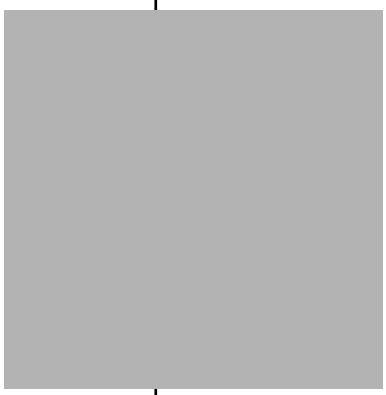
YAMATAKE

No. CP-UM-1589E

DIGITRONIK
CPL Communications
User's Manual
SDC30/31



Yamatake Corporation

RESTRICTIONS ON USE

When using this product in applications that require particular safety or when using this product in important facilities, pay attention to the safety of the overall system and equipment. For example, install fail-safe mechanisms, carry out redundancy checks and periodic inspections, and adopt other appropriate safety measures as required.

REQUEST

Ensure that this User's Manual is handed over to the user before the product is used.

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Considerable effort has been made to ensure that this User's Manual is free from inaccuracies and omissions.
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Introduction

Thanks for the choice of the DIGITRONIK digital indicating Controller SDC30/31.
The CPL (Control Products Link) communication means a base band system simplified communication whose connection object is a personal computer or equivalent.
This instruction manual not only outlines the CPL communication functions of the SDC30/31, but also describes its wiring methods, communication procedure, communication data table, troubleshooting, and communication specifications.
The items required for the SDC30/31 CPL communication functions to be properly used are given in this manual.
Persons in charge of design or maintenance of operation panels or equipment using the SDC30/31 CPL communication functions should read this manual without fail.

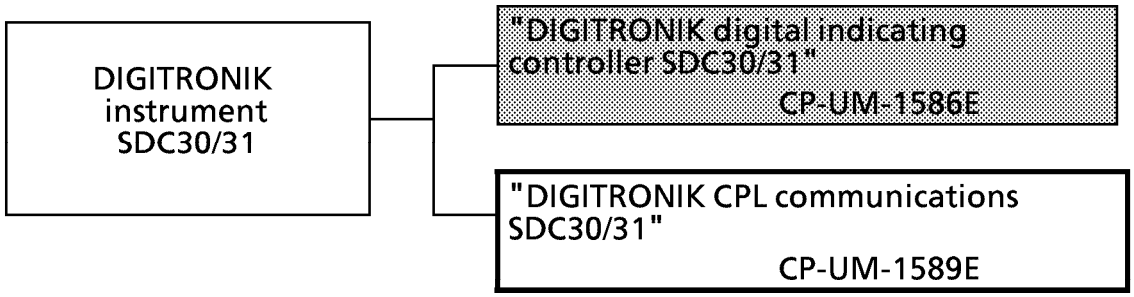
PRECAUTIONS

If it is necessary to change the parameters of the SDC30/31 frequently during communication, write data at addresses of not EEPROM but RAM. The guaranteed data write count at the EEPROM addresses is limited to 100,000 times.

Note that the data in RAM is cleared, and the data in EEPROM is copied on RAM if the power supply to the SDC30/31 is interrupted.

Positioning of this instruction manual

This instruction manual is essential to data exchange with a personal computer or the like, or a control system configuration, using the communication functions of the DIGITRONIK instruments. This instruction manual provides descriptions on the wiring methods, communication procedure, troubleshooting concerning communication, and communication specifications of the DIGITRONIK instruments.
The instruction manuals for the DIGITRONIK instruments are classified into the following parts:



"Instruction manual for DIGITRONIK Digital Indicating Controller SDC30/31" CP-UM-1586E.

Persons in charge of hardware design, maintenance, and operation of control panels or equipment using the DIGITRONIK instruments should read these manuals without fail.
These manuals outlines the DIGITRONIK instrument products and describes their panel mounting, and wiring methods, setting and operating methods, maintenance and inspection, troubleshooting, and hardware specifications.

Configuration of this instruction manual

This instruction manual consists of eight chapters, in which the respective items are described as shown below.

1. **Communication functions**
   Communication functions and model numbers of the DIGITRONIK instruments
2. **Wiring**
   RS-485 wiring methods to make communication between the DIGITRONIK instruments and other equipment
3. **Setting**
   Setting for communication of DIGITRONIK instruments
4. **Communication procedure**
   Communication procedure, message configuration, data read/write and signal timing
5. **Communication data table**
   Table of various data addresses used for communication of DIGITRONIK instruments
6. **Communication program for master station**
   Communication program example of DIGITRONIK instruments using N88BASIC in PC-9800 series personal computer.
7. **Troubleshooting**
   Check points required if the DIGITRONIK instrument communication should not operate normally.
8. **Specifications**
   Communication specifications for the DIGITRONIK instruments

APPENDIX
Code table and network configuration using the RS-232C/RS-485 converter CMA50

Contents

5. Communication data table

6. Communication program for master station

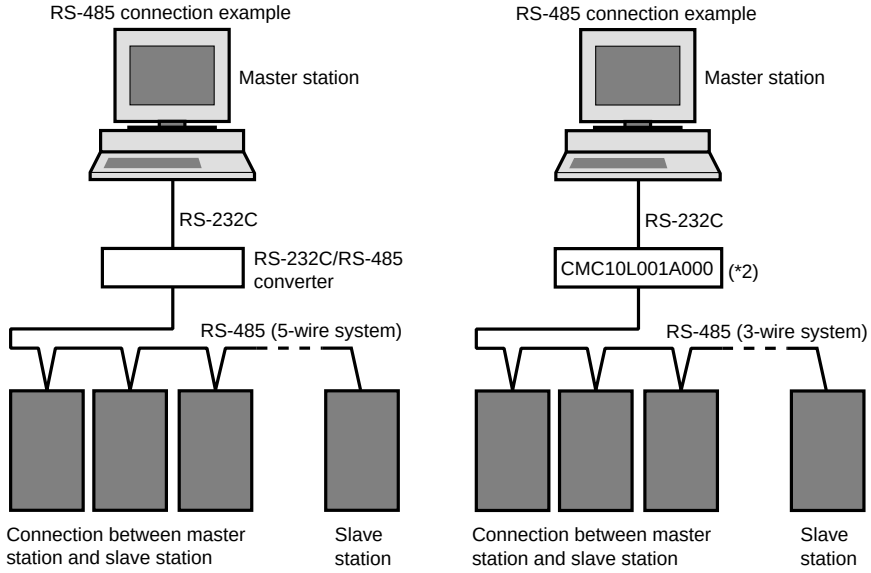
7. Troubleshooting

8. Specifications

Appendix

1. Communication functions

- In the RS-485 system, up to 31 instruments (see *1) can be connected with one master station. The “station addresses” are then used to identify mate stations for communication.
- When the following procedure is completed during communication, various data for the instrument can be read or written:
  (1)The master station (host computer) transmits a request message to a slave station (instrument).
  (2)The master station receives a response message from the slave station.
- Instructions from master station to slave station are classified into two types; “read” and “write”.
- The type of ready/write data can be optionally selected by “data address”.
- CPL(Control Peripheral Link) communications network is the Yamatake Corporation's host-communications system.



- The high-performance communication controller CMC410A102 is available for conversion between the RS-232C and RS-485 interfaces.

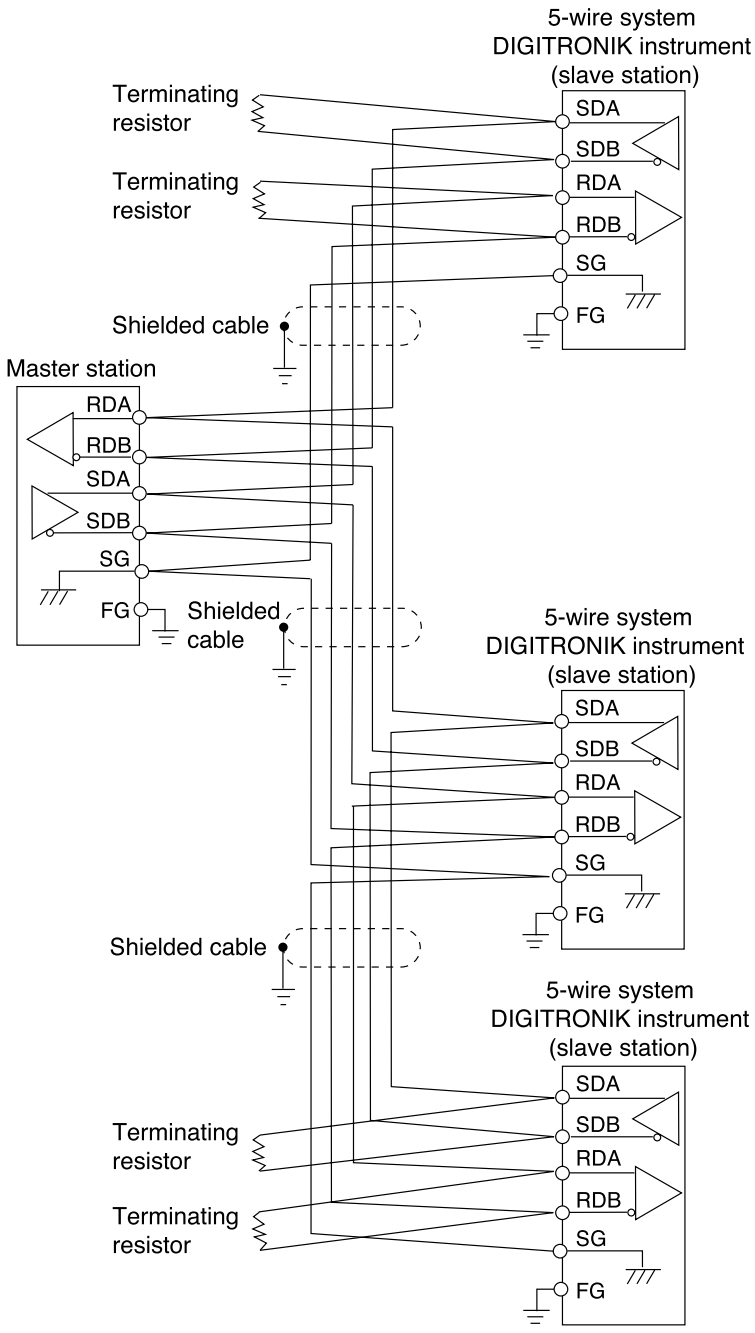
(*1) When the master station is an MA500 DIM or CMC410, it can be connected to up to 16 slave stations.
(*2) The CMC10L001A000 communication controller is an RS-232C/RS-485 (3-wires type) converter available from Yamatake Corporation.

