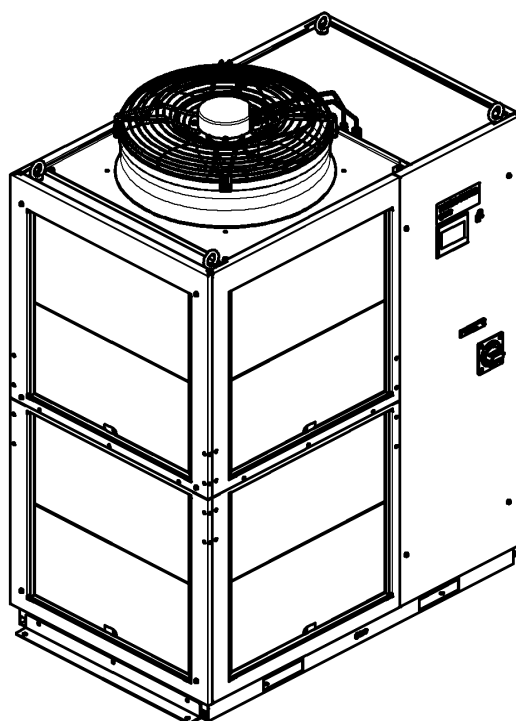




# Operation Manual

## Communication function

Thermo-chiller  
Air-Cooled refrigerated type  
*HRS400-A \*-46-\**



**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 installation and operation of the product. Only people who understand the basic operation of the product through this manual or who performs installation and operation of or have basic 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.**

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# Chapter 1 Read before using

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

- The serial communication protocol is a Modbus communication.

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 / Analog 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/RS232C) enables remote control of run/start of the product, temperature setting, and details of product condition and alarm condition can be obtained.

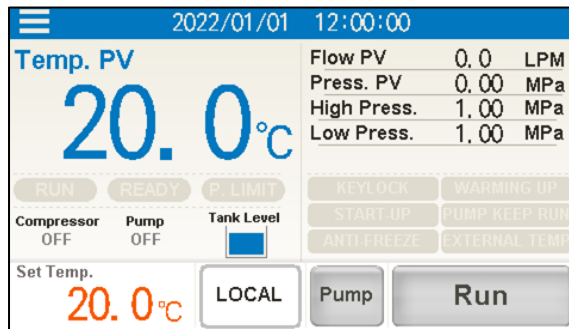
**●If using contact input/output communication, refer to chapter 2.**

**●If using serial communication Modbus, refer to chapter 3.**

# 1.1 Operation mode and operation method

LOCAL, DIO and SERIAL are available as the operation modes. Table 1.1-1 explains the operation modes. The default setting is LOCAL.

The operation method depends on the operation mode. Table 1.1-2 shows how the operation mode and method of operation are related.



Operation mode display and setting

Table 1.1-1 Operation modes.

Operation mode	Explanation	Contents	Display
LOCAL	Run / stop and circulating fluid temperature setting are possible with the touch panel.	Set the operation mode to "LOCAL".	To display the "LOCAL"
DIO	Run / stop by contact input. Circulating fluid temperature setting is done at the touch panel.	Set the operation mode to "DIO".	To display the "DIO"
SERIAL	Run / stop and circulating fluid temperature setting are possible with the serial	Set the operation mode to "SERIAL".	To display the "SERIAL"
		Set to "SERIAL" mode and set "DIO Run/Stop" "Serial Setting" to "ON" (enabled).	To display the "SERIAL (DIO Run)".

- Displays the current operation mode.
- You can change the operation mode by pressing it.

Table 1.1-2 Operation mode and operation

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

\*1 When Contact input 1 is set to Run / Stop, one external switch can be connected.

○ Applicable

## 1.2 Change of operation mode

There are the following methods to change the operation mode.

- Change by touch panel
- Change by mode request

### ■About mode request

The mode request, is the ability to change the operation mode by the contact input or serial communication.

When switching from OFF to ON for both contact input, serial communication, the mode request becomes effective and the operation mode changes.

Table 1.2-1 Operation mode change by mode request

Operation mode	Operation mode change method
LOCAL	None*1
DIO	Input the mode request signal (OFF to ON) to contact input 3.
SERIAL	The mode request flag is turned from OFF to ON by serial communication. *2

\*1 Change to LOCAL mode is possible only from touch panel operation.

\*2 When "DIO Run / Stop" is set in advance by the touch panel, run / stop is performed by the contact input signal.

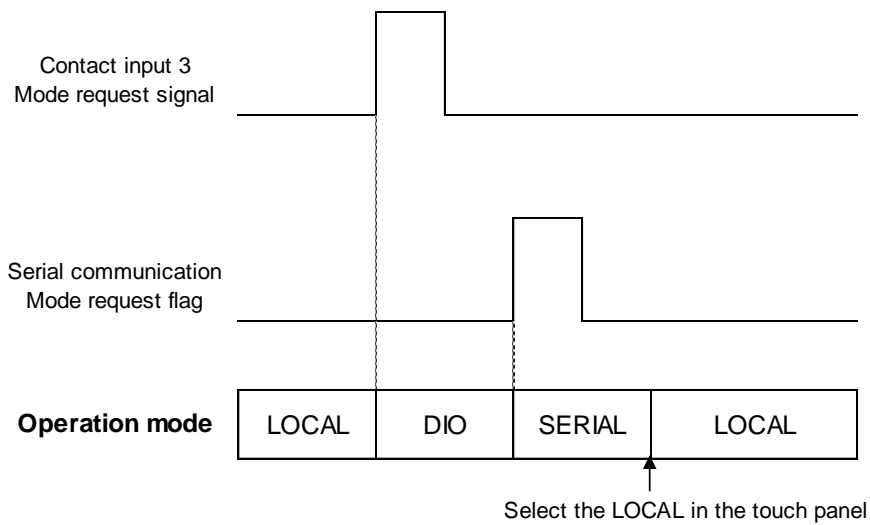


Fig. 1-1 Mode switching by the mode request (Standard)

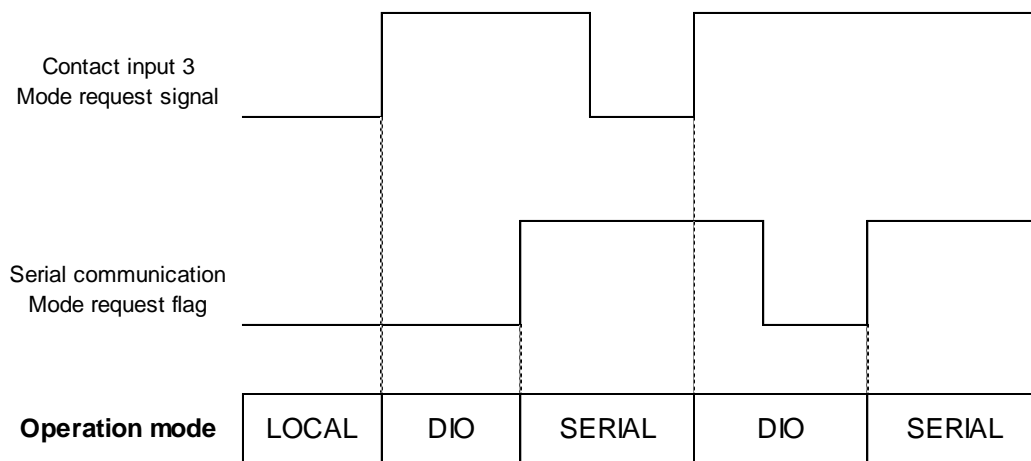


Fig.1-2 Mode switching by the mode request (ON state mixed)



## 1.3 Communication port

The communication port In the lower left of the electrical component box is used for communication.

Fig.1-3 shows the location of the communication port.

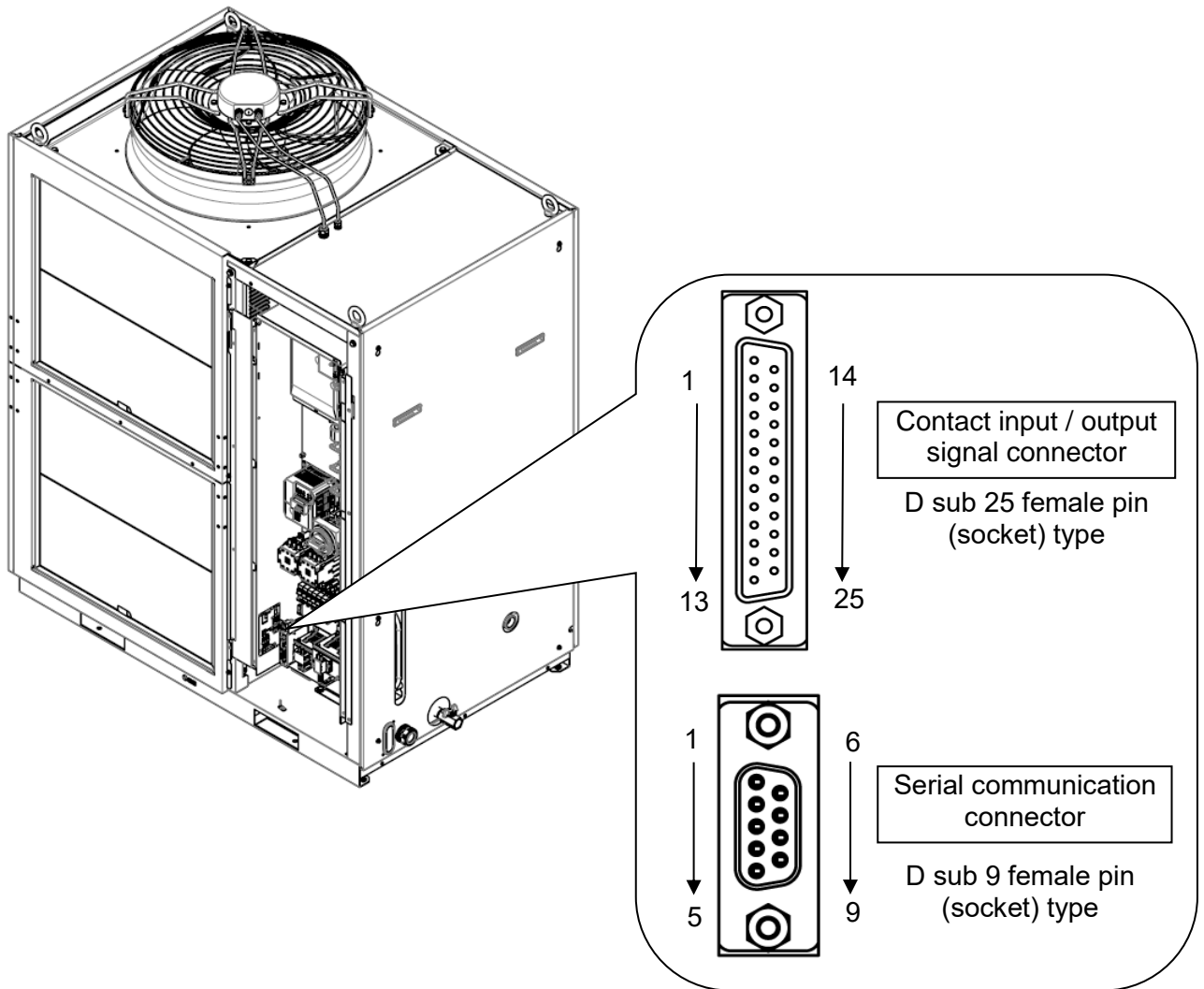


Fig.1-3 Communication port

# 1.4 Touch panel flow

Press the [Comm. Setting] on the menu, make the communication settings from the various setting screens.

