



MCF

Air Flowmeter NPT Model

User's Manual

for

Communication Functions



Thank you for purchasing the MCF Air Flowmeter.

This manual contains information for ensuring the correct use of the MCF. It also provides necessary information for installation, maintenance, and troubleshooting.

This manual should be read by those who design and maintain equipment that uses the MCF. Be sure to keep this manual nearby for handy reference.

Azbil Corporation

IMPORTANT

If it is necessary to change the parameters of the MCF flowmeter frequently by communications, write the changes to RAM, not to EEPROM. EEPROM is limited to 10,000 erase/write cycles.

Note that data in RAM is cleared and replaced with data from EEPROM if the power supply to the MCF is interrupted.

NOTICE

Be sure that the user receives this manual 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 manual are subject to change without notice.

Considerable effort has been made to ensure that this manual is free from inaccuracies and omissions. If you should find an error or omission, please contact the azbil Group.

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

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Conventions Used in This Manual

- To prevent injury to the operator and others, and to prevent property damage, the following types of safety precautions are indicated:



Warnings are indicated when mishandling this product might result in death or serious injury.



Cautions are indicated when mishandling this product might result in minor injury to the user, or only physical damage to the product.

- In describing the product, this manual uses the icons and conventions listed below.



Use caution when handling the product.



The indicated action is prohibited.



Be sure to follow the indicated instructions.

Handling Precautions:

Handling Precautions indicate items that the user should pay attention to when handling the MCF.



Note:

Notes indicate information that might benefit the user.



Hand:

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

(1), (2), (3):

Numbers within parentheses indicate steps in a sequence or parts of an explanation.

>>:

Indicates the result of an operation, details displayed on the personal computer or other devices, or the state of the device after operation.

03、P-07






This indicates 7-segment indication on the setup display.

[MODE] key:

This indicates a key on the setup display.

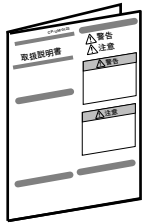
Safety Precautions

CAUTION

	Be sure to turn off the power supply when you connect the MCF. Failure to do so might cause malfunction.
	Do not disassemble the MCF. Doing so might cause malfunction.
	Wire this device properly, according to the standards given in this document, using the specified types of wire and connection procedures. Failure to do so could result in malfunction.
	Use this device within the operating ranges given in the specifications for temperature, humidity, voltage, vibration, shock, mounting direction, atmosphere, etc. Failure to do so might cause malfunction.
	Do not allow wire clippings, metal shavings, water, etc. to enter the device's case. If they do, they could cause faulty operation or device failure.

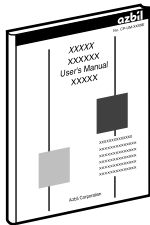
The Role of This Manual

A total of three different manuals are available for the MCF. Read them as necessary for your specific requirements. If a manual you require is not available, contact the azbil Group or its dealer.



MCF Air Flowmeter NPT Model User's Manual for Installation **Manual No. CP-UM-5573E**

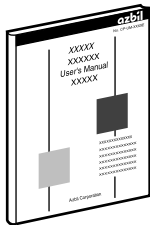
This manual is supplied with the device. Personnel in charge of design and/or manufacture of a system using this device must thoroughly read this manual. This manual describes the safety precautions, installation, wiring, list of parameters, and primary specifications.



MCF Air Flowmeter NPT Model User's Manual for Installation and Configuration

Manual No. CP-SP-1293E

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



MCF Air Flowmeter NPT Model User's Manual for Communication Functions

Manual No. CP-SP-1301E

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

Organization of This User's Manual

This manual is organized as follows:

Chapter 1. OVERVIEW

This chapter describes communication outline of the MCF series.

Chapter 2. WIRING

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

Chapter 3. SETTING

This chapter describes MCF 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 MCF series.

Chapter 6. TROUBLESHOOTING

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

Chapter 7. SPECIFICATIONS

This chapter lists communication specifications for the MCF series.

Appendix

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Chapter 1. OVERVIEW

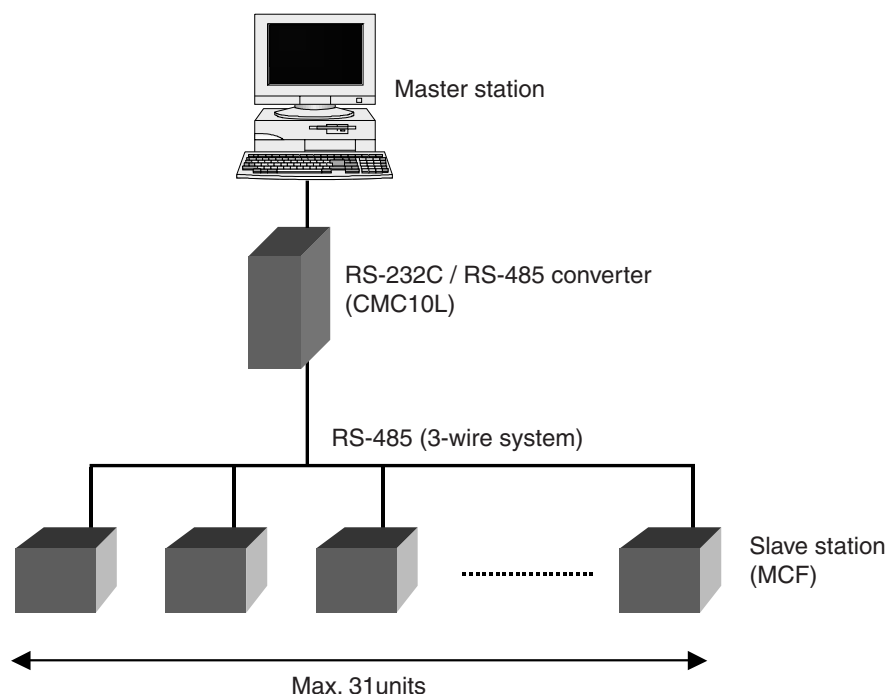
The MCF series flowmeter (hereafter referred to as the MCF or the slave station) can communicate settings and data with a host device, such as a PC or PLC (also called the master station). Users write a customized communication program for this purpose.

■ Features

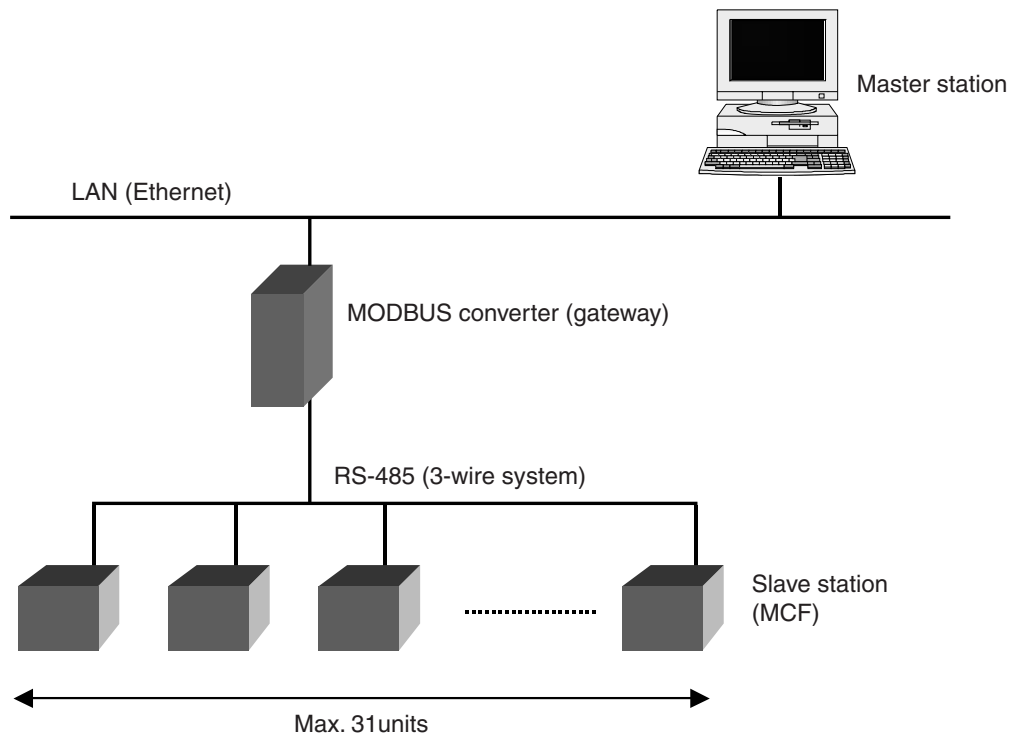
The MCF has the following communications features.

- Remote data collection and parameter setting by RS-485 communications.
- Support for Modbus communications protocol (ASCII/RTU mode).
- With RS-485 communications, up to 31 slave stations can be connected to the master station, which can read instantaneous flow rate and total flow values and various settings from slave stations, and can also write settings to slave stations using the user's own communications program.
- Uses "station addresses" for RS-485 communications to identify connected
- 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.

