

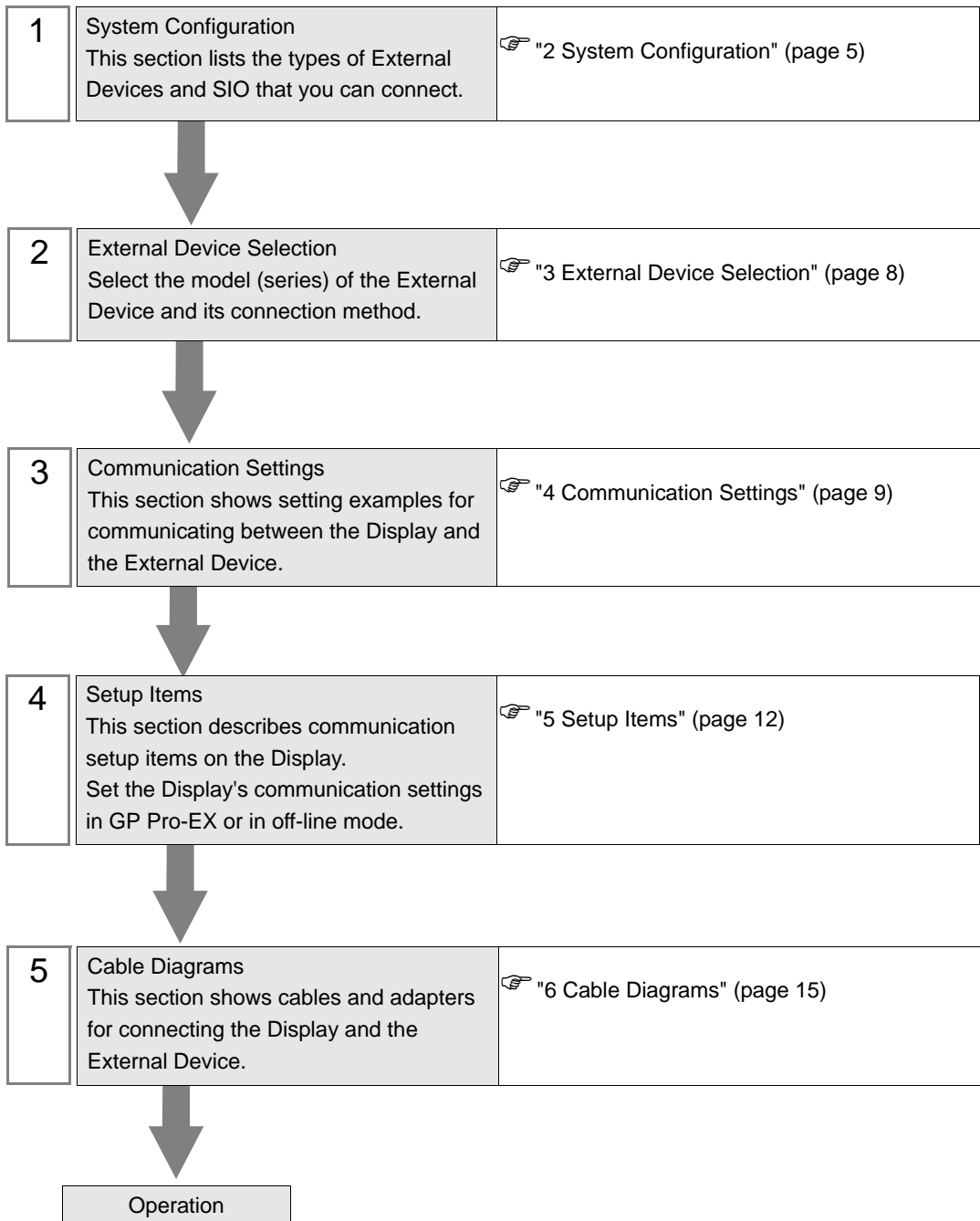
# General SIO Driver

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## Introduction

This manual describes how to connect the Display and the External Device (target PLC).

In this manual, the connection procedure is described in the sections identified below.



# 1 What Is a General SIO?

## 1.1 Overview

The general SIO driver is a driver which can be used for general purpose and not dedicated to specific SIO communication devices connected to the Display. It is suitable for devices with simple communication procedures, such as temperature controllers, card readers, barcode or serial printers.

Through the Display's D-script and ladder program (hereinafter referred to as "scripts"), communication packets are created as data in the Display's memory table. The general SIO driver then sends the memory table data to the Display's SIO port, and stores data received from the SIO port in the Display's memory table.

As described above, the communication packets themselves are created using scripts and this driver enables you to send and receive data to and from SIO communication devices using only Send/Receive functions through the SIO ports.

- 1:1 and 1:n serial connections are available.
- Up to 31 units can be connected.
- The maximum communication speed is 115200bps.

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**IMPORTANT**

- The general SIO driver features a memory link method. You can set a single memory link driver for each Display. Two or more memory link drivers are not available for simultaneous use.

For more information on the memory link method, see the GP-Pro EX Device/PLC Connection Manual. In the Manufacturer's List section, see "Communication Method" under "Important: Prior to reading the Device/PLC Connection manual".

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## 1.2 Glossary

Terms	Definition and Description
Memory table	A Display's internal memory table. The General SIO driver reads and writes data to and from the memory table. The system area has a 16-bit wide region of 0000 to 9999.
Scripts	This manual uses "scripts" as a generic term to indicate the function that reads and writes data to and from the memory table. Specifically, "scripts" represents a D-script and a ladder program.
Ring buffer	This memory region stores data temporarily in the FIFO format. The term "Ring Buffer" comes from the way data is read circularly. This driver creates a ring buffer in the Display's memory table and uses it as a receive buffer. To keep track of data position in a receive buffer, you control two pointers: the GET and PUT pointers.
GET pointer	This pointer indicates the location of the next piece of data that scripts should read out. This driver holds the offset value from the start address of the data area located in a ring buffer. Scripts read data from the region that the GET pointer indicates, then moves the GET pointer forward to the read-out position.
PUT pointer	This pointer indicates the location where this driver should write the next piece of incoming data. This driver holds the offset value from the start address of the data area located in a ring buffer. This driver writes incoming data into the region that the PUT pointer indicates, then moves the PUT pointer forward to the write position.
Receive-function control area	This area contains all management information for the receive buffer of this driver, and is defined within a fixed region in the Display's memory table.
Send-function control area	This area contains all management information for the send buffer of this driver, and is defined within a fixed region in the Display's memory table.
System data area	This area, in the Display's memory table, reflects its system information. Here you can read or write display screen numbers, calendar information, and other system information. This area is created within the fixed addresses (0000 to 0019) in the memory table.
Special relay	Like the system data area, this relay is a region located within the memory table and reflects the system information of the Display. This relay is created within the 2032 to 2047 fixed address range.
9000 area	This area mainly stores the Display's internal-processing information, such as line-graph logs and the communication scan time. Some of the regions are editable by the user.
User area	This area, in the Display's memory table, reflects its system information and contains memory regions other than the "system data area", "special relay", and "9000 area" regions. The regions are editable by the user.

## 2 System Configuration

The following table lists system configurations for connecting External Devices and the Display.

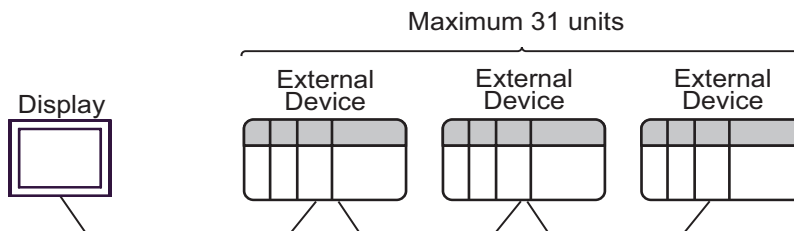
Series	CPU	Link I/F	SIO Type	Setting Example	Cable Diagram
External Device			RS-232C	Setting Example 1 (page 9)	Cable Diagram 1 (page 15)
			RS-422/485 (4-wire)	Setting Example 2 (page 10)	Cable Diagram 2 (page 17)
			RS-422/485 (2-wire)	Setting Example 3 (page 11)	Cable Diagram 3 (page 24)

### Connection Configuration

- 1:1 Connection



- 1:n Connection



## ■ IPC COM Port

When connecting an IPC with an External Device, the COM port used depends on the series and SIO type. Please refer to the IPC manual for details.

### Usable Port

Series	Usable Port		
	RS-232C	RS-422/485(4 wire)	RS-422/485(2 wire)
PS-2000B	COM1 <sup>*1</sup> , COM2, COM3 <sup>*1</sup> , COM4	-	-
PS-3450A, PS-3451A	COM1, COM2 <sup>*1*2</sup>	COM2 <sup>*1*2</sup>	COM2 <sup>*1*2</sup>
PS-3650A, PS-3651A	COM1 <sup>*1</sup>	-	-
PS-3700A (Pentium®4-M) PS-3710A	COM1 <sup>*1</sup> , COM2 <sup>*1</sup> , COM3 <sup>*2</sup> , COM4	COM3 <sup>*2</sup>	COM3 <sup>*2</sup>
PS-3711A	COM1 <sup>*1</sup> , COM2 <sup>*2</sup>	COM2 <sup>*2</sup>	COM2 <sup>*2</sup>
PL-3000B, PL-3600T, PL-3600K, PL-3700T, PL-3700K, PL-3900T	COM1 <sup>*1*2</sup> , COM2 <sup>*1</sup> , COM3, COM4	COM1 <sup>*1*2</sup>	COM1 <sup>*1*2</sup>

\*1 The RI/5V can be switched. Use the IPC's switch to change if necessary.

\*2 Set up the SIO type with the DIP switch. Please set up as follows according to SIO type to be used.

### DIP switch setting: RS-232C

DIP switch	Setting	Description
1	OFF <sup>*1</sup>	Reserved (always OFF)
2	OFF	SIO type: RS-232C
3	OFF	
4	OFF	Output mode of SD (TXD) data: Always output
5	OFF	Terminal resistance (220Ω) insertion to SD (TXD): None
6	OFF	Terminal resistance (220Ω) insertion to RD (RXD): None
7	OFF	Short-circuit of SDA (TXA) and RDA (RXA): Not available
8	OFF	Short-circuit of SDB (TXB) and RDB (RXB): Not available
9	OFF	RS (RTS) Auto control mode: Disabled
10	OFF	

\*1 When using PS-3450A and PS-3451A, turn ON the set value.

