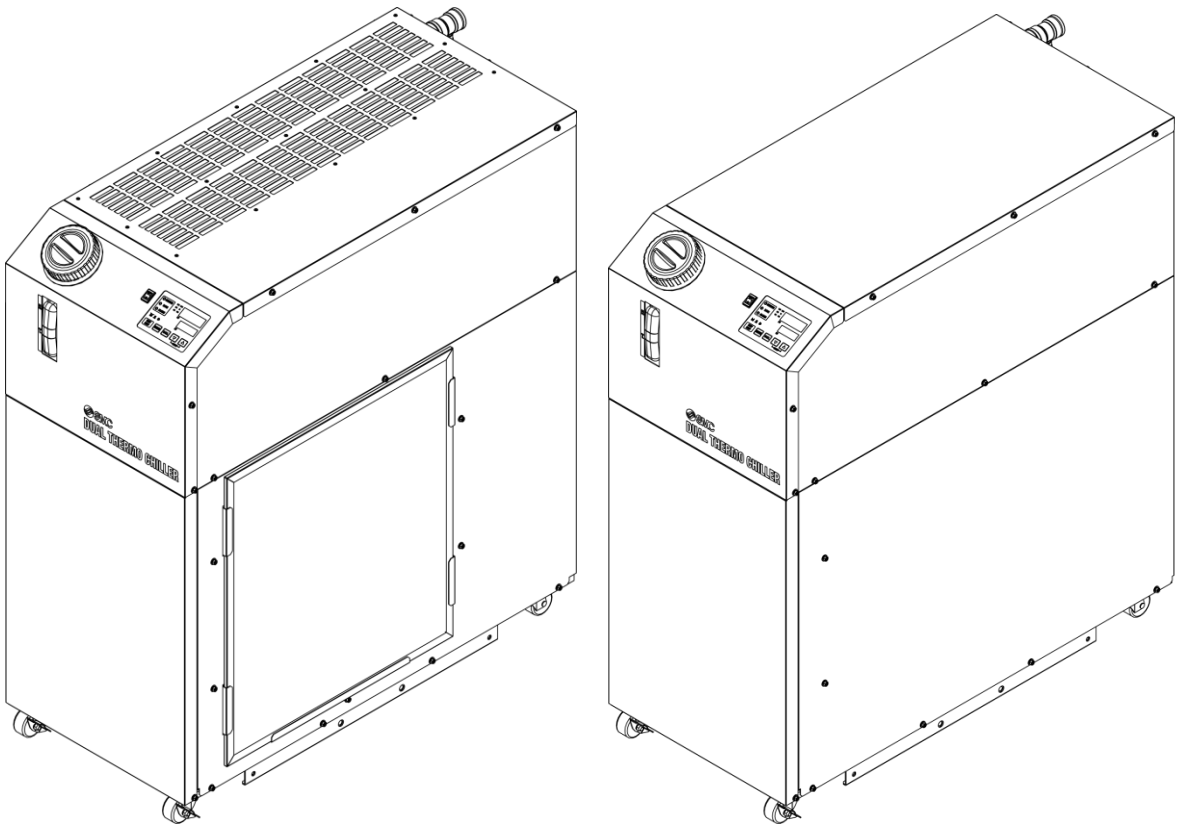
Operation Manual
Communication function

Thermo-chiller

HRLE Series



Keep this manual available whenever necessary

To Users,

Thank you for purchasing SMC's Thermo chiller (hereinafter referred to as the "product").

For safety and long life of the product, be sure to read this operation manual (hereinafter referred to as the "manual") and clearly understand the contents.

- Be sure to read and follow all instructions noted with "Warning" or "Caution" in this manual.
- This manual is intended to explain the communication function. Only people who understand the communication function through this manual or who performs installation and operation of or have knowledge about industrial machines are allowed to work on the product.
- This manual and other documents do not constitute a contract, and will not affect any existing agreements or commitments.
- It is strictly prohibited to copy this manual entirely or partially for the use by the third party without prior permission from SMC.

Note: This manual is subject to possible change without prior notice.

Contents

Chapter 1 Read before using

The communication of this product consists of contact input/output communication and serial communication.

The serial communication protocol is a MODBUS.

Depending on the customer's specification, communication can be changed to contact input/output communication or serial communication.

Table 1-1 Communication method

Contact input/output communication		This product is equipped with a terminal which runs / stops the product by remote control and a terminal which can pick up alarm signals. The terminals can be changed depending on the customer's application.
Serial communication	MODBUS standard protocol	Serial communication (RS-485) enables remote control of run / start of the product, temperature setting, and details of product condition and alarm condition can be obtained.

●If using contact input/output communication, refer to "Chapter 2".

●If using serial communication , refer to "Chapter 3".

1.1 Operation mode and operation method

LOCAL, DIO and SERIAL are available as the operation modes. Table 1-2 Operation modesTable 1-2 explains the operation modes. The default setting is LOCAL.

The operation method depends on the operation mode. Table 1-3 shows how the operation mode and method of operation are related.

Table 1-2 Operation modes

Operation mode	Description	Contents	Display
LOCAL	Run / stop and circulating fluid temperature setting are possible with the operation display panel.	Set the operation mode to "LOCAL".	To display the "LOC"
DIO	Run / stop by contact input. Circulating fluid temperature setting is done at the operation display panel.	Set the operation mode to "DIO".	To display the "DIO"
SERIAL	Run / stop and circulating fluid temperature setting are possible with the serial communication(RS-485).	Set the operation mode to "SERIAL".	To display the "SER"

Table 1-3 Operation mode and operation

Operation \ Operation mode		LOCAL	DIO	SERIAL
Operation display panel	Run / Stop	○	×	×
Operation display panel	Circulating fluid temperature setting	○	○	×
Operation display panel	Settings other than circulating fluid temperature setting	○	○	○
Touch panel	Condition reading	○	○	○
Contact input/output communication	Run/Stop	×	○	×
Contact input/output communication	Condition reading	○	○	○
Reading of the external switch		○	○*1	○
Serial communication	Run / Stop	×	×	○
Serial communication	Circulating fluid temperature setting	×	×	○
Serial communication	Condition reading	○	○	○

*1 Only one external switch can be connected

○ : Applicable
× : Not Applicable

1.2 Change of operation mode

There are the following methods to change the operation mode.
・Change by operation display panel
・Change by mode request

■About mode request
The mode request is the ability to change the operation mode by the serial communication.
When switching from 0 to 1 for mode request flag, the mode request becomes effective and the operation mode changes.

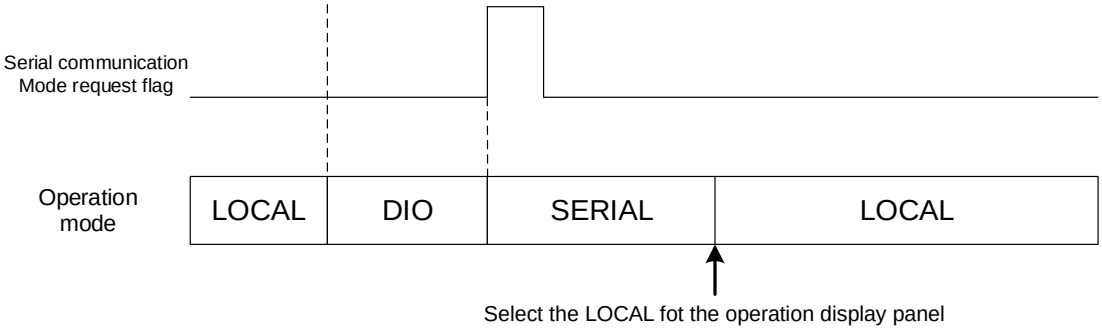


Fig.1-1 Opreration mode

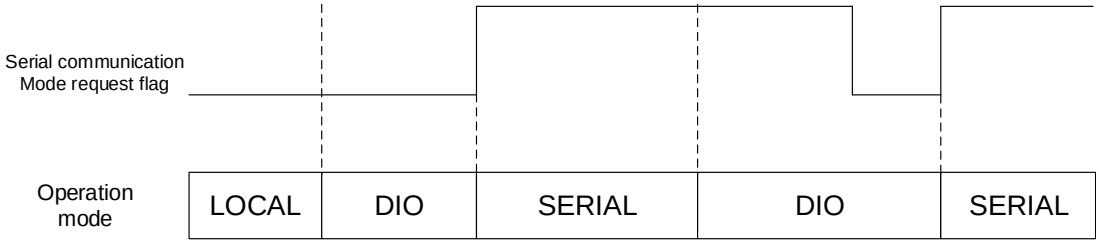


Fig.1-2 Mode switching by the mode request (ON state mixed)

1.3 Communication Terminal Block

The communication terminal block In the lower left of the electrical component box is used for communication.
Fig.1-3 shows the location of the communication terminal block.