■ Hardware configuration 1



■ Hardware configuration 2



Chapter 2. WIRING

CAUTION



Be sure to turn off the power supply when you connect the MCF. Failure to do so might cause malfunction.



Do not disassemble the MCF. Doing so might cause malfunction.



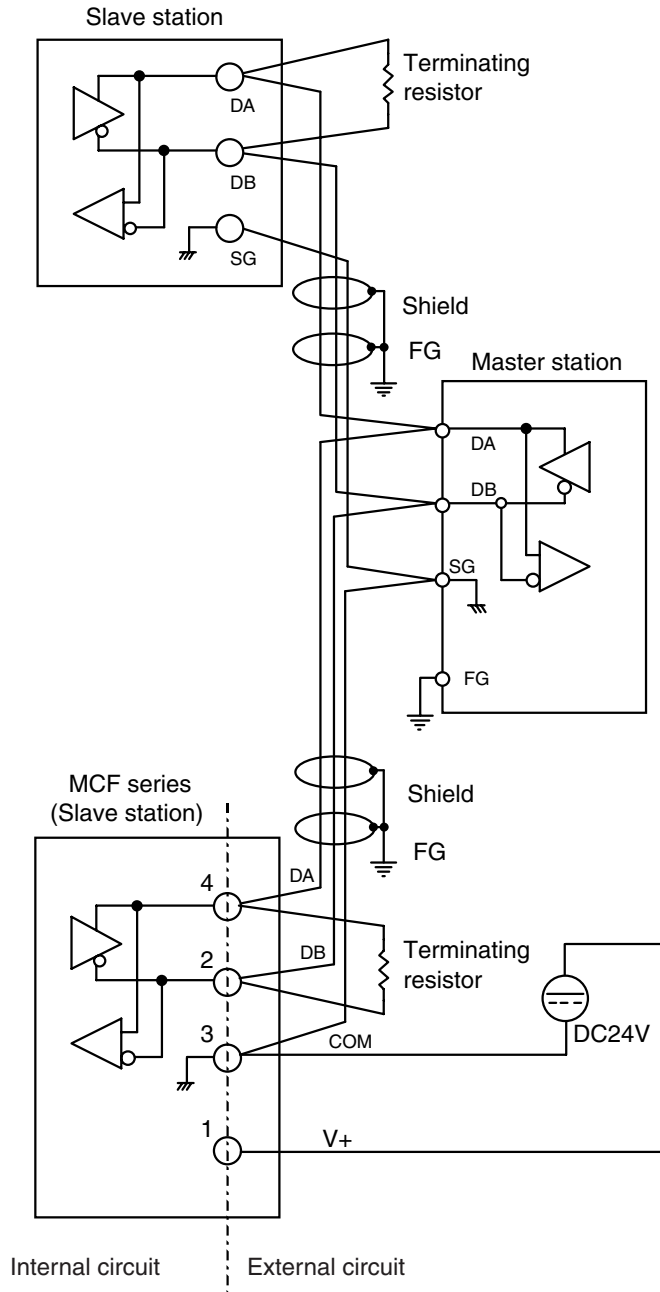
Wire this device properly, according to the standards given in this document, using the specified types of wire and connection procedures. Failure to do so could result in malfunction.



Do not allow wire clippings, metal shavings, water, etc. to enter the device's case. If they do, they could cause faulty operation or device failure.

An example of connection methods is shown below.

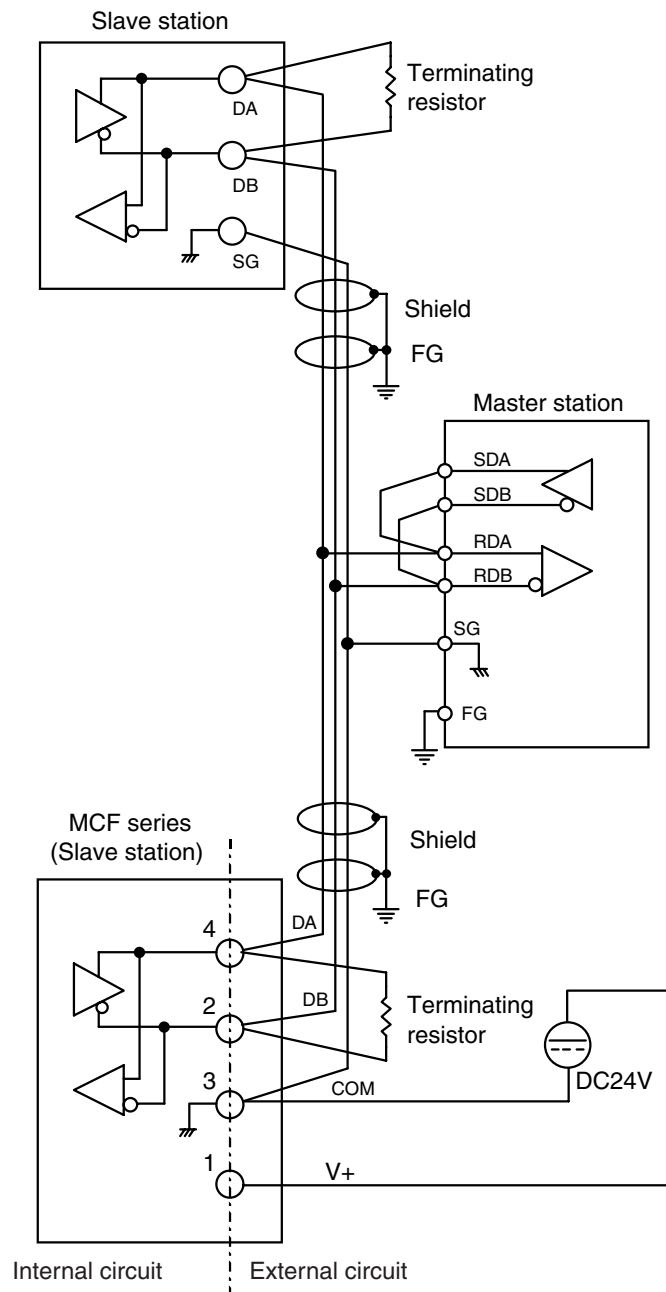
■ Connection with 3-wire system



⚠ Handling Precautions

- Connect terminating resistors of $150\ \Omega \pm 5\%$, 1/2W or more to both ends of the communication path.
- Ground the shield of shielded cable to the frame ground (FG) at one end. Do not ground the shield at both ends.
- Azbil Corporation's CMC10L001A000 controller can be used as a converter for the master station.
- Be sure to connect the SG terminals to each other. Failure to do so might cause unstable communications.

■ Connection with 5-wire system



! Handling Precautions

- Connect terminating resistors of $150\ \Omega \pm 5\%$, 1/2W or more to both ends of the communication path.
- Ground the shield of shielded cable to the frame ground (FG) at one end. Do not ground the shield at both ends.
- Azbil Corporation's CMC10L001A000 controller can be used as a converter for the master station.
- Be sure to connect the SG terminals to each other. Failure to do so might cause unstable communications.

Chapter 3. SETTING

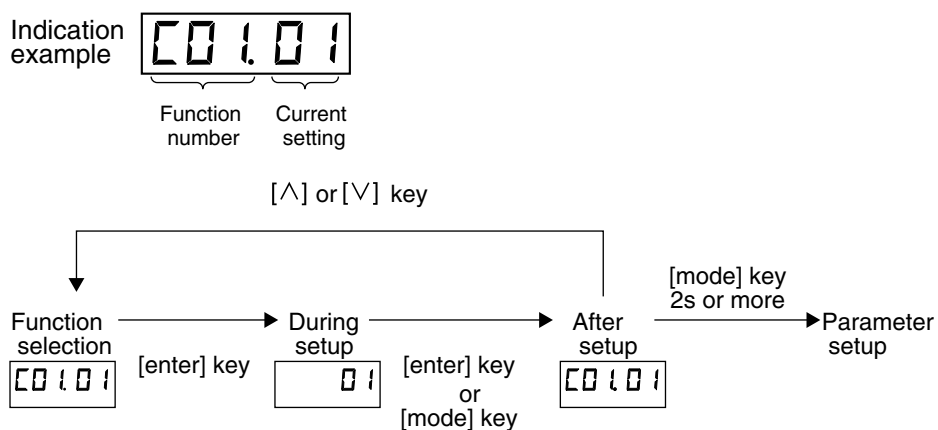
Before starting communication, set the communication condition and station address of the slave station to meet that of the master station.

■ Setting method

Before starting RS-485 communications, follow the procedure below to set the MCF's communication parameters and station address so that they are compatible with the master station.

(1) Push and hold the [mode] key for 2 seconds or more in the normal indication mode.