## DIP switch setting: RS-422/485 (4 wire)

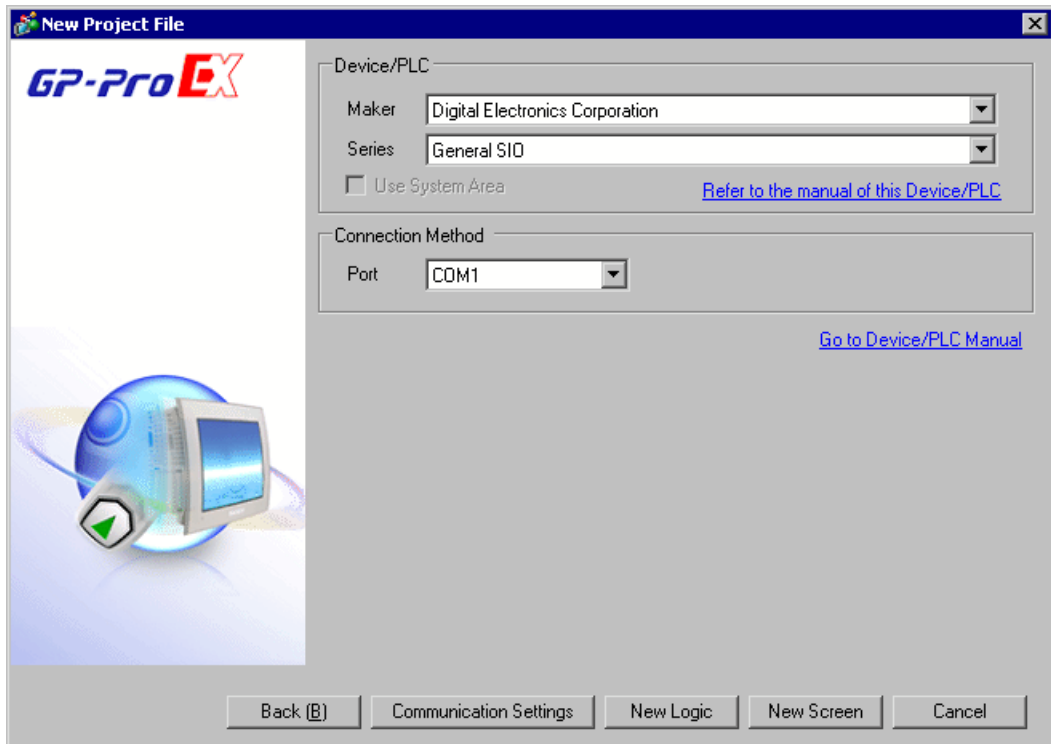
DIP switch	Setting	Description
1	OFF	Reserved (always OFF)
2	ON	SIO type: RS-422/485
3	ON	
4	OFF	Output mode of SD (TXD) data: Always output
5	OFF	Terminal resistance (220Ω) insertion to SD (TXD): None
6	OFF	Terminal resistance (220Ω) insertion to RD (RXD): None
7	OFF	Short-circuit of SDA (TXA) and RDA (RXA): Not available
8	OFF	Short-circuit of SDB (TXB) and RDB (RXB): Not available
9	OFF	RS (RTS) Auto control mode: Disabled
10	OFF	

## DIP switch setting: RS-422/485 (2 wire)

DIP switch	Setting	Description
1	OFF	Reserved (always OFF)
2	ON	SIO type: RS-422/485
3	ON	
4	OFF	Output mode of SD (TXD) data: Always output
5	OFF	Terminal resistance (220Ω) insertion to SD (TXD): None
6	OFF	Terminal resistance (220Ω) insertion to RD (RXD): None
7	ON	Short-circuit of SDA (TXA) and RDA (RXA): Available
8	ON	Short-circuit of SDB (TXB) and RDB (RXB): Available
9	ON	RS (RTS) Auto control mode: Enabled
10	ON	

### 3 External Device Selection

Select the External Device to be connected to the Display.



Setup Items	Setup Description
Maker	Select the maker of the External Device to be connected. Select "Digital Electronics Corporation".
Series	Select the model (series) of the External Device to be connected and connection method. Select "General SIO". Check the connection configuration in "General SIO" in system configuration. ☞ "2 System Configuration" (page 5)
Use System Area	Not available in this driver.
Port	Select the Display port to be connected to the External Device.



## 4 Communication Settings

This section provides examples of communication settings recommended by Pro-face for the Display and the External Device.

### 4.1 Setting Example 1

#### ■ GP-Pro EX Settings

##### ◆ Communication Settings

To display the setup screen, from the [System Settings] workspace, select [Device/PLC].

Device/PLC 1 | [Change Device/PLC](#)

Summary

Maker  Series  Port

Text Data Mode  [Change](#)

Communication Settings

SIO Type  RS232C  RS422/485(2wire)  RS422/485(4wire)

Speed

Data Length  7  8

Parity  NONE  EVEN  ODD

Stop Bit  1  2

Flow Control  NONE  ER(DTR/CTS)  XON/XOFF

Wait To Send  (ms)

Control Area Address

RI / VCC  RI  VCC

In the case of RS232C, you can select the 9th pin to RI (Input) or VCC (5V Power Supply). If you use the Digital's RS232C Isolation Unit, please select it to VCC.

#### ■ External Device Settings

The communication settings vary depending on the External Device.

Refer to your External Device manual for details.

## 4.2 Setting Example 2

### ■ GP-Pro EX Settings

#### ◆ Communication Settings

To display the setup screen, from the [System Settings] workspace, select [Device/PLC].

Device/PLC 1

Summary [Change Device/PLC](#)

Maker  Series  Port

Text Data Mode  [Change](#)

Communication Settings

SIO Type  RS232C  RS422/485(2wire)  RS422/485(4wire)

Speed

Data Length  7  8

Parity  NONE  EVEN  ODD

Stop Bit  1  2

Flow Control  NONE  ER(DTR/CTS)  XON/XOFF

Wait To Send  (ms)

Control Area Address

RI / VCC  RI  VCC

In the case of RS232C, you can select the 9th pin to RI (Input) or VCC (5V Power Supply). If you use the Digital's RS232C Isolation Unit, please select it to VCC.

### ■ External Device Settings

The communication settings vary depending on the External Device.

Refer to your External Device manual for details.

## 4.3 Setting Example 3

### ■ GP-Pro EX Settings

#### ◆ Communication Settings

To display the setup screen, from the [System Settings] workspace, select [Device/PLC].

Device/PLC 1

Summary [Change Device/PLC](#)

Maker: Digital Electronics Corporation Series: General SIO Port: COM1

Text Data Mode: 1 [Change](#)

Communication Settings

SIO Type:  RS232C  RS422/485(2wire)  RS422/485(4wire)

Speed: 9600

Data Length:  7  8

Parity:  NONE  EVEN  ODD

Stop Bit:  1  2

Flow Control:  NONE  ER(DTR/CTS)  XON/XOFF

Wait To Send: 0 (ms)

Control Area Address: 20

RI / VCC:  RI  VCC

In the case of RS232C, you can select the 9th pin to RI (Input) or VCC (5V Power Supply). If you use the Digital's RS232C Isolation Unit, please select it to VCC.

[Default](#)

### ■ External Device Settings

The communication settings vary depending on the External Device.

Refer to your External Device manual for details.

## 5 Setup Items

Set up the Display's communication settings in GP Pro-EX or in the Display's off-line mode.

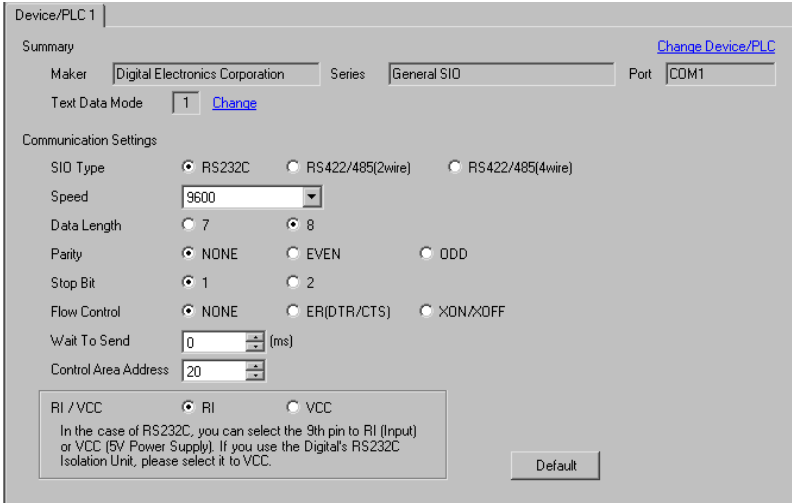
The setting of each parameter must match that of the External Device.

 "4 Communication Settings" (page 9)

### 5.1 Setup Items in GP-Pro EX

#### ■ Communication Settings

To display the setup screen, from the [System Settings] workspace, select [Device/PLC].



Setup Items	Setup Description
SIO Type	Select the SIO type to communicate with the External Device.
Speed	Select the communication speed between the External Device and the Display.
Data Length	Select the data length.
Parity	Select how to check parity.
Stop Bit	Select the stop bit length.
Flow Control	Select a communication control method to prevent transmission and reception data overflow.
Wait To Send	Use an integer from 0 to 255 to enter standby time (ms) for the Display from receiving packets to transmitting next commands.
Control Area Address	Use an integer from 20 to 9980 to enter the control area address. <b>NOTE</b> • Do not duplicate start addresses.
RI/VCC	You can switch RI/VCC of the 9th pin when you select RS232C for SIO type. When connecting with the IPC, it is necessary to change RI/5V using the IPC changeover switch. Refer to the IPC manual for details.

## 5.2 Setup Items in Off-line Mode

- NOTE** • Refer to the Maintenance/Troubleshooting manual for information on how to enter off-line mode or about the operation.

Cf. Maintenance/Troubleshooting Manual "2.2 Off-line Mode"

### ■ Communication Settings

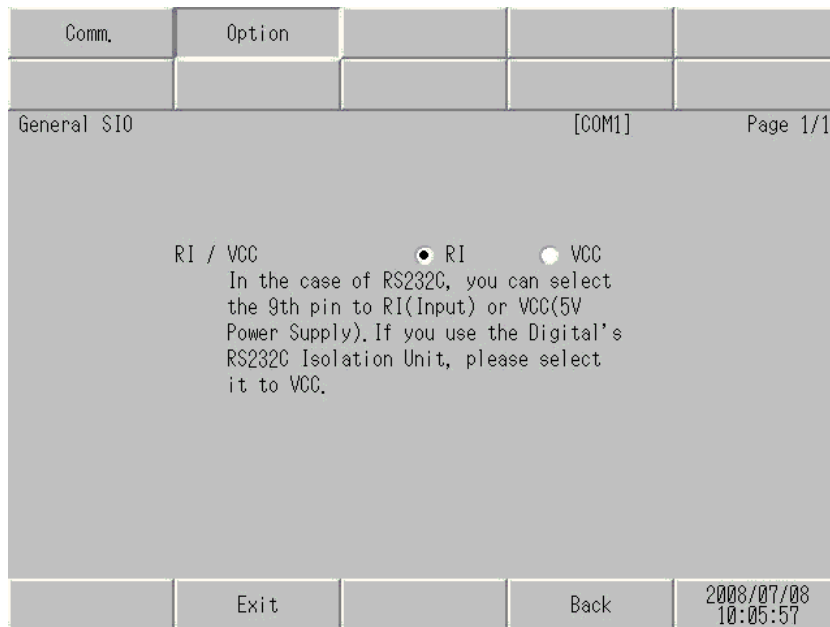
To display the setting screen, touch [Device/PLC Settings] from [Peripheral Equipment Settings] in off-line mode. Touch the External Device you want to set from the displayed list.

Comm.	Option			
General SIO		[COM1]	Page 1/1	
SIO Type	RS232C			
Speed	9600			
Data Length	<input type="radio"/> 7 <input checked="" type="radio"/> 8			
Parity	<input checked="" type="radio"/> NONE <input type="radio"/> EVEN <input type="radio"/> ODD			
Stop Bit	<input checked="" type="radio"/> 1 <input type="radio"/> 2			
Flow Control	NONE			
Wait To Send(ms)	0			
Control Area Address	20			
Exit		Back		2008/07/08 10:05:54

Setup Items	Setup Description
SIO Type	Select the SIO type to communicate with the External Device.
Speed	Select the communication speed between the External Device and the Display.
Data Length	Select the data length.
Parity	Select how to check parity.
Stop Bit	Select the stop bit length.
Flow Control	Select a communication control method to prevent transmission and reception data overflow.
Wait To Send	Use an integer from 0 to 255 to enter standby time (ms) for the Display from receiving packets to transmitting next commands.
Control Area Address	Use an integer from 20 to 9980 to enter the control area address. <b>NOTE</b> <ul style="list-style-type: none"> <li>Do not duplicate start addresses.</li> </ul>

## ■ Options

To display the setting screen, touch [Device/PLC Settings] from [Peripheral Equipment Settings]. Touch the External Device you want to set from the displayed list, and touch [Option].