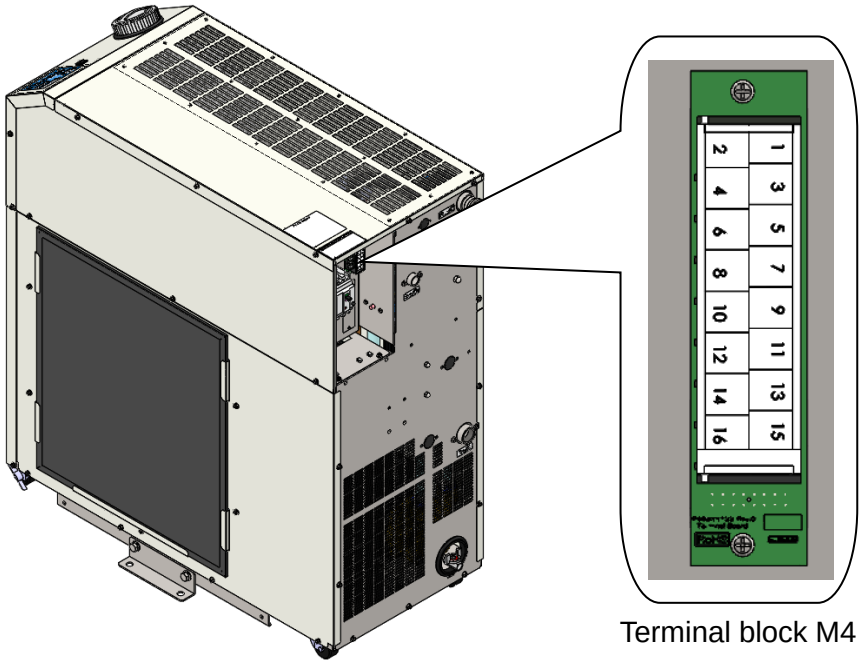


Fig.1-3 Communication port

1.4 Operation display panel flow

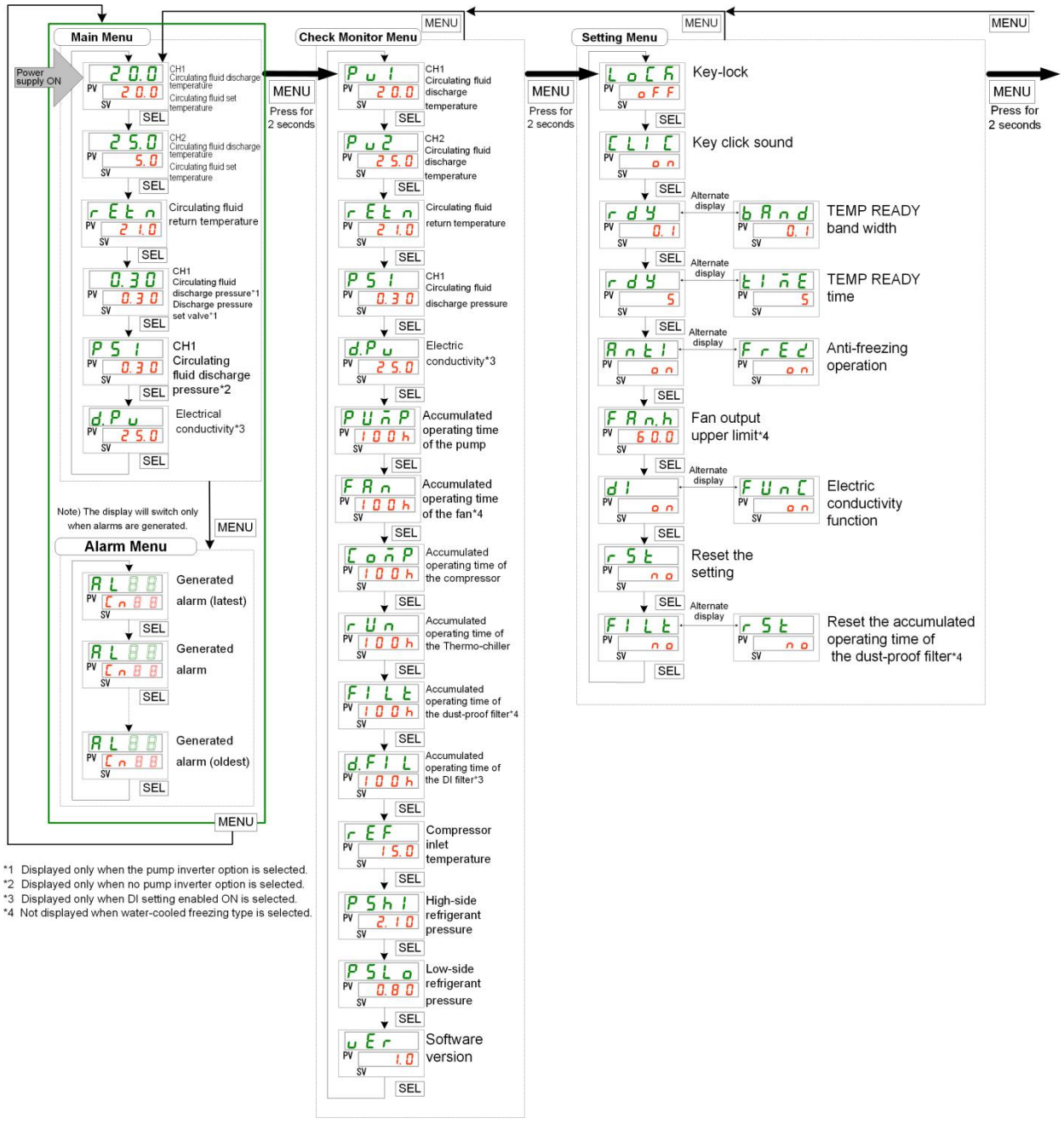


Fig.1-4 Communication setting operation display panel flow

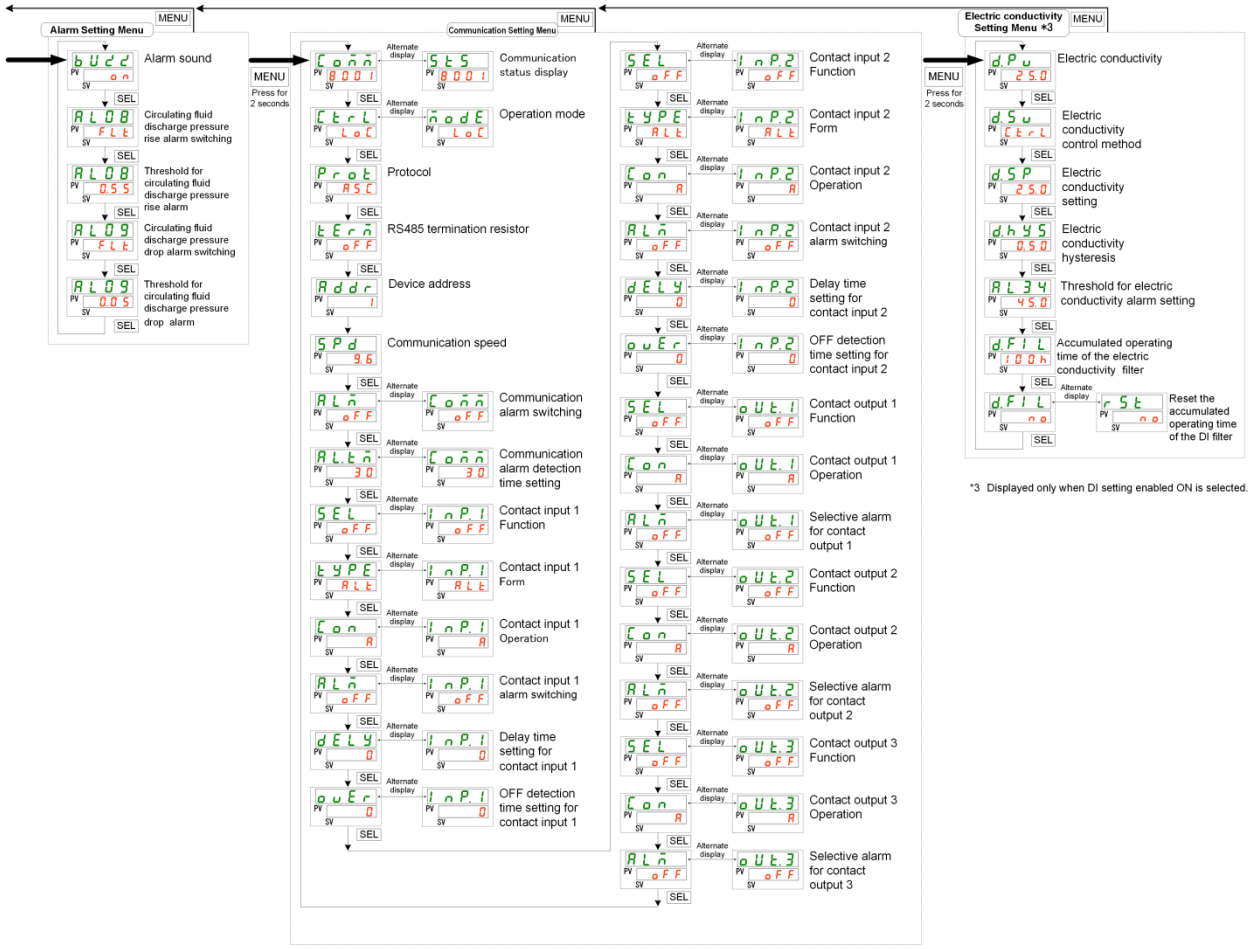


Fig.1-5 Communication setting operation display panel flow

Chapter 2 Contact input / output communication

The product is equipped with a terminal to control the start / stop of this product and a terminal to take out the operation signal, alarm signal, and setting status.
This product can be controllef remotly.

The product starts contact input / output communication according to the setting of the operation display panel. Contact input/output communication can be customized by changing the settings. The contact input / output signals that this product is equipped with are shown in Table 2-1.

Table 2-1　Contact input / output signal

Signal		Signal content
Contact input 2pcs.	Contact input 1	・Operation / stop signal, Run signal, Allowed input an external switch signal ・Selectable signal configuration (Alternate / Momentary) ・Selectable contact type (normally open / normally closed)
	Contact input 2	・Stop signal, Allowed input an external switch signal, Power saving mode ・Selectable signal configuration (Alternate / Momentary) ・Selectable contact type (normally open / normally closed)
Contact output 3pcs.	Contact output 1	・Selectable signal content(Refer to “2.4 Contact output signal”) ・Selectable contact type (normally open / normally closed)
	Contact output 2	
	Contact output 3	

2.1 Precautions for communication

2.1.1 Precautions wiring communication

○Communication wiring

A communication cable that connects the product and customer system is not included with the product. Please prepare according to “2.2 Communication specification”.In order to avoid malfunction, do not connect to any place other than those shown in “2.2 Communication specification”.

○Power supply

To use the power of the product, the total load current must be 200mA or less.

2.1.2 Precautions after wiring and before communication

○Check or set the Operation mode by the operation display panel.

・Operation mode shall be DIO.

You can read also in the other mode, but you can not run / stop if it is not DIO mode.

2.2 Communication specification

Table 2-2 Contact input/output communication connector

Connector specification (this product side)
M4 terminal block

Table 2-3 Contact input/output communication specification

Item		Specification	
Contact input signal 1,2	Insulation system	Photo coupler	・Run / Stop signal ・External switch signal ・Power saving mode etc
	Rated input voltage	DC24V	
	Operating voltage range	DC21.6V to 26.4V	
	Rated input current	5mA TYP	
	Input impedance	4.7kΩ	
Contact output signal 1,2,3	Rated load voltage	AC48V or less / DC30V or less	・Signal of operating status ・Alarm signal ・TEMP READY signal etc
	Maximum load current	AC / DC 500mA or less *1	
	Minimum load current	DC5V 10mA	
DC24V output voltage		DC24V±10% 200mA MAX *1 (It can not be used for inductive load.)	

