

SC Series
SC2102
Smart Card/Tag Dedicated Reader/Writer
User's Manual
Ver.1.3

AIOI SYSTEMS CO., LTD.

Introduction

This user manual explains the function of Smart Card Reader Writer, how to set it up, how to operate, cautions and things to watch for. Be sure to read it before using it.

Safely Use This Device

To use this device safely and correctly, always follow the safety points mentioned below. AIOI Systems Co. will not provide a warranty nor will it be responsible for any malfunction if these safety points are not followed.

■ Symbols

The following symbols are used for safe operation of this device.



DANGER

Mishandling by ignoring the content of this sign can cause death or severe injury.



Warning

Mishandling by ignoring the content of this sign can cause injury and damage to the device.



Indicates “warning” or “caution”



Indicates a must-follow instruction



Indicates “prohibited” or “banned”



Means important information for understanding this manual



Indicates only a qualified person can handle



Means grounding is necessary when installing



Sections referred in this manual or other manuals

Terminologies used in this manual have the following meanings

The expressions used in this manual have the following meanings:

Definition of Terms

Terminologies	Meaning
SC2102	Product name for Smart Card/Tag dedicated Reader/Writer
TOUCH	Action of bringing a Smart Card/Tag close to a dedicated Smart Card/Tag Reader-Writer
RELEASE	Action of moving the Smart Card/Tag away from the dedicated Smart Card/Tag Reader-Writer
Smart Tag	Product name for ST1129L/ST1129U
Smart Card	Product name for SC1029L/SC1029U
Smart Card/Tag	Collective term for Smart Tags and Smart Cards

For Safe Use

■ General Precaution



Caution

If there is damage to a device, it is very important to take necessary steps to prevent other devices from getting damaged.

Be aware that AIOI Systems cannot guarantee the functions and performance of this product if it is modified or misused by not following the instructions in this specification.

Do not disassemble or tamper with the device because the device may malfunction or be damaged.

To avoid possible damage, make sure that water or other liquids do not get on the device.

Use within the environmental conditions specified for this device. However, even when used within the specified environmental condition, a sudden temperature change that causes condensation can damage the device.

Do not drop or hit the device. If excessive force is going to be applied to the wiring, investigate ways to prevent this from happening. Otherwise, this device as well as other devices may be damaged.

Do not operate this device in a combustible, explosive, or steamy area. It is very dangerous to use this device in this type of environment.

If this device is used in conjunction with other devices, make sure the existing operating conditions and environment are suitable before combining it with other devices.

The company name and product name included in this manual are registered trademarks of the respective companies.

Microsoft, Windows is registered trademark of Microsoft Corporation in the United States and/or other countries.

■ Proper Use of the Device



Caution

Check the wiring to be sure it is correct before supplying power to the unit.

The device is an electronic device. Therefore, when installing various devices, always investigate the installation environment (primary electrical noise, driver type of noise, static electricity discharge noise, etc.) These noises may cause system malfunction or damage.

The power supply pinpoints to light modules are very sharp. If you touch them, you may be injured.

Use within the specification limits. Use of the device beyond these limits may damage or impair the device.

Always make sure to check if this device is used within the specifications for this device. Even within the specification, you may damage the device if the current is excessive. Investigate before using.

Revision History

Print History	Version	Revision Details
April 1, 2017	Ver.1.0	First Edition
December 3, 2018	Ver.1.1	Added: "4.2.2.11 .Response Types "
February 6, 2019	Ver.1.2	Added: "0 Appendix-1 Function Specifications "
October 1, 2025	Ver.1.3	Correction of expression definitions. 1.2 Replaced Appearance Drawing. 2.2 PC Connection: URL correction. 3. Smart Cards/Tags: Replaced images. Removed discontinued products. 3.3 ID: Replaced ID Format image. 4.2.2.4 ROM Number Reading: ROM number updated to release version. 4.6 Retry processing: Corrected Smart Card/Tag WaitTime. Appendix: Items requiring actual device verification Company address updated.

Related Manuals



Smart Card User Manual

Table of Contents

1.	OVERVIEW.....	1
1.1.	Overview	1
1.2.	Appearance, Names and Functions of Parts	2
2.	SETUP PROCEDURE.....	3
2.1.	Connection Configuration.....	3
2.2.	Connecting to PC	4
2.3.	Reader/Writer ID.....	7
2.3.1.	Precautions when installing multiple SC2102 units	8
2.4.	Reader/Writer ID Settings	10
3.	SMART CARD/TAG	11
3.1.	Smart Card Appearance, Component Names, and Functions	11
3.2.	: Appearance, Part Names, and Functions.....	11
3.3.	About ID.....	12
3.3.1.	Command Selection	12
4.	CONTROL METHOD	13
4.1.	Interface Specifications	14
4.1.1.	Communication Specifications.....	14
4.1.2.	Command Format	14
4.2.	Command	15
4.2.1.	Command List.....	15
4.2.2.	Command Details.....	16
4.2.3.	How to Acquire Smart Card/Tag ID Information	27
4.2.4.	Sequence	27
4.3.	Smart Card/Tag Status.....	28
4.3.1.	Status Types.....	28
4.3.2.	Status Transition.....	28
4.4.	Application.....	29
4.4.1.	Start monitoring (open) / Stop monitoring (close) the smart card/tag.....	29
4.4.2.	Send a command to the smart card/tag	30
4.5.	SC2102 Abnormal Detection.....	33
4.6.	Retry Processing	34
	APPENDIX-1 FUNCTION SPECIFICATIONS	37
	APPENDIX-2 EXTERNAL DIMENSIONS.....	38

APPENDIX 3 TROUBLESHOOTING.....	39
--	-----------

1. Overview

1.1. Overview

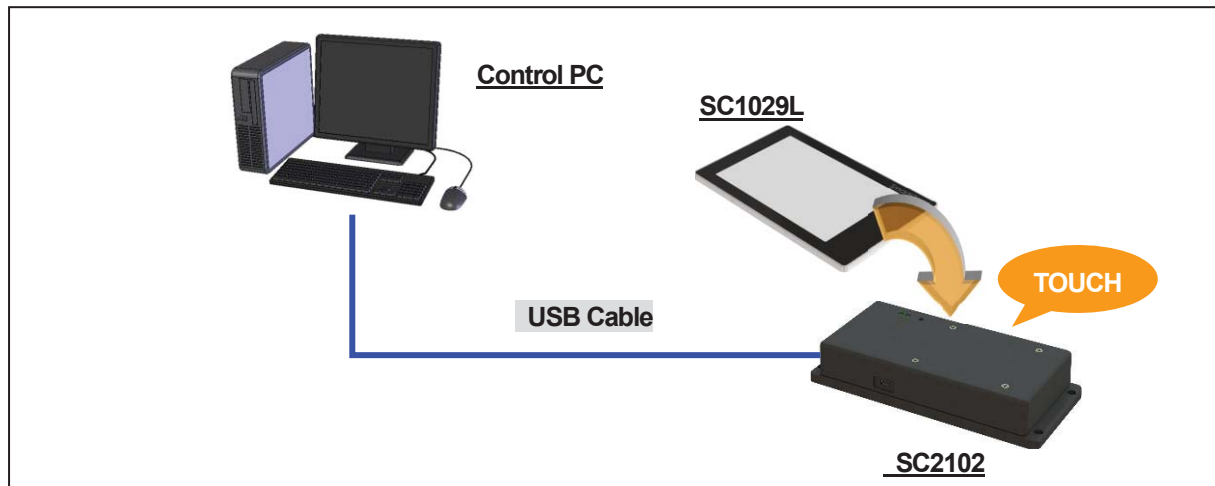
The Smart Card/Tag Reader-Writer (SC2102) is a dedicated reader-writer for smart cards/tags that connects directly to a PC via USB.

Applications can control smart cards/tags directly from the PC.

The smart card/tag is an electronic paper display with an embedded NFC communication chip.

Smart cards/tags have the following features:

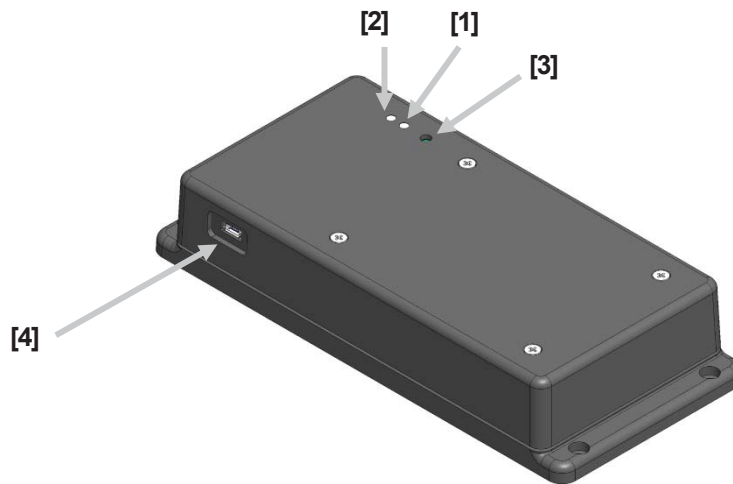
- Contactless communication is possible.
 - * The smart card/tag must be TOUCHED (held close) to the SC2102.
- The electronic paper display content can be freely rewritten.
- Content displayed on the electronic paper is retained without power.
- Display data for the electronic paper can be registered.
 - *The maximum number of registrations varies by smart card/tag model.
- It incorporates non-volatile memory, allowing free read/write operations.



Caution

Ensure that the connected device meets the specifications listed in the specifications for this device.

1.2. Appearance, Names and Functions of Parts



[1] LED Monitor 1

This is a dual-color LED (green/red). The monitor functions are as shown in the table below.

LED 1 Status	Monitor Content	
Red ON	SC2102 Status Monitor	Abnormal
Red OFF		Normal
Green ON		Open
Green OFF		Closed

※Red and green may light up simultaneously. In such cases, it will appear orange.

[2] LED Monitor 2

This is a dual-color LED (green/red). Its monitoring functions are as shown in the table below.

LED2 Status	Monitor Content	
Red ON	SC2102 Status Monitor	Processing
Red OFF		Standby
Green ON		IN
Green OFF		OUT

[3] Reset Switch Guide Hole

The settings reset switch is located beneath this hole. It is hidden inside the case to prevent accidental resets. To initialize settings, press the switch with a pointed object.

The settings that will be reset are: Reader/Writer ID, WRITE command retry count, and READ command retry count.

[Caution]

Press and hold the switch while powering on the SC2102 to initialize settings.

