

    ' ***************************************************************************************************************************************

    10000       ' CRC calculation subroutine IN:Txdat(Txsu) / OUT CRC1,CRC2    ***************************************************************
        CRC = &HFFFF
        For i = 0 To Txsu Step 1
            CRC = CRC Xor Txdat(i)
            For J = 1 To 8 Step 1
                CT = CRC And &H1
                If CRC < 0 Then CH = 1 Else: CH = 0: GoTo 11000
                CRC = CRC And &H7FFF
    11000       CRC = Int(CRC / 2)
                If CH = 1 Then CRC = CRC Or &H4000
                If CT = 1 Then CRC = CRC Xor &HA001
            Next J
        Next i
        CRC1 = CRC And &HFF
        CRC2 = ((CRC And &HFF00) / 256 And &HFF)
        Return

    End Sub
```

9. TROUBLESHOOTING

If the communication is unavailable, check the following items.

- □ Whether all devices related to communication are turned on.
- □ Whether wirings are correct. (Whether polarities are correct.)
- □ Whether the number of connected instruments and connection distance are as specified.
- □ Whether communication conditions coincide between the master station (host computer) and slave stations (PXH).
  - □ Transmission speed : 9600bps, 19200bps, 38400bps
  - □ Data length : 8 bits
  - □ Stop bit : 1 bit
  - □ Parity : □ odd
    □ even
    □ none
- □ Whether send/receive signal timing conforms to Section 5.4 in this manual.
- □ Whether the station No. designated as send destination by the master station coincides with the station No. of the connected PXH. (For PC loader communication, the station No. is fixed at "1".)
- □ Whether, at RS-485 communication, more than one instrument connected on the same transmission line does not share the same station No.
- □ Whether, at RS-485 communication, the station No. of instruments is not set at 0.
  If it is 0, the communication function does not work.
- □ Whether, at RS-485 communication, the 11th digit of type code of this controller is R.
  (PXH9□□□□ – □□R□□－□)
- □ Whether, at RS-485 communication, settings of communication conditions for RS-232C ⇔ RS-485 converter are correct.

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