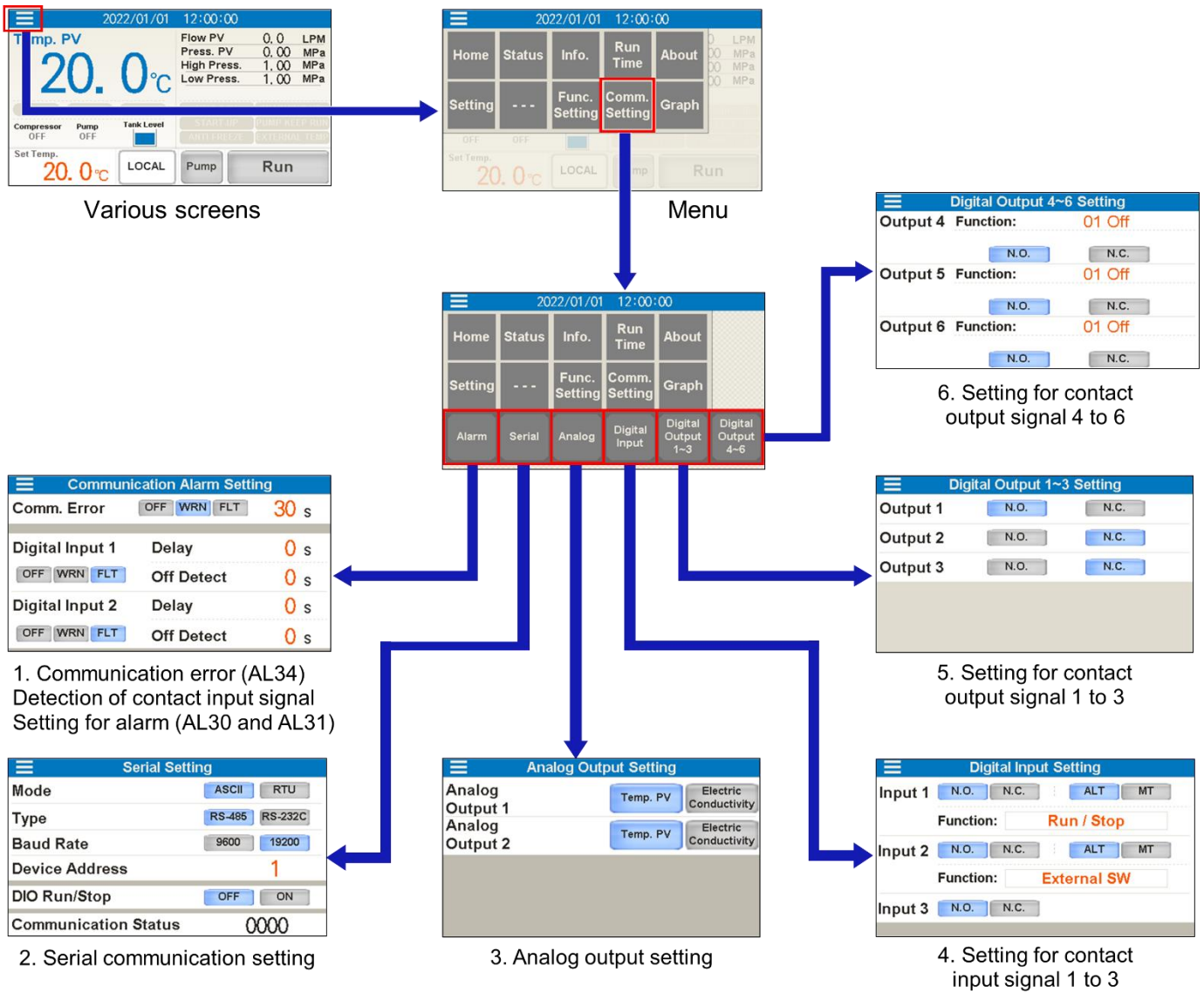


Fig.1-4 Communication setting touch panel flow

# Chapter 2 Contact input/output communication / Analog output communication

The device is equipped with a terminal which runs/stops the product. It is also equipped with a terminal which picks up operation signals, alarm signals and setting condition.

The device 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 and analog output signals that this product is equipped with are shown in Table 2-1.

Table 2-1 Contact input / output signal and analog output signal

Signal		Signal content
Contact input 3pcs.	Contact input 1	• Operation / stop signal, Allowed input an external switch signal • Selectable signal configuration (Alternate/Momentary)
	Contact input 2	• Selectable contact type (normally open / normally closed)
	Contact input 3	Mode request signal only (momentary)
Contact output 3pcs.	Contact output 1	• Output operation status (RUN / STOP) signal *1 • Selectable contact type (normally open / normally closed)
	Contact output 2	• Output the operation stop "FLT" alarm signal *1 • Selectable contact type (normally open / normally closed)
	Contact output 3	• Output the continued operation "WRN" alarm signal *1 • Selectable contact type (normally open / normally closed)
	Contact output 4	• Selectable signal content(Refer to "2.4 Contact output signal") • Selectable contact type (normally open / normally closed)
	Contact output 5	
	Contact output 6	
Analog output 2pcs.	Analog output 1	Selectable from the following • Circulating fluid discharge temperature
	Analog output 2	• Circulating fluid electric conductivity *2

\*1 Signal the contents of the contact output 1 to 3 is a fixed value.  
It is not possible to change the content of the signal.

\*2 For option D "With electrical conductivity control", you can select it.

## 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 touch 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 2.2-1 Contact input/output communication connector

<b>Connector specification (this product side)</b>
Dsub 25 pin female (socket) type

Table 2.2-2 Contact input/output/ analog output communication specification

Item		Specification	
Contact input signal 1,2,3	Insulation system	Photo coupler	<ul style="list-style-type: none"> <li>• Run/Stop signal</li> <li>• External switch signal</li> <li>• Operation mode request signal (Contact input 3 fixed)</li> </ul>
	Rated input voltage	DC24V	
	Operating voltage range	DC21.6V to 26.4V	
	Rated input current	5mA TYP	
	Input impedance	4.7kΩ	
Contact output signal 1,2,3,4,5,6	Rated load voltage	AC48V or less / DC30V or less	<ul style="list-style-type: none"> <li>• Signal of operating status</li> <li>• Alarm signal</li> <li>• TEMP READY signal etc. *2</li> </ul>
	Maximum load current	AC/DC 800mA or less *1	
	Minimum load current	DC5V 10mA	
Analog output signal 1,2	Output voltage range	0V to +10V	<ul style="list-style-type: none"> <li>• Circulating fluid discharge temperature</li> <li>• Circulating fluid electric conductivity *3</li> </ul>
	Maximum output current	10mA	
	Maximum accuracy	±0.4%F.S. or less	
DC24V output voltage		DC24V±10% 200mA MAX *1 (It can not be used for inductive load.)	

\*1 The total load current must be 800 mA or less. To use the power of the device, the total load current must be 200 mA or less.

\*2 Refer to “2.4.2 Contact output signal 4 to 6”.

\*3 For option D “With electrical conductivity control”, it can be set.

表 2.2-3 接点入出力/アナログ出力ピン番号

PIN No.	Item	Division	Factory default
1	DC24V output	Output	—
2	DC24V input	Input	—
3	Contact input signal 1	Input	Run/Stop *1
4	Contact input signal 3	Input	Operation mode request signal (fix)*2
5	Contact output signal 6	Output	OFF*1
6	Contact output signal 1	Output	Run status signal [N.O type](fix)*2
7	Contact output signal 3	Output	Operation continuation[WRN]alarm status signal [N.C. type ](fix)*2
8	Contact output signal 5	Output	OFF*1
9	None	—	Can not connect *3
10	Analog output signal 2	Output	Circulating fluid discharge temperature signal *4
11	Analog output signal 1	Output	Circulating fluid discharge temperature signal *4
12	None	—	Can not connect *3
13	None	—	Can not connect *3
14	24 COM output (Common of contact input signal)	Output	—
15	Common of contact output signal 1, 2, 3, 4, 5	Output	—
16	Contact input signal 2	Input	External switch signal *1
17	None	—	Can not connect *3
18	Common of contact output signal 6	Output	—
19	Contact output signal 2	Output	Operation stop [FLT] alarm status signal [N.C. type ](fix) *2
20	Contact output signal 4	Output	OFF*1
21	None	—	Can not connect *3
22	Common of contact output signal 2	Output	—
23	Common of contact output signal 1	Output	—
24	None	—	Can not connect *3
25	None	—	Can not connect *3

\*1 It is possible to change the setting.

\*2 You can not change the setting("N.O type / N.C. type" can be changed).

\*3 Do not wire.

\*4 For option D "With electrical conductivity control", it is possible to change the setting.

