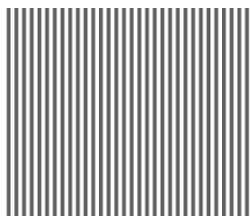


CHINO

Digital Indicating Controller

DB1000

**COMMUNICATIONS
INTERFACES**



INSTRUCTIONS

Retain this manual apart from the instrument
and in an easily accessible place.

Please make sure that this manual is handed to the final user of the instrument.

CHINO

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1. Introduction

Thank you for purchasing Digital Indicating Controller 'DB 1000 series'.

DB 1000 series is Digital Indicating Controller with indicator accuracy of $\pm 0.1\%$, control cycle of approximately 0.1 seconds and front size of 96X96mm.

Multi-range input and multi SV (8 type) etc. are various functionalities that are provided as standard provisions. Besides a digital indicator with large easy to view LED display, various settings have an interactive system with high resolution dot matrix LCD display and handling is also easy with precise control.

Understand the controller properly and read this instruction manual beforehand in order to avoid any trouble.

This is a 'Communication' instruction manual. For general specifications, read 'General' instruction manual along with this manual.

A Request

- For the persons doing instrumentation, installation and sales -

Be sure to handover this instruction manual to the persons using the controller.

- For the users of the controller -

Preserve this instruction manual until you scrap the controller.

Notice

1. You should not copy or forward fully or partially this document without prior notice.
2. The contents of this document may be changed without notice.
3. We have taken enough care regarding the contents of this document however if at all you notice a mistake or an omission contact our nearest office.
4. Please understand that regarding the result of the operation, whatever is the result the company will not be responsible.

2. For safe use of the product

In order to use the controller safely, read the following precautions and understand them.

2-1. Prerequisites for use




The controller is a general product of component type that is to be used by mounting it in a panel for instrumentation inside a room. Do not use it in any other condition.

When using, design a fail safe on the final product side and review regularly and use the controller after confirming the safety of the system. For the wiring, adjustment and operation of the controller, contact a professional having knowledge of instrumentation.

It is necessary that the people actually using this controller read this instruction manual, and have enough understanding of various precautions and the basic operations of the controller.

2-2. Symbol mark

The following symbol marks are used in the product itself and in this instruction manual hence understand the meaning of these symbol marks properly.

Symbol mark	Meaning
 Warning	If there is a possibility of death or severe injuries then explain the precautions to avoid that possibility.
 Precaution	If there is a possibility of small injuries or a possibility of the controller or its nearby devices getting damaged then explain the precautions to avoid those possibilities.
	It is a symbol for ground terminal. Always connect the ground terminal to protective grounding.

3. Overview

RS-232C , RS-422A, RS-485 are available in communication interface of DB and are used for communication with personal computer (hereinafter referred to as PC).

PC can receive measurement data from the DB, various parameters can be set and operation commands can be issued. Number of DB connections is 1 for RS-232 and maximum 31 for RS-422A, RS-485.

3-1. RS-232C communication interface

RS-232C is the data communication standard set and executed by Electronic India Alliance (EIA) and Japanese equivalent for that is JIS C 6361.

This standard is basically an interface with modem and data terminal device connected to it and only electrical and mechanical specifications are given.

Presently RS-232C communication interface that is used in industrial instrument like PC and DB series, only some of them completely conform to the above specifications, and signal wire count and connectors for connection etc. may sometime differ from the specifications.

As nothing is specified about the software part or what we call 'data transmission procedure' it does not mean that the devices that RS-232C communication interface has can be connected unconditionally.

Hence it is necessary that the designer investigates and confirms the mutual device for its specifications and transmission procedure. However if the connection partner is able to program those specifications optionally like the PC, the designer creates the appropriate program and can combine with almost all the devices.

When investigating the RS-232C specifications, the method of referring to JIS C 6361 is the simplest method.

3-2. RS-422A/485 communication interface

RS-422A/485 communication interface can communicate by connecting in parallel the DB series of a number of machines (maximum 31) through the signal that conforms to RS-422A/485.

PC that has RS-422A/485 communication interface is less however as it is a serial communication, connection can be easily done by using RS-232C \leftrightarrow RS-422A/485 signal converter.

Line converter (Our company model: SC8-10) for RS-232C \leftrightarrow RS-422A/485 is available with our company. You may order it from us.

Difference between RS-422A and RS-485 is that RS-422A uses 4 signal wires whereas RS-485 uses 2 signal wires.

4. Communication Protocol

DB has the following two protocols and switching can be done by front key settings.

4-1. MODBUS Protocol

MODBUS is a registered trademark of SCHNEIDER company. MODBUS protocol has two modes namely RTU mode and ASCII mode and switching can be done using front key settings. It has the transmission function of measurement data and settings, operation function.

4-2. PRIVATE Protocol

PRIVATE is usual CHINO protocol. Switching is done by setting the front key. It has the transmission function of measurement data and settings, operation function.

Old instrument of CHINO products is compatible with new instrument, however the parameter which can not be set by PRIVATE can be set by MODBUS. We recommended to use MODBUS protocol if communication is set newly.

5.Communication Specifications

5-1.MODBUS

- Communication system : Half duplex asynchronous system (Polling selecting system)
- Protocol : MODBUS protocol
- Communication speed : 38400, 19200, 9600, 4800, 2400 bps switching
- Start bit : 1 bit
- Data length : 7 bits (ASCII mode)
8 bits (RTU mode/ASCII mode)
- Parity bit : None/even/odd
- Stop bit : 1 bit/2 bits
- Transmission code : ASCII (ASCII mode)
Binary (RTU mode)
- Error check : LRC (ASCII mode)
(Error detection) CRC-16 (RTU mode)
- Data transmission procedure: No procedure
- Usage signal name: Sending and receiving data only (Without using the control signal)

5-2.PRIVATE

- Communication system : Half duplex asynchronous system (Polling selecting system)
- Protocol: PRIVATE protocol
- Communication speed : 38400, 19200, 9600, 4800, 2400 bps switching
- Start bit : 1 bit
- Data length : 7 bits
- Parity bit : Even
- Stop bit : 1 bit
- Transmission code : ASCII code
- Error check : BCC (Block check character) Check sum
(Error detection)
- Data transmission procedure : No procedure
- Usage signal name : Sending and receiving data only (Without using the control signal)

6. Setting the parameters for PC communication

According to the Pro diagram set these 6 parameters 'Communication speed', 'Device number', 'Communication function', 'Communication transmission type', 'Communication protocol', 'Communication character'.





- 1.1. Click key from the operation screen.
- 2.2. Select MODE7 from 'Select MODE screen' using keys.
- 3.3. Set the following items of Communication settings screen (MODE7).

Communication (Option) MODE 7 COMMUNICATION	
↓ key	
Communication speed COM BIT RATE 9600 bps	Select the following communication speeds using keys Register using key Setting range:2400,4800,9600,19200,38400
↓ key	
Device number COM NUMBER 01	Select instrument number using keys Register using key Setting range: 01 to 99
↓ key	
Communication function COM KIND COM REM TRANS	Select the communication function mentioned below using the key Register using key Setting range: COM,REM,TRANS
↓ key	
Communication transmission type COM TRANS KIND PV SV MV MFB RSV	Select communication transmission type using key Register using key Setting range : PV,SV,MV,MFB,RSV Using *[COM KIND] settings can be done on when TRANS is selected
↓ key	
Communication Protocol COM PROTOCOL MODBUS(RTU)	Select the communication protocol mentioned below using keys and register it using key Setting range: MODBUS(RTU), MODBUS(ASCII), PRIVATE
↓ key	
Communication character COM CHARACTER 8BIT/NON /STOP1	Select communication characters mentioned below using the keys and register it using key Setting range:7BIT/EVEN/STOP1,7BIT/EVEN/STOP2 7BIT/ODD /STOP1,7BIT/ODD /STOP2 8BIT/NON /STOP1,8BIT/NON /STOP2 8BIT/EVEN/STOP1,8BIT/EVEN/STOP2 8BIT/ODD /STOP1,8BIT/ODD /STOP2

In case if PRIVATE, the setting is 7BIT/EVEN/STOP1.

6-1. Communication speed (COM BIT RATE)

Use DB and PC in same communication speed. (Usually initial value can be 9600bps.)

- ① Display 'COM BIT RATE' using  key.
- ② Select communication speed using   keys and register it using  key.

Communication speed: 2400bps,4800bps,9600bps,19200bps,38400bps,(Initial value is 9600bps)

6-2. Set device number (COM NUMBER)

Set the device number of DB at the time of RS-422A/485.

In single to multiple DBs that are communicating with the PC, always do the settings such that this DB does not overlap with the other DBs.

- ① 'COM NUMBER' is displayed using the  key.
- ② Select device number (1 to 99) using    keys, select it and register it using  key.






Precautions

- ① Device number should be in a range from 1 to 99 and it should not overlap with the other DBs. (Initial value 1)
- ② In case of RS-232C, DB is connected to 1 machine but set the device number. Usually initial value can be 1.

6-3. Setting the communication function (COM KIND)

Set the communication function.

- ① Display 'COM KIND' using  key.
- ② Select communication function using  key and register it using  key.
- ③ If 'COM' is selected, it becomes a high order communication function.
- ④ If 'REM' is selected, it becomes communication remote function.
- ⑤ If 'TRANS' is selected, it becomes communication transmission function.

Communication function: COM, REM, TRANS

6-4. Setting communication transmission kind (COM TRANS KIND)

Set communication transmission kind.

- ① Display 'COM TRANS KIND' using key.
- ② Select transmission kind using key and register it using key.
- ③ If 'PV' is selected, transmit measurement value (PV).
- ④ If 'SV' is selected, transmit setting value (SV).
- ⑤ If 'MV' is selected transmit output value (MV).
- ⑥ If 'MFB' is selected, transmit operation terminal feedback value (MFB).
However, it can be selected only when output format is ON OFF servo type.
- ⑦ If 'RSV' is selected, transmit remote SV (RSV).
However, it can be selected only in case of specifications with remote signal input.
- ⑧ 2In case of output specifications, output 1 side 'MV1' and output 2 side 'MV2' can be selected individually.

Transmission type: PV, SV, MV, MFB, RSV

6-5. Setting communication protocol(COM PROTOCOL)

- ① 'COM PROTOCOL' is displayed using key.
- ② Select communication protocol using keys and register it using key.

Selection	Communication Protocol	Initial value
RTU	MODBUS RTU	RTU
ASCII	MODBUS ASCII	
PRIVATE	PRIVATE	

※ If communication protocol is changed, communication function changes to initial value.

6-6. Setting communication character (COM CHARACTER)

- ① 'COM CHARACTER' is displayed using key.
- ② Select communication character using keys and register it using key.

【MODBUS RTU】

Selection	Bit length	Parity	Stop bit	Initial value
8N1	8bit	None	1	8N1
8N2			2	
8E1		Even	1	
8E2			2	
8O1		Odd	1	
8O2			2	

【MODBUS ASCII】

Selection	Bit length	Parity	Stop bit	Initial value
7E1	7bit	Even	1	7E1
7E2			2	
7O1		Odd	1	
7O2			2	
8N1	8bit	None	1	
8N2			2	
8E1		Even	1	
8E2			2	
8O1		Odd	1	
8O2			2	

[PRIVATE]

Selection	Bit length	Parity	Stop bit	Initial value
7E1	7bit	Even	1	7E1

7. Wiring

7-1. Precautions while wiring

1. Communication terminal

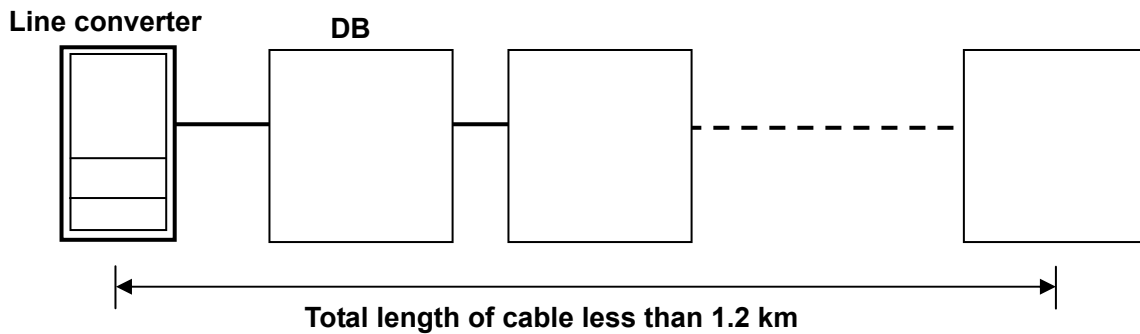
Depending on the communication interfaces that are specified, terminal arrangement differs.

No.	RS-232C	RS-422A	RS-485
⑫	RD	RDA	SA
⑬	SD	RDB	SB
⑭	SG	SDA	SG
⑮		SDB	
⑯		SG	

2. Total length of RS-422/485 communication cable is less than 1.2 km

Wiring space between each device can be anything but the total cable length distance is less than 1.2km.

(Line converter ↔ Last terminal DB)



3. Take action to avoid intermixing of noise.

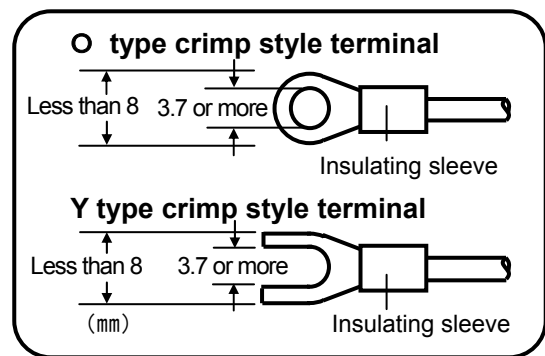
To avoid effect of noise place the power cable and other communication cables away from each other by at least 50 cm or more.

4. Always perform the crimp-style terminal process.

One of the causes of communication defect is loss of connection.

Always process the communication cable terminal using O type or Y type crimp style terminal with insulation sleeve.

(Terminal screw of DB, line converter is M3.5mm.)



5. Apply last terminal resistance.

When using RS-422A/485 communication, apply a resistance of 100Ω to the DB place in the last terminal. (For details see clause 7.4)

(Generally metal coating resistance is okay. It is available with our company and you may order it.)

6. Number of machines of DB connections

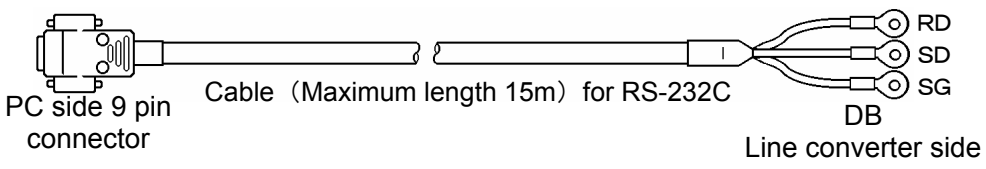
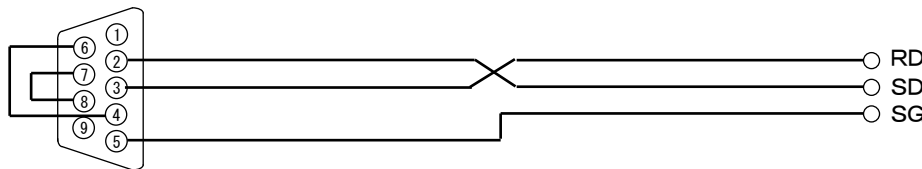
For RS-232C : 1
 For RS-422A/485 : Maximum 31

7-2. Cable for communication

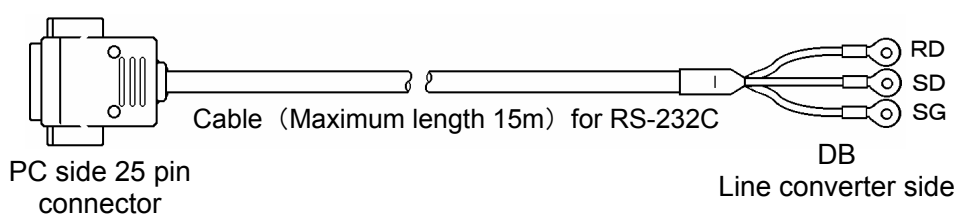
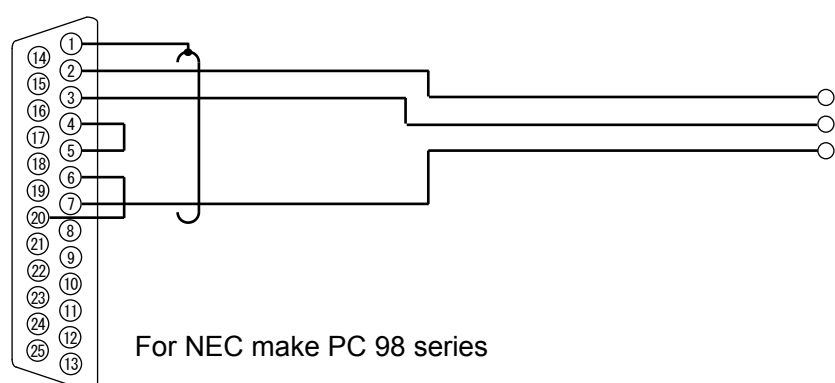
Before connecting get the exclusive communication cables ready. They are available with our company also and you can order them.

7-2-1. Communication cable for RS-232C (Between PC/Line converter)

① Connection between PC (9 pin) and DB, PC (9 pin) and line converter

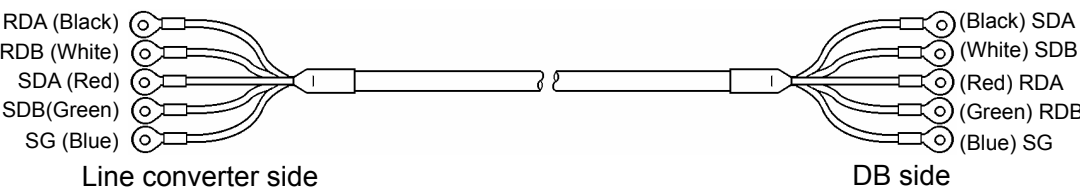
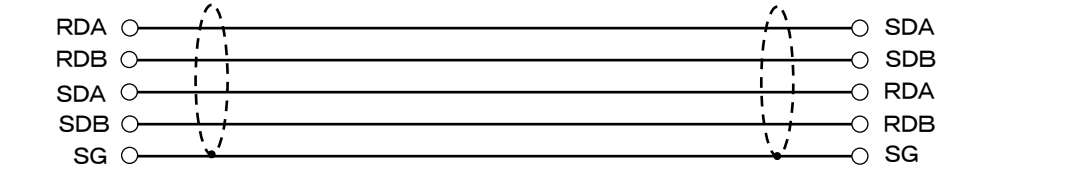
Cable	9 pin connector ↔ 0 type crimp-style terminal ↔ RS-232 cable
Format	 <p>Cable (Maximum length 15m) for RS-232C</p>
Internal wiring	
Model code	RZ-CRS6 □□ Cable length is 1 to 15m (Specified)

② Connection between PC (25 pin) and DB, PC (25 pin) and line converter

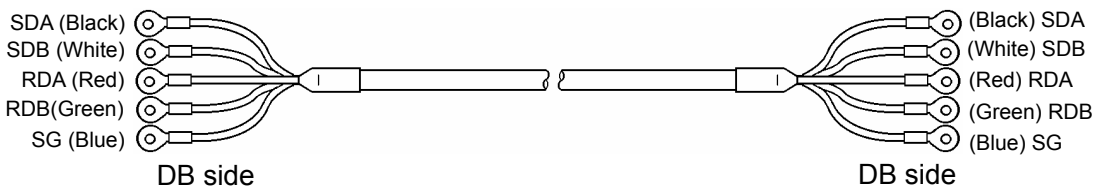
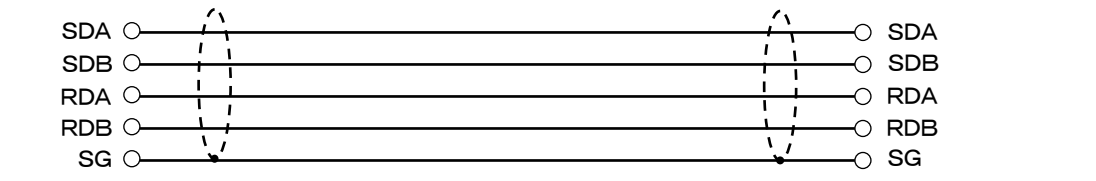
Cable	25 pin connector ↔ 0 type crimp-style terminal RS-232C cable
Format	 <p>Cable (Maximum length 15m) for RS-232C</p>
Internal wiring	 <p>For NEC make PC 98 series</p>
Model code	RZ-CRS2 □□ Cable length is 1 to 15m (Specify)