Setup Items	Setup Description
RI/VCC	You can switch RI/VCC of the 9th pin when you select RS232C for SIO type. When connecting with the IPC, it is necessary to change RI/5V using the IPC changeover switch. Refer to the IPC manual for details.

## 6 Cable Diagrams

The following cable diagrams may be different from cable diagrams recommended by Pro-face. Please be assured there is no operational problem in applying the cable diagrams shown in this manual.


- The FG pin of the External Device body must be D-class grounded. Refer to your External Device manual for details.
- The SG and FG are connected inside the Display. When connecting the External Device to the SG, design your system to avoid short-circuit loops.
- Connect an isolation unit if the communication is not stable due to noise or other factors.

Cable Diagram 1

Display (Connection Port)	Cable		Remarks
GP* <sup>1</sup> (COM1) ST * <sup>2</sup> (COM1) LT (COM1) IPC* <sup>3</sup> PC/AT	A	User-created cable (ER (DTR/CTS) control)	Cable length: 15m or less
	B	User-created cable (With XON/XOFF control or without control)	

\*1 All GP models except AGP-3302B

\*2 All ST models except AST-3211A

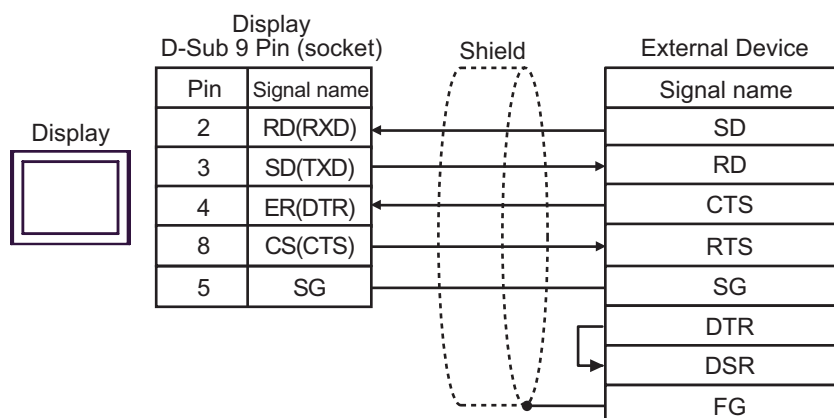
\*3 Only a COM port that can communicate with RS-232C can be used.  
 ■ IPC COM Port (page 6)

### IMPORTANT

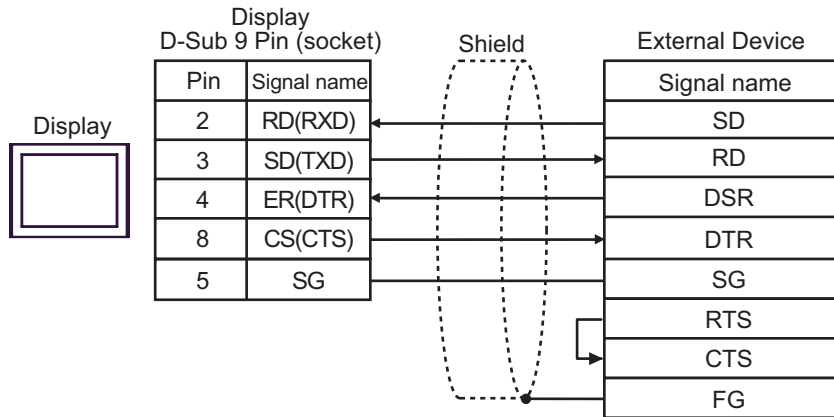
- The shapes of RS-232C connectors and the correspondence between the pin numbers and signal names vary depending on the External Device. Make the proper connection according to the External Device's interface specifications.

A) When using a user-created cable (ER (DTR/CTS) control)

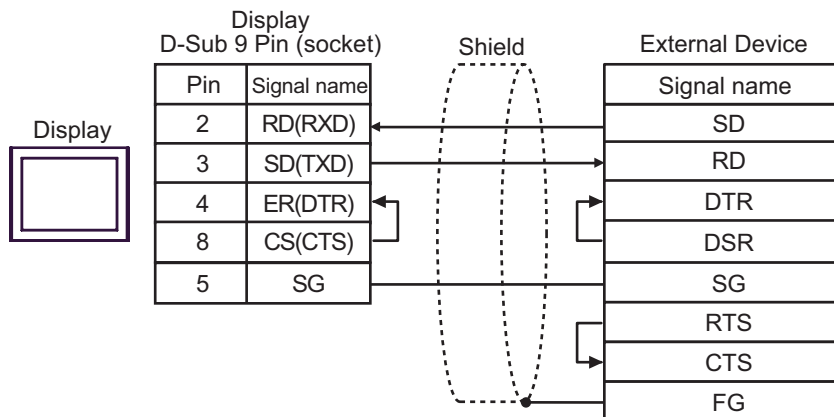
- When the External Device supports RTS/CTS control



- When the External Device supports DTR/DSR control



- B) When using a user-created cable (with XON/XOFF control or without control)






Cable Diagram 2

Display (Connection Port)	Cable		Remarks
GP*1 (COM1) AGP-3302B (COM2) LT (COM1) ST*2 (COM2) IPC*3	A	COM port conversion adapter by Pro-face CA3-ADPCOM-01 + Terminal block conversion adapter by Pro-face CA3-ADPTRM-01 + User-created cable	
	B	COM port conversion adapter by Pro-face CA3-ADPCOM-01 + RS-422 cable by Pro-face CA3-CBL422-01	
	C	User-created cable	
GP*4 (COM2)	D	Online adapter by Pro-face CA4-ADPONL-01 + Terminal block conversion adapter by Pro-face CA3-ADPTRM-01 + User-created cable	
	E	Online adapter by Pro-face CA4-ADPONL-01 + RS-422 cable by Pro-face CA3-CBL422-01	
	F	Online adapter by Pro-face CA4-ADPONL-01 + User-created cable	

\*1 All GP models except AGP-3302B

\*2 All ST models except AST-3211A

\*3 Only a COM port that can communicate with RS-422/485 (4-wire) can be used.  
 ■ IPC COM Port (page 6)

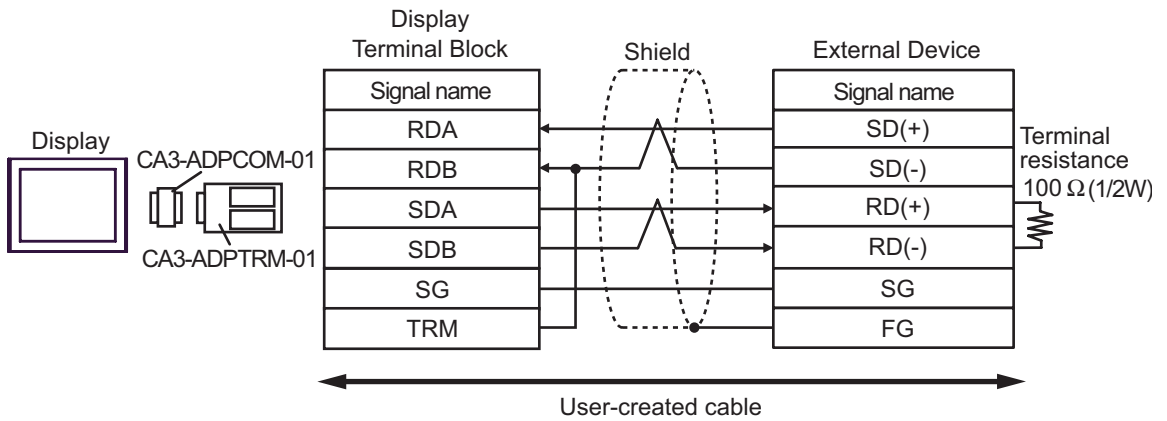
\*4 All GP models including the GP-3200 Series and AGP-3302B

**IMPORTANT**

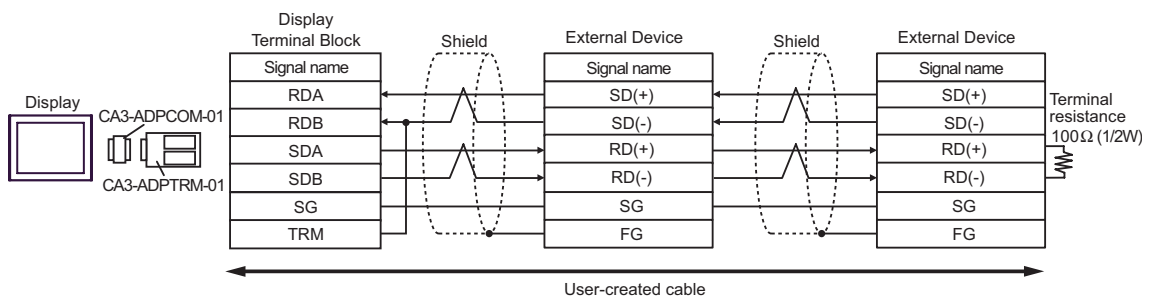
- The RS-422/485 cable length is normally 1000m or less, depending on the External Device. Refer to your External Device manual for details.
- The connection method and termination resistance depends on the External Device.
- The termination resistance on the Display is not isolated.

A) When using the COM port conversion adapter (CA3-ADPCOM-01), the terminal block conversion adapter (CA3-ADPTRM-01) by Pro-face, and a user-created cable

- 1:1 Connection

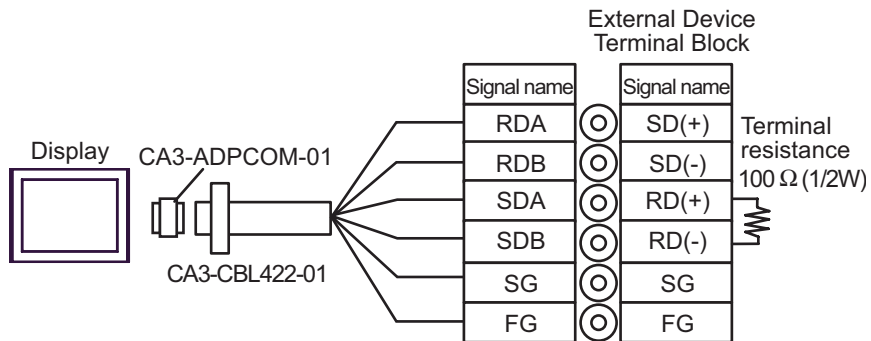


- 1:n Connection

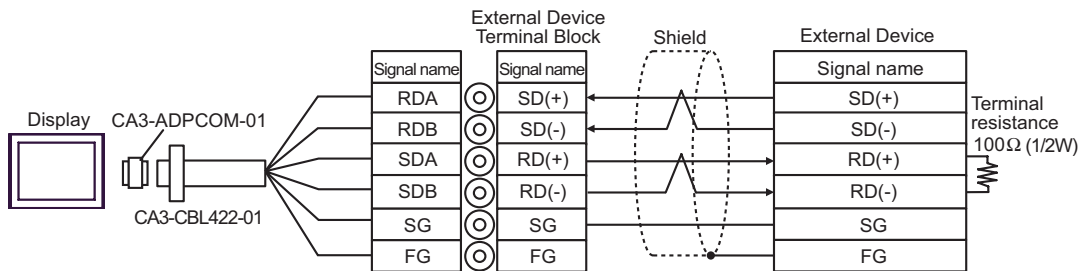


B) When using the COM port conversion adapter (CA3-ADPCOM-01), and the RS-422 cable (CA3-CBL422-01) by Pro-face

