Relevant instruction manual number: IMR01D02-E□

1. Preface

The SA series has several versions and available functions depend on the version. This manual describes differences in the communication function between the SA200 and the SA220. When using the communication function of the SA220, read the SA200 Communication Instruction Manual (IMR01D02-E□) together with this manual. When reading the SA200 Communication Instruction Manual (IMR01D02-E□), replace the SA200 with the SA220.

Major differences

• Communication speed of SA220: 38400 bps and 57600 bps are also available

• Transmission output can be specified for the SA220.

2. Differences from the SA200 series

The differences are described page by page of the **SA200 Communication Instruction Manual (IMR01D02-E□)**.

SA200 Communication Instruction Manual (IMR01D02-E□)...................... P. 1

Communication speed: 2400 bps, 4800 bps, 9600 bps, 19200 bps, <u>38400 bps, 57600 bps (Selectable)</u>

SA200 Communication Instruction Manual (IMR01D02-E□)...................... P. 2

Communication speed: 2400 bps, 4800 bps, 9600 bps, 19200 bps, <u>38400 bps, 57600 bps</u> (Selectable)

Data bit configuration: Start bit: 1
Data bit: 8 (Byte data corresponding to binary data or bit.)
Parity bit: None, Odd or Even (Selectable)
Stop bit: <u>1 or 2 (Selectable)</u>

Error code: 1: Function code error
2: When written to read only (RO) data, When any address other than <u>0000H to 0048H *</u> is specified, etc.
3: When the data written exceeds the setting range, When the specified number of data items in the query message exceeds the maximum number of data items available
4: Self-diagnostic error response

* The addresses at and after 0030H should be referred to the following manuals.
   • **SA200 Initial Setting Manual (IMR01D03-E□)**
   • **SA220 Initial Setting Difference Manual (IMR03F04-E□)**

■ Pin No. (CN4 connecter) and signal details

Pin No. 1   CN4 connector
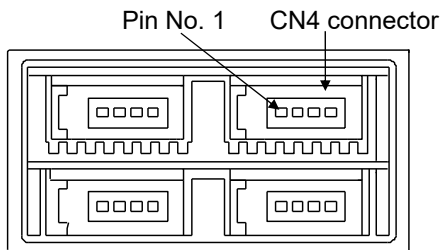
Pin No.	Symbol	Signal name
1	T/R (B)	Send data/Receive data
2	T/R (A)	Send data/Receive data
3	SG	Signal ground
4	SG	—