[4] USB Cable Connection Connector

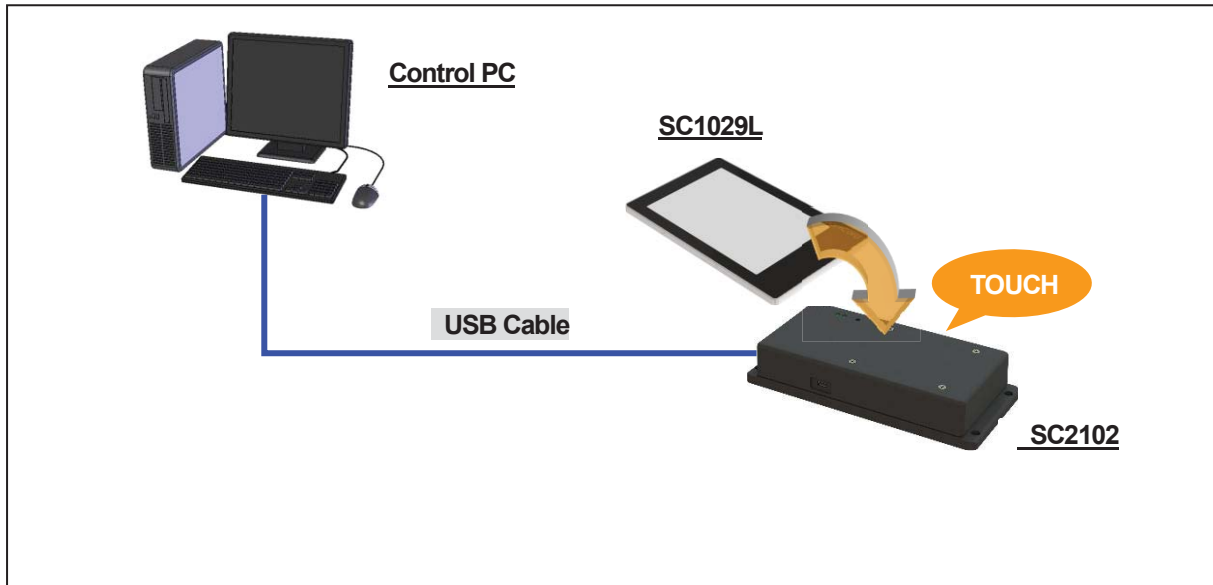
Connect to the PC using a USB cable.

2. Setup Procedure

This section explains the process from initial setup to verification of the SC2102.

2.1. Connection Configuration

Connect the SC2102 to a PC with the application installed using a USB cable.



2.2. Connecting to PC

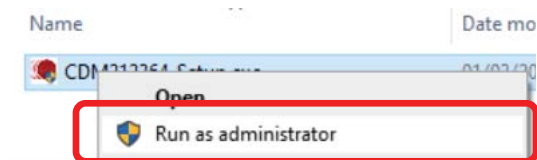
SC2102 incorporates the components manufactured by FTDI to communicate with PC.
Before use, please install the Virtual COM Port Drivers provided by FTDI.

- (1) Download Virtual COM Port Drivers from FTDI's website.
Download the setup executable listed in the Comments section.
<https://ftdichip.com/drivers/vcp-drivers/>

Currently Supported VCP Drivers:

Operating System	Release Date	Processor Architecture							Comments
		x86 (32-bit)	x64 (64-bit)	PPC	ARM	MIPSII	MIPSIV	SH4	
Windows*	2015-07-03	2.12.04	2.12.04	-	-	-	-	-	2.12.04 Windows Confirmed Available s_setup executable Release Notes

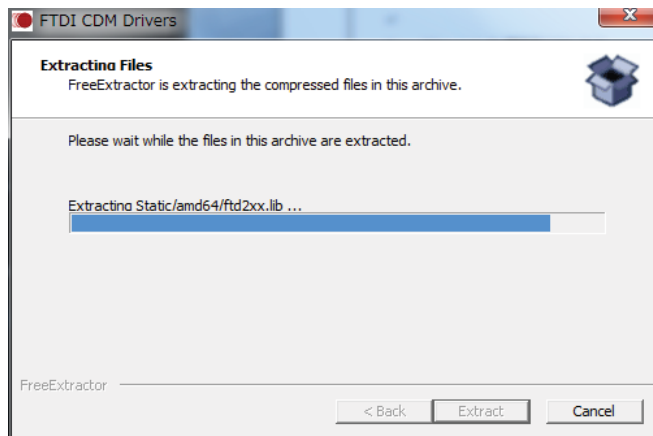
- (2) In File Explorer, right-click the downloaded Virtual COM Port Drivers and select Run **as administrator**.



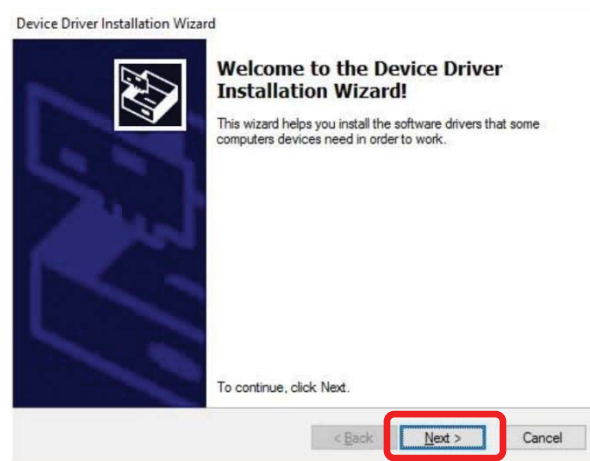
- (3) Select the **Extract** button.



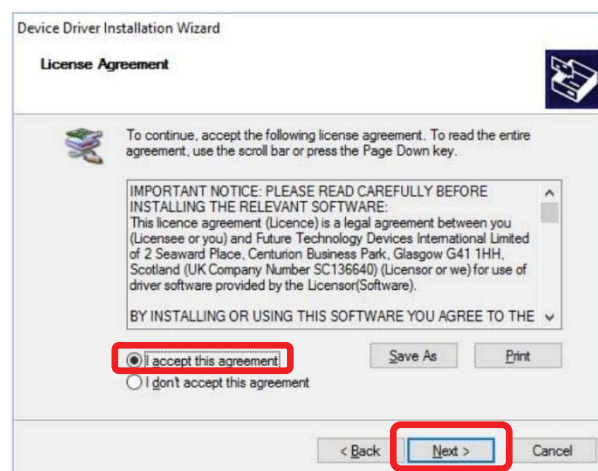
- (4) Extraction will begin.



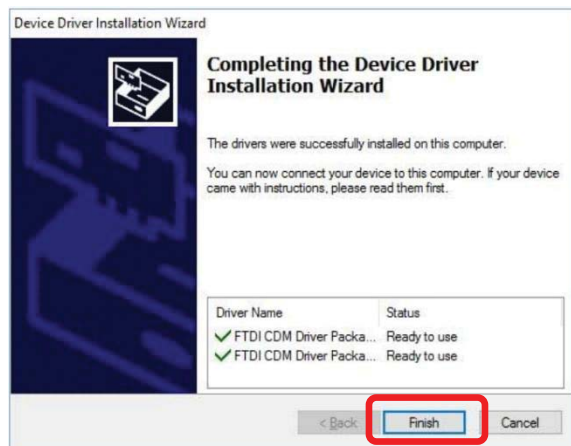
- (5) Select **Next (N) >** to begin installation.



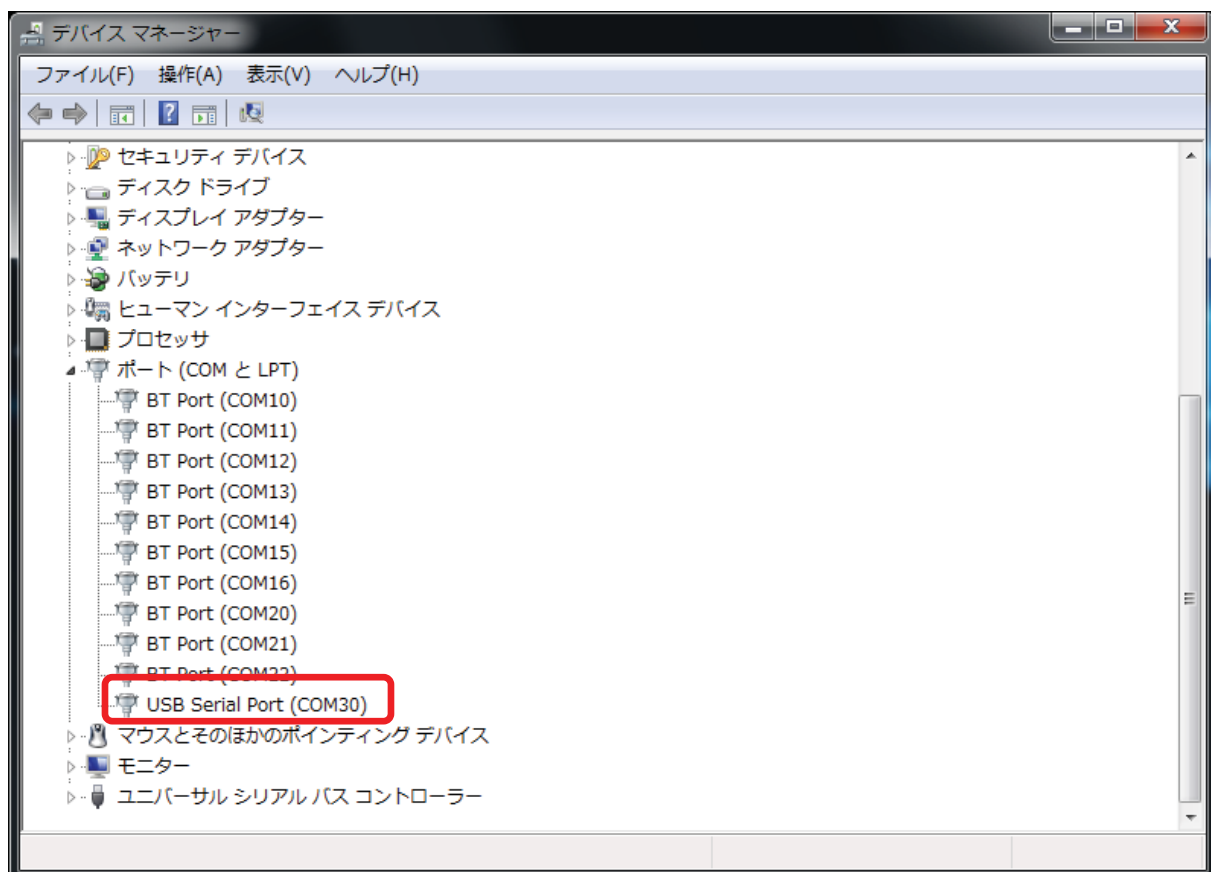
- (6) Select Agree (A), then select **Next (A) >**.



- (7) Select **Finish** to complete the installation.



After installation is complete, verify the COM port number via Device Manager.



2.3. Reader/Writer ID

SC2102 is a device with single Reader/Writer ID.

The ID is stored in the internal memory by sending the ID setting command.

Configurable ID Range	0 to 255 (00 to FF (hexadecimal))	Factory default ID value	01
-----------------------	---	-----------------------------	----



Depending on your environment, the COM port number to which the SC2102 is connected may change at startup.
To identify the SC2102 from the application, use the reader/writer ID along with the COM port number.

2.3.1. Precautions when installing multiple SC2102 units

2.3.1.1. Multiple Unit Installation



When installing multiple SC2102 units, ensure **a minimum spacing of 30 cm** between adjacent units.

2.3.1.2. Installation Environment

The presence of metal objects near the SC2102 significantly degrades the performance of wireless power supply and communication.