2. WIRING

2 - 1 RS-485 Connection

■ 5-wire system

When the DIGITRONIK instruments with the communication functions in compliance with the RS-485 are used in the 5-wires system, they are connected, for example, as follows:

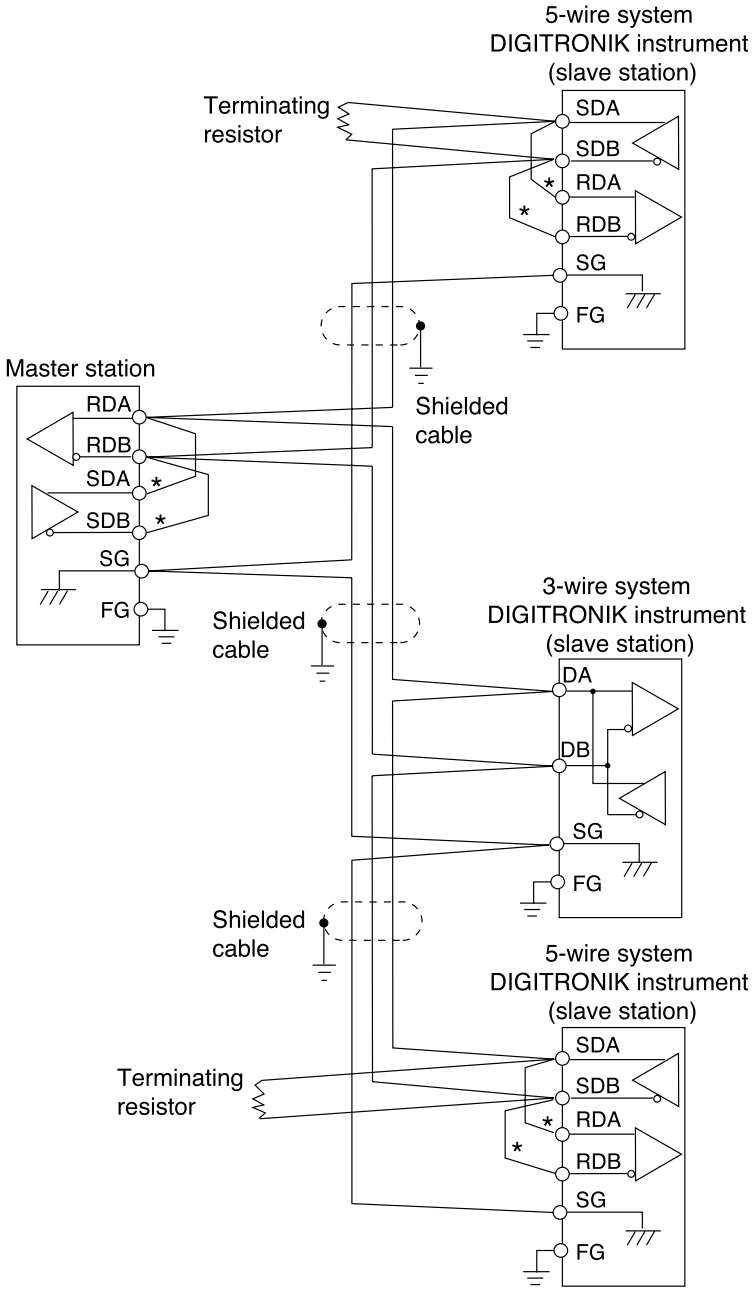


Connect two terminating resistors of 150Ω±5%, 1/2W min. to the instrument at each end of the transmission line. Also connect the shield wires to FG at one place.

In the 5-wires system, the Yamatake Corporation CMC10L can be used as a converter in the master station. It can also be used as a converter in the slave station when the number of the slave stations is only one, but cannot be used as a converter in a slave station when two or more slave stations are used.

■ 3-wire system

The DIGITRONIK instruments with the communication functions in compliance with the RS-485 can also be used in the 3-wires system. An example of connection methods in such a case is shown below.



Connect one terminating resistor of 150Ω±5%, 1/2W min. to the instrument at each end of the transmission line.

Also connect the shield wires to FG at one place.

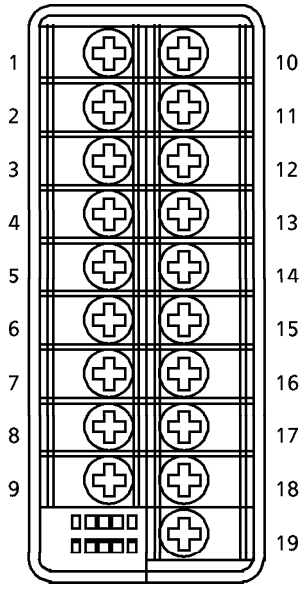
In the 3-wires system, the Yamatake Corporation CMC10L cannot be used as a converter in the master station or slave station.

In an instrument equipped with only three RS-485 terminals, the asterisked (*) wiring is done internally.

2 - 2 Terminal Array of SDC30/31

■ SDC30

The communication terminal array of the SDC30 having the communication functions is as shown below.

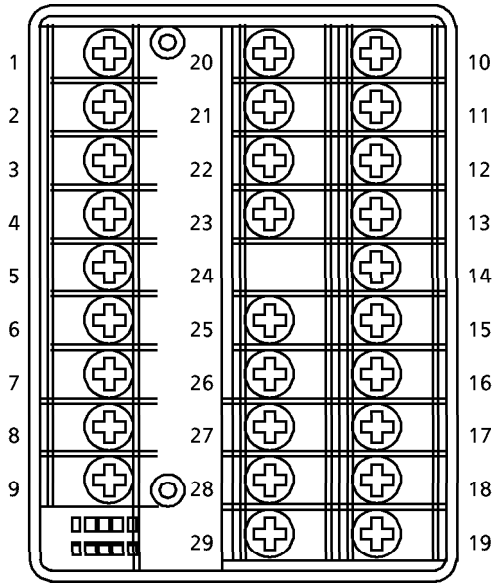


Optional Function Model No.	SDA	SDB	RDA	RDB	SG	FG
040	16	17	18	19	5	3.4
041	16	17	18	19	5	3.4

Note) Terminal Nos.3 and 4 are shorted inside the SDC30.

■ SDC31

The communication terminal array of the SDC31 having the communication functions is as shown below.



Optional Function Model No.	SDA	SDB	RDA	RDB	SG	FG
045	16	17	18	14	5	3.4
446	25	26	27	28	29	3.4
546	25	26	27	28	29	3.4

Note) Terminal Nos.3 and 4 are shorted inside the SDC31.

3. Setting

3 - 1 SETUP Items of SDC30/31

Code	Item	Setting at delivery from factory	Setting range
C31	Station address	0	0 to 127
C32	Transmission speed	0	0 : 9600bps 1 : 4800bps 2 : 2400bps 3 : 1200bps
C33	Character format	0	0 : 8bits, even parity, 1 stop bit 1 : 8 bits, no parity, 2 stop bits

3 - 2 Initialize

Before starting communication, initialize the communication conditions for the DIGITRONIK instrument and master station.

■ Station address

Set a decimal number within 0 to 127 to the SETUP item C31 of the DIGITRONIK instrument. In the RS-485 system, set a different address value from the addresses of the other slave stations connected in multi-drop on the same transmission line.
Address 0 is set as an station address at delivery from the factory. Since the communication function is not activated at address 0, be sure to set a value other than 0 to execute communication.

■ Baud rate

Set one of 0 to 3 to the SETUP item C32 of the DIGITRONIK instrument. At this time, set the same transmission speed value as in the master station.

0: 9600bps (factory setting)
1: 4800bps
2: 2400bps
3: 1200bps

■ Character format

Set 0 or 1 to the SETUP item C33 of the DIGITRONIK instrument.
At this time, set the same data format as the DIGITRONIK instrument in the master station.
0: 8 data bits, even parity, 1 stop bit (factory setting)
1: 8 data bits, no parity, 2 stop bits

4. Communication procedure

4 - 1 Outline of communication procedure and messages

The outline of communication procedure, and the concept of message configuration are given in this paragraph.

■ Communication procedure

The communication procedure used is given below in simple expression.

(1) The master station transmits a request message to a slave station to designate the mate instrument for communication.

(2) The slave station processes the request message and executes read and write.

(3) Further, the slave station transmits a response message according to the contents of processing.

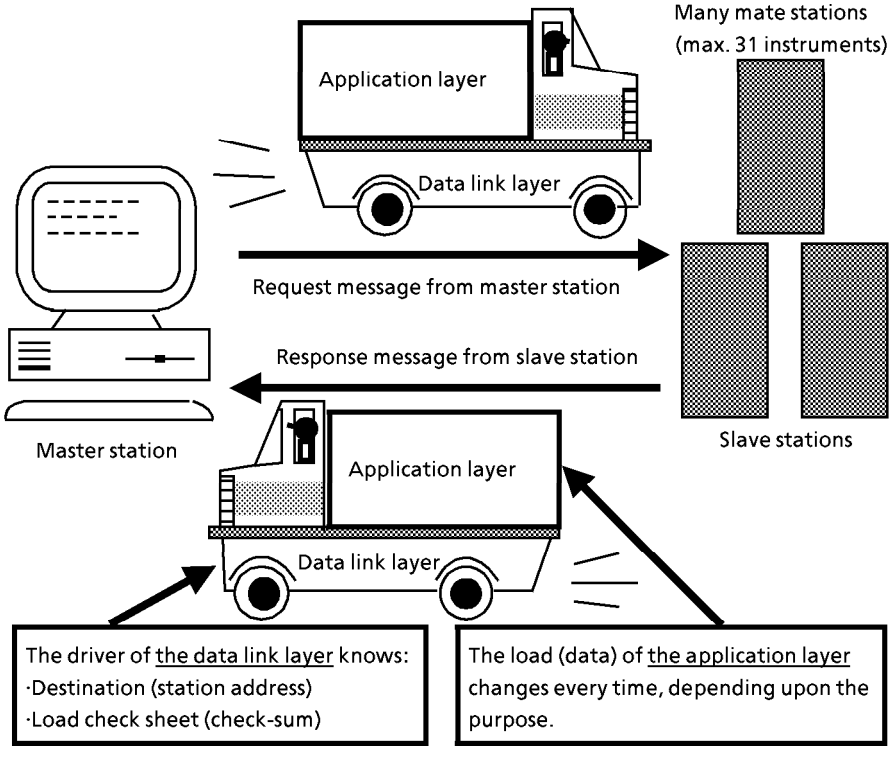
(4) The master station receives the response message and executes processing.

■ Configuration of message

One message consists of two layers as shown below. This is common to the request message from the master station and response message from a slave station.

- Data link layer
  - · This layer has the basic information required for communication.
  - · This layer has the destination of communication message and message check information.
- Application layer
  - · A layer for data read and write
  - · The contents change, depending upon the purpose.

The individual layers are detailed in the following items:



■ Definite examples

Definitely, the messages are as shown below.

● In case of read request

·Request message

STX	0	1	0	0	X	R	S	,	1	0	0	1	W	,	2	ETX	9	A	CR	LF

Data link layer — Application layer — Data link layer

·Response message

STX	0	1	0	0	X	0	0	,	0	,	4	2	ETX	9	4	CR	LF

Data link layer — Application layer — Data link layer

● In case of write request

·Request message

STX	0	1	0	0	X	W	S	,	1	0	0	1	W	,	5	8	ETX	5	A	CR	LF

Data link layer — Application layer — Data link layer

·Response message

STX	0	1	0	0	X	0	0	ETX	8	2	CR	LF

Data link layer — Application layer — Data link layer

The data link layer and application layer are detailed in and after the next paragraph.

■ Concept of data address

This instrument uses the concept of data address to facilitate reading or writing each intended data by addressing.

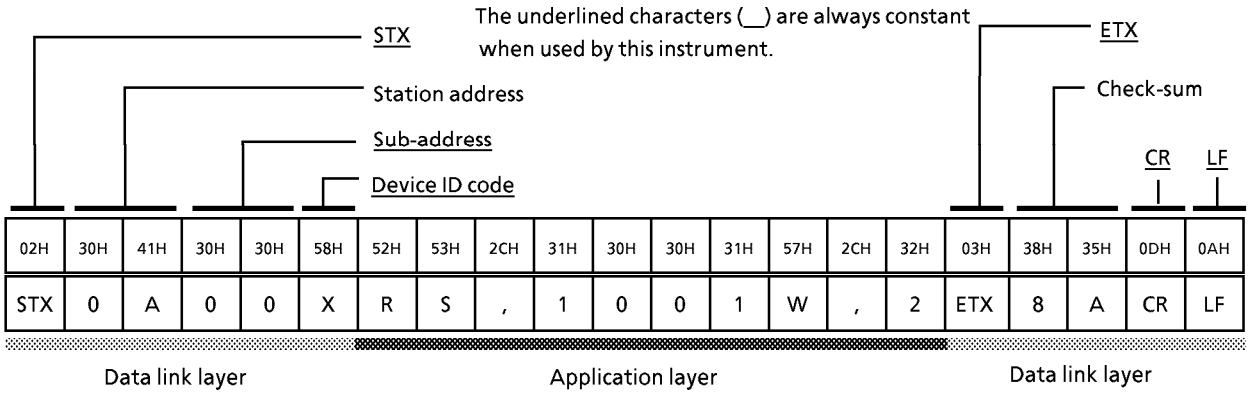
Data A	501W
Data B	502W
Data C	503W
:	:

For the actual correspondence between data and address, see the "Communication Data Table".