>> The function number is displayed in the first 3 digits and the current setting is displayed in the last 2 digits.



(2) Change the function setup to the desired item by pushing [v] or [^], and then press [enter].

>> The function setup number goes out, and the only the setting (in the last 2 digits) is shown.

(3) Change the setting with the [v] or [^] key, and then press [enter].

>> The changed setting is now entered, and both the function number and the setting are shown.

If the [mode] key is pressed instead of the [enter] key, the MCF exits setup mode without changing the setting.

(4) Repeat steps (2) to (3) if you want to continue setup.

To exit setup mode, press and hold the [mode] key for 2 seconds or more to move to parameter setup, and then again press and hold the [mode] key for 2 seconds or more to return to normal indication mode.

■ Function settings

Func No.	Name	Settings	Factory setting	Description
530	Station address	01 to 99	00	There is no communication if the address remains set at "00." Set an address that is not already being used by another unit.
531	Transmission speed	00: No communication 01: 19200 bps 02: 9600 bps 03: 4800 bps	02	
532	Communications format	00: 8-bit data, even parity, Stop bit 1 (RTU) 01: 8-bit data, no parity, Stop bit 2 (RTU) 02: 7-bit data, no parity, Stop bit 1 (ASCII) 03: 7-bit data, no parity, Stop bit 2 (ASCII)	00	For RTU, select "00" or "01" due to 8-bit data processing. For ASCII, select "02" or "03" due to 7-bit data processing. If RTU is selected, 8-bit data processing is always applied even though "02" or "03" is chosen.
533	Communications type	00: MODBUS (RTU) 01: MODBUS (ASCII)	00	

! Handling Precautions

- About the default station address setting
The default station address setting is 00. However, this address cannot be used because broadcasting is not supported. Instead, when first setting up the MCF, The special station address 247 can be used. Using the settings Modbus RTU, 8-bit data, even parity, 1 stop bit (RTU), and 9600 bps, and using the station address 247, do as follows.
 - Set EEPROM address 5030 (station address) to a unique address, not used by other slave stations.
 - Send "1" to address 2034 (power reset command) to reset the power of the MCF. Before doing so, be sure to turn off the power of any other slave stations whose station address is set to 00, so as not to affect them.

Chapter 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.

● Supported communication types and function codes

- (1) Transmission Modes

Supports Modbus ASCII and Modbus RTU.

	RTU format	ASCII format
Coding System	8bit binary	ASCII characters: 0–9, A–F
Bits per Bits	8-bit data, even parity, 1 stop bit. The MCF is also compatible with 8-bit data, no parity, 2 stop bits.	7-bit data, even parity, 1 stop bit. The MCF is also compatible with 7-bit data, no parity, 2 stop bits.
Checking System	CRC (Cyclic Redundancy Checking)	LRC (Longitudinal Redundancy Checking)

- (2) Function Codes

Supports the following Modbus public function codes.

Function	Description
0x03	Read Holding Registers (read multiple words)
0x06	Write Single Register (write 1 word)
0x10	Write Multiple Registers (write multiple words)

● Station address

Range: 0 to 99.

If the station address is set to 0, communications are not possible. To enable communications, set the station address at a value from 1 to 99. (In the Modbus communications protocol, if the station address of a device that is processing a command is set to 0, broadcasting activates the device. However, the MCF does not support broadcasting.)

● Maximum number of words

Read : 16 data

Write : 16 data

● Modbus communications frame

The communications frame varies depending on the mode.

● RTU

(1) Communications frames

All messages are written in binary data.

RTU communications frame

Frame structure	Number of bytes	Description
Start > 3.5 characters	0	Silent interval
Address	1	Station address
Function	1	Refer to function code descriptions.
Data	n*	Refer to function code descriptions.
CRC Check code	2	Check code
End > 3.5 characters	0	Silent interval

*1 byte or more.

(2) Silent interval

In RTU mode in Modbus communications protocol, the start and end of commands and responses must be marked by a time without data transmission that is equivalent in duration to at least 3.5 characters (the time varying depending on the baud rate).

The MCF checks for a silent interval with a timer interrupt every 200 μ s.

Silent intervals are illustrated below.

Silent interval times

Transmission speed	MCF silent interval	Time equivalent of 3.5 characters (8-bit data)	
		With parity, 1 stop bit (11 bit)	No parity, 2 stop bits (11 bit)
4800 bps	7.8 to 8 ms	8.0 ms	8.0 ms
9600 bps	3.8 to 4 ms	4.0 ms	4.0 ms
19200 bps	1.8 to 2 ms	2.0 ms	2.0 ms

(3) Check code

In Modbus RTU mode, a CRC check code is applied to both commands and responses.

- Calculation of CRC check code

Calculation of the check code is based on the section from the station address until just before the check code location in the message. (All 8-bit character data is included, but not start bits, stop bits, or parity bits.) The binary data in the message is used in the calculation without any conversion.

The CRC check code (16-bit data) can be calculated by the C language function `get_crc16()`.

In the message, the low byte precedes the high byte in the CRC check code.

This is the opposite of the treatment of other 16-bit data.

```

/*****
Argument 1: Length of character string (number of bytes)
Argument 2: Pointer to beginning of character string
Function value: Calculation result
*****/
UH get_crc16(INT len, UB *p)
{
    UH dt_16;
    UH next;
    UH carry;
    INT i;

    dt_16 = 0xffff;
    while (len > 0) {
        next = (UH)*p;
        dt_16 ^= next;
        for (i = 0; i < 8; i++) {
            carry = (UH)(dt_16 & 0x0001);
            dt_16 >>= 1;
            if (carry != 0) {
                dt_16 ^= 0xA001;
            }
        }
        p++;
        len--;
    }
    return dt_16;
}

```

(4) Example of communications frame

Contents: station address (1), function (03), initial word (2001 [decimal]), number of words to read (1).

01	01H	Address
03	03H	Function
07	07H	Word1, 1st byte
D1	D1H	Word1, 2nd byte
00	00H	Word2, 1st byte
01	01H	Word2, 2nd byte
D5	D5H	CRC 1, 1st byte
47	47H	CRC 2, 2nd byte

● **Calculation of CRC code**

- (1) The check code calculation is based on the section of the message from the station address until just before the check code, and therefore includes “01 03 07D1 00 01.” In this case the result of the calculation is 47D5H. For the method of calculation, see (3) “Check code” above.
- (2) When the result of the calculation, 47D5H, is added to the message, its order is changed so that the low byte precedes the high byte: D547H.

● ASCII

(1) Communications frame

The whole message except for delimiters is written with hexadecimal ASCII codes. The frame differs depending on the communications type.

Note: the MCF accepts only capital letters.

ASCII commands and responses

Frame structure	Number of characters	Description
Start	1 char	':' (3AH). This symbol cannot be changed.
Address	2 chars	Station address (hexadecimal ASCII)
Function	2 chars	Refer to function code descriptions (hexadecimal ASCII)
Data	n-chars	Refer to function code descriptions (hexadecimal ASCII)
LRC	2 chars	LRC (Check code)
CR	1 char	Delimiter CR (0DH)
LF	1 char	Delimiter LF (0AH)

Note: A character (char) = 2 bytes.

(2) Check code

In Modbus ASCII, an LRC code is used for both commands and responses.

- Calculation of LRC check code

Calculation of the check code is based on the section from the station address until just before the check code location in the message. In order to compute the check code, first convert the pairs of hexadecimal ASCII characters in the message to binary data. Sum up all of the target data as an 8-bit number without a carry bit. Then convert the two's complement of the calculated (8-bit) value to 2 hexadecimal ASCII characters. This is the check code. In the message, the high byte precedes the low byte.

If a received message has an odd number of bytes, a check code error will occur. No response will be sent because the LRC check code could not be calculated.

(3) Sample frame

‘:’	3AH	Start
‘0’	30H	Address 1st byte
‘A’	41H	Address 2nd byte
‘0’	03H	Function 1st byte
‘3’	33H	Function 2nd byte
‘0’	30H	Word1 1st byte
‘3’	30H	Word1 2nd byte
‘E’	45H	Word1 3rd byte
‘9’	39H	Word1 4th byte
‘0’	30H	Word2 1st byte
‘0’	30H	Word2 2nd byte
‘0’	30H	Word2 3rd byte
‘2’	32H	Word2 4th byte
‘0’	30H	LRC 1st byte
‘5’	35H	LRC 2nd byte
CF	0DH	
LF	0AH	

● **Sample LRC (check code) calculation**

- (1) Sum up all the bytes from the beginning of the station address until just before the check code location.

$$0AH + 03H + 03H + E9H + 00H + 02H = FBH$$

- (2) The low-order byte of FBH is FBH (no change). The two's complement of FBH is 05H.

- (3) Convert 05H to a 2-byte ASCII code.

0: 30H

5: 35H

Therefore, 30H and 35H are the check code.