Smart Card/Tag receives power and communicate wirelessly with the SC2102. If affected by metal, the smart card/tag display and data read/write operations may not function correctly. When installing the SC2102 in the field environment, observe the following:

(1) SC2102 Mounting Bracket



Do not use metal mounting brackets.
(Recommended) Use a plastic mounting bracket.

(2) Surrounding Metal



Do not place metal objects near the SC2102.
(Guideline) Do not place any metal objects within 20 cm of the SC2102.
***This is only a guideline. Always perform operational verification at the installation site.**

(3) Retry Processing Consideration

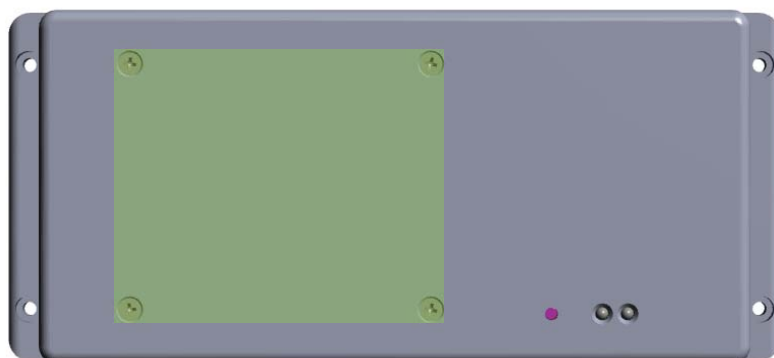
If wireless communication performance between the SC2102 and Smart Card/Tag is poor, please retry process for the software.

For details, refer to "4.6 .Retry Processing ".

2.3.1.3. Positioning of SC2102 relative to Smart Card/Tag

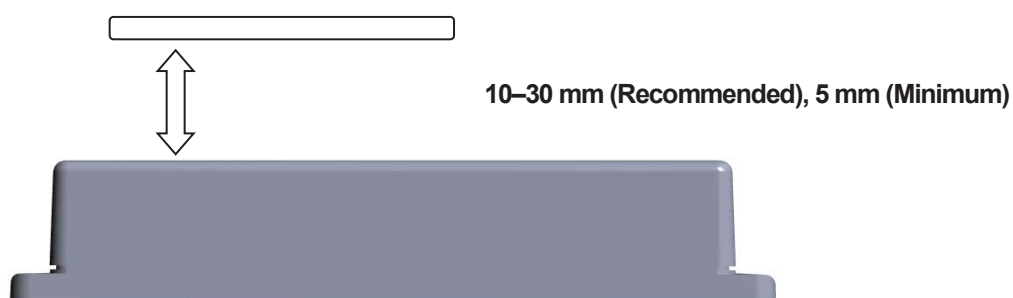
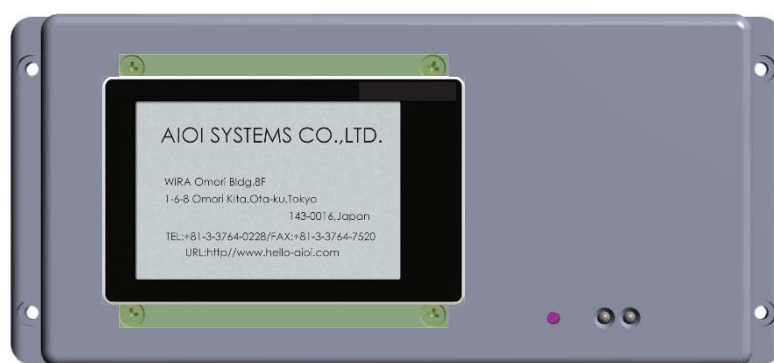
Install the SC2102 after confirming its positional relationship with the Smart Card/Tag.

(1) Confirming the antenna position



(Green area: Antenna embedded location)

(2) Confirming the Smart Card/Tag position (horizontal/vertical direction)



The explanation at "2.3.1.3 Positioning of SC2102 relative to Smart Card/Tag " assumes assumes no metal or other objects interfering with wireless communication are present near the SC2102.

Communication distance may decrease depending on the surrounding environment (such as the influence of metal).

2.4. Reader/Writer ID Settings

(1) Setting the Reader/Writer ID

Send the reader/writer setting command to configure the desired reader/writer ID.

(Default value is 01)

(2) Confirming the Reader/Writer ID

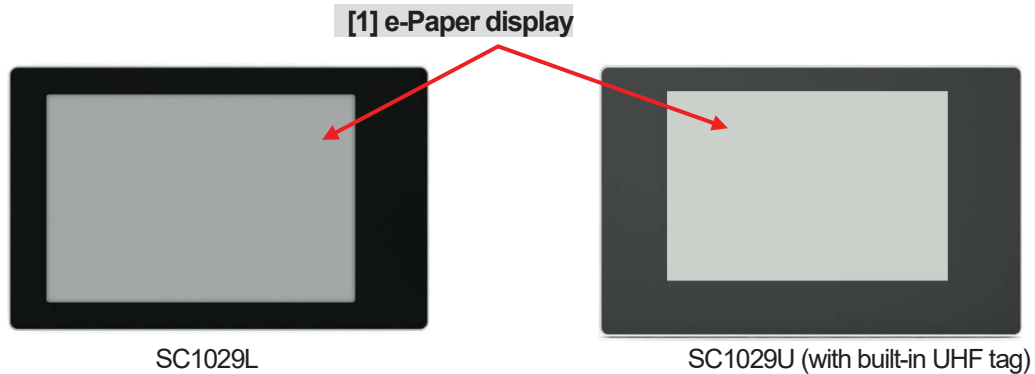
Send the Reader/Writer ID read command to verify the set address.

The response data from the read command corresponds to the reader/writer ID, so verify that it has been changed correctly.

3. Smart Card/Tag

3.1. Smart Card Appearance, Component Names, and Functions

【SC1029L/SC1029U】



[1] e-Paper Display

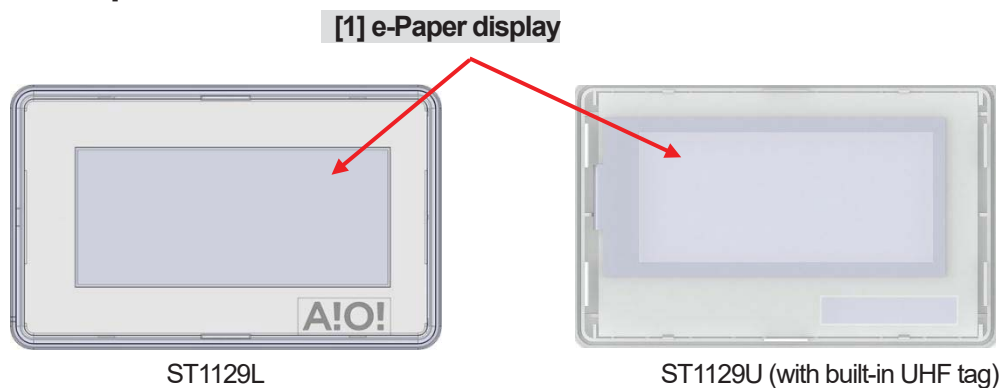
A 2.9-inch (300×200 dots) electronic paper display.

Supports bitmap format, enabling display of any font, barcode, QR code, or image.

*Bitmap format data must be prepared by the customer.

3.2. : Appearance, Part Names, and Functions

【ST1129L/ST1129U】



[1] e-Paper Display

This is a 296×128 dot electronic paper display.

It supports bitmap format and can display any font, barcode, QR code, or image.

*Bitmap format data must be prepared by the customer.

[Notes]

No built-in battery.

It receives power wirelessly from the radio waves emitted by the SC2102.

Touching the SC2102 turns the smart card power ON.

Releasing the SC2102 turns the smart card power OFF.

If the Smart Card/Tag is processing, please RELEASE after processing is complete.

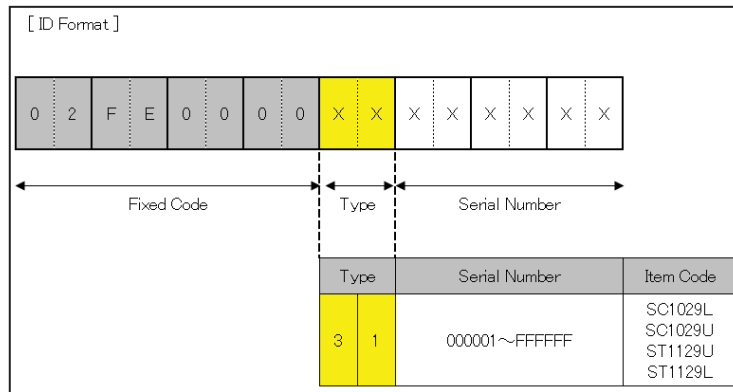
3.3. About ID

Smart Card/Tag has an 8-byte ID.

The ID is a number that identifies the Smart Card/Tag.

The ID format is described below.

Smart Card/Tag ID



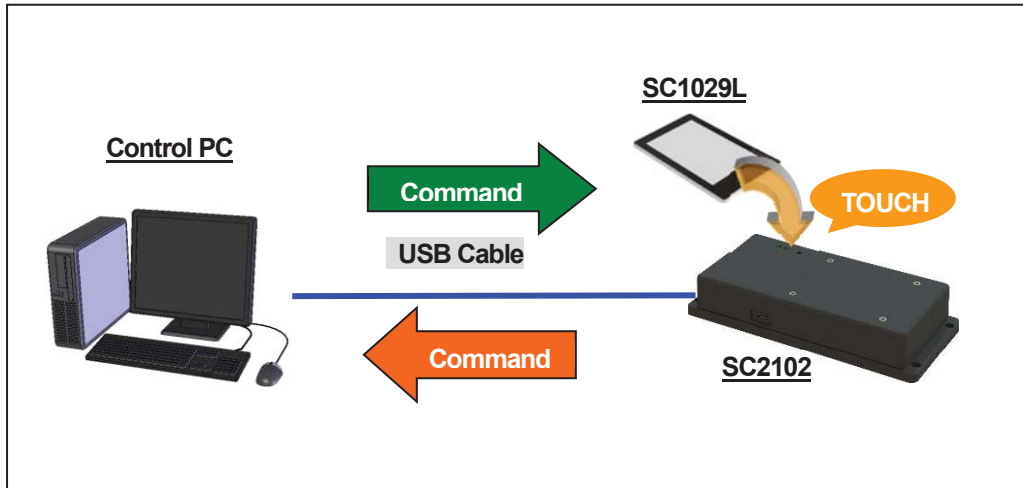
3.3.1. Command Selection

The command format differs depending on the Smart Card/Tag model.

For information on how to obtain the ID of Smart Card/Tag, refer to section4. .

4. Control Method

This section explains how to control smart cards/tags via the SC2102.



[Basic Control Flow]

- (1) Send a Reader/Writer Open Command to tSC2102 to initiate communication and RF output.
- (2) When Smart Card/Tag is TOUCHED to SC2102, the Smart Card/Tag is captured by the SC2102.
If Polling Command is sent at this moment, you can obtain Smart Card/Tag ID.
- (3) If you would like to control notified Smart Card/Tag ID, the application sends the command to SC2102.
The Smart Card/Tag begins processing.
- (4) The application monitors for the completion of the Smart Card/Tag's processing.
- (5) Send a Reader/Writer Close Command to the SC2102 to terminate communication and RF output.