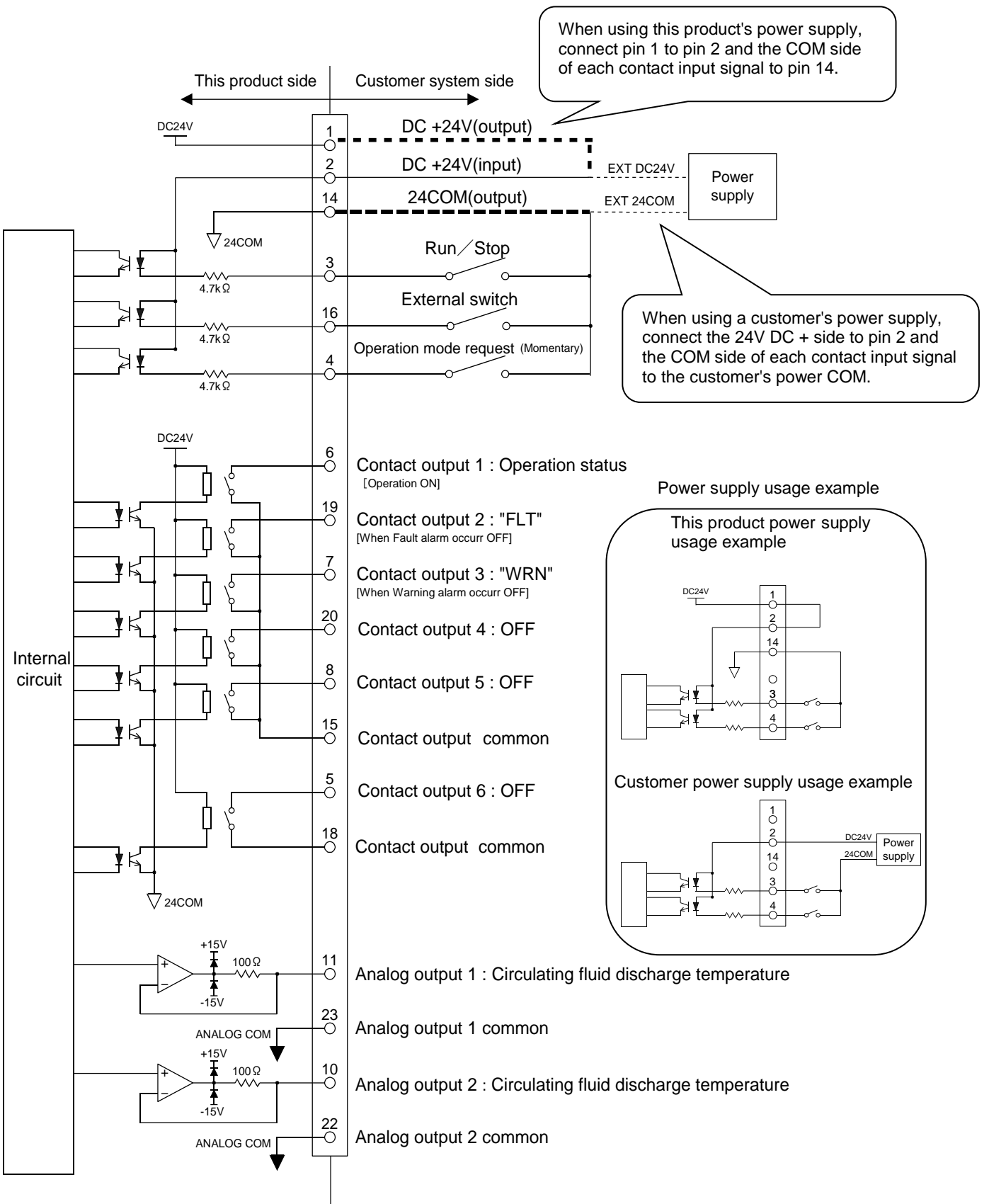


Fig.2-2 Circuit diagram

## 2.3 Contact input signal

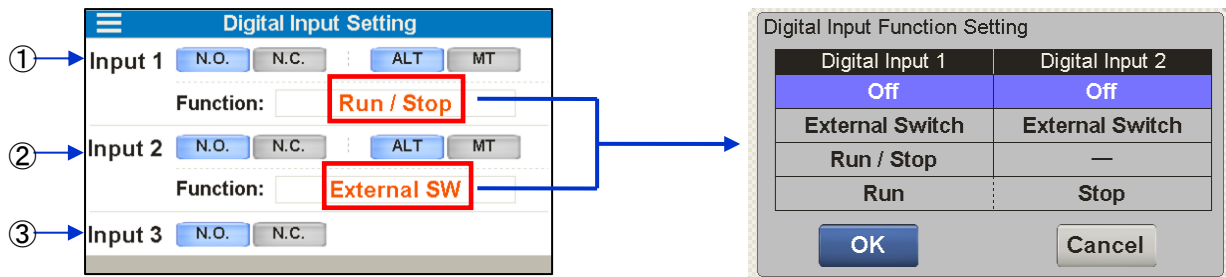
There are 3 contact input signals. Two of them can be customized by the customer.

### 2.3.1 Setting of contact input signal type and form

The type of contact input signal can be set from the "1.4 Touch panel flow" (Refer to "4. Setting for contact input signal 1 to 3" screen).

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), "external switch" (external switch signal) or "run/stop" (run/stop) signal, Run (run) signal, Stop (stop) signal



Setting for contact input signal 1 to 3

Table 2.3-1 Setting of contact input signal form

No.	Indication	Item	Setting and selection																					
(1)	Input 1	Contact input signal 1	<table border="1"> <tr> <td>Contact type</td> <td><input type="button" value="N.O."/> *1</td> <td>A contact (normally open)</td> </tr> <tr> <td></td> <td><input type="button" value="N.C."/> </td> <td>B contact (normally closed)</td> </tr> <tr> <td>Signal form</td> <td><input type="button" value="ALT"/> *1</td> <td>Alternate</td> </tr> <tr> <td></td> <td><input type="button" value="MT"/> </td> <td>Momentary</td> </tr> <tr> <td rowspan="4">Signal type</td> <td><input type="button" value="[Off]"/></td> <td>Disabled</td> </tr> <tr> <td><input type="button" value="[External Switch]"/></td> <td>External switch signal</td> </tr> <tr> <td><input type="button" value="[Run/Stop]"/> *1</td> <td>Run/stop signal</td> </tr> <tr> <td><input type="button" value="[Run]"/> *2</td> <td>Run signal</td> </tr> </table>	Contact type	<input type="button" value="N.O."/> *1	A contact (normally open)		<input type="button" value="N.C."/>	B contact (normally closed)	Signal form	<input type="button" value="ALT"/> *1	Alternate		<input type="button" value="MT"/>	Momentary	Signal type	<input type="button" value="[Off]"/>	Disabled	<input type="button" value="[External Switch]"/>	External switch signal	<input type="button" value="[Run/Stop]"/> *1	Run/stop signal	<input type="button" value="[Run]"/> *2	Run signal
			Contact type	<input type="button" value="N.O."/> *1	A contact (normally open)																			
				<input type="button" value="N.C."/>	B contact (normally closed)																			
			Signal form	<input type="button" value="ALT"/> *1	Alternate																			
				<input type="button" value="MT"/>	Momentary																			
			Signal type	<input type="button" value="[Off]"/>	Disabled																			
				<input type="button" value="[External Switch]"/>	External switch signal																			
<input type="button" value="[Run/Stop]"/> *1	Run/stop signal																							
<input type="button" value="[Run]"/> *2	Run signal																							
(2)	Input 2	Contact input signal 2	<table border="1"> <tr> <td>Contact type</td> <td><input type="button" value="N.O."/> *1</td> <td>A contact (normally open)</td> </tr> <tr> <td></td> <td><input type="button" value="N.C."/> </td> <td>B contact (normally closed)</td> </tr> <tr> <td>Signal form</td> <td><input type="button" value="ALT"/> *1</td> <td>Alternate</td> </tr> <tr> <td></td> <td><input type="button" value="MT"/> </td> <td>Momentary</td> </tr> <tr> <td rowspan="3">Signal type</td> <td><input type="button" value="[Off]"/></td> <td>Disabled</td> </tr> <tr> <td><input type="button" value="[External Switch]"/> *1</td> <td>External switch signal</td> </tr> <tr> <td><input type="button" value="[Stop]"/> *2</td> <td>Stop signal</td> </tr> </table>	Contact type	<input type="button" value="N.O."/> *1	A contact (normally open)		<input type="button" value="N.C."/>	B contact (normally closed)	Signal form	<input type="button" value="ALT"/> *1	Alternate		<input type="button" value="MT"/>	Momentary	Signal type	<input type="button" value="[Off]"/>	Disabled	<input type="button" value="[External Switch]"/> *1	External switch signal	<input type="button" value="[Stop]"/> *2	Stop signal		
			Contact type	<input type="button" value="N.O."/> *1	A contact (normally open)																			
				<input type="button" value="N.C."/>	B contact (normally closed)																			
			Signal form	<input type="button" value="ALT"/> *1	Alternate																			
				<input type="button" value="MT"/>	Momentary																			
			Signal type	<input type="button" value="[Off]"/>	Disabled																			
				<input type="button" value="[External Switch]"/> *1	External switch signal																			
<input type="button" value="[Stop]"/> *2	Stop signal																							
(3)	Input 3	Contact input signal 3 *3	<table border="1"> <tr> <td rowspan="2">Contact type</td> <td><input type="button" value="N.O."/> *1</td> <td>A contact (normally open)</td> </tr> <tr> <td><input type="button" value="N.C."/> </td> <td>B contact (normally closed)</td> </tr> </table>	Contact type	<input type="button" value="N.O."/> *1	A contact (normally open)	<input type="button" value="N.C."/>	B contact (normally closed)																
			Contact type		<input type="button" value="N.O."/> *1	A contact (normally open)																		
				<input type="button" value="N.C."/>	B contact (normally closed)																			

\*1 By default.

\*2 This setting assigns “run” signal to “contact input 1” and “stop” signal to “contact input 2”.