7-2-2. Communication cable for RS-422A

① Connection between line converter and DB

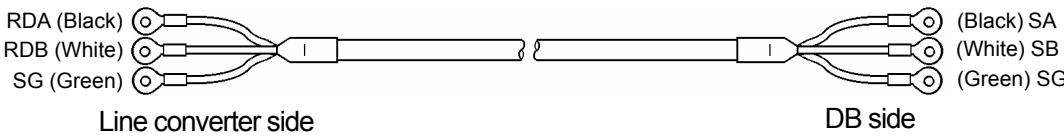
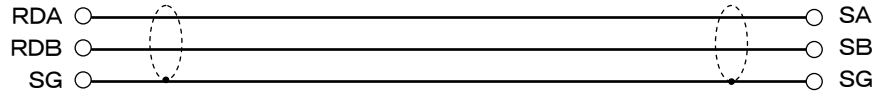
Cable	0 type crimp style terminal ↔ 0 type crimp style terminal RS-422A cable (For line converter)
Format	 <p>Line converter side</p> <p>DB side</p> <p>SG (Signal grand) wiring is available on both sides using 2 wick VCTF wire which is further twisted to 4 wicks. It is disconnected and used as there is no SG terminal on the line converter side.</p>
Internal wiring	
Model code	<p>RZ-CRA2□□</p> <p>└ Cable length is 01 to 99m (Specified)</p>

② Connection between DBs

Cable	0 type crimp style wire ↔ 0 type crimp style RS-422A cable (For serial connection)
Format	 <p>DB side</p> <p>DB side</p> <p>SG (Signal grand) wiring is available on both sides using 2 wick VCTF wire which is further twisted to 4 wicks.</p>
Internal wiring	
Model code	<p>RZ-CRA1□□</p> <p>└ Cable length is 01 to 99m (Specified)</p>

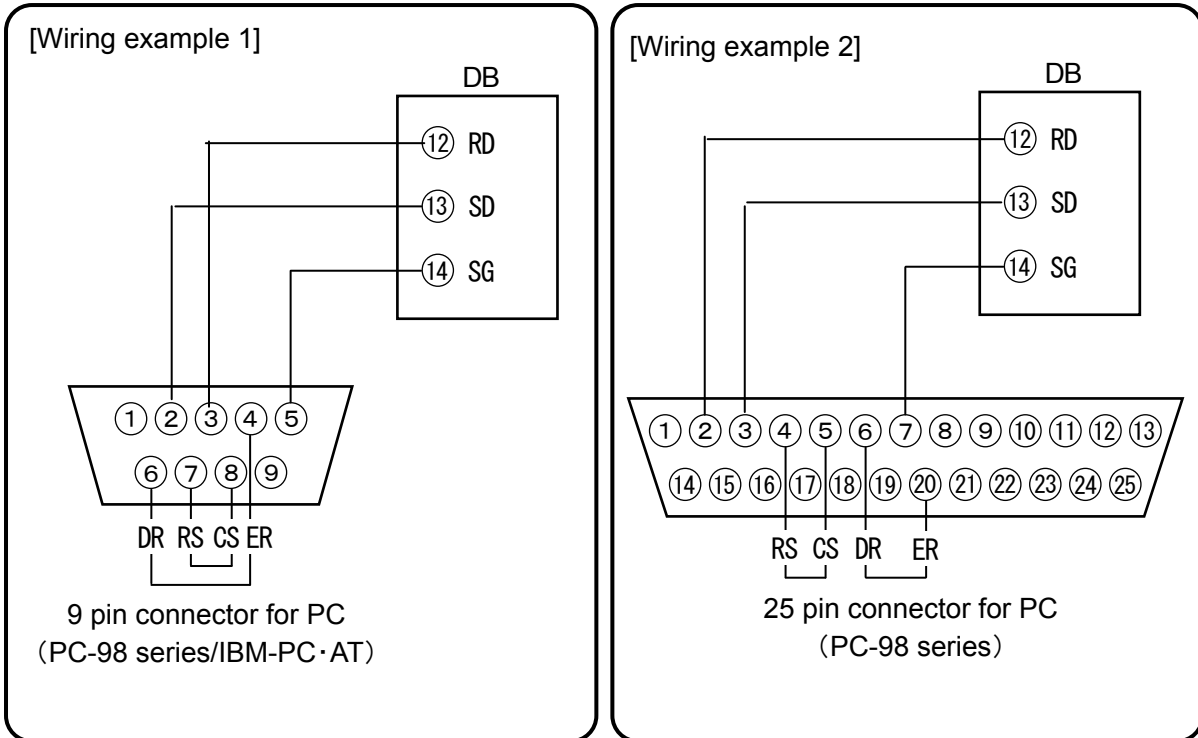
7-2-3. Communication cable for RS-485

① Connection between line converter and DB; and between DBs

Cable	0 type crimp style terminal ↔ 0 type crimp style terminal RS-485 cable
<p>Format</p>	 <p>Line converter side</p> <p>DB side</p> <p>SG (Signal Grand) wire is available in both the terminals using 2 wick cable made by twisting CVVS wire. It is disconnected and used as there is no SG terminal on the line converter side.</p>
<p>Internal wiring</p>	 <p>RDA ○ SA</p> <p>RDB ○ SB</p> <p>SG ○ SG</p>
<p>Model code</p>	<p>RZ-LEC□□□</p> <p>└─ Cable length is 001 to 200m (Specified)</p>

7-3. RS-232C connection

DB uses sending, receiving and Signal Grand (SG) only and does not use any other control signal. In general PC as controlling is done by control signal, it does not operate just by connecting 3 signal wires. As the wiring process in the connector, differs on how the PC controls the control signal, see the instruction manual of the PC that is being used.



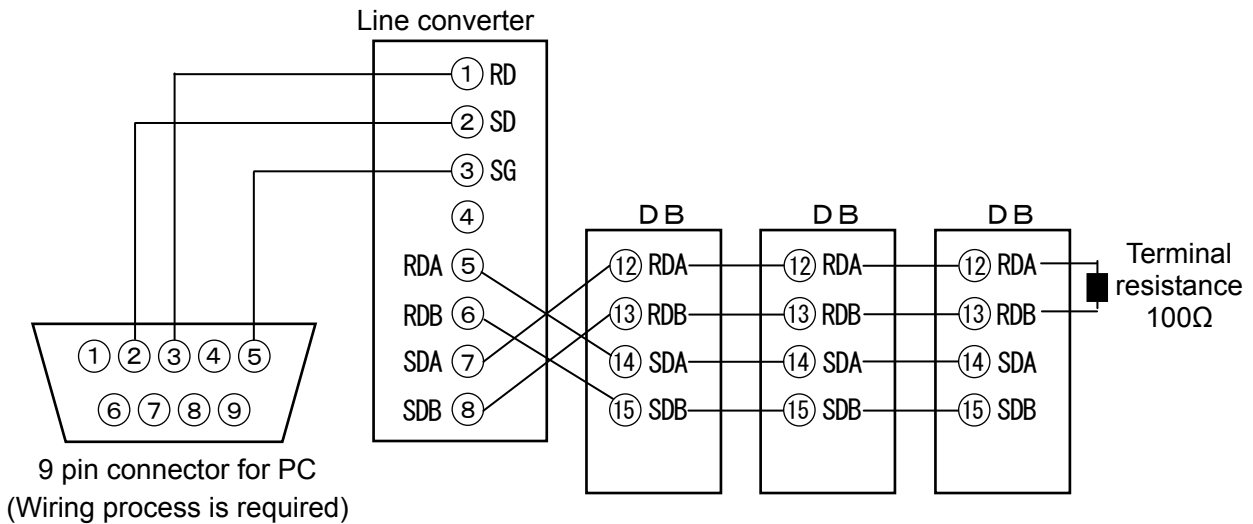
Precautions

RS-232C cable length is maximum 15m. NEC make PC98 series 9 bit connector is 'Wiring example 1' and 25 pin connector is connected as shown in 'Wiring example 2'.

7-4. Wiring of RS-422A/485

Connect RS-422A communication interface to the PC using line converter (Our company model:SC8-10). Line converter and PC use only three signals namely send, receive and signal grand and do not use any other control signal. Hence wiring process in the connector similar to that in RS-232C connection, is necessary. (For details see the instruction manual of the line converter.)

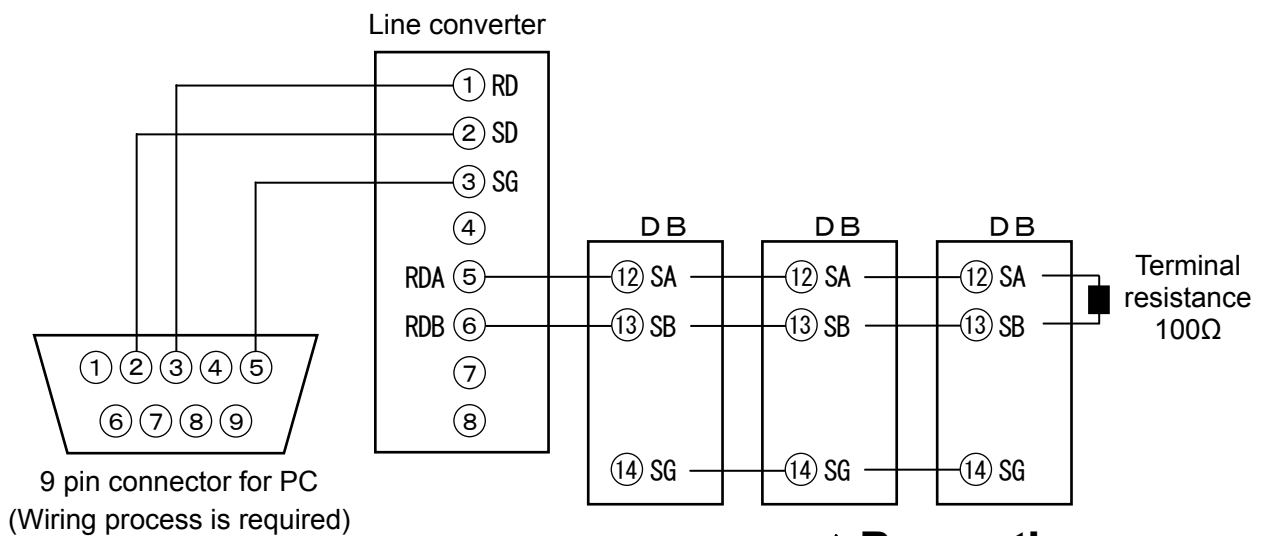
Wiring of RS-422A



⚠ Precautions

Do not connect the SG wire to FG terminal or grounding terminal of the device.

Wiring of RS-485



⚠ Precautions

Do not connect the SG wire to FG terminal or grounding terminal of the device.

8. MODBUS protocol

Basic procedure and precautions regarding communication



Precautions

In order to avoid accidents always read the contents and understand them.

1. When setting (Right) the parameters, setting is controlled using key operations.

Communication is possible any time in DB. Response is received against the data request from the PC at any time.

2. Device number is necessary in RS-232C also.

In RS-232C, PC and DB are connected on one to one basis. Device is set and communication for this device number is performed.

3. As control signal wire is not used, consider resending the command.

Serial interface of DB communicates without using the control wire. As a result, sometimes reception defect may occur due to DB status hence consider resending the command.

4. Do not remove the communication cable or a device and do not switch ON-OFF the power supply during communication.

If cable or device that makes up the serial interface is removed or power supply is switched ON-OFF, operation is stopped and error may occur. If this is the status, it is necessary to reset all the devices that make up the serial interface and redo everything from the beginning.

5. Send the next command only after confirming that the communication drive is OFF.

In RS-422A/485, multiple devices are connected to the same communication line and only one machine whose device number is specified by the PC drives the communication line. At that time in order that the PC receives all the characters for sure, let some time elapse after the last character is sent and then switch OFF the drive of communication line. If command for the next device is sent by the PC before it gets switched OFF, signals conflict and normal communication is not performed, hence take care when using high speed PCs. This interval is approximately 5ms.

8-1. Message transmission mode

There are two types of modes namely RTU(Remote Terminal Unit) mode and ASCII mode and they are selected using the front key setting.

<Table 1 Comparison between RTU mode and ASCII mode>

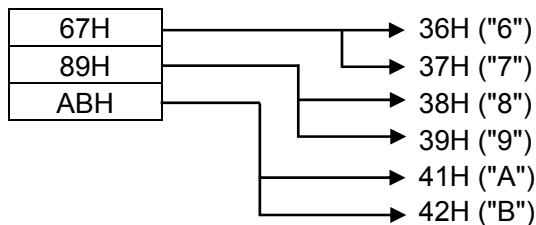
Item		RTU mode	ASCII mode
Interface		RS-232C, RS-422A, RS-485	
Communication system		Half duplex asynchronous system	
Communication speed		2400,4800,9600,19200,38400bps	
Transmission code		Binary	ASCII
Error check (Error detection)	Vertical direction	Parity	
	Horizontal direction	CRC-16	LRC
Character configuration	Start bit	1 bit	
	Data length	7 bit/8 bits	
	Parity bit	None/even/odd	
	Stop bit	1 bit/2 bits	
Message start code		None	: (Colon)
Message end code		None	CR, LF
Data time interval		Less than 28 bit time	Less than 1 second

8-1-1. Transmission data

RTU mode is binary forwarding. ASCII mode splits the RTU 8 bit binary into high order and low order 4 bits and garbles each character (0 to 9, A to F).

Example) RTU mode

ASCII mode

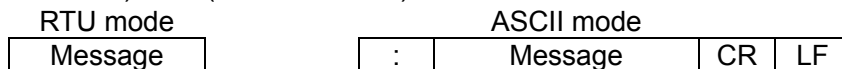


As the length of message in RTU mode is half that of ASCII mode and hence effective transmission is done.

8-1-2. Configuration of the message frame

RTU mode is made up of message part only.

ASCII mode is made up of start character ": (Colon, 3AH)", message and end character "CR (Carriage return, 0DH) + LF (Line feed, 0AH)".



ASCII mode has a strong point that, as the start character is ":" it facilitates troubleshooting.

8-2. Data time interval

During RTU mode: Less than 9600bps:20msec, 9600bps or more:5msec

During ASCII mode: Less than 1 second

When sending a message, do not let the time interval of data that makes up one message exceed the time span mentioned above. If it exceeds the time interval mentioned above, the receiving side (this device), in order to judge the end of transmission from the transmission side, processes it as an abnormal message reception.

In RTU mode message characters should be sent continuously whereas in ASCII mode as character gap is maximum 1 second, master (PC) processing speed is comparatively slow but it can be used.

8-3. Message configuration

MODBUS message is made up of the following, in case of both the RTU and ASCII mode.

Slave address
Function code
Data
Error check

8-3-1. Slave address

Set the slave address beforehand in a range of 1 to 99 using front key setting. Master usually does the transmission with one slave. All the connected devices receive in common the message sent from the master. However, the slave whose slave address matches with the slave address in the command message only responds to that message.

Slave address '0' is used in message(broad cast) for all the slaves from the master. In this case the slave does not return a response.

8-3-2. Function code

Function code is a code that is to be executed in the slave and each data is roughly categorized as follows. For details see the reference table.

- ① Digital setting value : AT start
- ② Digital input data : Event status etc.
- ③ Analog setting value : Various setting information. Numeric value range is a numeric value within the range of 16 bits.
-32768 to 32767 (For details see reference table).
- ④ Analog input data : Measurement data, status etc. Numeric value range is a numeric value within a range of 16 bits.

<Table 2. Function code table>

Code	Function	Unit	MODBUS original function (Reference)
01	Read digital (ON/OFF) setting value	1 bit	Read coil status
02	Read digital input data	1 bit	Read input relay status
03	Read analog setting value	16 bits	Read the contents of maintenance register
04	Read analog input data	16 bits	Read the contents of input register
05	Write the digital setting value	1 bit	Change the status of single coil
06	Write the analog setting value	16 bits	Write to single maintenance register
08	Loop back test (Send the received data)		Loop back test
15	Write multiple digital setting values		Change the status of multiple coils
16	Write multiple analog setting values		Write to multiple maintenance registers

8-3-3. Data division

Function of data differs depending on the function code. During the request from the master, it consists of code number (relative number calculated from reference number mentioned hereinafter) of the data that is to be read and written and the data unit count etc. Response from the slave is made up of data etc. that is requested.

Basic data of MODBUS is 16 bit integer on a whole and presence or absence of tag is specified for each data. Thus by putting the decimal point after another number make it as an integer value or by fixing the decimal point position make it standard by upper and lower limit of the scale and express it. In DB a system of putting the decimal point in a different position is fetched.

Precautions

In the data division, specific numeric value can be assigned as error data, like input data. When using such data, first judge the error of the data and then combine it with decimal point data. If it is combined with decimal data earlier, then error data is mistook as normal data.

8-3-4. Reference number

In the DB there is a number called 'Reference number' that is allotted and it is required when reading and writing the data. The data in the DB is categorized depending on its type into, 'Digital setting value', 'Digital input data', 'analog input data' and 'analog settings value'. (8-7. DB relative number table)

When reference number of MODBUS original is to be specified, see section 8.8 Reference table for MODBUS protocol.

<Table 3. Reference number and relative number>

Data kind	Reference number	Relative number	MODBUS original (Reference)
Digital setting value	1 to 10000	Reference number-1	Coil
Digital input data	10001 to 20000	Reference number-10001	Input relay
Analog input data	30001 to 40000	Reference number-30001	Input register
Analog setting value	40001 to 50000	Reference number-40001	Maintenance register

Example) Relative number of measurement value (PV) of 'Reference number 30101' is '100'.

<Table 4. DB reference number chart table>

Data kind	Parameter	Reference number	Relative number	Code	Reference table
Digital setting value	AT start FB tuning	101 111	100 110	01 05 15	Section 8-7-3
Digital input Data	Error status Event status	10002 to 10124	1 to 123	02	Section 8-7-4
Analog setting value	Setup parameter 1 Setup parameter 2 1 type parameter Execution parameter & specific parameter 8 type parameter No.1 8 type parameter No.2 8 type parameter No.3 8 type parameter No.4 8 type parameter No.5 8 type parameter No.6 8 type parameter No.7 8 type parameter No.8	40001 to 40047 40051 to 40093 40101 to 40148 40151 to 40187 40201 to 40246 40251 to 40296 40301 to 40346 40351 to 40396 40401 to 40446 40451 to 40496 40501 to 40546 40551 to 40596	0 to 46 50 to 92 100 to 147 150 to 186 200 to 245 250 to 298 300 to 345 350 to 395 400 to 445 450 to 495 500 to 545 550 to 545	03 06 16	Section 8-7-1
Operation status setting	Operation status information	49056 to 49513	9055 to 9512	03 06 16	Section 8-7-1
Analog input data	Real data parameter	30101 to 30143	100 to 142	04	Section 8-7-2

8-3-5. Error check

Error check of transmission frame differs depending on the mode.

RTU mode: CRC-16

ASCII mode: LRC

① Calculation of CRC-16

CRC system assigns the information that is to be sent, by generating polynomials, and sends the rest of the information by appending it at the end. Generating polynomial is as follows.

$$1 + X^2 + X^{15} + X^{16}$$

Target extends from slave address to the end of the data and calculation is done by the following procedure.

- 1) Initialization(=FFFFH) of CRC-16 data (Consider it as X)
- 2) Exclusive-OR (EX-OR) of data 1 and X→X
- 3) Shift X one bit to the right→X
- 4) If carry appears get A001H and EX-OR. If it does not appear go to 5).→X
- 5) Repeat 3) and 4) until shifting is done for 8 times.
- 6) Net data and EX-OR of X.→X
- 7) Same as 3) to 5).
- 8) Repeat till the end of the data.
- 9) Create messages in low order and high order of 16 bit data (X) that is calculated.

Example) When data is [02H] [07H], CRC-16 becomes 1241H hence the error check data becomes [41H] [12H].

Reference: CRC-16 calculation program

```
/***** CRC-16 calculation program (C language) *****/
#include <stdio.h>
#include <conio.h>

void main(void)
{
    /*** Internal change declaration ***/
    unsigned int    iLoopCnt;          /* Loop counter          */
    unsigned short  usData;            /* Input data            */
    unsigned short  usCrcData;         /* CRC-16 data          */
    unsigned short  usErrChkData;     /* Error check data     */
    int             iDummy;           /* Dummy variable       */

    /* Initialize the output result of CRC-16 data */
    usCrcData = 0xffff;

    printf(" Enter hexadecimal data.(End using [q]) >¥n");
    while( scanf("%x",&usData) != 0 )
    {
        /* Get the exclusion of CRC output result and the data that is input */
        usCrcData = usData ^ usCrcData;

        /*** Do the CRC calculation ***/
        /* Repeat till shifting up to 8 bits is done */
        for( iLoopCnt = 0 ; iLoopCnt < 8 ; iLoopCnt++ )
        {
            /* Check the presence of carry */
            if( usCrcData & 0x0001 )
            {
                /* When carry occurs */
                /* Shift CRC output result 1 bit to the right */
                usCrcData = usCrcData >> 1;

                /* Get the exclusion with A001H */
                usCrcData = usCrcData ^ 0xa001;
            }
            else
            {
                /* When carry does not occur */
                /* Shift CRC output result 1 bit to the right */
                usCrcData = usCrcData >> 1;
            }
        } /* for */
    } /* while */

    printf("CRC-16 data is %xH.¥n", usCrcData );

    /* Create error check data */
    usErrChkData = ( usCrcData >> 8 ) | ( usCrcData << 8 );
    printf("Data for error check is %xH.", usErrChkData );

    iDummy = getch();
}
```


② LRC calculation method

Target extends from slave address to the end of the data and calculation is done by the following procedure.

