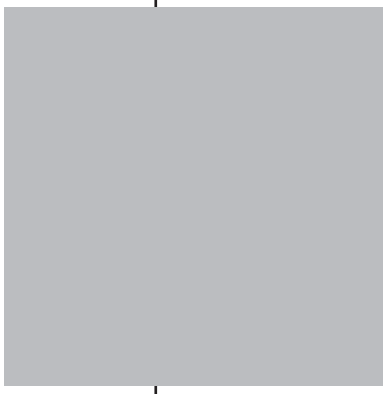
YAMATAKE

No. CP-SP-1154E

Panel Mount Mass Flow Controller MPC Series

User's Manual

"Communication Functions"



Thank you for purchasing the Panel Mount Mass Flow Controller MPC series.
This manual contains information for ensuring correct use of the communication functions of the MPC series. Those who design and maintain devices that use the communication functions of the MPC series should read this manual. It also provides necessary information for installation, maintenance, and troubleshooting. Be sure to keep this manual nearby for handy reference.

Yamatake Corporation

RESTRICTIONS ON USE

This product has been designed, developed and manufactured for general-purpose application in machinery and equipment.
Accordingly, when used in applications outlined below, special care should be taken to implement a fail-safe and/or redundant design concept as well as a periodic maintenance program.

- Safety devices for plant worker protection
- Start/stop control devices for transportation and material handling machines
- Aeronautical/aerospace machines
- Control devices for nuclear reactors

Never use this product in applications where human safety may be put at risk.

IMPORTANT

If it is necessary to change the parameters of the MPC series frequently by communication, write data at addresses of RAM. The endurance of EEPROM is limited to 10,000 erase/write cycles.
Note, that the data in RAM is cleared, and is replaced with the data in EEPROM if the power supply to the MPC series is interrupted.

REQUEST

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

Copying or duplicating this User's Manual in part or in whole is forbidden. The information and specifications in this User's Manual are subject to change without notice.

Considerable effort has been made to ensure that this User's Manual is free from inaccuracies and omissions.
If you should find any inaccuracies or omissions, please contact Yamatake Corporation.

In no event is Yamatake Corporation liable to anyone for any indirect, special or consequential damages as a result of using this product.

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SAFETY PRECAUTIONS

■ About Icons

Safety precautions are for ensuring safe and correct use of this product, and for preventing injury to the operator and other people or damage to property. You must observe these safety precautions. The safety precautions described in this manual are indicated by various icons.
As the following describes the icons and their meanings, be sure to read and understand the descriptions before reading this manual:

⚠**WARNING**	Warnings are indicated when mishandling this product might result in death or serious injury to the user.
⚠**CAUTION**	Cautions are indicated when mishandling this product might result in minor injury to the user, or only physical damage to this product.

■ Examples

	Triangles warn the user of a possible danger that may be caused by wrongful operation or misuse of this product. These icons graphically represent the actual danger. (The example on the left warns the user of the danger of electric shock.)
	White circles with a diagonal bar notify the user that specific actions are prohibited to prevent possible danger. These icons graphically represent the actual prohibited action. (The example on the left notifies the user that disassembly is prohibited.)
	Black filled-in circles instruct the user to carry out a specific obligatory action to prevent possible danger. These icons graphically represent the actual action to be carried out. (The example on the left instructs the user to remove the plug from the outlet.)

⚠WARNING

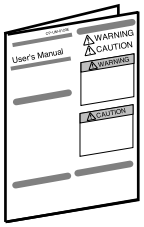
	**Do not use the MPC for medical instruments.**

⚠CAUTION

	**Be sure to turn off the power supply when you connect the MPC. Failure to do so might cause malfunction.**
	**Do not disassemble the MPC. Doing so might cause malfunction.**
	**Wire the MPC in compliance with the predetermined standards. Also wire the MPC with specified power cables according to recognized installation methods. Failure to do so might cause malfunction.**
	**Use the MPC within the operating ranges (temperature, humidity, voltage, vibration, shock, mounting direction, atmosphere, etc.) recommended in the specifiations. Failure to do so might cause malfunction.**
	**Make sure that wire scraps, chips or water do not enter inside the case of the MPC. Failure to do so might cause faulty operation or malfunction.**

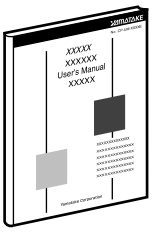
The Role of This Manual

Three manuals are available for the MPC series. Read the manual according to your specific requirements. The below lists all the manuals that accompany the MPC series and gives a brief outline of the manual. If you do not have the required manual, contact Yamatake Corporation or your dealer.



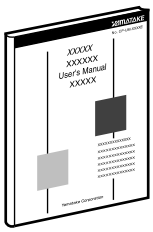
Panel Mount Mass Flow Controller MPC Series
Manual No.CP-UM-5317E

This manual is supplied with the product. Personnel in charge of design and/or manufacture of a system using this unit must thoroughly read this manual. This manual describes the safety precautions, installation, wiring and primary specifications. For further information about operation, refer to other manuals, "Installation & Configurations".



Panel Mount Mass Flow Controller MPC Series "Installation & Configurations" **Manual No.CP-SP-1153E**

This manual describes the hardware and all functions of this unit. Personnel in charge of design, manufacture, operation, and/or maintenance of a system using this unit must thoroughly read this manual. This manual also describes the installation, wiring, all functions and settings of this unit, operating procedures, troubleshooting, and detailed specifications.



Panel Mount Mass Flow Controller MPC Series "Communication Functions" **Manual No.CP-SP-1154E**

This manual.
Those using the "communication functions" of the MPC series should read this manual.
This manual describes an outline of communications, wiring, communication procedures, a list of MPC series communication data, how to remedy trouble, and communication specifications.

Organization of This User's Manual

This manual is organized as follows:

Chapter 1. INTRODUCTION

This chapter describes communication outline of the MPC series.

Chapter 2. WIRING

This chapter describes RS-485 wiring methods to make a communication link between the MPC series and other instruments.

Chapter 3. SETTING

This chapter describes MPC series communication settings.

Chapter 4. COMMUNICATION PROCEDURE

This chapter describes communication procedures, message configuration, data read/write and signal timing operations.

Chapter 5. COMMUNICATION DATA TABLE

This chapter provides various data address tables for communications on the MPC series.

Chapter 6. COMMUNICATION PROGRAM FOR MASTER STATION

This chapter gives precautions for programming and an example of a communication program for the MPC series.

Chapter 7. TROUBLESHOOTING

This chapter describes checkpoints to diagnose failures in MPC series communications.

Chapter 8. SPECIFICATIONS

This chapter lists communication specifications for the MPC series.

Appendix

The appendix provides code tables.

Contents

Chapter 5. COMMUNICATION DATA TABLE

Chapter 6. COMMUNICATION PROGRAM FOR MASTER STATION

Chapter 7. TROUBLESHOOTING

Chapter 8. SPECIFICATIONS

APPENDIX

Conventions Used in This Manual

The following conventions are used in this manual:

Handling Precautions : Handling precautions indicate items that the user should pay attention to when handling the MPC series.

Note : Notes indicate useful information that the user might benefit by knowing.

☞ : This indicates the item or page that the user is requested to refer to.

(1), (2), (3) : The numbers with the parenthesis indicate steps in a sequence or indicate corresponding parts in an explanation.

>> : This indicates the contents shown on the personal computer or unit as a result of operation or unit status after completion of operation.

OFF : This indicates 7-segment indication on the setup display.

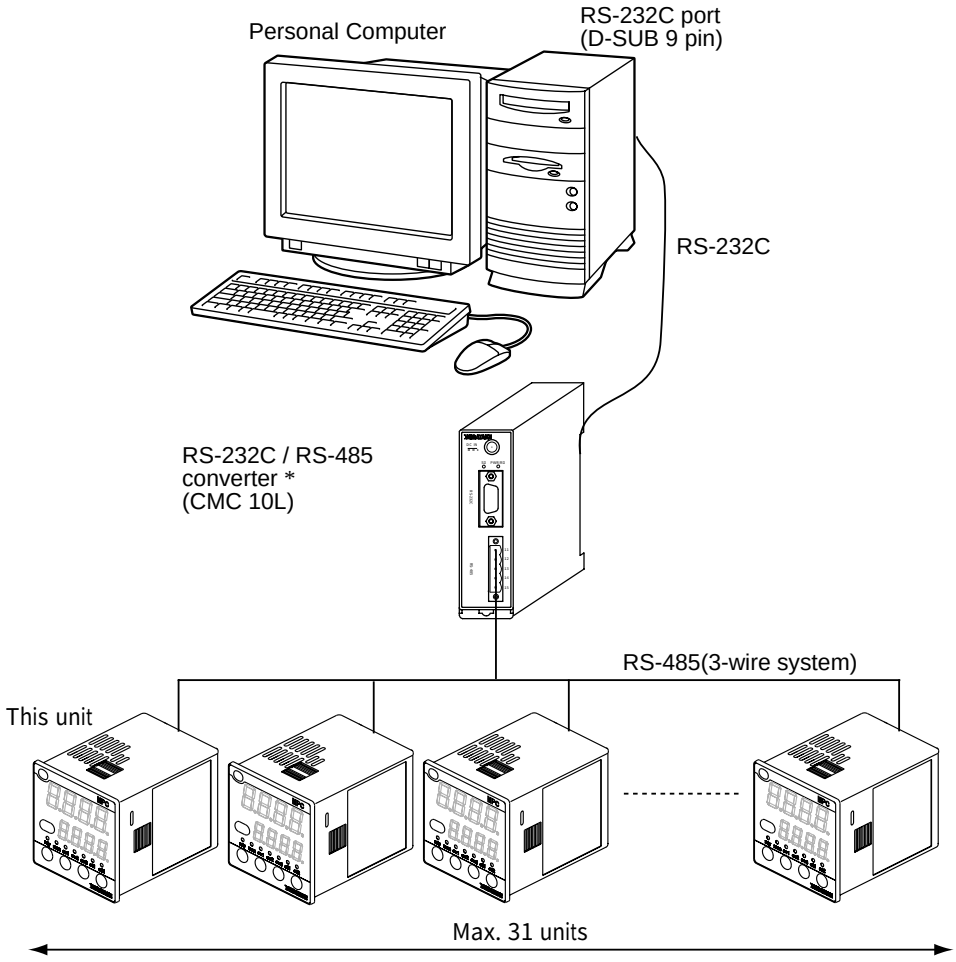
"OK" lamp : This indicates an LED lamp on the setup display.