● **Abnormal termination codes**

In keeping with the Modbus protocol, when an error occurs there is a response to the error. The same set of error responses is used for all the function codes.

The tables below show the responses to error for RTU and ASCII modes.

RTU mode responses to error

Frame structure	Number of bytes	Description
Start >3.5 characters	0	Silent interval
Address	1	Station address
Function	1	Function code + 0x80
Data	1	The abnormal termination code
CRC Check code	2	Check code
End >3.5 characters	0	Silent interval

ASCII mode responses to error

Frame structure	Frame structure	Description
Start	1 CHAR	';' (3AH). This symbol cannot be changed.
Address	2 CHARS	Station address (hexadecimal ASCII)
Function	2 CHARS	Function code + 0x80 (hexadecimal ASCII)
Data	2 CHARS	The abnormal termination code (hexadecimal ASCII)
LRC Check code	2 CHARS	Check code (hexadecimal ASCII)
CR	1 CHAR	Delimiter CR (0DH)
LF	1 CHAR	Delimiter LF (0AH)

Exception codes

Error code	Item	Remarks
01	ILLEGAL FUNCTION	<ul style="list-style-type: none"> • Unsupported function code. • No processing was executed.
02	ILLEGAL DATA ADDRESS	<ul style="list-style-type: none"> • First word address error (out of range) • Word count error (the specified number includes an illegal address) • Word address conversion error (character error in ASCII communications) • No processing was executed.
03	ILLEGAL DATA VALUE	<ul style="list-style-type: none"> • Reading was not executed because the specified number of words was out of range. • Writing was not executed because the value to write was out of range. • Conversion error in number of words to read or value to write (character error during ASCII communications) • If the numerical value to write is out of range, processing continues except for the relevant addresses. • If a character conversion error occurs during the reception of a data frame, processing is interrupted at the relevant word address and data processing is aborted. However, data processing done before the error occurred remains valid. • Reading/writing is impossible due to communications lock.

● **Conditions under which no response message is sent**

The MCF sends no response messages under the following conditions:

- When it receives a message during initialization (the first 8 seconds or so after power-on).
- When an LRC or CRC error occurs.
- When the data size of a received message exceeds 100 bytes (overflow).
- If a message is received between the time when another received message ends and the sending of the response message ends.
- In ASCII mode, when characters other than colon (:), 1-9, and capital A-F are received.

4 - 2 Command

■Function 0x03 (Read multiple words command)

Function 0x03, Read holding registers, is the command for reading multiple words.

(1) RTU mode

Commands and responses are shown in the table below.

Refer to “RTU mode responses to error” above.

RTU mode send command

Frame structure		Number of bytes	Description
Start		0	Silent interval
Address		1	Station address
Function		1	0x03
Data	Word address (high-order byte)	1	Word address high-order 8 bits
	Word address (low-order byte)	1	Word address low-order 8 bits
	Word count (high-order byte)	1	Data count high-order 8 bits
	Word count (low-order byte)	1	Data count low-order 8 bits
CRC Check code		2	Check code
End		0	Silent interval

Example:

01H	03H	07H	D1H	00H	02H	95H	46H
(1)	(2)	(3)		(4)		(5)	

(1) Station address. (2) Function code. (3) Address of first word.

(4) Number of words to read. (5) CRC.

RTU mode normal response

Frame structure		Number of bytes	Description
Start		0	Silent interval
Address		1	Station address
Function		1	0x03
Data	Number of data bytes	1	Number of 8-bit data bytes (twice the word count)
	First word (high-order)	1	Word high-order 8 bits
	First word (low-order)	1	Low-order 8 bits of word
	:		(Continuation of word)
	nth word (high)	1	Word high-order 8 bits
	nth word (low)	1	Low-order 8 bits of word
CRC Check code		2	Check code
End		0	Silent interval

Example:

01H	03H	04H	00H	00H	00H	01H	3BH	F3H
(1)	(2)	(3)	(4)		(5)		(6)	

(1) Station address. (2) Function code. (3) Words to read × 2 (number of bytes)

(4) Word to read 1. (5) Word to read 2 (6) CRC

(2) ASCII mode

Commands and normal responses are shown below.

For abnormal responses refer to “ASCII mode responses to error” above.

ASCII mode send command

Frame structure		Number of bytes	Description
Start		1	‘:’ fixed
Address		2	Station address (hexadecimal ASCII)
Function		2	‘0’ + ‘3’
Data	Word address (high-order byte)	2	Word address high-order 8 bits (hexadecimal ASCII)
	Word address (low-order byte)	2	Word address low-order 8 bits (hexadecimal ASCII)
	Word count (high-order byte)	2	Data count high-order 8 bits (hexadecimal ASCII)
	Word count (low-order byte)	2	Data count low-order 8 bits (hexadecimal ASCII)
LRC check code		2	Check code (hexadecimal ASCII)
End		2	CR + LF (fixed)

Example:

3AH	30H	31H	30 H	33 H	30 H	37 H	44 H	31 H	30H	30H	30H	31H
:	0	1	0	3	0	7	D	1	0	0	0	2
(1)	(2)	(3)	(4)	(5)								

32H	32H	0DH	0A H
2	2	CR	LF
(6)	(7)		

(1) Beginning of message. (2) Station address. (3) Function code.

(4) Address of first word. (5) Number of words to read. (6) LRC (7) Delimiter.

ASCII mode normal response

Frame structure		Number of bytes	Description
Start		1	‘:’ fixed
Address		2	Station address (hexadecimal ASCII)
Function		2	‘0’ + ‘3’
Data	Number of data bytes	2	Number of 8-bit data bytes (hexadecimal ASCII) (twice the word count)
	First word (high-order)	2	Word high-order 8 bits (hexadecimal ASCII)
	First word (low-order)	2	Low-order 8 bits of word (hexadecimal ASCII) (Continuation of word)
	n th word (high)	2	Word high-order 8 bits (hexadecimal ASCII)
	n th word (low)	2	Low-order 8 bits of word (hexadecimal ASCII)
LRC check code		2	Check code (hexadecimal ASCII)
End		2	CR + LF (fixed)

Example:

3AH	30H	31H	30 H	33 H	30 H	34 H	30H	30H	30H	30H
:	0	1	0	3	0	4	0	0	0	0
(1)	(2)	(3)	(4)	(5)						

30H	30H	30H	31H	46H	36H	0DH	0A H
0	0	0	2	F	6	CR	LF
(6)	(7)	(8)					

(1) Beginning of message. (2) Station address. (3) Function code.

(4) Words to read × 2 (number of bytes) (5) Word to read 1. (6) Word to read 2.

(7) LRC (8) Delimiter.

■ Function 0x06, Write single register (write 1 word command)

(1) RTU mode

Commands and normal responses are shown below. (Commands and normal responses are the same.)

For abnormal responses refer to “RTU mode responses to error” above.

RTU mode send command, normal responses

Frame structure		Number of bytes	Description
Start		0	Silent interval
Address		1	Station address
Function		1	0x06
Data	Word address (high-order byte)	1	Word address high-order 8 bits
	Word address (high-order byte)	1	Word address low-order 8 bits
	Word count (high-order byte)	1	Word high-order 8 bits
	Word count (low-order byte)	1	Word low-order 8 bits
CRC check code		2	Check code
End		0	Silent interval

Example:

01H	06H	07H	D1H	00H	01H	D5H	47H
(1)	(2)	(3)	(4)		(5)		

(1) Station address. (2) Function code. (3) Word address. (4) Word to write. (5) CRC

(2) ASCII mode

Commands and normal responses are shown below. (Commands and normal responses share the same table.)

For abnormal responses refer to “ASCII mode responses to error” above.

ASCII mode commands, normal responses

Frame structure		Number of bytes	Description
Start		1	‘:’ fixed
Address		2	Station address (hexadecimal ASCII)
Function		2	‘0’ + ‘6’
Data	Word address (high-order byte)	2	Word address high-order 8 bits (hexadecimal ASCII)
	Word address (low-order byte)	2	Word address low-order 8 bits (hexadecimal ASCII)
	Word count (high-order byte)	2	Word high-order 8 bits (hexadecimal ASCII)
	Word count (low-order byte)	2	Word low-order 8 bits (hexadecimal ASCII)
LRC check code		2	Check code (hexadecimal ASCII)
End		2	CR + LF (fixed)

Example:

3AH	30H	31H	30H	33H	30H	37H	44H	31H	30H	30H	30H	31H
:	0	1	0	6	0	7	D	1	0	0	0	1
(1)	(2)	(3)	(4)					(5)				

32H	30H	0DH	0AH
2	0	CR	LF
(6)		(7)	

(1) Beginning of message (2) Station address. (3) Function code. (4) Word address (5) Word to write (6) LRC (7) Delimiter.

■ Function 0x10, Write multiple registers (Write multiple words command)

(1) RTU mode

Commands and normal responses are shown below. (The same table applies to both.)