*1 : The total load current must be 500 mA or less. To use the power of the product, the total load current must be 200 mA or less.

Table 2-4 Contact input/output communication terminal number

PIN No.	Application	Division	Initial value(Default setting)
1	COM of contact input signal	Input	-
2	Contact input signal 1	Input	START/STOP signal(N.O type) *1
3	Contact input signal 2	Input	External switch signal(N.O type) *1
4	None	-	-
5	RS-485 communication	SD+	-
6	RS-485 communication	SD-	-
7	RS-485 communication	SG	-
8	None	-	-
9	Contact output signal 1	Output	Run status signal(N.O type) *1
10	COM of contact output signal 1	Output	-
11	Contact output signal 2	Output	Alarm signal(N.C type) *1
12	COM of contact output signal 2	Output	-
13	Contact output signal 3	Output	TEMP READY signal(N.O type) *1
14	COM of contact output signal 3	Output	-
15	DC24V output	Output	-
16	24COM output	Output	-

∗1 : It is possible to change the setting.

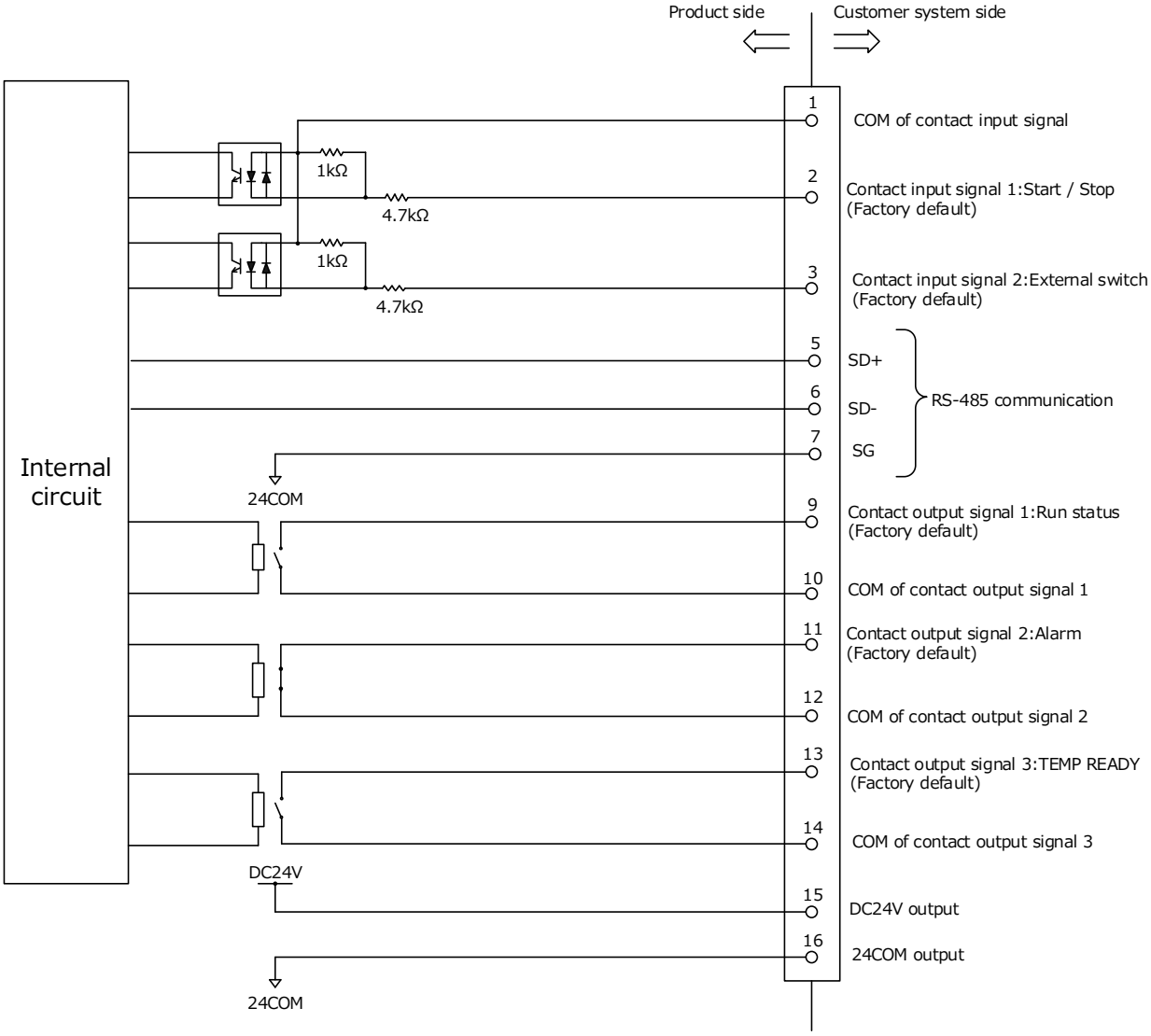


Fig.2-1 Circuit diagram

2.3 Contact input signal

There are 2 contact input signals and can be customized by the customer.

2.3.1 Contact input signal Type・Format・Form・Setting

The type of contact input signal can be set from the “1.4 Operation display panel flow” (Refer to Communication menu).

Following items can be set for contact input signal 1 and 2:

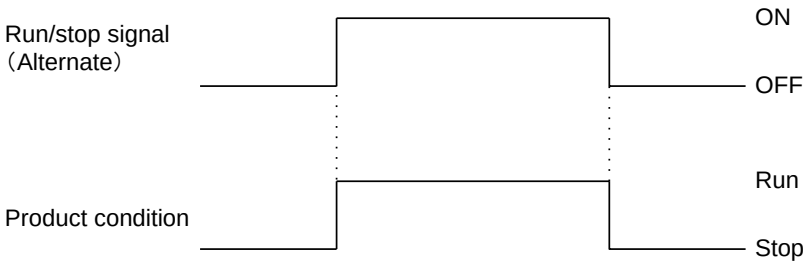
- Contact type — selects “N.O. ” (A contact) or “N.C.” (B contact).
- Signal form —— selects “ ALT ” (Alternate) or “MT” (Momentary).
- Signal type —— selects “OFF” (disabled), “SW” (external switch signal) or “RN.ST” (run/stop) signal, “RUN” (run) signal, “STOP (stop) signal, “ECO” (power saving mode) signal.
- Alarm select — selects “OFF” (disabled), or “FLT” (Operation stop), or “WRN” (Continuing operation) when an alarm (AL31,AL32) occurs by the contact input signal.
- Delay time —— selection of contact signal alarm delay time of 0 to 300s
- OFF detection time —— selection of contact signal alarm off detection time of 0 to 10s

Table 2-5 Setting of contact input signal form

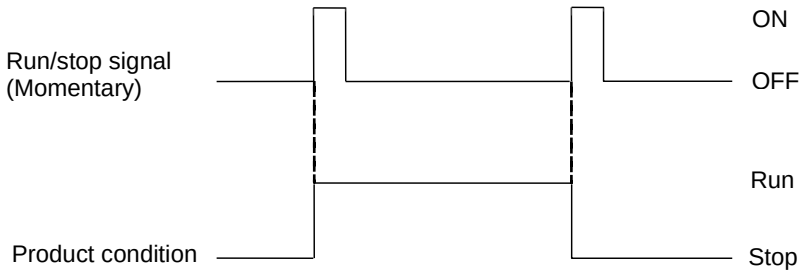
Type	Display			Item	Setting
Contact input 1	Upper line	SEL	INP.1	Signal type	OFF:Disabled, RN.ST:Run/Stop signal, RUN：Run signal, SW：External switch signal
	Lower line(Initial value)		RN.ST		
	Upper line	TYPE	INP.1	Signal form	ALT：Alternate MT：Momentary
	Lower line(Initial value)		ALT		
	Upper line	CON	INP.1	Contact type	A：A contact(Normally open) B：B contact(Normally close)
	Lower line(Initial value)		A		
	Upper line	ALM	INP.1	Alarm type	OFF:Disabled, FLT:Operation stop, WRN:Operation continue
	Lower line(Initial value)		OFF		
	Upper line	DELY	INP.1	Delay time	0 to 300s
	Lower line(Initial value)		0		
	Upper line	OVER	INP.1	Off detect time	0 to 10s
	Lower line(Initial value)		0		
Contact input 2	Upper line	SEL	INP.2	Signal type	OFF:Disabled, STOP：Stop signal, SW：External switch signal, ECO：Energy saving mode
	Lower line(Initial value)		SW		
	Upper line	TYPE	INP.2	Signal form	ALT：Alternate MT：Momentary
	Lower line(Initial value)		ALT		
	Upper line	CON	INP.2	Contact type	A：A contact(Normally open) B：B contact(Normally close)
	Lower line(Initial value)		A		
	Upper line	ALM	INP.2	Alarm type	OFF:Disabled, FLT:Operation stop, WRN:Operation continue
	Lower line(Initial value)		OFF		
	Upper line	DELY	INP.2	Delay time	0 to 300s
	Lower line(Initial value)		0		
	Upper line	OVER	INP.2	Off detect time	0 to 10s
	Lower line(Initial value)		0		

2.3.2 Run / stop･Run･Stop･External switch signal

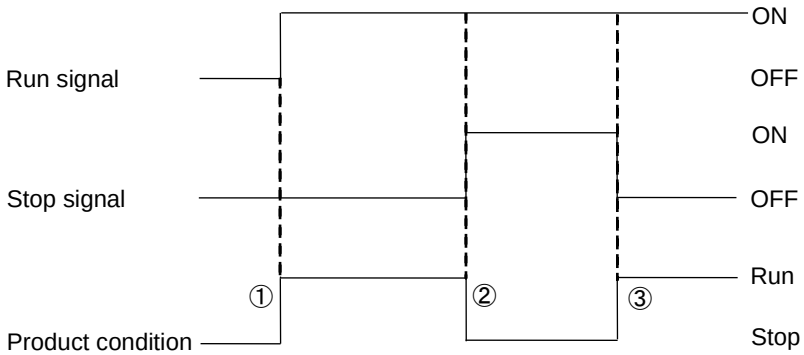
1) Run / stop signal (Signal type: Alternate)
The product keeps operating while the input signal from the customer is ON.