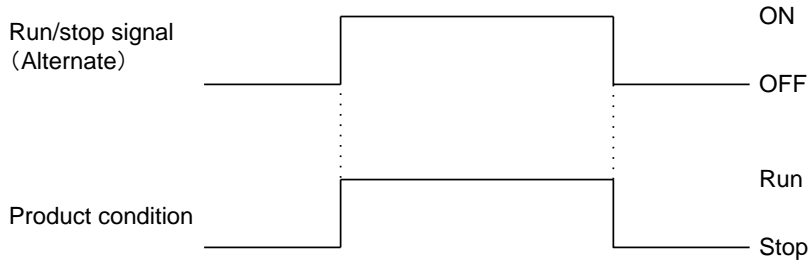
\*3 The signal form of contact input 3 is “momentary”.



### 2.3.2 Run/stop·Run·Stop·External switch signal

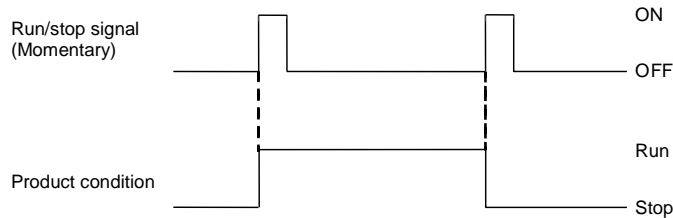
1) Run/stop signal (Signal type: Alternate)

The product keeps operating while the input signal from the customer is ON.



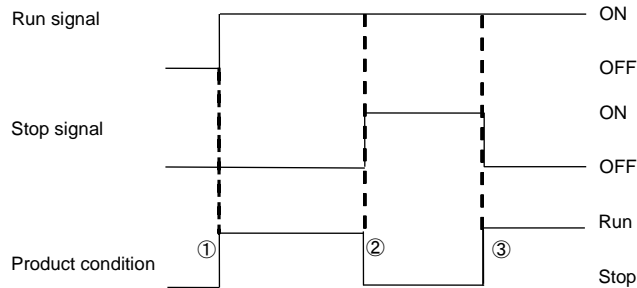
2) Run/stop signal (Signal type: Momentary)

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.



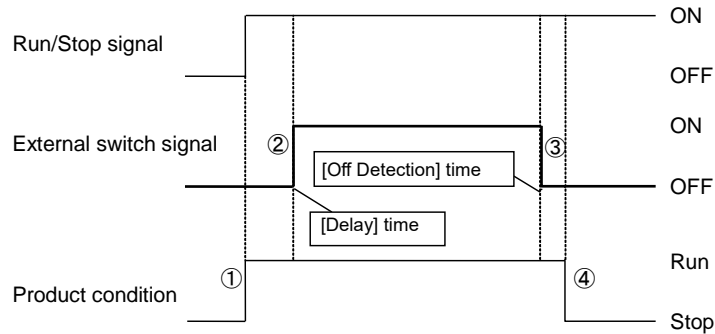
3) Run signal (Signal type: Alternate) /Stop signal (Signal type: Alternate)

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) Digital input signal 1 is for Run/Stop signal (Signal type: Alternate), digital input signal 2 is for external switch signal (Signal type: Alternate). Refer to Chapter 2.3.3 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.O type) after the time which has been set for the [Delay] time.
- (3) When the external switch signal (N.O. type) has been turned off for the time set for [Off Detection] time, it is recognized as OFF.
- (4) Alarm [AL 31: 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.

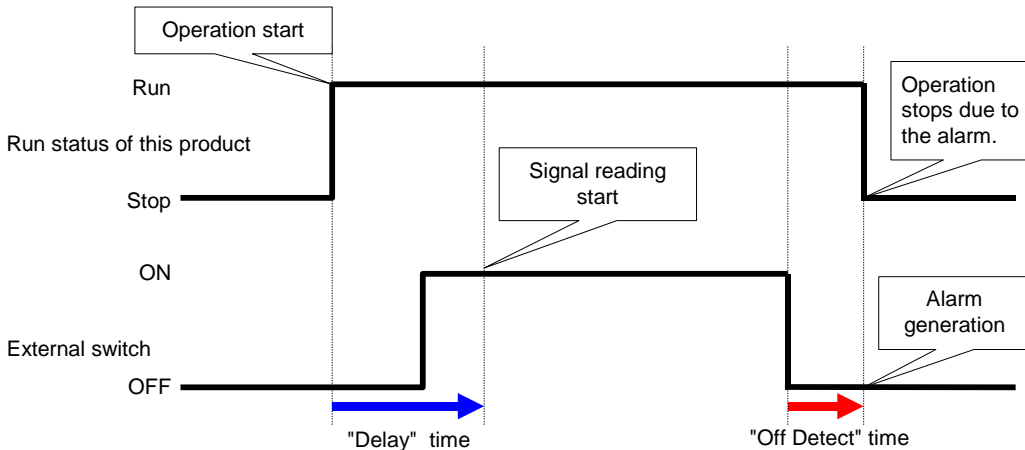
### 2.3.3 External switch signal

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 “External Switch” (external switch signal) for the type of contact input signal. (Refer to “2.3.1 Setting of contact input signal type and form”)  
 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 “AL30: Detection of contact input 1 signal” is activated.
- If the signal of “contact input 2” is detected: the alarm “AL31: 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 2.3-2 Monitoring method for contact input signal

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



"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

Set "Delay" time, "Off Detect" time and "Operation at alarm occurrence" of external switch signal from "1.4 Touch panel flow (Refer to "1. Communication error (AL34), contact input signal detection alarm (AL30, AL31) setting" screen).

Communication Alarm Setting			
(1)	Comm. Error	OFF WRN <b>FLT</b>	30 s
(2)	Digital Input 1	Delay	0 s
		OFF WRN <b>FLT</b>	Off Detect 0 s
(3)	Digital Input 2	Delay	0 s
		OFF WRN <b>FLT</b>	Off Detect 0 s

Communication error, detection alarm

Table 2.3-3 Communication error, detection of contact input signal and operation setting

No.	Indication	Item	Setting and selection		Setting range	
(1)	Comm. Error	Alarm "AL34: Communication error"	<input type="button" value="OFF"/>	Disabled	Waiting time	30 to 600sec *30sec
			<input type="button" value="WRN"/> *	Operation continues during the alarm		
			<input type="button" value="FLT"/>	Operation stops during alarm		
(2)	Digital Input 1	Alarm "AL30: Detection of contact input 1 signal"	<input type="button" value="OFF"/>	Disabled	Delay	0 to 300sec *0sec
			<input type="button" value="WRN"/>	Operation continues during the alarm	Off Detect	0 to 10sec *0sec
			<input type="button" value="FLT"/> *	Operation stops during alarm		
(3)	Digital Input 2	Alarm "AL31: Detection of contact input 2 signal"	<input type="button" value="OFF"/>	Disabled	Delay	0 to 300sec *0sec
			<input type="button" value="WRN"/>	Operation continues during the alarm	Off Detect	0 to 10sec *0sec
			<input type="button" value="FLT"/> *	Operation stops during alarm		

\* By default

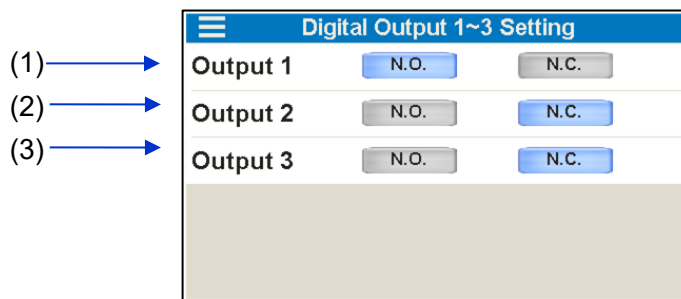
## 2.4 Contact output signal

There are 6 contact output signals. Setting of the contact output signal is done by the "1.4 Touch panel flow" (Refer to "5. Setting for contact output signal 1 to 3" screen and "6. Setting for contact output signal 4 to 6" screen).

Contact output signal 4 to 6 can be used to change the signal type.

### 2.4.1 Contact output signal 1 to 3

The contact type of contact output signals 1 to 3 can be set. Contact output signal is continuously output.



Setting of contact output signal 1 to 3

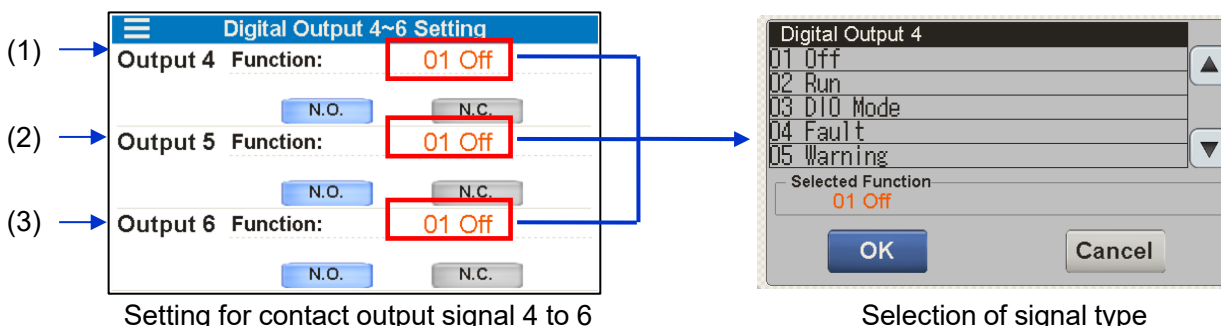
Table 2.4-1 Setting of contact output signal 1 to 3

No.	Indication	Item	Signal type	Setting and selection	
(1)	Output 1	Contact output signal 1	Operation status signal	<input type="button" value="N.O."/> *	A contact (normally open)
				<input type="button" value="N.C."/>	B contact (normally closed)
(2)	Output 2	Contact output signal 2	Operation stop (FLT) alarm status signal	<input type="button" value="N.O."/>	A contact (normally open)
				<input type="button" value="N.C."/> *	B contact (normally closed)
(3)	Output 3	Contact output signal 3	Continuous operation "WRN" alarm status signal	<input type="button" value="N.O."/>	A contact (normally open)
				<input type="button" value="N.C."/> *	B contact (normally closed)

\* By default

### 2.4.2 Contact output signal 4 to 6

Contact output signal 4 to 6 can be set to "signal type", "contact form". A "signal type" for contact output signal 4 to 6 can be selected by the customer. Refer to "Table 2.4-3 Signal type for contact output signal 4 to 6".