For abnormal responses refer to “RTU mode responses to error” above.

RTU mode commands

Frame structure		Number of bytes	Description
Start		0	Silent interval
Address		1	Station address
Function		1	0x10
Data	Word address (high-order byte)	1	Word address high-order 8 bits
	Word address (low-order byte)	1	Word address low-order 8 bits
	Word count (high-order byte)	1	Data count high-order 8 bits
	Word count (low-order byte)	1	Data count low-order 8 bits
	Number of data bytes	1	Number of 8-bit data bytes (twice the word count)
	First word (high-order)	1	Word high-order 8 bits
	First word (low-order)	1	Word low-order 8 bits
	:		(Continuation of word)
	:		
	nth word (high)	1	Word high-order 8 bits
nth word (low)	1	Word low-order 8 bits	
CRC check code		2	Check code
End		0	Silent interval

Example:

3AH	30H	31H	30 H	33 H	30 H	37 H	44 H	31 H	30H	30H	30H	31H
01H	10H	07H	D1H	00H	02H	04H	00H	01H	00H	02H	C9H	0EH
(1)	(2)	(3)		(4)		(5)	(6)		(7)		(8)	

(1) Station address. (2) Function code. (3) Address of first word. (4) Number of words to write.

(5) Number of bytes to write (twice the number of words to write) (6) Word to write 1.

(7) Word to write 2. (8)CRC

RTU mode normal responses

Frame structure		Number of bytes	Description
Start		0	Silent interval
Address		1	Station address
Function		1	0x10
Data	Word address (high-order byte)	1	Word address high-order 8 bits
	Word address (low-order byte)	1	Word address low-order 8 bits
	Word count (high-order byte)	1	Data count high-order 8 bits
	Word count (low-order byte)	1	Data count low-order 8 bits
CRC check code		2	Check code
End		0	Silent interval

Example:

01H	10H	07H	D1H	00H	02H	10H	85H
(1)	(2)	(3)		(4)		(5)	

(1) Station address. (2) Function code. (3) Address of first word.

(4) Number of words to write (5) CRC

(2) ASCII mode

Commands and normal responses are shown below.

For abnormal responses refer to “ASCII mode responses to error” above.

ASCII mode commands

Frame structure		Number of bytes	Description
Start		1	“:” fixed
Address		2	Station address (hexadecimal ASCII)
Function		2	“1” + “0”
Data	Word address (high-order byte)	2	Word address high-order 8 bits (hexadecimal ASCII)
	Word address (high-order byte)	2	Word address low-order 8 bits (hexadecimal ASCII)
	Word count (high-order byte)	2	Data count high-order 8 bits (hexadecimal ASCII)
	Word count (low-order byte)	2	Data count low-order 8 bits (hexadecimal ASCII)
	Number of data bytes	2	Number of 8-bit data bytes (hexadecimal ASCII) (twice the word count)
	First word (high-order)	2	Word high-order 8 bits (hexadecimal ASCII)
	First word (low-order)	2	Word low-order 8 bits (hexadecimal ASCII)
	:		(Continuation of word)
	:		
	nth word (high)	2	Word high-order 8 bits (hexadecimal ASCII)
nth word (low)	2	Word low-order 8 bits (hexadecimal ASCII)	
LRC check code		2	(hexadecimal ASCII)
End		2	CR + LF (fixed)

Example:

3AH	30H	31H	30H	33H	30H	37H	44H	31H	30H	30H	30H	32H	30H	34H
:	0	1	1	0	0	7	D	1	0	0	0	2	0	4
(1)	(2)	(3)	(4)	(5)	(6)									

30H	30H	30H	31H	30H	30H	30H	31H	30H	45H	0DH	0A H
0	0	0	1	0	0	0	2	0	E	CR	LF
(7)	(8)	(9)	(10)								

- (1) Beginning of message. (2) Station address. (3) Function code. (4) Address of first word.
 (5) Number of words to write. (6) Number of bytes to write (twice the number of words to write)
 (7) Word to write 1. (8) Word to write 2. (9) LRC (10) Delimiter.

ASCII mode normal responses

Frame structure		Number of bytes	Description
Start		1	“:” fixed
Address		2	Station address (hexadecimal ASCII)
Function		2	“1” + “0”
Data	Word address (high-order byte)	2	Word address high-order 8 bits (hexadecimal ASCII)
	Word address (high-order byte)	2	Word address low-order 8 bits (hexadecimal ASCII)
	Word count (high-order byte)	2	Data count high-order 8 bits (hexadecimal ASCII)
	Word count (low-order byte)	2	Data count low-order 8 bits (hexadecimal ASCII)
LRC check code		2	Check code [hexadecimal ASCII]
End		2	CR + LF (fixed)

Example:

3AH	30H	31H	30H	33H	30H	37H	44H	31H	30H	30H	30H	32H
:	0	1	1	0	0	7	D	1	0	0	0	2
(1)	(2)	(3)		(4)				(5)				

31H	35H	0DH	0AH
1	5	CR	LF
(6)		(7)	

(1)Beginning of message. (2)Station address. (3)Function code.
 (4)Address of first word. (5)Number of words to write. (6)LRC (7)Delimiter.

4 - 3 Timing Specifications

■ Timing specifications for instruction and response messages

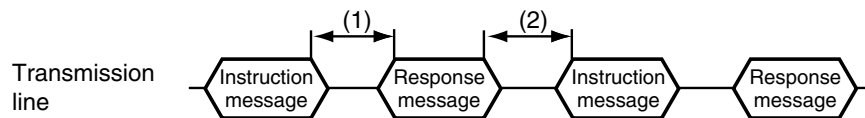
The following precautions regarding the transmission timing of instruction messages from the master station and response messages from the slave station should be observed:

● 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.

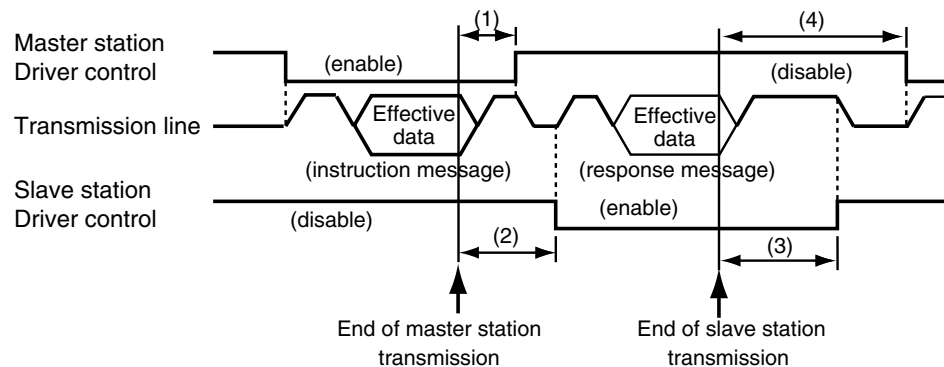
● Transmission start time



- (1) End of master station transmission - Transmission start time of slave station = 2 s max.
(For the master station, the response time-out after the end of instruction message transmission should be set to 2 s.)
- (2) End of slave station transmission - Transmission start time of master station = 10 ms min.
(For the master station, stand by for 10 ms 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 = 500 μ s max.
- (2) End of slave station reception - Driver enable time = 8 ms min.
- (3) End of slave station transmission - Driver disable time = 10 ms max.
- (4) End of master station reception - Driver enable time = 10 ms min.

- 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.

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 flow rate 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 (instantaneous flow rate, 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 MCF series frequently by communication, write data at addresses of RAM. The endurance of EEPROM is limited to 100,000 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 MCF 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 100,000 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	Offset value decimal number (hex number)	Address decimal number (hex number)	Offset value decimal number (hex number)	Address decimal number (hex number)
Device related data	1000 (03E8)	1001 to 1199 (03E9 to 04AF)	4000 (0FA0)	4001 to 4199 (0FA1 to 1067)
Operating status related data	1200 (04B0)	1201 to 1399 (04B1 to 0577)	4200 (1068)	4201 to 4399 (1069 to 112F)
Instantaneous flow rate related data	1400 (0578)	1401 to 1599 (0579 to 063F)	4400 (1130)	4401 to 4599 (1131 to 11F7)
Integrated flow rate related data	1600 (0640)	1601 to 1799 (0641 to 0707)	4600 (11F8)	4601 to 4799 (11F9 to 12BF)
Function setup related data	2000 (07D0)	2001 to 2199 (07D1 to 0897)	5000 (1388)	5001 to 5199 (1389 to 144F)
Parameter setup related data	2200 (0898)	2201 to 2399 (0899 to 095F)	5200 (1450)	5201 to 5399 (1451 to 1517)
Maintenance mode related data	2800 (0AF0)	2801 to 2999 (0AF1 to 0BB7)	5800 (16A8)	5801 to 5999 (16A9 to 176F)

■ Number of data read / write

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

	RAM	EEPROM
Read	16	16
Write	16	16

■ 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 MCF 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:

○ : R/W (Read/Write) possible

× : R/W (Read/Write) impossible (An error code is returned.)