Pin Nos. 3-4 are internally shorted respectively.
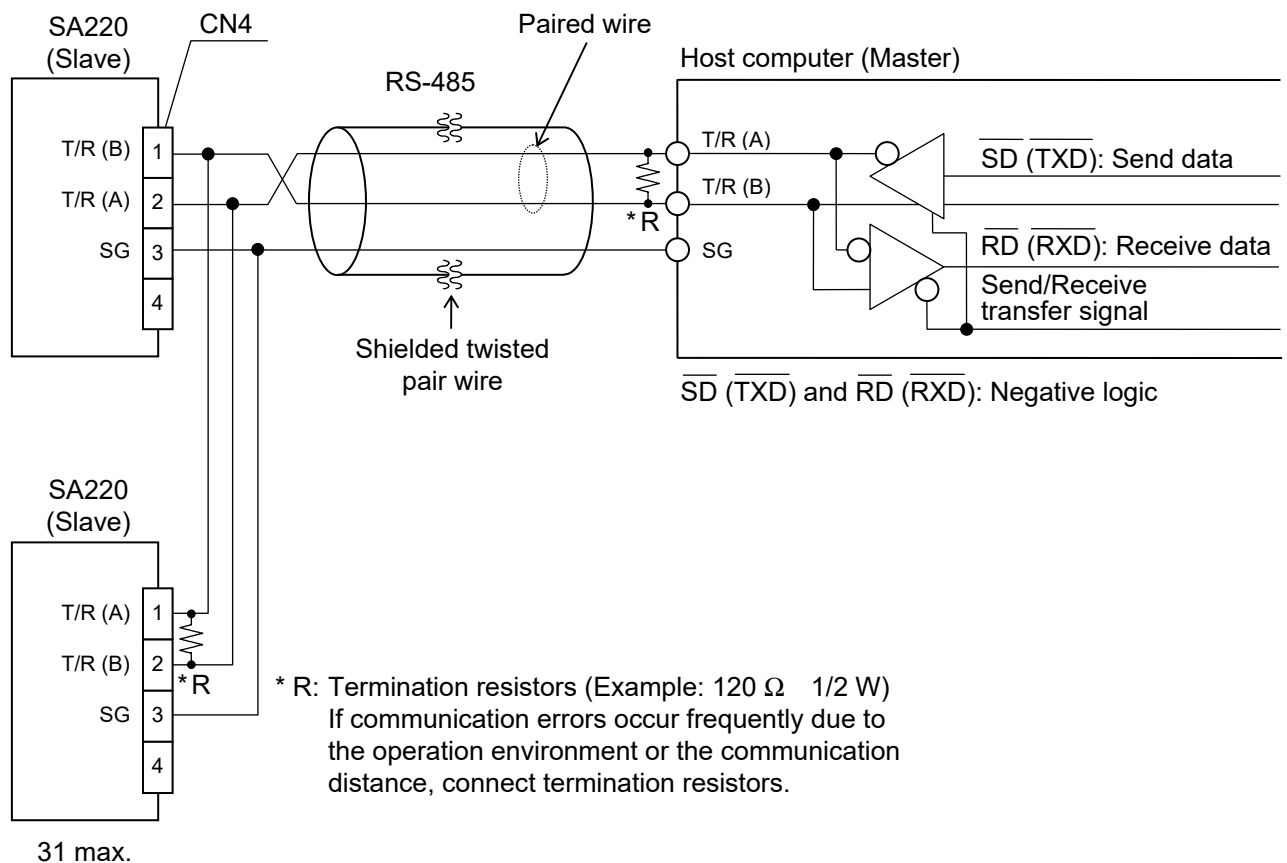
📖 The plug and cable must be provided by the customer.
Recommended plug (e-CON compliant plug): Mini-Clamp Plug, Wiremount
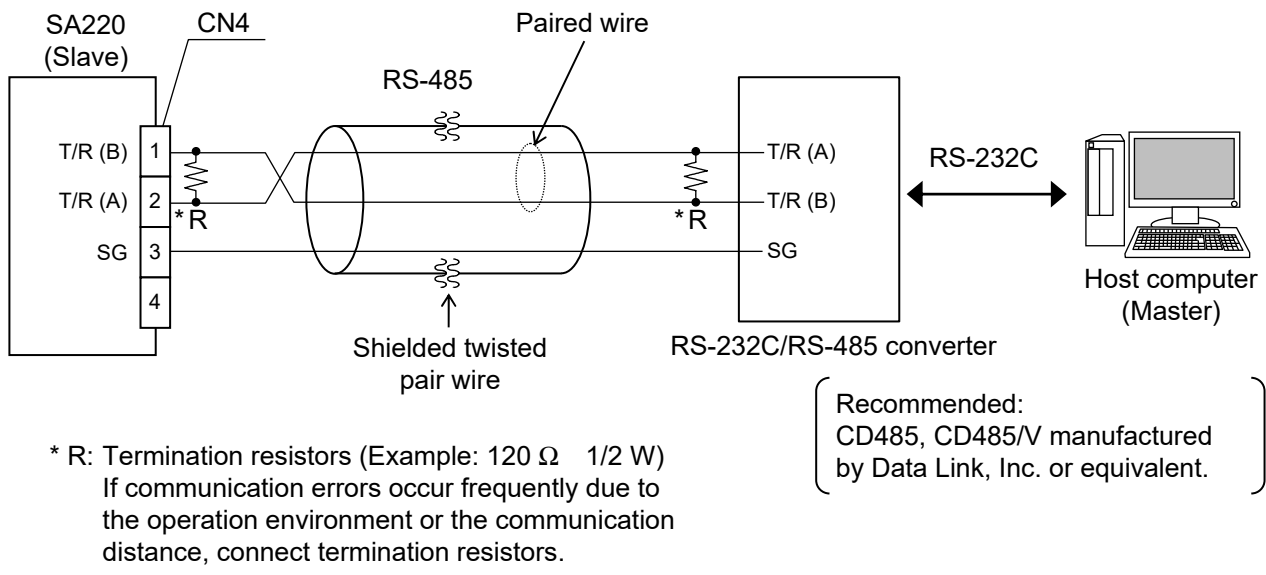[3M product or equivalent]
[Cable size: AWG No. 20 to 22, AWG No. 24 to 26]