- 1:1 Connection

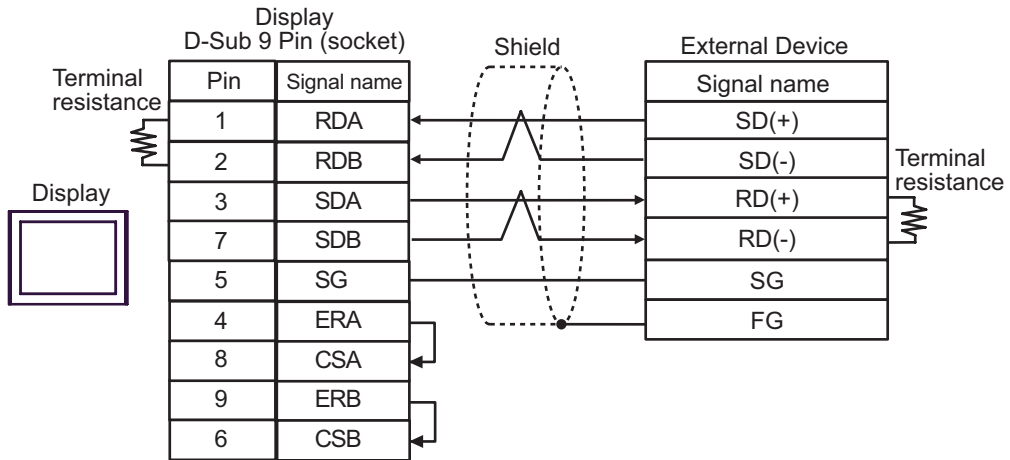


- 1:n Connection

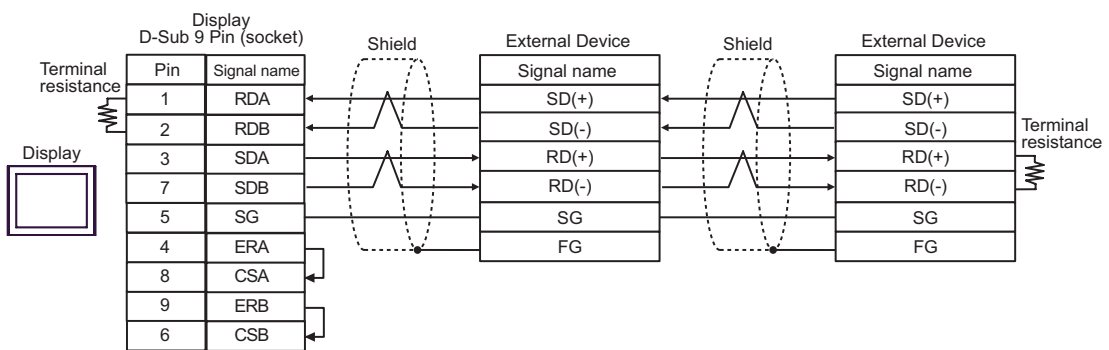


C) When using a user-created cable

- 1:1 Connection



- 1:n Connection

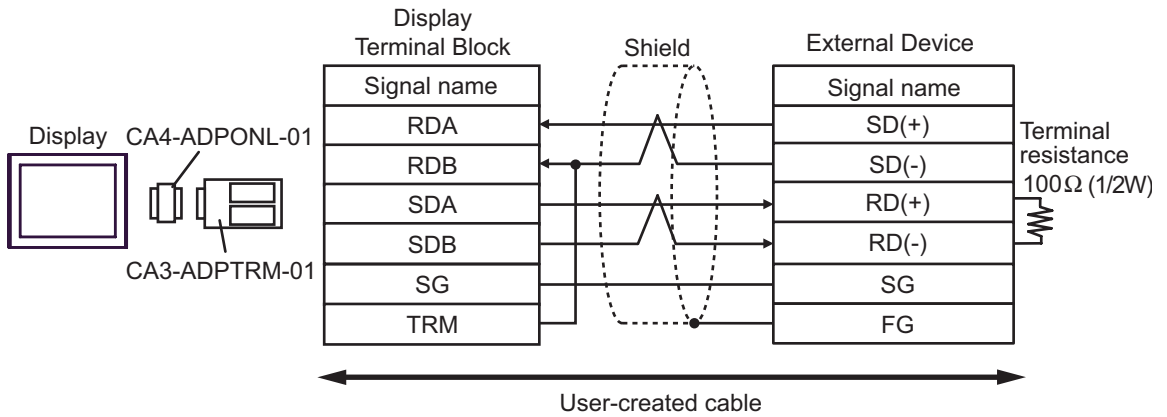


**NOTE**

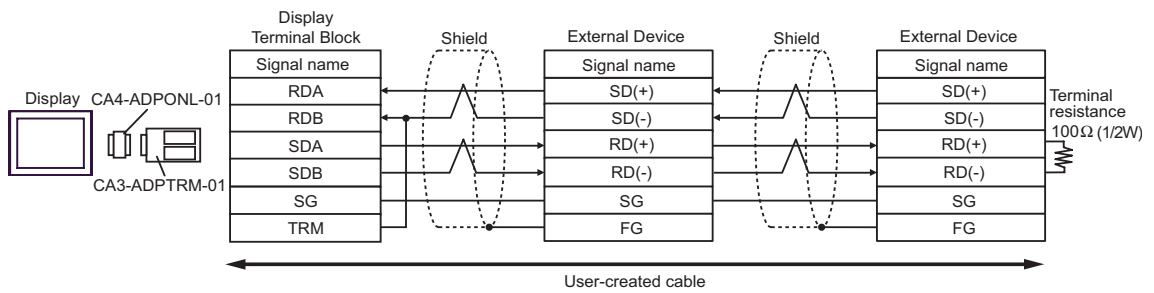
- The termination resistor varies depending on the External Device. Refer to your External Device manual for details.

D) When using the online adapter (CA4-ADPONL-01), the terminal block conversion adapter (CA3-ADPTRM-01) by Pro-face, and a user-created cable

- 1:1 Connection

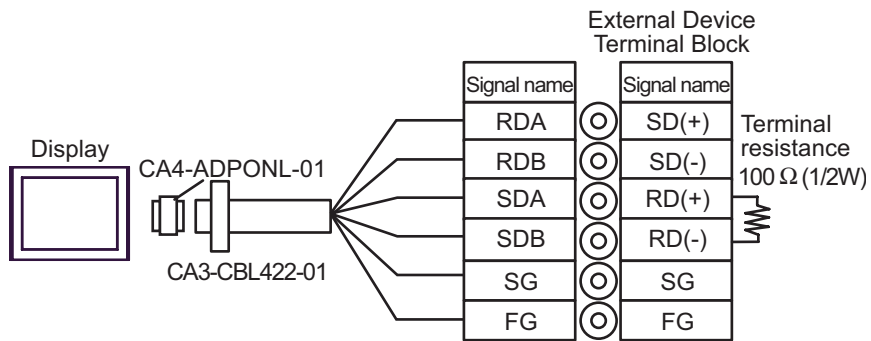


- 1:n Connection

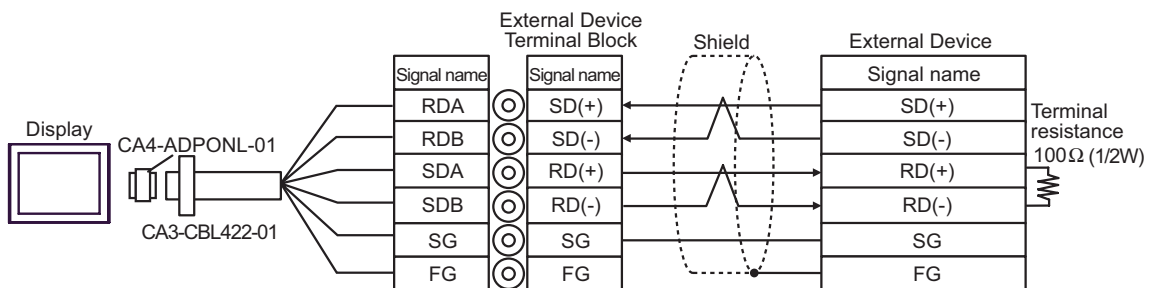


E) When using the online adapter (CA4-ADPONL-01), and the RS-422 cable (CA3-CBL422-01) by Pro-face

- 1:1 Connection

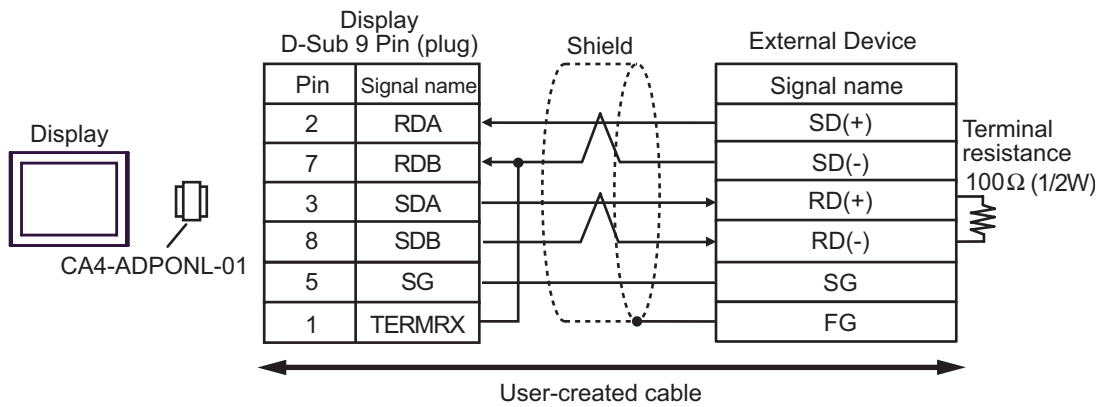


- 1:n Connection

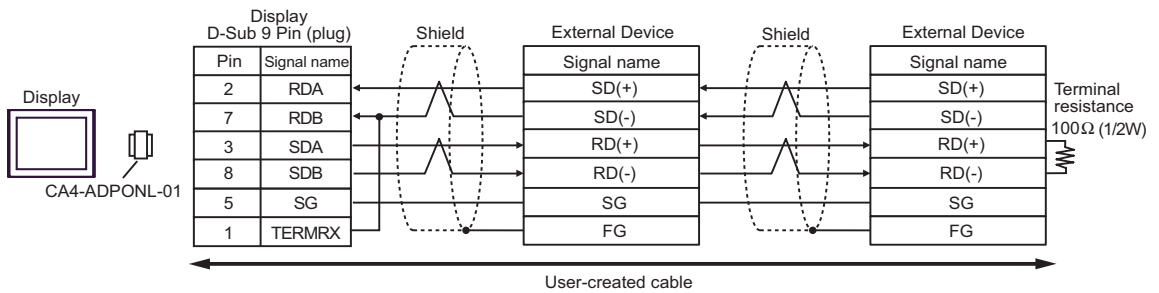


F) When using the online adapter (CA4-ADPONL-01) by Pro-face and a user-created cable

- 1:1 Connection



- 1:n Connection



Cable Diagram 3


Display (Connection Port)	Cable		Remarks
GP* <sup>1</sup> (COM1) AGP-3302B (COM2) LT (COM1) ST* <sup>2</sup> (COM2)	A	COM port conversion adapter by Pro-face CA3-ADPCOM-01 + Terminal block conversion adapter by Pro-face CA3-ADPTRM-01 + User-created cable	
	B	User-created cable	
GP* <sup>3</sup> (COM2)	C	Online adapter by Pro-face CA4-ADPONL-01 + Terminal block conversion adapter by Pro-face CA3-ADPTRM-01 + User-created cable	
	D	Online adapter by Pro-face CA4-ADPONL-01 + User-created cable	
IPC* <sup>4</sup>	E	COM port conversion adapter by Pro-face CA3-ADPCOM-01 + Terminal block conversion adapter by Pro-face CA3-ADPTRM-01 + User-created cable	
	F	User-created cable	

\*1 All GP models except AGP-3302B

\*2 All ST models except AST-3211A

\*3 All GP models except the GP-3200 Series and AGP-3302B

\*4 Only a COM port that can communicate with RS-422/485 (2-wire) can be used.