Setting for contact output signal 4 to 6

Selection of signal type

Table 2.4-2 Setting for output signal 4 to 6

No.	Indication	Item	Signal type	Contact type	
(1)	Output 4 Function	Contact output signal 4	Select from "Table 2.4-3 Signal type for contact output signal 4 to 6" *「Off」	<input type="button" value="N.O."/> *	A contact (normally open)
				<input type="button" value="N.C."/>	B contact (normally closed)
(2)	Output 5 Function	Contact output signal 5		<input type="button" value="N.O."/> *	A contact (normally open)
				<input type="button" value="N.C."/>	B contact (normally closed)
(3)	Output 6 Function	Contact output signal 6		<input type="button" value="N.O."/> *	A contact (normally open)
				<input type="button" value="N.C."/>	B contact (normally closed)

\* By default

Table 2.4-3 Signal type for contact output signal 4 to 6

No.	Indication	Item	Contact type	Explanation
1	Off	Disabled	N.O.	Normally open
			N.C.	Normally closed
2	Run	Operation status signal	N.O.	Operation : closed
			N.C.	Stop : closed
3	DIO Mode	DIO mode signal	N.O.	DIO mode : closed
			N.C.	DIO mode : open
4	Fault	Operation stop "FLT" alarm status signal	N.O.	Alarm occurred : closed
			N.C.	Alarm occurred : open
5	Warning	Continuing operation "WRN" alarm status signal	N.O.	Alarm occurred : closed
			N.C.	Alarm occurred : open
6	Alarm	Alarm status signal	N.O.	Alarm occurred : closed
			N.C.	Alarm occurred : open
7	Maintenance	Maintenance reminders status signal	N.O.	Maintenance reminders occurred : closed
			N.C.	Maintenance reminders occurred : open
8	TEMP READY	TEMP READY signal	N.O.	TEMP READY status : closed
			N.C.	TEMP READY status : open
9	TEMP OUT	TEMP OUT signal	N.O.	TEMP OUT status : closed
			N.C.	TEMP OUT status :open
10	EXTERNAL TEMP	None	—	—
11	START-UP	Startup setting status signal	N.O.	Enabled : closed
			N.C.	Enabled : open
12	ANTI-FREEZEING	Anti-freezing setting status signal	N.O.	Enabled : closed
			N.C.	Enabled : open
13	WARMING UP	Warming up setting status signal	N.O.	Enabled : closed
			N.C.	Enabled : open
14	Digital Input 1	Pass through signal of the contact input signal 1	N.O.	Output the input signal as it is
			N.C.	Reverse output of the input signal
15	Digital Input 2	Pass through signal of the contact input signal 2	N.O.	Output the input signal as it is
			N.C.	Reverse output of the input signal
16	Mode Request Input	Mode request input signal (DIO) (Pass through signal of the contact input signal 3)	N.O.	Output the input signal as it is
			N.C.	Reverse output of the input signal
17	Select Alarm	Selected alarm status signal	N.O.	Selected alarm occurred : closed
			N.C.	Selected alarm occurred : open
Refer to "Table 2.4-4 List of alarm selection" for selectable alarms.				
18	Select Maintenance	Selected maintenance reminders status signal	N.O.	Selected maintenance reminders occurred : closed
			N.C.	Selected maintenance reminders occurred : open
Refer to "Table 2.4-5 List of maintenance reminders" for selectable maintenance reminders.				

Table 2.4-4 List of alarm selection \*1

Alarm No.	Indication	Explanation
AL01	Low Level FLT	Abnormal low tank fluid level
AL02	Low Level WRN	Low tank fluid level
AL06	Fan Inverter	Fan failure
AL09	High Temp. FLT	Abnormal rise of circulating fluid temperature
AL10	High Temp.	Circulating fluid temperature rise
AL11	Low Temp.	Circulating fluid temperature drop
AL12	TEMP READY ALARM	TEMP READY alarm
AL17	HX In High Temp. FLT	Abnormal rise in heat exchanger inlet temperature
AL18	Press. Sensor	Failure of circulating fluid discharge pressure sensor
AL19	High Press.	Circulating fluid discharge pressure rise
AL20	Low Press.	Circulating fluid discharge pressure drop
AL28 *2	High Electric Conductivity	Electric conductivity increase
AL29	No Power Supply	Power supply error
AL30	Digital Input 1	Contact input 1 signal detection
AL31	Digital Input 2	Contact input 2 signal detection
AL34	Communication	Communication error
AL35	Ambient Temp.	Outside of the ambient temperature range
AL36	Maintenance	Maintenance alarm
AL37	Refrigeration Circuit	Compressor circuit failure
AL38	Sensor	Sensor failure
AL39	Controller	Controller failure
AL40	Compressor Inverter	Compressor inverter error
AL41	Compressor Inverter Comm.	Compressor inverter communication error
AL42	Pump Inverter	Pump inverter error
AL43	Pump Inverter Comm.	Pump inverter communication error

\*1 Refer to Operation Manual "Installation / Operation".

\*2 For option D "With electrical conductivity control", you can select it.

Table 2.4-5 List of maintenance reminders \*1

Maintenance No.	Indication	Explanation
MT01	Pump	Pump maintenance
MT02	Compressor	Compressor maintenance
MT03	Fan	Fan maintenance
MT04	Dustproof Filter	Dust-proof filter maintenance
MT07	Low Battery	Battery maintenance
MT08	Pressure Sensor	Circulating fluid discharge pressure sensor maintenance
MT11 *2	DI Filter	DI filter maintenance

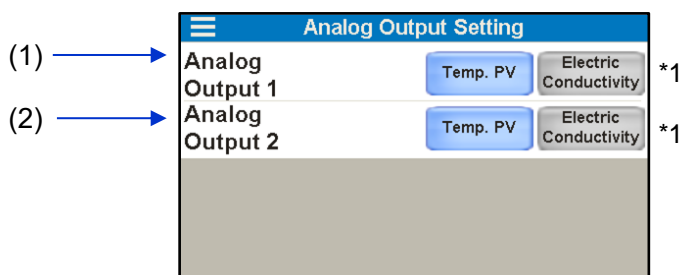
\*1 Refer to Operation Manual "Installation / Operation".

\*2 For option D "With electrical conductivity control", to display.

## 2.5 Analog output signal

The product has two analog output signals.  
 Setting of the analog output signal is done by the "1.4 Touch panel flow"  
 (Refer to "3. Analog Output Setting" screen).  
 The following signals can be output as analog signals:

- Analog output signal 1— "Circulating fluid discharge temperature",  
 or "Circulating fluid electric conductivity" \*1.
- Analog output signal 2— "Circulating fluid discharge temperature",  
 or "Circulating fluid electric conductivity" \*1.



Setting of analog output signal

\*1 For option D "With electrical conductivity control", it can be set.

Table 2.5-1 Setting of analog output signal

No.	Indication	Item	Setting, selection and display		Output	
(1)	Analog Output 1	Analog output signal 1	Temp. PV	*1	Circulating fluid discharge temperature	0 to 100°C:0~10V
			Electric Conductivity	*2	Circulating fluid electric conductivity	0.1~50.0μS/cm: 0.02~10.0V
(2)	Analog Output 2	Analog output signal 2	Temp. PV	*1	Circulating fluid discharge temperature	0 to 100°C:0~10V
			Electric Conductivity	*2	Circulating fluid electric conductivity	0.1 to 50.0μS/cm: 0.02~10.0V

\*1 By default

\*2 For option D "With electrical conductivity control", it can be set.



# Chapter 3 Serial communication

Serial communication (RS-485/RS232C) enables the remote control of run/stop of the product and temperature setting, 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 controller computer (e.g. PC).

The communication protocol is Modbus protocol.

## 3.1 Precautions wiring communication

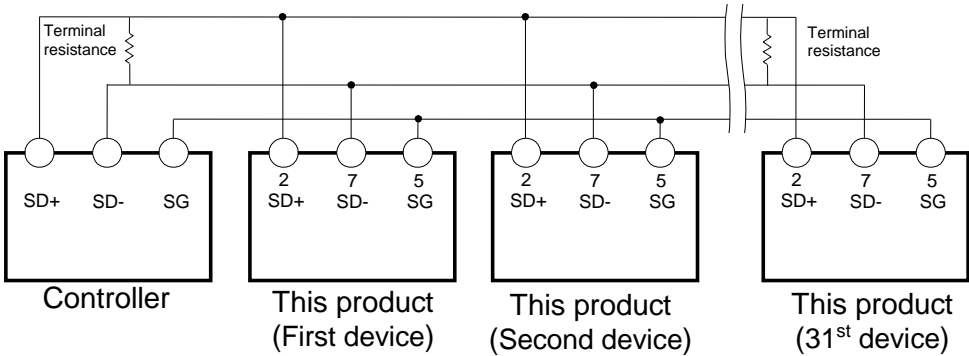
### ○Communication wiring

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. Fig.3-2 shows the wiring when RS-232C is selected.

A communication cable that connects the product and customer system is not included with the product. Prepare a cable, referring to Fig.3-1 or Fig 3-2.

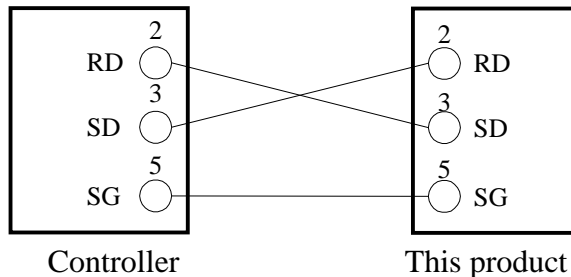


**Do not connect any wire to other PIN numbers.**

Fig.3-1 RS-485 connector connection

**[Tips]**

- 1 controller : 1 product, or 1 controller: N products.  
 In the latter case, up to 31 products can be connected.
- Both ends of the communication connection (the end nodes) need to be connected to the higher level computer.