2) Run / stop signal (Signal type: Momentary)
The state changes when the input signal from the customer goes ON. This signal operates while the product is stopped, and stops while the product is being operated.

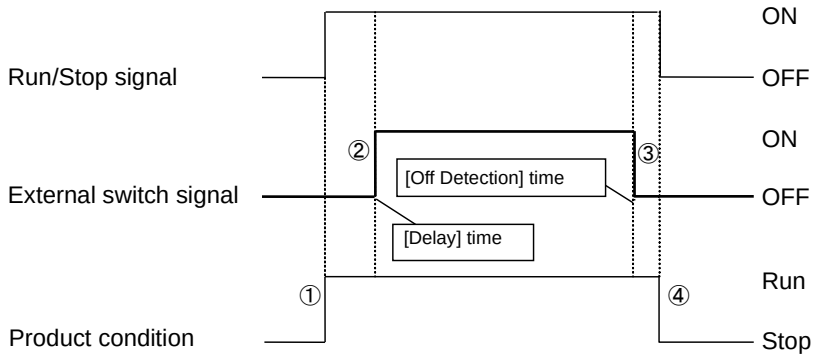


3) Run signal (Signal type: Alternate) / Stop signal (Signal type：Alternate)
Digital input signal 1 is for Run signal（Signal type：Alternate）, digital input signal 2 is for stop signal(Signal type: Alternate). Stop signal becomes valid when both signals are turned ON.



(1) The product starts operation when the contact input signal 1 is turned ON.
(2) The product stops operation when the contact input signal 2 is turned ON.
(3) The product starts operation because the contact input signal 1 is turned ON although the contact input signal 2 is OFF.

4) Contact input signal 1 is for Run / Stop signal (Signal type: Alternate), contact input signal 2 is for external switch signal (Signal type: Alternate). Refer to “Chapter2.3.3 External switch signal” for details of the external switch.



(1) The product starts operation when the Run / Stop signal from the user is turned ON.
(2) It reads the signal of the external switch signal (N.C. type) after the time which has been set for the [Delay] time.
(3) When the external switch signal has been turned off for the time set for
[Off Detection] time, it is recognized as OFF.
(4) Alarm [AL32: Contact input 2 signal detection] is generated. The operation of the product stops.
(5) The product stops operation when the Run / Stop signal is turned OFF during operation. Afterwards, the alarm is not generated even if the external switch signal is turned OFF.

2.3.3 External switch signal

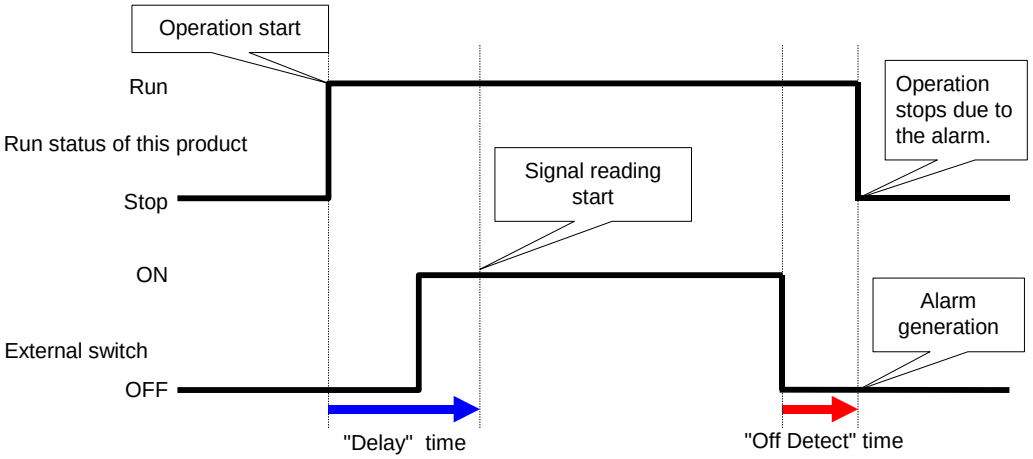
The product has two contact inputs available to detect the contact input signal. This allows reading and monitoring the contact signal from an external switch. When inputting an external switch signal to the contact input, select “SW” (external switch signal) for the type of contact input signal.(Refer to “2.3.1 Contact input signal　Type・Format・Form・Setting”)
If an input from an external switch is detected, it can be generated as an alarm.Options to select “continuous monitoring” or “monitoring during operation” are available. Also, the detection start time after the start of operation and the detection end time can be set.

- If the signal of “contact input 1” is detected: the alarm “AL31: Detection of contact input 1 signal” is activated.
- If the signal of “contact input 2” is detected: the alarm “AL32: Detection of contact input 2 signal” is activated.
- “Delay” time: sets the start time to detect the contact input signal after the start of operation.
- “Off detect” time: sets the time between the detection of the contact input OFF signal and the activation of the alarm.

Table 2-6　Monitoring method for contact input signal

“Delay” time	Monitoring method
0sec	Continuous monitoring
1 to 300sec	Monitoring during operation

Contact input signal 1 is for external switch signal (Signal type: Alternate).



“Delay” time and “off detect” time

You can select the operation of this product when an alarm occurs by the contact input signal.

- [WRN]——Continue operation of the product when an alarm occurs
- [FLT]——Stop operation of this product when an alarm occurs

2.4 Contact output signal

There are 3 contact output signals and can be customized by the customer.

2.4.1 Contact output signal

The setting of the contact output signal is done by the “1.4 Operation display panel flow” (Communication menu).
Contact output signal is continuously output.

Table 2-7 Setting of contact output signal 1 to 3

Type	Display			Item	Setting
Contact output 1	Upper line	SEL	OUT.1	Signal type	*Refer to Table 2-8
	Lower line(Initial value)		RUN		
	Upper line	CON	OUT.1	Contact type	A : A contact(Normally open) B : B contact(Normally close)
	Lower line(Initial value)		A		
	Upper line	ALM	OUT.1	Alarm	Alarm No.
	Lower line(Initial value)		1		
Contact output 2	Upper line	SEL	OUT.2	Signal type	*Refer to Table 2-8
	Lower line(Initial value)		ALM		
	Upper line	CON	OUT.2	Contact type	A : A contact(Normally open) B : B contact(Normally close)
	Lower line(Initial value)		B		
	Upper line	ALM	OUT.2	Alarm	Alarm No.
	Lower line(Initial value)		1		
Contact output 3	Upper line	SEL	OUT.3	Signal type	*Refer to Table 2-8
	Lower line(Initial value)		RDY		
	Upper line	CON	OUT.3	Contact type	A : A contact(Normally open) B : B contact(Normally close)
	Lower line(Initial value)		A		
	Upper line	ALM	OUT.3	Alarm	Alarm No.
	Lower line(Initial value)		1		

Table 2-8 Signal type for contact output signal

Signal type of contact output			
Setting	**Item**	**Contact type**	**Contents**
OFF	Disabled	A	Normally open
		B	Normally open
RUN	Operation status signal	A	Operation : Close
		B	Operation : Open
RMT	Remote mode signal	A	Remote mode : Close
		B	Remote mode : Open
FLT	Operation stop “FLT” alarm status signal	A	The time of “FLT” alarm : Close
		B	The time of “FLT” alarm : Open
WRN	Continuing operation “WRN” alarm status signal	A	The time of “WRN” alarm : Close
		B	The time of “WRN” alarm : Open
ALM	Alarm status signal	A	The time of alarm : Close
		B	The time of alarm : Open
RDY	TEMP READY signal	A	TEMP READY status : Close
		B	TEMP READY status : Open
FREZ	Anti-freezing setting status signal	A	Enabled : Close
		B	Enabled : Open
SW1	Pass through signal of the contact input signal 1	A	Output the input signal as it is
		B	Reverse output of the input signal
SW2	Pass through signal of the contact input signal 2	A	Output the input signal as it is
		B	Reverse output of the input signal
A.SEL	Selected alarm status signal	A	Selected alarm occurrence : Close
		B	Selected alarm occurrence : Open

Table 2.4-4 List of alarm selection

Alarm No.	Explanation
AL01	Low tank fluid level
AL02	CH1 abnormal high circulating fluid temp.
AL05	Abnormal high circulating fluid return temp.
AL06	Abnormal high circulating fluid discharge pressure.
AL08	High circulating fluid discharge pressure rise
AL09	High circulating fluid discharge pressure drop
AL11	Abnormal low compressor suction temp.
AL13	Abnormal rise of refrigerant circuit pressure (high pressure side)
AL15	Refrigerant leak
AL16	Abnormal rise of refrigerant circuit pressure (low pressure side)
AL17	Abnormal drop of refrigerant circuit pressure (low pressure side)
AL18	Compressor running failure
AL19	Communication error
AL22	CH1 circulating fluid discharge temp. sensor failure(PT1)
AL23	Circulating fluid return temp. sensor failure(PT2)
AL24	Compressor suction temp. sensor failure(TH2)
AL25	Circulating fluid discharge pressure sensor failure (PS1)
AL26	Refrigerant circuit pressure (high pressure side) sensor failure(PS2)
AL27	Refrigerant circuit pressure (low pressure side) sensor failure(PS3)
AL31	Contact input 1 signal detection
AL32	Contact input 2 signal detection
AL34	Electric conductivity rise
AL35	Electric conductivity drop
AL36	Electric conductivity sensor failure
AL37	Compressor discharge temp. sensor failure (TH1)
AL38	Compressor discharge temp. rise
AL43	Fan failure
AL46	Compressor inverter error
AL47	Pump running failure
AL48	Pump inverter error
AL50	CH2 abnormal high circulating fluid temp.
AL51	CH2 circulating fluid discharge temp. sensor failure(PT3)
AL52	Memory error 1
AL53	Memory error 2
AL56	Abnormal missing-phase / anti-phase
AL57	Compressor inverter communication error
AL58	Pump inverter parameter error
AL59	Pump inverter communication error
AL62	Internal communication error
AL63	Refrigerant circuit pressure (high pressure side) rise
AL64	Power supply error
AL65	Refrigerant circuit pressure (high pressure side) switch actuation
AL66	Compressor inverter parameter error

*Refer to Operation Manual “Installation・Operation”.