 ■ IPC COM Port (page 6)

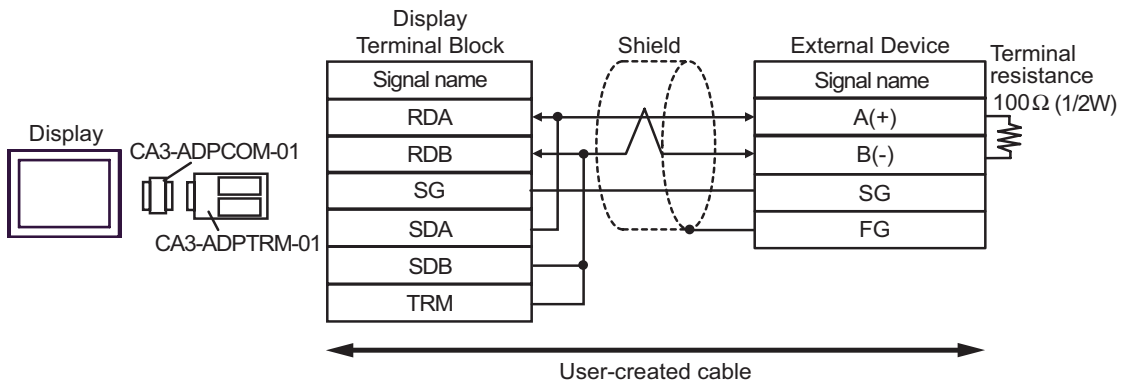
**IMPORTANT**

- The RS-422/485 cable length is normally 1000m or less, depending on the External Device. Refer to your External Device manual for details.
- The connection method and termination resistance depends on the External Device.
- The termination resistance on the Display is not isolated.

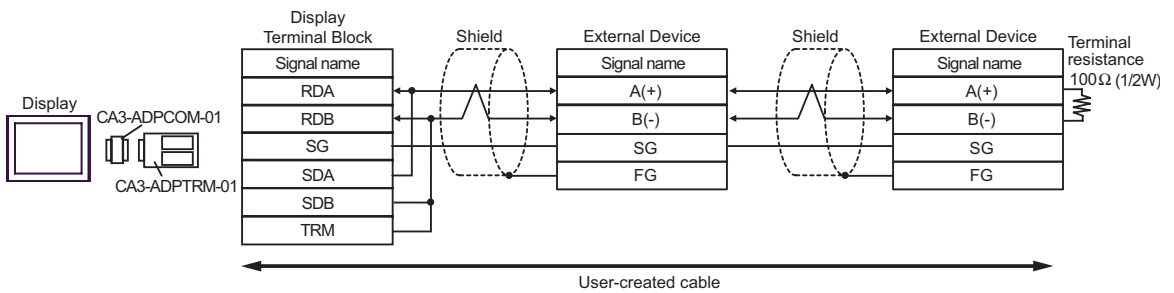


A) When using the COM port conversion adapter (CA3-ADPCOM-01), the terminal block conversion adapter (CA3-ADPTRM-01) by Pro-face, and a user-created cable

- 1:1 Connection

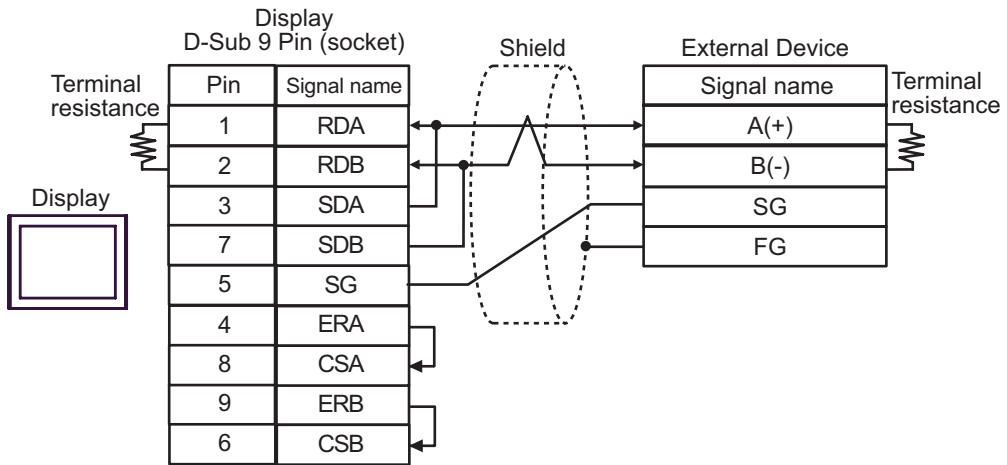


- 1: n Connection

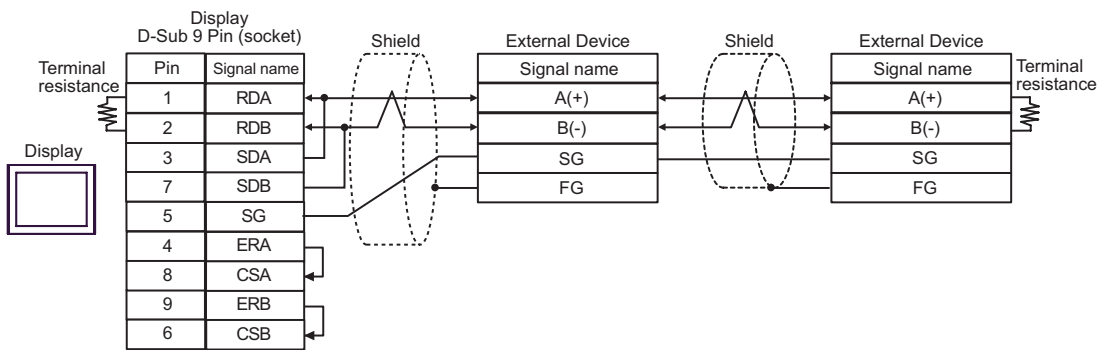


B) When using a user-created cable

- 1:1 Connection



- 1: n Connection

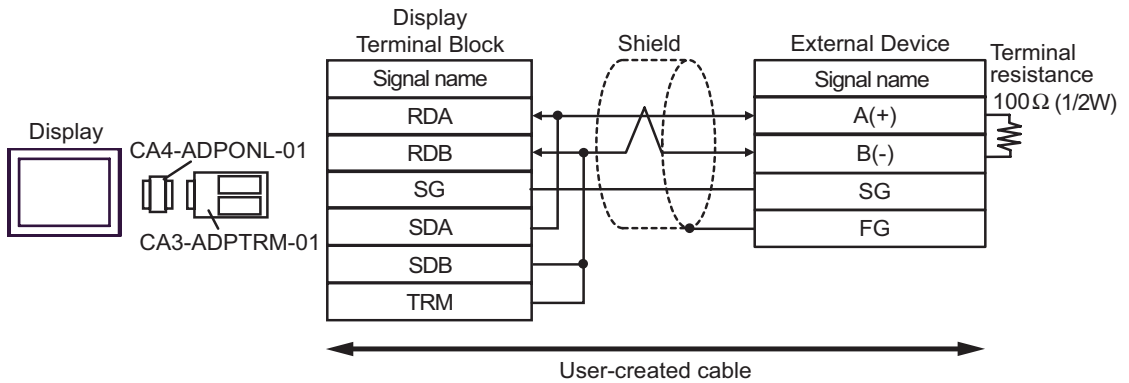


**NOTE**

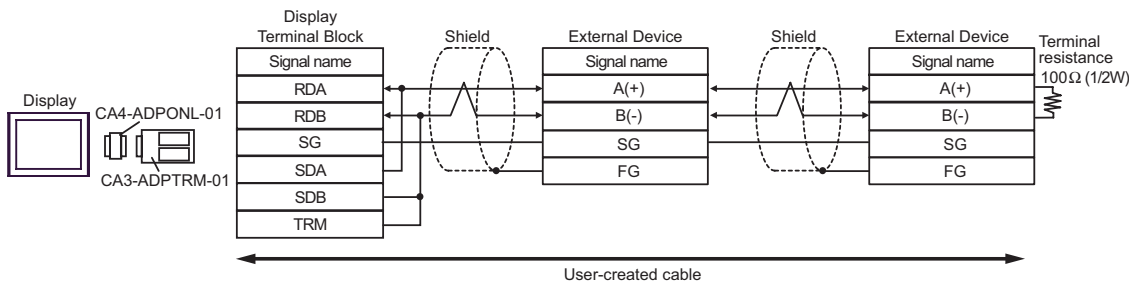
- The termination resistor varies depending on the External Device. Refer to your External Device manual for details.

C) When using the online adapter (CA4-ADPONL-01), the terminal block conversion adapter (CA3-ADPTRM-01) by Pro-face, and a user-created cable