**Do not connect any wire to other PIN numbers.**

Fig.3-2 RS-232C connector connection

### 3.3 Communication specification

Table 3.3-1 Serial communication specification

Item	Specification
Connector type (for the product)	D-sub9P type Female connector
Standard	Select from EIA RS-485 / RS-232C
Circuit type	Half duplex
Transmission type	Start-stop
Protocol	Modbus terminal <sup>*1</sup>
Terminal resistance	None

■ : Default setting

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

Table 3.3-2 Communication specification of Modbus communication function

Item	Specification
Standard	Select from EIA RS-485 / RS-232C
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 address
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 Reads the circulating fluid flow rate.
- Reads the circulating fluid electric conductivity (only option D).
- 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 touch panel.
  - The communication specification shall be the customer's communication standard.
  - The operation mode shall be the SERIAL mode. (When mode request flag is activated, SERIAL mode is selected. Refer to 3.13.9).

Other modes can perform reading, but only SERIAL mode can perform writing.

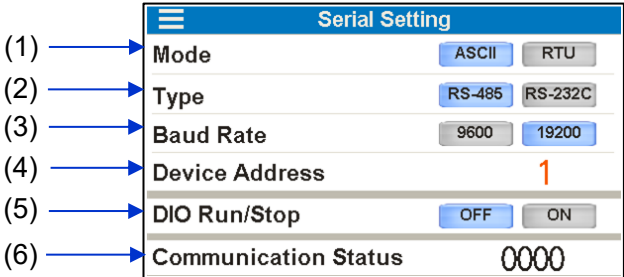
- Check or set the communication parameters using the touch panel.
  - Check or set the communication speed so that the product synchronizes with the controller computer (controller) prepared by the customer.
- Check the device address by the touch panel.
  - No response is returned when a request message 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 the circulating fluid set 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 Touch panel flow” (Refer to "2. Serial communication setting" screen).



Serial communication setting

Table 3.6-1 Serial communication setting

No.	Indication	Item	Setting, selection and display		Default setting
(1)	Mode	Communication format	ASCII	ASCII code	○
			RTU	Binary data	-
(2)	Type	Standard	RS-485	EIA RS-485	○
			RS-232C	EIA RS-232C	-
(3)	Baud Rate	Communication speed	9600	9600bps	-
			19200	19200bps	○
(4)	Device Address	Device address	1 to 32	Select from 1 to 32	1
(5)	DIO Run/Stop *1	“Run/stop” by contact input	OFF	Disabled	○
			ON	Enabled	-
(6)	Communication Status	Communication status *2	0000	Displays the communication status	-

\*1 “Run/stop” operation of the product is carried out by the contact input signal, and reading/writing the “change in set value of circulating fluid temperature” and “operation status” by serial communication.

\*2 It is a function to display the status of serial communication. It displays relevant contents for communication nonconformities, such as device address mismatch or register map of this product and accessing outside the area. The table 3.6-2 shows the display and its contents.

Table 3.6-2 Communication status

Communication setting	Contents
8001	Normal message
4801	An abnormal number of data has been sent from the customer's equipment.
4401	Trying to access to the outside address of the register map that supported by this product. Or trying to write to read-only address.
4201	Function code does not supported by this product is being sent from the customer's equipment.
0081	The device addresses set for this product and customer's equipment 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's equipment.
0000 *3	Bad wiring or no message sent from customer's equipment.

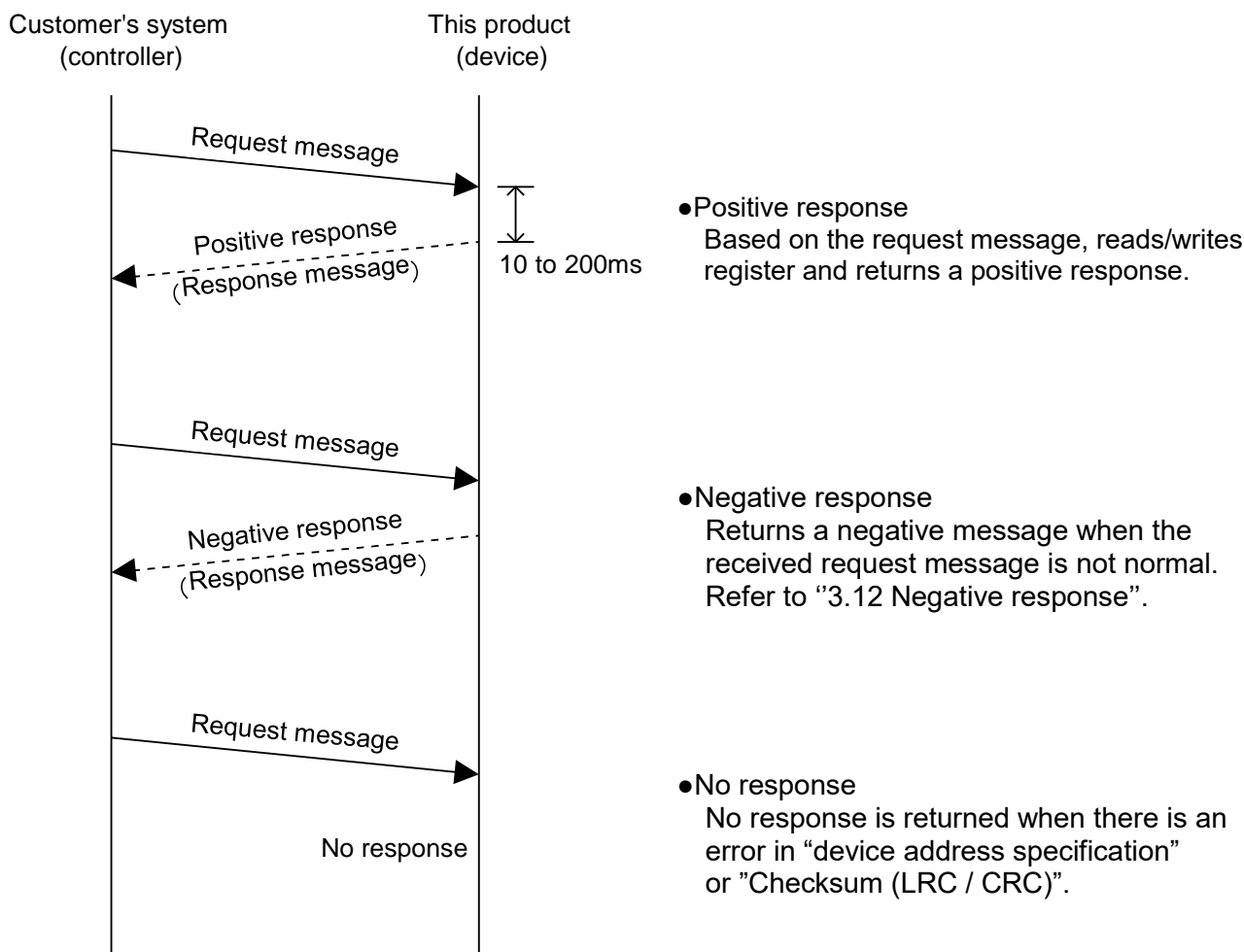
\*1 CRC (Refer to 3.10.2), LRC (Refer to 3.10.2)

\*2 "XX" means that it is undefined.

\*3 Initial state or 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.

## 3.7 Communication sequence

Starts with a request message from the customer's system (controller), and finishes with a response message from this product (device). This product operates as a device. It does not send any requests.



## 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 3.8-1 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 3.8-2 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 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) 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 code

Table 3.9-1 shows function codes to read or write register. Refer to "3.11 Explanation of function codes".

Table 3.9-1 Function codes

NO	Code	Name	Function
1	04(04h)	read input registers	Reading multiple registers
2	06(06h)	preset single register	Writing registers *1
3	16(10h)	preset multiple registers	Writing multiple registers

\*1 Broadcast is not supported.

## 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 LRC 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 0106000B00EA

- Device Address: No.1
- Function: No.6
- Writing address: 000Bh
- Writing data: 00EAh

No	Classification	Contents	Calculation result
1	LRC message for calculation	0106000B00EA	-
2	Calculation	Added for each 8 bit 01h+06h+00h+0Bh+00h+EAh=FCh	FCh
3		complement of 2 FCh→03h→04h	04h(LRC)
4	Sending message	[:]0106000B00EA04[CR][LF]	-

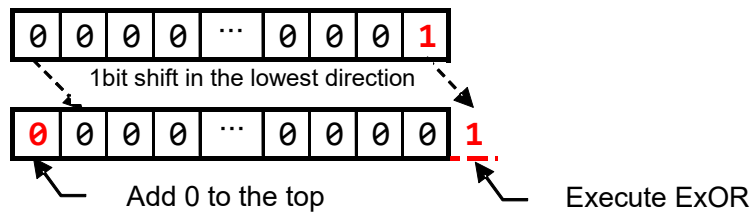
### 3.10.2 CRC(RTU)

CRC checks the content of the message. The sending side calculates the data every 2 bytes (16 bits). 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 calculation result and received CRC do not match.

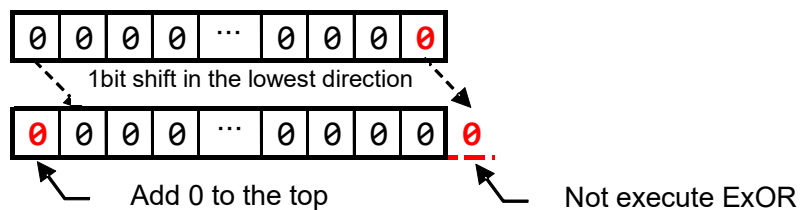
#### ■ Calculation procedure

- (1) Preload "FFFFh" (set 0xFFFF as initial value).
- (2) Exclusive OR the first byte of the transmitted message with the value in (1)
- (3) Shift the result of (2) by one bit toward the least significant bit, and fill a zero into the most significant bit position.
- (4) If the least significant bit was a 1, exclusive OR the result of (3) with "A001h" (Example 1). If the least significant bit was a 0, no exclusive OR takes place (Example 2).
- (5) Repeat (3) to (4) until eight shifts have been performed.
- (6) After eight shifts, exclusive OR the result of (5) with the next 1-byte (2nd byte).
- (7) The processes (3) to (6) are repeated for all the remaining bytes of the message.
- (8) The 2-byte data of the result of (7) is the CRC value.