Chapter 3 Serial communication

Serial communication (RS-485) enables the remote control of run / start of the product, temperature setting and details of product condition, and alarm condition can be obtained.

The operating state of the product (run / stop) and the temperature setting can be monitored by sending a request message made by the program of the host computer (e.g. PC).

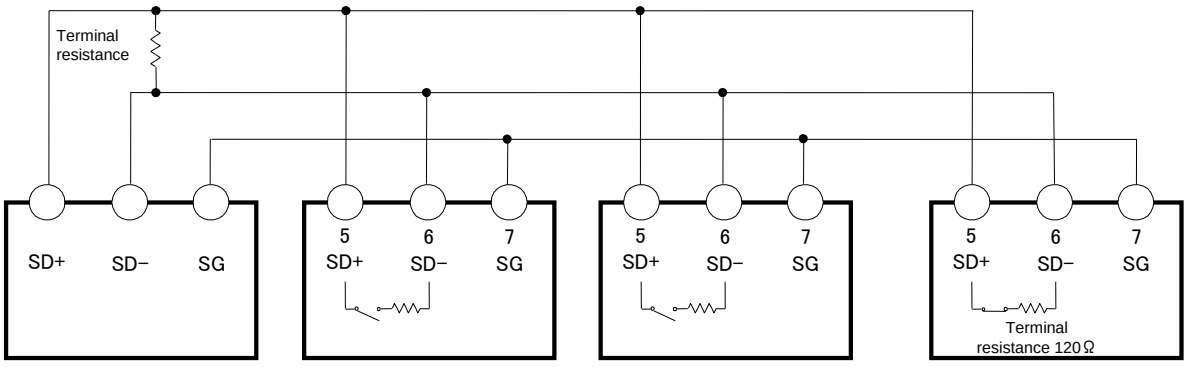
The communication protocol is MODBUS protocol.

3.1 Precautions wiring communication

A communication cable that connects the product and customer system is not included with the product. Please prepare a cable, referring to “3.2 Connected explanation’’. In order to avoid malfunction, do not connect to any place other than those shown in “3.2 Connected explanation’’.

3.2 Connected explanation

Fig.3-1 shows the wiring when RS-485 is selected as the communication standard.
A communication cable that connects the product and customer system is not included with the product. Prepare a cable, referring to Fig.3-1.



Do not connect any wire to other terminal.

Fig.3-1 RS-485 connection

[Tips]

- 1 controller : 1 product, or 1 controller: N products.
  In the latter case, up to 32 products can be connected.
- Both ends of the communication connection (the end nodes) need to be connected to the higher level computer.

3.3 Communication specification

Table 3-1 Serial communication specification

Item	Specification
Communication block (for the product)	Terminal block M4
Standard	EIA RS-485
Circuit type Half duplex	Half duplex
Transmission type	Start-stop
Protocol	MODBUS terminal*1
Terminal resistance	Selectable

*1：Refer to Modicon Co. protocol specifications "PI-MBUS-300 Rev.J".

Table 3-2 Communication specification of MODBUS communication function

Item	Specification
Standard	EIA RS-485
Communication speed	Select from 9600bps／19200bps
Data・bit length	7bit(ASCII) / 8bit(RTU)
Stop・bit length	1bit
Data transfer direction	LSB
Parity	Even parity
Letter code	ASCII character string (ASCII) / Binary data(RTU)
Node type	Device (Controller)
Device address set range	Select from 1 to 32
Error check	LRC method (ASCII) / CRC method (RTU)

:Default setting

3.4 MODBUS communication function

MODBUS protocol is a communication protocol developed by Modicon. It is used to communicate with a PC or PLC.

Register content is read and written by this communication protocol.

This communication has the following features.

- Controls run / stop.
- Sets and reads the circulating fluid set temperature.
- Reads the circulating fluid discharge temperature.
- Reads the circulating fluid discharge pressure.
- Reads the condition of the product.
- Reads the alarm generating condition of the product.
- The operation mode can be switched to "SERIAL" mode.
- You can reset the alarm.

Refer to “3.13 Register Map” for the register of the product.

3.5 Precautions for communication

3.5.1 Precautions after wiring and before communication

○Check or set the each communication setting by the operation display panel.
・The communication specification shall be the customer's communication standard.
・The operation mode shall be the SERIAL mode. (When mode request flagis activated, SERIAL mode is selected. Refer to 3.13.7). Other modes can perform reading, but only SERIAL mode can perform writing.

○Check or set the communication parameters using the operation display panel.
Check or set the communication speed so that the product ynchronizes with the host computer (controller) prepared by the customer.

○Check the device address by the operation display panel.
No response is returned when a request message is sent from a device address other than those set in the product.

3.5.2 Precautions for communicating

○Allow a suitable interval between requests.
To send request messages in series, wait for 100 msec. or longer after receiving a response message from the product before sending the next message.

○Retry (resend request message).
The response may not be returned due to noise. If no message is returned 1sec. after sending a request message, resend the request message.

○If necessary send a read request message to check if it was written correctly.
Message to notify the completion of the process is returned when the action for the written request message is completed.
Send a read request message to confirm if the setting was written as requested.

○Setting limit of circulating fluid temperature
When the circulating fluid set temperature is written by communication, the data is stored in FRAM. When the product restarts, it restarts with the value which was set before the restart. The number of times it is possible to overwrite FRAM is limited. Data is only stored in FRAM when it receives a circulating fluid set temperature which is different from the previous temperatures. Please check how many times it is possible to overwrite FRAM, and avoid unnecessary changes of the circulating fluid set temperature during communication

3.6 Setting method

Set of serial communication is done from “1.4 Operation display panel flow” (Communication menu).

Table 3-3 Setting of serial communication

Type	Display			Item	Setting
Serial communication	Upper line	COMM	STS	Communication status	*Refer to next table
	Lower line		0000		
	Upper line	PROT		Protocol	ASC : ASCII RTU : RTU
	Lower line(Initial value)		ASC		
	Upper line	TERM		RS-485 terminal resistance	OFF : None ON : Yes
	Lower line(Initial value)		OFF		
	Upper line	ADDR		Device address	1 to 32
	Lower line(Initial value)		1		
	Upper line	SPD		Communication speed	9.6 : 9600bps 19.2:19200bps
	Lower line(Initial value)		19.2		
	Upper line	ALM	COMM	Communication alarm type	FLT / WRN / OFF
	Lower line(Initial value)		FLT		
	Upper line	AL.TM	COMM	Communication alarm detection time	0 to 600s
	Lower line(Initial value)		30		

Table 3-4 Communication status

Communication setting	Contents
8001	Normal message
4801	An abnormal number of data has been sent from the customer product.
4401	This product is trying to access to the outside address of the register map that support.Or trying to write to read-only address.
4201	Function code that this product does not support is being sent from the customer's equipment.
0081	The device addresses set for this product and customer's product are different.
0041	CRC (*1) does not match in the RTU settings.
0021	LRC (*1) does not match in the ASCII settings.
00XX(*2)	Mismatched communication settings(Baud Rate, parity, number of data bits, etc.) or very short message intervals from customer equipment.
0000(*3)	Bad wiring or no message sent from customer equipment.

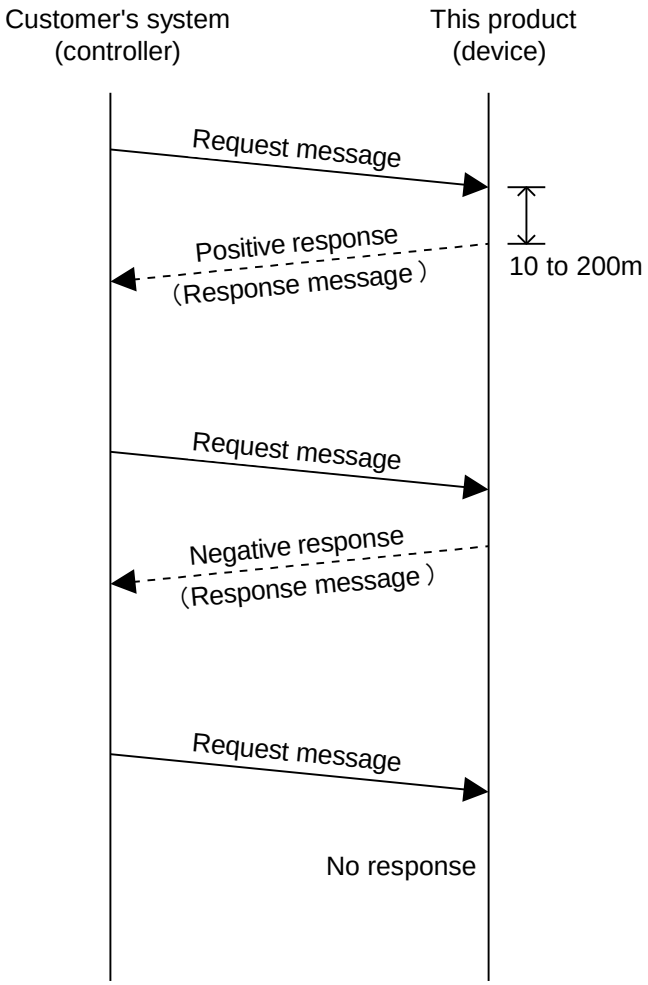
(∗1) CRC(Refer to 3.10.2), LRC(Refer to 3.10.1).
(∗2) “XX” means that it is undefined.
(∗3) After the outgoing message is received from the customer, and displays it in case the message is a state that can not be received was continued for 30 seconds.

It is a function to display the status of serial communication.
Device address mismatch or register map of this product display relevant contents for communication nonconformities, such as accessing outside the area.

3.7 Communication sequence

Starts with a request message from the customer's system (controller), and finishes with a response message from the product (device).

This product operates as a device. It does not send any requests.



●Positive response
Based on the request message, reads Register / writes register and returns a positive response.

●Negative response
Returns a negative message when the received request message is not normal. Refer to ''3.12 Negative response''.

●No response
No response is returned when there isan error in "device address specification" or "Checksum(LRC / CRC)".

3.8 Message configuration

3.8.1 Message frame

The message configuration is shown below. The communication of this product uses 2 transmission modes, ASCII or RTU.