4.1. Interface Specifications

The interface between the PC (application) and SC2102 is as follows.

Communicate between the application and SC2102 according to the interface specifications.

4.1.1. Communication Specifications

Communication Method : Serial communication via FTDI driver (USB connection)

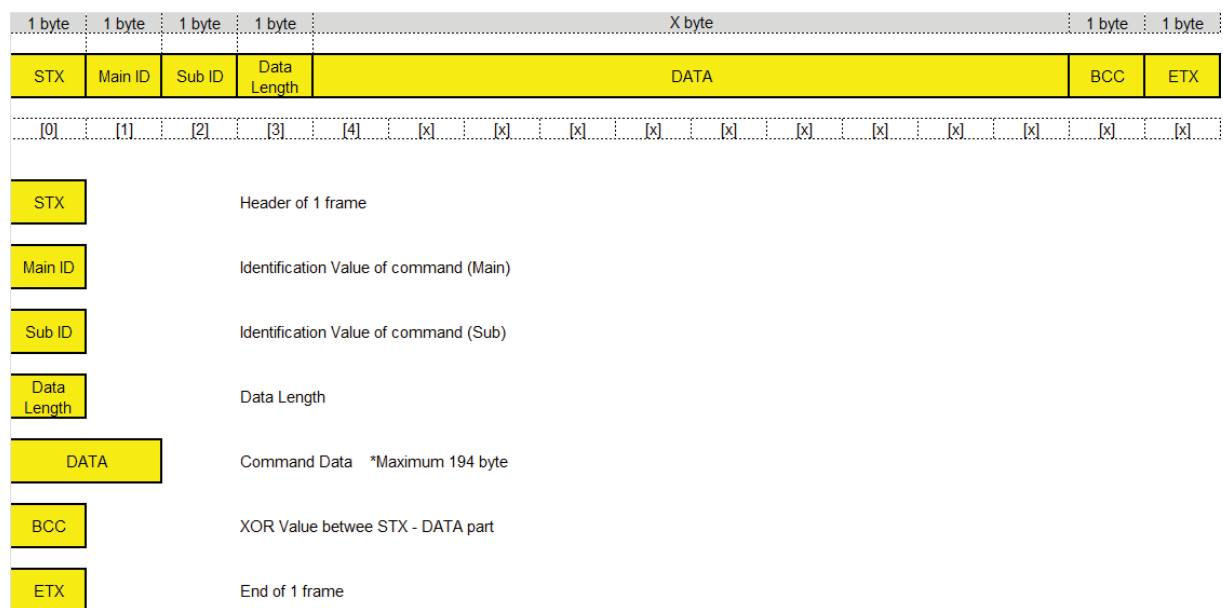
Transmission Speed : 230.4 kbps

Data Length : 8 BIT

Parity : None

Stop Bit : 1 BIT

4.1.2. Command Format



4.2. Command

4.2.1. Command List

The list of commands is shown in the table below.

Main ID	Sub ID	Maximum Frame Number	DATA Presence	Command Name	Command Transmission Direction	Maximum Response Wait Time
00	00	1		Polling	Application → SC2102	500ms
11	00	1		Reader Read Close	Application → SC2102	500ms
12	00	1		Reader/Writer Open	Application → SC2102	500ms
30	00, 01	2 to 44	Yes	WRITE (WWE equivalent)	Application → Smart Card/Tag	Retry count dependent※
31	00, 01	1	Yes	WRITE response	Application ← Smart Card/Tag	
32	00, 01	1	Yes	READ (RWE equivalent)	Application → Smart Card/Tag	Retry count dependent※
33	00, 01	1	Yes	READ response	Application ← Smart Card/Tag	
40	00	1		ROM Number Read	Application → SC2102	500ms
41	00	1	Yes	ROM Number Read Response	Application ← SC2102	
50	00	1	Yes	Reader/Writer ID Setting	Application → SC2102	500ms
51	00	1		Reader/Writer ID Read	Application → SC2102	
52	00	1	Yes	Reader/Writer ID Read Response	Application ← SC2102	500ms
53	00	1	Yes	Setting the retry count for WRITE and READ commands	Application → SC2102	
54	00	1		Reading the retry count for WRITE and READ commands	Application → SC2102	
55	00	1	Yes	Retry count for WRITE and READ commands Read response	Application ← SC2102	500ms
80	00 to 05	1	Yes	Response	Application ← SC2102	

※Retry count dependency: (Retry count + 1) × 100ms



Data Length Specification Method

For commands without DATA, specify 0 for the data length

For commands with DATA presence, specify the length of the DATA section as the data length



To control smart cards/tags, commands must be sent via the SC2102.

Commands where the "Target" in the table above is "Smart Card/Tag" are also sent to the SC2102.

4.2.2. Command Details

4.2.2.1. Reader/Writer Open

(1) Command Format

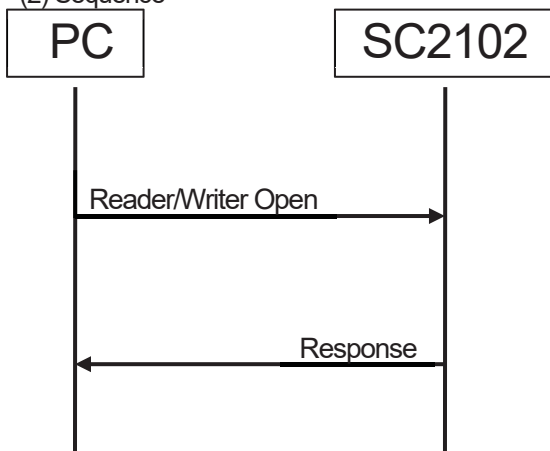
Transmission Data

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x12	0x00	0x00	None	(BCC)	0x03

Response Data

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x80	0x00	0x00	None	(BCC)	0x03

(2) Sequence



(3) Command Examples

Transmission Data

02-12-00-00-10-03

Response Data

02-80-00-00-82-03

(4) Additional Notes

When opening multiple reader/writers, execute the reader/writer ID read operation beforehand.

4.2.2.2. Reader/Writer Close

(1) Command Format

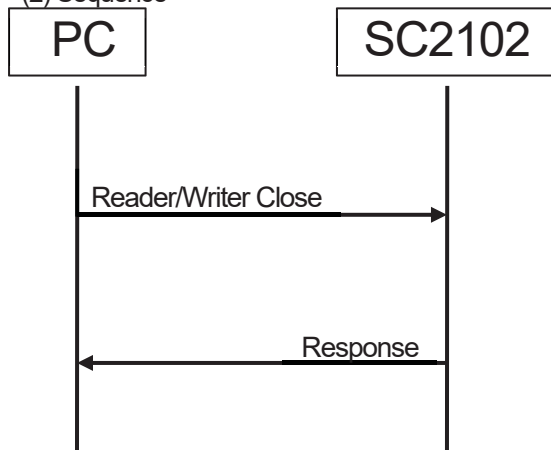
Transmission Data

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x11	0x00	0x00	None	(BCC)	0x03

Response Data

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x80	0x00	0x00	None	(BCC)	0x03

(2) Sequence



(3) Command Examples

Transmission Data

02-11-00-00-13-03

Response Data

02-80-00-00-82-03

4.2.2.3. Polling

(1) Command Format
Transmission Data

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x00	0x00	0x00	None	(BCC)	0x03

Response Data (Capturing Card)

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x80	0x00	0x10	*	(BCC)	0x03

*

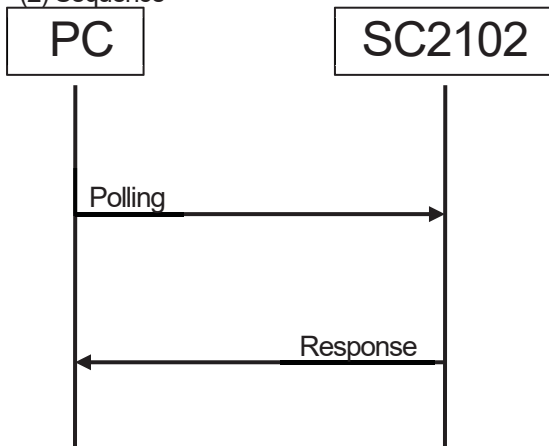
Bytes 1–8: IDm

Bytes 9–16: PMm

Response Data (Card Not Captured)

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x80	0x01	0x00	None	(BCC)	0x03

(2) Sequence



(3) Command Example

Transmission Data
02-00-00-00-02-03

Response Data
02-80-00-10-02-FE-00-00-31-00-0D-38-FF-FF-00-00-00-FF-FF-FF-95-03

4.2.2.4. ROM Number Read

(1) Command Format

Transmission Data

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x40	0x00	0x00	None	(BCC)	0x03

Response Data

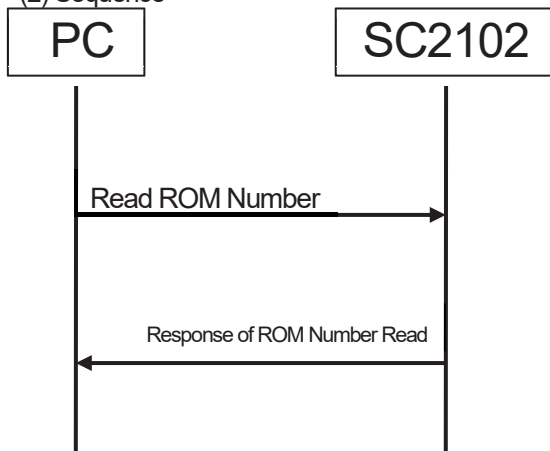
STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x41	0x00	0x02	*	(BCC)	0x03

*

First byte: 0x20 (Upper 2 digits of ROM number)

Second byte: 0x65 (ROM number lower 2 digits)

(2) Sequence



(3) Command Example

Transmission Data

02-40-00-00-42-03

Response Data

02-41-00-02-20-65-04-03

(4) Additional Notes

4.2.2.5. Reader/Writer ID Setting

(1) Command Format

Transmission Data

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x50	0x00	0x01	*	(BCC)	0x03

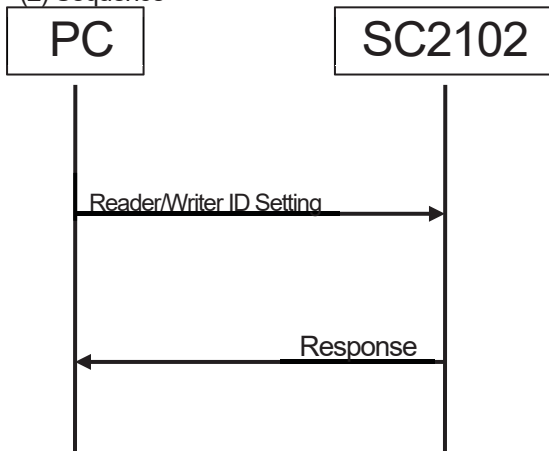
*

First byte: Reader/Writer ID

Response Data

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x80	0x00	0x00	None	(BCC)	0x03

(2) Sequence



(3) Command Example

Transmission Data (Set Reader/Writer ID to 5)

02-50-00-01-05-56-03

Response Data

02-80-00-00-82-03

(4) Additional Notes

The default value for the reader/writer ID is 1 (hexadecimal 0x01).