4 - 2 Data link layer

■ Description of data link layer

- The data link layer includes eight basic information for transmitting a message.
- The data link layers of a request message and response message have the same structure.



Each function of the data link layer is shown below.

● STX (Start of TeXt)

◆Role : Indicates the head of a message.

◇Description · Fixed at 02H.

· When the instrument receives "STX", it is identified as the first character of a new request message even on the course of any message.

● Station address

◆Role : Designates the destination instrument. Communication with one instrument designated is permitted.

◇Description · If 0 is set as a station address, the communication function is stopped.
Therefore, to make communication be sure to set an address value of 1 or more.

· 2 hexadecimal characters. For details, see the example.

· For the details of setting of the station address, see the"SETTING".

□Example : When the station address of the mate is 10:

(1) 10 (decimal) = 0AH (hexadecimal)

(2) When converted into character codes:
0 = 30H, A = 41H

(3) "0A" (30H, 41H) found in (2) is used as the station address.

◇Caution◇ ● Note that the function of the station address differs absolutely from that of the data address of the application layer.

● Sub-address

◇Description: The sub-address is meaningless in this instrument. Be sure to set "00" (30H, 30H) as the sub-address in the same format as in the station address.

● Device ID code

◇Description: The character code "X" (58H) or "x" (78H) only can be designated in this instrument.

● ETX (End of TeXt)

◆Role : Indicates that the application layer existed up to immediately before.

◇Description: Fixed at 03H.

● Check-sum

◆Role : A value to be used to check whether or not the message has been changed due to any error (such as noise) on the course of communication.

◇Description · Two hexadecimal characters

. The preparing method for the check-sum is as follows;

(1) The character codes of the message from STX to ETX are added byte by byte.

(2) The two's complement of the result of addition is taken.

(3) The above value is converted into character codes.

□Example : Description is given below, citing the example of the above request message on the preceding page.

(1) The character codes from STX to ETX are added byte by bytes. The one lower byte of the result of calculation is 76H.

(2) The two's complement of the result of addition is taken. The result is 8AH.

(3) The 85H is converted into character codes. this value is used as the check-sum. The result is "8A"; (38H) and (41H).

For the conversion into character codes, see the example of the station address (on the preceding page).

◇Caution◇ • The check-sum in the request message can be omitted, but no check-sum is then included in the response message. The check-sum should not be omitted to assure the proper reception of a message.

● CR and LF (Carriage Return/Line Feed)

◆Role : Indicates the end of a message.

◇Description · "CR" is (0DH), and "LF" is (0AH).

· Be sure to use CR and LF in pair.

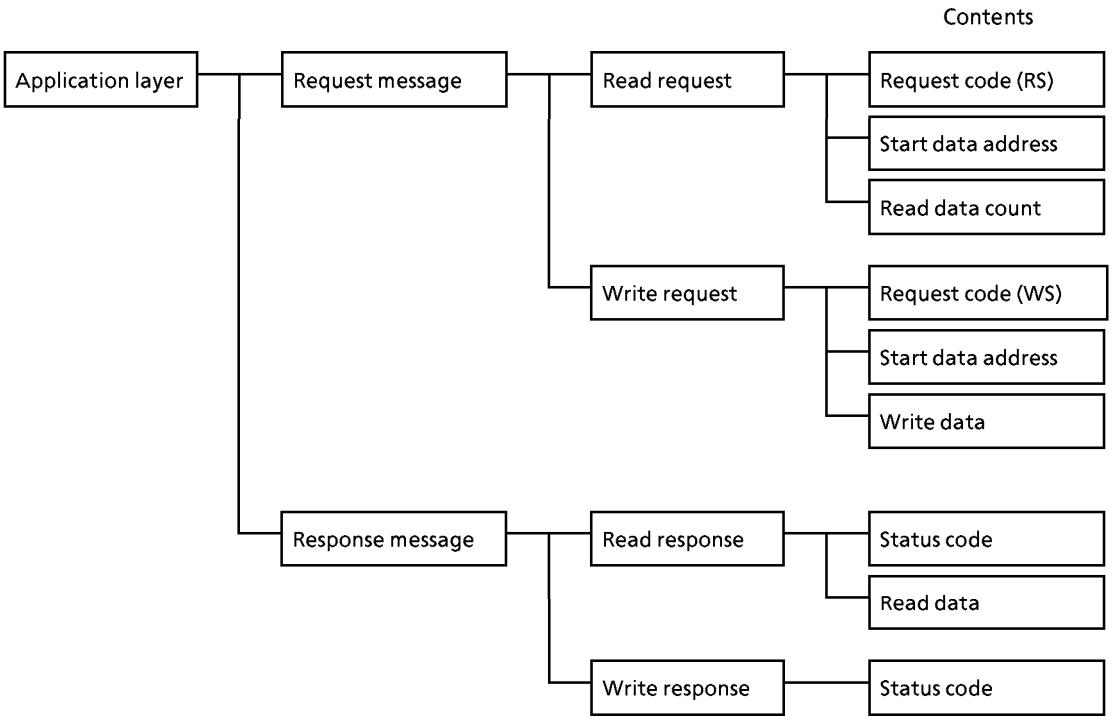
◇Caution◇

- If any of the following errors has occurred in the contents of the data link layer, the instrument does not respond to them:
  - · The communication conditions for both stations do not meet each other (such as different transmission speeds, or parity error occurrence).
  - · The transmitted station address differs from the station address of the object instrument.
  - · The station address is "00".
  - · STX, ETX, CR and LF are not placed at the specified positions.
  - · The device distinction code is neither "X" nor "x".
  - · The station address, sub-address, or check-sum is not two characters long.
  - · The calculation result of the check-sum does not meet the check-sum of the message.
  - · Non-designated characters are included in the message.
- As for the contents of the data link layer, the same message as the request message of an instrument is set as a response message, except for the check-sum.
- Use the upper-case characters "A" to "F" in the hexadecimal numeric part to be used for the station address and check-sum.

4 - 3 Application layer

■ Outline of application layer

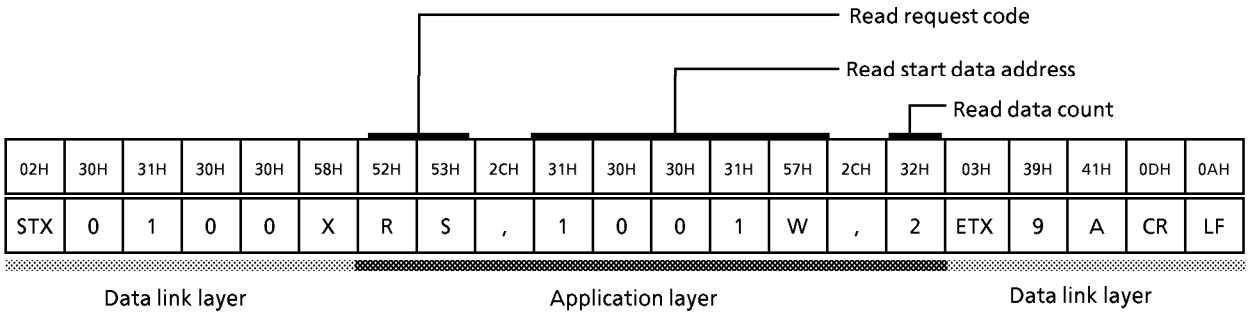
- The application layer includes a request, data, data count, and message decision information (status code).
- The application layers of the request message and response message differ in structure from each other.
- There are two types of request messages; "a read request" and "a write request".
  The response message includes a response corresponding to each request.
- It can be identified by a Status code how the request message has been processed.



4 - 4 Data read

■ Description of read request

- This request permits the contents of continuous data addresses starting with the read start data address designated to be read in one message.
- The application layer of a read request consists of the following three types of data:



- Individual data are partitioned by a comma "," (character code 2CH), respectively.
- An upper-case character code is used for each numeric or character in the application layer.
- Decimal number is used for each numeric.
- Unnecessary "0" or a space cannot be added to each data.
  - ☐Example : The underlined part of "RS, 01001W, 2" is wrong.
  - ☐Example : The underlined parts of "RS, 1001W, 02" are wrong.
  - ☐Example : The above figure indicates an example that two-data information is read from 1001W in one message.

● Read request code (RS)

◆Role : A command which indicates read.

◇Description : Two characters "RS" (52H, 53H).

● Read start data address

◆Role : Designates the start data address from which data is to be read.

◇Description : The correspondence between data address and read data is shown in the "Communication Data Table"

· Be sure to add "W" (57H) immediately after the numeric of the data address.

● Read data count

◆Role : It is designated how many data are read continuously, starting with the designated data address.

◇Caution◇

- For the high limit of the read data count, see the "Communication Data Table".

■ Read response

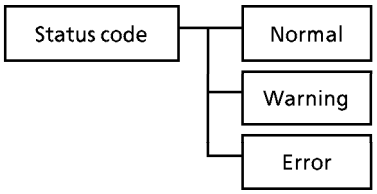
◆Role : When the message in the data link layer is proper, a response message is sent back according to the contents of the request message.

◇Description : All the data in the application layer are expressed in decimal character codes.

● Status code

◆Role : A numeric by which it can be identified how the request message has been processed on the instrument side. Different value is set according to the result of processing.

◇Description : The response message includes a "Status code" without fail. The status codes are classified as follows;



* The status code is two decimal digits.

● Normal response/warning response

◆Role : Sends back the read data.

◇Description : Information in the application layer

· Status code : For the details of the status code, see the "Status code Table".

· Read data : Data are put in by the designated count.

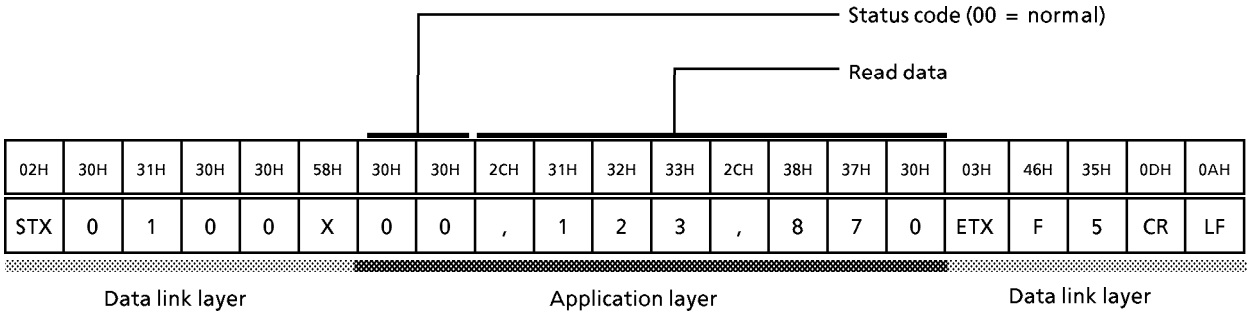
: The decimal point is removed from a numeric to be put in.

□Example : "55.6" is converted into "556" when it is put in.

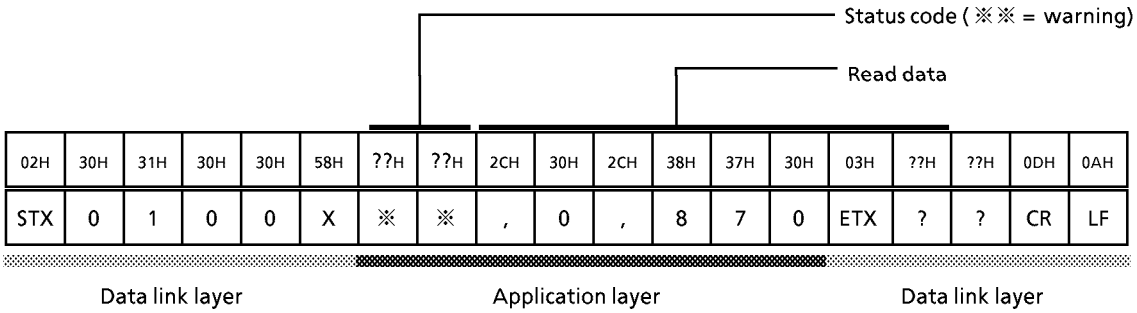
: Individual data are partitioned with a comma (2CH), respectively.