[ENT] key : This indicates a key on the setup display.

Capter 1. INTRODUCTION

The MPC series (hereafter referred to as slave station) are able to communicate with personal computer or PLC as a host computer (hereafter referred to as master station) about setup value and data throgh RS-232C/RS-485 converter.
In the RS-485 system, up to 31 units can be connected with one master station. The station address is used to identify slave station for communication.
To write a setup value or read a monitor from master station to slave station, you must write a communication program for this purpose.

- When the following procedure is completed during communication, various data for the controller can be read or written:
  (1) The master station transmits a request message to the slave station.
  (2) The master station receives a response message from the slave station.
- The commands from master station to slave station are classified into two types; read and write.
- The type of read/write data can be selected by data address.



* The CMC10L communication controller is an RS-232C/RS-485 (3-wires system) converter available from Yamatake.

Chapter 2. WIRING

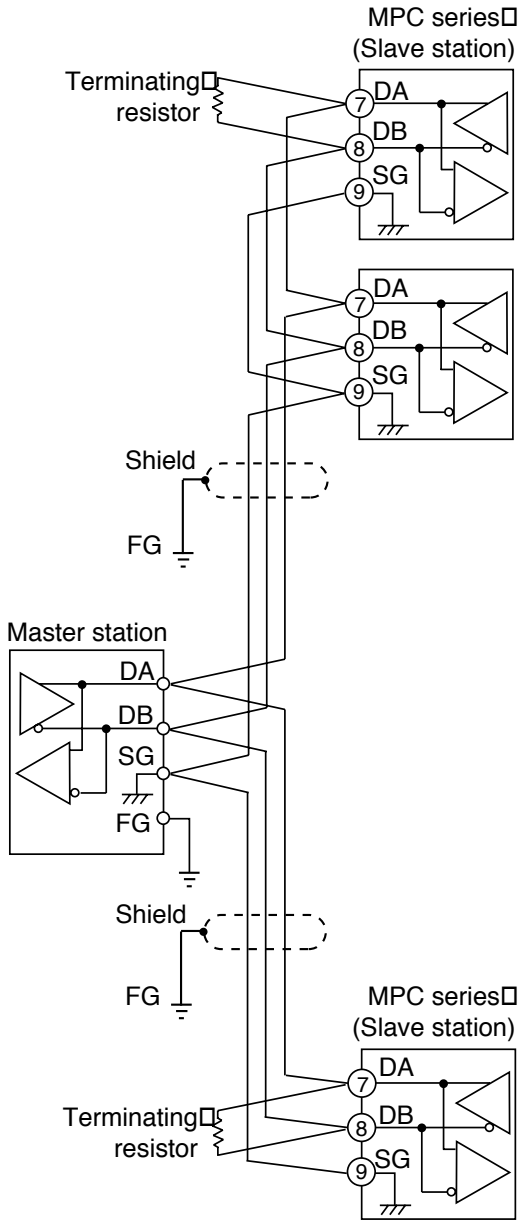
⚠CAUTION

- Be sure to turn off the power supply when you connect the MPC.
  Failure to do so might cause malfunction.
- Do not disassemble the MPC.
  Doing so might cause malfunction.
- Wire the MPC in compliance with the predetermined standards. Also wire the MPC with specified power cables according to recognized installation methods.
  Failure to do so might cause malfunction.
- Use the MPC within the operating ranges (temperature, humidity, voltage, vibration, shock, mounting direction, atmosphere, etc.) recommended in the specifiations.
  Failure to do so might cause malfunction.

Handling Precautions

• For wiring except for RS-485 communication line, refer to
☞ MPC series User's Manual CP-UM-5317E and
MPC series User's Manual "Installation & Configurations" CP-SP-1153E.

An example of connection methods is shown below.



! Handling Precautions

- Connect terminating resistors of 150Ω±5%, 1/2W or more to the both ends of the communication path.
- Ground the shield to the FG at one end of the shiled.
  Make sure that the shield is not grounded at both ends of the shield.
- On 3-wire system, Yamatake's CMC10L001A000 controller can be used as a converter of the master station.
- Be sure to connect SG terminals each other.
  Failure to do so might cause unstable communications.

Capter 3. SETTING

Before starting communication, set the communication condition and station address of the slave station to meet that of the master station.

■ Setting method

Operate the following procedure to set the communication functions:

(1) Put the integrated display mode by pressing the [DISP] key.
>>The "L" lamp lights.

(2) Keep pressing the [<] key for about 3s.
>> The 0.rn9 displays on the upper display and the mode transit the parameter settings mode.

(3) Keep pressing the [<] key for about 3s again.
>> The item No.C-01 appears on the upper display and the mode transit the function setting mode.

(4) Select a target setting item by pressing either [∧] key or [∨] key.

(5) Press the [ENT] key.
>> The current setting value blinks on the lower display.

(6) Select a target setting by pressing either [∧] key or [∨] key.

(7) Press the [ENT] key at the target setting.
>> The setting value stores in memory and renews.

(8) When wanting to set another setting items, return to (4) operation, and wanting no more, go to (9) operation.

(9) Press the [DISP] key
>> The mode returns to the normal display of instantaneous PV indication.

⚠ Handling Precautions

- If any key is not pressed for 1min after the function settings mode, the mode returns to the normal display of instantaneous PV indication.
- When pressing the [DISP] key without pressing the [ENT] key after (6) operation, the setting is not renewed but remained as the previous value.
- When setting a station address zero, the communication function does not work.

■ Setting items of communication

Display	Description	Contents	Initial value	Remarks
C-30	Station address	0: Communications function disabled 1 to 127: Communications address	0	The communications function does not work at 0. Set a different address among the slave stations.
C-31	Transmisson speed selection	0: 38400bps 1: 19200bps 2: 96 00bps 3: 4800bps 4: 2400bps	1	
C-32	Communications condition	0: 8 bits data, even parity, 1 stop bit 1: 8 bits data, no parity, 2 stop bits	0	

Capter 4. COMMUNICATION PROCEDURE

4 - 1 Outline of Communication Procedure and Messages

This chapter describes the outline of communication procedure and the concept behind message configuration.

■ Communication procedure

The following is a simple breakdown of the communication procedure:

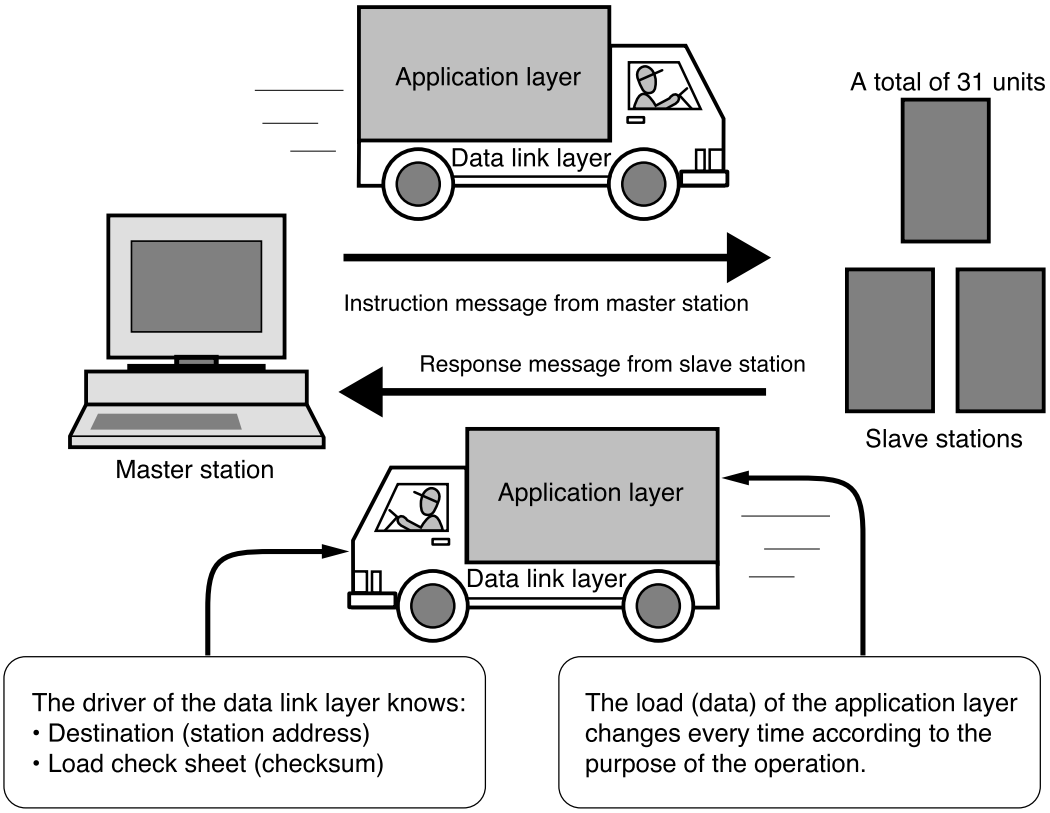
(1) The master station transmits an instruction message to a slave station to specify a station for communication.
(2) The slave station processes the instruction message, and executes read and write operations.
(3) The slave station transmits a response message according to the contents of processing.
(4) The master station receives the response message and executes processing.

■ Message configuration

A message consists of two layers as shown below. Both the instruction message from a master station and the response message from a slave station take this form.

- Data link layer
  - This layer contains the basic information required for communication.
  - It also contains message destination and check information.
- Application layer
  - This layer is where data read and write operations are executed.
  - The content of this layer varies according to the purpose of the operation.