The configurable range for the reader/writer ID is 0 to 255 (hexadecimal 0x00 to 0xFF).

The reader/writer ID setting is accepted regardless of whether the device is open or closed.

4.2.2.6. Reader/Writer ID Read/Response

(1) Command Format

Transmit Data

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x51	0x00	0x00	None	(BCC)	0x03

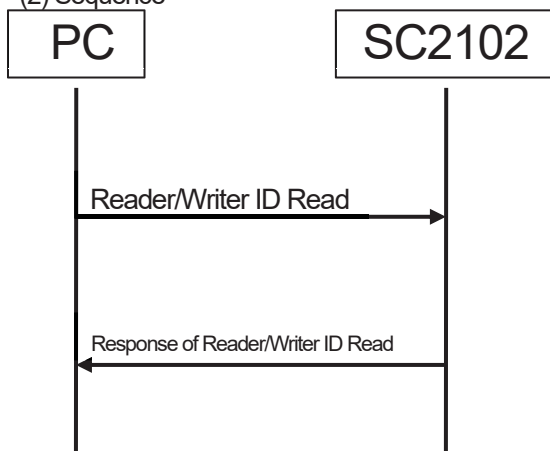
Response Data

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x52	0x00	0x01	*	(BCC)	0x03

*

1st byte: Reader/Writer ID

(2) Sequence



(3) Command Example

Transmission Data

02-51-00-00-53-03

Response Data (Reader/Writer ID is 1)

02-52-00-01-01-50-03

(4) Additional Notes

The initial value for the reader/writer ID is 1 (hexadecimal 0x01).

The configurable range for the reader/writer ID is 0 to 255 (hexadecimal 0x00 to 0xFF).

The reader/writer ID is read regardless of whether the device is open or closed.

4.2.2.7. Retry Count Setting Command

(1) Command Format

Transmission Data

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x53	0x00	0x00	None	(BCC)	0x03

*

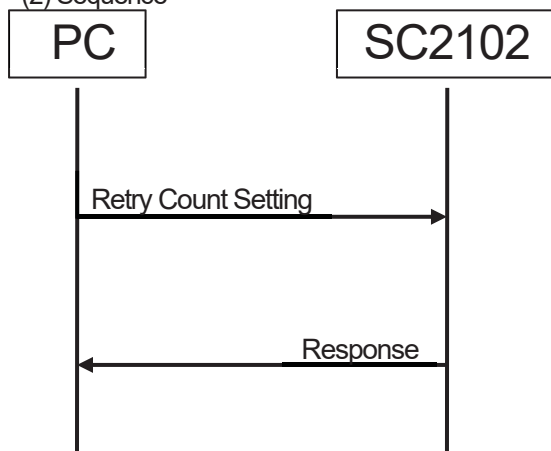
1st byte: WRITE command retry count

2nd byte: READ command retry count

Response Data

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x80	0x00	0x00	None	(BCC)	0x03

(2) Sequence



(3) Command Example

Transmission Data (Set retry count to 5)

02-53-00-02-05-05-53-03

Response Data

02-80-00-00-82-03

(4) Additional Notes

The initial retry count is 9 (hexadecimal 0x09).

The retry count can be set within the range of 0 to 255 (hexadecimal: 0x00 to 0xFF).

Settings can be changed regardless of whether the device is open or closed.

The timeout period for READ and WRITE commands is 100ms.

After the timeout period elapses, an internal retry transmission is performed.

4.2.2.8. Retry Count Read Command

(1) Command Format

Transmission Data

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x54	0x00	0x02	None	(BCC)	0x03

Response Data

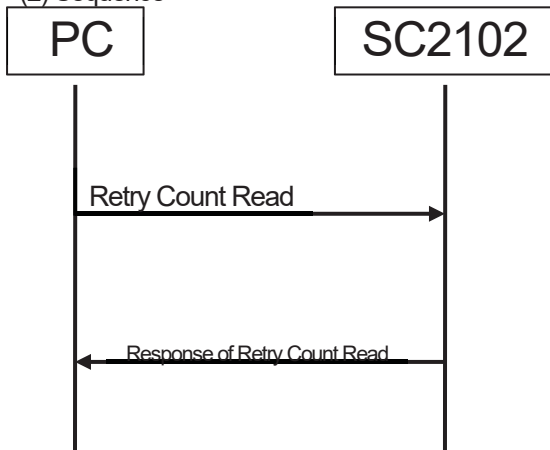
STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x55	0x00	0x02	*	(BCC)	0x03

*

1st byte: WRITE command retry count

2nd byte: READ command retry count

(2) Sequence



(3) Command Example

Transmission Data (Set retry count to 5)

02-54-00-00-56-03

Response Data

02-55-00-02-09-09-55-03

(4) Additional Notes

The initial retry count is 9 (hexadecimal 0x09).

The retry count can be set within the range of 0 to 255 (hexadecimal: 0x00 to 0xFF).

Settings can be changed regardless of whether the device is open or closed.

The timeout period for READ and WRITE commands is 100ms.

After the timeout period elapses, an internal retry transmission is performed.

4.2.2.9. WRITE Command

(1) Command Format

Transmission Data

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x30	0x00	1 - 193	*	(BCC)	0x03

*

1st byte: Write start address

Bytes 2 to 193: Smart card/tag command data

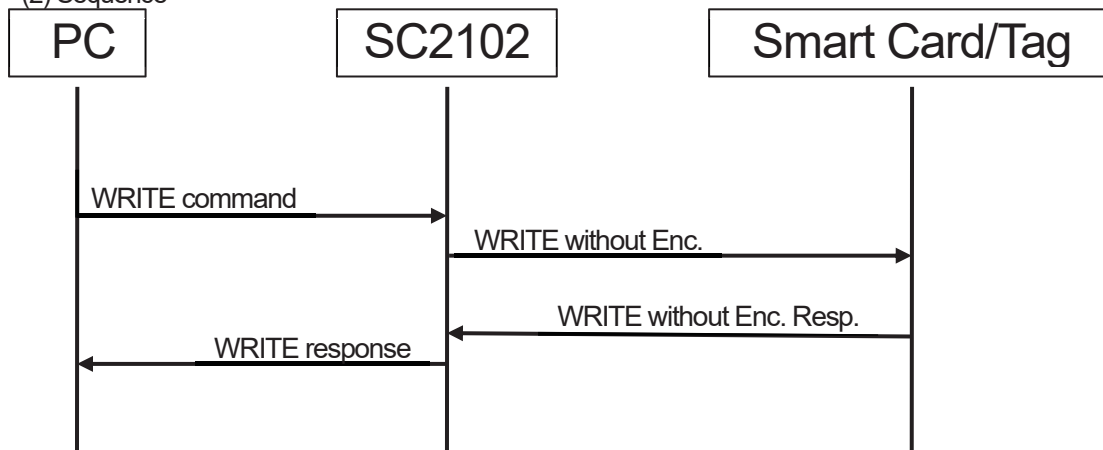
Response Data

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x31	0x00	0x02	*	(BCC)	0x03

*

Bytes 1 and 2: Not used

(2) Sequence



(3) Command Example

Transmission Data (Write sequential numbers from 0 to F to address 0 of the smart card/tag)

02-30-00-21-00-B0-01-01-10-03-30-30-30-00-00-00-10-00-00-00-00-00-01-02-03-04-05-06-07-08-09-0A-0B-0C-0D-0E-0F-90-03

Response Data

02-31-00-02-00-00-31-03

(4) Additional Notes

The start address specifies the block number in the block list where writing should begin.

For 2-byte block list: 80XX

For a 3-byte block list: 00XX04

To access the card memory area using a 2-byte block list, send with the identification sub-address set to 0x01.

When sent with identification sub 0x01, the response data will also return with identification sub 0x01.

4.2.2.10. READ Command

(1) Command Format

Transmission Data

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x32	0x00	0x02	*	(BCC)	0x03

*

1st byte: Read start address

2nd byte: Number of blocks to read

Response Data

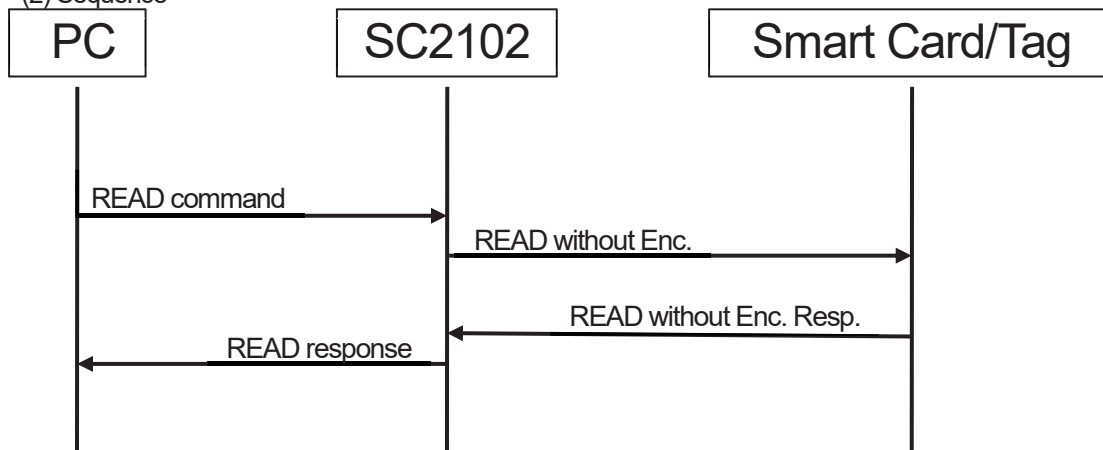
STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x80	0x00	0x00	None	(BCC)	0x03

*

Bytes 1 and 2: Not used

Bytes 3–194: Smart card/tag command data

(2) Sequence



(3) Command Example

Transmission Data

02-32-00-02-00-02-30-03

Response Data (Read one block starting from address 0 on the smart card/tag)

02-33-00-22-00-00-C0-01-01-F0-04-00-00-00-00-00-00-00-00-00-00-01-02-03-04-05-06-07 -08-09-0A-0B-0C-0D-0E-0F-27-03

(4) Additional Notes

The start address specifies the block number of the block list from which you wish to begin reading.

For 2-byte block lists: 80XX

For a 3-byte block list: 00XX04

To access the card memory area using a 2-byte block list, send with the identification sub-address set to 0x01.

When sent with identification sub 0x01, the response data's identification sub will also return as 0x01.

4.2.2.11. Response Types

(1) Normal Response

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x80	0x01	0x00	None	(BCC)	0x03

(2) Abnormal Response

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x80	0x02	0x00	None	(BCC)	0x03

Example: When sending a WRITE command while the card is closing or not captured

(3) Command transmission timeout

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x80	0x02	0x00	None	(BCC)	0x03

(4) BCC Error for Sent Command

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x80	0x03	0x00	None	(BCC)	0x03

(5) Command size error

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x80	0x04	0x00	None	(BCC)	0x03

(6) Internal Reader/Writer Communication Error

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x80	0x05	0x00	None	(BCC)	0x03

*When Monitor LED 1 is lit red

(7) Other command format errors

STX	Main ID	Sub ID	Data Length	Data	BCC	ETX
0x02	0x80	0x10	0x00	None	(BCC)	0x03

※STX error, ETX error, etc.