- 1:1 Connection

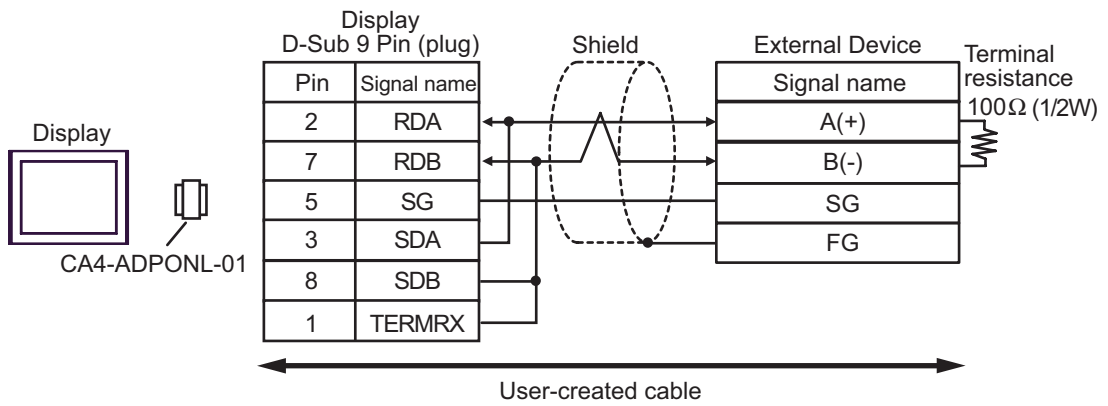


- 1: n Connection

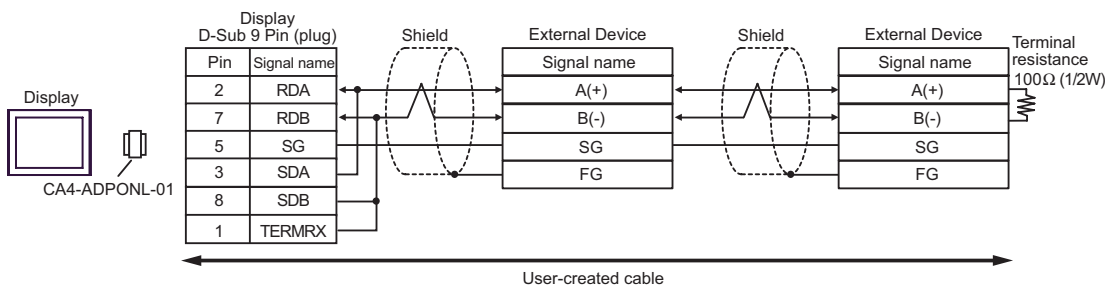


D. When using the online adapter (CA4-ADPONL-01) by Pro-face, and a user-created cable

- 1:1 Connection

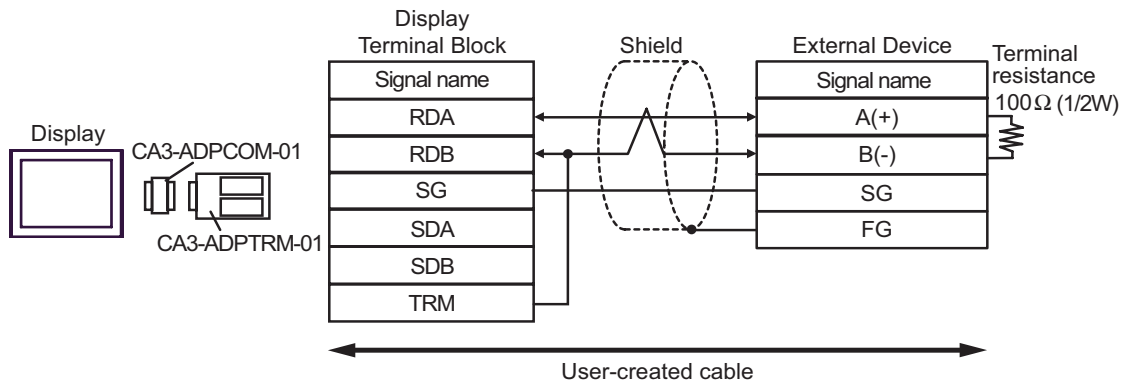


- 1: n Connection

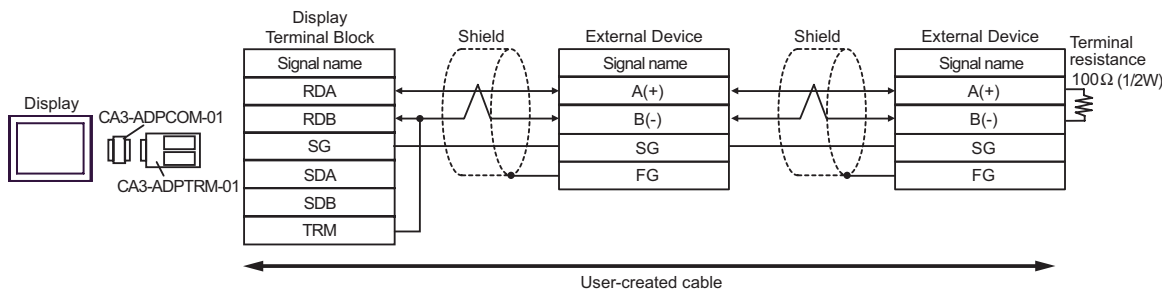


E) When using the COM port conversion adapter (CA3-ADPCOM-01), the terminal block conversion adapter (CA3-ADPTRM-01) by Pro-face, and a user-created cable

- 1:1 Connection

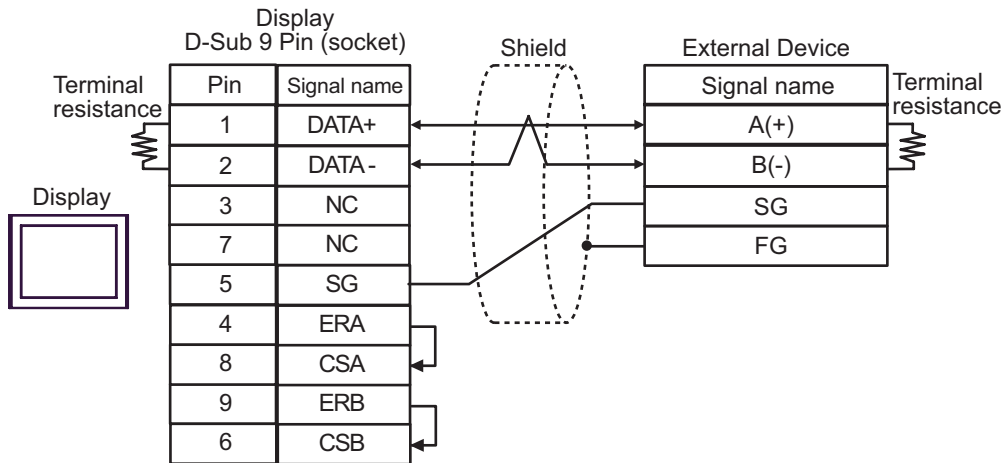


- 1: n Connection

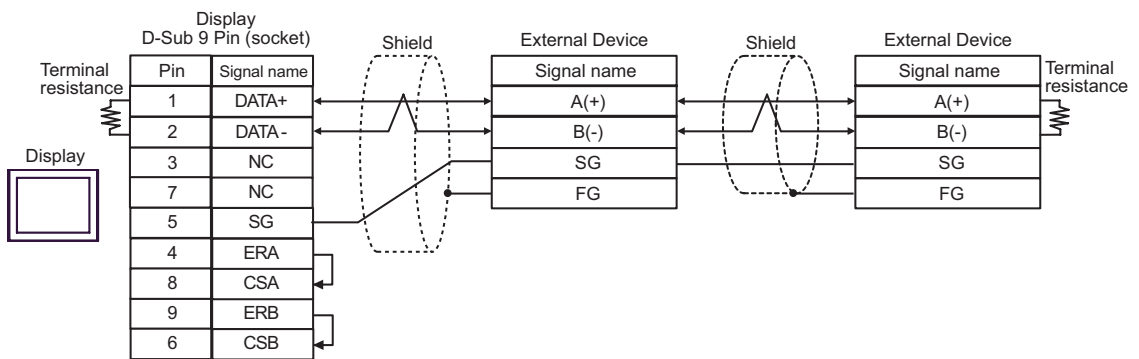


F) When using a user-created cable

- 1:1 Connection



- 1: n Connection



**NOTE**

- The termination resistor varies depending on the External Device. Refer to your External Device manual for details.

## 7 Supported Devices

The following table shows the range of supported device addresses. Note that the actual supported range of the devices varies depending on the External Device to be used. Check the actual range in the manual of your External Device.

Device	Bit Address	Word Address	32 bits	Remarks
Internal Device	000000 - 999915	0000 - 9999	<b>[H/L]</b>	

---

**IMPORTANT**

- This driver supports the internal device only.
  - The system data area employs the memory link method.
  - The available control area ranges from 20 to 2031 and from 2096 to 8191.
- 

**NOTE**

- Refer to the precautions on manual notation for icons in the table.

 "Manual Symbols and Terminology"

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## 8 Device Code and Address Code

Use device code and address code if you select "Device Type & Address" for the address type in data display or other devices.

Device	Device Name	Device Code (HEX)	Address Code
Internal Device	-	0000	Word address



## 9 Error Messages

Error messages are displayed on the Display screen as follows: "No. : Device Name: Error Message (Error Occurrence Area)". Each description is shown below.

Item	Description
No.	Error number
Device Name	Name of the External Device where an error has occurred. Device/PLC name is the title of the External Device set with GP-Pro EX. (Initial value [PLC1])
Error Messages	Displays messages related to an error that has occurred.
Error Occurrence Area	<p>Displays the IP address or device address of the External Device where an error has occurred, or error codes received from the External Device.</p> <p><b>NOTE</b></p> <ul style="list-style-type: none"> <li>Received error codes are displayed as "Decimal [Hex]".</li> <li>Device addresses are displayed as "Address: Device address".</li> <li>IP addresses are displayed as "IP address (Decimal): MAC address (Hex)".</li> </ul>

Display Examples of Error Messages

"RHAA035: PLC1: Error has been responded for device write command (Error Code: 1[01H])"

- 
- NOTE**
- Refer to your External Device manual for details on received error codes.
  - Refer to "When an error is displayed (Error Code List)" in "Maintenance/Troubleshooting Manual" for details on the error messages common to the driver.
-

## ■ Driver-Specific Error Messages

The following shows the error messages specific to this driver.


Error No.	Message	Description
RHxx128	(Node Name): The address that can't be used as control area is used	This error appears if: <ul style="list-style-type: none"> <li>• The start addresses of the receive/send buffers are out of the "20 to 8191" range.</li> <li>• "The start address of the receive buffer + the word count of the receive buffer" exceeds address 8192.</li> <li>• "The start address of the send buffer + the word count of the send buffer" exceeds address 8192.</li> <li>• "The start address of the control area + 20" exceeds address 10000.</li> </ul>
RHxx129	(Node Name): (Port Name) The Received data has an error (Code: %02XH)	This error appears if the received data has an error.
RHxx130	(Node Name):The cable has been disconnected or the target has been powered off	This error appears if the cable is not connected or the External Device is off.
RHxx131	(Node Name): The setting of the PUT pointer or GET pointer is illegal	This error appears if the PUT or the GET pointer is specified as follows: <ul style="list-style-type: none"> <li>• The PUT pointer position is equal to or more than the word count of the receive ring buffer.</li> <li>• The GET pointer position exceeds the word count of the receive ring buffer.</li> </ul>
RHxx132	Can use only one COM port	This error appears if multiple COM ports are used.
RHxx014	(Driver Name): Memory link type drivers cannot be used at the same time	This error appears if the general SIO driver and a memory link driver are used simultaneously.

## 10 Direct Communication Function























Using the Display's scripts, this driver creates data in the Display's memory table, supporting the function that allows communication through the SIO. This is called "Direct Communication Function".

### 10.1 Memory Table

The following shows the Display's memory table map.

: Indicates areas that this protocol uses.

a: Start address of the control area


0		System data area
19		 "10.4 System Data Area" (page 42)
20		User area
a+0		Receive-function control area
a+1		 "10.2 Receive-function Control Area" (page 36)
a+2		
a+3		
a+4		
a+5		
a+6		
a+9		
a+10		Send-function control area
a+11		 "10.3 Send-function Control Area" (page 39)
a+12		
a+13		
a+14		
a+15		
a+16		
a+17		
a+18		
a+19		
a+20		User area
2031		
2032		Special relay  "10.5 Special Relay" (page 45)
2047		
2048		Reserved area
2095		
2096		User area
8191		
8192		
9999		

## 10.2 Receive-function Control Area

The general SIO driver receives data from SIO communications devices, and stores it in a receive buffer.

You can select any size and any address in the Display's memory table when creating this receive buffer. The area where you define a receive buffer and handle received data is called the "Receive-function Control Area". This receive-function control area is created and fixed at specific address positions (a+0 to a+9) in the Display's memory table, as shown below.

a: Start address of the control area

 " ■ Details of Send-function Control Area" (page 38)

a+0		Receive-function control (0: Function stopped, 1: Processing executed)
a+1		Reception result (0: Normal, 1: Error)
a+2		Start memory address of the receive buffer
a+3		Word count of the receive buffer
a+4		GET pointer (offset value from the buffer head)
a+5		PUT pointer (offset value from the buffer head)
a+6		Reserved
a+9		

You use the receive-function control area to define the receive buffer that stores received data. Generally, you set this definition immediately after the Display starts.

