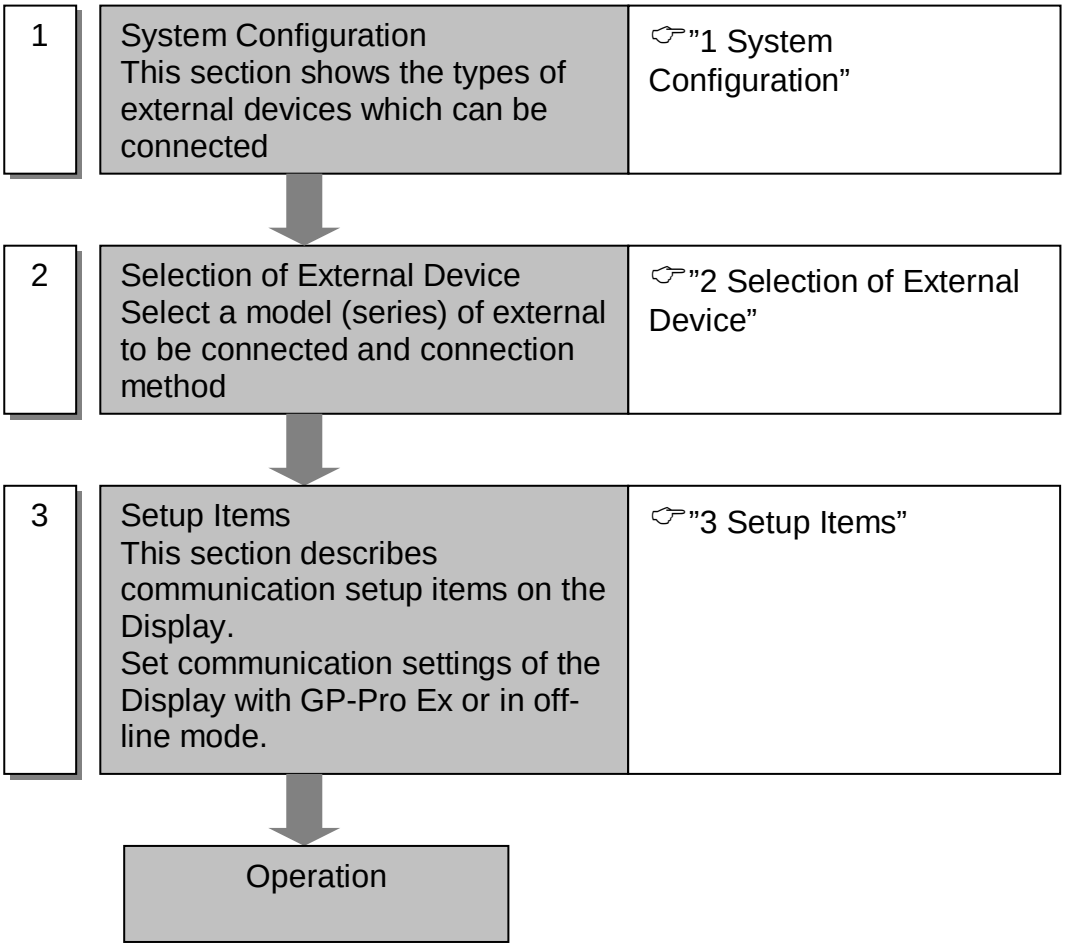
IEC 60870-5-101 Driver

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

In this manual, the connection procedure will be described by the following sections:



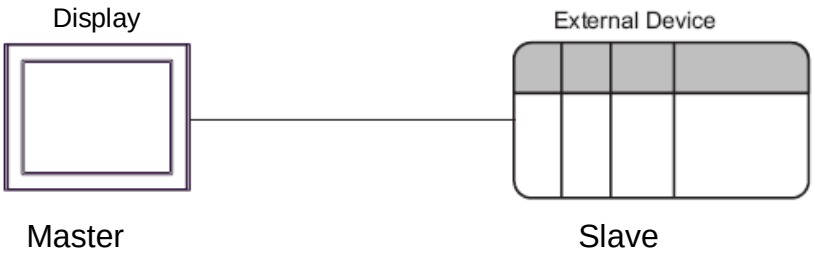
1. System Configuration

The system configuration for IEC 60870-5-101 devices and the display connected are shown as follows.