- 1) Create message in RTU mode.
- 2) Add from the beginning (Slave address) to the end of data. → X
- 3) Get the complement (bit inversion) of X. → X
- 4) Add 1. (X=X+1)
- 5) Add X as LRC at the end of the message.
- 6) Convert everything to ASCII character.

Example) When data is [02H][07H], LRC becomes [F7H] hence

Binary message becomes [02H] [07H] [F7H]
ASCII message becomes [30H] [32H] [30H] [37H] [46H] [37H]

Reference: LRC calculation program

```
/* LRC calculation program (C language) */
#include <stdio.h>
#include <conio.h>

void main(void)
{
    /** Internal change declaration */
    unsigned short usData; /* Input data */
    unsigned short usLrcData; /* LRC data */
    int iDummy; /* Dummy variable */

    /* Initialize the output result of LRC data */
    usLrcData = 0;

    printf(" Enter hexadecimal data.(End using [q]) >¥n");
    while( scanf("%x",&usData) != 0 )
    {
        /* Add from the beginning to the end of the data */
        usLrcData += usData;
        /* Cancel high order 1 byte */
        usLrcData = usLrcData & 0xff;
    } /* while */

    /* Get the exclusion with FFH */
    usLrcData = usLrcData ^ 0xff;

    /* Add 1 */
    usLrcData = usLrcData++;
    /* Cancel high order 1 byte */
    usLrcData = usLrcData & 0xff;

    /* LRC error check */
    printf("LRC-16 data is %xH..¥n", usLrcData );

    iDummy = getch();
}
```

8-3-6. Precautions while processing the data

- ① Decimal point position of each data is clearly mentioned in the reference table. There are various points like fixing the decimal point position, points to be decided for every measurement range (See section 8.9), items as per linear decimal point setting. Take care about the decimal point position when data is regenerated.
- ② As every data can be accessed (changed), it is necessary to take care at the time of setting the related data. For example, there exists data initialization process etc. depending on the change in the measurement range. Process contents are mentioned in reference number table.
- ③ Read and write the data in the range of the numbers, specified by reference number. If data is read and written for the reference numbers that are not specified, device operation may get affected.
- ④ Many reference numbers that are not continuous can be read and write, however, if the reference number that is not specified is the starting number than it is an error (Error-02H).
- ⑤ When reading a number of reference numbers, the data of the number that is not specified by the reference becomes '0'.
- ⑥ When writing multiple reference numbers, if an error occurs all the settings become disabled.

8-4. Method of creating a message

Message is made up of ① Slave address, ② Function code, ③ Data division, ④ Error check code. (See section 8-3.)

Message that can be read and written once is within the following range.

Function code	Number of data units	
	ASCII mode	RTU mode
01	64	64
02	64	64
03	32	64
04	32	64
15	64	64
16	32	64

Note) Number of units of data is the request from high order

Method of creating a message is explained in the following example.

Example) Reading the measurement value of 'Slave address 02' DB

8-4-1. Message in RTU mode

① Slave address: 02 [02H]

Function code: 04 [04H]

Becomes 'Reading analog input data (Reading contents of input register)'. When action code is '04' specify 'Relative number of data 2 bytes' and 'number of units of data' that is to be read in data division. (See section 8-5. For 'function code:04', see section 8-5-4.)

× It is necessary to confirm the number of bytes of data.

③ Data division: Starting relative number 100 ([00H][64H]), Number of units 2 ([00H][02H])

Measurement value (Analog input data) is stored in reference number '30301 to 30143' (See section 8-3-4. table 3). From the table it is understood that measurement value (PV) is stored in '30101' and PV status is stored in '30102'. (See section 8-7. For details on reading the measurement value see sections 8-7-2.) Relative number of the beginning 'Reference number 30101' is 30101-30001=100 and if displayed in 2 bytes it becomes '[00H] [64H]' (See section 8-3-4 table 3).

Number of units of data to be read is '2 units' of measurement value and PV status, hence when displayed in 2 bytes, it becomes [00H] [02H].

④ Error check: Calculate using CRC-16 2730H ([30H][27H])

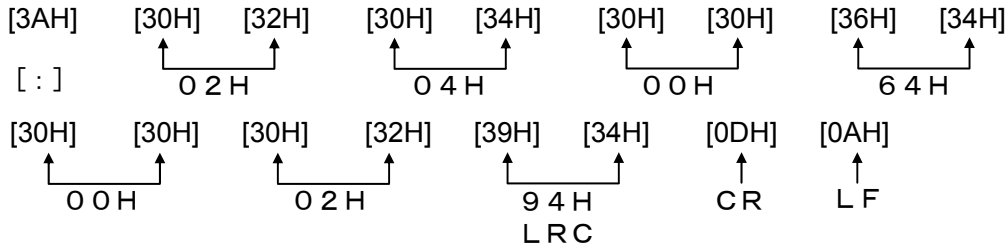
Error check in RTU mode is calculated using CRC-16. (See section 8-3-5.①) Data of message basic division becomes [02H] [04H] [00H] [64H] [00H] [02H] according to ① to ③ and CRC-16 becomes 2730H. Thus error check data becomes [30H] [27H].

⑤ Message: [02H] [04H] [00H] [64H] [00H] [02H] [30H] [27H]

Create message according to the message configuration. (See 8-3.)

8-4-2. ASCII mode message

Calculate error check LRC from message basic division. LRC becomes 94H (See section 8-3-5.②). Convert each data of basic division to ASCII code and also convert LRC to ASCII code and add it to basic division. Starting character of message is ":" and add "CR", "LF" at the end.



8-5. Function code

Function code wise response is shown below. (See section 8-3-2 <Table 2. Function code table>)

Note) See section 8-6 for response in case of abnormality

8-5-1. Reading digital setting value (Reading the coil status)

[Function code : 01 (01H)]

Read only from specified number to specified units 'Continuous (ON/OFF) digital setting value of the number' is read. ON/OFF data is made up of data (1 byte) that contains 8 units in numeric order and the response message data. LSB (DO side) of each data becomes a digital data of the smallest number. If the units that are to be read are not in multiples of 8, then the bits that are not required become 0.

Example) Reading the digital settings value reference number 101 of slave 2

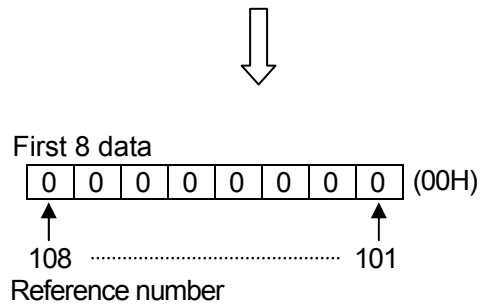
Reference number	101
Data	OFF

AT stop

<RTU mode>

Master → Device	
Slave address	02H
Function code	01H
Starting number (H)	00H
Starting number (L)	64H
Number of units (H)	00H
Number of units (L)	01H
CRC(L)	BCH
CRC(H)	26H

Device → Master (Normal)	
Slave address	02H
Function code	01H
Data count	01H
Initial 8 data	00H
CRC(L)	51H
CRC(H)	CCH



<ASCII mode error check>

Error check CRC (L), CRC (H) part is as follows.

LRC	98H	LRC	FCH
-----	-----	-----	-----

Note) Starting number (Relative number) is 'Reference number-1'. (Decimal 100(=101-1)→Hexadecimal 64H)

Note) Data count is the number of bytes of data.

(It differs from request units. For example request unit is 1 unit, data count is 1 unit).

8-5-2. Reading digital input data (Reading the status of input relay)

[Function code : 02 (02H)]

Read only from specified number to specified units 'Digital (ON/OFF) input data with continuous numbers'. ON/OFF data is made up of data (1 byte) that contains 8 units in numeric order and the response message data. LSB (DO side) of each data becomes a digital data of the smallest number. If the units that are to be read are not in multiples of 8, then the bits that are not required become 0. Example of response is same as that of 'Function code 01'. However starting number (Relative number) is 'Reference number-10001'.

8-5-3. Reading analog setting value (Reading the contents of maintenance register)

[Function code : 03 (03H)]

From the specified number, only the number of units of the continuation of number 'Analog setting value (2 bytes:16 bytes) data' that are specified are read. Data is split into high order 8 bits to low order 8 bits and is arranged in numeric order and consists of the data of response message. Example) Reading P=5.0%,I=60 seconds, D=30 seconds of parameter 1 PID of slave 1.

(Reading 3 units of analog setting value reference number from 49003 to 49005 of slave 1.)

Reference number (Relative number)	40206 (00CDH)	40207 (00CEH)	40208 (00CFH)
Data	50 (0032H)	60 (003CH)	30 (001EH)

← Example of P=50, I=60, D=30

<RTU mode>

Master → Device

Slave address	01H
Function code	03H
Starting number (H)	00H
Starting number (L)	CDH
Number of units (H)	00H
Number of units (L)	03H
CRC(L)	94H
CRC(H)	34H

Device → Master (Normal)

Slave address	01H
Function code	03H
Data count	06H
P(H)	00H
P(L)	32H
I(H)	00H
I(L)	3CH
D(H)	00H
D(L)	1EH
CRC(L)	58H
CRC(H)	B5H

<ASCII mode error check>

LRC	2CH
-----	-----

LRC	6AH
-----	-----

Note) Starting number(Relative number)is 'Reference number-40001'.

Note) Data count is the number of bytes of data.

(It differs from request units. In the example request unit count is 3 units, data count is 6 unit).

Note) There is a limitation on the number of data units of the message (This device can be sent) that can be received once.

(See section 8-4.)

8-5-4. Reading analog input data (Reading the contents of input register)

[Function code : 04 (04H)]

From the specified number, only the number of units 'Analog input (2 bytes:16 bytes) data of the continuation number' that are specified are read. Data is split into high order 8 bits to low order 8 bits and is arranged in numeric order and consists of the data of response message. Response example is similar to that of 'Function code 03'. However starting number (Reference number) is 'Reference number-30001'.

8-5-5. Writing the digital setting value (Changing the status of single coil)

[Function code : 05 (05H)]

Consider the digital setting value of the specified number as the status (ON/OFF) that is specified.

Example) Execute AT of slave 2. (Switch ON the digital setting value reference number 101 of slave 2.)

<RTU mode>

Master → Device		Device → Master (Normal)	
Slave address	02H	Slave address	02H
Function code	05H	Function code	05H
Setting value number (H)	00H	Setting value number (H)	00H
Setting value number (L)	64H	Setting value number (L)	64H
Setting status (H)	FFH	Setting status (H)	FFH
Setting status (L)	00H	Setting status (L)	00H
CRC(L)	CDH	CRC(L)	CDH
CRC(H)	D6H	CRC(H)	D6H

<ASCII mode error check>

LRC	96H	LRC	96H
-----	-----	-----	-----

Note) During normal response the response is same as command message.

Note) Setting value number(Relative number)is 'Reference number-1'. (Decimal 100(=101-1)→Hexadecimal 64H)

Note) At the time of executing, set 'FF00H'. Set '0000H' at the time of stopping AT.

Note) If slave address is considered as 0, all the slave machines execute that command. However no slave machine responds.

8-5-6. Writing analog setting value (Writing to single maintenance register)

[Function code : 06 (06H)]

Consider the analog setting value of the specified number as the set value.

Example) Set input type number of slave 1 as 5(K1).

<RTU mode>

Master → Device		Device → Master (Normal)	
Slave address	01H	Slave address	01H
Function code	06H	Function code	06H
Setting value number (H)	00H	Setting value number (H)	00H
Setting value number (L)	00H	Setting value number (L)	00H
Set data (H)	00H	Set data (H)	00H
Set data (L)	05H	Set data (L)	05H
CRC(L)	49H	CRC(L)	49H
CRC(H)	C9H	CRC(H)	C9H

<ASCII mode error check>

LRC	F4H	LRC	F4H
-----	-----	-----	-----

Note) Starting number(Relative number)is 'Reference number-40001'.

Note) During normal response the response is same as command message.

Note) If slave address is considered as 0, all the slave machines execute that command.
However no slave machine responds.

8-5-7. Loop back test

[Function code : 08 (08H)]

Perform transmission check between master slaves. Respond for the diagnosis code that is specified. In this device perform 'return check to send the received data as it is' and diagnosis code is fixed as '0000H'.

Example) Implement 'Loop back test' to slave 2.

<RTU mode>

Master → Device		Device → Master (Normal)	
Slave address	02H	Slave address	02H
Function code	08H	Function code	08H
Diagnosis code (H)	Fixed	Diagnosis code (H)	00H
Diagnosis code (L)		Diagnosis code (L)	00H
Option data	*	Received data	*
Option data	*	Received data	*
CRC(L)	*	CRC(L)	*
CRC(H)	*	CRC(H)	*

8-5-8. Writing multiple digital setting value (Change is status of multiple coils)

[Function code : 15 (0H)]

From the specified number consider the digital setting value of the specified number of units as the specified status (ON/OFF).

ON/OFF specification becomes, one data of 8 units in numeric order. LSB (DO side) of each data becomes the digital data of smallest number. If the units to be written are not in multiples of 8, ignore the bits that are not required.

Example) Set AT of slave 2 to start.

(Change the digital setting value reference number 101 of slave 2 to the following status.)

Reference number	101
Data	ON

AT start

<RTU mode>

Master → Device

Slave address	02H
Function code	0FH
Starting number (H)	00H
Starting number (L)	64H
Number of units (H)	00H
Number of units (L)	01H
Data count	01H
Initial 8 data	01H
CRC(L)	DEH
CRC(H)	8AH

Device → Master (Normal)

Slave address	02H
Function code	0FH
Starting number (H)	00H
Starting number (L)	64H
Number of units (H)	00H
Number of units (L)	01H
CRC(L)	D5H
CRC(H)	E7H

<ASCII mode error check>

Error check CRC(L),CRC(H)part is as follows.

LRC	88H
-----	-----

LRC	8AH
-----	-----

Note) Starting number(Relative number)is 'Reference number-1'. (Decimal 100(=101-1)→Hexadecimal 64H)

Note) If slave address is changed to 0, all the slave machines execute that command. However no slave machine responds.

Note) There is a restriction on the number of data units of message that can be sent once (That this device can receive). (See section 8-4.)

8-5-9. Writing multiple analog setting values (Writing to multiple maintenance register)

[Function code : 16 (10H)]

From the specified number, change the analog setting value of specified number of units to the specified value. Data is split into high order 8 bits and low order 8 bits, is arranged in numeric order and then sent.

Example) Set parameter 1 PID of slave 1 as P=12.0%,I=90 seconds, D=25 seconds.

(Set 3 units of analog setting value reference number from 40206 to 40208 of slave 1.)

Reference number (Relative number)	205 (00CDH)	206 (00CEH)	207 (00CFH)
Data	120 (0078H)	90 005AH	25 (0019H)

<RTU mode>

Master → Device		Device → Master(Normal)	
Slave address	01H	Slave address	01H
Function code	10H	Function code	10H
Starting number (H)	00H	Starting number (H)	00H
Starting number (L)	CDH	Starting number (L)	CDH
Number of units (H)	00H	Number of units (H)	00H
Number of units (L)	03H	Number of units (L)	03H
Data count	06H	CRC(L)	11H
Initial data (H)	00H	CRC(H)	C4H
Initial data (L)	78H		
Second data (H)	00H		
Second data (L)	5AH		
Third data (H)	00H		
Third data (L)	19H		
CRC(L)	33H		
CRC(H)	95H		

<ASCII mode error check>

LRC	2EH	LRC	1EH
-----	-----	-----	-----

Note) Starting number(Relative number)is 'Reference number-40001'.

Note) If slave address is considered as 0, all the slave machines execute that command. However no slave machine responds.

Note) There is a restriction on the number of data units of message that can be sent once (That this device can receive). (See section 8-4.)

8-6. Process during abnormality

If there is an error in the contents of the message from the master, respond as follows.

8-6-1. In case of no response

In the following cases the messages are ignored and no response is given.

- ① When transmission error (over run, framing, parity, CRC or LRC) is detected in the message.
- ② When the slave address during the message is not the self address.
- ③ When the data interval of the message is long.
 - RTU mode...When less than 9600bps:20msec or more
When 9600bps or more:5msec or more
 - ASCII mode...1 second or more
- ④ When transmission parameters do not match.
- ⑤ When received message exceeds the number of bytes that can be received (Sometimes no response is given when the number of messages that can be received are received.)

Note) When slave address is '0' by write function, it there is no error in the message, message is executed but there is no response. If the error mentioned above occurs in the message then also there is no response, hence when slave address is '0' the normality/abnormality cannot be judged.

8-6-2. Response of error message

In the contents of the message from the master if the errors mentioned in section 8-6-1 do not occur instead if the following error is detected, then display (respond) as 'error message' the code that shows error contents

Format of error message is as follows.

Slave address	Function code	Function code + 80H
Function code + 80H	01	81H
Error code	02	82H
CRC(L)	03	83H
CRC(H)	04	84H
	05	85H
	06	86H
	08	88H
	15	8FH
	16	90H

Error codes are as follows.

Error code	Contents
01H	Function code defect When function code that is not specified is received
02H	Relative number (reference number) defect When received starting data or setting value number is other than what is specified
03H	Defect of number of units of data <ul style="list-style-type: none"> · When the number of units of data to be sent in response to the received message exceeds the specified number of units · When requested number of data units is 0 · When received data count and actual data count do not match
11H	Other than setting value range When numeric value that is out of setting range is mentioned in the reference table
12H	Cannot be set <ul style="list-style-type: none"> · When linear decimal point is written during TC/Pt input · When linear scale is written during TC/Pt input · When AT is started during AT · When FB tuning is executed during AT, FB tuning · When manual output is written when there is no manual operation · When remote SV is written when local status or communication status is other than REM

8-7.DB relative number table

8-7-1. Analog setting value

① Setup parameter 1

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Setting range (Communication range)	Initial value	Remarks
40001	03 06 16	R W W	Input type number	<p>[Standard input]</p> <p>1/2/3/4/5/6/7/8/9/ 10/11/12/13/14/15/ 16/17/18/19/20/ 21/22/23/24/25/26/ 27/28/31/32/33/ 34/35/36/37/41/42/ 44/45/46/47/49/ 50/51/53/54/56/57 (1/2/3/4/5/6/7/8/9/1 0/11/12/13/14/15/1 6/17/18/19/20/ 21/22/23/24/25/26/ 27/28/31/32/33/ 34/35/36/37/41/42/ 44/45/46/47/49/ 50/51/53/54/56/57)</p> <p>[4-wire type input]</p> <p>41/42/44/45/46/47/ 49/50/51/52/53/ 54/56/57 (41/42/44/45/46/ 47/49/50/51/52/53/ 54/56/57)</p>	<p>[Standard input]</p> <p>5 (K1)</p> <p>[4-wire type input] 53 (Pt100Ω1)</p>	<p>[Standard input]</p> <p>1= B 2= R1 3= R2 4= S 5= K1 6= K2 7= K3 8= E1 9= E2 10= E3 11= E4 12= J1 13= J2 14= J3 15= J4 16= T1 17= T2 18= WRe5-26 19= W-WRe26 20= NiMo-Ni 21= CR-AuFe 22= N 23= PR5-20 24= PtRh40-20 25= Plati II 1 26= Plati II 2 27= U 28= L 31= ±10mV 32= ±20mV 33= ±50mV 34= ±100mV 35= ±5V 36= 0-20mA 37= ±10V 41= JPt100Ω1 42= JPt100Ω2 44= JPt100Ω4 45= JPt100Ω5 46= QPt100Ω1 47= QPt100Ω2 49= QPt100Ω4 50= QPt100Ω5 51= Pt50Ω 53= Pt100Ω1 54= Pt100Ω2 56= Pt100Ω4 57= Pt100Ω5</p>

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Setting range (Communication range)	Initial value	Remarks
						[4-wire type input] 41= JPt100Ω1 42= JPt100Ω2 44= JPt100Ω4 45= JPt100Ω5 46= QPt100Ω1 47= QPt100Ω2 49= QPt100Ω4 50= QPt100Ω5 51= Pt50Ω 52= Pt-Co 53= Pt100Ω1 54= Pt100Ω2 56= Pt100Ω4 57= Pt100Ω5 See range list. (Section 8-9)
40002	03 06 16	R W W	Unit number	0/2 (0/2)	0 (°C)	0= Celsius temperature (°C) 2=Absolute temperature (K) When input type is 21:CR-AuFe, 52: Pt-Co setting,0:°C cannot be written. 1 means 'Do not set'.
40003	03 06 16	R W W	RJ	0/1 (0/1)	0	0=RJ_INT (internal) 1=RJ_EXT (external)
40004	03 06 16	R W W	Range 'Zero'	Within input range, Range in which 5 digits can be displayed (-19999 to 30000)	Auto development	Always set zero<span. Range is within the input range and WRITE is performed. (See section 8-9 measurement range and decimal point position)
40005	03 06 16	R W W	Range 'span'	Within input range, Range in which 5 digits can be displayed (-19999 to 30000)	Auto development	Always set zero<span. Range is within the input range and WRITE is performed. (See section 8-9 measurement range and decimal point position)
40006 40007	03 06 16	R W W	Linear scale 'MIN' Linear scale 'MAX'	-19999 to 30000 (-19999 to 30000) -19999 to 30000 (-19999 to 30000)	0 2000.0	Input whose range is set... Decimal point position depends on linear decimal point settings. In TC/Pt input status is READ only and writing is not possible.