(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 0106000B00EA

- Device Address: No.1
- Function: No.6
- Writing address: 000Bh
- Writing data: 00EAh

Data No.	1st value	2nd value	3rd value	4th value	5th value	6th value
Data contents	0001h	0006h	0000h	000Bh	0000h	00EAh

No	Classification	Contents	Calculation Result
1	CRC Message for calculation	0106000B00EA	-
2	Calculation	Perform (1) to (4) for the 1st value (0001h) and then, perform (5).	807Eh
3		Perform (6) for the 2nd value (0006h) and then, perform (5).	2280h
4		Perform (6) for the 3rd value (0000h) and then, perform (5).	A023h
5		Perform (6) for the 4th value (000Bh) and then, perform (5).	1EA0h
6		Perform (6) for the 5th value (0000h) and then, perform (5).	781Eh
7		Perform (6) for the 6th value (00EAh) and then, perform (5).	8779h (CRC)
8	Addition to the sent message	0106000B00EA7987*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 11 pieces data from register 0000h.

- Circulating fluid discharge temperature [ 20.0°C ]
- Circulating fluid flow rate [ 45.0LPM ]
- Circulating fluid discharge pressure [ 0.45MPa ]
- Circulating fluid electrical conductivity [ 20.0uS/cm ] \*1
- Status flag [during operation,TEMP READY status]
- Alarm flag 1 to 3 [no alarm ]
- Unused register \*2
- Data display 1 to 2 [non-selection (all 0) ]

\*1 "0" is displayed except for option D.

\*2 When the contents of the unused register are read, 0000h (0) is displayed.

Request message 01040000000B			
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	0x0000	“0”,“0”,“0”,“0”	0x00,0x00
Quantity of register to read	0x000B	“0”,“0”,“0”,“B”	0x00,0x0B
Checksum ASCII:LRC RTU:CRC	-	“F”,“0”	0xB1,0xCD
Trailer	-	CR/LF	None
	Total quantity of byte	17	8

Response message			
01041600C801C2002D00C80011000000000000000000000000			
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	0x16	“1”, “6”	0x16
Information of 0000h (Circulating fluid discharge temperature)	0x00C8	“0”, “0”, “C”, “8”	0x00, 0xC8
Information of 0001h (Circulating fluid flow rate)	0x01C2	“0”, “1”, “C”, “2”	0x01, 0xC2
Information of 0002h (Circulating fluid discharge pressure)	0x002D	“0”, “0”, “2”, “D”	0x00, 0x2D
Information of 0003h (Circulating fluid electrical conductivity)*1	0x00C8	“0”, “0”, “C”, “8”	0x00, 0xC8
Information of 0004h (Status flag)	0x0011	“0”, “0”, “1”, “1”	0x00, 0x11
Information of 0005h (Alarm flag 1)	0x0000	“0”, “0”, “0”, “0”	0x00, 0x00
Information of 0006h (Alarm flag 2)	0x0000	“0”, “0”, “0”, “0”	0x00, 0x00
Information of 0007h (Alarm flag 3)	0x0000	“0”, “0”, “0”, “0”	0x00, 0x00
Information of 0008h (Unused register)	0x0000	“0”, “0”, “0”, “0”	0x00, 0x00
Information of 0009h (Data display 1)	0x0000	“0”, “0”, “0”, “0”	0x00, 0x00
Information of 000Ah (Data display 2)	0x0000	“0”, “0”, “0”, “0”	0x00, 0x00
Checksum ASCII:LRC RTU:CRC	-	“5”, “4”	0x6F, 0x6B
Trailer	-	CR/LF	None
	Total quantity of byte	55	27

\*1 "0" is displayed except for option D.

### 3.11.2 Function code: 06 Writing registers

Write data to assigned address.

#### ■Communication example

- Device Address: No.1
- Write data to register 000Ch  
(The mode request indication)

Request message 0106000C0002			
Field name	Example (HEX)	ASCII mode character data	RTU mode binary data
Header	-	"."	None
Device address	0x01	"0", "1"	0x01
Function	0x06	"0", "6"	0x06
Head address of specified register	0x000C	"0", "0", "0", "C"	0x00, 0x0C
Information written to 000Ch (Mode request)	0x0002	"0", "0", "0", "2"	0x00, 0x02
Checksum ASCII:LRC RTU:CRC	-	"E", "B"	0xC8, 0x08
Trailer	-	CR/LF	None
-	Total quantity of byte	17	8

Response message 0106000C0002			
Field name	Example (HEX)	ASCII mode character data	RTU mode binary data
Header	-	"."	None
Device address	0x01	"0", "1"	0x01
Function	0x06	"0", "6"	0x06
Address of register to write	0x000C	"0", "0", "0", "C"	0x00, 0x0C
Information of register to write	0x0002	"0", "0", "0", "2"	0x00, 0x02
Checksum ASCII:LRC RTU:CRC	-	"E", "B"	0xC8, 0x08
Trailer	-	CR/LF	None
-	Total quantity of byte	17	8

### 3.11.3 Function code: 16 Writing multiple registers

Register data of assigned points from assigned address is written.

#### ■ Communication example

- Device Address: No.1
- Write two consecutive data from register 000Bh.
  - Change of circulating fluid set temperature [ 23.5°C ]
  - Operation start instruction

Request message 0110000B00020400EB0001			
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	0x000B	“0”, “0”, “0”, “B”	0x00, 0x0B
Quantity of register to write	0x0002	“0”, “0”, “0”, “2”	0x00, 0x02
Quantity of byte to read	0x04	“0”, “4”	0x04
Information written to 000Bh (Circulating fluid set temperature)	0x00EB	“0”, “0”, “E”, “B”	0x00, 0xEB
Information written to 000Ch (Operation stop flag)	0x0001	“0”, “0”, “0”, “1”	0x00, 0x01
Checksum ASCII:LRC RTU:CRC	-	“F”, “2”	0x03, 0xE8
Trailer	-	CR/LF	None
-	Total quantity of byte	27	13

Response message 0110000B0002			
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	0x000B	“0”, “0”, “0”, “B”	0x00, 0x0B
Quantity of register to write	0x0002	“0”, “0”, “0”, “2”	0x00, 0x02
Checksum ASCII:LRC RTU:CRC	-	“E”, “2”	0x30, 0x0A
Trailer	-	CR/LF	None
-	Total quantity of byte	17	8

## 3.12 Negative response

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 response 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 response 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

Received 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 (04h+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
0000h	Circulating fluid discharge temperature	Hexadecimal number : F334h, FD44h to 08FCh Decimal number :-3276, -700 to 2300( $\times 0.1^{\circ}\text{C}$ )	R
0001h	Circulating fluid flow rate	Hexadecimal number : 8000h, 0000h to 06F3h Decimal number :-32768, 0 to 1779( $\times 0.1\text{LPM}$ )	
0002h	Circulating fluid discharge pressure	Hexadecimal number : F334h, 0000h to 008Ch Decimal number :-3276, 0 to 140( $\times 0.01\text{MPa}$ )	
0003h	Circulating fluid electrical conductivity	Hexadecimal number : 8000h, 0000h to 01F4h Decimal number :-32768, 0 to 500( $\times 0.1\mu\text{S/cm}$ )	
0004h	Status flag	Refer to 3.13.5 Status flag	
0005h	Alarm flag 1	Refer to 3.13.6 Alarm flag	
0006h	Alarm frag 2	Refer to 3.13.6 Alarm flag	
0007h	Alarm frag 3	Refer to 3.13.6 Alarm flag	
0008h	None	—	
0009h	Data display 1	Follow the data instructions *1	
000Ah	Data display 2	Follow the data instructions *1	
000Bh	Circulating fluid set temperature	Positive number :0000h to 7FFFh( $0.1^{\circ}\text{C /dig}$ ) Negative number :8000h to FFFFh( $0.1^{\circ}\text{C /dig}$ ) *2	R/W
000Ch	Operation instruction	*3(Operation start instruction, mode request, alarm reset)	
000Dh	None	—	
000Eh	None	—	
000Fh	Data instruction	*4	

\*1 Data display (Refer to 3.13.7 Data display)

\*2 Negative numbers are two's complement representation

\*3 Operation instruction (Refer to 3.13.9 Operation instruction)

\*4 Data instruction (Refer to 3.13.10 Data instruction)

### **3.13.1 Circulating fluid discharge temperature**

Notifies the circulating fluid discharge temperature of this product. (°C or °F). Read the circulating fluid discharge temperature which is displayed on the touch panel. (Offset temperature is displayed if offset function is set). Displays F334h (-3276) during circulating fluid discharge temperature sensor alarm.

### **3.13.2 Circulating fluid flow rate**

Notifies the circulating fluid flow rate of this product. Displays 8000h (-32768) during circulating fluid discharge pressure sensor alarm.

### **3.13.3 Circulating fluid discharge pressure**

Notifies the circulating fluid discharge pressure of this product. Displays F334h (-3276) during circulating fluid discharge pressure sensor alarm.

### **3.13.4 Circulating fluid electrical conductivity**

Notifies the circulating fluid discharge pressure of this product. 0000h (0) is displayed except for option D. Displays 8000h (-32768) during circulating fluid electrical conductivity sensor alarm.