The figure below shows the individual layers.



■ Examples

Messages have the following structure:

● Read instruction

• Instruction 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

● Write instruction

• Instruction 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 following sections describe in detail the data link layer and application layer:

■ Data address concept

The MPC series uses "data addresses" to read and write data. Data addresses allow data to be written and read to and from a corresponding address for the data.

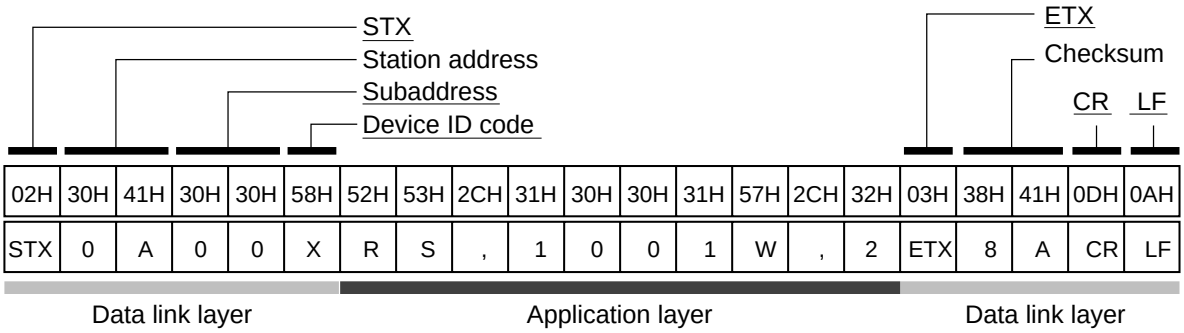
Data A	1001W
Data B	1002W
Data C	1003W
:	:

See 5-2 "Communication Data Table" (page 5-3) for information on the relationship between data and address.

4 - 2 Data Link Layer

■ Description

- The data link layer contains eight types of basic message transmission information.
- The instruction message and response message have the same structure in the data link layer.



The following describes each function of the data link layer:

● STX (Start of TeXt)

✥ Role : Indicates the beginning of a message.

✧ Description
- Fixed at 02H.
- When the instrument receives an STX, it is identified as the first character of a new instruction message regardless of location with a message.

● Station address

✥ Role : Specifies the destination station, and allows communication with the specified station.

✧ Description
- If "0" is set as the station address, the communication function is disabled. So, to enable communication be sure to set an address value of "1" or more.
- Two hexadecimal characters. For details, see the example.

❒ Example : When the station address of the destination is "10":
(1) 10 (decimal) = 0AH (hexadecimal)
(2) Converting into character codes:
0 = 30H, A = 41H
(3) "0A" (30H, 41H) is used as the station address.

Note
See Chapter 3 "SETTING" for information on station address settings.

! Handling Precautions

- Note that the function of the station address differs entirely from that of the data address of the application layer.

● **Subaddress**

✧ Description : The subaddress is meaningless on the MPC series.
Be sure to set a subaddress of "00" (30H, 30H) that has the same format as the station address.

● **Device ID code**

✧ Description : Only character codes "X" (58H) or "x" (78H) can be set on the MPC series.

● **ETX (End of TeXt)**

✥ Role : Indicates the end of the application layer.

✧ Description : Fixed at 03H.

● **Checksum**

✥ Role : A value to be used to check whether or not a message has been corrupted by an error (such as noise) during communication.

✧ Description
- Two hexadecimal characters.
- This function operates as follows:
  (1) Add one byte each to the character codes of the message from STX to ETX.
  (2) Calculate the two's complement of the result of this addition.
  (3) Convert the result into character codes.

❒ Example : The instruction message on the page 4-3 is used in the following example:
(1) Add one byte each to the character codes from STX to ETX. The lower-order one byte of the calculation result is 76H.
(2) The result of two's complement addition is 8AH.
(3) Converted into character codes and use as the checksum value. The result is "8A", (38H) and (41H).
See the station address example (on the page 4-3) for information on character code conversion.

! Handling Precautions

• Do not omit the checksum in the instruction 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.

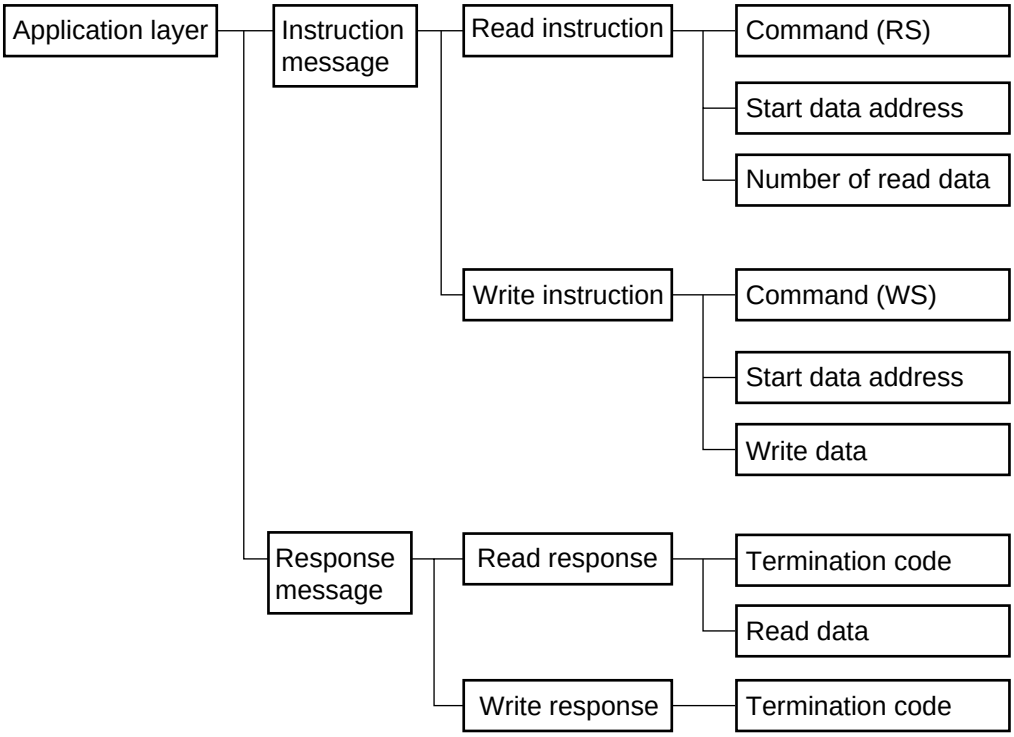
! Handling Precautions

- If any of the following errors occur in the data link layer, the MPC series does not respond:
  - The communication conditions for both stations do not match (different transmission speeds or the occurrence of a parity error).
  - STX, ETX, CR and LF are not placed at the right positions.
  - The device ID code is neither "X" nor "x".
  - The station address, subaddress or checksum is not two character codes.
  - The calculation of the checksum does not agree with that of the message.
  - Non-specified characters are included in the message.
  - The destination station address differs from the station address for the receiving station.
  - The station address set to "00".
- The contents of the data link layer of the response message are same as the instruction message except for the checksum function.
- Use capital letters "A" to "F" in the hexadecimal numerics for the station address and checksum.

4 - 3 Application Layer

■ Outline

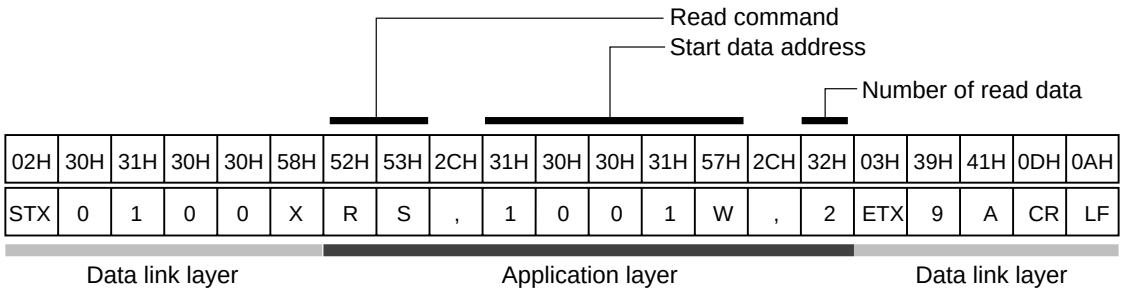
- The application layer contains instructions, data, number of data and termination code.
- In the application layer, the instruction message and response message have a different structure.
- There are two types of instruction messages: read instructions and write instructions. Each of these instruction messages have their own responses.
- A termination code indicates how an instruction message has been processed.



4 - 4 Data Read

■ Description of read instruction

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



❒ Example : The above example shows that two-data items are read from 1001W as one message.

- Individual data items are delimited by a comma "," (character code 2CH).
- An capital letter code is used for each numeric or character in the application layer.
- A decimal number is used for each numeric.
- Additional "0"s or spaces cannot be added to each data item.

❒ Example : The underlined portion of "RS,01001W,2" is not allowed.
The underlined portions of "RS, 1001W,02" are not allowed.

● Read command (RS)

✥ Role : A read command

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

● Start data address

✥ Role : Specifies the start data address.

✧ Description
- See Chapter 5 "COMMUNICATION DATA TABLE" for information on the relationship between data addresses and read data.
- Be sure to append the numeric representing the data address with "W" (57H).

● Number of read data

✥ Role : Specifies how many data items are read continuously, starting with the specified data address.

✧ Description : There is a limit for the number of data to read in one message. For details refer to ■ Number of data read/write (page 5-2).

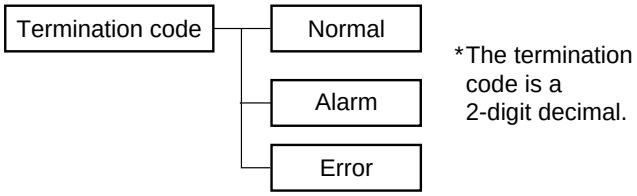
■ Read response

When the message in the data link layer is correct, a response message is sent back according to the contents of the instruction message.
All data in the application layer is expressed in decimal character code.