: The range and number of digits of each data depend upon the read data.

□Example : In case of normal response (when there are two read data, and all the data are read properly)



□Example : In case of warning response (numeric corresponding to the warning code is put in ※※ .)



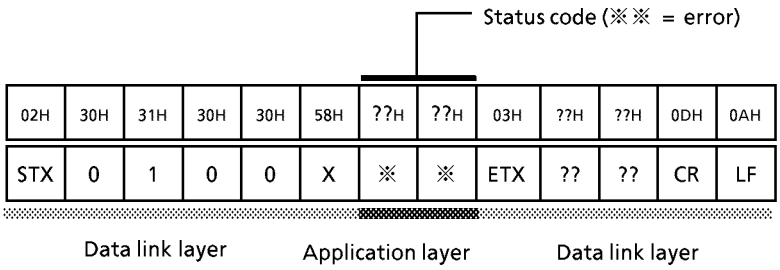
● Error response

◆Role : Indicates that there is an error in the request message, and it cannot be normally read. Therefore, there is no data herein.

◇Description : Information in the application layer.

· Status code : Indicates an error type.
For details, see the "Status code Table".

□Example : In case of error response:



■ Expression of decimal numeric (numeric data)

◆Role : All the numeric part, read count, write value (described in WS command), and read data at the data address follow the rules given below.

(1) When a numeric is negative, add a minus sign "-" (2DH) before the numeric.

□Example : "-123" (2DH, 31H, 32H, 33H)

(2) When a numeric is 0, use one 0.

□Example : "0" (30H)

□Example : "00" (30H, 30H) is wrong.

(3) When a numeric is positive, never add a plus sign "+" before the numeric.

□Example : "+123" (2BH, 31H, 32H, 33H) is wrong.

(4) Never add unnecessary 0 or a space before a numeric.

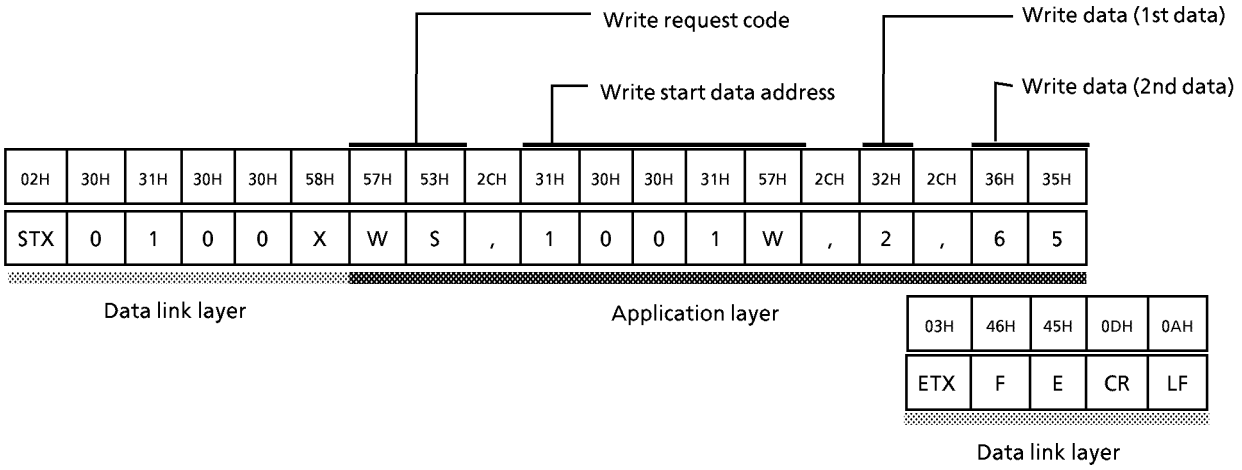
□Example: "0123" (30H, 31H, 32H, 33H) is wrong,

□Example : " 123" (20H, 31H, 32H, 33H)

4 - 5 Data Write

■ Description of write request

- This request permits the contents of continuous data addresses, starting with the designated write start data address to be simultaneously written in one message.
- The application layer of a write request consists of the following three types of data:



- Individual data are partitioned with a comma "," (character code 2CH), respectively.
- The write data count need not be designated.
- An upper case character code is used for each numeric or character in the application layer.
- Decimal number is used for each numeric.
- Unnecessary "0" (30H) or a space cannot be added to each data.
  - ☐Example : The underlined part of "WS, 01001W, 2" is wrong.
  - ☐Example : The underlined parts of "WS, 1001W, 02" are wrong.
  - ☐Example : The above figure shows an example that 2 and 65 are written at addresses 1001W and 1002W, respectively, in one message.

● Write request code (WS)

◆Role : A command which indicates write.
◇Description : Two characters "WS" (57H, 53H)

● Write start data address

◆Role : Designates the start data address for write.
· For the correspondence between the data address and write data, see the "Communication Data Table".
· Be sure to add "W" (57H) after the numeric representing the data address.

● Write data

◆Role : Data to be written at continuous addresses starting with the designated data address.

◇Description : The range of a numeric to be written differs, depending upon each data address.

· Individual data are partitioned with a comma (2CH), respectively.

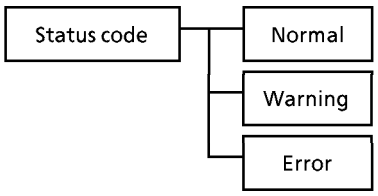
· The data address at which the corresponding data is written is incremented by 1 sequentially, starting with the start data address (see the example given on the preceding page).

· The number of data which can be written in one message is limited. For details, see the Communication Data Table".

■ Write response

◆Role : When the message in the data link layer is proper, the status code only is sent back.

◇Description : The status codes are classified as follows:



* The status code is expressed in two decimal digits.

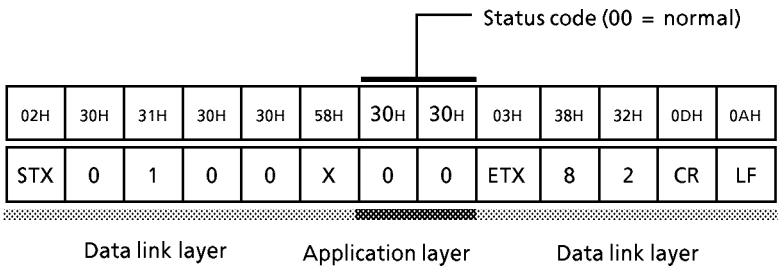
● Normal response/warning response

◆Role : Information concerning the result of processing the write request message is sent back.
Only the normal status code or warning status code is sent back.

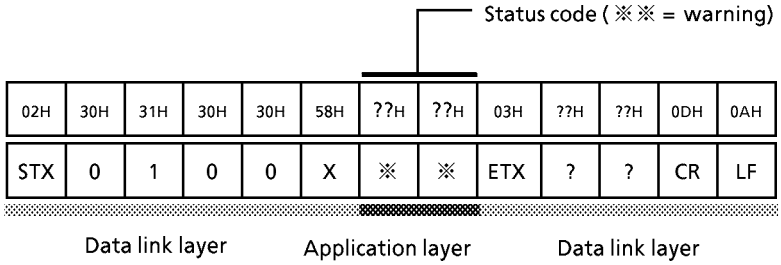
◇Description : Information in the application layer

· Status code : A numeric by which it can be identified how the request message has been processed on the instrument side.

□Example : An example of normal response (when all data are properly written)



☐Example : In case of warning response (numeric corresponding to the warning code is put in ※※.)



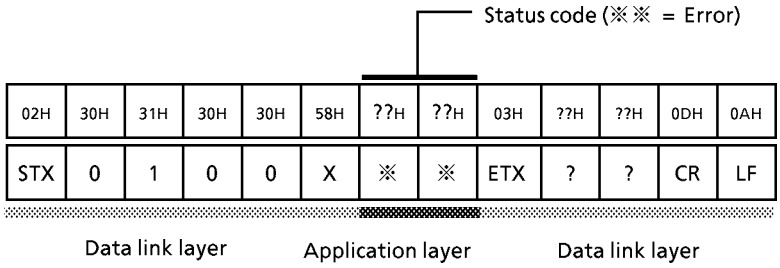
● Error response

◆Role : Only the error status code is sent back.

◇Description : Information in the application layer

· Status code : Indicates that there is an error in the request message, and write processing cannot be done.
For details, see the "4-6 Status code Table".

☐Example : In case of error response (numeric corresponding to the error code is put in ※※).



4 - 6 Status code table

■ Normal and warning ends

Status code	Type	Contents and action
00	—	Normal end
21	Warning	● Data is written at a protected word address due to an influence of other parameters. ● Data is written for a parameter, which has not been set to the relevant instrument. ● Data is written for a SETUP parameter during RUN. ● Processing is continued, except for the relevant word address.
23	Warning	● Read is all stopped since an address out of the range has been accessed. ● The following write processing is stopped since an address out of the range has been accessed. However, the write processing so far has been executed.
27	Warning	● Data is attempted to be written at a protected word address of RAM. Write is continued without writing any data at the relevant word address.
28	Warning	● Data is attempted to be written at a protected word address of EEPROM. Write is continued without writing any data at the relevant word address.
40	Error	● "W" and "," have not been set at a word addresses. All messages are aborted.
43	Error	● "ETX" (03H) is not set at a proper position. ● "," after a word address is not set. All messages are aborted.
46	Error	● There is an error in a word address (there is a character string other than a numeric). All messages are aborted.
47	Error	● There is an error in the read (word) count during read (there is a character string other than a numeric). All messages are aborted.
83	Error	● A set value exceeds the predetermined range. ● Processing is continued, except for the relevant address.
99	Error	● An undefined command ● Other message error

4 - 7 Timing specifications

■ Timing specifications for request message and response message

The following precautions should be observed concerning the transmit timings of an request message from the master station and a response message from the slave station:

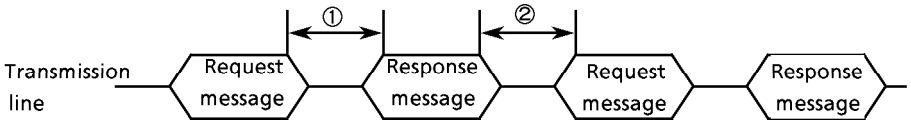
● Response monitor time

The maximum response time required from the end of transmitting an request message from the master station to the start of receiving a response message from the slave station is 2sec (section (1)). Therefore, the response monitor time should be set to 2sec.
Generally, when the response monitor time reaches time up, the request message is retransmitted.
For details, see the "6 Communication Program for Master Station".

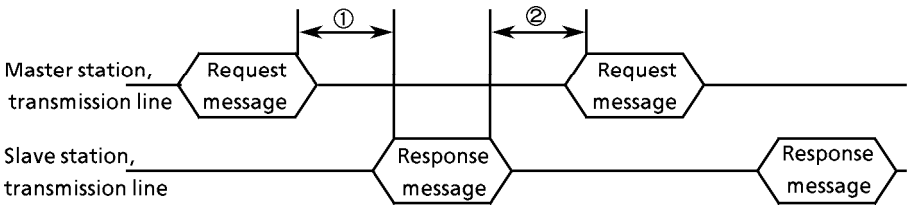
● Transmit start time

A wait time of 10ms or more is required before the master station starts to transmit the next request message (to the same slave station or a different slave station) after the end of receiving a response message (section (2)).