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Setting range (Communication range)	Initial value	Remarks
40008	03 06 16	R W W	SV decimal point	0 to 4 digits (0 to 4)	1	Set decimal point position of linear scale In TC/Pt input, fixed value for each range can be READ. Writing is not possible.
40011	03 06 16	R W W	PV decimal point	0 to 4 digits (0 to 4)	1	
40012	03 06 16	R W W	Digital filter	0.0 to 99.9 (0 to 999)	0.1seconds	0.0=OFF
40020	03 06 16	R W W	SV decimal point for display	0 to 4 digits (0 to 4)	1	SV decimal point position of the first display part
40021	03 06 16	R W W	Direct/Reverse of control action	0/1 (0/1)	1 (REVERSE)	0= Direct (DIRECT: Direct operation) 1= Reverse (REVERSE: Reverse operation)
40022	03 06 16	R W W	Pulse cycle	1 to 180 (1 to 180)	30 seconds	Control output 1 can WRITE only ON OFF pulse/SSR drive pulse
40023	03 06 16	R W W	FB zero	0.0 to 99.9 (0 to 999)	0.0	Always set by zero<span. Control output 1 can write ON OFF servo type only.
40024			FB span	0.1 to 100.0 (1 to 1000)	100.0	
40025			FB dead band	0.5 to 5.0 (5 to 50)	1.0	
40026	03 06 16	R W W	Direct/reverse of control action of output 2	0/1 (0/1)	1 (REVERSE)	0= Direct (DIRECT: Direct operation) 1= Reverse (REVERSE: Reverse operation)
40027	03 06 16	R W W	Pulse 2 cycle	1 to 180 (1 to 180)	30 seconds	Control output 2 can WRITE only ON OFF pulse/SSR drive pulse.
40030	03 06 16	R W W	Cancel report output	0/1 (0/1)	0 (Usual alarm)	0= (Usual alarm) 1= Cancel alarm

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Setting range (Communication range)	Initial value	Remarks				
40031	03 06 16	R W W	Alarm format 'AL1'	[Alarm format] 0/1 (0/1) [Alarm assistance] 0/1/4/5 (0/1/4/5)	[Format] 1 (Deviation) [Assistance] 0 (Higher limit)	Alarm format 0=A (Absolute value) 1=D (Deviation) · Alarm assistance 0= H__(Higher limit, No wait, No maintenance) 1= HW_(High limit, Wait exists, No maintenance) 4= L__(Low limit, No Wait, No maintenance) 5= LW_(Low limit, Wait exists, No maintenance) * Low order 8 bits is the alarm format setting, high order 8 bit does alarm assistance function setting. High order 8 bit Low order 8 bit <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="width: 50px;">Alarm support</td> <td style="width: 50px;">Alarm format</td> </tr> <tr> <td colspan="2" style="text-align: center;">Setting value</td> </tr> </table>	Alarm support	Alarm format	Setting value	
Alarm support	Alarm format									
Setting value										
40032	03 06 16	R W W	Alarm dead band 'AL1'	0.00 to 200.00 (0 to 20000)	2.00	Decimal point position when alarm format has absolute value/deviation: When SV DOT=0 it is→1 When SV DOT=1 it is→2 When SV DOT=2 it is→3 When SV DOT=3 it is→4 When SV DOT=4 it is→4				
40036	03 06	R W	Alarm format 'AL2'	Same as alarm format 'AL1'	[Format] 1 (Deviation) [Assistance] 4 (Lower limit)	Same as alarm format 'AL1'				
40037	03 06 16	R W W	Alarm dead band 'AL2'	Same as alarm dead band 'AL1'	2.00	Same as alarm dead band 'AL1'				
40041	03 06 16	R W W	Alarm format 'AL3'	Same as alarm format 'AL1'	[Format] 1 (Deviation) [Assistance] 0 (Higher limit)	Same as alarm format 'AL1'				
40042	03 06 16	R W W	Alarm dead band 'AL3'	Same as alarm dead band 'AL1'	2.00	Same as alarm dead band 'AL1'				

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Setting range (Communication range)	Initial value	Remarks
40046	03 06 16	R W W	Alarm format 'AL4'	Same as alarm format 'AL1'	[Format] 1 (Deviation) [Assistance] 4 (Lower limit)	Same as alarm format 'AL1'
40047	03 06 16	R W W	Alarm dead band 'AL4'	Same as alarm dead band 'AL1'	2.00	Same as alarm dead band 'AL1'

② Setup parameter 2

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Setting range (Communication range)	Initial value	Remarks
40051	03 06 16	R W W	Transmission (H) analog type	0/1/2/3/4/5 (0/1/2/3/4/5)	1 (PV)	0=SV 1=PV 2=MV1 3=MV2 4=MFB 5=RSV WRITE is not possible when there is no transmission signal output MV2 writing is not possible when there is not control output 2. MFB cannot be written when control output 1 is other than ON/OFF servo. RSV cannot be written when there is no remote signal input
40052 40053	03 06 16	R W W	Transmission (H) and transmission scale 'zero' Transmission (H) transmission scale (span)	[In case of PV/SV] -19999 to 30000 (-19999 to 30000) [In case of MV1/MV2/MFB] -1999.9 to 3000.0 (-19999 to 30000)	Measurement range	Writing is not possible when there is no transmission signal output. [In case of PV/SV] Decimal point position: SV decimal point position
40079	03 06 16	R W W	Digital transmission type 1	0/1/2/3/4/5 (0/1/2/3/4/5)	1 (PV)	0=SV 1=PV 2=MV1 3=MV2 4=MFB 5=RSV Writing is not possible when it is not a function with communication MV2 writing is not possible when there is no control output 2. MFB cannot be written when control output 1 is other than ON/OFF servo. RSV cannot be written when there is no remote signal input

③ 1 type parameter

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Setting range (Range after communication)	Initial value	Remarks
40101	03 06 16	R W W	Output 2 gap	-100.0 to 100.0 (-1000 to 1000)	0.0%	
40102	03 06 16	R W W	Output 2 PID 'P'	0:2 position control 0.1 to 999.9 (0:2 position control 1 to 9999)	5.0%	
40103	03 06 16	R W W	Output 2 PID 'I'	0(∞) 1 to 9999 (0: Infinity 1 to 9999)	60 seconds	
40104	03 06 16	R W W	Output 2 PID 'D'	0 to 9999 (0 to 9999)	30 seconds	
40105	03 06 16	R W W	Output 2 limit (Output 2 scale) 'Lower limit value'	-5.0 to 100.0 (-50 to 1000)	0.0%	Always set output 2 limit as lower limit<higher limit.
40106	03 06 16	R W W	Output 2 limit (Output 2 scale) 'Higher limit value'	0.0 to 105.0 % (0 to 1050)	100.0%	Always set output 2 limit as lower limit<higher limit.
40108	03 06 16	R W W	Dead band of output 2	0.1 to 9.9 (1 to 99)	0.5%	
40111	03 06 16	R W W	Output dead band	0.1 to 9.9 (1 to 99)	0.5%	
40112	03 06 16	R W W	Output during PV abnormality 'Low limit'	-5.0 to 105.0 (-50 to 1050)	0.0%	
40113	03 06 16	R W W	Output during PV abnormality 'High limit'	-5.0 to 105.0 (-50 to 1050)	0.0%	
40116	03 06 16	R W W	Descending SV change rate	0.0: function OFF -1999.9 to -0.1 (-19999 to 0)	0.0	
40117	03 06 16	R W W	Ascending SV change rate	0.0: function OFF 0.1 to 2000.0 (Seconds or minutes or hours) (0 to 20000)	0.0	
40118	03 06 16	R W W	SV slope unit	0/1/2 (0/1/2)	1	0=seconds 1=Minutes 2=Hours
40131	03 06 16	R W W	Remote filter	0.0: function OFF 0.1 to 99.9 (seconds) (0 to 999)	0.0	

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Setting range (Range after communication)	Initial value	Remarks
40133	03 06 16	R W W	Cascade ratio	0.00 to 1.00 (0 to 100)	1.00	
40134	03 06 16	R W W	Cascade bias	-99.9 to 100.0 (-999 to 1000)	0.0	
40143	03 06 16	R W W	Remote/local switching	0/1 (0/1)	0	0=LOCAL 1=REMOTE
40144	03 06 16	R W W	Remote scale MIN	-19999 to 30000 (-19999 to 30000)	0000.0	Decimal point position: SV decimal point position
40145	03 06 16	R W W	Remote scale MAX	-19999 to 30000 (-19999 to 30000)	2000.0	Decimal point position: SV decimal point position
40148	03 06 16	R W W	Control algorithm	0/1 (0/1)	0	0=Position type PID 1= Speed type PID

④ Execution parameter, Specific parameter

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Setting range (Range after communication)	Initial value	Remarks
40151	03	R	'SV (target) value' during adoption	Within the range of range scale	-	
40156	03 06 16	R W W	PID 'P' during execution	0:2 position control 0.1 to 999.9 (0 to 9999)	-	
40157	03 06 16	R W W	PID 'I' during execution	0(∞) 1 to 9999 (0 to 9999)	-	
40158	03 06 16	R W W	PID 'D' during execution	0 to 9999 (0 to 9999)	-	
40181	03 06 16	R W W	Alarm value 1 during execution	-19999 to 30000 (-19999 to 30000)	-	Decimal point position: SV decimal point position
40183	03 06 16	R W W	Alarm value 2 during execution	-19999 to 30000 (-19999 to 30000)	-	Decimal point position: SV decimal point position
40185	03 06 16	R W W	Alarm value 3 during execution	-19999 to 30000 (-19999 to 30000)	-	Decimal point position: SV decimal point position
40187	03 06 16	R W W	Alarm value 4 during execution	-19999 to 30000 (-19999 to 30000)	-	Decimal point position: SV decimal point position

⑤ 8 type parameter No. 1

FNC code... ..Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Setting range (Range after communication)	Initial value	Remarks
40201	03 06 16	R W W	SV8 type 'Parameter'	Within SV limit range (Within SV limit range)	0	
40206	03 06 16	R W W	PID 8 types 'Parameter of P'	0:2 position control 0.1 to 999.9 (0:2 position control 1 to 9999:P value)	5.0%	
40207	03 06 16	R W W	PID 8 types 'Parameter of I'	0(∞) 1 to 9999 (0: Infinity 1 to 9999:I value)	60 seconds	
40208	03 06 16	R W W	PID 8 types 'Parameter of D'	0 to 9999 (0 to 9999)	30 seconds	
40209 40210	03 06 16	R W W	Output limit 8 types (Output scale 8 types) 'Parameter 1 of lower limit value' Output limit 8 types (Output scale 8 types) 'Parameter 1 of higher limit value'	-5.0 to 100.0 (-50 to 1000) 0.0 to 105.0 (0 to 1050)	0.0% 100.0%	Always set output limit as lower limit<higher limit.
40211	03 06 16	R W W	Output variation limiter 8 types 'Descending parameter 1'	-100.0 to -0.1 (-1000 to -1)	-100.0%	
40212	03 06 16	R W W	Output variation limit 8 types 'Ascending parameter 1'	0.1 to 100.0 (1 to 1000)	100.0%	
40213	03 06 16	R W W	Sensor correction 'Parameter'	-19999 to 20000 (-19999 to 20000)	0.0%	Decimal point position:0.1 times resolution of PV decimal point position
40214	03 06 16	R W W	A.R.W 'Parameter 1 of lower limit value'	-100.0 to 0.0 (-1000 to 0)	-50.0%	
40215	03 06 16	R W W	A.R.W 'Parameter 1 of higher limit value'	0.0 to 100.0 (0 to 1000)	50.0%	
40216	03 06 16	R W W	Output preset	-100.0 to 100.0 (-1000 to 1000)	50.0%	
40231	03 06 16	R W W	Alarm value 1 8 types 'Parameter 1'	-19999 to 30000 (-19999 to 30000)	3000.0	Decimal point position: SV decimal point position
40233	03 06 16	R W W	Alarm value 2 8 types 'Parameter 1'	-19999 to 30000 (-19999 to 30000)	-1999.9	Decimal point position: SV decimal point position

FNC code... ..Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Setting range (Range after communication)	Initial value	Remarks
40235	03	R	Alarm value 3 8 types 'Parameter 1'	-19999 to 30000 (-19999 to 30000)	3000.0	Decimal point position: SV decimal point position
	06	W				
	16	W				
40237	03	R	Alarm value 4 8 types 'Parameter 1'	-19999 to 30000 (-19999 to 30000)	-1999.9	Decimal point position: SV decimal point position
	06	W				
	16	W				
40246	03	R	Remote shift 'Parameter 1'	-19999 to 20000 (-19999 to 20000)	0	Decimal point position:0.1 times resolution of SV decimal point position
	06	W				
	16	W				

⑥ 8 type parameter No. 2

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Setting range (Range after communication)	Initial value	Remarks
40251	03 06 16	R W W	SV 8 types 'Parameter 2'	Within SV limit range (Within SV limit range)	0	
40256	03 06 16	R W W	PID 8 types 'Parameter 2 of P'	0:2 position control 0.1 to 999.9 (0:2 position control 1 to 9999:P value)	5.0%	
40257	03 06 16	R W W	PID 8 types 'Parameter 2 of I'	0(∞) 1 to 9999 (0: Infinity 1 to 9999:I value)	60 seconds	
40258	03 06 16	R W W	PID 8 types 'Parameter 2 of D'	0 to 9999 (0 to 9999)	30 seconds	
40259 40260	03 06 16	R W W	Output limit 8 types (Output scale 8 types) 'Parameter 2 of lower limit value' Output limit 8 types (Output scale 8 types) 'Parameter 2 of higher limit value'	-5.0 to 100.0 (-50 to 1000) 0.0 to 105.0 (0 to 1050)	0.0% 100.0%	Always set output limit as lower limit<higher limit.
40261	03 06 16	R W W	Output variation limit 8 types 'Descending parameter 2'	-100.0 to -0.1 (-1000 to -1)	-100.0%	
40262	03 06 16	R W W	Output variation limit 8 types 'Ascending parameter 2'	0.1 to 100.0 (1 to 1000)	100.0%	
40281	03 06 16	R W W	Alarm value 1 8 types 'Parameter 2'	-19999 to 30000 (-19999 to 30000)	3000.0	Decimal point position: SV decimal point position
40283	03 06 16	R W W	Alarm value 2 8 types 'Parameter 2'	-19999 to 30000 (-19999 to 30000)	-1999.9	Decimal point position: SV decimal point position
40285	03 06 16	R W W	Alarm value 3 8 types 'Parameter 2'	-19999 to 30000 (-19999 to 30000)	3000.0	Decimal point position: SV decimal point position
40287	03 06 16	R W W	Alarm value 4 8 types 'Parameter 2'	-19999 to 30000 (-19999 to 30000)	-1999.9	Decimal point position: SV decimal point position

⑦ 8 type parameter No. 3

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Setting range (Range after communication)	Initial value	Remarks
40301	03 06 16	R W W	SV 8 types 'Parameter 3'	Within SV limit range (Within SV limit range)	0	
40306	03 06 16	R W W	PID 8 types 'Parameter 3 of P'	0:2 position control 0.1 to 999.9 (0:2 position control 1 to 9999:P value)	5.0%	
40307	03 06 16	R W W	PID 8 types 'Parameter 3 of I'	0(∞) 1 to 9999 (0: Infinity 1 to 9999:I value)	60 seconds	
40308	03 06 16	R W W	PID 8 types 'Parameter 3 of D'	0 to 9999 (0 to 9999)	30 seconds	
40309 40310	03 06 16	R W W	Output limit 8 types (Output scale 8 types) 'Parameter 3 of lower limit value' Output limit 8 types (Output scale 8 types) 'Parameter 3 of higher limit value'	-5.0 to 100.0 (-50 to 1000) 0.0 to 105.0 (0 to 1050)	0.0% 100.0%	Always set output limit as lower limit<higher limit.
40311	03 06 16	R W W	Output variation limit 8 types 'Descending Parameter 3'	-100.0 to -0.1 (-1000 to -1)	-100.0%	
40312	03 06 16	R W W	Output variation limit 8 types 'Ascending Parameter 3'	0.1 to 100.0 (1 to 1000)	100.0%	
40331	03 06 16	R W W	Alarm value 1 8 types 'Parameter 3'	-19999 to 30000 (-19999 to 30000)	3000.0	Decimal point position: SV decimal point position
40333	03 06 16	R W W	Alarm value 2 8 types 'Parameter 3'	-19999 to 30000 (-19999 to 30000)	-1999.9	Decimal point position: SV decimal point position
40335	03 06 16	R W W	Alarm value 3 8 types 'Parameter 3'	-19999 to 30000 (-19999 to 30000)	3000.0	Decimal point position: SV decimal point position
40337	03 06 16	R W W	Alarm value 4 8 types 'Parameter 3'	-19999 to 30000 (-19999 to 30000)	-1999.9	Decimal point position: SV decimal point position

⑧ 8 type parameter No. 4

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Setting range (Range after communication)	Initial value	Remarks
40351	03 06 16	R W W	SV 8 types 'Parameter 4'	Within SV limit range (Within SV limit range)	0	
40356	03 06 16	R W W	PID 8 types 'Parameter 4 of P'	0:2 position control 0.1 to 999.9 (0:2 position control 1 to 9999:P value)	5.0%	
40357	03 06 16	R W W	PID 8 types 'Parameter of I'	0(∞) 1 to 9999 (0: Infinity 1 to 9999:I value)	60 seconds	
40358	03 06 16	R W W	PID 8 types 'Parameter 4 of D'	0 to 9999 (0 to 9999)	30 seconds	
40359 40360	03 06 16	R W W	Output limit 8 types (Output scale 8 types) 'Parameter 4 of lower limit value' Output limit 8 types (Output scale 8 types) 'Parameter 4 of higher limit value'	-5.0 to 100.0 (-50 to 1000) 0.0 to 105.0 (0 to 1050)	0.0% 100.0%	Always set output limit as lower limit<higher limit.
40361	03 06 16	R W W	Output variation limit 8 types 'Descending Parameter 4'	-100.0 to -0.1 (-1000 to -1)	-100.0%	
40362	03 06 16	R W W	Output variation limit 8 types 'Ascending Parameter 4'	0.1 to 100.0 (1 to 1000)	100.0%	
40381	03 06 16	R W W	Alarm value 1 8 types 'Parameter 4'	-19999 to 30000 (-19999 to 30000)	3000.0	Decimal point position: SV decimal point position
40383	03 06 16	R W W	Alarm value 2 8 types 'Parameter 4'	-19999 to 30000 (-19999 to 30000)	-1999.9	Decimal point position: SV decimal point position
40385	03 06 16	R W W	Alarm value 3 8 types 'Parameter 4'	-19999 to 30000 (-19999 to 30000)	3000.0	Decimal point position: SV decimal point position
40387	03 06 16	R W W	Alarm value 4 8 types 'Parameter 4'	-19999 to 30000 (-19999 to 30000)	-1999.9	Decimal point position: SV decimal point position

⑨ 8 type parameter No. 5

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Setting range (Range after communication)	Initial value	Remarks
40401	03 06 16	R W W	SV 8 types 'Parameter 5'	Within SV limit range (Within SV limit range)	0	
40406	03 06 16	R W W	PID 8 types 'Parameter 5 of P'	0:2 position control 0.1 to 999.9 (0:2 position control 1 to 9999:P value)	5.0%	
40407	03 06 16	R W W	PID 8 types 'Parameter 5 of I'	0(∞) 1 to 9999 (0: Infinity 1 to 9999:I value)	60 seconds	
40408	03 06 16	R W W	PID 8 types 'Parameter 5 of D'	0 to 9999 (0 to 9999)	30 seconds	
40409 40410	03 06 16	R W W	Output limit 8 types (Output scale 8 types) 'Parameter 5 of lower limit value' Output limit 8 types (Output scale 8 types) 'Parameter 5 of higher limit value'	-5.0 to 100.0 (-50 to 1000) 0.0 to 105.0 (0 to 1050)	0.0% 100.0%	Always set output limit as lower limit<higher limit.
40411	03 06 16	R W W	Output variation limit 8 types 'Descending Parameter 5'	-100.0 to -0.1 (-1000 to -1)	-100.0%	
40412	03 06 16	R W W	Output variation limit 8 types 'Ascending Parameter 5'	0.1 to 100.0 (1 to 1000)	100.0%	
40431	03 06 16	R W W	Alarm value 1 8 types 'Parameter 5'	-19999 to 30000 (-19999 to 30000)	3000.0	Decimal point position: SV decimal point position
40433	03 06 16	R W W	Alarm value 2 8 types 'Parameter 5'	-19999 to 30000 (-19999 to 30000)	-1999.9	Decimal point position: SV decimal point position
40435	03 06 16	R W W	Alarm value 3 8 types 'Parameter 5'	-19999 to 30000 (-19999 to 30000)	3000.0	Decimal point position: SV decimal point position
40437	03 06 16	R W W	Alarm value 4 8 types 'Parameter 5'	-19999 to 30000 (-19999 to 30000)	-1999.9	Decimal point position: SV decimal point position