● Termination code

✥ Role : A numeric which specifies how the instruction message has been processed by the instrument.
Different values are set according to the processing result.

✧ Description : The response message must include a termination code. The termination codes are classified as follows:

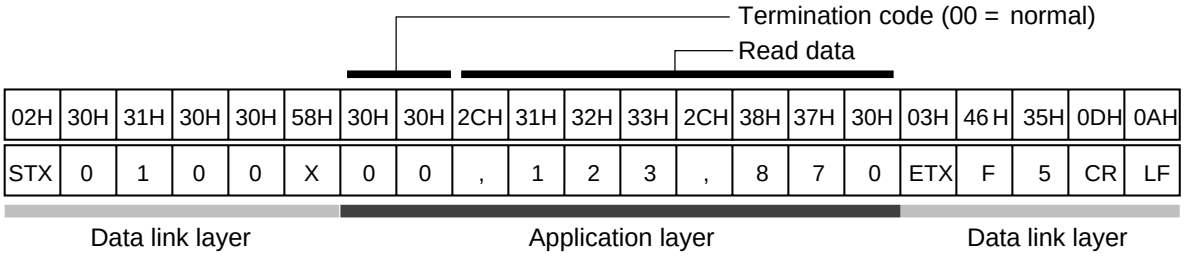


● Normal response

✥ Role : Sends back the read data.
- Data items are delimited with a comma "," (character code 2CH).
- Each data range and number of digits depend on the read data.
- Digit without a decimal point is used for read data.

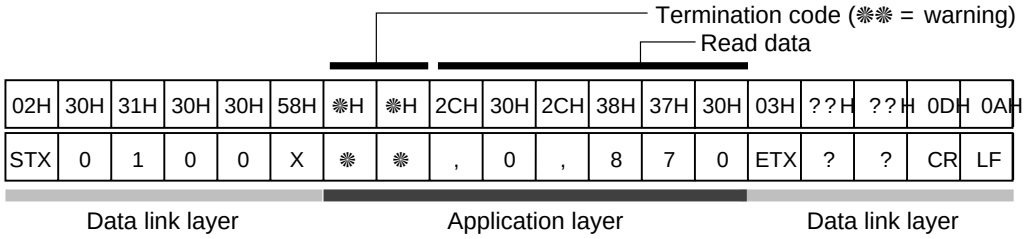
❒ Example : "20.0" is converted to "200" when entered.

A normal response. (when two data items are read properly.)



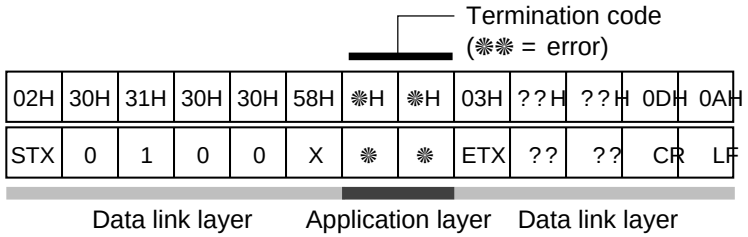
● Alarm response

A warning response. (❋❋ indicates the warning code numeric.)



● **Error response**

Indicates that there is an abnormality in an instruction message, which contains no data and cannot be normally read.
A warning response. (❋❋ indicates the warning code numeric.)



■ Decimal numeric expression (numeric data)

✦ Role : All the numeric, read count, write value and read data in the data address follow the rules given below.

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

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

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

❒ Example: "0" (30H)
"00" (30H, 30H) is not allowed.

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

❒ Example: "+123" (2BH, 31H, 32H, 33H) is not allowed.

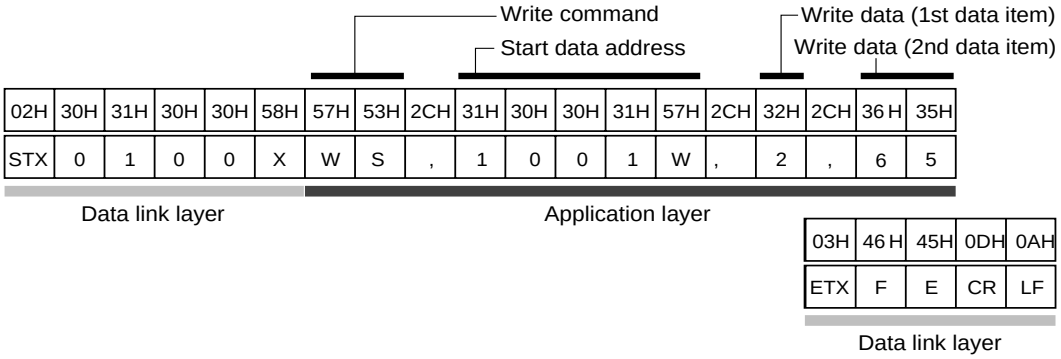
(4)Never add additional "0"s or spaces before a numeric.

❒ Example: "0123" (30H, 31H, 32H, 33H) is not allowed.
" 123" (20H, 31H, 32H, 33H) is not allowed.

4 - 5 Data Write

■ Description of write instruction

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



❒ Example : The above example shows that "2" and "65" are written at address 1001W and 1002W in one message.

- Individual data items are delimited with a comma "," (character code 2CH).
- The number of write data does not need to specify.
- A capital letter code is used for each numeric or character in the application layer.
- A decimal number is used for each numeric.
- Additional "0"s (30H) or spaces cannot be added to each data item.

❒ Example : The underlined portion of "WS,0̲1001W,1" is not allowed.
The underlined portions of "WS,_1001W,0̲1" are not allowed.

● Write command (WS)

✥ Role : A write command
✧ Description : Two "WS" (57H, 53H) characters

● Start data address

✥ Role : Specifies the start data address.

- See 5-2 "Communication Data Table" (page 5-3) for information on the relationship between data addresses and write data.
- Be sure to append the numeric representing the data address with "W" (57H).

● Write data

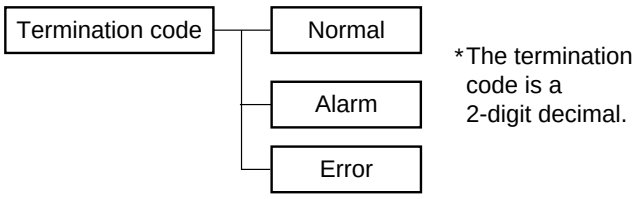
✥ Role : Data to be written to continuous addresses starting with the specified data address.

✧ Description
- The range of a numeric to be written differs according to each data address.
- Individual data are delimited by a comma "," (2CH).
- The data address at which the corresponding data is written, is incremented by 1 sequentially, starting with the start data address (see the example above).
- The number of data item which can be written in one message is limited. See ■ Number of data read / write (page 5-2) for details.

■ Write response

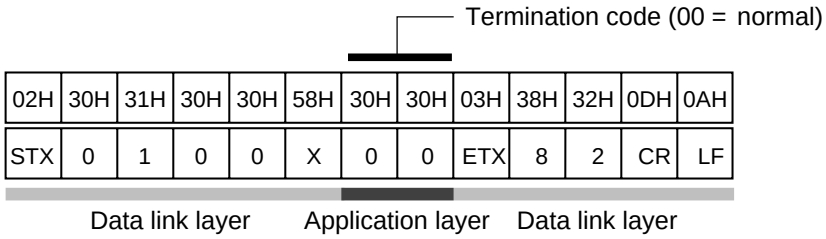
✥ Role : When the message in the data link layer is correct, only the termination code is sent back.

✧ Description : The termination codes are classified as follows:



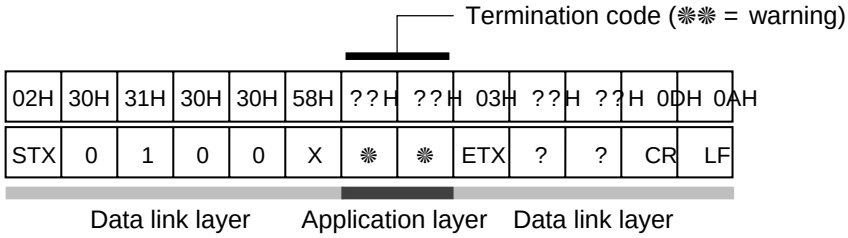
● Normal response

✥ Role : Returns how the write instruction message has been processed. Only a normal termination code or warning termination code is returned.



❒ Example : Normal response (when all data items are correctly written)

● Alarm response

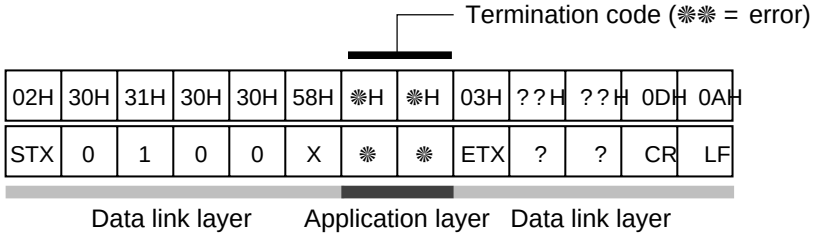


A warning response (❋❋ indicates the warning code numeric.)

● Error response

✥ Role : Only the abnormal termination code is returned.

❒ Example : An abnormal response (❋❋ indicates an abnormal response.)



4 - 6 Termination Code Table

■ Normal and warning termination

Termination code	Type	Contents and action
00	Normal	Normal end
21	Alarm	Wrote data in the address that could not be set in the communication due to the setup allotment by external switching inputs. Continue the process without writing any in the concerned address.
23	Alarm	The Read is stopped due to access to the address outside the scope. The Write is stopped due to access to the address outside the scope. All messages are processed except the address outside the scope.