The GET pointer (a+4) shows the start address of the memory table in which to store received data that scripts should read. The PUT pointer (a+5) shows the start address of the memory table that the Display uses to write received data into the receive buffer. The GET and PUT pointers hold the offset value (0 or more) from the start address of the receive buffer created above. When it reaches the defined receive-buffer size, these pointers set the offset to "0" again.

The receive-function control word (a+0) controls whether or not data is taken from the Display's receive buffer to the receive ring buffer. When "0" is selected, reception processing is stopped, and no data is taken from the Display's receive buffer to the receive ring buffer. When "1" is selected, the received data is taken to the receive ring buffer.

## ■ Receive Buffer

The following shows the state in which a receive buffer is created and data is received.

The following figure shows the state in which a ring buffer is created from memory table address a+50 using 6 words, and 2 bytes ("A", "B") are received.

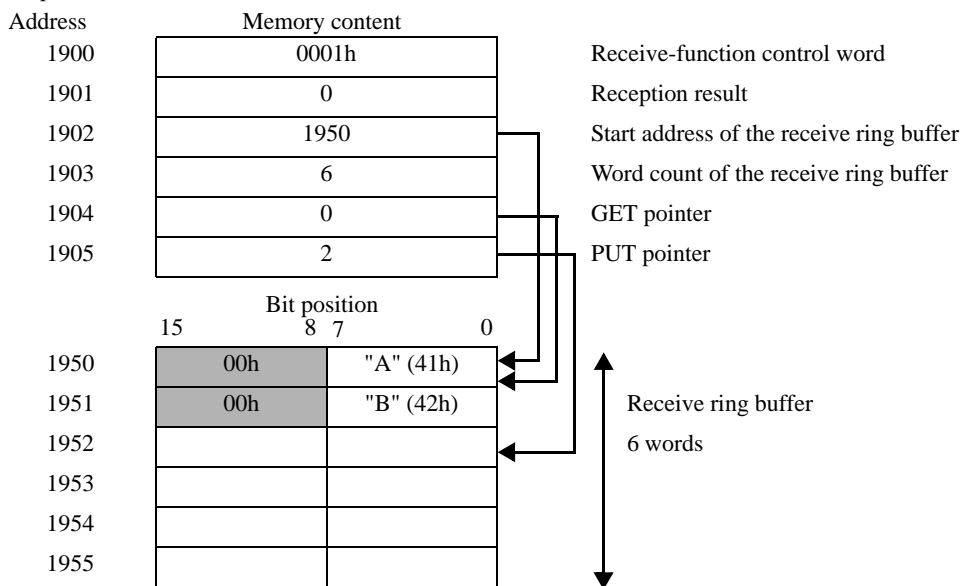
The Display's receive function stores received data at the PUT pointer position every time 1 byte is received, and then moves the PUT pointer forward to the next address.

Scripts read out data from the GET pointer position, and moves the GET pointer forward according to the amount of the read-out data. Received data is stored per byte in the lower bytes of each address in the memory table (word: 16-bit length).

The PUT pointer, controlled by the Display, shows the write position for the next piece of received data.

When the PUT pointer reaches the end address (a+55) of the receive buffer, it attempts to store data in the start address (a+50) again. However, the GET pointer position is never exceeded. (Data cannot be overwritten where readout is not complete.) This means you need to move the GET pointer forward appropriately after scripts read out the received data. If the GET pointer is not repositioned, and received data cannot be written into the Display's receive buffer for some time, the receive buffer may overflow.

Example: when the start address of the control area is 1900



Received data is stored per byte in the lower bytes of each address in the memory table (word: 16-bit length).

## ■ Details of Send-function Control Area

a: Start address of the control area

System area address	Name	Update responsibility* <sup>1</sup> (Trigger)	Description
a+0	Receive-function control word	Scripts	0: Receive-function stopped 1: Receive-function enabled Data is taken from the Display's receive buffer to the receive ring buffer. Scripts update the data.
a+1	Reception result	Display	Indicates reception results using bits. 1: Framing error 2: Parity error 4: Overrun error 8: Buffer overflow Except 0: Error Scripts write "0" in this area after an error is confirmed, and then the next piece of data is received.
a+2	Start memory address of the receive ring buffer	Scripts	Set the memory table start address for the receive ring buffer. You can set this in any of the memory addresses (0 to 8191) as long as it is a user area other than a system data area or special relay.
a+3	Word count of the receive ring buffer	Scripts	Set the word count of the receive buffer. (Match the word count specified here with the number of bytes that can be received.) Specify the word count that begins from the above start address. For ring buffers, you need to specify two or more words. (If you specify "0" or "1", words cannot be received.)
a+4	GET pointer	Scripts	The GET pointer indicates the address position of the next received data that scripts should read, and holds the offset value (0 or more) from the start address of the receive ring buffer. Scripts retrieve data from this pointer position. The position is then updated.
a+5	PUT pointer	Display	The PUT pointer indicates the write position for data that the Display has received in its receive buffer. Whenever the Display receives data, this pointer is automatically updated.
a+6	Reserved		
:	Reserved		
a+9	Reserved		

\*1 To ensure this function operates properly, the "Update responsibility" shows what item is responsible for updating data.

Display: The Display performs updates.

Scripts: A D-Script/ladder program using this function is necessary in order to perform updates.


### IMPORTANT

- Make sure that the definition regions for the receive buffers do not overlap those of send buffers or other system data areas of the Display. Overlapping definition regions may cause the system to malfunction.

## 10.3 Send-function Control Area

This driver has a send buffer that temporarily stores send packets before sending data to SIO communications devices. You can select any size and any address in the Display's memory table when creating this send buffer. The area where to define a send buffer and handle data to be sent is called the "Send-function Control Area". This send-function control area is created and fixed at specific address positions (a+10 to a+19) in the Display's memory table, as shown below.

a: Start address of the control area

 " ■ Details of Send-function Control Area" (page 41)

a+10		Send-function control (0: Function stopped, 1: Processing executed)
a+11		Transmission result (0: Normal, Except 0: Error)
a+12		Start memory address of the send buffer
a+13		Number of data bytes to be sent
a+14		Reserved
a+19		

A send buffer temporarily stores data that will be sent to the SIO. You can then run the Send command to send the data in the buffer from the SIO.

First you specify the start address of the send buffer for its initial memory address (a+12). Then, after the specified buffer has stored the data to be sent, you set the data bytes (a+13). When you write "1" into the send-function control word (a+10) after a send packet is created, the packet is sent through the SIO.

After each of the processing commands is complete, the send-function control word automatically becomes "0".

### IMPORTANT

Writing "1" into the send-function control word does not send packets if:

- The range of the control area exceeds address 8192.
- "The initial address of the receive ring buffer + the word count of the receive ring buffer" exceeds address 8192.
- "The initial address of the send buffer + the number of data bytes to be sent" exceeds address 8192.
- The GET or the PUT pointer position exceeds the receive ring buffer end.

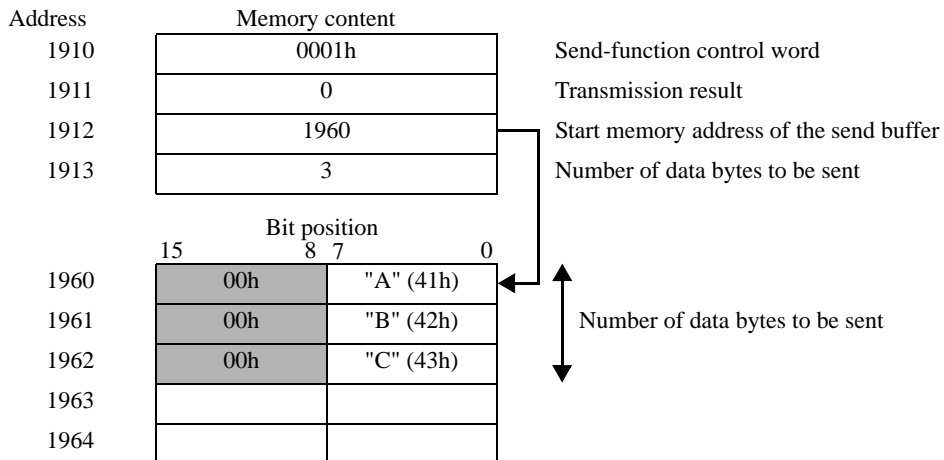
## ■ Send Buffer

The following shows the state in which a send buffer is created and data is sent.

The following figure shows the state in which a send buffer is created from memory table address a+60, and 3 bytes ("A", "B", "C") are sent.

A send buffer stores data, beginning with the start address specified. You specify the byte size (occupied memory table area size) for the data length. Note that data is stored per byte in the lower bytes of 1 word in the memory table, and thus the byte size is equal to the number of words occupied in the memory table.

Example: when the start address of the control area is 1900



\* Be sure to store the data to be sent per byte in the lower bytes of each address in the memory table (word: 16-bit length).



## ■ Details of Send-function Control Area

a: Start address of the control area

System area address	Name	Update responsibility *1 (Trigger)	Description
a+10	Send-function control word	Scripts	0: Function stopped (or processing completed) 1: The send buffer sends data to the COM port. Scripts update the data. After the following processing is complete, the Display resets this area value to "0".
a+11	Transmission result	Display	Indicates reception results using bits. 1: Framing error 2: Parity error 4: Overrun error 8: Buffer overflow Except 0: Error Scripts write "0" in this area after an error is confirmed, and then the next piece of data is received.
a+12	Start address of the send buffer	Scripts	Set the start memory address for the send buffer. You can set this in any of the Display's memory tables as long as you use a user area other than a system data area or special relay.
a+13	Number of data bytes to be sent	Scripts	Set the send-buffer word count. (Set the number of bytes stored in the send buffer.) Specify the consecutive word count from the above start address.
a+14	Reserved		
:	Reserved		
a+19	Reserved		

\*1 To ensure this function operates properly, the "Update responsibility" shows what item is responsible for updating data.

Display: The Display performs updates.

Scripts: A D-Script/ladder program using this function is necessary in order to perform updates.

### IMPORTANT

- Make sure that the definition regions for the send buffers do not overlap those of receive buffers or other system data areas of the Display. Overlapping definition regions may cause the system to malfunction.

## 10.4 System Data Area

The system data area stores data necessary for the system's operation, such as the Display's screen control data and error information. The following describes the system data area.

Address	Description	Function	Bit	Remarks
0000	Reserved			
0001	Status <sup>*1</sup>		0, 1	Reserved
			2	Printing <sup>*2</sup>
			3	Setting value writing <sup>*3</sup>
			4 to 7	Reserved
			8	K-tag input error <sup>*4</sup>
			9	Display 0: ON, 1: OFF <sup>*5</sup>
			10	Backlight burnout detected <sup>*6</sup>
			11	Touch panel input error <sup>*7</sup>
12 to 15	Reserved			
0002	Reserved			
0003	Error status When an error occurs in the Display, the corresponding bit turns on. The bit is kept ON until either the power is turned off and then turned on again or the off-line mode is switched back to active mode.		0, 1	Reserved
			2	System ROM/RAM
			3	Screen memory check sum
			4	SIO framing
			5	SIO parity
			6	SIO overrun
			7, 8	Reserved
			9	Internal memory initialization required
			10	Timer lock error
11 to 15	Reserved			
0004	Clock data (year)	"Year, Month, Day, Hour, and Minute" are each stored in two BCD digits.	0 to 7	Stores the last two digits of the year in two BCD digits.
			8 to 15	Not used
0005	Clock data (month)		0 to 7	Stores the month, from 01 to 12, in two BCD digits.
			8 to 15	Not used
0006	Clock data (day)		0 to 7	Stores the day, from 01 to 31, in two BCD digits.
			8 to 15	Not used
0007	Clock data (hour)		0 to 7	Stores the hour, from 00 to 23, in two BCD digits.
			8 to 15	Not used
0008	Clock data (minute)		0 to 7	Stores the minute, from 00 to 59, in two BCD digits.
			8 to 15	Not used
0009	Reserved			

Continued on next page.