⑩ 8 type parameter No. 6

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Setting range (Range after communication)	Initial value	Remarks
40451	03 06 16	R W W	SV 8 types 'Parameter 6'	Within SV limit range (Within SV limit range)	0	
40456	03 06 16	R W W	PID 8 types 'Parameter 6 of P'	0:2 position control 0.1 to 999.9 (0:2 position control 1 to 9999:P value)	5.0%	
40457	03 06 16	R W W	PID 8 types 'Parameter 6 of I'	0(∞) 1 to 9999 (0: Infinity 1 to 9999:I value)	60 seconds	
40458	03 06 16	R W W	PID 8 types 'Parameter 6 of D'	0 to 9999 (0 to 9999)	30 seconds	
40459 40460	03 06 16	R W W	Output limit 8 types (Output scale 8 types) 'Parameter 6 of lower limit value' Output limit 8 types (Output scale 8 types) 'Parameter 6 of higher limit value'	-5.0 to 100.0 (-50 to 1000) 0.0 to 105.0 (0 to 1050)	0.0% 100.0%	Always set output limit as lower limit<higher limit.
40461	03 06 16	R W W	Output variation limit 8 types 'Descending Parameter 6'	-100.0 to -0.1 (-1000 to -1)	-100.0%	
40462	03 06 16	R W W	Output variation limit 8 types 'Ascending Parameter 6'	0.1 to 100.0 (1 to 1000)	100.0%	
40481	03 06 16	R W W	Alarm value 1 8 types 'Parameter 6'	-19999 to 30000 (-19999 to 30000)	3000.0	Decimal point position: SV decimal point position
40483	03 06 16	R W W	Alarm value 2 8 types 'Parameter 6'	-19999 to 30000 (-19999 to 30000)	-1999.9	Decimal point position: SV decimal point position
40485	03 06 16	R W W	Alarm value 3 8 types 'Parameter 6'	-19999 to 30000 (-19999 to 30000)	3000.0	Decimal point position: SV decimal point position
40487	03 06 16	R W W	Alarm value 4 8 types 'Parameter 6'	-19999 to 30000 (-19999 to 30000)	-1999.9	Decimal point position: SV decimal point position

① 8 type parameter No. 7

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Setting range (Range after communication)	Initial value	Remarks
40501	03 06 16	R W W	SV 8 types 'Parameter 7'	Within SV limit range (Within SV limit range)	0	
40506	03 06 16	R W W	PID 8 types 'Parameter 7 of P'	0:2 position control 0.1 to 999.9 (0:2 position control 1 to 9999:P value)	5.0%	
40507	03 06 16	R W W	PID 8 types 'Parameter 7 of I'	0(∞) 1 to 9999 (0: Infinity 1 to 9999:I value)	60 seconds	
40508	03 06 16	R W W	PID 8 types 'Parameter 7 of D'	0 to 9999 (0 to 9999)	30 seconds	
40509 40510	03 06 16	R W W	Output limit 8 types (Output scale 8 types) 'Parameter 7 of lower limit value' Output limit 8 types (Output scale 8 types) 'Parameter 7 of higher limit value'	-5.0 to 100.0 (-50 to 1000) 0.0 to 105.0 (0 to 1050)	0.0% 100.0%	Always set output limit as lower limit<higher limit.
40511	03 06 16	R W W	Output variation limit 8 types 'Descending Parameter 7'	-100.0 to -0.1 (-1000 to -1)	-100.0%	
40512	03 06 16	R W W	Output variation limit 8 types 'Ascending Parameter 7'	0.1 to 100.0 (1 to 1000)	100.0%	
40531	03 06 16	R W W	Alarm value 1 8 types 'Parameter 7'	-19999 to 30000 (-19999 to 30000)	3000.0	Decimal point position: SV decimal point position
40533	03 06 16	R W W	Alarm value 2 8 types 'Parameter 7'	-19999 to 30000 (-19999 to 30000)	-1999.9	Decimal point position: SV decimal point position
40535	03 06 16	R W W	Alarm value 3 8 types 'Parameter 7'	-19999 to 30000 (-19999 to 30000)	3000.0	Decimal point position: SV decimal point position
40537	03 06 16	R W W	Alarm value 4 8 types 'Parameter 7'	-19999 to 30000 (-19999 to 30000)	-1999.9	Decimal point position: SV decimal point position

⑫ 8 type parameter No. 8

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Setting range (Range after communication)	Initial value	Remarks
40551	03 06 16	R W W	SV 8 types 'Parameter 8'	Within SV limit range (Within SV limit range)	0	
40556	03 06 16	R W W	PID 8 types 'Parameter 8 of P'	0:2 position control 0.1 to 999.9 (0:2 position control 1 to 9999:P value)	5.0%	
40557	03 06 16	R W W	PID 8 types 'Parameter 8 of I'	0(∞) 1 to 9999 (0: Infinity 1 to 9999:I value)	60 seconds	
40558	03 06 16	R W W	PID 8 types 'Parameter 8 of D'	0 to 9999 (0 to 9999)	30 seconds	
40559 40560	03 06 16	R W W	Output limit 8 types (Output scale 8 types) 'Parameter 8 of lower limit value' Output limit 8 types (Output scale 8 types) 'Parameter 8 of higher limit value'	-5.0 to 100.0 (-50 to 1000) 0.0 to 105.0 (0 to 1050)	0.0% 100.0%	Always set output limit as lower limit<higher limit.
40561	03 06 16	R W W	Output variation limit 8 types 'Descending Parameter 8'	-100.0 to -0.1 (-1000 to -1)	-100.0%	
40562	03 06 16	R W W	Output variation limit 8 types 'Ascending Parameter 8'	0.1 to 100.0 (1 to 1000)	100.0%	
40581	03 06 16	R W W	Alarm value 1 8 types 'Parameter 8'	-19999 to 30000 (-19999 to 30000)	3000.0	Decimal point position: SV decimal point position
40583	03 06 16	R W W	Alarm value 2 8 types 'Parameter 8'	-19999 to 30000 (-19999 to 30000)	-1999.9	Decimal point position: SV decimal point position
40585	03 06 16	R W W	Alarm value 3 8 types 'Parameter 8'	-19999 to 30000 (-19999 to 30000)	3000.0	Decimal point position: SV decimal point position
40587	03 06 16	R W W	Alarm value 4 8 types 'Parameter 8'	-19999 to 30000 (-19999 to 30000)	-1999.9	Decimal point position: SV decimal point position

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Setting range (Range after communication)	Initial value	Remarks
40707	03 06 16	R W W	Preset manual	-5.0 to 105.0 % (-50 to 1050)	0.0%	
40708	03 06 16	R W W	Output 2 Preset manual	-5.0 to 105.0 % (-50 to 1050)	0.0%	Writing is possible only in case of output 2 specifications
40727	03 06 16	R W W	Output variation limit 'Ascending of No. 9'	-100.0 to -0.1 (-1000 to -1)	-100.0%	
40728	03 06 16	R W W	Output variation limit 'Ascending of No. 9'	0.1 to 100.0 (1 to 1000)	100.0%	

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Setting range (Range after communication)	Initial value	Remarks
48001	03 06 16	R W W	Display backlight	0/1/2 (0/1/2)	2 (AUTO)	0=Green 1=Orange 2=AUTO (Green and Orange auto switching)
48002	03 06 16	R W W	Display contrast	0 to 100 % (0 to 100)	50%	
48003	03 06 16	R W W	Key backlight	0/1/2 (0/1/2)	0 (AUTO)	0=AUTO (Automatic ON/OFF) 1=OFF (Does not glow when normal) 2=ON (Glows when normal)

⑬ Operation status information

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Setting range (Range after communication)	Initial value	Remarks																
49056	03 06 16	R W W	Executing SV (Mode 0)	Within SV limit range (Within SV limit range)	0																	
49501	03 06 16	R W W	Setting screen mode lock (bit support)	(0 to 65535)	-	<p>0=Setting screen normal display 1=Setting screen lock status 1=Setting screen non display</p> <p>*Bit 0 to Bit 7 of low order 8 bits are set as mode 0 to mode 7 sequentially, bit 3 and 4 high order 8 bit are set as mode 11, mode 12.</p> <p>Low order 8 bits</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td> </tr> </table> <p style="text-align: center;">Mode 7 Mode 0</p> <p>High order 8 bits</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td> </tr> </table> <p style="text-align: center;">Mode 12 Mode 11</p>	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
7	6	5	4	3	2	1	0															
7	6	5	4	3	2	1	0															
49502	03 06 16	R W W	AT start/stop	0/1 (0/1)	0 (END)	<p>0= Stop 1= Start</p> <p>[When starting] · Writing is not possible when auto tuning is executed.</p>																
49503	03 06 16	R W W	Operation screen 'A/M switching 1'	0/1 (0/1)	1	0=AUTO 1=MANUAL																
49504	03 06 16	R W W	Operation screen 'MANUAL output 1'	-5.0 to 105.0 % (-50 to 1050)	0.0%	Writing is possible only in case of manual operation																
49505	03 06 16	R W W	Operation screen 'A/M switching 2'	0/1 (0/1)	1	0=AUTO 1=MANUAL																
49506	03 06 16	R W W	Operation screen 'MANUAL output 2'	-5.0 to 105.0 % (-50 to 1050)	0.0%	Writing is possible only in case of manual operation																
49510	03 06 16	R W W	Run/Ready	0/1 (0/1)	0	<p>0=RUN status 1=READY status</p> <p>*In DB1000 when writing is performed, RUN status is fixed. Even when Ready is written, Run is set</p>																
49511	03 06 16	R W W	Select execution number	1 to 8 (1 to 8)	1	<p>1=Execution No.1 2=Execution No.2 8=Execution No.8</p>																

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Setting range (Range after communication)	Initial value	Remarks
49512	03 06 16	R W W	Remote SV	Within SV limit range (Within SV limit range)	-	Communication function is REM and remote SV setting from communication can be done. R/L switching depends on front operation. Local status or communication status can be written only in case of REM.

8-7-2. Analog input data (READ only)

① Real data, parameter information

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Detail explanation
30101	04	R	Measurement value (PV)	Decimal point position: Depends on PV decimal point setting When PV exceeds positively 32767 When PV exceeds negatively -32768
30102	04	R	PV status	0= Normal 1= + Over range 2= - Over range
30103	04	R	Setting value (SV)	SV that is being used currently (Setting value SV, remote SV, SV in the slope etc.) Decimal point position: TC/Pt input = Fixed for each range Depends on Linear input = Linear decimal point settings
30104	04	R	SV status	0= Setting value 1= Remote SV 2= During slope operation
30105	04	R	Control output value 1	-50 to 1050= -5.0 to 105.0%
30106	04	R	MV1 status	0=AUTO 1=MAN 2=AT 4=PV ERR OUT 5=FB AT
30107	04	R	Control output value 2	-50 to 1050= -5.0 to 105.0%
30108	04	R	MV2 status	0=AUTO 1=MAN 2=AT 4=PV ERR OUT 5=FB AT
30109 30110 30111 30112 30113	04	R	Execution SV Execution alarm value 1 Execution alarm value 2 Execution alarm value 3 Execution alarm value 4	Execution SV setting value (Decimal point is same as that of 30103) Execution alarm 1 setting value (Decimal point position is same as that of 40231) Execution alarm 2 setting value (Decimal point position is same as that of 40233) Execution alarm 3 setting value (Decimal point position is same as that of 40235) Execution alarm 4 setting value (Decimal point position is same as that of 40237)
30114 30115 30116	04	R	Execution P Execution I Execution D	Execution P setting value (0 to 9999=0.0 to 999.9%) Execution I setting value (0 to 9999=0 to 9999 seconds) Execution D setting value (0 to 9999=0 to 9999 seconds)
30124	04	R	Execution No.	Executing No. (1 to 8)
30134	04	R	FB value	FB value of operation screen 2

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Detail explanation																																
30141	04	R	Lock status	<p>0=Setting screen normal display 1=Setting screen lock status 0= Setting screen non display</p> <p>*Bit 0 to Bit 7 of low order 8 bits are set as mode 0 to mode 7 sequentially, bit 0 and bit 3, 4 of high order 8 bit are set as mode 8 and mode 3,4 respectively.</p> <p>Low order 8 bits</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td> </tr> </table> <p style="text-align: center;">Mode 7 Mode 0</p> <p>High order 8 bits</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td> </tr> </table> <p style="text-align: center;">Mode 12 Mode 11 Mode 8</p>	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0																
7	6	5	4	3	2	1	0																													
7	6	5	4	3	2	1	0																													
30142	04	R	Alarm status	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td> </tr> <tr> <td colspan="4" style="text-align: center;">Alarm 4</td> <td colspan="4" style="text-align: center;">Alarm 3</td> <td colspan="4" style="text-align: center;">Alarm 2</td> <td colspan="4" style="text-align: center;">Alarm 1</td> </tr> </table> <p style="text-align: right; margin-right: 50px;">Alarm OFF→ 0 0 0 0 Alarm ON→ 0 1 0 1 Alarm OFF during wait operation→ 1 0 1 0</p>	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Alarm 4				Alarm 3				Alarm 2				Alarm 1			
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0																					
Alarm 4				Alarm 3				Alarm 2				Alarm 1																								
30143	04	R	Error other status	<p>0= No error 1= Error occurrence</p>																																

8-7-3. Digital setting value

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Setting range (Range after communication)	Initial value	Remarks
101	01 05 15	R W W	AT start	0/1 [0000h/FF00h] (End/Start) [In the bracket] When FNC code is 05.	0 (End)	0= AT end (Exit) 1= AT starting or AT executing Cannot be executed during 2 position control. Cannot be executed during FB tuning.
111	01 05 15	R W W	FB tuning	0/1 [0000h/FF00h] (End/Start) [In the bracket] When FNC code is 05.	0 (End)	0= FB tuning end (End) 1= FB tuning start of FB tuning executing Cannot be executed during program operation. Cannot be executed during AT tuning or FB tuning.

8-7-4. Digital input data (READ only)

FNC code.....Application function code, R/W.....R: READ (Read), W: WRITE (Write)

Reference number	FNC code	R/W	Data name	Detail explanation
10002	02	R	A/D error	0= Normal 1=A/D error is occurring
10005	02	R	Correct data error	0= Normal 1= Correction data error is occurring
10117	02	R	Alarm 1 status	0= Alarm OFF 1= Alarm ON 0=Alarm OFF during wait operation
10118			0 0 1	
10119			0= Alarm OFF 1= Alarm ON 0=Alarm OFF during wait operation	
10120			0 0 1	
10121			0= Alarm OFF 1= Alarm ON 0=Alarm OFF during wait operation	
10122			0 0 1	
10123			0= Alarm OFF 1= Alarm ON 0=Alarm OFF during wait operation	
10124			0 0 1	

8-8.Reference table corresponding to MODBUS protocol

Analog setting value (40001 to 49999)							
Setup parameter		Setup parameter 2		1 type parameter		Execution parameter & Specific parameter	
No.	Contents	No.	Contents	No.	Contents	No.	Contents
40001	Input type number	40051	Transmission(H) analog type	40101	Output 2 gap	40151	SV (R) being used
40002	Unit number	40052	Transmission (H) scale MIN	40102	Output 2 P	40152	
40003	RJ	40053	Transmission (H) scale MAX	40103	Output 2 I	40153	
40004	Range ZERO	40054		40104	Output 2 D	40154	
40005	Range SPAN	40055		40105	Output 2 limit L	40155	
40006	Linear scale MIN	40056		40106	Output 2 limit H	40156	P
40007	Linear scale MAX	40057		40107		40157	I
40008	SV decimal point position	40058		40108	Output 2/Position 2 DB	40158	D
40009		40059		40109		40159	
40010		40060		40110		40160	
40011	PV decimal point position	40061		40111	Position 2 dead band	40161	
40012	Digital filter	40062		40112	Output lower limit during PV abnormality	40162	
40013		40063		40113	Output upper limit during PV abnormality	40163	
40014		40064		40114		40164	
40015		40065		40115		40165	
40016		40066		40116	SV change rate DW	40166	
40017		40067		40117	SV change rate UP	40167	
40018		40068		40118	SV slope unit	40168	
40019		40069		40119		40169	
40020		40070		40120		40170	
40021	Control action Direct/Reverse	40071		40121		40171	
40022	Pulse cycle	40072		40122		40172	
40023	FB·ZERO	40073		40123		40173	
40024	FB·SPAN	40074		40124		40174	
40025	FB gain	40075		40125		40175	
40026	Output 2 Direct/reverse	40076		40126		40176	
40027	Pulse 2 cycle	40077		40127		40177	
40028		40078		40128		40178	
40029		40079	Digital transmission type 1	40129		40179	
40030	Cancel alarm output	40080		40130		40180	
40031	Alarm format 1	40081		40131	Remote filter	40181	Alarm value 1 setting
40032	Alarm dead band 1	40082		40132		40182	
40033		40083		40133	Cascade ratio r	40183	Alarm value 2 setting
40034		40084		40134	Cascade bias b	40184	
40035		40085		40135		40185	Alarm value 3 setting
40036	Alarm format 2	40086		40136		40186	
40037	Alarm dead band 2	40087		40137		40187	Alarm value 4 setting
40038		40088		40138		40188	
40039		40089		40139		40189	
40040		40090		40140		40190	
40041	Alarm format 3	40091		40141		40191	
40042	Alarm dead band 3	40092		40142		40192	
40043		40093		40143	Remote/local switching	40193	
40044		40094		40144	Remote scale MIN	40194	
40045		40095		40145	Remote scale MAX	40195	
40046	Alarm format 4	40096		40146		40196	
40047	Alarm dead band 4	40097		40147		40197	
40048		40098		40148	Control algorithm	40198	
40049		40099		40149		40199	
40050		40100		40150		40200	

Analog setting value (40001 to 49999)							
8 type parameter No. 1		8 type parameter No. 2		8 type parameter No. 3		8 type parameter No. 4	
No.	Contents	No.	Contents	No.	Contents	No.	Contents
40201	Target SV	40251	Target SV	40301	Target SV	40351	Target SV
40202		40252		40302		40352	
40203		40253		40303		40353	
40204		40254		40304		40354	
40205		40255		40305		40355	
40206	P	40256	P	40306	P	40356	P
40207	I	40257	I	40307	I	40357	I
40208	D	40258	D	40308	D	40358	D
40209	Output limit L	40259	Output limit L	40309	Output limit L	40359	Output limit L
40210	Output limit H	40260	Output limit H	40310	Output limit H	40360	Output limit H
40211	Output variation limit DW	40261	Output variation limit DW	40311	Output variation limit DW	40361	Output variation limit DW
40212	Output variation limit UP	40262	Output variation limit UP	40312	Output variation limit UP	40362	Output variation limit UP
40213	Sensor correction	40263		40313		40363	
40214	A.R.W. Lower limit value	40264		40314		40364	
40215	A.R.W. Upper limit value	40265		40315		40365	
40216	Output preset	40266		40316		40366	
40217		40267		40317		40367	
40218		40268		40318		40368	
40219		40269		40319		40369	
40220		40270		40320		40370	
40221		40271		40321		40371	
40222		40272		40322		40372	
40223		40273		40323		40373	
40224		40274		40324		40374	
40225		40275		40325		40375	
40226		40276		40326		40376	
40227		40277		40327		40377	
40228		40278		40328		40378	
40229		40279		40329		40379	
40230		40280		40330		40380	
40231	Alarm value 1 setting	40281	Alarm value 1 setting	40331	Alarm value 1 setting	40381	Alarm value 1 setting
40232		40282		40332		40382	
40233	Alarm value 2 setting	40283	Alarm value 2 setting	40333	Alarm value 2 setting	40383	Alarm value 2 setting
40234		40284		40334		40384	
40235	Alarm value 3 setting	40285	Alarm value 3 setting	40335	Alarm value 3 setting	40385	Alarm value 3 setting
40236		40286		40336		40386	
40237	Alarm value 4 setting	40287	Alarm value 4 setting	40337	Alarm value 4 setting	40387	Alarm value 4 setting
40238		40288		40338		40388	
40239		40289		40339		40389	
40240		40290		40340		40390	
40241		40291		40341		40391	
40242		40292		40342		40392	
40243		40293		40343		40393	
40244		40294		40344		40394	
40245		40295		40345		40395	
40246	Remote shift	40296		40346		40396	
40247		40297		40347		40397	
40248		40298		40348		40398	
40249		40299		40349		40399	
40250		40300		40350		40400	