■ Error termination

Termination code	Type	Contents and action
40	Error	"W" has not been set at the address. All messages are scrapped.
41	Error	"WS", or "RS" has not been set. All messages are scrapped.
43	Error	ETX(03H) is not set in the correct position. "," is not set after the address. All messages are scrapped.
46	Error	The address is erroneous. All messages are scrapped.
47	Error	There is an error in the written numeric. All messages are scrapped.
48	Error	There is an error in the written numeric. Write has been executed, except for the error address.
99	Error	An undefined command or other message error. All messages are scrapped.

4 - 7 Timing Specifications

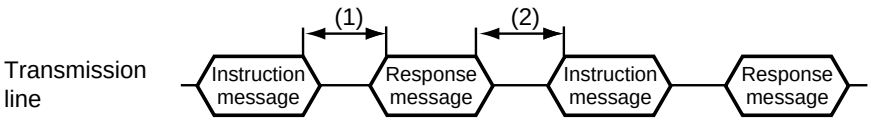
■ Timing specifications for instruction and response messages

The following precautions regarding the transmission timing of instruction messages from the master station and response messages from the slave station should be observed:

● Response time-out

The maximum response time from the end of the instruction message transmission by the master station until when the master station receives a response message from the slave station is 2 seconds ((1) in figure). So, the response time-out should be set to 2 seconds.
Generally, when a response time-out occurs, the instruction message is resent.
For details, see Chapter 6 "COMMUNICATION PROGRAM FOR MASTER STATION."

● Transmission start time

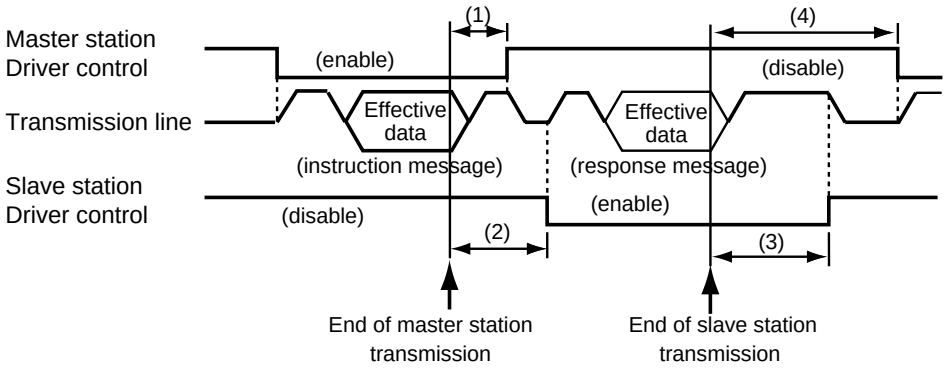


(1) End of master station transmission - Transmission start time of slave station = 2s max.
(For the master station, the response time-out after the end of instruction message transmission should e set to 2s.)

(2) End of slave station transmission - Transmission start time of master station = 10ms min.
(For the master station, stand by for 10ms or more from the end of response message receipt to the start time of next transmission.)

■ RS-485 driver control timing specifications

When the transmission/reception on the RS-485 3-wire system is directly controlled by the master station, care should be paid to the following timing:



(1) End of master station transmission - Driver disable time = 500μs max.
(2) End of slave station reception - Driver enable time = 15ms min.
(3) End of slave station transmission - Driver disable time = 10ms max.
(4) End of master station reception - Driver enable time = 10ms min.

■ Other precautions

- The time required for the master station to finish the transmittal of instruction message and for the slave station to start the transmittal of response message becomes longer if the number of data to write and read increases.
  When the faster response time is required by the slave station, make sure to keep the number of data to read / write at the minimum in one message.
- When the number of data is one data to read / write in one message, the time required for the master station to finish the instruction message and for the slave station to transmit the response message is about 30ms.

Chapter 5. COMMUNICATION DATA TABLE

5 - 1 Basic Communication Data Processing

■ Communication data types and formats

● Types of communication data

The communications data are categorized as follow:

- Device related data
- Operating status related data
- Instantaneous flowrate related data
- Integrated flow related data
- Function setup related data
- Parameter setup related data

● Format of communication data

Communication data is classified into the following formats:

- Numeric data: Data indicating a numeric value (PV, SP, etc.).
- Bit data: Data where each bit is significant (alarms, etc.). Bit data must be composed by transmission and decomposed by reception.

IMPORTANT

If it is necessary to change the parameters of the MPC series frequently by communication, write data at addresses of RAM. The endurance of EEPROM is limited to 10,000 erase/write cycles.
Note, that the data in RAM is cleared, and is replaced with the data in EEPROM if the power supply to the MPC series is interrupted.

■ Communication data storage memory

● Memory type

The communication data are stored in the following two types of memory:

- RAM: Stored data is cleared when the power is turned OFF. However data can be written to this memory infinitely.
- EEPROM: Stored data is retained even when the power is turned OFF, whereas data erase/write cycles are limited to a total of 10,000 times owing to device characteristics.

● Communication object memory

In communication, it is necessary to read/write data from/into the abovementioned 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.

■ Data address

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

Communication data	RAM		EEPROM	
	Offset value	Address	Offset value	Address
Device related data	1000	1001 to 1199	4000	4001 to 4199
Operating status related data	1200	1201 to 1399	4200	4201 to 4399
Instantaneous flow-rate related data	1400	1401 to 1599	4400	4401 to 4599
Integrated flowrate related data	1600	1601 to 1799	4600	4601 to 4799
Function setup related data	2000	2001 to 2199	5000	5001 to 5199
Parameter setup related data	2200	2201 to 2399	5200	5201 to 5399

■ Number of data read / write

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

	RAM	EEPROM
Read	1 to 10 words	1 to 10 words
Write	1 to 10 words	1 to 10 words

■ Data unit and decimal point position

Read/write data is not appended with a decimal point.
The unit and decimal point position is determined for each data item.
For details on the data unit and decimal point position, see the MPC series User's Manual.

5 - 2 Communication Data Table

The enabling conditions for the address and R/W (Read/Write) of each data are specified in the following table:

The meaning of R/W column marks:
❍ Possible
× Impossible

■ Device related data

Display	Data range	RAM			EEPROM			Remarks
		Address	R	W	Address	R	W	
Gas type	0: User Setting 1: Nitrogen/Air 3: Argon 4: Carbon dioxide	1001	❍	×	4001	×	×	Change in gas type is possible with the function setup (Address 5018).
Full- scale flow	Depended on each flowrate range	1002	❍	×	4002	×	×	The value with excluded decimal point.
Decimal point display position of instantaneous flowrate	0: No decimal point 1: XXXX. 2: XXX.X 3: XX.XX 4: X.XXX	1003	❍	×	4003	×	×	
Decimal point display position of integrated flowrate	0: No decimal point 1: XXXXXXXX. 2: XXXXXXX.X 3: XXXXXX.XX 4: XXXXX.XXX	1004	❍	×	4004	×	×	

■ Operating status related data

Display	Data range	RAM			EEPROM			Remarks
		Address	R	W	Address	R	W	
Alarm status bit	Refer to *1	1201	❍	×	4201	×	×	Status is shown in decimal numbers
Event status bit	Refer to *2	1202	❍	×	4202	×	×	Status is shown in decimal numbers
Control status bit	Refer to *3	1203	❍	×	4203	×	×	Status is shown in decimal numbers
Operation mode	0: Valve full close 1: Valve control 2: Valve full open	1204	❍	❍	4204	❍	❍	Can not write when the valve is in full close or full open resulted forcibly by external inputs.
Instantaneous SP No. in use	0: SP-0 1: SP-1 2: SP-2 3: SP-3	1205	❍	❍	4205	❍	❍	Can not write when SP No. switching is being selected by external inputs. The number larger than the one being selected with SP No.(Address 5004) of the function setup can not be written.
Instantaneous SP value in use	(0 to 100%FS) L/min(standard)	1206	❍	×	4206	×	×	The value with excluded decimal point of flow (L/min standard) multiplied by the percent in the full-scale flow bracket.
Instantaneous PV value	(0 to 100%FS) L/min(standard)	1207	❍	×	4207	×	×	
Valve drive current output	0.0 to 100.0%	1208	❍	×	4208	×	×	The value with excluded decimal point.

*1 : Alarm status bit configuration (Address 1201) 0: Nomal 1: Error

Bit No.	Description
0	Flowrate deviation lower limit alarm
1	Flowrate deviation upper limit alarm
2	Undefined (normally 0)
3	Undefined (normally 0)
4	Sensor error
5	Input / output adjustment data error
6	Sensor calibration data error
7	User setup data error
8	Valve overheat prevention limit is operated

*2 : Event status bit configuration (Address 1202) 0: OFF 1: ON

Bit No.	Description
0	Event output 1 status
1	Event output 2 status
2	Undefined (normally 0)
3	External switch input 1 status
4	External switch input 2 status
5	Undefined (normally 0)
6	Undefined (normally 0)
7	Undefined (normally 0)

*3 : Control status bit configuration (Address 1203) 0: OFF 1: ON

Bit No.	Description
0	OK lamp (Instantaneous PV control status) 0: Light-out 1: Lighting (Instantaneous PV OK)
1	Slow start operation 0: Normal operation 1: Slow start operation
2	Digital setting / Analog setting 0: Digital setting 1: Analog setting
3	Integrated count status 0: Integrated PV < Integrated SP 1: Integrated PV ≥ Integrated SP
4	Undefined (normally 0)
5	Undefined (normally 0)
6	Undefined (normally 0)
7	Undefined (normally 0)

■ Instantaneous flowrate related data

Display	Data range	RAM			EEPROM			Remarks
		Address	R	W	Address	R	W	
Digital instantaneous flowrate SP-0	(0 to 100%FS) L/min(standard)	1401	❍	❍	4401	❍	❍	The value with excluded decimal point of flow (L/min (standard)) multiplied by the percent in the full-scale flow bracket
Digital instantaneous flowrate SP-1	(0 to 100%FS) L/min(standard)	1402	❍	❍	4402	❍	❍	
Digital instantaneous flowrate SP-2	(0 to 100%FS) L/min(standard)	1403	❍	❍	4403	❍	❍	
Digital instantaneous flowrate SP-3	(0 to 100%FS) L/min(standard)	1404	❍	❍	4404	❍	❍	