- RS-485 3-wires system



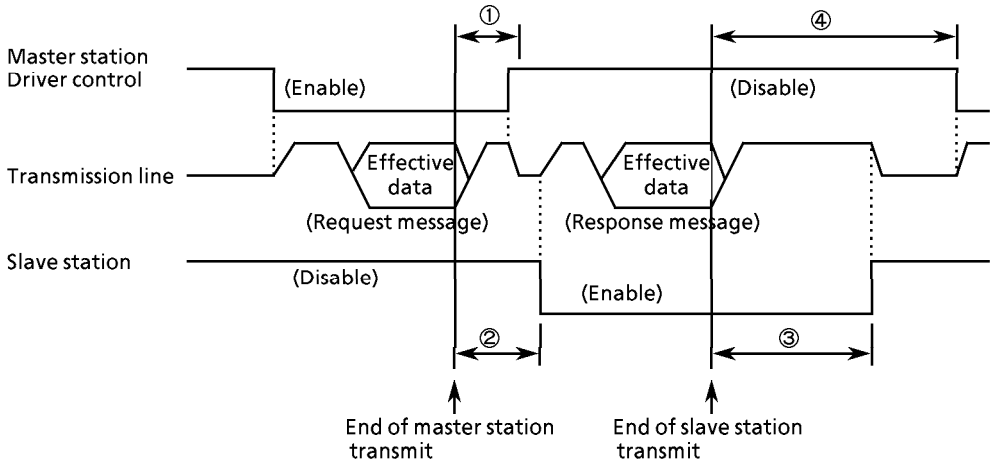
- RS-485 5-wires system



① End of master station transmit - Request interval time of slave station = 2000ms max.
② End of slave station transmit - Request interval time of master station = 10ms min.

■ RS-485 driver control timing specification

When the transmit/receive of the RS-485 3-wires system is directly controlled by the master station, utmost care should be exercised about the following timing:



① Transmit end of master station - Driver disable time = 500μs max.
② Receive end of slave station - Driver enable time = 1ms min.
③ Transmit end of slave station - Driver disable time = 10ms max.
④ Receive end of master station - Driver enable time = 10ms min.

■ Other cautions

1. If the number of characters per message exceeds 200 characters upon receipt of a message, the instrument ceases to take in the message, and it is placed in an STX wait status. The instrument ignores the message and does not return a response.
2. The instrument returns an error response whenever the total character count of the STX, address, instrument code, status code, and application layer exceeds 190 bytes.
3. The maximum number of word address is not specially designated during execution of the RS or WS command.
   However, when there are many set words in a message, and the case is relevant to either of the above-mentioned items 1 and 2, no response or an error response is returned.
4. The maximum word count for EEPROM write or read is limited to 5 words per message to assure the update cycle of 200ms.
5. The maximum word count for RAM write or read is limited to 10 words to assure the update cycle of 200ms.
6. When the above-mentioned cautions are observed, the response time is 1sec max. from the end of receive of the whole messages to the beginning of response return.

5. Communication data table

5 - 1 Preliminary knowledge of communication data handling

■ Types and formats of communication data

● Types of communication data

The communication data are classified into the following types:

- Run status : Data indicating the run status of instrument. (PV, alarm, etc.)
- SETUP : Data for setting the status of instrument before running (setting of input range, etc.).
- Parameter : Data to be changed/operated during running (PID constants or the like). These data are communicated every data type.

● Format of communication data

The communication data are classified into the following formats:

- Numeric data : Data indicating numerics (PV, SP, etc.)
- Bit data : Data, each bit of which is given meaning (alarm, etc.). The bit data must be composed during transmit, and be decomposed during receive.

■ Communication data storing memory

● Types of memory

Communication data are stored in the memory (storage device). The following two types of memory are used in this instrument:

- RAM : Data in RAM are cleared when the power supply is turned off. However, data can be written in RAM any number of times.
- EEPROM : Data in EEPROM are not cleared even when the power supply is turned off. However, the data write count is limited due to the characteristics of the device. The allowable maximum write count is 10,000 times.

● Communication object memory

In communication, it is necessary to read/write data from/into the above-mentioned two types of memory according to the purpose and use. There is a difference between the object memories as follows:

- RAM :Data is read/written from/into RAM only. If the power supply is turned off after writing data into RAM, and then it is turned on again, the data in EEPROM is copied on RAM, so the data in RAM becomes the same as in EEPROM.
- EEPROM :Data are written in both RAM and EEPROM.

PRECAUTION

The write count in EEPROM is 100,000 times or less.

When such data as an SP must be written frequently and repeatedly by communication, select RAM as an object memory.

■ Data address

The data addresses are allocated as shown in the table below.

Communication date	RAM		EEPROM	
	Offset value	Address	Offset value	Address
Run status relation	500	501 ~ 999	3500	3501 ~ 3999
SP relation	1000	1001 ~ 1499	4000	4001 ~ 4499
Event relation	1500	1501 ~ 1999	4500	4501 ~ 4999
PID relation	2000	2001 ~ 2499	5000	5001 ~ 5499
Parameter relation	2500	2501 ~ 2999	5500	5501 ~ 5999
SETUP relation	3000	3001 ~ 3499	6000	6001 ~ 6499

■ Data read/write count

The number of data which can be continuously read/written by once communication is as shown in the table below.

	RAM	EEPROM
Read	1 to 10	1 to 5
Write	1 to 10	1 to 5

Among the continuous data, any data which do not exist due to difference in model number are handled as shown below.

- Read : 0 is read as a dummy data (normal end).
- Write : Not written (warning end).

■ Data unit and decimal point position

A decimal point is not added to read/write data.
The unit or decimal point position is predetermined every data.
For the unit and decimal point position of each data, see the user's manual for the main unit of instrument.

Example : When data to be read/written is numeric value 105, its unit or decimal point position is automatically determined by the data address, the SETUP item of the instrument and the others.
Therefore, the numeric data 105 is expressed as 10.5%, 105°C, or the like according to the data address of data to be read/written.

5 - 2 Communication data table

The address and read/write (R/W) enable status of each data are determined as shown in the table below.

- Meaning of symbols in R/W column
  ○ : Read/write enable × : Read/write disable

● Run status relation addresses

The asterisked (*) items are detailed later as bit information data.

Display of PV indicator	Item	RAM			EEPROM		
		Address	R	W	Address	R	W
ALxx	Alarm status *	501	○	×	3501	×	×
Non display	Event status *	502	○	×	3502	×	×
Non display	Control action status *	503	○	×	3503	×	×
SP__X	SP Group No. in use Notes 1, 3 and 4	504	○	○	3504	○	○
SP X	SP value in use Notes 2, 4 and 5	505	○	○	3505	○	○
Non display	PV (Process Variable)	506	○	×	3506	×	×
Non display	MV (Manipulated Variable)	507	○	○	3507	×	×
Fb	Motor feedback value (%)	508	○	×	3508	×	×
Non display	PID group in use Note 7	509	○	×	3509	×	×
Non display	Mode action status * Note 6	510	○	○	3510	○	○

(Notes)

1 An SP group in use is read/written.

2 An SP value selected is read/written. In the case of EEPROM write, an SP value is written in the EEPROM of the SP group currently in use.

3 If a value other than 0 (SP selection) is set to C26 in a model having the remote input switch function, the remote input switch has priority, so the written SP Group No. is rejected, and an error response is returned.
During AT operation, an SP group cannot be selected, so an error response is returned if it is selected.

4 The result of read from RAM may differ from that of read from EEPROM, depending upon the status of the remote input switch (SP selection or SP setting).
This difference is caused by that the status of the remote input switch or an SP value is written in RAM, but not written in EEPROM.

5 In case of the RAM read, an SP value in a ramp segment is read during an SP ramp action.
When SP ramp is not used, the SP value is same for addresses 505 and 3505.
When SP ramp is used, the SP value is the SP value for address 3505 (SP value of currently selected SP group for either one of addresses 4001 to 4008), and is the current SP value for address 505.
After reaching the SP value, the value becomes the same for addresses 505 and 3505.
However, if the value of RAM (address 1001 to 1008) for the SP value of currently selected SP group is rewritten, the value becomes the SP value of SP ramp.
If SP is frequently changed while using SP ramp, rewrite the value of RAM.
In this case, rewriting cannot be executed for the ROM address 3505.

6 Each changeover of AUTO/MANUAL, LOCAL/REMOTE, RUN/READY, and AT start/stop is done by turning OFF/ON the relevant bit.
When EEPROM write is executed, the current status is all preserved.
In the case of EEPROM read, the same result as the RAM read is returned.

7 When the zone is used, the SP group and PID group in use change. The PID group in use is read from this word address. The read result with no zone used is the same as in the 504W.

- When an SP group and SP value are rewritten in the remote SP, the SP to be executed by the instrument is kept unchanged. However, when the LOCAL mode is restored, the written values become effective. The status code is 00.
- When data is written at 3510W, the current mode status is all stored in EEPROM. When data is written at 510W, the status is set only to RAM.
- Even when AT is executed from either 3510W or 510W, the PID constants of the AT result are stored in EEPROM.
- Even when AT is executed by communication, the AT display (indicated with the MODE key pressed) on the console is kept unchanged.
- If mode write cannot be executed due to setting of the remote input switch or the status of another parameter or the instrument, etc., the status code 21 is indicated.

● Bit information data

The information data of 16-bit data is a character code in decimal notation. For the details of each bit information, see the instruction manual (CP-UM-1586E) for the main instrument.

No. 1 Alarm staus

2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
⑯	⑮	⑭	⑬	⑫	⑪	⑩	⑨	⑧	⑦	⑥	⑤	④	③	②	①

①: – –
②: AL07 T wire disconnection, or FB wire input error
③: AL03 C wire or CJ wire input error
④: – –
⑤: AL01 PV input overrange
⑥: AL02 PV input underrange
⑦: AL05 RSP overrange (indicated only with remote SP)
⑧: AL06 RSP underrange (occurs only with remote SP)
⑨: – –
⑩: AL08 Motor adjustment error (position proportional model)
⑪: – –
⑫: ALxx Alarm occurrence
⑬: AL96 Parameter error (communication RAM area)
⑭: AL91 Illegal loader communication message
⑮: AL97 Parameter error (check sum)
⑯: AL98 Adjustment data error (check sum)

Cautions

- For details, see the instruction manual (CP-UM-1586E) for the main instrument.
- ⑫ ALxx goes to 1 if any one alarm occurs in the instrument.

No. 2 Event status

2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
⑯	⑮	⑭	⑬	⑫	⑪	⑩	⑨	⑧	⑦	⑥	⑤	④	③	②	①

①: – –
②: EV1 Event 1 status
③: EV2 Event 2 status
④: – –
⑤: RSW1 Remote switch input 1 status
⑥: RSW2 Remote switch input 2 status
⑦: RSW3 Remote switch input 3 status
⑧: RSW4 Remote switch input 4 status
⑨: – –
⑩: – –
⑪: – –
⑫: – –
⑬: – –
⑭: – –
⑮: – –
⑯: – –

Cautions

- For details, see the instruction manual (CP-UM-1586E) for the main instrument.
- The EV status and RSW status go to 1 in the ON status.

No. 3 Control action status

2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
⑯	⑮	⑭	⑬	⑫	⑪	⑩	⑨	⑧	⑦	⑥	⑤	④	③	②	①

①: PID 0:PID control 1:ON/OFF control
②: AI 0:Learning stop status 1:During learning (over-shoot control function)
③: NFB 0:A motor feedback value is in use. 1:A motor feedback presumed value is in use.
④: – –
⑤: CLOSE Close relay ON (position proportional model)
⑥: OPEN Open relay ON (position proportional model)
⑦: – –
⑧: – –
⑨: – –
⑩: – –
⑪: – –
⑫: – –
⑬: – –
⑭: – –
⑮: – –
⑯: – –

Cautions

- For details, see the instruction manual (CP-UM-1586E) for the main instrument.