If an undefined address is accessed, an error code is returned.

■ Device related data

Name	Settings	RAM address	R	W	EEPROM address	R	W	Remarks
Model number ID	0 to 65535	1001	○	×	---	-	-	See the description for "1d-01."
Measurement range ID	0 to 65535	1002	○	×	---	-	-	See the description for "1d-02."
Firmware version	0 to 65535	1003	○	×	---	-	-	See the description for "1d-03."
Device address	00 to 99	1004	○	×	---	-	-	See the settings for "C30."
Transmission speed	00: No communication 01: 19200bps 02: 9600bps 03: 4800bps	1005	○	×	---	-	-	See the settings for "C31."
Communication conditions	00: 8-bit data, Even parity, Stop bit 1 (RTU) 01: 8-bit data, No parities, Stop bit 2 (RTU) 02: 7-bit data, No parities, Stop bit 1 (ASCII) 03: 7-bit data, No parities, Stop bit 2 (ASCII)	1006	○	×	---	-	-	See the settings for "C32."
Communications type	00: MODBUS (RTU) 01: MODBUS (ASCII)	1007	○	×	---	-	-	See the settings for "C33."
Serial No. of measuring instrument	0 to 65535	1008	○	×	---	-	-	
Serial No. of flow passage	0 to 65535	1009	○	×	---	-	-	
Date code	0 to 65535	1010	○	×	---	-	-	

■ Operating status related data

Name	Settings	RAM address	R	W	EEPROM address	R	W	Remarks
Alarm status	*1	1201	○	×	---	-	-	
Event status	0: Event OFF 1: Event ON	1202	○	×	---	-	-	*4
Undefined	(normally 0)	1203	○	×	---	-	-	
Decimal point position for total flow	*2	1204	○	×	---	-	-	The same value as address 1611.
Total flow (high)	0 to 65535	1205	○	×	---	-	-	The same value as address 1601.
Total flow (low)	0 to 15258	1206	○	×	---	-	-	The same value as address 1602.
Instantaneous flow rate status	*3	1207	○	×	---	-	-	The same value as address 1401.
Instantaneous flow rate	0 to 65535	1208	○	×	---	-	-	The same value as address 1402.
Base temperature	0 to 35	1209	○	×	---	-	-	The settings are the same as those for function selection $\zeta 11$.
Flow rate units	0 to 5	1210	○	×	---	-	-	The settings are the same as those for function selection $\zeta 02$.

*1: [1201] Alarm status

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

Bit No.	Description	Bit No.	Description
8	AL92 Property error	0	AL40 Flow rate range exceeded
9	AL93 Setup data error	1	AL51 Registered data error 1
10	AL94 Integrated data error	2	AL52 Registered data error 2
11	Undefined (normally 0)	3	AL81 Sensor error 1 (Flowmeter signal error)
12	Undefined (normally 0)	4	AL82 Sensor error 2 (Flowmeter signal unmatched)
13	Undefined (normally 0)	5	AL83 Sensor error 3 (Flowmeter signal unmatched)
14	Undefined (normally 0)	6	AL84 Sensor error 4 (Heater voltage error)
15	Undefined (normally 0)	7	AL91 Instrument information error

*2: Decimal point position for total flow

Depending on the value read out, the decimal point position varies as shown below.

Value	Description
1	No decimal point xxxxx
2	1 digit after the decimal point xxxx.x
4	2 digits after the decimal point xxx.xx
8	3 digits after the decimal point xx.xxx

*3: For details of instantaneous flow rate status, see note *1 under “Instantaneous flow rate related data” on the next page.

*4: The table below shows events that can be checked.

For event selection, see the settings for Event output under “Function setup related data.”

Instantaneous flow rate switch	Instantaneous flow rate upper limit	Turns on when the PV exceeds the value set for instantaneous flow rate event 1 in the parameter setup.
	Instantaneous flow rate lower limit	Turns on when the PV falls below the value set for instantaneous flow rate event 1 in the parameter setup.
	Instantaneous flow rate within range	Turns on when the PV is within the range set for instantaneous flow rate events 1 and 2 in the parameter setup.
Integrated flow	Integrated count-up	Turns on when the integrated flow exceeds the value set for integrated flow event in the parameter setup.
	Integrated countdown	Turns on when the integrated data becomes 0, decreasing from the value set for integrated flow event in the parameter setup.
Alarm output	Alarm occurrence	Turns on when an alarm occurs.

■ Instantaneous flow rate related data

Name	Settings	RAM address	R	W	EEPROM address	R	W	Remarks
Instantaneous flow rate status	*1	1401	○	×	---	-	-	
Instantaneous flow rate *2	0 to 65535	1402	○	×	---	-	-	
Flow rate units	0 to 5	1403	○	×	---	-	-	See the settings for "C02."
Peak value status	*1	1404	○	×	---	-	-	
Instantaneous flow rate peak value *2	0 to 65535	1405	○	×	---	-	-	
Low value status	*1	1406	○	×	---	-	-	
Instantaneous flow rate low value *2	0 to 65535	1407	○	×	---	-	-	
Peak/low value reset	0 to 2	1408	○	○	---	-	-	When data is read, 0 is always read out. Writing "1" resets the peak value. Writing "2" resets the low value.

*1: Instantaneous flow rate status, peak value status, and low value status

Instantaneous flow rate status

Bit number	Description
0	Undefined
1	1 digit after the decimal point: xxxx.x 10 ⁻¹ (0: OFF 1: ON)
2	2 digit after the decimal point: xxxx.x 10 ⁻² (0: OFF 1: ON)
3	3 digit after the decimal point: xxxx.x 10 ⁻³ (0: OFF 1: ON)
4	4 digit after the decimal point: xxxx.x 10 ⁻⁴ (0: OFF 1: ON)
5	Undefined
6	SFLG Sensor signal direction discrimination flag (0: Normal direction, 1: Reverse direction) For internal processing, so usually not used.
7	MFLG Instantaneous flow rate minus flag (0: Normal direction, 1: Reverse direction)
8~15	Undefined (normally 0)

- Bits No. 1 to 4 indicate the decimal point positions for the instantaneous flow rate. If all of them are set to 0, there is no decimal point.

*2: Instantaneous flow rate

Displays the instantaneous flow rate value used for flow rate output.

The decimal point is determined by one of decimal point flags of bits 0 to 4 in the instantaneous flow rate status (address 1402). For example, if the read value of instantaneous flow rate is "xxx" H (decimal: 1234) and bit 2 of Instantaneous flow rate status is ON, the displayed instantaneous flow rate is calculated as $1234 \times 10^{-2} = 12.34$.

The flow rate unit used is the one selected at address 2002.

■ Integrated flow rate related data

Name	Data range	RAM address	R	W	EEPROM address	R	W	Remarks
Integrated flow (last digits) *1	0 to 65535	1601	○	○	4601	○	○	Be sure to use 1 command, namely the command for reading continuous words, to read the peak and low values. If they are read separately with 2 commands, they may not be read correctly.
Integrated flow (first digits) *1	0 to 15258	1602	○	○	4602	○	○	
Cost (last digits) *1	0 to 65535	1603	○	×	4603	×	×	
Cost (first digits) *1	0 to 15258	1604	○	×	4604	×	×	
Reverse integrated flow (last digits) *1	0 to 65535	1605	○	○	4605	○	○	
Reverse integrated flow (first digits) *1	0 to 15258	1606	○	○	4606	○	○	
Total integrated flow (last digits) *1	0 to 65535	1607	○	×	4607	×	×	
Total integrated flow (first digits) *1	0 to 15258	1608	○	×	4608	×	×	
Integrated flow before resetting (last digits) *1	0 to 65535	1609	○	×	4609	×	×	
Integrated flow before resetting (first digits) *1	0 to 15258	1610	○	×	4610	×	×	
Decimal point position for total flow	*2	1611	○	×	4611	×	×	
Undefined	(normally 0)	1612 to 1630	○	×	4612 to 4630	×	×	
Reset command for total flow	0 to 65535	1631	○	○	4631	–	–	Writing “1” resets the total flow value, total backflow value, and cost displays to 0. When data is read, 0 is always read out. If any other value is input, there is no response.
Permission for rewriting total flow value	0 to 65535	1632	○	○	---	–	–	If “1” is input, writing total flow values (1601, 1602) and total backflow values (1605, 1606) is allowed. If any other value is input, changing the settings is not allowed.

*1: Processing of total flow high- and low-order data

To read each total flow value, use 1 command, namely the command for reading continuous words. After read-out of the data, do the following calculation:
(High value × 65536) + Low value.