4.2.3. How to Acquire Smart Card/Tag ID Information

- (1) Send the reader/writer open command

The SC2102 enters the [Open] state and begins monitoring the smart card/tag.
SC2102's LED Monitor 1 lights up green.

- (2) Send the polling command

Touch the smart card/tag to the SC2102.

When the SC2102 detects the smart card/tag, it performs the following actions:

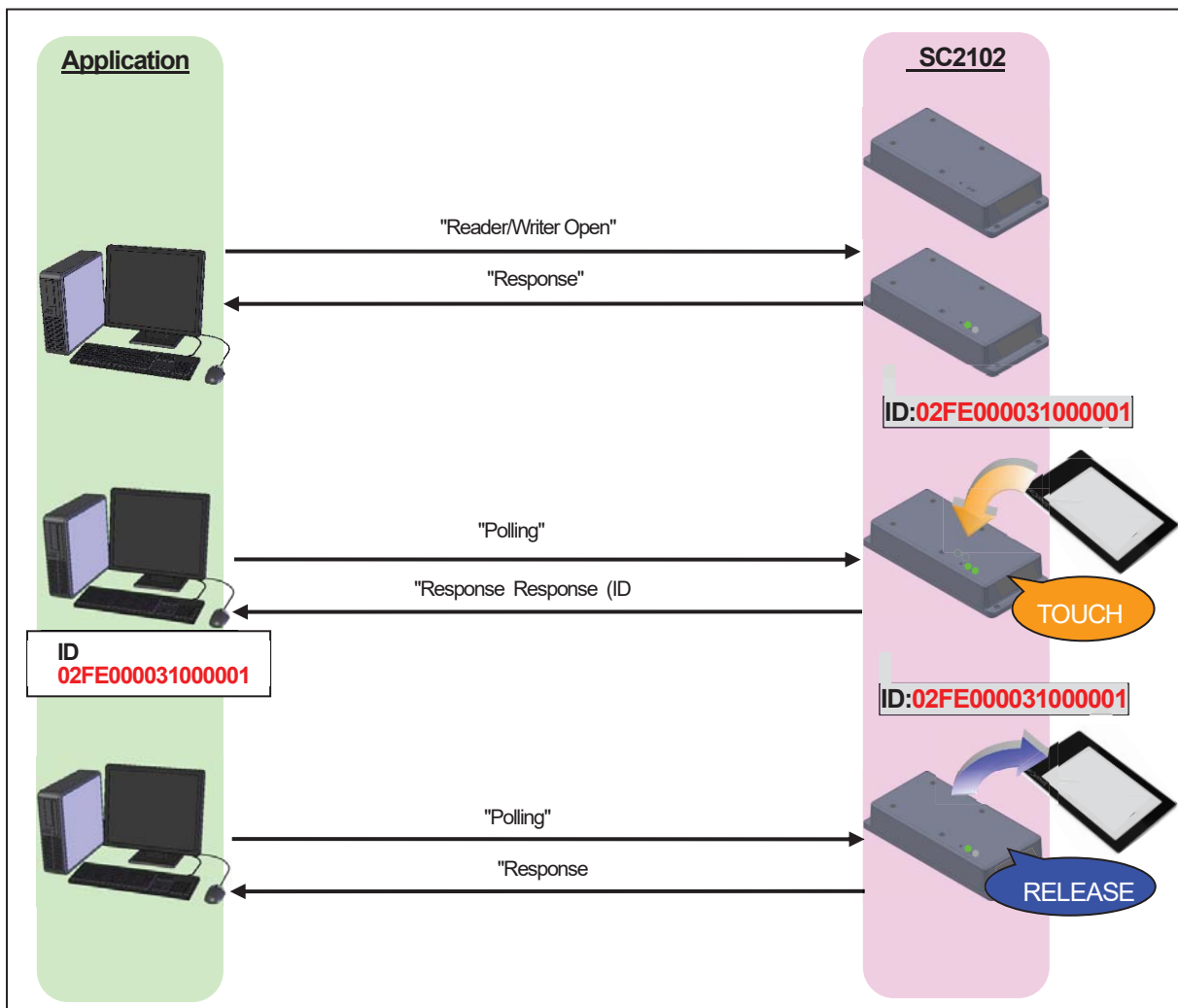
SC2102's LED Monitor 2 lights up green.

Transmits the smart card/tag information.

The polling command is sent.

The application should refer to the response to the polling command to obtain the ID information.

4.2.4. Sequence



4.3. Smart Card/Tag Status

4.3.1. Status Types

Smart cards/tags have four types of status.

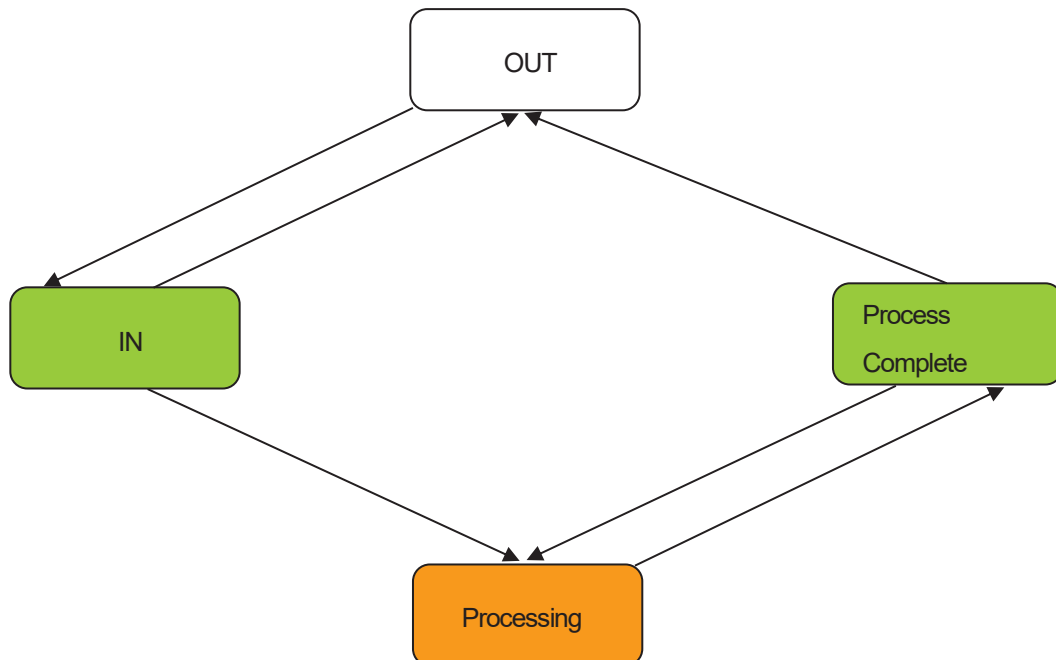
Status	Description	Command
OUT	The smart card/tag is in the RELEASE state from SC2102.	Receive Not Possible
IN	Smart card/tag is in the TOUCH state with SC2102	Receiving possible
Processing	Smart card/tag is processing the command	Unable to receive
Processing complete	Smart card/tag has completed command processing	Receive enabled

4.3.2. Status Transition

The status transition of the smart card/tag is as shown in the figure below.

The operation shown below assumes that the SC2102 is monitoring the smart card/tag.

(Sending the reader/writer open command to the SC2102 initiates smart card/tag monitoring.)



- ① The timing when the smart card/tag was TOUCHED to SC2102
- ② The moment the application sends a command and the smart card/tag receives it.
- ③ The timing when the smart card/tag is released from the SC2102.
- ④ The timing when processing of the command received from the application is complete.

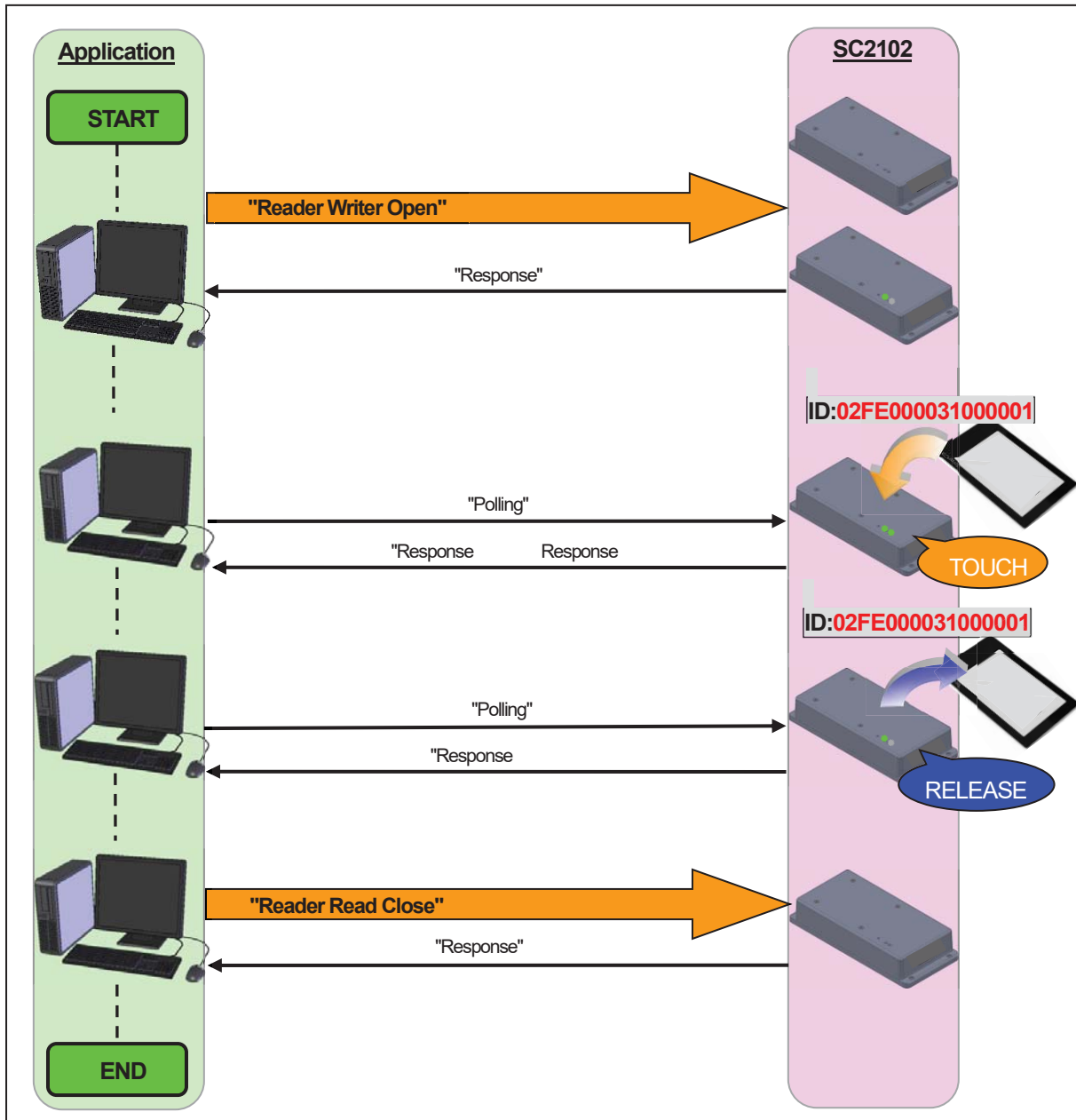
4.4. Application

4.4.1. Start monitoring (open) / Stop monitoring (close) the smart card/tag

(1) To control the smart card/tag, the SC2102 must be opened.