No. 4 Mode action status

2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
⑯	⑮	⑭	⑬	⑫	⑪	⑩	⑨	⑧	⑦	⑥	⑤	④	③	②	①

⑯⑮⑭⑬	⑫⑪⑩⑨	⑧⑦⑥⑤	④③②①
0000:*1	0000:*1	0000:*1	0000:*1
0001:AT stop	0001:LOCAL	0001:RUN	0001:AUTO
0010:AT start	0010:REMOTE	0010:READY	0010:MANUAL
0100:*1	0100:*1	0100:*1	0100:*1
1000:*1	1000:*1	1000:*1	1000:*1

Cautions

- For details, see the instruction manual (CP-UM-1586E) for the main instrument.
- Even when the value of *1 is written, the status of the instrument is kept unchanged.
- In each mode reading, the current status of the instrument is read, but the value written previously cannot be read.
- As for AT, the start/stop of AT is read, but the display on the console by the mode key cannot be read.
- Even when both RUN and AT start are executed at the same time by one request message with the instrument put in the AUTO and READY modes, the instrument is not started.
  After running the instrument by the first message, transmit an AT execution request in the next message.

(1) When 4 bits each are set to 0000(2), each mode status of the instrument is kept unchanged.
(2) When 4 bits each are set to 0001(2) or 0010(2), the instrument is changed into each mode status.
(3) When 4 bits each are set to 0100(2) or 1000(2), each mode status of the instrument is kept unchanged.
(4) The mode may not the changed, depending upon the status of the instrument. (See the following table:)

Mode	Conditions for write disable	Others
AUTO / MANUAL	Allocated to the remote switch input.	AT is stopped when set to MANUAL.
RUN / READY	Allocated to the remote switch input.	AT is stopped when set to READY.
LOCAL / REMOTE	Allocated to the remote switch input. A model having no REMOTE function.	
AT	Allocated to the remote switch input. In MANUAL mode, In READY mode.	

● SP relation addresses

Display of PV indicator	Item	RAM			EEPROM		
		Address	R	W	Address	R	W
SP0	Set point SP0	1001	○	○	4001	○	○
SP1	Set point SP1	1002	○	○	4002	○	○
SP2	Set point SP2	1003	○	○	4003	○	○
SP3	Set point SP3	1004	○	○	4004	○	○
SP4	Set point SP4	1005	○	○	4005	○	○
SP5	Set point SP5	1006	○	○	4006	○	○
SP6	Set point SP6	1007	○	○	4007	○	○
SP7	Set point SP7	1008	○	○	4008	○	○

For the setting range and read/write conditions, see the instruction manual (CP-UM-1586E) for the main instrument.

● Event relation addresses

Display of PV indicator	Item	RAM			EEPROM		
		Address	R	W	Address	R	W
E1	Event 1 set value	1501	○	○	4501	○	○
E2	Event 2 set value	1502	○	○	4502	○	○

For the setting range and read/write conditions, see the instruction manual (CP-UM-1586E) for the main instrument.

● PID relation addresses

Display of PV indicator	Item	RAM			EEPROM		
		Address	R	W	Address	R	W
P	Proportional band P 0	2001	○	○	5001	○	○
I	Integral time I 0	2002	○	○	5002	○	○
d	Derivative time D 0	2003	○	○	5003	○	○
oL	Manipulated variable low limit OL 0	2004	○	○	5004	○	○
oH	Operation use high limit OH 0	2005	○	○	5005	○	○
rE	Manual reset RE 0	2006	○	○	5006	○	○
dIFF	Differential DIF 0	2007	○	○	5007	○	○
P 1	Proportional band P 1	2008	○	○	5008	○	○
I 1	Integral time I 1	2009	○	○	5009	○	○
d 1	Derivative time D 1	2010	○	○	5010	○	○
oL 1	Manipulated variable low limit OL 1	2011	○	○	5011	○	○
oH 1	Operation use high limit OH 1	2012	○	○	5012	○	○
rE 1	Manual reset RE 1	2013	○	○	5013	○	○
dIF 1	Differential DIF 1	2014	○	○	5014	○	○
P 2	Proportional band P 2	2015	○	○	5015	○	○
I 2	Integral time I 2	2016	○	○	5016	○	○
d 2	Derivative time D 2	2017	○	○	5017	○	○

Display of PV indicator	Item	RAM			EEPROM		
		Address	R	W	Address	R	W
oL 2	Manipulated variable low limit OL 2	2018	○	○	5018	○	○
oH 2	Operation use high limit OH 2	2019	○	○	5019	○	○
rE 2	Manual reset RE 2	2020	○	○	5020	○	○
dIF 2	Differential DIF 2	2021	○	○	5021	○	○
P 3	Proportional band P 3	2022	○	○	5022	○	○
I 3	Integral time I 3	2023	○	○	5023	○	○
d 3	Derivative time D 3	2024	○	○	5024	○	○
oL 3	Manipulated variable low limit OL 3	2025	○	○	5025	○	○
oH 3	Operation use high limit OH 3	2026	○	○	5026	○	○
rE 3	Manual reset RE 3	2027	○	○	5027	○	○
dIF 3	Differential DIF 3	2028	○	○	5028	○	○
P 4	Proportional band P 4	2029	○	○	5029	○	○
I 4	Integral time I 4	2030	○	○	5030	○	○
d 4	Derivative time D 4	2031	○	○	5031	○	○
oL 4	Manipulated variable low limit OL 4	2032	○	○	5032	○	○
oH 4	Operation use high limit OH 4	2033	○	○	5033	○	○
rE 4	Manual reset RE 4	2034	○	○	5034	○	○
dIF 4	Differential DIF 4	2035	○	○	5035	○	○
P 5	Proportional band P 5	2036	○	○	5036	○	○
I 5	Integral time I 5	2037	○	○	5037	○	○
d 5	Derivative time D 5	2038	○	○	5038	○	○
oL 5	Manipulated variable low limit OL 5	2039	○	○	5039	○	○
oH 5	Operation use high limit OH 5	2040	○	○	5040	○	○
rE 5	Manual reset RE 5	2041	○	○	5041	○	○
dIF 5	Differential DIF 5	2042	○	○	5042	○	○
P 6	Proportional band P 6	2043	○	○	5043	○	○
I 6	Integral time I 6	2044	○	○	5044	○	○
d 6	Derivative time D 6	2045	○	○	5045	○	○
oL 6	Manipulated variable low limit OL 6	2046	○	○	5046	○	○
oH 6	Operation use high limit OH 6	2047	○	○	5047	○	○
rE 6	Manual reset RE 6	2048	○	○	5048	○	○
dIF 6	Differential DIF 6	2049	○	○	5049	○	○
P 7	Proportional band P 7	2050	○	○	5050	○	○
I 7	Integral time I 7	2051	○	○	5051	○	○
d 7	Derivative time D 7	2052	○	○	5052	○	○
oL 7	Manipulated variable low limit OL 7	2053	○	○	5053	○	○

Display of PV indicator	Item		RAM			EEPROM		
			Address	R	W	Address	R	W
oH 7	Operation use high limit	OH 7	2054	○	○	5054	○	○
rE 7	Manual reset	RE 7	2055	○	○	5055	○	○
dIF 7	Differential	DIF 7	2056	○	○	5056	○	○
P r	Proportional band	P r	2057	○	○	5057	○	○
I r	Integral time	I r	2058	○	○	5058	○	○
d r	Derivative time	D r	2059	○	○	5059	○	○
oL r	Manipulated variable low limit	OL r	2060	○	○	5060	○	○
oH r	Operation use high limit	OH r	2061	○	○	5061	○	○
rE r	Manual reset	RE r	2062	○	○	5062	○	○
dIF r	Differential	DIF r	2063	○	○	5063	○	○
dP 0	Proportional band	dP 0	2064	○	○	5064	○	○
dI 0	Integral time	dI 0	2065	○	○	5065	○	○
dd 0	Derivative time	dd 0	2066	○	○	5066	○	○
dP 1	Proportional band	dP 1	2067	○	○	5067	○	○
dI 1	Integral time	dI 1	2068	○	○	5068	○	○
dd 1	Derivative time	dd 1	2069	○	○	5069	○	○
dP 2	Proportional band	dP 2	2070	○	○	5070	○	○
dI 2	Integral time	dI 2	2071	○	○	5071	○	○
dd 2	Derivative time	dd 2	2072	○	○	5072	○	○
dP 3	Proportional band	dP 3	2073	○	○	5073	○	○
dI 3	Integral time	dI 3	2074	○	○	5074	○	○
dd 3	Derivative time	dd 3	2075	○	○	5075	○	○
dP 4	Proportional band	dP 4	2076	○	○	5076	○	○
dI 4	Integral time	dI 4	2077	○	○	5077	○	○
dd 4	Derivative time	dd 4	2078	○	○	5078	○	○
dP 5	Proportional band	dP 5	2079	○	○	5079	○	○
dI 5	Integral time	dI 5	2080	○	○	5080	○	○
dd 5	Derivative time	dd 5	2081	○	○	5081	○	○
dP 6	Proportional band	dP 6	2082	○	○	5082	○	○
dI 6	Integral time	dI 6	2083	○	○	5083	○	○
dd 6	Derivative time	dd 6	2084	○	○	5084	○	○
dP 7	Proportional band	dP 7	2085	○	○	5085	○	○
dI 7	Integral time	dI 7	2086	○	○	5086	○	○
dd 7	Derivative time	dd 7	2087	○	○	5087	○	○
dP r	Proportional band	dP r	2088	○	○	5088	○	○
dI r	Integral time	dI r	2089	○	○	5089	○	○
dd r	Derivative time	dd r	2090	○	○	5090	○	○

Cautions

- For the setting range and read/write conditions, see the instruction manual (CP-UM-1586E) for the main instrument.
- Data can be written within 2064 to 2090W, and 5064 to 5090W by setting C19 = 0, 1, respectively.

● Parameter relation addresses

Display of PV indicator	Item	RAM			EEPROM		
		Address	R	W	Address	R	W
HYS 1	Event 1 hysteresis	2501	○	○	5501	○	○
dl 1	Event 1 on delay	2502	○	○	5502	○	○
HYS 2	Event 2 hysteresis	2503	○	○	5503	○	○
dl 2	Event 2 on delay	2504	○	○	5504	○	○
FILt	PV filter	2505	○	○	5505	○	○
Pd1A	PV bias	2506	○	○	5506	○	○
rb1A	RSP bias	2507	○	○	5507	○	○
cY	Output cycle	2508	○	○	5508	○	○
outL	Manipulated variable change limit	2509	○	○	5509	○	○
Zn 0	Zone setting (Zn 0)	2510	○	×	5510	○	×
Zn 1	Zone setting (Zn 1)	2511	○	○	5511	○	○
Zn 2	Zone setting (Zn 2)	2512	○	○	5512	○	○
Zn 3	Zone setting (Zn 3)	2513	○	○	5513	○	○
Zn 4	Zone setting (Zn 4)	2514	○	○	5514	○	○
Zn 5	Zone setting (Zn 5)	2515	○	○	5515	○	○
Zn 6	Zone setting (Zn 6)	2516	○	○	5516	○	○
Zn 7	Zone setting (Zn 7)	2517	○	○	5517	○	○
C 40	SP ramp up gradient	2527	○	○	5527	○	○
C 41	SP ramp down gradient	2528	○	○	5528	○	○

For the setting range and read/write conditions, see the instruction manual (CP-UM-1586E) for the main instrument.