■ Wiring method

● **Connection to the RS-485 port of the host computer (master)**

SA220 (Slave)   CN4   Paired wire   Host computer (Master)   RS-485

Shielded twisted pair wire

SD (TXD): Send data
RD (RXD): Receive data
Send/Receive transfer signal

SD (TXD) and RD (RXD): Negative logic

SA220 (Slave)

* R: Termination resistors (Example: 120 Ω   1/2 W)
If communication errors occur frequently due to the operation environment or the communication distance, connect termination resistors.

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● **Connection to the RS-232C port of the host computer (master)**

* R: Termination resistors (Example: 120 Ω 1/2 W)
If communication errors occur frequently due to
the operation environment or the communication
distance, connect termination resistors.

Recommended:
CD485, CD485/V manufactured
by Data Link, Inc. or equivalent.

3.4 Communication Speed Setting

The communication speed of 2400 bps, 4800 bps, 9600 bps, 19200 bps, 38400 bps or 57600 bps is selectable.
To select the speed of the *bPS* setting, press the UP or DOWN key.

Symbol	Name	Setting range	Description	Factory set value
bPS bPS	Communication speed	240: 2400 bps 480: 4800 bps 960: 9600 bps 1920: 19200 bps 3840: 38400 bps 5760: 57600 bps	Select the communication speed	960

📖 **Set the same communication speed for both the SA220 (slave) and the host computer (master).**

📖 **When the communication parameter is changed, turn the power on and off again or switch from STOP to RUN to refresh and make the new value effective. If neither action is taken, the SA220 will maintain the set value prior to change.**

📖 All communication speed settings must be stored by pressing the SET key. If changes are made and the SET key is not pressed within one minute, the display will automatically return to the PV/SV display and the communication speed will return to the value prior to set change.

Communication data related to the transmission output are added after "EEPROM storage status (Identifier: EM)" in the case of RKC communication.

(Attribute RO: Read only, R/W: Read and Write)

Name	Iden-tifier	Data range	Factory set value	Attrib-ute
Cool-side proportioning cycle time	**T1**	1 to 100 seconds	Relay contact output: 20 Voltage pulse output: 2	R/W [6]

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Name	Iden-tifier	Data range	Factory set value	Attrib-ute
EEPROM storage status [9]	**EM**	0: Mismatch 1: Match	-----	RO
Transmission output (AO) specification	**LA**	0: Measured value (PV) 1: Set value (SV) 2: Deviation (DEV) 3: Manipulated output value (MV)	0	R/W [10]
Transmission output scale high (AHS) [11]	**HV**	Measured value (PV): Same as input range Set value (SV): Same as input range Deviation (DEV): −span to +span (Within −1999 to +9999 digits) Manipulated output value (MV): 0.0 to 100.0 %	Measured value (PV), Set value (SV): Input range high Deviation (DEV): +span Manipulated output value (MV): 100.0	R/W [10]
Transmission output scale low (ALS) [11]	**HW**		Measured value (PV), Set value (SV): Input range low Deviation (DEV): −span Manipulated output value (MV): 0.0	R/W [10]

[1] Any number other than *0* indicates errors (RAM write error, etc.) detected by the controller self-diagnosis function. Please contact RKC sales office or the agent.