Example: If the total flow high-order value is 000A (decimal: 10) and the low-order value is 1B3A (decimal: 6970), the calculation is done as follows: (10 × 65536) + 6970 = 662330

*2: Decimal point position for total flow

The table below shows that the decimal point position varies depending on the value read.

Value	Description
1	No decimal point xxxxx
2	1 digit after the decimal point xxxx.x
4	2 digits after the decimal point xxx.xx
8	3 digits after the decimal point xx.xxx

■ Function setup related data

Name	Settings	RAM address	R	W	EEPROM address	R	W	Remarks
Key lock setting	00: Unlocked 01: Key locked	2001	○	○	5001	○	○	The available settings are the same as those for “ L01. ”
Flow rate units	Unit of instantaneous flow rate and 00: L/min, L 01: m ³ /h, m ³ 02: m ³ /min, m ³ 03: kg/h, kg 04: CFH 05: CFM	2002	○	○	5002	○	○	The available settings are the same as those for “ L02. ”
Event output	00: Not used 01: Instantaneous flow rate upper limit 02: Instantaneous flow rate lower limit 03: Within range for instantaneous flow rate 04 to 06: (Reserved) Does not affect any operations. 07: Set value reached by integrated flow count-up 08: (Reserved) Does not affect any operations. 09: Zero reached by integrated flow countdown 10 to 13: (Reserved) Does not affect any operations. 14: Alarm 15: (Reserved) Does not affect any operations.	2003	○	○	5003	○	○	The available settings are the same as those for “ L03. ” Communications models have no external outputs. The blinking LED (EV lamp) alone indicates an event.
Normal indication	00: Instantaneous flow rate indication 01: Last digits of integrated flow 02: First digits of integrated flow 03: No display mode	2004	○	○	5004	○	○	The available settings are the same as those for “ L04. ”
Event standby	00: Disabled 01: Enabled	2005	○	○	5005	○	○	The available settings are the same as those for “ L07. ”
Gas type	00: Air, nitrogen (fixed)	2006	○	○	5006	○	○	The available settings are the same as those for “ L08. ”
Operating pressure	00: 0.3 MPa standard 01: 0.1 MPa standard 02: 0.5 MPa standard 03: 0.7 MPa standard	2007	○	○	5007	○	○	The available settings are the same as those for “ L10. ”
Reference temperature	00 to 35 °C (every 1 °C)	2008	○	○	5008	○	○	The available settings are the same as those for “ L11. ”
Integrated flow option	00: Integrate only normal flow 01: Integrate both normal flow and reverse flow (as a minus)	2009	○	○	5009	○	○	The available settings are the same as those for “ L12. ”

Name	Settings	RAM address	R	W	EEPROM address	R	W	Remarks
Undefined	(normally 0)	2010 to 2029	○	×		×	×	
Station address (setting effective on reboot)	00 to 99	---	-	-	5030	○	○	The settings will become effective at the next power-on. * 00 is the factory setting. Use keys for setting.
Transmission speed (setting effective on reboot)	00: No communication 01: 19200 bps 02: 9600 bps 03: 4800 bps	---	-	-	5031	○	○	The settings will become effective at the next power-on.
Data format (setting effective on reboot)	00: 8-bit data, Even parity, 1 stop bit 01: 8-bit data, No parity, 2 stop bits 02: 7-bit data, Even parity, 1 stop bit 03: 7-bit data, No parity, 2 stop bits	---	-	-	5032	○	○	The settings will become effective at the next power-on. * In RTU mode, even if 02 or 03 is set, 8-bit data processing will be automatically imposed.
Communication conditions (setting effective on reboot)	00: MODBUS (RTU) 01: MODBUS (ASCII)	---	-	-	5033	○	○	The settings will become effective at the next power-on.
Power-on reset	0: Disabled 1: Power-on reset	2034	○	○	---	-	-	Writing "1" resets the power. After the reset, allow 10 seconds before resuming communications. When data is read, 0 is always read out.

Parameter setup related data

Name	Settings	RAM address	R	W	EEPROM address	R	W	Remarks
Event 1 instantaneous flow rate 1	Any flow rate within a range equivalent to 0 to 400 % FS can be set.*1	2201	<input type="radio"/>	<input type="radio"/>	5201	<input type="radio"/>	<input type="radio"/>	The available settings are the same as those for "E1.SP."
Hysteresis for event 1	0 to 10	2202	<input type="radio"/>	<input type="radio"/>	5202	<input type="radio"/>	<input type="radio"/>	The available settings are the same as those for "E1.HYS."
ON delay for event 1	0 to 60	2203	<input type="radio"/>	<input type="radio"/>	5203	<input type="radio"/>	<input type="radio"/>	The available settings are the same as those for "E1.DLY."
Event 2 instantaneous flow rate 2	Any flow rate within a range equivalent to 0 to 400 % FS can be set.*1	2204	<input type="radio"/>	<input type="radio"/>	5204	<input type="radio"/>	<input type="radio"/>	The available settings are the same as those for "E2.SP."
Hysteresis for event 2	0 to 10	2205	<input type="radio"/>	<input type="radio"/>	5205	<input type="radio"/>	<input type="radio"/>	The available settings are the same as those for "E2.HYS."
ON delay for event 2	0 to 60	2206	<input type="radio"/>	<input type="radio"/>	5206	<input type="radio"/>	<input type="radio"/>	The available settings are the same as those for "E2.DLY."
Output correction factor	100 to 2000	2207	<input type="radio"/>	<input type="radio"/>	5207	<input type="radio"/>	<input type="radio"/>	The available settings are the same as those for "CF." Since the decimal point is omitted, "100" here means 0.100.
Low flow cutoff	1 to 50	2208	<input type="radio"/>	<input type="radio"/>	5208	<input type="radio"/>	<input type="radio"/>	The available settings are the same as those for "LFCUT."
Upper limit for indication	100 to 200	2209	<input type="radio"/>	<input type="radio"/>	5209	<input type="radio"/>	<input type="radio"/>	The available settings are the same as those for "HLT."
Last 5 digits of integrated flow (event setup)	0 to 65535	2210	<input type="radio"/>	<input type="radio"/>	5210	<input type="radio"/>	<input type="radio"/>	The available settings are the same as those for "E1.LO."
First 4 digits of integrated flow (event setup)	0 to 15258	2211	<input type="radio"/>	<input type="radio"/>	5211	<input type="radio"/>	<input type="radio"/>	The available settings are the same as those for "E1.HI."
Flow rate cost multiplier	10 to 1000	2212	<input type="radio"/>	<input type="radio"/>	5212	<input type="radio"/>	<input type="radio"/>	The available settings are the same as those for "COST." Since the decimal point is omitted, "10" here means 1.0.

*1 The setting range depends on the model number and the flow rate indication units. See the table below.

There is no decimal point in write/read data. As shown below, the decimal point position varies according to the setting for Flow rate units under "Function setup related data" above.

Flow rate unit	MCF0080	MCF0150	MCF0151	MCF0250	MCF0400	MCF0500
00: [L/min]	0 to 800	0 to 2000	0 to 4000	0 to 12000	0 to 24000	0 to 48000
01: [m ³ /h]	0 to 48.0	0 to 120.0	0 to 240.0	0 to 720.0	0 to 1440.0	0 to 2880.0
02: [m ³ /min]	0 to 0.800	0 to 2.000	0 to 4.000	0 to 12.000	0 to 24.000	0 to 48.000
03: [kg/h]	0 to 62.1	0 to 155.2	0 to 310.4	0 to 931.0	0 to 1862.0	0 to 3724.0

■ Maintenance mode

Name	Settings	RAM address	R	W	EEPROM address	R	W	Remarks
Calculation filter	1 to 32	2801	○	○	5801	○	○	The available settings are the same as those for "FLT."
Measurement cycle	5 to 100	2802	○	○	5802	○	○	The available settings are the same as those for "CYCLE"
Pressure correction adjustment	800 to 1200	2803	○	○	5803	○	○	The available settings are the same as those for "PSCF1." Since the decimal point is omitted, the data range is actually 0.8 to 1.200.
Pressure correction adjustment	800 to 1200	2804	○	○	5804	○	○	The available settings are the same as those for "PSCF2." Since the decimal point is omitted, the data range is actually 0.8 to 1.200.
Pressure correction adjustment	800 to 1200	2805	○	○	5805	○	○	The available settings are the same as those for "PSCF3." Since the decimal point is omitted, the data range is actually 0.8 to 1.200.
Flow path identifier 0	0 to 32768	2806	○	×	---	-	-	The available settings are the same as those for "SP.0." (Since the measurement unit cannot be changed on the MCF0080, MCF0150, and MCF0151, the settings are fixed.)
Flow path identifier 1	0 to 32768	2807	○	×	---	-	-	The available settings are the same as those of SP.1." (Since the measurement unit cannot be changed on the MCF0080, MCF0150, and MCF0151, the settings are fixed.)
Flow path identifier 2	0 to 32768	2808	○	×	---	-	-	The available settings are the same as those for "SP.2." (Since the measurement unit cannot be changed on the MCF0080, MCF0150, and MCF0151, the settings are fixed.)
Model number	0 to 5	2809	○	×	---	-	-	The available settings are the same as those for "SYS01."
Reserved	0 to 9999	2810	○	×	---	-	-	The available settings are the same as those for "P-Code." This item is usually not used because it is for flowmeter maintenance use. Keep the setting at 0.