■ Integrated flowrate related data

Display	Data range	RAM			EEPROM			Remarks
		Address	R	W	Address	R	W	
Integrated SP setup lower 4 digits	0 to 9999	1601	❍	❍	4601	❍	❍	Same as RAM address 2217 and 5217 in parameter set up
Integrated SP setup upper 4 digits	0 to 9999	1602	❍	❍	4602	❍	❍	Same as RAM address 2218 and 5218 in parameter set up
Integrated PV setup lower 4 digits	0 to 9999	1603	❍	❍	4603	❍	❍	When resetting the integrated value,make sure to write “0” for the both lower and upper digits.
Integrated PV setup upper 4 digits	0 to 9999	1604	❍	❍	4604	❍	❍	

■ Function setup related data

Display	Setting range	RAM			EEPROM			Remarks
		Address	R	W	Address	R	W	
Key lock	0: Key lock disabled 1: Settings other than instantaneous SP and integrated SP are key-locked 2: All settings key-locked	2001	❍	❍	5001	❍	❍	
Operation mode selection (selection by key operation)	0: Disabled selection by key operation 1: Enabled selection by key operation	2002	❍	❍	5002	❍	❍	
Instantaneous flow -rate setup method (instantaneous SP setup method selection)	0: Digital setup (set by key operation or communcations) 1: Analog setup (set by external analog input voltage)	2003	❍	×	5003	❍	×	*1
Number of instantaneous flowrate setups selection (number of instantaneous SPs selection)	0: Number of SPs = 1 (SP-0 only) 1: Number of SPs = 2 (SP-0, SP-1) 2: Number of SPs = 3 (SP-0 to SP-2) 3: Number of SPs = 4 (SP-0 to SP-3)	2004	❍	❍	5004	❍	❍	
Instantaneous flowrate analog input voltage range selection (SP analog input voltage range selection)	0: 0 to 5V input 1: 1 to 5V input	2005	❍	×	5005	❍	×	*1
Instantaneous flowrate analog output voltage range selection (PV analog output voltage range selection)	0: 0 to 5V output 1: 1 to 5V output	2006	❍	×	5006	❍	×	*1
Event 1 output type assignment	0: Not used (normally OFF) 1: ON at alarm occurred 2: Integrated pulse output 3: ON at instantaneous PV OK 4: ON during control mode 5: ON during fully open mode 6: ON during control or fully open mode 7: ON during fully closed mode 8: Instantaneous high limit event 9: Instantaneous low limit event 1 10:Instantaneous low limit event 2 11:Integrated flowrate event -1 to -11:Reversed output 1 to 11 above. (ON at normal times, OFF at event occurrence)	2007	❍	❍	5007	❍	❍	
Event 2 output type assignment		2008	❍	❍	5008	❍	❍	

Display	Setting range	RAM			EEPROM			Remarks
		Address	R	W	Address	R	W	
Undefined	0	2009	❍	×	5009	❍	×	*1
External contact 1 input function assignment	0: Not used 1: Reset integration 2: Stop integration count operation 3: Switching of instantaneous SP No. 4: Switching of instantaneous flowrate setup method 5: Operating mode forced fully closed 6: Operating mode forced fully open 7: Switching of slow start operation 8: Switching of operation mode (Control at contact ON, forced fully closed at contact OFF)	2010	❍	❍	5010	❍	❍	
External contact 2 input function assignment		2011	❍	❍	5011	❍	❍	
Undefined	0	2012	❍	×	5012	❍	×	*1
Automatic valve shut-off function at integrated flowrate event occurrence	0: Function disabled 1: Function enabled	2013	❍	❍	5013	❍	❍	
Switching of integrated reset function at start of control	0: Function disabled 1: Function enabled	2014	❍	❍	5014	❍	❍	
Flowrate alarm setup type	0: Function disabled 1: Only upper limit alarm use 2: Only lower limit alarm used 3: Upper/lower limit alarm used	2015	❍	❍	5015	❍	❍	
Operation selection at alarm occurrence	0: Control continued (alarm ignored) 1: Forced fully closed 2: Forced fully open	2016	❍	❍	5016	❍	❍	
Slow start setup	0: Slow start disabled 1 to 8: Slow start enabled (equivalent to about 1 to 6 seconds settling time)	2017	❍	❍	5017	❍	❍	
Gas type selection	0: Conversion factor for each gas type set by the user 1: Air, nitrogen 3: Argon 4: Carbon dioxide (CO_2)	2018	❍	❍	5018	❍	❍	

Display	Setting range	RAM			EEPROM			Remarks
		Address	R	W	Address	R	W	
Flowrate display unit selection	0: Referenced to 20˚C, 1 atmosphere 1: Referenced to 0˚C, 1 atmosphere 2: Referenced to 25˚C, 1 atmosphere 3: Referenced to 35˚C, 1 atmosphere	2019	❍	❍	5019	❍	❍	
Inlet pressure setup	0: 0 to 0.1MPa 1: 0.05 to 0.15MPa 2: 0.15 to 0.25MPa 3: 0.25 to 0.35MPa 4: 0.35 to 0.45MPa 5: 0.45 to 0.5MPa	2020	❍	❍	5020	❍	❍	
Instantaneous flow-rate direct setting functional change	0: Function disabled 1: Function enabled	2021	❍	❍	5021	❍	❍	
Undefined	0	2022	❍	×	5022	❍	×	*1
PV filter (Average)	0: No filtering 1: Moving average of 2 samples 2: Moving average of 4 samples 3: Moving average of 8 samples	2023	❍	❍	5023	❍	❍	
Undefined	0	2024	❍	×	5024	❍	×	*1
Undefined	0	2025	❍	×	5025	❍	×	*1
Undefined	0	2026	❍	×	5026	❍	×	*1
Undefined	0	2027	❍	×	5027	❍	×	*1
Analog optional scaling function	0: Function disabled 1: Function enabled	2028	❍	×	5028	❍	×	*1
PV forced zero function	0: Function disabled 1: Function enabled	2029	❍	❍	5029	❍	❍	
Station address setting	0: Communication functions disabled 1 to 127: Station address	2030	❍	×	5030	❍	×	*1
Transmission speed selection	0: 38400bps 1: 19200bps 2: 9600bps 3: 4800bps 4: 2400bps	2031	❍	×	5031	❍	×	*1
Communication conditions selection	0: 8 data bits, even parity, 1 stop bit 1: 8 data bits, no parity, 2 stop bits	2032	❍	×	5032	❍	×	*1

*1: Though a normal termination code is returned after sending the write instruction message, the data cannot be written.

■ Parameter setup related data

Display	Setting range	RAM			EEPROM			Remarks
		Address	R	W	Address	R	W	
Instantaneous flowrate O.K judgment range	(0.5 to 100%FS) L/min(standard)	2201	❍	❍	5201	❍	❍	The result becomes the flowrate (L/min(standard)) obtained by multiplying the full-scale flowrate by the percentage in parentheses. (The setting range vary according to the model.)
Instantaneous flowrate O.K judgment hysteresis	(0.5 to 100%FS) L/min(standard)	2202	❍	❍	5202	❍	❍	
Instantaneous flowrate deviation high limit alarm	(0.5 to 100%FS) L/min(standard)	2203	❍	❍	5203	❍	❍	
Instantaneous flowrate deviation high limit alarm hysteresis	(0.5 to 100%FS) L/min(standard)	2204	❍	❍	5204	❍	❍	
Instantaneous flowrate deviation lower limit alarm	(0.5 to 100%FS) L/min(standard)	2205	❍	❍	5205	❍	❍	
Instantaneous flowrate deviation lower limit alarm hysteresis	(0.5 to 100%FS) L/min(standard)	2206	❍	❍	5206	❍	❍	
Instantaneous flowrate deviation alarm judgment delay time	1.0 to 999.9s	2207	❍	❍	5207	❍	❍	
Event 1 output delay time	0.0 to 999.9s	2208	❍	❍	5208	❍	❍	Even if the delay time is set, it is disabled during selection of integration pulse output.
Event 2 output delay time	0.0 to 999.9s	2209	❍	❍	5209	❍	❍	
User setup conversion factor(C.F.)	0.100 to 9.999	2210	❍	❍	5210	❍	❍	Under the gas type selection (Address 5018) of the function setup, the setup value is only effective when the" User setup" is selected.
Undefined	0	2211	❍	×	5211	❍	×	*1
Undefined	0	2212	❍	×	5212	❍	×	*1
Event 1 output high-low limit flowrate setup	(0 to 100%FS) L/min(standard)	2213	❍	❍	5213	❍	❍	
Event 2 output high-low limit flowrate setup	(0 to 100%FS) L/min(standard)	2214	❍	❍	5214	❍	❍	
Undefined	0	2215	❍	*1	5215	❍		*1
Undefined	0	2216	❍	*1	5216	❍		*1
Analog option scaling function	(10 to 100%FS) L/min(standard)	2217	❍	*1	5217	❍		*1
Integrated SP setup lower 4 digits	0 to 9999	2218	❍	❍	5218	❍	❍	Same as address 1601 and 4601.
Integrated SP setup upper 4 digits	0 to 9999	2219	❍	❍	5219	❍	❍	Same as address 1602 and 4602.
PV forced zero function delay time	0.0 to 999.9s	2220	❍	❍	5220	❍	❍	

*1: Though a normal termination code is returned after sending the write instruction message, the data cannot be written.

Chapter 6. COMMUNICATION PROGRAM FOR MASTER STATION

6 - 1 Precautions for Programming

Pay attention to the following points when making communications programs:

- The longest response time on the device is 2s. For this reason, set the response monitor time to 2s.
- Resend the same message if there is no response within 2s. Set a communications error to occur if there is no response even after 2 retries.
- Be sure to make the above resends to guard against the case when the message cannot be send correctly due to the influence of noise, for example, during communications.