1） ASCII mode frame
For ASCII mode, the message starts with ASCII characters ":"(3Ah) and ends with "CR/LF"(0Dh,0Ah). A response message will not be returned unless the request includes [:] and [CR][LF]. This product clears all previously received code when [:] is received.

Table 3-5 ASCII mode message frame

a) Start	b) Device Address		c) Function		d) Data			e) Checksum (LRC)		f) End	
[:]	XX	XX	XX	XX	XX	～	XX	XX	XX	[CR]	[LF]

a) Start

The start of the message. [:] (3Ah) (ASCII)

b) Device Address

This is a number to identify this product. "1" is the default setting. This can be changed by the touch panel.

c) Function (Refer to "3.9 Function codes")

Command is assigned.

d) Data

Depending on the function, the address and the number of the register, the value of reading / writing are assigned.

e) LRC

LRC method

Refer to ''3.10.1 LRC(ASCII)''.

f) END

The end of the message. [CR](0Dh)＋[LF](0Ah)

2） RTU mode frame
RTU mode starts from and ends with at least 3.5 characters of silent interval. Silent
interval is indicated by T1-T2-T3-T4.

Table 3-6 RTU mode message frame

a) Start	b) Device Address	c) Function	d) Data			e) Checksum (CRC)		f) End
T1-T2-T3-T4	XX	XX	XX	～	XX	XX	XX	T1-T2-T3-T4

a) Start

In Modbus RTU mode, message frames are separated by a silent interval (non-communication time). At least 3.5 characters of silent interval are necessary at the beginning and the end of the communication frame.

b) Device Address

This is a number to identify this product. “1" is the default setting. This can be changed by the operation display panel.

c) Function (Refer to “3.9 Function codes”)

Command is assigned.

d) Data

Depending on the function, the address and the number of the register, the value of reading/writing are assigned.

e) CRC

CRC method.

Refer to “3.10.2 CRC(RTU)”.

f) End

3.5 characters of silent interval indicates the end of a message.

3.9 Function codes

Table 3-7 shows function codes to read or write register. Refer to "3.11 Explanation of function codes".

Table 3-7 Function codes

NO	Code	Name	Function
1	04(04h)	read holding registers	Reading multiple registers
2	16(10h)	preset multiple registers	Writing multiple registers

3.10 Checksum calculation method

3.10.1 **LRC(ASCII)**

LRC checks the content of the message other than [:] of START and [CR][LF] of END. The sending side calculates and sets. The receiving side calculates based on the received message, and compares the calculation result with the received LRC. The received message is deleted if the calculation result and received LRC do not match. Consecutive 8 bits of the message are added, and the result without carry (overflow) is converted to 2's complement.

■ Calculation example

Example) Change circulating fluid set temperature 23.4 °C

Sending data 0110004000010200EA

○Device Address : No.1

○Function : No.16

○Writing address : 0040h

○Writing data number: 1

○Writing data : 00EAh

No	Classification	Contents	calculation result
1	LRC message for calculation	0110004000010200EA	-
2	Calculation	Added for each 8Byte 01h+10h+00h+40h+00h+01h+02+00h+EAh=13Eh	3Eh
3		complement of 2 3Eh→C1h→C2h	C2h(LRC)
4	Sending message	[:]0110004000010200EAC2[CR][LF]	-

3.10.2 **CRC(RTU)**

CRC checks the content of the message. The sending side calculates the data every 2 byte (16 bit). The receiving side calculates CRC based on the received message, and compares the calculation result with the received CRC. The received message is deleted if the calculated CRC is different from the received CRC.

■ Calculation procedure

1） Preload “FFFFh” (set 0xFFFF as initial value).

2） Execute ExOR of 1 Byte (1st value) value and 1) value from the beginning of the transmitted data.

3） Shift the result of (2) by 1 bit toward the least significant bit, and fill a 0 into the most significant bit position.

4） If the bit extracted as a result of 1 bit shift is 1, the result of 3) and the value ExOR of "A001h" are executed (Example 1). If the extracted bit is 0, ExOR is not performed (Example 2).

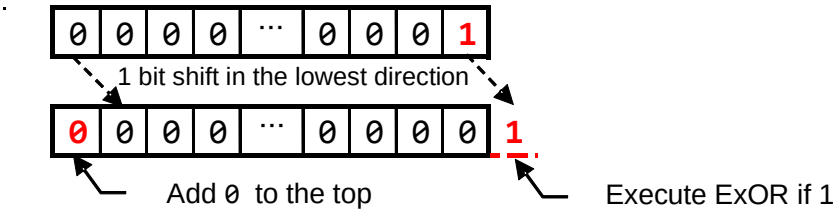
5） Repeat (3) to (5) above until 8 bit shift is performed.

6） Execute ExOR of the next 1 Byte value of the result of 5) and the transmitted data.

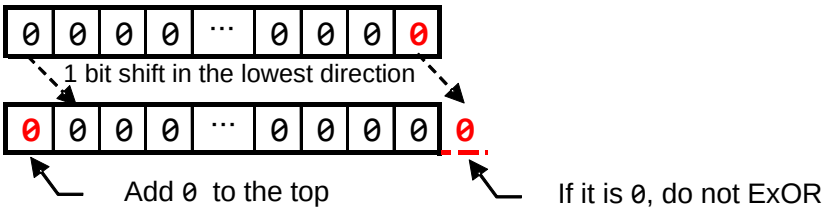
7） Repeat steps 3) to 6) for all remaining data.

8） The 2-byte data of the result of (7) is the CRC data

(Example 1) The least significant bit was a 1.



(Example 2) The least significant bit was a 0.



■ Calculation example

Example) Change circulating fluid set temperature 23.4 ° C

Sending data 0110004000010200EA

○Device Address : No.1

○Function : No.16

○Writing address : 0040h

○Writing data number：1

○Writing data : 00EAh

Data No.	1st value	2nd value	3rd value	4th value	5th value	6th value	7th value	8th value	9th value
Data contents	0001h	0010h	0000h	0040h	0000h	0001h	0002h	0000h	00EAh

No	Classification	Contents	Result
1	CRC message for calculation	0110004000010200EA	-
2	Calculation	Perform (1) to (4) for the 1st value (0001h) and then, perform (5).	807Eh
3		Perform (6) for 2nd value (0010h) and then, perform (5).	EC01h
4		Perform (6) for 3rd. value (0000h) and then, perform (5).	C02Dh
5		Perform (6) for 4th value (0040h) and then, perform (5).	ED01h
6		Perform (6) for 5th value (0000h) and then, perform (5).	C02Ch
7		Perform (6) for 6th value (0001h) and then, perform (5).	1D00h
8		Perform (6) for 7th value (0002h) and then, perform (5).	C19Ch
9		Perform (6) for 8th value (0000h) and then, perform (5).	69C1h
10		Perform (6) for 9th value (00EAh) and then, perform (5).	1F29h (CRC)
11	Addition to the sent message	0110004000010200EA291F *1	-

*1 When incorporating it into the message, set it in order of low byte and high byte.

3.11 Explanation of function codes

3.11.1 Function code：04 Reading multiple registers

Register data of assigned points from assigned address is read.

■ Communication example

○Device Address : No.1

○Read 16 pieces data from register 0030h.

- CH1 Circulating fluid discharge temperature [20.0℃]
- CH2 Circulating fluid discharge temperature [25.0℃]

- Circulating fluid discharge pressure [0.45MPa]
- Data display 1 to 4 [non-selection (all 0)]
- Status flag [during operation, CH1 TEMP READY status]
- Alarm flag 1 to 5 [no alarm]

Request message 010400300010

Field name	Example (HEX)	ASCII mode character data	RTU mode binary data
Header	-	":"	None
Device Address	0x01	"0","1"	0x01
Function	0x04	"0","4"	0x04
Head address of specified register	0x0030	"0","0","3","0"	0x00,0x30
Quantity of register to read	0x0010	"0","0","1","0"	0x00,0x10
Checksum ASCII:LRC RTU:CRC	-	"B","B"	0xF1,0xC9
Trailer	-	CR/LF	None
	Total quantity of byte	17	8

Response message
01042000C800FA000000C8002D0000000000000000000000110000000000000000000000

Field name	Example (HEX)	ASCII mode character data	RTU mode binary data
Header	-	":"	None
Device Address	0x01	"0","1"	0x01
Function	0x04	"0","4"	0x04
Quantity of bytes to read	0x20	"2","0"	0x20
Information of 0030h (CH1 Circulating fluid discharge temperature)	0x00C8	"0","0","C","8"	0x00,0xC8
Information of 0031h (CH2 Circulating fluid discharge temperature)	0x00FA	"0","0","F","A"	0x00,0xFA
Information of 0032h (Reservation)	0x0000	"0","0","0","0"	0x00,0x00
Information of 0033h (Reservation)	0x0000	"0","0","0","0"	0x00,0x00
Information of 0034h (CH1 Circulating fluid discharge pressure)	0x002D	"0","0","2","D"	0x00,0x2D
Information of 0035h (Reservation)	0x0000	"0","0","0","0"	0x00,0x00
Information of 0036h (Reservation)	0x0000	"0","0","0","0"	0x00,0x00
Information of 0037h (Reservation)	0x0000	"0","0","0","0"	0x00,0x00
Information of 0038h (Data display 1)	0x0000	"0","0","0","0"	0x00,0x00
Information of 0039h (Data display 2)	0x0000	"0","0","0","0"	0x00,0x00
Information of 003Ah (Status flag)	0x0011	"0","0","1","1"	0x00,0x11
Information of 003Bh (Alarm flag 1)	0x0000	"0","0","0","0"	0x00,0x00
Information of 003Ch (Alarm flag 2)	0x0000	"0","0","0","0"	0x00,0x00
Information of 003Dh (Alarm flag 3)	0x0000	"0","0","0","0"	0x00,0x00
Information of 003Eh (Alarm flag 4)	0x0000	"0","0","0","0"	0x00,0x00
Information of 003Fh (Alarm flag 5)	0x0000	"0","0","0","0"	0x00,0x00
Checksum ASCII:LRC RTU:CRC	-	"1","3"	0x93,0xF1

Trailer	-	CR/LF	None
	Total quantity of byte	75	37

3.11.2 **Function code：16 Writing multiple registers**

Register content of assigned points of assigned address is written.