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[10] R/W (Read and Write) when OUT1 is a Transmission output, and RO (Read only) when OUT1 is other than a Transmission output.

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| Error code	Contents
1	Function code error (Specifying nonexistent function code)
2	When written to read only (RO) data, When any address other than 0000H to 0048H * is specified, etc.
3	When the data written exceeds the setting range, When the specified number of data items in the query message exceeds the maximum number of data items available
4	Self-diagnostic error response

Priority order of error codes: Error code 1 > Error code 3 > Error code 2 > Error code 4

* The addresses at and after 0030H should be referred to the following manuals.
  - **SA200 Initial Setting Manual (IMR01D03-E□)**
  - **SA220 Initial Setting Difference Manual (IMR03F04-E□)**

Inversion of the high-order and low-order bytes of the CRC register is added to the CRC calculation flow.

■ The flow chart of CRC-16
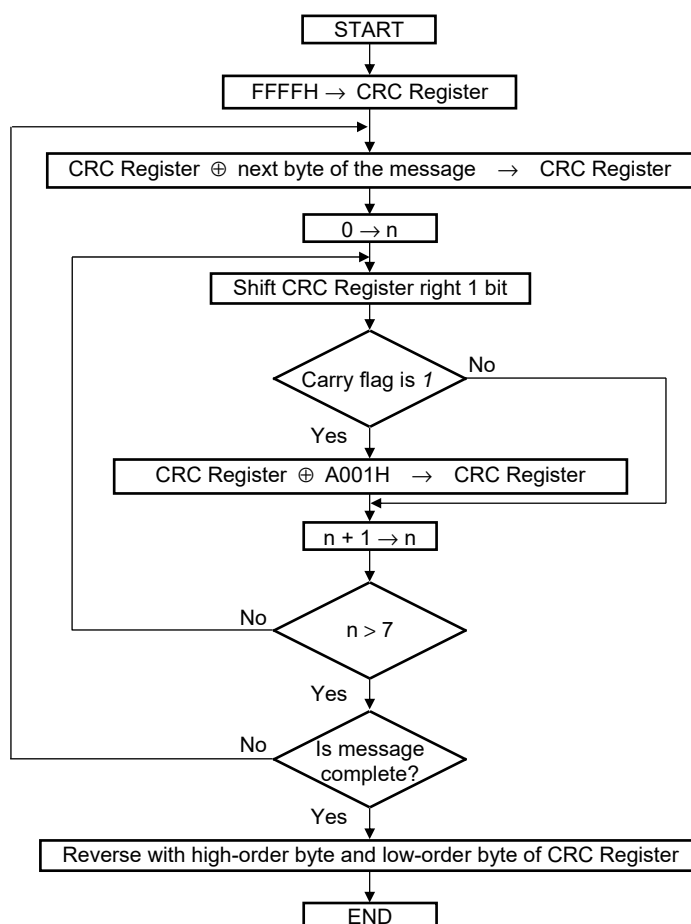
📖   The $\oplus$ symbol indicates an *exclusive OR* operation. The symbol for the number of data bits is *n*.

● **Data with one decimal place**
The Modbus protocol does not recognize data with decimal points during communication.

Control loop break alarm
Heat-side manipulated output value
Cool-side manipulated output value

● **Data without decimal points**

Alarm 1 status	Anti-reset windup
Alarm 2 status	Heat-side proportioning cycle time
Burnout	Cool-side proportional band
Autotuning	Cool-side proportional cycle time
Self-tuning	Set data lock function
Integral time	RUN/STOP function
Derivative time	Digital filter

● **Data whose decimal point's presence and/or position depends on input range**
The position of the decimal point changes depending on the input range type because the Modbus protocol does not recognize data with decimal points during communication.
The following data can have one of three decimal point positions:
• No decimal point
• One decimal place
• Two decimal place

☞   For details, see **6. INPUT RANGE TABLES (P. 44)**.