Use the Reader/Writer Open command and Reader/Writer Close command.

(2) Send the open command at the start of operation and the close command at the end of operation.



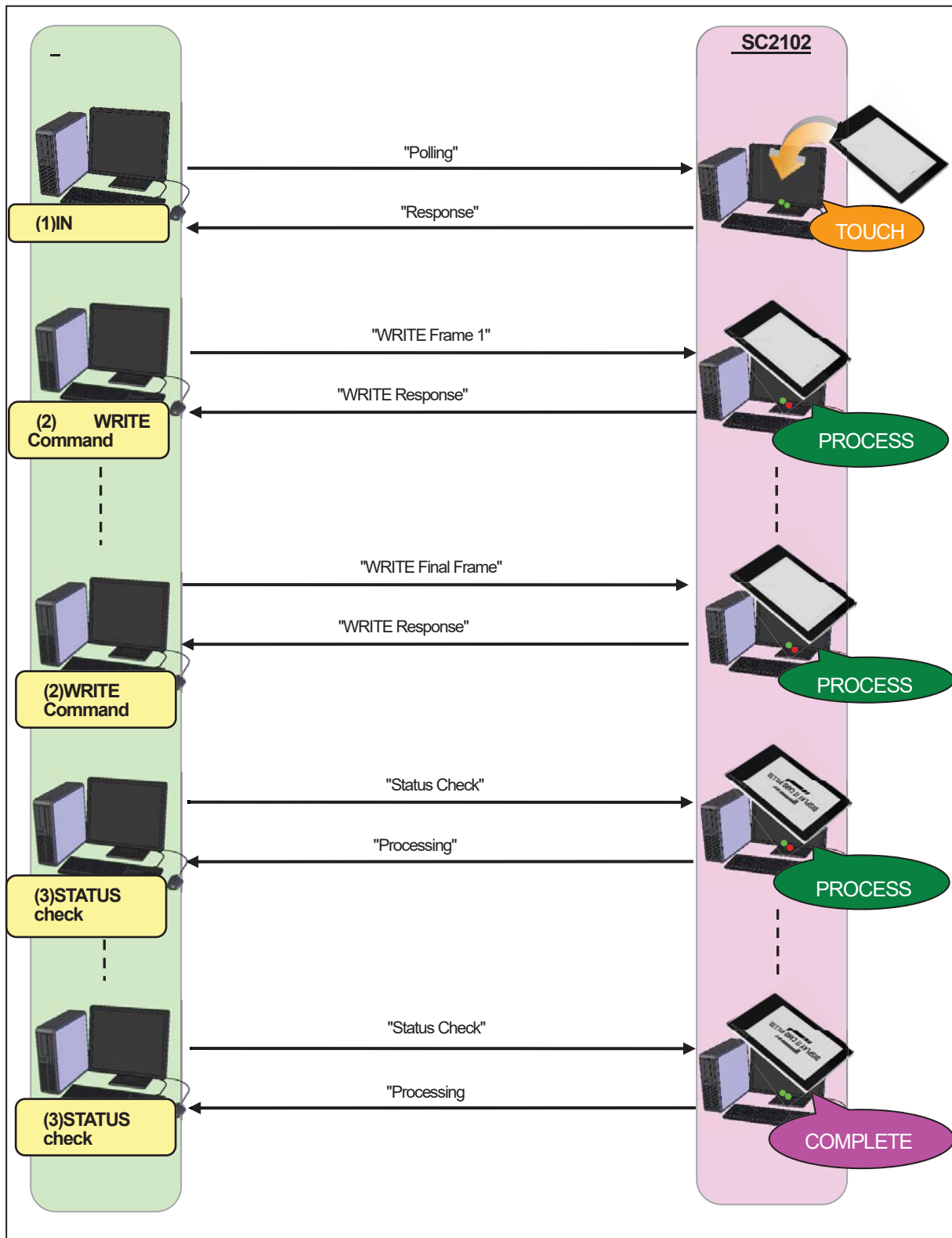
4.4.2. Send a command to the smart card/tag

- (1) Verify the smart card/tag is in a state where it can receive commands
 - Touch the smart card/tag to the SC2102.
 - Receive the response to the status check command and refer to the smart card/tag status information within the command.
 - Confirm that the status information is "IN" or "Processing Complete".
- (2) Send the command
 - LED monitor 2 on the SC2102 will light up red.
- (3) Confirm that the smart card/tag has completed processing the command
 - Receive the status check command response and refer to the smart card/tag status information within the command.
 - Confirm that the status information is "Processing Complete".
- (4) Perform error handling if necessary
 - This occurs when the "OUT" status is notified while waiting for confirmation of the smart card/tag status as "Processing Complete" in step (3).
 - This occurs when the "OUT" status is notified.
 - This occurs when the operator RELEASES the smart card/tag even though processing is not complete.
 - .
 - In this case, the application must implement a process to notify the operator with a warning message or similar.

Sequence examples are provided on the following pages.

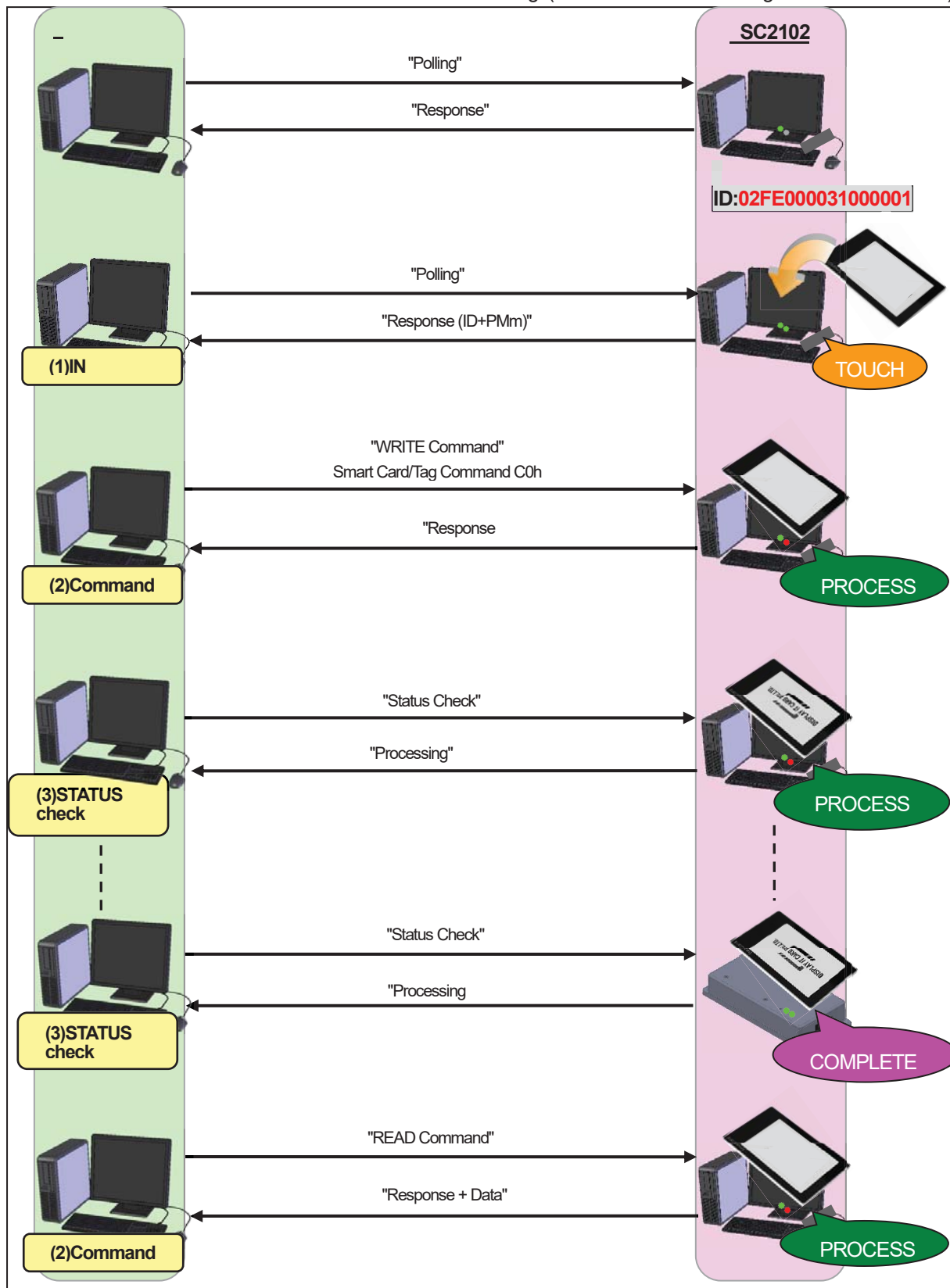
[WRITE Sequence]

Use the WRITE command to send the smart card/tag command data electronic paper display command.
This example applies when the application confirms the smart card/tag status is "Process Complete".



[READ Sequence]

Send the READ command to read data from the smart card/tag. (Refer to the smart card/tag user manual as well.)



4.5. SC2102 Abnormal Detection

[SC2102]

Reader/Writer Status

- This indicates the status of the reader/writer built into SC2102.
- If "Abnormal", LED Monitor 1 will light red. (It lights orange during reader/writer open transmission.)
Replace the SC2102.

4.6. Retry Processing

The SC2102 communicates wirelessly with the smart card/tag. Therefore, communication may not always be processed successfully.

If command transmission to the smart tag does not complete successfully, perform a retry process.