Analog setting value (40001 to 49999)							
8 type parameter No. 5		8 type parameter No. 6		8 type parameter No. 7		8 type parameter No. 8	
No.	Contents	No.	Contents	No.	Contents	No.	Contents
40401	Target SV	40451	Target SV	40501	Target SV	40551	Target SV
40402		40452		40502		40552	
40403		40453		40503		40553	
40404		40454		40504		40554	
40405		40455		40505		40555	
40406	P	40456	P	40506	P	40556	P
40407	I	40457	I	40507	I	40557	I
40408	D	40458	D	40508	D	40558	D
40409	Output limit L	40459	Output limit L	40509	Output limit L	40559	Output limit L
40410	Output limit H	40460	Output limit H	40510	Output limit H	40560	Output limit H
40411	Output variation limit DW	40461	Output variation limit DW	40511	Output variation limit DW	40561	Output variation limit DW
40412	Output variation limit UP	40462	Output variation limit UP	40512	Output variation limit UP	40562	Output variation limit UP
40413		40463		40513		40563	
40414		40464		40514		40564	
40415		40465		40515		40565	
40416		40466		40516		40566	
40417		40467		40517		40567	
40418		40468		40518		40568	
40419		40469		40519		40569	
40420	SV decimal point for display	40470		40520		40570	
40421		40471		40521		40571	
40422		40472		40522		40572	
40423		40473		40523		40573	
40424		40474		40524		40574	
40425		40475		40525		40575	
40426		40476		40526		40576	
40427		40477		40527		40577	
40428		40478		40528		40578	
40429		40479		40529		40579	
40430		40480		40530		40580	
40431	Alarm value 1 setting	40481	Alarm value 1 setting	40531	Alarm value 1 setting	40581	Alarm value 1 setting
40432		40482		40532		40582	
40433	Alarm value 2 setting	40483	Alarm value 2 setting	40533	Alarm value 2 setting	40583	Alarm value 2 setting
40434		40484		40534		40584	
40435	Alarm value 3 setting	40485	Alarm value 3 setting	40535	Alarm value 3 setting	40585	Alarm value 3 setting
40436		40486		40536		40586	
40437	Alarm value 4 setting	40487	Alarm value 4 setting	40537	Alarm value 4 setting	40587	Alarm value 4 setting
40438		40488		40538		40588	
40439		40489		40539		40589	
40440		40490		40540		40590	
40441		40491		40541		40591	
40442		40492		40542		40592	
40443		40493		40543		40593	
40444		40494		40544		40594	
40445		40495		40545		40595	
40446		40496		40546		40596	
40447		40497		40547		40597	
40448		40498		40548		40598	
40449		40499		40549		40599	
40450		40500		40550		40600	

Analog setting value (40001 to 49999)							
No. 9 Parameter				DI/DO function allocation		Operation status information	
No.	Contents	No.	Contents	No.	Contents	No.	Contents
40601		40701		48001	Display backlight	49001	
40602		40702		48002	Display contrast	49002	
40603		40703		48003	Key backlight	49003	
40604		40704		48004		49004	
40605		40705		48005		49005	
40606		40706		48006		49006	
40607		40707	Preset manual	48007		49007	
40608		40708	Output 2 Preset manual	48008		49008	
40609		40709		48009		49009	
40610		40710		48010		49010	
40611		40711		48011		49011	
40612		40712		48012		49012	
40613		40713		48013		49013	
40614		40714		48014		49014	
40615		40715		48015		49015	
40616		40716		48016		49016	
40617		40717		48017		49017	
40618		40718		48018		49018	
40619		40719		48019		49019	
40620		40720		48020		49020	
40621		40721		48021		49021	
40622		40722		48022		49022	
40623		40723		48023		49023	
40624		40724		48024		49024	
40625		40725		48025		49025	
40626		40726		48026		49026	
40627		40727	No. 9 variation limit (lower)	48027		49027	
40628		40728	No.9 variation limit (Higher)	48028		49028	
40629		40729		48029		49029	
40630		40730		48030		49030	
40631		40731		48031		49031	
40632		40732		48032		49032	
40633		40733		48033		49033	
40634		40734		48034		49034	
40635		40735		48035		49035	
40636		40736		48036		49036	
40637		40737		48037		49037	
40638		40738		48038		49038	
40639		40739		48039		49039	
40640		40740		48040		49040	
40641		40741		48041		49041	
40642		40742		48042		49042	
40643		40743		48043		49043	
40644		40744		48044		49044	
40645		40745		48045		49045	
40646		40746		48046		49046	
40647		40747		48047		49047	
40648		40748		48048		49048	
40649		40749		48049		49049	
40650		40750		48050		49050	

Analog setting value (40001 to 49999)							
Operation status information		Operation status information					
No.	Contents	No.	Contents	No.	Contents	No.	Contents
49051		49501	Mode lock (bit support)	49551			
49052		49502	AT start/stop	49552			
49053		49503	A/M switching 1	49553			
49054		49504	MAN output 1 value	49554			
49055		49505	A/M switching 2	49555			
49056	SV (Mode 0)	49506	MAN output 2 value	49556			
49057		49507		49557			
49058		49508		49558			
49059		49509		49559			
49060		49510	Run/Ready	49560			
49061		49511	Execution No. Select	49561			
49062		49512	Remote SV	49562			
49063		49513		49563			
49064		49514		49564			
49065		49515		49565			
49066		49516		49566			
49067		49517		49567			
49068		49518		49568			
49069		49519		49569			
49070		49520		49570			
49071		49521		49571			
49072		49522		49572			
49073		49523		49573			
49074		49524		49574			
49075		49525		49575			
49076		49526		49576			
49077		49527		49577			
49078		49528		49578			
49079		49529		49579			
49080		49530		49580			
49081		49531		49581			
49082		49532		49582			
49083		49533		49583			
49084		49534		49584			
49085		49535		49585			
49086		49536		49586			
49087		49537		49587			
49088		49538		49588			
49089		49539		49589			
49090		49540		49590			
49091		49541		49591			
49092		49542		49592			
49093		49543		49593			
49094		49544		49594			
49095		49545		49595			
49096		49546		49596			
49097		49547		49597			
49098		49548		49598			
49099		49549		49599			
49100		49550		49600			

Analog input data (30001 to 39999)							
Model information		Real data and parameter					
No.	Contents	No.	Contents	No.	Contents	No.	Contents
30001		30101	PV data				
30002		30102	PV status				
30003		30103	SV being used				
30004		30104	SV status				
30005		30105	MV1				
30006		30106	MV1 status				
30007		30107	MV2				
30008		30108	MV2 status				
30009		30109	Execute SV (Mode 0)				
30010		30110	Execute alarm 1 (mode 0)				
30011		30111	Execute alarm 2 (mode 0)				
30012		30112	Execute alarm 3 (mode 0)				
30013		30113	Execute alarm 4 (mode 0)				
30014		30114	Execute P (mode 0)				
30015		30115	Execute I (Mode 0)				
30016		30116	Execute D (Mode 0)				
30017		30117					
30018		30118					
30019		30119					
30020		30120					
30021		30121					
30022		30122					
30023		30123					
30024		30124	Execution No.				
30025		30125					
30026		30126					
30027		30127					
30028		30128					
30029		30129					
30030		30130					
30031		30131					
30032		30132					
30033		30133					
30034		30134	FB value				
30035		30135					
30036		30136					
30037		30137					
30038		30138					
30039		30139					
30040		30140					
30041		30141	Lock status				
30042		30142	Alarm status				
30043		30143	Error other status				
30044		30144					
30045		30145					
30046		30146					
30047		30147					
30048		30148					
30049		30149					
30050		30150					

8-9. Measurement range and decimal point position

<Measurement range list table>

Input type		Range		SV DOT	Range		SV DOT
Thermocouple		SV (°C)			SV (K)		
		Setting, display range			Setting, display range		
	B	0.0	to 1820.0	1	273.0	to 2093.0	1
	R1	0.0	to 1760.0	1	273.0	to 2033.0	1
	R2	0.0	to 1200.0	1	273.0	to 1473.0	1
	S	0.0	to 1760.0	1	273.0	to 2033.0	1
	K1	-200.0	to 1370.0	1	73.0	to 1643.0	1
	K2	0.0	to 600.0	1	273.0	to 873.0	1
	K3	-200.0	to 300.0	1	73.0	to 573.0	1
	E1	-270.0	to 1000.0	1	3.0	to 1273.0	1
	E2	0.0	to 700.0	1	273.0	to 973.0	1
	E3	-270.0	to 300.0	1	3.0	to 573.0	1
	E4	-270.0	to 150.0	1	3.0	to 423.0	1
	J1	-200.0	to 1200.0	1	73.0	to 1473.0	1
	J2	-200.0	to 900.0	1	73.0	to 1173.0	1
	J3	-200.0	to 400.0	1	73.0	to 673.0	1
	J4	-100.0	to 200.0	1	173.0	to 473.0	1
	T1	-270.0	to 400.0	1	3.0	to 673.0	1
	T2	-200.0	to 200.0	1	73.0	to 473.0	1
	W5-26	0.0	to 2310.0	1	273.0	to 2583.0	1
	W0-26	0.0	to 2310.0	1	273.0	to 2583.0	1
NiMO	-50.0	to 1410.0	1	223.0	to 1683.0	1	
AuFe	0.0	to 280.0 (K)	1	0.0	to 280.0	1	
N	0.0	to 1300.0	1	273.0	to 1573.0	1	
PR5-20	0.0	to 1800.0	1	273.0	to 2073.0	1	
PR20-40	0.0	to 1880.0	1	273.0	to 2153.0	1	
Plati1	0.0	to 1390.0	1	273.0	to 1663.0	1	
Plati2	0.0	to 600.0	1	273.0	to 873.0	1	
U	-200.0	to 400.0	1	73.0	to 673.0	1	
L	-200.0	to 900.0	1	73.0	to 1173.0	1	
Direct voltage current		Range setting scope					
	10mV	-10	to 10 (mV)	0 to 4	to		
	20mV	-20	to 20 (mV)	0 to 4	to		
	50mV	-50	to 50 (mV)	0 to 4	to		
	100mV	-100	to 100 (mV)	0 to 4	to		
	5V	-5	to 5 (V)	0 to 4	to		
	mA	-20	to 20 (mV)	0 to 4	to		

	SV (°C)			SV (K)			
	Setting, display range			Setting, display range			
Thermometer resistance	JPt100Ω1	-200.0	to 649.0	1	73.0	to 922.0	1
	JPt100Ω2	-200.0	to 400.0	1	73.0	to 673.0	1
	JPt100Ω4	-200.0	to 200.0	1	73.0	to 473.0	1
	JPt100Ω5	-100.0	to 100.0	1	173.0	to 373.0	1
	QPt100Ω1	-200.0	to 649.0	1	73.0	to 922.0	1
	QPt100Ω2	-200.0	to 400.0	1	73.0	to 673.0	1
	QPt100Ω4	-200.0	to 200.0	1	73.0	to 473.0	1
	QPt100Ω5	-100.0	to 100.0	1	173.0	to 373.0	1
	Pt50Ω	-200.0	to 649.0	1	73.0	to 922.0	1
	Pt100Ω1	-200.0	to 850.0	1	73.0	to 1123.0	1
	Pt100Ω2	-200.0	to 400.0	1	73.0	to 673.0	1
	Pt100Ω4	-200.0	to 200.0	1	73.0	to 473.0	1
	Pt100Ω5	-100.0	to 100.0	1	173.0	to 373.0	1
	Pt-Co (Exclusive 4-wire system)	4.0	to 374.0 (K)	1	4.0	to 374.0	1

9.PRIVATE protocol

9-1.Difference between RS—232C and RS-422A/485

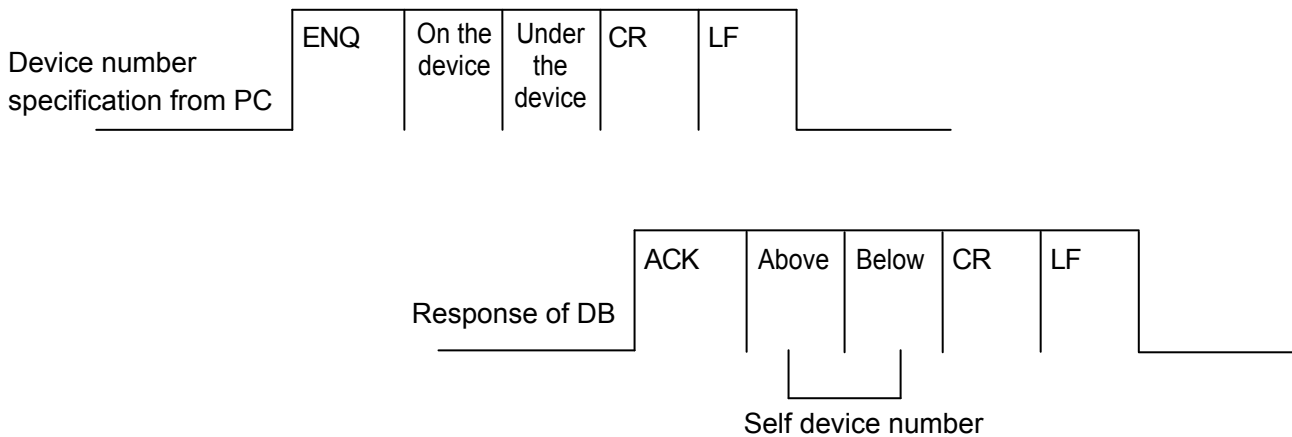
Only the level of RS-232C and RS-422A/RS-485 differs electrically, the communication procedure is the same.

However RS-422A/RS-485, by connecting a number of devices in series, from 1 amongst that .

This is called establishing the data link. For that each device sets its own device number beforehand such that it does not overlap with the other device number.(See 'setting parameters for communication') After the data link is established, communication procedure of RS-232C and RS-422A/RS-485 is exactly the same.

9-1-1. Establishing the data link (RS-422A/RS-485 only)

From the PC if you want to communicate by using the following procedure, send the device numbers before hand and establish data link with that device and communicate. After establishing the data link communicate with that device according to the procedure explained in 'Communication format'.



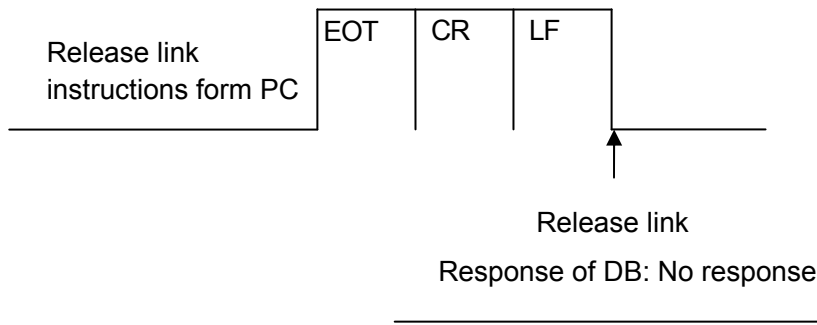
Precautions

To avoid accidents always read these contents and understand them.

- 1.Send the device numbers in 2 digits always from 01 to 99.
2. Do not use the device number 00. (Number 00 is used during RS-232C communication)
- 3.The specified device only responds within 1 second.
- 4.When the device of the specified device number does not exist, then there is no response.
- 5.If there is a device whose data link is already established the data link of that device is automatically released.
- 6.ENQ, ACK are control loads and hexadecimally they are expressed as follows.
ENQ: 05H
ACK: 06H
- 7.When device number 1 is sent response of DB is as follows.
ACK 31 CR LF
When device number 99 is sent response of DB is as follows.
ACK 39 39 CR LF

9-1-2. Releasing the data link

When communicating with the DB other than the DB that is currently being communicated with, after releasing the data link by the following procedure from the PC, establish the data link with the following DB by the procedure mentioned in the earlier section.



Precautions

To avoid accidents always read these contents and understand them.

1. By using this command, the data link of all the DBs that are connected is released and following data link is established.
2. Data link of each DB which is connected is released within 10msec by using this command, hence for sending from PC a time of 10msec or more is necessary.
3. ENQ is control loads and hexadecimally it is expressed as follows.
EOT: 04H

9-2. Basic procedure of communication

9-2-1. Text format at the time of sending and receiving

STX	TEXT	ETX	BCC L	BCC H	CR	LF
-----	------	-----	-------	-------	----	----

- ① Character received before STX is not received.
- ② Always add CR(0DH), LF(0AH) as end code. (For both sending and receiving).

9-2-2. Check sum

This device adds check sum data as BCC (Block Check Code).

Check sum means, seeing each text data as binary and sending low order 8 bits of that total sum as hexadecimal character.

- ① Target range of BCC



- ② BCC (Check sum)

The low order 8 bit data of the pure binary total sum of target range data is split into high and low order 4 bits and are converted to characters(30 to 39, 41 to 46H) 0 to F, and is kept in high order and low order sequence. (2 characters)

STX	TEXT	ETX	BCC L	BCC H	CR	LF
-----	------	-----	-------	-------	----	----

- ③ When adding parity to BCC, the parity of BCC itself is considered.
- ④ BCC is not added in positive and negative response.
- ⑤ Nor it is added to ENQ, ACK, EOT.
- ⑥ BCC is added and checked for both sending and receiving.

STX	1	2	,	0	ETX	BCC L	BCC H	CR	LF
	31	32	2C	30	03	32	43		
						(2)	(C)		

When the data to be sent and received is changed due to noise etc, by comparing with that value calculated on the receiving side, that occurrence may be detected.

9-2-3. Positive and negative response of DB

① Positive response

A	CR	LF
---	----	----

② Negative response

N	CR	LF
---	----	----

 : During error

C	CR	LF
---	----	----

 : Check sum error

L	CR	LF
---	----	----

 : When each mode of DB is not key locked and when PC has done the parameter settings

F	CR	LF
---	----	----

 : Format error

D	CR	LF
---	----	----

 : Setting error

9-2-4. Basic procedure of communication

- ① In case of DB with communication option is possible at any point of time.
However when setting the parameter from the PC, if each mode of DB is not locked, DB cannot accept the settings. A negative response "L" is sent.
Method of locking is, key locking all the modes from mode 0 to mode 7 after confirming the settings of mode 7.
Data can be sent from DB at any point of time.
- ② First of all data link is established in RS—422A/RS-485 and the communication with DB is performed according to the communication format. At the end the data link is released and made available for next communication.
- ③ In RS-232C, communication with DB is done by following the communication format from the beginning.
- ④ When DB receives the data request from the PC, if the request is correct it sends the data. If there is a mistake in the request, negative response is sent.
- ⑤ When DB receives parameter settings from PC, if the settings are correct, positive response "A" is sent after internal processing. If there is a mistake in the settings negative response is sent.

9-2-5. Control load

Following code is used in communication control.

STX(Text start signal) : 02H
ETX (Text end signal) : 03H

[For RS-422A/RS-485]

ENQ (Enquiry signal) : 05H
ACK (Positive response) : 06H
EOT (transmission end signal) : 04H

9-3. Communication format



Precautions

When transfer the parameter from old instrument to this instrument, check the setting range of each parameter because some parameters of setting range (for example, SV (setting value), alarm value etc.) is different from old instrument.

9-3-1. Request command of PC and send format of DB

① Data request command

Command name	Command format	Function	Reference section
(1) Real data request	STX Δ1, Δ1, ETX BCC CR LF (DF)	Requesting PV, SV, MV data	72
(2) Execution parameter request	STX Δ1, Δ2, ETX BCC CR LF (EF)	Execute SV,P,I,D,AL1 to AL4 data request	72
(3) Individual setting parameter request	STX Δ1, Δ3, □□, □, └─ No. └─ Parameter type ETX BCC CR LF	Data request after specifying 1 setting parameter	73
(4) Status 1 request	STX Δ1, Δ8, ETX BCC CR LF (40)	Occurrence status of execution No. AL1 to AL4, PV, hardware error status request	73
(5) Status 2 request	STX Δ1, Δ9, ETX BCC CR LF (50)	A/M,AT,R/L status request	73

(Note) Δ= Space

② Command that moves the DB status

Command status	Command format	Function
(1) AUTO/MAN switching	STX Δ2, Δ1, □, □□□, □□□, ETX BCC CR LF <div style="margin-left: 40px;"> └─ MV1 └─ MV2 (During output 2) └─ Output 2 option └─ Set space when none └─ Set manual output value └─ at that time space is set for └─ MV1, MV2 └─ 0=AUTO, 1=MAN </div>	Auto/manual switching and manual output setting
(2) Cancel alarm output	STX Δ2, Δ2, 1, ETX BCC CR LF (C5)	Same as alarm output release in mode 1
(3) Remote/local switching	STX Δ2, Δ3, □, ETX BCC CR LF <div style="margin-left: 40px;"> └─ 1= Remote └─ 0= Local </div>	Same as Remote/local switching in mode 1
(4) Execution No. selection	STX Δ2, Δ4, □, ETX BCC CR LF <div style="margin-left: 40px;"> └─ Execution No. 1 to 8 </div>	Execution no. in mode 1 Same as select
(5) Start/Stop auto tuning	STX Δ2, Δ5, □, ETX BCC CR LF <div style="margin-left: 40px;"> └─ 1= AT start └─ 0=AT stop </div>	Same as AT start, stop in mode 1

(Note) Δ= Space

③ Real data request

Real data request: STX Δ1, Δ1, ETX BCC CR LF
(DF)

DB sending: STX Δ1, □, □□□□□□□□, □, □□□□□□□□,

PV status

0: Normal

1:+ over range

2:— over range

PV (Measurement value)

SV (Setting value)

During over range

Total digits 9

1 to 8: SVNo.

0: Remote SV

□□□□□□□□, □□□□□□□□, ETX BCC CR LF

MV1 (Output value)

MV2 (Output value 2)

In case of output 2 option,
Dummy data when there is no option

[Reference] When DB sends a numeric value data, right justified or 0 suppressed data is send in 8 digits

PV, SV data with up to 4 digits after the decimal is sent. If it exceeds 6 digits including the decimal point then the last digit is truncated and the data is sent..