Address	Description	Function	Bit	Remarks
0010	Interrupt output <sup>*8</sup> (When touch is OFF)	If writing to a Word Switch (16 bit), when you take your finger off the Switch, the bottom 8 bits are output as an interrupt code. (Control code "FFh" will not be outputted.)		
0011	Control <sup>*9</sup>		0	Backlight <sup>*10</sup>
			1	Buzzer ON <sup>*11</sup>
			2	Print started
			3	Reserved
			4	Buzzer sound <sup>*11</sup> 0: ON, 1: OFF
			5	AUX output <sup>*11</sup> 0: ON, 1: OFF
			6	The interrupt output when the display is switched from OFF to ON by pressing the touch panel. <sup>*12</sup> (Interrupt code: ffh) 0: Interrupt not output 1: Interrupt output
			7 to 10	Reserved
			11	Hardcopy output <sup>*13</sup> 0: Displayed, 1: Output cancelled
			12 to 15	Reserved
0012	Screen display ON/ OFF <sup>*14</sup>	"FFFFh" turns off the screen display. "0h" turns on the screen display. Values other than "FFFFh" and "0h" are used as "Reserved".		
0013	Interrupt output <sup>*8</sup>	When writing to a Word Switch (16 bit), the lower 8 bits are output from the Display to the External Device as an interrupt code.		
0014	Reserved			
0015	Display screen No.	Writing a screen number switches the display screen.	0 to 14	Switching screen Nos. 1 to 8999 (For the BCD input, 1 to 1999)
			15	Forced screen switching (0: Normal, 1: Forced screen switching)
0016	Window control		0	Display 0: OFF, 1: ON
			1	Changing the order of overlapping windows 0: Enabled, 1: Disabled
			2 to 15	Reserved
0017	Window registration No.	The registration number of the global window selected by indirect designation. (BIN or BCD)		
0018	Window display position (X-coordinate data)	The display position of the global window selected by indirect designation. (BIN or BCD)		
0019	Window display position (Y-coordinate data)			

\*1 Status

- Monitor only the necessary bits.
- The "reserved" bits may be used for the Display's system maintenance. You do not need to turn them on/off.

\*2 The bit turns on during printing. If you switch to off-line mode while this bit is on, the printout may be corrupted.

\*3 This bit is reversed each time a write occur from a Data Display (Setting Value Input).

- \*4 This bit turns on if an alarm is set for the Data Display that you are currently inputting and you input a value outside of the alarm range. When you input a value inside the alarm range or the screen is switched, this bit turns off.
- \*5 You can detect "Display ON/OFF" from External Devices. This bit also changes if:
- (1) FFFFh is written to the system data area's "Display ON/OFF" (LS0009 when link type is used.), and the display is turned off (bit 9 = 1).
  - (2) The standby time elapses and the display automatically turns off. (bit 9 = 1)
  - (3) The display is switched from off to on through screen switching etc.(bit 9 = 0)
  - (4) This bit does not change in "Backlight OFF" (bit 0) in the system area's "Control".
- \*6 When a backlight burnout is detected, this bit turns on. Note that this is available only for models with a backlight.
- \*7 If the same part of a touch panel display is continuously used over a specific period of time, this bit turns on.
- \*8 Do not write control codes from 00 to 1F into addresses 10 and 13. Communications may be disabled.
- \*9 Reserved bits may be used for maintenance. Be sure to turn them off.
- \*10 When this bit turns on, the backlight turns off (the LCD is left as is). When this bit turns off, the backlight turns on.  
If you turn on the "Backlight OFF" bit in the system area's control range, only the backlight turns off, with the LCD left as is. The touch switches specified on the screen remain active as well.  
In most cases, use "Screen display ON/OFF" to turn off the screen display.
- \*11 When bit 1 (Buzzer ON) in the control range is on, the output destinations are as follows:  
Buzzer sound: While bit 1 in the control range is on, the Display's buzzer sounds.  
AUX output: While bit 1 in the control range is on, the buzzer output from the AUX is turned on.
- \*12 An interrupt is output only when you use the touch panel to turn on the display.
- \*13 By turning on bit 11 (Hardcopy output) in the control range, you can cancel the display printing in progress.
- After the printing is cancelled, bit 11 in the control range is not turned off automatically. Be sure to monitor the "Printing" under "Status" to turn it off.
  - While bit 11 in the control range is turned on, the print function is not available and any print jobs are cancelled. If printing is cancelled while underway, a single line of data on the screen is printed, and then printing stops. Data already sent to the printer's buffer is not cleared.
- \*14 If you use the system data area's "Screen display ON/OFF" to turn on the display, touching the screen after the display is turned off turns it back on again.

**IMPORTANT**

- Addresses "0", "2", "9", and "14" are reserved. Do not write data to them.
- Because addresses "3", "12", "13", and "15" are used for system control, do not use tags to display data.
- Because addresses "12", "13", and "15" are controlled in units of words, you cannot write bits.
- When you write "FFFFh" into address 12, the screen display instantly turns off. When you write "0000h" into address 12, the screen display turns off during the standby-mode time specified in the initial settings for the Display's offline mode.
- Do not write control codes from 00 to 1F into addresses 10 and 13. Otherwise, communications may be disabled.

## 10.5 Special Relay

The following describes the special relay.

2032		Common relay information
2033		Base screen information
2034		Reserved
2035		1-second binary counter
2036		Tag scan time
2037		Reserved
2038		Tag scan counter
2039		Communication error code
2040		Reserved
2047		

- Common relay information (2032)

Bit	Description
0	Reserved
1	Turns on when the screen (base/window) is switched on until the tag processing is complete.
2	Reserved
3	Turns on while the initial screen number is displayed immediately after power is turned on.
4	Always on
5	Always off
6	Turns on if the backup SRAM data is deleted. (Available only for Displays with backup SRAM)
7	Turns on if a BCD error occurs when the D-script is used.
8	Turns on if a zero-operation error occurs when the D-script is used.
9	Turns on when filing data fails to be transferred to the backup SRAM.
10	Turns ON when filing data transferred according to the Control Word Address could not be transferred from External Device. Also, if transferring between the External Device by means of a Special Data Display, when there is a Transfer Complete Bit Address, turns ON when data could not be transferred from External Device Area, or External Device SRAM.
11	Turns on while the File Items Display device transfers filing data between the SRAM and LS area.
12	Turns on if a communication error occurs in reading out memcopy() and the assigned address offset when the D-script is used. After the data is read successfully, this bit turns off.
13 to 15	Reserved

- Base screen information (2033)

Bit	Description
1	Turns on when the base screen is switched on until the tag processing is complete.

- 1-second binary counter (2035)  
Increments the count per second immediately after power-on. Data is binary.
- Tag scan time (2036)  
Indicates the period from when the system starts processing the first tag specified on the display screen until it finishes processing the last tag. Data is stored in binary format, in units of milliseconds (ms). The data is updated after all the target tags are processed. The default value of the data is "0". Note that the value has an error of  $\pm 10$ ms.
- Tag scan counter (2038)  
Increments the count each time the system finishes processing all the tags specified on the display screen.  
Data is binary.

---

**IMPORTANT**

- The special relay is not write-protected. Be sure not to turn it off using tags, etc.
-

## 11 Sample Program

The following provides an example of the procedure for sending and receiving data, and shows its sample script.

### <System Configuration>



### <Program Overview>

This sample program performs the following communications:

1. Sends 3-byte data (ABC) to the External Device.
2. Receives 2 bytes of the data sent.

### <Example of Procedure for Sending/Receiving Data>

The following provides an example of a procedure where the Display sends a command to and receives a response from the External Device.

1. Setting the receive-function control area
  - (1) Clear the reception result.
  - (2) Set the start address for the receive ring buffer.
  - (3) Set the word count of the receive ring buffer.
  - (4) Correct the gap of the GET and PUT pointers (to ensure they are indicating valid data locations).
  - (5) Set the receive-function control word (0x0001: Reception enabled).
2. Setting the send-function control area
  - (1) Clear the transmission result.
  - (2) Set the start address for the send buffer.
  - (3) Set the send-function control word.
3. Creating and sending data
  - (1) Create data to be sent.
  - (2) Set the send-function control word (0x0001: Transmission enabled).

## &lt;Sample Script&gt;

The following shows a sample script, based on the states described in " ■ Receive Buffer" (page 37) and " ■ Send Buffer" (page 40).

Here is a memory map in use, with the start address of the control area set to 1900.

Address	Memory content		
1900	0001h	Receive-function control word	
1901	0	Reception result	
1902	1950	Start address of the receive ring buffer	
1903	6	Word count of the receive ring buffer	
1904	6	GET pointer	
1905	2	PUT pointer	
:	:		
1910	0000h	Send-function control word	
1911	0	Transmission result	
1912	1960	Start address of the send buffer	
1913	3	Number of data bytes to be sent	
:	:		
	Bit position		
	15      8      7      0		
1950	00h	"A" (41h)	Receive ring buffer 6 words
1951	00h	"B" (42h)	
1952			
1953			
1954			
1955			
:	:		
	15      8      7      0		
1960	00h	"A" (41h)	Send buffer
1961	00h	"B" (42h)	
1962	00h	"C"(43h)	
1963			
1964			



## 1. Open processing (Setting the receive-function control area)

- Trigger condition

The screenshot shows a configuration window titled 'ID:00001'. The window has a title bar with a close button. Inside, there are several sections:
 

- ID and Comment:** ID is '00001', Comment is 'Open process'.
- Language:** Set to 'ASCII'.
- Enable Debug Function:** A checkbox that is currently unchecked.
- Trigger:** A dropdown menu set to 'Bit ON'.
- Bit Address:** A dropdown menu set to '[#MEMLINK]016000'.
- Data Type:** A dropdown menu set to 'Bin'.
- Bit Length:** A dropdown menu set to '16 Bit'.
- Sign +/-:** A checkbox that is currently unchecked.

- Execution formula

```
// Initializing the control area

// Setting the receive-function control area -----
[w:[#MEMLINK]1901] = 0           // Reception result cleared
[w:[#MEMLINK]1902] = 1950       // Start address of the receive buffer
[w:[#MEMLINK]1903] = 6          // Word count of the receive buffer
[w:[#MEMLINK]1904] = 6          // GET pointer
[w:[#MEMLINK]1905] = 0          // PUT pointer

// Enabling reception
[w:[#MEMLINK]1900] = 1          // Reception of the receive-control word enabled

// Setting the send-function control area -----
[w:[#MEMLINK]1911] = 0          // Transmission result cleared
[w:[#MEMLINK]1912] = 1960       // Start address of the send buffer
[w:[#MEMLINK]1913] = 3          // Word count of the send buffer
```

## 2. Transmission processing (Creating and sending data)

- Trigger condition

- Execution formula

```
// Creating and sending packets

if ([w:[#MEMLINK]1901]==0)
[
//Creating packets -----
[w:[#MEMLINK]1960] = 0x41      // 'A'
[w:[#MEMLINK]1961] = 0x42      // 'B'
[w:[#MEMLINK]1962] = 0x43      // 'C'

// Sending packets -----
[w:[#MEMLINK]1910] = 1         // Setting the send-function control word -----
]
endif
```