Measured value (PV)	LBA deadband
Set value (SV)	PV bias
Alarm 1 set value	Overlap/deadband
Alarm 2 set value	Transmission output scale high
Heat-side proportional band	Transmission output scale low

5.7.2 Data processing precautions

• Definitions of registers
  ① Undefined register

    Reserved register for extension within the data map range defined in Specification.

  ② Illegal register

    Register outside of the data map range defined in Specification.

• Register handling
  (1) Reading register

Register types contained in communication data	Action at the time of reading
① Undefined register	Return 0000h only for undefined register.
② Illegal register	Error code 2 * is returned if illegal register is included.
③ Registers except the above	Register can be read.

* When an error with higher error code determination is active, priority is given to it.

Continued from the previous page.

(2) Preset single register

Register types contained in communication data	Action at the time of writing
① Undefined register	Destroy write data.
② Illegal register	Return error code 2* and destroy write data.
③ Write-protected register (Read-only register)	Destroy write data.
④ Write a value outside the setting range	
⑤ Registers except the above	Capable of writing into register.

* When an error with higher error code determination is active, priority is given to it.

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Communication data related to the transmission output are added after "Cool-side manipulated output value (address: 1EH)" in the case of Modbus communication.

(Attribute　　RO: Read only, R/W: Read and Write)

Address	Name	Data range	Factory set value	Attrib-ute
18H	Set data lock function [6]	0 to 7	0	R/W

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Address	Name	Data range	Factory set value	Attrib-ute
1EH	Cool-side manipulated output value	−5.0 to +105.0 %	-----	RO
1FH	Transmission output (AO) specification	0: Measured value (PV) 1: Set value (SV) 2: Deviation (DEV) 3: Manipulated output value (MV)	0	R/W [9]
20H	Transmission output scale high (AHS) [10]	Measured value (PV): Same as input range Set value (SV): Same as input range Deviation (DEV): −span to +span (Within −1999 to +9999 digits) Manipulated output value (MV): 0.0 to 100.0 %	Measured value (PV), Set value (SV): Input range high Deviation (DEV): +span Manipulated output value (MV): 100.0	R/W [9]
21H	Transmission output scale low (ALS) [10]		Measured value (PV), Set value (SV): Input range low Deviation (DEV): −span Manipulated output value (MV): 0.0	R/W [9]

[1] If no alarm for first alarm or control loop break alarm is selected, the attribute becomes RO.

⋮

[9] R/W (Read and Write) when OUT1 is a Transmission output, and RO (Read only) when OUT1 is other than a Transmission output.

■ Modbus

Problem	Probable cause	Solution
No response	Wrong connection , no connection or disconnection of the communication cable	Confirm the connection method or condition and connect correctly
	Breakage, wrong wiring, or imperfect contact of the communication cable	Confirm the wiring or connector and repair or replace the wrong one
	Mismatch of the setting data of communication speed and data bit configuration with those of the host	Confirm the settings and set them correctly
	Wrong address setting	
	A transmission error (overrun error, framing error, parity error or CRC-16 error) is found in the query message	Re-transmit after time-out occurs or verify communication program
	The time interval between adjacent data in the query message is too long, exceeding 24 bit's time	
Error code 1	Function cod error (Specifying nonexistent function code)	Confirm the function code
Error code 2	When written to read only (RO) data, When any address other than 0000H to 0048H * is specified, etc.	Confirm the address of holding register
Error code 3	When the data written exceeds the setting range, When the specified number of data items in the query message exceeds the maximum number of data items available	Confirm the setting data
Error code 4	Self-diagnostic error	Turn off the power to the instrument. If the same error occurs when the power is turned back on, please contact RKC sales office or the agent.

* The addresses at and after 0030H should be referred to the following manuals.
- **SA200 Initial Setting Manual (IMR01D03-E□)**
- **SA220 Initial Setting Difference Manual (IMR03F04-E□)**