● SETUP relation addresses

Display of PV indicator	Item	RAM			EEPROM		
		Address	R	W	Address	R	W
C 01	Selection of key lock status	3001	○	○	6001	○	○
C 02	Selection of temperature unit	3002	○	○	6002	○	○
C 03	Selection of control action	3003	○	○	6003	○	○
C 04	Selection of input range type	3004	○	○	6004	○	○
C 05	Selection of decimal point position	3005	○	○	6005	○	○
C 06	Setting of PV range low limit	3006	○	○	6006	○	○
C 07	Setting of PV range high limit	3007	○	○	6007	○	○
C 08	Selection of SP setting system	3008	○	○	6008	○	○
C 09	Setting of low limit of SP limit	3009	○	○	6009	○	○
C 10	Setting of high limit of SP limit	3010	○	○	6010	○	○
C 11	Selection of manipulated variable at input error	3011	○	○	6011	○	○
C 12	Setting of manipulated variable in READY mode or at PV input error	3012	○	○	6012	○	○
C 13	Selection of manual output	3013	○	○	6013	○	○
C 14	Setting of preset manual value	3014	○	○	6014	○	○
C 15	Setting of PID operation initial manipulated variable	3015	○	○	6015	○	○
C 16	Selection of PID operation initialize	3016	○	○	6016	○	○
C 17	Selection of zone PID action	3017	○	○	6017	○	○
C 18	Selection of control system	3018	○	○	6018	○	○
C 19	Selection of disturbance suppression function action	3019	○	○	6019	○	○
C 20	Selection of neural network auto tuning action	3020	○	○	6020	○	○
C 21	Selection of event 1 action type	3021	○	○	6021	○	○
C 22	Selection of event 1 stand-by action	3022	○	○	6022	○	○
C 23	Selection of event 2 action type	3023	○	○	6023	○	○
C 24	Selection of event 2 stand-by action	3024	○	○	6024	○	○
C 25	Selection of event action in READY mode	3025	○	○	6025	○	○
C 26	Setting of the number of LSPs which can be set by remote switch input	3026	○	○	6026	○	○
C 27	Selection of remote switch input 1 function	3027	○	○	6027	○	○
C 28	Selection of remote switch input 2 function	3028	○	○	6028	○	○

Display of PV indicator	Item	RAM			EEPROM		
		Address	R	W	Address	R	W
C 29	Selection of remote switch input 3 function	3029	○	○	6029	○	○
C 30	Selection of remote switch input 4 function	3030	○	○	6030	○	○
C 31	Communication address	3031	○	×	6031	○	×
C 32	Transmission speed	3032	○	×	3032	○	×
C 33	Data format	3033	○	×	6033	○	×
C 34	Setting of dead zone	3034	○	○	6034	○	○
C 35	Selection of M/M control	3035	○	○	6035	○	○
C 36	Automatic M/M adjustment start	3036	○	○	6036	×	×
C 37	Setting of M/M adjustment value (fully close)	3037	○	○	6037	○	○
C 38	Setting of M/M adjustment value (fully open)	3038	○	○	6038	○	○
C 39	Setting of M/M fully close/fully open time	3039	○	○	6039	○	○
C 40	Setting of SP ramp up gradient	3040	○	○	6040	○	○
C 41	Setting of SP ramp down gradient	3041	○	○	6041	○	○
C 42	Selection of SP ramp time unit	3042	○	○	6042	○	○
C 43	Setting of green belt range	3043	○	○	6043	○	○
C 44	Selection of auxiliary output type	3044	○	○	6044	○	○
C 45	Setting of auxiliary output 4mA	3045	○	○	6045	○	○
C 46	Setting of auxiliary output 20mA	3046	○	○	6046	○	○
C 47	Setting of RSP 0% (4mA, 1V)	3047	○	○	6047	○	○
C 48	Setting of RSP 100% (20mA, 5V)	3048	○	○	6048	○	○
C 49	Selection of cold junction compensation action	3049	○	○	6049	○	○

Cautions

- For the setting range and read/write conditions, see the instruction manual (CP-UM-1586E) for the main instrument.
- All the SETUP parameters can be written only during the READY mode.
- When data write at 3036W ends normally, the result is stored in EEPROM as well.

6. Communication for master station

6 - 1 Precautions for programming

- The longest response time of the instrument is 2sec.
  Therefore, the response monitor time should be set to 2sec.
- If no response is obtained within 2sec, retransmit the same message. When no response remains coming even after making retransmission twice, it should be regarded as a communication error.
- The above-mentioned retransmission is required since a message may not be properly transmitted due to noise or the like during communication.

Note

When the device distinction codes "X" and "x" are used alternately during message retransmission from the master station, the received response message can be conveniently identified to be the latest message or preceding one.

6 - 2 Examples of communication program

The program examples given in this paragraph are written in FUJITSU F-BASIC Ver.6.0 for Windows95/98/NT. This program is shown as a reference for making a program.

■ Before executing the program

Check the instrument communication conditions, and station address.

■ Executing the program

This program is used for data read and data write. When the program is executed, the application layers of the request message and response message communicated are indicated.

```
RS, 123W, 4
Application layer in response message
00, 10, - 20, 0, 40
Application layer in  request message
WS, 234W, 1, 1
Application layer in response message
00
```

Example of indication of execution result

● Setting for communication

Set the station address of a mate instrument to "ADDRESS".
Open the RS-232C and call the subroutine *INIT. DATA.

● Data reading

After setting the read start data address to "READ. ADRS" and the read data count to "READ. LEN", call the subroutine *DATA. READ.
This program permits four data to be read from the data address 123.
Change the setting so as to meet the instrument used.

● Data writing

After setting the write start data address to "WRITE. ADRS", the write data count to "WRITE. LEN", and the write data to "WRITE. DATA", call the subroutine *DATA. WRITE.
This program permits two data to be written from the data address 234. Change the setting so as to meet the instrument used.

■ Data read/write sample program

! Handling Precautions

Yamatake Corporation won't be absolutely responsible for any trouble caused by applying this program sample.

```
'*************************************************************
'* Data Read Write Sample Program  (Ver.1.00)                *
'*                                                           *
'* OS:Windows 95/98                                          *
'* Language: Fujitsu F-BASIC V6.0                            *
'* All rights reserved. Copyright(C) 1999, Yamatake Corporation *
'*************************************************************
'
'Initilize data
*INITIALIZE
    DEFLNG A - Z
    dim READ_DATA( 100 ), WRITE_DATA( 100 )  'Read/write data area
    ADDRESS  = 1              'Device address
    OPEN "COM0:(S8E1N8NN,SD200,RB4096)" AS #1               'Open RS-232C
                              '(8bit,Even parity,1 stop bit)
                              '(8bit,No Parity,2stop bit"S8N2N8NN")
    baud 0,9600               'Transmission Speed(9600bps)

    GOSUB *INIT_DATA
'
' Main routine
*MAIN
    'Reading 4 data from the data address 123
    READ_ADRS =  123          'Read start data address
    READ_LEN  =      4        'Read count
    GOSUB *DATA_READ          '<Output>COM_ERROR:Communication error
                              '        RESPONSE:End code
                              '        READ_DATA(i)(i=0 to READ_LEN-1):Read data
    '
    'Writing 4 data from the data address 234
    WRITE_ADRS =  234         'Write start data address
    WRITE_LEN  =      2       'Write count
    WRITE_DATA(0) = 1         'Write data No.1
    WRITE_DATA(1) = 1         'Write data No.2
    gosub *DATA_WRITE         '<Output>COM_ERROR:Communication error
                              '       RESPONSE:End code
    goto *PROCESS_END
'
'Ending routine
*PROCESS_END
    CLOSE #1                  'Close RS-232C
    INPUT "Press any key", x$:END
'
'**********************
'* Read Subroutine     *
'**********************
*DATA_READ
    A = READ_ADRS: gosub *BIN_TO_ASCII
    CMD$ = "RS," + A$ + "W,"
    A = READ_LEN: gosub *BIN_TO_ASCII
    CMD$ = cmd$ + A$
    GOSUB *COMMUNICATION
    IF COM_ERROR <> 0 OR RESPONSE <> 0 THEN RETURN
    A$ = RIGHT$( RECEIVE$, LEN( RECEIVE$ ) - 3 ) + ","
    J1 = 1
    FOR I = 0 TO READ_LEN - 1
        J2 = INSTR( J1, A$, "," )
        READ_DATA( I ) = VAL( MID$( A$, J1, J2 - J1 ) )
```

```
        J1 = J2 + 1
    NEXT
    RETURN
'
'**********************
'* Write Subroutine   *
'**********************
*DATA_WRITE
    A = WRITE_ADRS: GOSUB *BIN_TO_ASCII
    CMD$ = "WS," + A$ + "W"
    FOR I = 0 TO WRITE_LEN - 1
        A = WRITE_DATA( I ): GOSUB *BIN_TO_ASCII
        CMD$ = CMD$ + "," + A$
    NEXT
    GOSUB *COMMUNICATION
    RETURN
'
'ASCII character conversion subroutine
'
*BIN_TO_ASCII
    A$ = STR$( A )
    IF LEFT$( A$, 1 ) = " " THEN A$ = RIGHT$( A$, LEN( A$ ) - 1 )
    RETURN
'
'****************************
'* Communication Subroutine *
'****************************
*COMMUNICATION
    COM_RETRY = 3: COM_ERROR = -1
    WHILE ( COM_RETRY > 0 AND COM_ERROR <> 0 )
            COM_ERROR = 0                       '
            WHILE ( eof( 1 )=0 ): A$ = INPUT$( 1, #1 ): WEND '
            GOSUB *SEND_COMMAND       '
                   PRINT "Application layer in response message": PRINT CMD$
            GOSUB *RECEIVE_COMMAND    '
                   IF COM_ERROR=0 THEN PRINT "Application layer in response message": PRINT RECEIVE$
                   IF COM_ERROR=1 THEN PRINT "Time out error"
                   IF COM_ERROR=2 THEN PRINT "Check sum error"
                   IF COM_ERROR<0 THEN PRINT "Data link layer error"
                   PRINT
            COM_RETRY = COM_RETRY - 1
    WEND
    RETURN
'
'********************
'*  Send Subroutine *
'********************
*SEND_COMMAND
    A$ = RIGHT$( "0" + HEX$( ADDRESS ), 2 )
    A$ = STX$ + A$ + SUB_ADR$ + DEVICE$ + CMD$ + ETX$
    GOSUB *MAKE_SUM
    SEND$ = A$ + SUM$ + CR$ + LF$
    PRINT #1, SEND$;
    RETURN
'
'**********************
'*  Recive Subroutine *
'**********************
'COM_ERROR:
'   = 0: Normal
'   = 1: Time out error
'   = 2: Check sum error
'   < 0: Data link layer error
'
*RECEIVE_COMMAND
     '
     'Waiting for STX
```

```
    A$ = ""
    WHILE ( A$ <> STX$ )
            RECEIVE$ = ""
            GOSUB *RECV_SUB: IF COM_ERROR THEN RETURN
    WEND
    '
    'Waiting for ETX
    WHILE ( A$ <> ETX$ )
            GOSUB *RECV_SUB: IF COM_ERROR THEN RETURN
    WEND
    IF SUM_FLAG = 0 THEN SUM$ = "": GOTO *RECV_CR
    '
    'Waiting for 1'st character in check sum
    GOSUB *RECV_SUB: IF COM_ERROR THEN RETURN
    '
    'Waiting for 2'nd character in check sum
    GOSUB *RECV_SUB: IF COM_ERROR THEN RETURN
    A$ = LEFT$( RECEIVE$, LEN( RECEIVE$ ) - 2 ): GOSUB *MAKE_SUM
    IF RIGHT$( RECEIVE$, 2 ) <> SUM$ THEN COM_ERROR = 2: RETURN
    '
    'Waiting for CR
*RECV_CR
    GOSUB *RECV_SUB: IF COM_ERROR THEN RETURN
    IF A$ <> CR$ THEN COM_ERROR = -2: RETURN
    '
    'Waiting for LF
    GOSUB *RECV_SUB: IF COM_ERROR THEN RETURN
    IF A$ <> LF$ THEN COM_ERROR = -3: RETURN
    '
    'Checking data link layer
    IF MID$(SEND$,2,5) <> MID$(RECEIVE$,2,5) THEN COM_ERROR = -1: RETURN
    RECEIVE$ = MID$( RECEIVE$, 7, LEN( RECEIVE$ ) - LEN( SUM$ ) - 9 )
    RESPONSE = VAL( LEFT$( RECEIVE$, 2 ) )
    RETURN
'
'Waiting for 1 character subroutine
'(Same routine as time out monitoring)
'
*RECV_SUB
    A = 0
    WHILE ( 1 )
            A$ = TIME$
            WHILE ( A$ = TIME$ )
                    IF EOF(1)=0 THEN A$ = INPUT$(1,#1): RECEIVE$=RECEIVE$+A$: RETURN
                    A = A + 1: IF A = TIME_CNT THEN *RECV_ERR
            WEND
    WEND
*RECV_ERR
    COM_ERROR = 1
    RETURN
'
'Check sum subroutine
'
*MAKE_SUM
    A = 0: SUM$ = ""
    IF SUM_FLAG = 0 THEN RETURN
    FOR I = 1 TO LEN( A$ )
            A = A + ASC( MID$( A$, I, 1 ) )
    NEXT
    SUM$ = RIGHT$( "0" + HEX$( (-A) AND &HFF ), 2 )
    RETURN
'
'Data initializeing subroutine
'
*INIT_DATA
    STX$ = CHR$(  2 )        'STX code
    ETX$ = CHR$(  3 )        'ETX code
```

```
        CR$  = CHR$( 13 )        'CR code
        LF$  = CHR$( 10 )        'LF code
        '
        SUB_ADR$ = "00"  '
        DEVICE$  = "X"   '
        SUM_FLAG = 1             '
        TIME_OUT = 2000  '
        TIME_CNT = 0             '
        '
        'Time out monitoring
        '(Same routine as waiting for 1 charcter subroutine)
        A = 0
        while ( eof( 1 )=0 ): A$ = input$( 1, #1 ): wend
        A$ = TIME$
        WHILE ( A$ = TIME$ ): WEND
        A$ = TIME$
        WHILE ( A$ = TIME$ )
                if eof( 1 )=0 then *I_LOOP1
    *I_LOOP1
                TIME_CNT = TIME_CNT + 1: IF TIME_CNT = A THEN *I_LOOP2
    *I_LOOP2
        WEND
        TIME_CNT = (TIME_OUT / 1000!) * TIME_CNT + 1 'Round up
        RETURN
    '
    '--- Last Line ---
```