■ Communication example

○Device Address : No.1

○Write three consecutive data from register 0040h.

- CH1 Change of circulating fluid set temperature [23.5℃]
- CH2 Change of circulating fluid set temperature [(CH1+)4.9℃]
- Operation start instruction

Request message 01100040000306 00EB00310001			
Field name	**Example (HEX)**	**ASCII mode character data**	**RTU mode binary data**
Header	-	“**:**”	None
Device Address	0x01	“0”,“1”	0x01
Function	0x10	“1”,“0”	0x10
Head address of specified register	0x0040	“0”,“0”,“4”,“0”	0x00,0x40
Quantity of register to write	0x0003	“0”,“0”,“0”,“3”	0x00,0x03
Quantity of byte to read	0x06	“0”,“6”	0x06
Information written to 0040h (CH1 Circulating fluid set temperature)	0x00EB	“0”,“0”,“E”,“B”	0x00,0xEB
Information written to 0041h (CH2 Circulating fluid set temperature)	0x0031	“0”,“0”,“3”,“1”	0x00,0x31
Information written to 0042h (Operation stop flag)	0x0001	“0”,“0”,“0”,“1”	0x00,0x01
Checksum ASCII:LRC RTU:CRC	-	“8”,”9”	0x50,0x4C
Trailer	-	CR/LF	None
	Total quantity of byte	31	15

Response message 011000400003			
Field name	**Example (HEX)**	**ASCII mode character data**	**RTU mode binary data**
Header	-	“**:**”	None
Device Address	0x01	“0”,“1”	0x01
Function	0x10	“1”,“0”	0x10
Head address of register to write	0x0040	“0”,“0”,“4”,“0”	0x00,0x40
Quantity of register to write	0x0003	“0”,“0”,“0”,“3”	0x00,0x03
Checksum ASCII:LRC RTU:CRC	-	“A”,”C”	0x81,0xDC
Trailer	-	CR/LF	None
	Total quantity of byte	17	8

3.12 Negative response

A negative response is returned when the following request message is received.

1) When unspecified function code is used.

2) An address out of range is specified.

3) The data field is not normal.

■ Negative response message (Device to Controller)

1） Negative acknowledgment message frame in ASCII mode.

Start	Device Address		1)Function		2)Error Code		LRC		End	
[:]	XX	XX	XX	XX	XX	XX	XX	XX	[CR]	[LF]

2） Negative acknowledgment message frame in RTU.

Start	Device Address	1)Function	2)Error Code		CRC		End
T1-T2-T3-T4*1	XX	XX	XX	XX	XX	XX	T1-T2-T3-T4*1

*1 Silent interval for 3.5 characters

1) Function

Assign the value consisting of the request function code (hexadecimal

value) plus 80h.

Example 1) ASCII mode

Received function code: “04”(0000 0100)” ASCII code 30h, 34h

Abnormal function code: ”84”（1000　0100）” ASCII code 38h, 34h

Example 2) RTU mode

Receive function code: "04" (0000 0100)

Abnormal function code: "84" (1000 0100）

2) Error Code

Assign error code below.

01 : Function code of a command is outside the standard

02 : The specified address of register is outside the range.

03 : Data field of a command is not normal.

■ Communication example

○Device Address : No 1

○Read seven consecutive data from register 0100h which is out of range.

Request message 010401000007

Field name	Example (HEX)	ASCII mode character data	RTU mode binary data
Header	-	“**:**”	None
Device Address	0x01	“0”,“1”	0x01
Function	0x04	“0”,“4”	0x04
Head address of register out of range	0x0100	“0”,“1”,“0”,“0”	0x01,0x00
Quantity of register to read	0x0007	“0”,“0”,“0”,“7”	0x00,0x07
Checksum ASCII:LRC RTU:CRC	-	“F”,”3”	0xB0,0x34
Trailer	-	CR/LF	None
	Total quantity of byte	17	8

Response message 018402

Field name	Example (HEX)	ASCII mode character data	RTU mode binary data
Header	-	“**:**”	None
Device Address	0x01	“0”,“1”	0x01
Function (03h+80h)	0x84	“8”,“4”	0x84
Error Code (Specified register address is out of range.)	0x02	“0”,“2”	0x02
Checksum ASCII:LRC RTU:CRC	-	“7”,“9”	0xC2,0xC1
Trailer	-	CR/LF	None
	Total quantity of byte	11	5

3.13 Register Map

Address	Contents	value	R/W
0030h	CH1 Circulating fluid discharge temperature	Decimal number : -327.6 to 327.6℃ Hexadecimal number : F334h to 0CCCh (0.1℃/dig)	R
0031h	CH2 Circulating fluid discharge temperature	Decimal number : -327.6 to 327.6℃ Hexadecimal number : F334h to 0CCCh (0.1℃/dig)	
0032h	Reservation	―	
0033h	Reservation	―	
0034h	CH1 Circulating fluid discharge pressure	Decimal number : -32.76 to 32.76MPa Hexadecimal number : F334h to 0CCCh (0.01MPa/dig)	
0035h	Reservation	―	
0036h	Reservation	―	
0037h	Reservation	―	
0038h	Data display 1	Follow the data instructions *1	
0039h	Data display 2	Follow the data instructions *1	
003Ah	Status flag	Refer to 3.13.3 Status flag	
003Bh	Alarm flag 1	Refer to 3.13.4 Alarm flag	
003Ch	Alarm flag 2	Refer to 3.13.4 Alarm flag	
003Dh	Alarm flag 3	Refer to 3.13.4 Alarm flag	
003Eh	Alarm flag 4	Refer to 3.13.4 Alarm flag	
003Fh	Alarm flag 5	Refer to 3.13.4 Alarm flag	
0040h	CH1 Circulating fluid set temperature	Positive number : 0000h to 7FFFh(0.1℃/dig) Negative number : 8000h to FFFFh(0.1℃/dig) *2	R / W
0041h	CH2 Circulating fluid set temperature	Positive number : 0000h to 7FFFh(0.1℃/dig) Negative number : 8000h to FFFFh(0.1℃/dig) *2	
0042h	Operation instruction	*3(Operation start instruction, mode request, alarm reset)	
0043h	Data instruction	*4	

∗ 1 Data display(Refer to 3.13.5 Data display)

∗ 2 Negative numbers are two's complement representation

∗ 3 Operation instruction(Refer to 3.13.7 Operation instruction)

∗ 4 Data instruction(Refer to 3.13.8 Data instruction)

3.13.1 **Circulating fluid discharge temperature**

To notify the circulating fluid discharge temperature of the product. (°C or °F). Read the circulating fluid discharge temperature which is displayed on the operation display panel.

3.13.2 **Circulating fluid discharge pressure**

To notify the circulating fluid discharge pressure of the product.

3.13.3 **Status flag**

The status of the product is read by the following assignment.

Status flag

Name	Status flag															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit	Name	Explanation
0	Run flag	Run status 0= Stop 1= Run
1	Operation stop alarm flag	Operation stop alarm given off status 0= Not occurred 1= Operation stop alarm given off
2	Operation continued alarm flag	Operation continued alarm given off status 0= Not occurred 1= Operation continued alarm given off
3	None	—
4	Completion of preparation (TEMP READY) flag	Completion of preparation (TEMP READY) status 0= Condition isn't formed 1= Condition is formed
5	None	—
6	None	—
7	None	—
8	None	—
9	None	—
10	None	—
11	None	—
12	None	—
13	None	—
14	None	—
15	Anti-freezing flag	Anti-freezing setting status 0= Unset 1= During setting

3.13.4 **Alarm flag**

Each type of alarm which occurs in the product is read with the following assignment.

Name	Alarm flag 1															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Name	Alarm flag 2															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Name	Alarm flag 3															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Name	Alarm flag 4															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Name	Alarm flag 5															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit		Name	Explanation
Alarm flag 1	0	Low tank fluid level	Alarm given off status 0= Not occurred 1= Occurred
	1	CH1 abnormal high circulating fluid temp.	
	2	Reservation	
	3	Reservation	
	4	Abnormal high circulating fluid return temp.	
	5	Abnormal high circulating fluid discharge pressure.	
	6	Reservation	
	7	High circulating fluid discharge pressure rise	
	8	High circulating fluid discharge pressure drop	
	9	Reservation	
	10	Abnormal low compressor suction temp.	
	11	Reservation	
	12	Abnormal rise of refrigerant circuit pressure (high pressure side)	
	13	Reservation	
	14	Refrigerant leak	
	15	Abnormal rise of refrigerant circuit pressure (low pressure side)	
Alarm flag 2	0	Abnormal drop of refrigerant circuit pressure (low pressure side)	Alarm given off status 0= Not occurred 1= Occurred
	1	Compressor running failure	
	2	Communication error	
	3	Reservation	
	4	Reservation	
	5	CH1 circulating fluid discharge temp. sensor failure(PT1)	
	6	Circulating fluid return temp. sensor failure(PT2)	
	7	Compressor suction temp. sensor failure(TH2)	
	8	Circulating fluid discharge pressure sensor failure (PS1)	
	9	Refrigerant circuit pressure (high pressure side) sensor failure(PS2)	
	10	Refrigerant circuit pressure (low pressure side) sensor failure(PS3)	
	11	Reservation	
	12	Reservation	
	13	Reservation	
	14	Contact input 1 signal detection	
	15	Contact input 2 signal detection	

Alarm flag 3	0	Reservation	Alarm given off status 0= Not occurred 1= Occurred
	1	Electric conductivity rise	
	2	Electric conductivity drop	
	3	Electric conductivity sensor failure	
	4	Compressor discharge temp. sensor failure (TH1)	
	5	Compressor discharge temp. rise	
	6	Reservation	
	7	Reservation	
	8	Reservation	
	9	Reservation	
	10	Fan failure	
	11	Reservation	
	12	Reservation	
	13	Compressor inverter error	
	14	Pump running failure	
	15	Pump inverter error	
Alarm flag 4	0	Reservation	Alarm given off status 0= Not occurred 1= Occurred
	1	CH2 abnormal high circulating fluid temp.	
	2	CH2 circulating fluid discharge temp. sensor failure(PT3)	
	3	Memory error 1	
	4	Memory error 2	
	5	Reservation	
	6	Reservation	
	7	Abnormal missing-phase / anti-phase	
	8	Compressor inverter communication error	
	9	Pump inverter parameter error	
	10	Pump inverter communication error	
	11	Reservation	
	12	Reservation	
	13	Internal communication error	
	14	Refrigerant circuit pressure (high pressure side) rise	
	15	Power supply error	
Alarm flag 5	0	Refrigerant circuit pressure (high pressure side) switch actuation	Alarm given off status 0= Not occurred 1= Occurred
	1	Compressor inverter parameter error	
	2	Reservation	
	3	Reservation	
	4	Reservation	
	5	Reservation	
	6	Reservation	
	7	Reservation	
	8	Reservation	
	9	Reservation	
	10	Reservation	
	11	Reservation	
	12	Reservation	
	13	Reservation	
	14	Reservation	
	15	Reservation	

3.13.5 **Data display**

The contents selected in the data instruction will be displayed on the data display 1 and 2.Table below shows the data type which can be displayed and the range.