### 3.13.5 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 occurred status 0 = Not occurred 1 = Operation stop alarm occurred
2	Operation continued alarm flag	Operation continued alarm occurred status 0 = Not occurred 1 = Operation continued alarm occurred
3	Notice for maintenance	Notice for maintenance status 0 = Not generated 1 = Generated
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	TEMP OUT flag	TEMP OUT status 0= Condition isn't formed 1= Condition is formed
7	None	-
8	None	-
9	None	-
10	None	-
11	None	-
12	External tuning function flag	External tuning function setting states 0 = Unset 1 = During setting
13	Warm-up function flag	Warm-up function setting status 0 = Unset 1 = During setting
14	Startup operation flag	Startup operation setting status 0 = Unset 1 = During setting
15	Anti-freezing flag	Anti-freezing setting status 0 = Unset 1 = During setting

### 3.13.6 Alarm flag

Each type of alarm which occurs in this 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

Bit	Name	Explanation	
Alarm flag 1	0	Abnormal low tank fluid level	Alarm given off status 0= Not occurred 1= Occurred
	1	Low tank fluid level	
	2	None	
	3	None	
	4	None	
	5	Fan failure	
	6	None	
	7	None	
	8	Abnormal rise of circulating fluid temperature	
	9	Circulating fluid temperature rise	
	10	Circulating fluid temperature drop	
	11	TEMP READY Alarm	
	12	None	
	13	None	
	14	None	
Alarm flag 2	0	Abnormal rise in heat exchanger inlet temperature	
	1	Failure of circulating fluid discharge pressure sensor	
	2	Circulating fluid discharge pressure rise	
	3	Circulating fluid discharge pressure drop	
	4	None	
	5	None	
	6	None	
	7	None	
	8	None	
	9	None	
	10	None	
	11	Electric conductivity increase *	
	12	No power supply	
	13	Contact input signal 1 detection	
	14	Contact input signal 2 detection	
15	None		

Alarm flag 3	0	None	Alarm given off status 0= Not occurred 1= Occurred
	1	Communication error	
	2	Outside of the ambient temperature range	
	3	Maintenance alarm	
	4	Refrigeration circuit failure	
	5	Sensor failure	
	6	Controller failure	
	7	Compressor inverter error	
	8	Compressor inverter communication error	
	9	Pump inverter error	
	10	Pump inverter communication error	
	11	None	
	12	None	
	13	None	
	14	None	
15	None		

\*: For option D "With electrical conductivity control", it can be set.

### 3.13.7 Data display

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

No.	Item	Range
0	None	Hexadecimal number : 0000h Decimal number : 0
1	Ambient temperature	Hexadecimal number : F334h, FF42h to 0316h Decimal number : -3276, -190 to 790(×0.1°C)
2	External tuning temperature *	Hexadecimal number : F334h, 0032h to 015Eh Decimal number : -3276, 50 to 350(×0.1°C)
3	Heat exchanger inlet temperature	Hexadecimal number : F334h, FE0Ch to 0834h Decimal number : -3276, -500 to 2100(×0.1°C)
4	Notice for maintenance	Occurrence status of each maintenance 0= Not occurred 1= Occurred
5	Refrigerant circuit high pressure	Hexadecimal number : F334h, FFF6h to 0226h Decimal number : -3276, -10 to 550(×0.01MPa)

\* When the external tuning function is OFF, it will be -327.6°C (F334h) fixed.

### 3.13.8 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.

### 3.13.9 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 = Stop 1 = Run
1	Mode request flag	Mode request 0 = None 1 = Yes
2	Alarm reset flag	Alarm reset 0 = None 1 = Yes
3 to 15	None	-

#### Operation start command

SERIAL mode, you can control the operation start / stop of this product. However, this function is invalidated when the setting of "DIO Run / Stop" is ON on the touch panel.

#### 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.

### 3.13.10 Data instruction

By setting the data instructions to display the data that you selected in each data display 1, 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 displays data of the type instructed in 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

Value		Name
Data instruction 1	0	None
	1	Ambient temperature
	2	External tuning temperature
	3	Heat exchanger inlet temperature
	4	Notice for maintenance
	5	Refrigerant circuit high pressure
Data instruction 2	0	None
	1	Ambient temperature
	2	External tuning temperature
	3	Heat exchanger inlet temperature
	4	Notice for maintenance
	5	Refrigerant circuit high pressure

■ **Communication example**

- When reading the ambient temperature to the data display 1
- Device Address: No.1
- Write one data to Function code: 000Fh  
(Set ambient temperature to data instruction 1.)



Request message 0106000F0001			
Field name	Example (HEX)	ASCII mode character data	RTU mode binary data
Header	-	“.”	None
Device address	0x01	“0”, “1”	0x01
Function	0x06	“0”, “6”	0x06
Address of the specified register	0x000F	“0”, “0”, “0”, “F”	0x00, 0x0F
Information written to 0043h (Data instruction)	0x0001	“0”, “0”, “0”, “1”	0x00, 0x01
Checksum ASCII:LRC RTU:CRC	-	“E”, “9”	0x78, 0x09
Trailer	-	CR/LF	None
-	Total quantity of byte	17	8

Response message 0106000F0001			
Field name	Example (HEX)	ASCII mode character data	RTU mode binary data
Header	-	“.”	None
Device address	0x01	“0”, “1”	0x01
Function	0x06	“0”, “6”	0x06
Address of register to write	0x000F	“0”, “0”, “0”, “F”	0x00, 0x0F
Information of register to write	0x0001	“0”, “0”, “0”, “1”	0x00, 0x01
Checksum ASCII:LRC RTU:CRC	-	“E”, “9”	0x78, 0x09
Trailer	-	CR/LF	None
-	Total quantity of byte	17	8

- Function code 4 : Read one data of 0009h  
(Read out the ambient temperature of data display 1.)

Request message 010400090001			
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	0x0009	“0”, “0”, “0”, “9”	0x00, 0x09
Quantity of register to read	0x0001	“0”, “0”, “0”, “1”	0x00, 0x01
Checksum ASCII:LRC RTU:CRC	-	“F”, “1”	0xE1, 0xC8
Trailer	-	CR/LF	None
	Total quantity of byte	17	8

Response message 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 0009h(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 an ambient temperature of 25.0°C

# Chapter 4 Communication alarm function

Monitors whether the serial communication is sent/received properly between this product and the customer's equipment. 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's equipment. When the communication is restored, the alarm is automatically reset.

Do not use this function when the customer's equipment does not send messages regularly.

## 4.1 Communication alarm occurs

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

- Communication alarm
  - Operation continues when an alarm occurs
- Time for monitoring the communication alarm
  - 180 sec

When the customer's equipment is sending messages every 60sec, if the communication cable is disconnected and no message is received for 180sec, this product generates AL34 communication error alarm to notify the error.

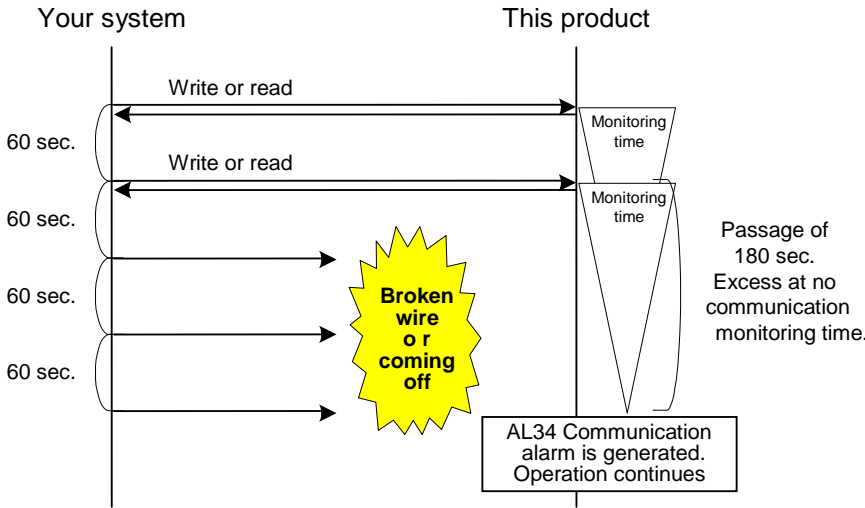


Fig. 4-1 Communication alarm example

## 4.2 Communication alarm reset

When AL34 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.

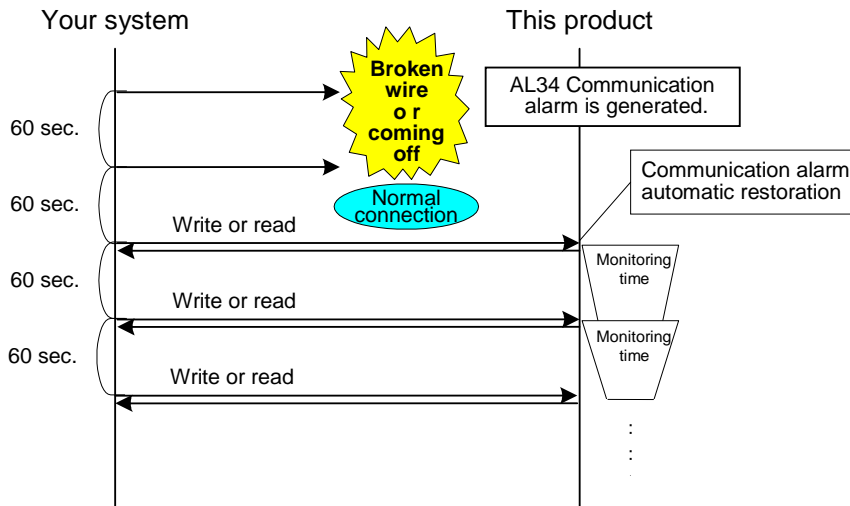
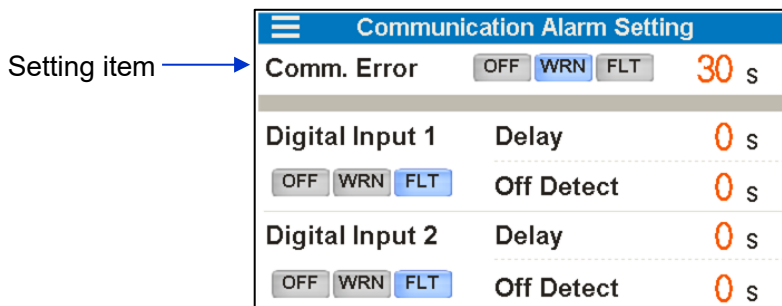


Fig. 4-2 Communication alarm restoration example

## 4.3 Setting method

Set of serial communication is done from “1.4 Touch panel flow” (Refer to “2. Serial communication settings” screen).



Indication	Item	Setting and selection		Setting range	
Comm. Error	Alarm “AL34 : Communication error”	<input type="button" value="OFF"/>	Disabled	Communication alarm detection time *2	30 to 600sec 30sec *1
		<input type="button" value="WRN"/> *1	Operation continues during the alarm		
		<input type="button" value="FLT"/>	Operation stops during alarm		

\*1 Default setting

\*2 Time from communication error to alarm occurrence (monitoring time)



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