Note

When the master station resends the message, alternatively use the device ID codes "X" and "x." This is convenient as you can tell whether or not the received message is the previously received message.

6 - 2 Examples of Communication Program

The program is written in Borland's C++Builder5.0 or Borland C++Compiler5.5 for Windows95/98/NT/2000. This program is given here as a reference when the user makes a program, and does not assure all the operations. You can download Borland C++Compiler5.5 from Borland Home Page.

■ Prior to running the sample program

Make sure to check the settings for communications type, station address, transmission speed and data format of the instrument.

■ Running the sample program

This program is used for reading and writing data. When the program is executed, the application layers of the instruction message and response message communicated are indicated.

```
command:RS,1000W,2
result:00,0,0
command:WS,1000W,2
result:00
```

Sample indication of execution results

- **Communication settings**

  Call open() and initialize the RS-232C serial port.

- **Command execution**

  Set a desired character string in "command" and call AppCPL().

■ Data read/write sample program

! Handling Precautions

Yamatake assumes no responsiblity with regard to any trouble caused by using this program.

```
//---------------------------------------------------------------------------
// C++ Builder 5
// Borland C++
//  bcc32 cpl.cpp
//
// cygwin + gcc
//  gcc cpl.cpp
//
#include <stdio.h>
#include <windows.h>
#pragma hdrstop

#define     COMRESENDNUM    2
#define     BUFFERSIZE      4096
#define     TIMEOUT         2000

HANDLE  handle;
unsigned long   ErrorCode;
bool            CheckSum;

bool AppCPL( char* tosend, char * received );
int  Open( void );
int  Close( void );
bool Write( unsigned char *Mesg, unsigned long Size );
bool Read( unsigned char *Buffer, unsigned long SizeToRead,
           unsigned long *ReadSize, unsigned long *ErrFlag );
void CPLSum( unsigned char *str, int len, unsigned char *buf );

//---------------------------------------------------------------------------
int main(int argc, char* argv[])
{
    char command[255];
    char recieve[255];

    handle      = (void *)0xffffffff;
    ErrorCode   = 0;
    CheckSum  = true;

    if(Open()==0){
        strcpy(command,"RS,1000W,2");
        AppCPL(command,recieve);
        printf("command :%s¥n",command);
        printf("result  :%s¥n",recieve);

        strcpy(command,"WS,1000W,2");
        AppCPL(command,recieve);
        printf("command :%s¥n",command);
        printf("result  :%s¥n",recieve);
        Close();
        getchar();
    }
    return 0;
}

//---------------------------------------------------------------------------
int     Open(void)
{
    COMMTIMEOUTS Timeouts;
    _DCB    DCB;

    handle = CreateFile( "¥¥¥.¥¥COM1", GENERIC_READ|GENERIC_WRITE,
                         0, 0, OPEN_EXISTING, FILE_ATTRIBUTE_NORMAL, 0 );
    if( handle==(void *)0xffffffff ) return 3;

    if( !SetupComm( handle, BUFFERSIZE, BUFFERSIZE ) ){
        CloseHandle( handle );
        handle = (void*)0xffffffff;
        return 4;
    }
```

```
    if( !PurgeComm( handle, PURGE_TXABORT|PURGE_RXABORT|
                    PURGE_TXCLEAR|PURGE_RXCLEAR ) ){
        CloseHandle( handle );
        handle = (void*)0xffffffff;
        return 5;
    }

    Timeouts.ReadIntervalTimeout         = 0xFFFFFFFF;
    Timeouts.ReadTotalTimeoutMultiplier  = 0;
    Timeouts.ReadTotalTimeoutConstant    = 0;
    Timeouts.WriteTotalTimeoutMultiplier = 0;
    Timeouts.WriteTotalTimeoutConstant   = 0;

    if( !SetCommTimeouts( handle, &Timeouts ) ){
        CloseHandle( handle );
        handle = (void*)0xffffffff;
        return 6;
    }

    if( !GetCommState( handle, &DCB ) ){
        CloseHandle( handle );
        handle = (void*)0xffffffff;
        return 7;
    }

    DCB.BaudRate=CBR_19200;
    DCB.fBinary=1;
    DCB.fParity= 1;
    DCB.ByteSize=0x08;
    DCB.Parity=EVENPARITY;
    DCB.StopBits=ONESTOPBIT;

    if( !SetCommState( handle, &DCB ) ){
        CloseHandle( handle );
        handle = (void*)0xffffffff;
        return 8;
    }

    return  0;
}

int     Close( void )
{
    if( handle!=(void *)0xffffffff ){
        if( !SetCommMask( handle, 0 ) ){
            CloseHandle( handle );
            handle = (void*)0xffffffff;
            return 2;
        }
        if( !EscapeCommFunction( handle, CLRDTR ) ){
            CloseHandle( handle );
            handle = (void*)0xffffffff;
            return 3;
        }
        if( !CloseHandle( handle ) ) return 4;
        handle = (void*)(0xffffffff);
    }else{
        return 1;
    }

    return 0;
}
//---------------------------------------------------------------------------
bool    Write( unsigned char *Mesg, unsigned long Size )
{
    unsigned long   Error;
    unsigned long   Errors;
    unsigned long   SizeWritten;
    COMSTAT         Stat;

    if( handle==(void *)0xffffffff ){
        return false;
    }
    if( Size>BUFFERSIZE ){
        printf( "trans mission data is too long" );
        return false;
    }
```

```
    do{
        ClearCommError( handle, &Errors, &Stat );
    }while( BUFFERSIZE < Stat.cbOutQue + Size );

    if( WriteFile( handle, Mesg, Size, &SizeWritten, 0 )==false ){
        if( GetLastError()==ERROR_IO_PENDING ){
            while( GetOverlappedResult( handle, 0, &SizeWritten, true ) ){
                Error = GetLastError();
                if( Error==ERROR_IO_INCOMPLETE ){
                    continue;
                }else{
                    ClearCommError( handle, &Errors, &Stat );
                    break;
                }
            }
        }else{
            ClearCommError( handle, &Errors, &Stat );
        }
    }

    if( Size==SizeWritten ){
        return true;
    }else{
        return false;
    }
}
//---------------------------------------------------------------------------
bool Read( unsigned char *Buffer, unsigned long SizeToRead,
           unsigned long *ReadSize, unsigned long *ErrFlag )
{
    BOOL            rt;
    unsigned char   RecvMesg[BUFFERSIZE];
    unsigned char   *cptr;
    unsigned long   i;
    unsigned long   stime;
    unsigned long   dtime;
    unsigned long   Error=0;
    unsigned long   Size;
    COMSTAT         Stat;

    *ReadSize = *ErrFlag = dtime = 0;

    if( handle==(void *)0xffffffff ){
        return false;
    }

    stime = GetTickCount();
    do{
        ClearCommError( handle, &Error, &Stat );
        if( Stat.cbInQue>0 ){
            ZeroMemory( RecvMesg, BUFFERSIZE );
            rt = ReadFile( handle, RecvMesg, Stat.cbInQue, &Size, 0 );
            RecvMesg[Stat.cbInQue] = 0x00;
            if( !rt ){
                // clear error flag
                ClearCommError( handle, &Error, &Stat );
                // set a argument error flag
                *ErrFlag = Error;
                return false;
            }

            for( cptr=&RecvMesg[0],i=0 ; cptr<&RecvMesg[Stat.cbInQue] ; cptr++,i++ ){
                if( SizeToRead==0xFFFFFFFF ){
                    if( *cptr==0x02 ){
                        *ReadSize = 0;
                        Buffer[(*ReadSize)++] = *cptr;
                    }else{
                        if( (*cptr=='¥n') ){
                            Buffer[(*ReadSize)++] = cptr[0];
                            if( Buffer[(*ReadSize)-2]=='¥r' ){
                                Buffer[(*ReadSize)]   = 0x00;
                                goto OutOfWhile;
                            }
                        }
                        Buffer[(*ReadSize)++] = *cptr;
                    }
```

```
                }else{
                    Buffer[(*ReadSize)++] = *cptr;
                    if( (*ReadSize)>=SizeToRead ){
                        goto OutOfWhile;
                    }
                }
            }
        }
        Sleep(1);
        dtime = GetTickCount() - stime;
    }while( (SizeToRead>*ReadSize) && (dtime<TIMEOUT) );

OutOfWhile:

    if( ((SizeToRead>*ReadSize)&&(SizeToRead!=0xFFFFFFFF))||(*ReadSize==0) ){
        *ErrFlag = 0x00010000;
        return false;
    }
    return true;
}
//---------------------------------------------------------------------------
void CPLSum( unsigned char *str, int len, unsigned char *buf )
{
    int             num=0;
    unsigned char   *ch;

    for( ch=&str[0] ; ch<&str[len] ; ch++ ) num += *ch;
    num = (-(num&0x000000FF)&0x000000FF);
    sprintf( (char*)buf, "%02X", num );
}
//---------------------------------------------------------------------------

bool AppCPL( char* tosend, char * received )
{
    unsigned char   theMsg[BUFFERSIZE];
    unsigned char   theApp[BUFFERSIZE];
    unsigned char   theHdr[16];
    unsigned long   SzToSnd;
    unsigned long   RdSz;
    unsigned long   ErrFlg;
    bool            rt;
    int             Cnt=0;
    unsigned char   Sum[4];
    char            *etx;

    if( handle==(void*)(0xFFFFFFFF) ){
        return false;
    }

    ZeroMemory( theMsg, BUFFERSIZE );
    sprintf( (char*)theHdr, "¥x02¥x30¥x31¥x30¥x30¥x58" );
    sprintf( (char*)theMsg, "%s%s¥x03", theHdr, tosend );

    if( CheckSum ){
        SzToSnd = strlen( (char*)theMsg );
        CPLSum( theMsg, SzToSnd, &theMsg[SzToSnd] );
    }
    strcat( (char*)theMsg, "¥r¥n" );
    SzToSnd = strlen( (char*)theMsg );

resend:
    Write( theMsg, SzToSnd );
    rt = Read( theMsg, 0xFFFFFFFF, &RdSz, &ErrFlg );

    if( !rt ){
        if(Cnt++ < COMRESENDNUM ){
            goto resend;
        }
        if( ErrFlg ){
            ErrorCode = ErrFlg;
        }else{
            ErrorCode = 0x000f0000;
        }
        return false;
```

```
        }else{
            if( strncmp( (char*)theMsg, (char*)theHdr, 6 )!=0 ){
                ErrorCode = 0x00020000;
                if( Cnt++<COMRESENDNUM ){
                    goto resend;
                }
                return false;
            }
            if( CheckSum ){
                CPLSum( theMsg, RdSz-4, Sum );
                if( (theMsg[RdSz-4]!=Sum[0])||(theMsg[RdSz-3]!=Sum[1]) ){
                    ErrorCode = 0x00040000;
                    if( Cnt++<COMRESENDNUM ){
                        goto resend;
                    }
                    return false;
                }
            }
            ZeroMemory( theApp,BUFFERSIZE );
            CopyMemory( theApp, &theMsg[6], RdSz-6 );
            etx = strstr( (char*)theApp, "¥x03" );

            if( etx==NULL ){
                ErrorCode = 0x00200000;
                if( Cnt++<COMRESENDNUM ){
                    goto resend;
                }
                return false;
            }else{
                *etx = 0x00;
            }
            strcpy( received, (char*)&theApp[0] );
        }
        return true;
    }
    //---------------------------------------------------------------------------
```