(Note)Δ= Space

④ Execution parameter request

Execution parameter request: STX Δ1, Δ2, ETX BCC CR LF
(EF)

DB sending: STX Δ2, □, □□□□□□□□, □□□□□□□□,

Execution No. SV

Execute P

1 to 8: Execution No.

Execute I

Execute D

Execute AL1

Execute AL2

Execute AL3

Execute AL4

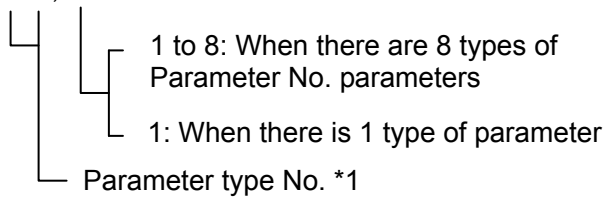
□□□□□□□□, □□□□□□□□, ETX BCC CR LF

[Reference] When DB sends a numeric value data, right justified or 0 suppressed, data is send as 8 digits.

(Note)Δ= Space

⑤ Individual parameter request

(1) Individual setting parameter request: STX Δ1, Δ3, □□, □ ETX BCC CR LF



(2) Sending DB :DB sends the setting parameters that are requested.

Send format is the same as format order at the time of setting it in DB from PC. However the number of digits of the data differ. For details see appendix 11.1 communication format list.

*1 parameter type No. is a no. given to setting parameter and is indicated in section 8.2.

[Reference] When DB sends a numeric value data, right justified or 0 suppressed, data is sent as 8 digits.

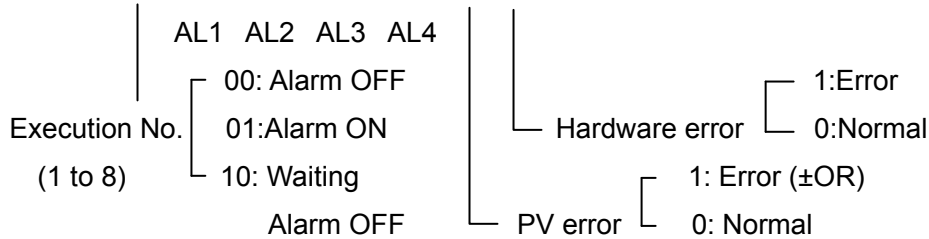
(Note)Δ= Space

⑥ Status 1 request

(1) Status 1 request: STX Δ1, Δ8, ETX BCC CR LF

(40)

(2) DB sending: STX Δ8, □, □□, □□, □□, □□, □, □, ETX BCC CR LF



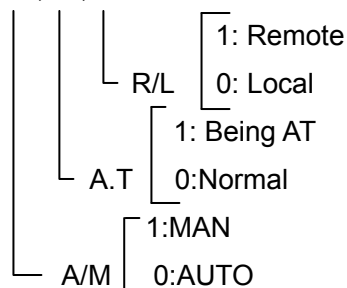
(Note) Δ= Space

⑦ Status 2 request

(1) Status 2 request: STX Δ1, Δ9, ETX BCC CR LF

(50)

(2) DB sending: STX Δ9, □, □, □, ETX BCC CR LF

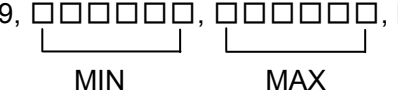
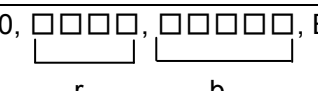
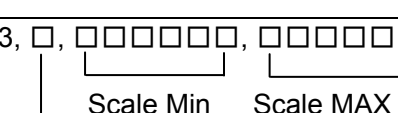
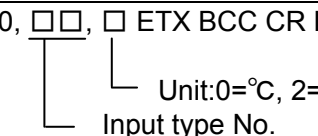


(Note)Δ= Space

9-3-2. Type and format of the parameter that is to be set in DB from the PC

(Parameter communication format of DB: Number of digits of data is 8.)

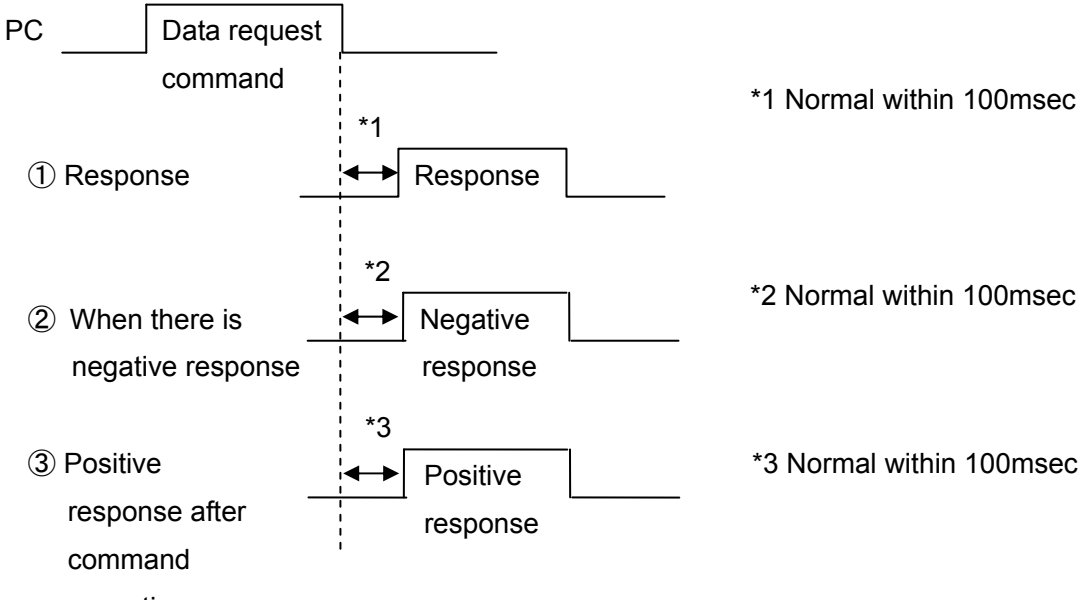
Parameter type	No.	Format
SV (1 to 8)	11	STX 11, □, □□□□□□, ETX BCC CR LF SV [1 to 8=PID No. 0=Copy to Nos. 1 to 8
Alarm (1 to 8)	12	STX 12, □, □□□□□□, □□□□□□, □□□□□□, AL1 AL2 AL3 □□□□□□ ETX BCC CR LF AL4 When 6 digits, all digits are space do not change the setting. [1 to 8=PID No. 0=Copy to Nos. 1 to 8 (Note) When alarm format is other than that, AL becomes dummy data.
PID (1 to 8)	13	STX 13, □, □□□□□□, □□□□□, □□□□□ ETX BCC CR LF P I D When all digits are space do not change the settings. [1 to 8=PID No. 0=No.1 to 8, 90=Copy to No.91 to 98
Output variation limit (1 to 8)	14	STX 14, □, □□□□□□, ETX BCC CR LF [1 to 8=PID No. 0=Copy to Nos. 1 to 8 (Note) When output variation limit is read, ascending value is read and when it is written ascending/descending absolute value is set.
Higher and lower limit output limit (1 to 8)	15	STX 15, □, □□□□□□, □□□□□□, ETX BCC CR LF OL-L OL-H [1 to 8=PID No. 0=Copy to Nos. 1 to 8

Parameter type	No.	Format
Sensor correction	16	STX 16, □□□□□□, ETX BCC CR LF
Digital filter	17	STX 17, □□□□, ETX BCC CR LF
Setting value variation rate	18	STX 18, □□□□□, ETX BCC CR LF (Note) When set value variation rate is read, ascending value is read and when it is written, ascending/descending absolute value is set.
Remote scale	19	STX 19, □□□□□□, □□□□□□, ETX BCC CR LF <div style="text-align: center;">  <p>MIN MAX</p> </div> When 6 digits, all digits are space do not change the setting.
Cascade	20	STX 20, □□□□, □□□□□□, ETX BCC CR LF <div style="text-align: center;">  <p>r b</p> </div> When all digits are space do not change the settings.
Remote shift	21	STX 21, □□□□□□, ETX BCC CR LF
Remote filter	22	STX 22, □□□□□□, ETX BCC CR LF
Transmission type Transmission scale	23	STX 23, □, □□□□□□, □□□□□□, ETX BCC CR LF <div style="text-align: center;">  <p>Scale Min Scale MAX</p> </div> When 6 digits, all digits are space do not change the setting. Transmission type { <ul style="list-style-type: none"> 0=SV 1=PV 2=MV 3= Others
Output 2 P	24	STX 24, □□□□□□, ETX BCC CR LF
Output 2 gap	25	STX 25, □□□□□□, ETX BCC CR LF
Measurement input unit	30	STX 30, □□, □ ETX BCC CR LF <div style="text-align: center;">  <p>Unit:0=°C, 2=K</p> <p>Input type No.</p> </div>

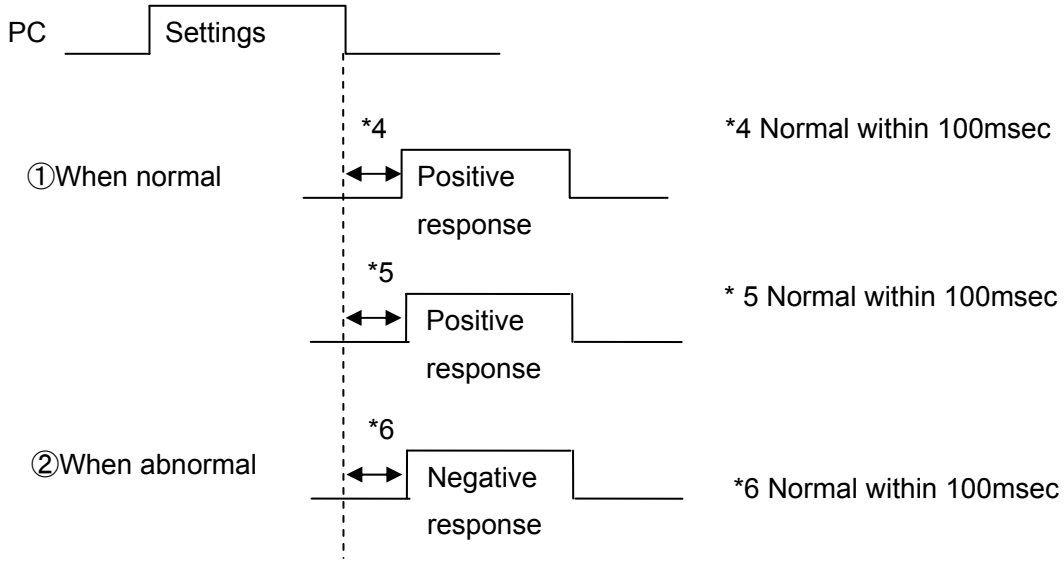
Parameter type	No.	Format
RJ INT/EXT	31	STX 31, □, ETX BCC CR LF <div style="margin-left: 100px;"> ┌ ├ 0=INT └ 1=EXT </div>
Linear scale	32	STX 32, □□□□□□, □□□□□□, ETX BCC CR LF <div style="margin-left: 100px;"> ┌──────────┐ ┌──────────┐ MIN MAX When 6 digits, all digits are space do not change the setting. </div>
PV DOT	33	STX 33, □, ETX BCC CR LF
Scale DOT	34	STX 34, □, ETX BCC CR LF (Note) Differs from displayed SV decimal point.
Alarm format Alarm dead band	35	STX 35, □, □, □□□□□, ETX BCC CR LF <div style="margin-left: 100px;"> ┌──────────┐ Alarm dead band Alarm Alarm:0=DV-H, 1=DV-HW, 2=DV-L, 3=DV-LW, 4=PV-H, 5=PV-L, 6=Other ┌ ├ 1 to 4=Alarm No. └ 0=Copy to Nos. 1 to 4 </div> (Note)Alarm format:6=Nothing else can be written.
Dead band	36	STX 36, □□□, ETX BCC CR LF (Note) When dead band is read, dead band of output 1 is read and when it is written, it is set in dead band of output 1 and output 2.
Pulse cycle	37	STX 37 □□□, ETX BCC CR LF (Note) When pulse cycle is read, pulse cycle of output 1 is read and when it is written, it is set in pulse cycle of output 1, output 2.
FB zero Span Gain	38	STX 38, □□□□□, □□□□□, □□□, ETX BCC CR LF <div style="margin-left: 100px;"> ┌──────────┐ ┌──────────┐ ┌──┐ Zero Span Gain When all digits are space do not change the settings. </div>
Output preset	39	STX 39, □□□□□, ETX BCC CR LF
Output during PV abnormality	40	STX 40, □□□□□, ETX BCC CR LF
Output direct/reverse	41	STX 41, □, ETX BCC CR LF <div style="margin-left: 100px;"> ┌ ├ 0=DIRECT └ 1=REV. </div> (Note) When output direct/reverse is read, direct/reverse of control action of output 1 is read and when it is written, it is set in direct/reverse control action of output 1, output 2.

9-4. Communication time chart

9-4-1. Response to request command

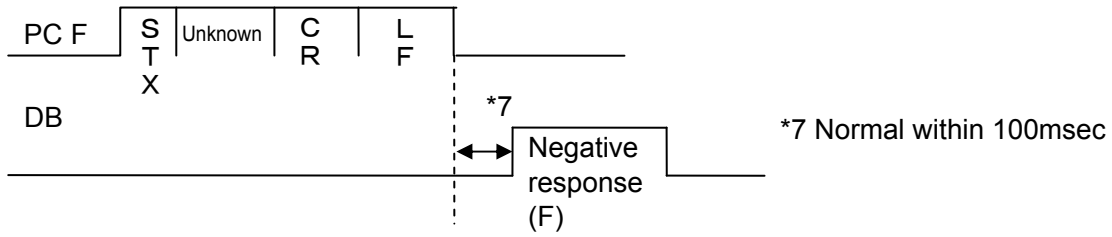


9-4-2. Response to the settings from the PC

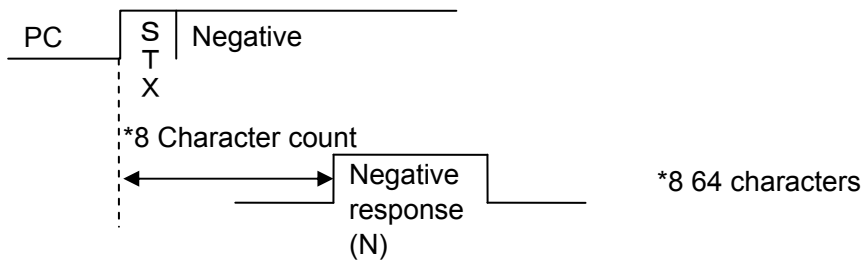


9-4-3. During other abnormalities

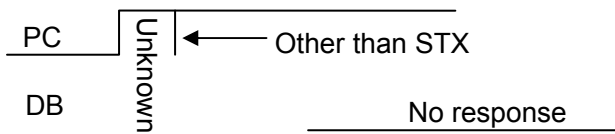
① Contents not clear



② Excess number of characters (buffer over)



③ First is STX



9-4-4. Response of the PC

As indicated in sections from 9-5-1. to 9-5-3., regarding the settings and the requests from PC, DB responds after a specific time. If there is no response from the DB even after the specific time, it is necessary to perform the settings, requests again from the PC. For the timer time up to resending from the PC, see the time chart in sections from 9-5-1. to 9-5-3.



Precautions

To avoid accidents always read these contents and understand them.

This device, starting from the SV value writes each parameter once in EEPROM and takes a backup until the next setting change, but there is a limitation to the write count. (Approximately million times)

Thus avoid the following usage method as the write count increases.

- If program is controlled using a PC, SV value is written frequently and in a short time the limiting write count is reached and EEPROM breaks.

[Counter measures]

When controlling the program using PC use communication remote function (See section 10.). If this method is used, there is no load on EEPROM.

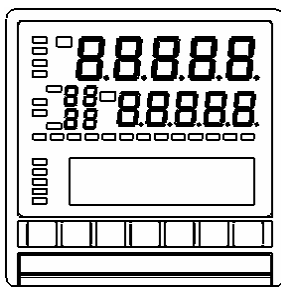
(However communication is not performed.)

10. Communication transmission, communication remote

10-1. Overview

DB can not only communicate with the PC but also can digitally communicate with DB→DB device (Between our company's controller-DB). It is called "Communication transmission" "Communication remote".

When multiple DBs operate with the same condition when this function is used, 1 machine from amongst them is the base unit set for communication transmission and the others are cordless handsets set in communication remote. Maximum 31 cordless SVs can be set using communication. To change it to DB (base unit) doing communication transmission or to communication remote DB (base unit) receiving it, it can be done by key settings of device itself.



In communication function of mode 7 is set as 'TRANS', it becomes a communication transmission (Base unit) function.

If remote/local switching of mode 1 is set to 'REMOTE', it becomes a communication remote (cordless handset) function.

(Communication function settings and transmission data contents)

Mode 8, communication function settings (Base unit)→(Cordless handset)	Transmission data contents
Protocol=PRIVATE (Transmission)→(Remote) [DB]	<ul style="list-style-type: none"> ● Base unit transmits the remote SV data and cordless handset receives it ● PRIVATE protocol
Protocol=MODBUS (Transmission)→(Remote) [DB]	<ul style="list-style-type: none"> ● Base unit transmits Run/Ready, execution no. selection, remote SV and cordless receives it. ● MODBUS protocol

※ In order that cordless does the reception it to necessary to switch it to remote mode.

※ Base unit sends the following data.

· PRIVATE protocol

Remote SV data = Data selected in communication transmission type

· MODBUS protocol

① Run/Ready =Run status

② Execution No. selection =Executing No.

③ Remote SV = Data selected in communication transmission type

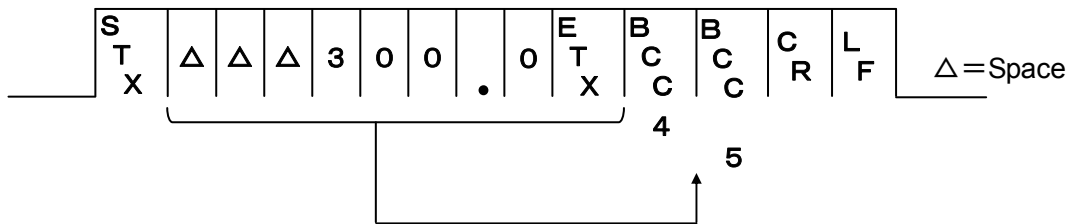
10-2. Specifications of communication division

- Communication system :Asynchronous method
- Communication speed :38400, 19200, 9600, 4800, 2400bps switching communication speed
- Start bit :1 bit
- Data length :7 bit (ASCII mode/PRIVATE mode) or 8 bits (RTU mode/ASCII mode)
- Parity bit :None (RTU mode/ASCII mode), Even (RTU mode/ASCII mode/PRIVATE mode), Odd (RTU mode/ASCII mode)
- Stop bit :1 bit (RTU mode/ASCII mode/PRIVATE mode), 2 bits (RTU mode/ASCII mode)
- Transmission code :ASCII (ASCII mode/PRIVATE mode) or Binary (RTU mode)
- Error check :Check sum ※1...For PRIVATE mode
:CRC-16 ...For RTU mode
:LRC ...For ASCII mode
- Usage signal name : Send or receive data only, without using control signal

※1 Check sum (BCC)

Check sum means, total sum of characters after STX up to ETX is calculated, lower order 8 bits are split into high and low order 4 bits and are converted to characters from 0 to F and are sent and received sequentially in high order and low order.

(Example)



Character	Δ	Δ	Δ	3	0	0	.	0	ETX	Total sum=BCC
ASCII code	20h	20h	20h	33h	30h	30h	2Eh	30h	03h	154h=45

10-3. Communication transmission setting

Set the following parameters in communication transmission KP.

- 1) Setting the communication speed (COM BIT RATE). (See 6-1)
- 2) Setting the communication function (COM KIND).(See 6-3)
- 3) Setting communication transmission type (COM TRANS KIND).(See 6-4)
- 4) Setting communication protocol(COM PROTOCOL). (See 6-5)
- 5) Setting communication character (COM CHARACTER). (See 6-6)

Reference In case of 'PRIVATE mode' communication transmission, KP outputs the data in the following format.



Data output: PV (measurement value), SV (Control setting value), MV1 (Output 1 value), MV2 (Output 2 value), MFB (Feedback value), RSV (Remote SV)

※ In case of 'RTU/ASCII mode' communication transmission, output the data by slave address '0' in MODBUS format mentioned earlier.

10-4. Communication remote settings

If communication remote is set, SV data is received instead of analog, by digital communication. Just by the reception of SV data not being analog but digital communication, it has a function similar to remote/local; (Option). However in communication remote, there is no remote scale function. By combination of communication transmission DB and communication remote DB, remote control and zone control that do not depend on analog are possible.