Typically, after sending a command to the smart card/tag, the application receives a response and confirms the status information is "Processing Complete". If the wireless communication environment is poor, the application may receive an "OUT" or "IN" signal while waiting for this "Processing Complete" status. (Unstable communication)

[Retry Procedure]

(1) Receive the response and confirm the smart card/tag is in "IN" or "Processing Complete" state

(2) Send a command to the smart card/tag

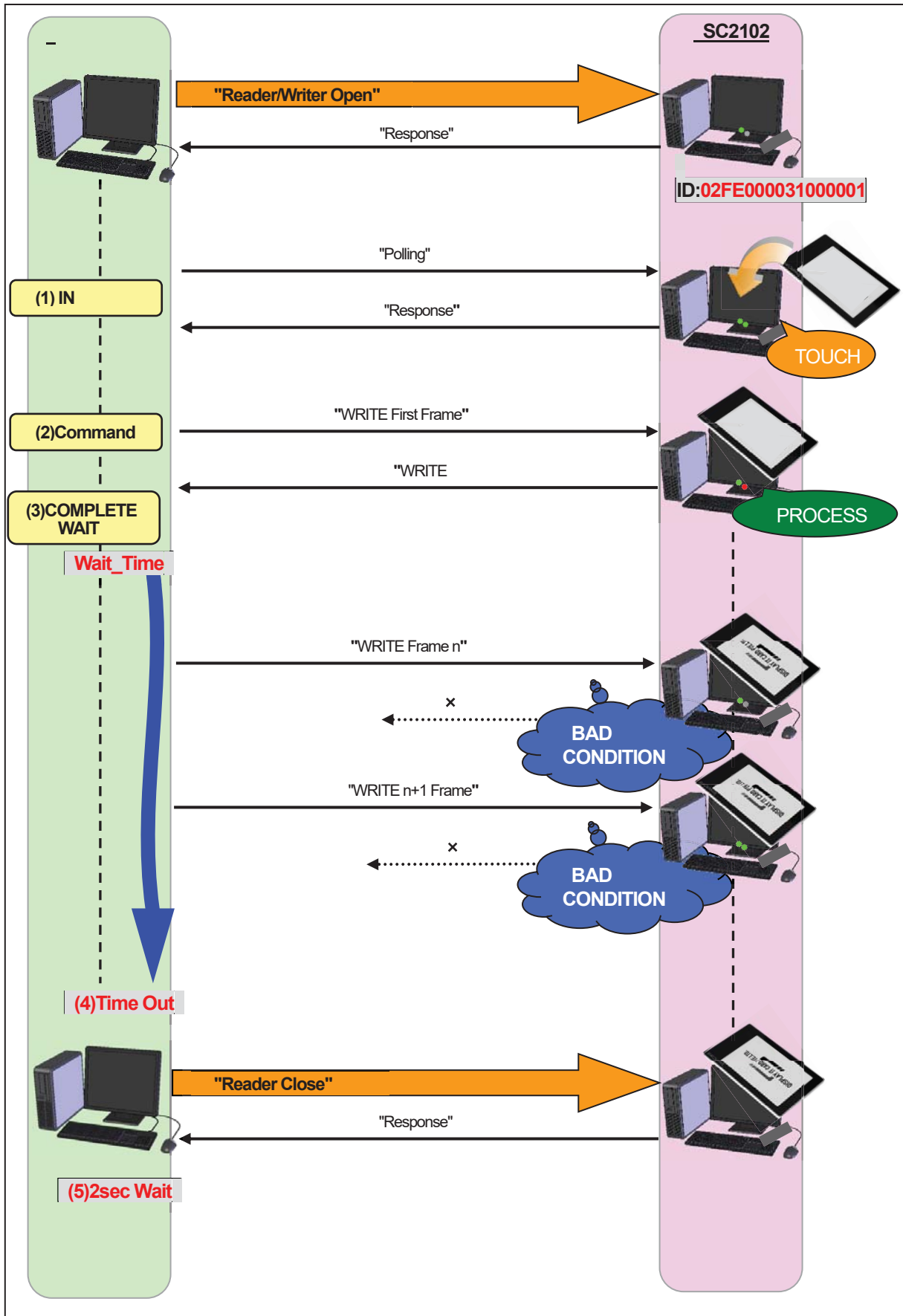
(3) Wait for "Processing Complete" for Wait_Time

If "OUT" or "IN" is received during this time, discard it. (Wait_Time is described later)

(4) If a timeout occurs, send the reader/writer close command

(5) Send the reader/writer open command

After opening the reader/writer, monitor the smart card/tag. If "IN" is detected, return to (1) and perform the retry process.



[Retry Count]

Please perform the overall retry process 2 to 3 times. If all retry attempts fail, you need to review the SC2102 installation environment. For details on the SC2102 installation environment, refer to: "2.3.1 . Precautions when installing multiple SC2102 units "

[Wait_Time]

This is the time until the smart tag reaches "Processing Complete". Use the values in the table below as Wait_Time.

Smart Card	Wait_Time [sec]
SC1029L	10
SC1029U	10

Smart Tag	Wait_Time [sec]
ST1129L	10
ST1129U	10

Appendix-1 Function Specifications

Configurable Reader/Writer ID	0 to 255 0x00 to 0xFF (hexadecimal)
Cable Length	USB 2.0 cable (microB): Maximum 3m
Power	Supplied via USB cable (360mA)
Operating Temperature/Humidity	0°C to 35°C, 20% to 80% (no condensation)
Storage Temperature/Humidity	-20°C to 70°C, 10% to 90% (no condensation)
Power	1.8W
Electrostatic Discharge Resistance	*1 IEC 61000-4-2 Level 4 Contact discharge $\pm 8\text{kV}$ / Air discharge $\pm 15\text{kV}$
Weight	Approx. 220g
PC – SC2102 Communication Standard	Serial communication via FTDI driver (USB connection)
SC2102 – Smart Card/Tag Interfaces Communication Standard	ISO/IEC 18092
SC2102 – SC1029L Communication Distance	10 to 30 mm *2
SC2102 – SC1029U Communication Distance	10 to 30 mm *2
SC2102 – ST1129U Communication distance	10 to 50 mm *2
SC2102 – ST1129L Communication Distance	10 to 40 mm *2
Electronic Paper Display Display Speed	Refer to the Smart Card/Tag User Manual
Compliance Standards	Complies only with Japan's Radio Law*3

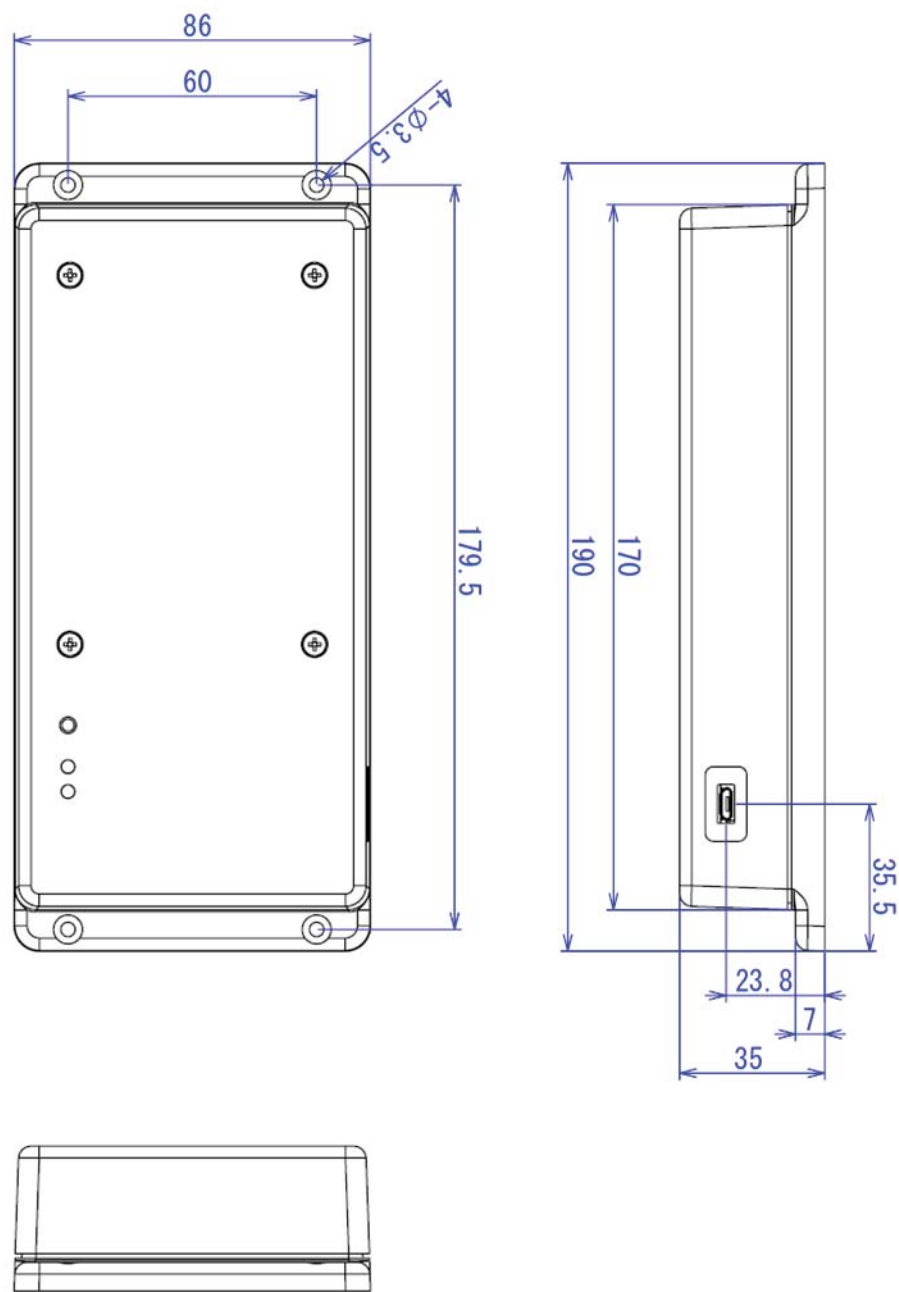
*1 Ground the surrounding metal parts where the reader/writer is installed.

*2 Distance may be reduced depending on the installation environment.

*3 For overseas export, please contact our representative.

Appendix-2 External Dimensions

[mm]



Appendix 3 Troubleshooting

Symptom	Cause	Check
Unable to communicate with SC2102	Driver not installed	Refer to section "2.2. Connecting to a PC" and install the driver.
	Incorrect COM port number	Check the COM port number via Control Panel → System → Device Manager.
Unable to obtain smart card/tag ID Commands to the smart card/tag do not complete	Influence of metal objects near the SC2102	Refer to the section "2.3.1.2 .Installation Environment " and review the installation environment.
	Positioning between SC2102 and Smart Card/Tag	Please review the positioning between the SC2102 and the smart card/tag. Especially when the vertical gap is 10mm, increase the gap. (20–40mm: Recommended)



If the issue persists after these checks, please contact our customer support center.

Appendix 4

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

AIOI Systems USA Corp.

ADDR. 10080 N. Wolfe Rd., Suite SW3-200 Cupertino, CA 95014

TEL. +1-408-973-7835

FCC CAUTION

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Attach ferrite cores to the cables to suppress radio interference.

Attach the ferrite cores(SEIWA:E04SR301334) to both ends of the USB cable. Wind two turns.



Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines. This equipment must be installed and operated keeping the radiator at least 20cm or more away from person's body.

[Note] Specifications and manual contents for the SC series are subject to change without notice. Copying or reproducing any part or the entirety of this manual, in any form, is strictly prohibited without written permission from AIOI Systems Co., Ltd.

[Contact] For any questions regarding the specifications or manual content of the SC series, or for inquiries about application program development, please contact our customer support center via fax or email: info1@hello-aioi.com

SC Series SC2102 Smart Card Reader/Writer

User's Manual



AIOI•SYSTEMS CO., LTD.

9F Omori Bellport E Building,
6-22-7 Minami-Oi, Shinagawa-ku, Tokyo, Japan
Tel: +81-3-3764-0228 E-Mail: info1@hello-aioi.com