Chapter 7. TROUBLESHOOTING

■ Check items in case communication is disabled

(1) Check the power supply.

(2) Check the wiring.

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

Transmission speed	: 2400, 4800, 9600, 19200, 38400bps
Data length	: 7, 8 bits
Parity	: No parity, odd parity, even parity
Stop bit	: 1 stop bit, 2 stop bits

(4) Check if the destination address of the command frame transmitted from the host computer meets the address set to the MPC series.
The address of the MPC series set to "0" for factory setting.
Even when the destination address of the command frame is set to 00 (30H, 30H), the MPC series does not respond to such a message.

(5) Are those multi-dropped MPC series being operated themselves with different station address setups?

(6) Is the communication timing conformed with the 4-7 Timing Specifications (Page 4-13) specifications?

(7) Use the capital letter character codes for all the character codes other than the device ID code ("X" or "x" in this instrument).

Chapter 8. SPECIFICATIONS

■ RS-485 specifications

Item	Remarks
Transmission mode	Balanced
Transmission line	3-wire system
Transmission speed (bps)	2400, 4800, 96 00, 19200, 38400
Transmission distance	500m max. (300m when connected with the MA500DIM and CMC410.)
Communications flow	Half duplex
Synchronization	Start-stop synchronization
Data format	8 data bits, 1 stop bit, even parity 8 data bits, 2 stop bits, no parity
Error detection	Parity check, checksum
Station address	0 to 127 (Communication function is inhibited when set to "0".)
Network type	1: N (31 units or less)
Other items	Conforms to RS-485 interface specifications.

Appendix

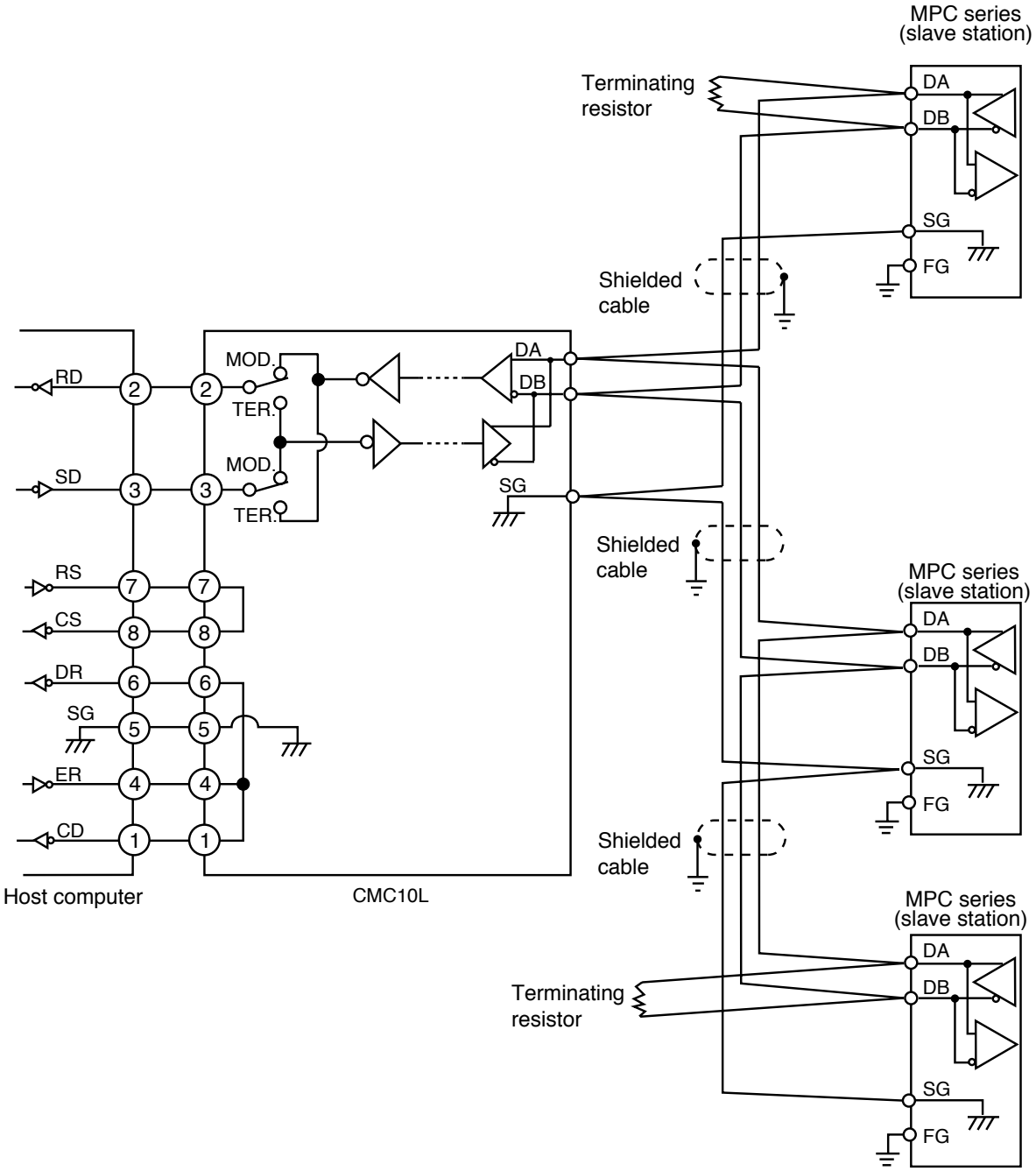
■ Code table

UPPER / LOWER	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 part ( ) is not used for this communication system. (The codes to be used change every instrument.)

■ Connection with CMC10L

The following diagram shows an example of wiring using a straight cable for a host computer in the terminal mode:



! Handling Precautions

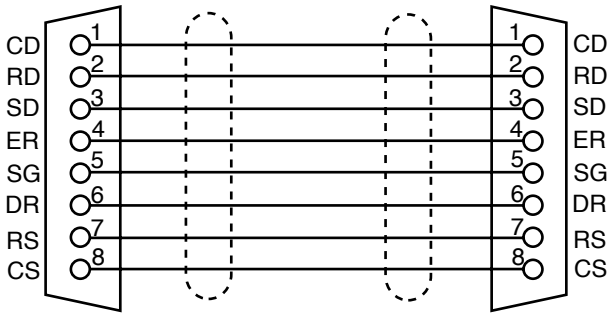
- Connect terminating resistors of 150Ω±5%, 1/2W or more to the both ends of the communication path.
- Ground the shield to the FG at one end of the shield. Make sure that the shield is not grounded ato both ends of the shield.
- Be sure to connect SG terminals each other.
  Failure to do so might cause unstable communications.

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:

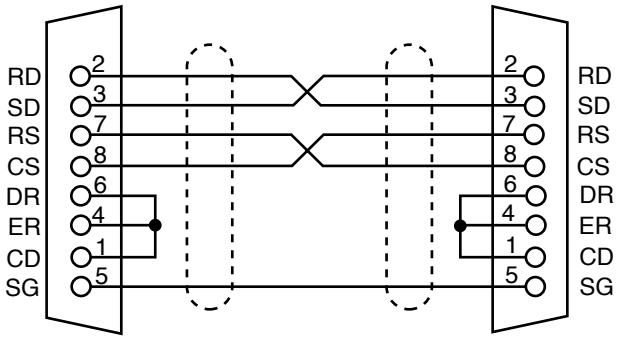
RS-232C	Cable type	MODE switch
TERMINAL	Straight	MODEM
TERMINAL	Cross	TERMINAL
MODEM	Straight	TERMINAL
MODEM	Cross	MODEM

- **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)

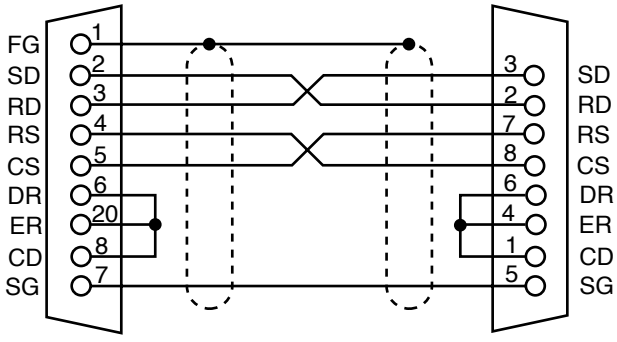


Cross: An RS-232C cable with a D-SUB (9-pin) connector at each end where different number pins are connected (for example, pin 2 to pin 3, and pin 3 to pin 2)



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)



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