Chapter 6. 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 MCF 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 MCF series side.

Transmission speed : 4800, 9600, 19200 bps

Communication parameters:

Available settings	ASCII	RTU
Data length: 8 data bits, 1 stop bit, even parity	×	○
Data length: 8 data bits, 2 stop bits, no parity	×	○
Data length: 7 data bits, 1 stop bit, even parity	○	×
Data length: 7 data bits, 2 stop bits, no parity	○	×

“X” means that communication is not possible.

- (4) Does the communication timing conform to the specifications in section 4-3, Timing Specifications (page 4-14)?
- (5) Check if the destination address of the command frame transmitted from the host computer meets the address set to the MCF series.
The address of the MCF series set to “0” for factory setting.
Even when the destination address of the command frame is set to 00 (30H, 30H), the MCF series does not respond to such a message.
- (6) Are those multi-dropped MCF series being operated themselves with different station address setups?

Chapter 7. SPECIFICATIONS

■ RS-485 specifications

Item	Remarks
Transmission mode	Balanced
Transmission line	3-wire system
Transmission speed (bps)	2400, 4800, 9600, 19200, 38400
Transmission distance	500m max.
Communications flow	Half duplex
Synchronization	Start-stop synchronization
Data format	8 data bits, 1 stop bit, even parity (RTU) 8 data bits, 2 stop bits, no parity (ASCII) 7 data bits, 1 stop bit, even parity (RTU) 7 data bits, 2 stop bits, no parity (ASCII)
Error detection	Parity check, checksum
Station address	0 to 99 (Communication function is inhibited when set to "0".)
Network type	1: N (31 units or less)

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			"	2	B	R	b	r
3			#	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			*	:	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.)

Terms and Conditions

We would like to express our appreciation for your purchase and use of Azbil Corporation's products.

You are required to acknowledge and agree upon the following terms and conditions for your purchase of Azbil Corporation's products (field instruments, control valves, and control products), unless otherwise stated in any separate document, including, without limitation, estimation sheets, written agreements, catalogs, specifications and instruction manuals.

1. Warranty period and warranty scope

1.1 Warranty period

Azbil Corporation's products shall be warranted for one (1) year from the date of your purchase of the said products or the delivery of the said products to a place designated by you.

1.2 Warranty scope

In the event that Azbil Corporation's products has any failure attributable to azbil during the aforementioned warranty period, azbil shall, without charge, deliver a replacement for the said product to the place where you purchased, or repair the said product and deliver it to the aforementioned place.

Notwithstanding the foregoing, any failure falling under one of the following shall not be covered under this warranty:

- (1) Failure caused by your improper use of Azbil Corporation's products (noncompliance with conditions, environment of use, precautions, etc. set forth in catalogs, specifications, instruction manuals, etc.);
- (2) Failure caused for other reasons than Azbil Corporation's products;
- (3) Failure caused by any modification or repair made by any person other than azbil or azbil's subcontractors;
- (4) Failure caused by your use of Azbil Corporation's products in a manner not conforming to the intended usage of that product;
- (5) Failure that the state-of-the-art at the time of Azbil Corporation's shipment did not allow us to predict; or
- (6) Failure that arose from any reason not attributable to Azbil Corporation, including, without limitation, acts of God, disasters, and actions taken by a third party.

Please note that the term "warranty" as used herein refers to equipment-only-warranty, and Azbil Corporation shall not be liable for any damages, including direct, indirect, special, incidental or consequential damages in connection with or arising out of Azbil Corporation's products.

2. Ascertainment of suitability

You are required to ascertain the suitability of Azbil Corporation's products in case of your use of the same with your machinery, equipment, etc. (hereinafter referred to as "Equipment") on your own responsibility, taking the following matters into consideration:

- (1) Regulations and standards or laws that your Equipment is to comply with.
- (2) Examples of application described in any documents provided by Azbil Corporation are for your reference purpose only, and you are required to check the functions and safety of your Equipment prior to your use.
- (3) Measures to be taken to secure the required level of the reliability and safety of your Equipment in your use. Although Azbil Corporation is constantly making efforts to improve the quality and reliability of Azbil Corporation's products, there exists a possibility that parts and machinery may break down. You are required to provide your Equipment with fool-proof design, fail-safe design, anti-flame propagation design, safety design, or the like so that the said Equipment may satisfy the level of the reliability and safety required in your use, whereby preventing any occurrence of physical injuries, fires, significant damage, and so forth.

3. Precautions and restrictions on application

Azbil Corporation's products other than those explicitly specified as applicable (e.g. azbil Limit Switch For Nuclear Energy) shall not be used in a nuclear energy controlled area (radiation controlled area). Any Azbil Corporation's products shall not be used for/with medical equipment.

In addition,

you are required to conduct a consultation with our sales representative and understand detail specifications, cautions for operation, and so forth by reference to catalogs, specifications, instruction manual, etc. in case that you intend to use Azbil Corporation's products for any purposes specified in (1) through (6) below.

Moreover, you are required to provide your Equipment with fool-proof design, fail-safe design, anti-flame propagation design and other designs of protection/safety circuit on your own responsibility to ensure the reliability and safety, whereby preventing problems caused by failure or nonconformity.

- (1) For use under such conditions or in such environments as not stated in technical documents, including catalogs, specification, and instruction manuals
- (2) For use of specific purposes, such as:
 - * Nuclear energy/radiation related facilities
[For use outside nuclear energy controlled areas] [For use of Azbil Corporation's Limit Switch For Nuclear Energy]
 - * Machinery or equipment for space/sea bottom
 - * Transportation equipment
[Railway, aircraft, vessels, vehicle equipment, etc.]
 - * Antidisaster/crime-prevention equipment
 - * Burning appliances
 - * Electrothermal equipment
 - * Amusement facilities
- (3) Supply systems such as electricity/gas/water supply systems, large-scale communication systems, and traffic/air traffic control systems requiring high reliability
- (4) Facilities that are to comply with regulations of governmental/public agencies or specific industries
- (5) Machinery or equipment that may affect human lives, human bodies or properties
- (6) Other machinery or equipment equivalent to those set forth in items (1) to (5) above which require high reliability and safety

4. Precautions against long-term use

Use of Azbil Corporation's products, including switches, which contain electronic components, over a prolonged period may degrade insulation or increase contact-resistance and may result in heat generation or any other similar problem causing such product or switch to develop safety hazards such as smoking, ignition, and electrification.

Although acceleration of the above situation varies depending on the conditions or environment of use of the products, you are required not to use any Azbil Corporation's products for a period exceeding ten (10) years unless otherwise stated in specifications or instruction manuals.

5. Recommendation for renewal

Mechanical components, such as relays and switches, used for Azbil Corporation's products will reach the end of their life due to wear by repetitious open/close operations.

In addition, electronic components such as electrolytic capacitors will reach the end of their life due to aged deterioration based on the conditions or environment in which such electronic components are used. Although acceleration of the above situation varies depending on the conditions or environment of use, the number of open/close operations of relays, etc.

as prescribed in specifications or instruction manuals, or depending on the design margin of your machine or equipment, you are required to renew any Azbil Corporation's products every 5 to 10 years unless otherwise specified in specifications or instruction manuals.

Field instruments (sensors such as pressure/flow/level sensors, regulating valves, etc.) will reach the end of their life due to aged deterioration of parts.

For those parts that will reach the end of their life due to aged deterioration, recommended replacement cycles are prescribed. You are required to replace parts based on such recommended replacement cycles.

6. Other precautions

Prior to your use of Azbil Corporation's products, you are required to understand and comply with specifications (e.g., conditions and environment of use), precautions, warnings/cautions/notices as set forth in the technical documents prepared for individual Azbil Corporation's products, such as catalogs, specifications, and instruction manuals to ensure the quality, reliability, and safety of those products.

7. Changes to specifications

Please note that the descriptions contained in any documents provided by Azbil Corporation are subject to change without notice for improvement or for any other reason.

For inquires or information on specifications as you may need to check, please contact our branch offices or sales offices, or your local sales agents.

8. Discontinuance of the supply of products/parts

Please note that the production of any Azbil Corporation's products may be discontinued without notice.

For repairable products, we will, in principle, undertake repairs for five (5) years after the discontinuance of those products. In some cases, however, we cannot undertake such repairs for reasons, such as the absence of repair parts.

For field instruments, we may not be able to undertake parts replacement for similar reasons.

azbil

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