- ① In DB of communication remote, set the following parameters,
 - 1) Setting communication speed (COM BIT RATE).(See 6-1)
 - 2) Setting communication function(COM KIND).(See 6-3)
 - 3) Setting communication transmission type (COM TRANS KIND). (See 6-4)
 - 4) Setting communication protocol. (See 6-5)
 - 5) Setting communication character(COM CHARACTER).(See 6-6)
 - 6) Setting remote shift (REMOTE SHIFT).(Setting as per the requirement)(See General user's manual mode 2)
- ② If remote/local switching of mode 1 is set to 'REMOTE', and communication function of mode 7 is set to 'REM' then it becomes communication remote (cordless handset) function.
- ③ For setting of communication parameter, see section 6.
- ④ When the status is remote status, control using SV in case of local, until the initial remote SV data is received.

In case of 'PRIVATE mode' communication remote DB receives in the following format. When communication function is set as 'REM' in 'PRIVATE mode' DB does not respond.

$\overset{S}{T}_X$ ○ ○ ○ ○ ○ ○ ○ ○ ○ $\overset{E}{T}_X$ $\overset{B}{C}_C$ $\overset{B}{C}_C$ $\overset{C}{R}$ $\overset{L}{F}$



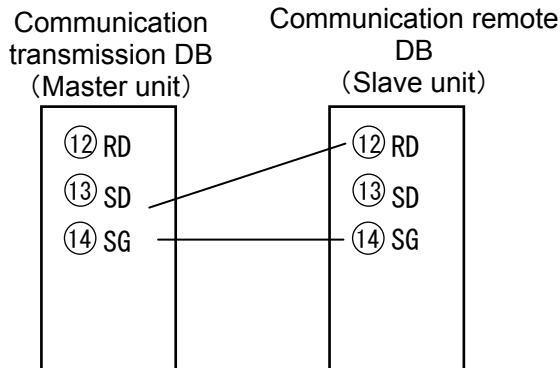
Precautions

- ① When connecting KP using communication transmission and DB using communication remote, make the communication protocol and communication speed of the device same.
- ② If analog remote and communication remote are used simultaneously analog remote takes precedence.
- ③ Analog transmission type and communication transmission type can be set separately.
- ④ If analog transmission option and communication transmission option are used simultaneously, transmission output is done from both.

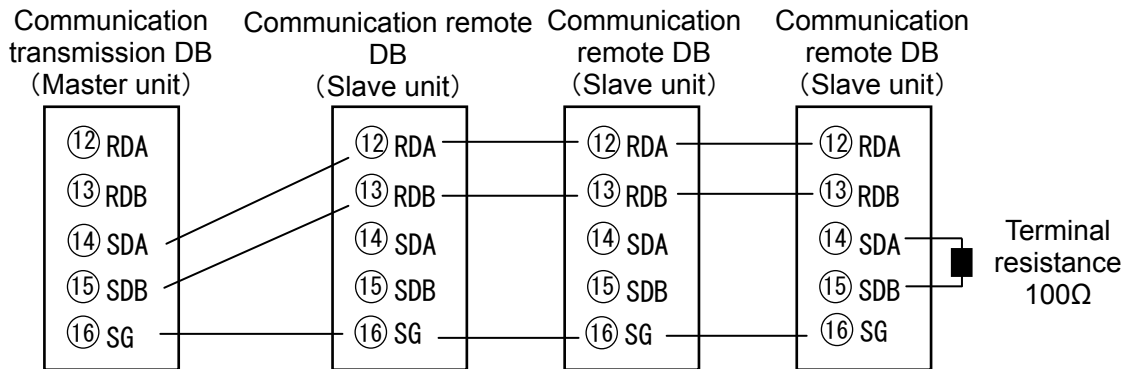
'Transmission scale lower limit' 'Transmission scale higher limit' 'remote scale lower limit' 'remote scale higher limit' of the parameter is set at the time of analog transmission/remote. Thus when using communication transmission one need not set them.

10-5. Wiring

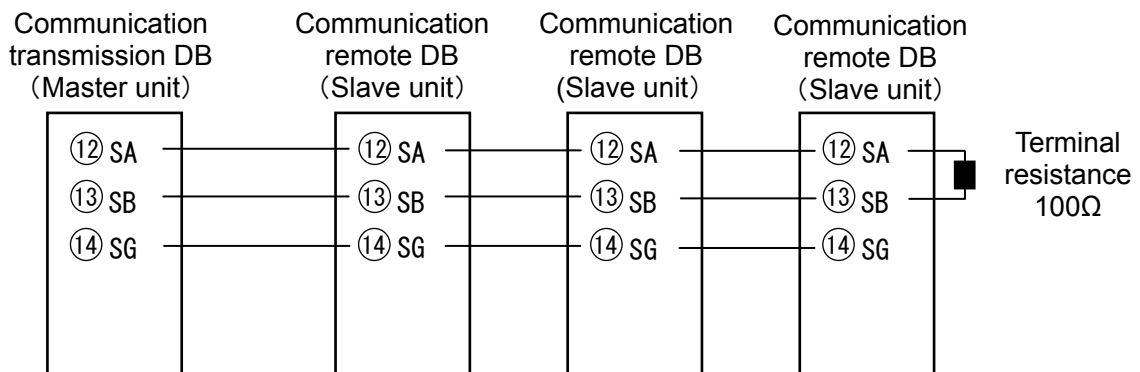
10-5-1. For RS-232C



10-5-2. For RS-422A



10-5-3. For RS-485

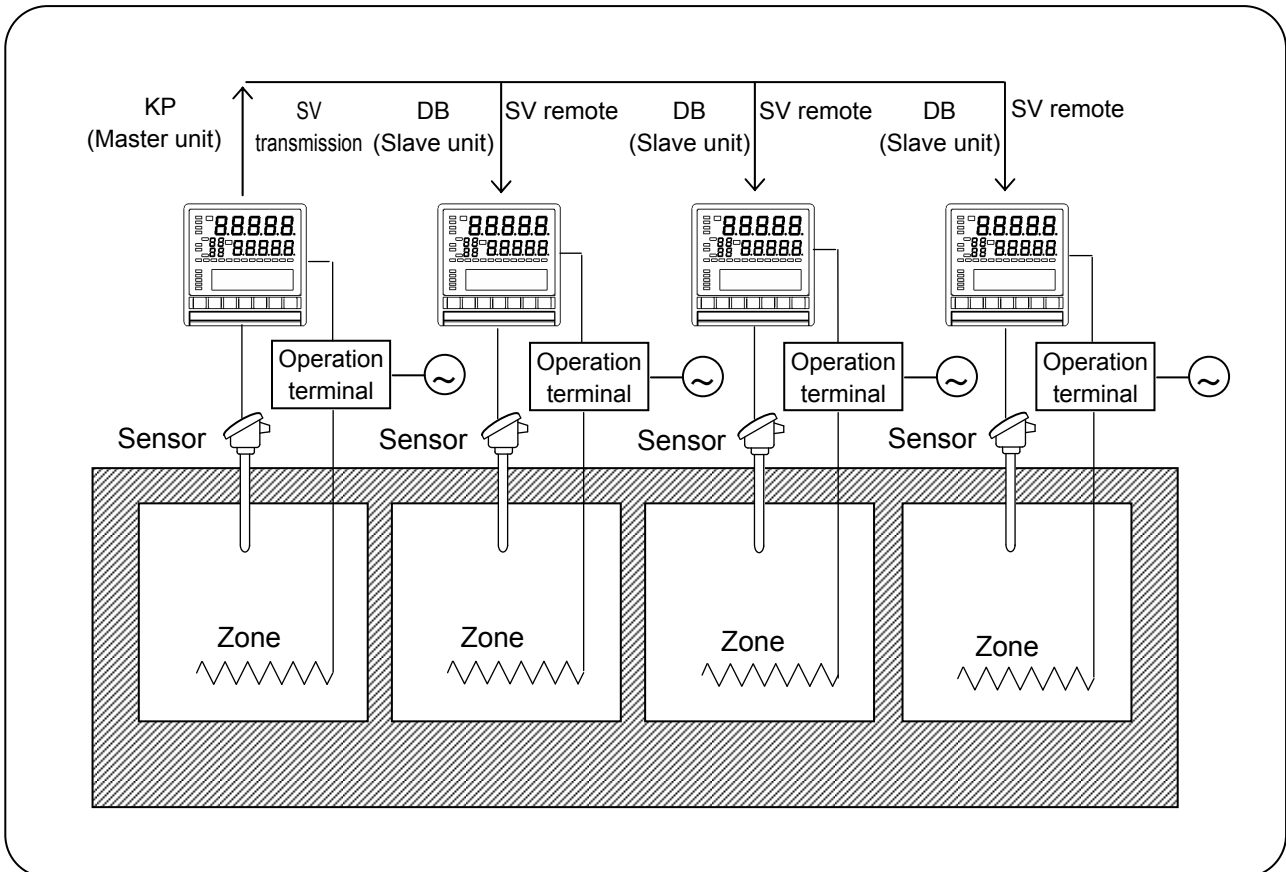


10-6. Example of combination

10-6-1. Multizone temperature control

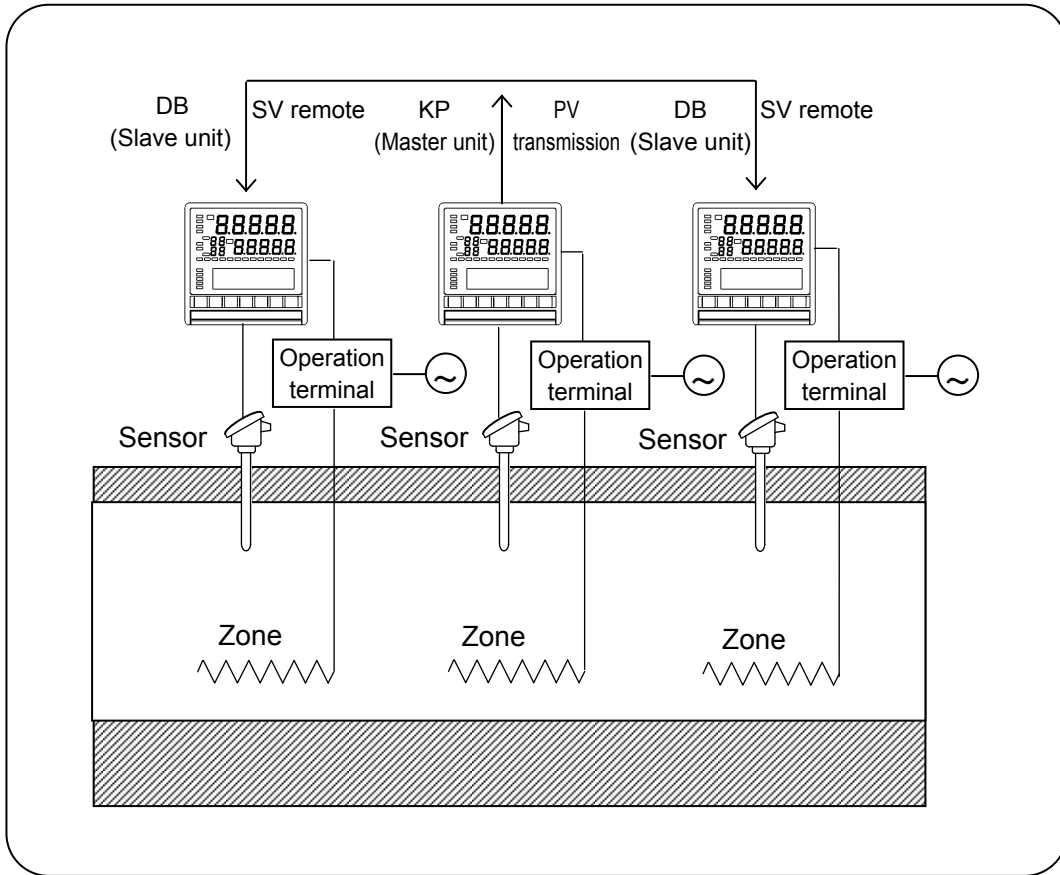
Perform communication transmission for SV using KP of base unit, and slave unit DB receives using communication remote.

As there is no error in analog division remote control with good precision is possible. If remote shift is used temperature slope can be held in multizone,



10-6-2. Controlling burning furnace zone

Communication transmission for PV is done using base unit in the center and both the cordless handsets receive SV as PV using communication remote and soakability can be controlled properly.



11. Appendix

11-1. Communication format list

As mentioned below Δ=Space(20H), X=Code data and numeric data at the time of setting, ○=Code data and numeric value data at the time of sending DB, SX=STX(02H), EX=ETX(03H), BCBC=BCC, CR=CR(0DH), LF=LF(0AH).

Communication Item	Format																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Real data request	SX	Δ	1	,	Δ	1	,	EX	BC	BC	LF																				
	SX	Δ	1	,	○	,	○	○	○	○	○	○	○	○	,	○	,	○	○	○	○	○	○	○	○	○	,	○	○	○	○
	PV										SV										MV 1	○									
Execution parameter request	○	○	○	○	,	○	○	○	○	○	○	○	○	,	EX	BC	BC	CR	LF												
	SX	Δ	1	,	Δ	2	,	EX	BC	BC	CR	LF																			
	SX	Δ	2	,	○	,	○	○	○	○	○	○	○	○	,	○	○	○	○	○	○	○	○	○	,	○	○	○	○	○	○
	SV										P										I	○									
Individual settings parameter request	○	○	,	○	○	○	○	○	○	○	○	,	○	○	○	○	○	○	○	○	,	○	○	○	○	○	○	○	○	○	
	○	○	○	○	○	○	○	,	○	○	○	○	○	○	○	○	○	○	○	,	EX	BC	CR	LF							
	AL3										AL4																				
	○	○	○	○	○	○	○	,	○	○	○	○	○	○	○	○	○	○	○	,	EX	BC	CR	LF							
Status 1 request	SX	Δ	1	,	Δ	3	,	x	x	,	x	,	EX	BC	BC	CR	LF														
	SX	Δ	8	,	○	,	○	○	,	○	○	,	○	○	,	○	○	,	○	○	,	EX	BC	BC	CR	LF					
Status 2 request	AL1										AL2										AL3	AL4									
	SX	Δ	1	,	Δ	9	,	EX	BC	BC	CR	LF																			
A/M switching	SX	Δ	9	,	○	,	○	,	○	,	EX	BC	BC	CR	LF																
	SX	Δ	2	,	Δ	1	,	x	,	x	x	x	,	x	x	x	,	EX	BC	BC	CR	LF									
Alarm output cancel	MV 1										MV 2																				
	SX	Δ	2	,	Δ	2	,	1	,	EX	BC	BC	CR	LF																	
R/L switching	SX	Δ	2	,	Δ	3	,	x	EX	BC	BC	CR	LF																		
Execution number select	SX	Δ	2	,	Δ	4	,	x	EX	BC	BC	CR	LF																		
AT start	SX	Δ	2	,	Δ	5	,	x	EX	BC	BC	CR	LF																		

Communication Item	Format																																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30			
SV (1 to 8)	SX	1	1	.	x	.	x	x	x	x	x	.	EX	BC	BC	CR	LF	CR	LF														
	SX	1	1	.	O	.	O	O	O	O	O	O	.	O	.	EX	BC	BC	CR	LF	CR	LF											
Alarm (1 to 8)	SX	1	2	.	x	.	x	x	x	x	x	.	x	x	x	x	x	x	x	.	x	x	x	x	x	x	.	x	x	x			
	SX	1	2	.	O	.	O	O	O	O	O	O	.	O	.	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O		
PID (1 to 8)	SX	1	3	.	x	.	x	x	x	x	x	.	x	x	x	x	.	x	x	x	x	.	EX	BC	BC	CR	LF	O	O	O			
	SX	1	3	.	O	.	O	O	O	O	O	O	.	O	.	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O		
output variation limit (1 to 8)	SX	1	4	.	x	.	x	x	x	x	x	.	EX	BC	BC	CR	LF	BC	CR	LF													
	SX	1	4	.	O	.	O	O	O	O	O	O	.	O	.	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O		
output high and low limit (1 to 8)	SX	1	5	.	x	.	x	x	x	x	x	.	x	x	x	x	.	x	x	x	x	.	EX	BC	BC	CR	LF	.	EX	BC	BC	CR	LF
	SX	1	5	.	O	.	O	O	O	O	O	O	.	O	.	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
Sensor correction	SX	1	6	.	x	x	x	x	x	x	.	EX	BC	BC	CR	LF	CR	LF															
	SX	1	6	.	O	O	O	O	O	O	O	O	.	O	.	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
Digital filter	SX	1	7	.	x	x	x	x	.	EX	BC	BC	CR	LF	EX	BC	BC	CR	LF														
	SX	1	7	.	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
SV variation rate	SX	1	8	.	x	x	x	x	x	EX	BC	BC	CR	LF	BC	CR	LF																
	SX	1	8	.	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
Remote scale	SX	1	9	.	x	x	x	x	x	x	.	x	x	x	x	x	x	.	EX	BC	BC	CR	LF	EX	BC	BC	CR	LF					
	SX	1	9	.	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
Cascade	SX	2	0	.	x	x	x	x	.	x	x	x	x	.	EX	BC	BC	CR	LF	BC	CR	LF	.	EX	BC	BC	CR	LF					
	SX	2	0	.	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
Remote Shift	SX	2	1	.	x	x	x	x	x	.	EX	BC	BC	CR	LF	BC	CR	LF															
	SX	2	1	.	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
Remote filter	SX	2	2	.	x	x	x	.	EX	BC	BC	CR	LF	EX	BC	BC	CR	LF															
	SX	2	2	.	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	
Transmission type Transmission scale	SX	2	3	.	x	.	x	x	x	x	x	.	x	x	x	x	x	.	x	x	x	x	.	EX	BC	BC	CR	LF	EX	BC	BC	CR	LF
	SX	2	3	.	O	.	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O

Communication Item	Format																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Output 2 P	SX SX	2 2	4 4	.	x O	x O	x O	x O	x O	.	EX O	BC O	BC O	CR EX	LF BC	BC	CR	LF												
output 2 gap	SX SX	2 2	5 5	.	x O	x O	x O	x O	x O	.	EX O	BC O	BC O	CR EX	LF BC	BC	CR	LF												
Measurement input unit	SX SX	3 3	0 0	.	x O	x O	.	x O	.	EX EX	BC BC	BC BC	CR CR	LF LF																
Linear scale	SX SX	3 3	2 2	.	x O	x O	x O	x O	x O	.	EX O	BC O	BC O	CR EX	LF EX	BC	BC	CR	LF											
											MIN																			
PV DOT	SX SX	3 3	3 3	.	x O	.	EX EX	BC BC	BC BC	CR CR	LF LF																			
scale DOT	SX SX	3 3	4 4	.	x O	.	EX EX	BC BC	BC BC	CR CR	LF LF																			
Alarm format	SX SX	3 3	5 5	.	x O	.	x O	.	x O	x O	x O	x O	x O	.	EX O	BC O	BC O	CR EX	LF BC	BC	CR	LF	BC	CR	LF					
Alarm dead band	SX SX	3 3	5 5	.	x O	.	x O	.	x O	x O	x O	x O	x O	.	EX O	BC O	BC O	CR EX	LF BC	BC	CR	LF	BC	CR	LF					
Dead band	SX SX	3 3	6 6	.	x O	x O	x O	.	EX O	BC O	BC O	CR O	LF O	.	EX BC	BC BC	CR CR	LF LF												
Pulse cycle	SX SX	3 3	7 7	.	x O	x O	x O	.	EX EX	BC BC	BC BC	CR CR	LF LF																	
FB zero span	SX SX	3 3	8 8	.	x O	x O	x O	x O	x O	.	x O	x O	x O	x O	x O	.	x O	x O	x O	.	EX O	BC O	BC O	CR O	LF O	O	O	O	O	O
Gain											ZER O																			
output preset	SX SX	3 3	9 9	.	x O	x O	x O	x O	x O	.	EX O	BC O	BC O	CR EX	LF BC	BC	CR	LF												
During PV abnormality output	SX SX	4 4	0 0	.	x O	x O	x O	x O	x O	.	EX O	BC O	BC O	CR EX	LF BC	BC	CR	LF												
output Direct/reverse	SX SX	4 4	1 1	.	x O	.	EX EX	BC BC	BC BC	CR CR	LF LF																			

11-2. Input type No.-Input type support table

- ① Thermocouple scale ② Direct current and current scale ③ Resistance thermometer

No.	Input type
1	B
2	R1
3	R2
4	S
5	K1
6	K2
7	K3
8	E1
9	E2
10	E3
11	E4
12	J1
13	J2
14	J3
15	J4
16	T1
17	T2
18	WRe5-26
19	WRe0-26
20	NiMo
21	AuFe
22	N
23	PR5-20
24	PR20-40
25	Plati1
26	Plati2
27	U
28	L

No.	Input type
31	10mV
32	20mV
33	50mV
34	100mV
35	5V
36	20mA
37	10V

No.	Input type
41	JPt100Ω1
42	JPt100Ω2
44	JPt100Ω4
45	JPt100Ω5
46	QPt100Ω1
47	QPt100Ω2
49	QPt100Ω4
50	QPt100Ω5
51	JPt50Ω
52	Pt-Co
53	Pt100Ω1
54	Pt100Ω2
56	Pt100Ω4
57	Pt100Ω5

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