7. Troubleshooting

■ Check items in case communication is disabled

(1) Check if the communication conditions for the DIGITRONIK instrument meet those for the host computer.
If any one of the below setting items is different between both stations, communication is disabled.
The underlined items mean that they can be set on the DIGITRONIK side.

Transmission speed : 1200, 2400, 4800, 9600bps
Data length : 7、 8 bits
Stop bit : 1 stop bit, 2 stop bits
Parity : No parity, odd parity, even parity

(2) Check if the destination address of the command frame transmitted from the host computer meets the address set to the SDC30.
The address of the SDC30 is set to 0 at delivery from the factory. Even when the destination address of the command frame is set to 00 (30H, 30H), the SDC30 does not respond to such a message.

(3) Use the upper-case character codes for all the character codes other than the device distinction code ("X" or "x" in this instrument).

8. Specifications

■ RS-485 Specifications

Name	Remarks
Transmission mode	Unbalanced type
Transmission line	5-wires/3-wires system
Transmission speed (bps)	1200、2400、4800、9600
Transmission distance	500m max. (300m when connected with the MA500 DIGITRONIK interface module)
Communication system	Half duplex
Synchronous method	Start/stop transmission
Data format	8 data bits, 1 stop bit, even parity 8 data bits, 2 stop bits, no parity
Error detection	Parity check, check sum
Station address	0 to 127 (Communication functions are disabled when set to 0.)
Network type	1:N (31 units max.)

Appendix

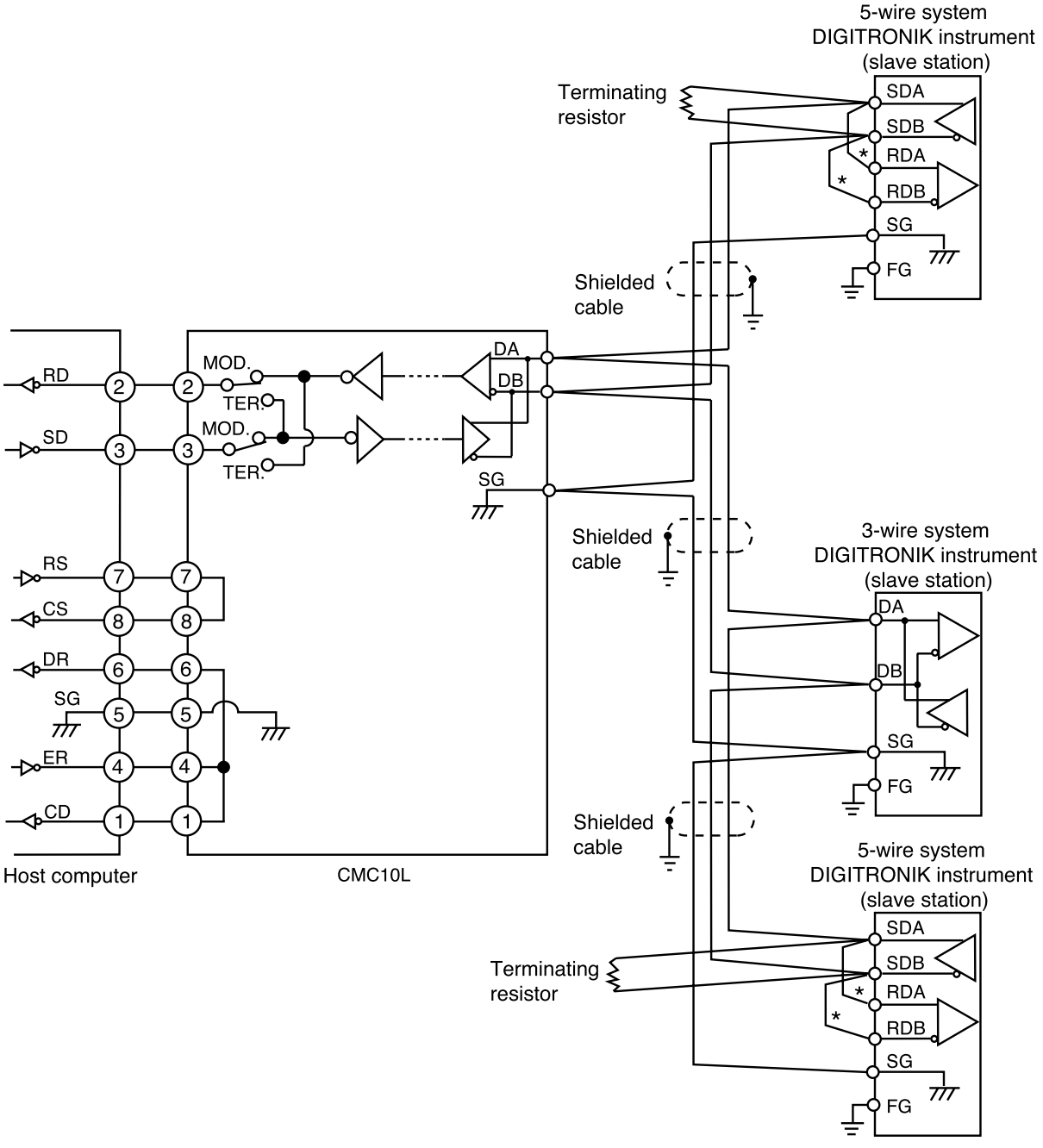
■ Code Table

Upper Bits / Lower Bits	0	1	2	3	4	5	6	7
0			SPACE	0	@	P	、	p
1			!	1	A	Q	a	q
2	STX		"	2	B	R	b	r
3	ETX		#	3	C	S	c	s
4			$	4	D	T	d	t
5			%	5	E	U	e	u
6			&	6	F	V	f	v
7			'	7	G	W	g	w
8			(	8	H	X	h	x
9			)	9	I	Y	i	y
A	LF		*	:	J	Z	j	z
B			+	;	K	[	k	{
C			,	<	L	¥	l	¦
D	CR		—	=	M	]	m	}
E			.	>	N	^	n	~
F			/	?	O	_	o	

The shaded areas ( ) are not used by this communication system. (The codes depend on the station.)

■ Connection with CMC10L

The CMC10L001A000 is available as an RS-232C/RS-485 (3-wire system) converter from Yamatake Corporation. The following diagram shows an example of wiring using a straight cable for a host computer in the terminal mode:



Connect two terminating resistors of 150Ω±5%, 1/2W min. to the instrument at each end of the transmission line.

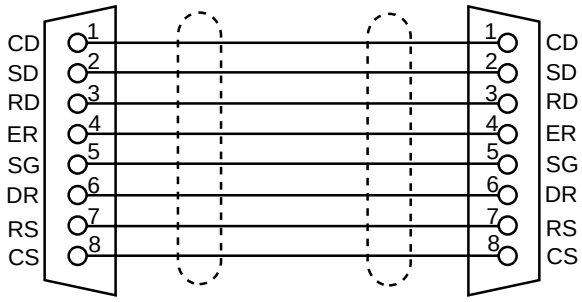
Conduct the wiring externally for the wires marked with an asterisk.

Connect the master station SD to the slave station RD, and the master station RD to the slave station SD.
To execute this connection, set the MODE switch provided in the CMC10L as shown in the following table in accordance with the host computer side RS-232C connector pin arrangement (modem/terminal) and the type of cable (cross/straight) used:

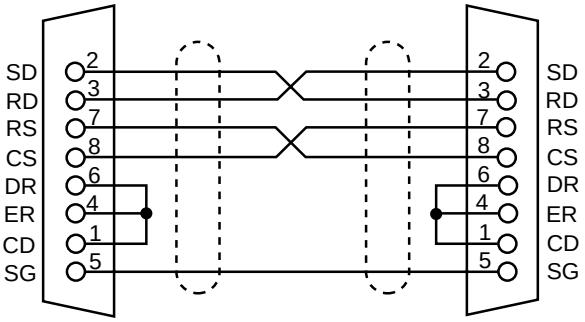
RS-232C	Cable type	MODE switch
TERMINAL	Straight	MODEM
TERMINAL	Cross	TERMINAL
MODEM	Straight	TERMINAL
MODEM	Cross	MODEM

- **RS-232C cable**

Straight: An RS-232C cable with a D-Sub (9-pin) connector at each end where pins with the same number are mutually connected (for example, pin (2) to pin (2), and pin (3) to pin (3))

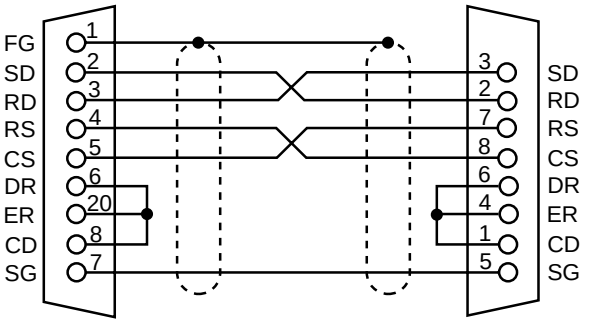


Cross: An RS-232C cable with a D-Sub (9-pin) connector at each end where different number pins are connected (for example, pin (2) to pin (3), and pin (3) to pin (2))



D-Sub (25-pin) – D-Sub (9-pin) conversion cable:

An RS-232C cable for conversion between D-Sub (25-pin) and D-Sub (9-pin)



Revision History

Printed Date	Manual Number	Edition	Revised pages	Description
94-10	**CP-UM-1589E**	**1st Edition**		
01-11		**2nd Edition**	i,5-2 1-1,2-1,2-2 2-1,2-2, Appendix1 to 3 4-2 4-4 5-3 5-5 to 5-12 5-12 5-6 6-1 to 6-5 6-6 Appendix4	Data write Count (EEPROM) 10,000 changed to 100,000. CMA50 changed to CMC10L . RS-232C and RS-485 connection diagrams changed. Check sum 35H 5 corrected to A. Example of check sum corrected. (1) 7BH to 76H, (2) 85H to 8AH, (3) "85" to "8A", 35H to 41H (Notes)Item5 revised. Page 5-4 to 5-11 changed to 5-5 to 5-12 Page added. No.3 Control action status corrected. (5)OPEN to CLOSE, (6)CLOSE to OPEN Sample program changed. Page added. Page deleted.
01-12		**3rd Edition**	1-1	Connection example corrected.(RS-232C deleted)

Specifications are subject to change without notice.

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