No.	Item	Range
0	None	0
1	Circurating fluid return temperature	Decimal number : -327.6 to 327.6℃ Hexadecimal number : F334h to 0CCCh (0.1℃/dig)
2	Circulating fluid electrical conductivity	Decimal number : –3276.8 to 3276.7μS/cm Hexadecimal number : 8000h to 7FFFh (0.1μS/cm/dig)
3	Pressure of high pressure refrigerant circuit	Decimal number : -32.76 to 32.76MPa Hexadecimal number : F334h to 0CCCh (0.01MPa/dig)

3.13.6 **Circulating fluid set temperature**

In SERIAL mode, you can set the circulating fluid set temperature of this product by specifying the circulating fluid set temperature.
If the temperature exceeds the upper limit of the circulating fluid set temperature range, the circulating fluid set temperature is changed to the upper limit value. If it is lower than the lower limit, the circulating fluid set temperature is changed to the lower limit value.

3.13.7 **Operation instruction**

Name	Operation instruction															
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Bit	Name	Explanation
0	Operation Start Command	Operation Start / Stop 0= Operation Stop 1= Operation Start
1	Mode request flag	Mode request 0= None 1= Yes
2	Alarm reset flag	Alarm reset 0= None 1= Yes
3 to15	None	-

Operation Start Command

SERIAL mode, you can control the operation start / stop of this product.

Mode request flag

The mode request flag can be switched to the SERIAL mode is changed from 0 to 1. After that, even if it changes to 0, it keeps SERIAL mode.
(For details, Refer to “1.2 Change of operation mode”)

Alarm reset flag

Alarm reset can be performed by changing the alarm reset flag from 0 to 1 in SERIAL mode.

3.13.8 **Data instruction**

By setting the data instructions to display the data that you selected in each data display 1and 2.
The types of data that can be displayed are shown below.
Data display 1 displays data of the type instructed in data instruction 1 (data instruction 0-3 bits), data display 2 data instruction 2 (data instruction high 4-7 bits).

Name	Data instruction 2				Data instruction 1			
Bit	7	6	5	4	3	2	1	0

Numeric value		Description
Data instruction 1	0	None
	1	Circurating fluid return temperature
	2	Circulating fluid electrical conductivity
	3	Pressure of high pressure refrigerant circuit
Data instruction 2	0	None
	1	Circurating fluid return temperature
	2	Circulating fluid electrical conductivity
	3	Pressure of high pressure refrigerant circuit

■ Communication example

When reading the circulating fluid return temperature to the data display 1

○Device Address : No.1

○Function code 16 : Write one data to 0043 h
(Set a circurating fluid return temperature to data instruction 1.)

Request message 01100043 0001 02 0001			
Field name	Example (HEX)	ASCII mode character data	RTU mode binary data
Header	-	“**:**”	None
Device Address	0x01	“0”,“1”	0x01
Function	0x10	“1”,“0”	0x10
Address of the specified register	0x0043	“0”,“0”,“4”,“3”	0x00,0x43
Number of register to write	0x0001	“0”,“0”,“0”,“1”	0x00,0x01
Number of bite to write	0x02	“0”,“2”	0x02
Information written to 0043h (Data instruction)	0x0001	“0”,“0”,“0”,“1”	0x00,0x01
Checksum ASCII:LRC RTU:CRC	-	“A”,”B”	0x69,0x63
Trailer	-	CR/LF	None
-	Total quantity of byte	23	11

Response message 01 1000 4300 01			
Field name	Example (HEX)	ASCII mode character data	RTU mode binary data
Header	-	“**:**”	None
Device Address	0x01	“0”,“1”	0x01
Function	0x10	“1”,“0”	0x10
Address of register to write	0x0043	“0”,“0”,”4”,”3”	0x00,0x43
Number of register to write	0x0001	“0”,“0”,“0”,“1”	0x00,0x01
Checksum ASCII:LRC RTU:CRC	-	“A”,“B”	0xF0,0x1D
Trailer	-	CR/LF	None
-	Total quantity of byte	17	8

●Function code 4 : Read one data of 0038 h
(Read out the circurating fluid return temperature of data display 1.)

Request message 01040038 0001			
Field name	Example (HEX)	ASCII mode character data	RTU mode binary data
Header	-	“:”	None
Device Address	0x01	“0”,“1”	0x01
Function	0x04	“0”,“4”	0x04
Head address of specified register	0x0038	“0”,“0”,“3”,“8”	0x00,0x38
Quantity of register to read	0x0001	“0”,“0”,“0”,“1”	0x00,0x01
Checksum ASCII:LRC RTU:CRC	-	“C”,”2”	0xB0,0x07
Trailer	-	CR/LF	None
	Total quantity of byte	17	8

Response 01040200FA			
Field name	Example (HEX)	ASCII mode character data	RTU mode binary data
Header	-	“:”	None
Device Address	0x01	“0”,“1”	0x01
Function	0x04	“0”,“4”	0x04
Quantity of bytes to read	0x02	“0”,“2”	0x02
Information of 0038h (Data display 1)	0x00FA	“0”,“0”,“F”,“A”	0x00,0xFA
Checksum ASCII:LRC RTU:CRC	-	“F”,”F”	0x39,0x73
Trailer	-	CR/LF	None
	Total quantity of byte	15	7

∗ Response message at a circurating fluid return temperature of 25.0℃

Chapter 4 Communication alarm function

Monitors whether the serial communication is sent/received properly between the product and the customer's product. This feature is only valid when the operation mode is set to SERIAL mode.

Abnormal signals or disconnection of the communication cable can be notified immediately by setting the alarm function to match the interval at which messages are sent from the customer product. When the communication is restored, the alarm is automatically reset.

Do not use this function when the customer product does not send messages regularly.

4.1 Communication alarm occurs

Fig.4-1 shows when an alarm occurs. Refer to "4.3 Setting method" for the setting method.

●Communication alarm

Operation continues when an alarm occurs.

●Time for monitoring the communication alarm

180 sec

When the customer's product is sending messages every 60sec, if the communication cable is disconnected and no message is received for 180sec, the product generates AL19 communication error alarm to notify the error.

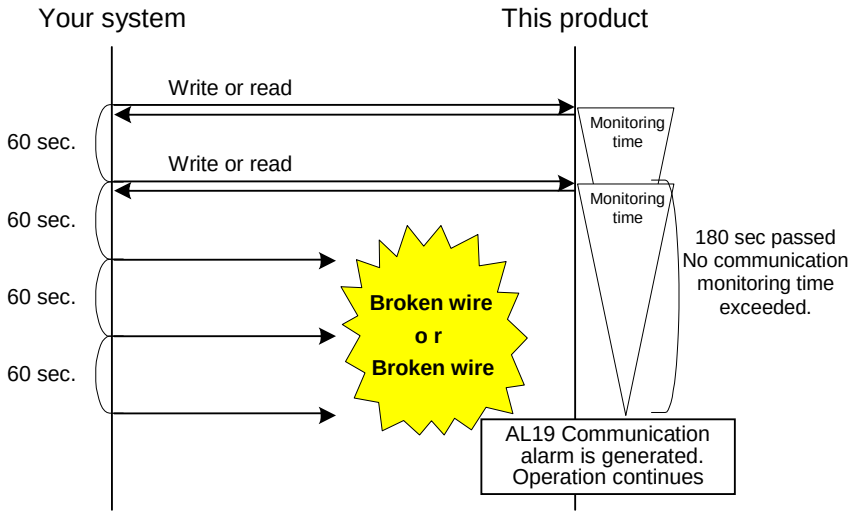


Fig.4-1 Communication alarm example

4.2 Communication alarm reset

When AL19 communication error has been generated, the alarm is automatically reset when the disconnection of the communication cable is fixed, and the message from the customer is received. If operation is set to stop when a communication alarm occurs, restart the operation if necessary.

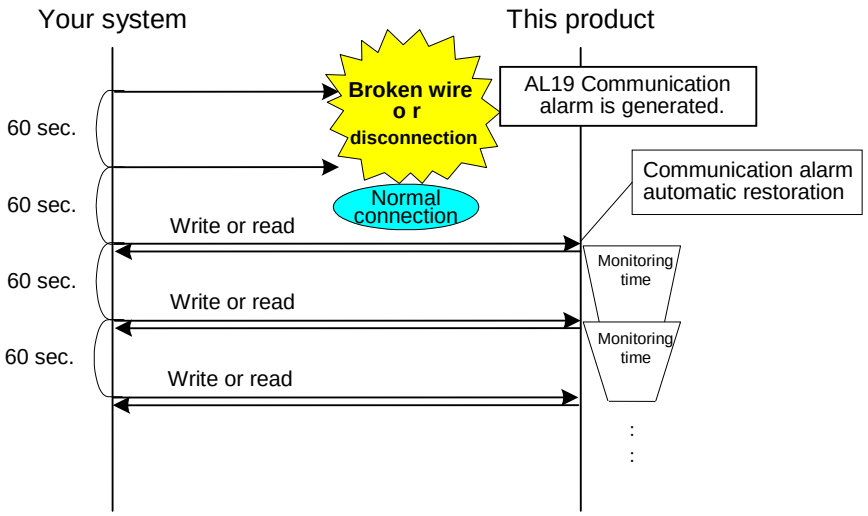


Fig.4-2 Communication alarm restoration example

4.3 Setting method

Set of serial communication is done from “1.4 Operation display panel flow” (Communicataion menu).

Refer to “3.6 Setting method”.

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