Series Name	CPU	Link I/F	SIO Type	Configuration Example	Cable Diagram
TELVENT	SM-CPU	COM	RS-232C	Example 1	1
Selta STCE	CPU2000	COM A COM B		Example 2	2

■ Connection Configuration

- 1:1 Connection



■ IPC COM Port

When connecting 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[*1], COM2, COM3[*1], COM4	-	-
PS-3450A, PS-3451A, PS3000-BA, PS3001-BD	COM1, COM2[*1*2]	COM2[*1*2]	COM2[*1*2]
PS-3650A (T41 model), PS-3651A (T41 model)	COM1[*1]	-	-
PS-3650A (T42 model), PS-3651A (T42 model)	COM1[*1*2], COM2	COM1[*1*2]	COM1[*1*2]
PS-3700A (Pentium®4-M) PS-3710A	COM1[*1], COM2[*1], COM3[*2], COM4	COM3[*2]	COM3[*2]
PS-3711A	COM1[*1], COM2[*2]	COM2[*2]	COM2[*2]
PS4000[*3]	COM1, COM2	-	-
PL3000	COM1[*1*2], COM2[*1], COM3, COM4	COM1[*1*2]	COM1[*1*2]
PE-4000B Atom N270	COM1, COM2	-	-
PE-4000B Atom N2600	COM1, COM2	COM3[*4], COM4[*4], COM5[*4], COM6[*4]	COM3[*4], COM4[*4], COM5[*4], COM6[*4]
PS5000 (Slim Panel Type Core i3 Model)[*5*6]	COM1, COM2[*4]	COM2[*4]	COM2[*4]
PS5000 (Slim Panel Type Atom Model) [*5*6]	COM1, COM2[*7]	COM2[*7]	COM2[*7]
PS5000 (Enclosed Panel Type) [*8]	COM1	--	
PS5000 (Modular Type PFXPU/PFXPP)[*5*6] PS5000 (Modular Type PFXPL2B5-6)	COM1[*7]	COM1[*7]	COM1[*7]
PS5000 (Modular Type PFXPL2B1-4)	COM1, COM2[*7]	COM2[*7]	COM2[*7]

*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.

*3 When making communication between an External Device and COM port on the Expansion slot, only RS-232C is supported. However, ER (DTR/CTS) control cannot be executed because of the specification of COM port.
For connection with External Device, use user-created cables and disable Pin Nos. 1, 4, 6 and 9. Please refer to the IPC manual for details of pin layout.

*4 Set up the SIO type with the BIOS. Please refer to the IPC manual for details of BIOS.

*5 When setting up communication between an External Device and the RS-232C/422/485 interface module, use the IPC (RS-232C) or PS5000 (RS-422/485) cable diagrams. However, when using PFXZPBMPR42P2 in a RS-422/485 (4-wire) configuration with no flow control, connect 7.RTS+ and 8.CTS+, and connect 6.RTS- and 9.CTS-.
When using RS-422/485 communication with External Devices, you may need to reduce the transmission speed and increase the TX Wait time.

*6 To use RS-422/485 communication on the RS-232C/422/485 interface module, the DIP Switch setting is required. Please refer to "Knowledge Base" (FAQs) on the support site. (http://www.pro-face.com/trans/en/manual/1001.html)

Settings	FAQ ID
PFXZPBMPR42P2, RS422/485 change method	FA263858
PFXZPBMPR42P2 termination resistor setting	FA263974
PFXZPBMPR44P2, RS422/485 change method	FA264087
PFXZPBMPR44P2 termination resistor setting	FA264088

*7 Set up the SIO type with the DIP Switch. Please refer to the IPC manual for details of DIP Switch.
The BOX Atom has not a switch to set the RS-232C, RS-422/485 mode. Use the BIOS for the setting.

*8 For the connection with the External Device, on the user-created cable read as if the connector on the Display-side is a M12 A-coding 8 pin socket. The pin assignment is the same as described in the cable diagram. For the M12 A-coding connector, use PFXZPSCNM122.

DIP Switch settings (PL3000 / PS3000 Series)

RS-232C

DIP Switch	Setting	Description
1	OFF*1	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, PS-3451A, PS3000-BA and PS3001-BD, turn ON the set value.

RS-422/485 (4 wire)

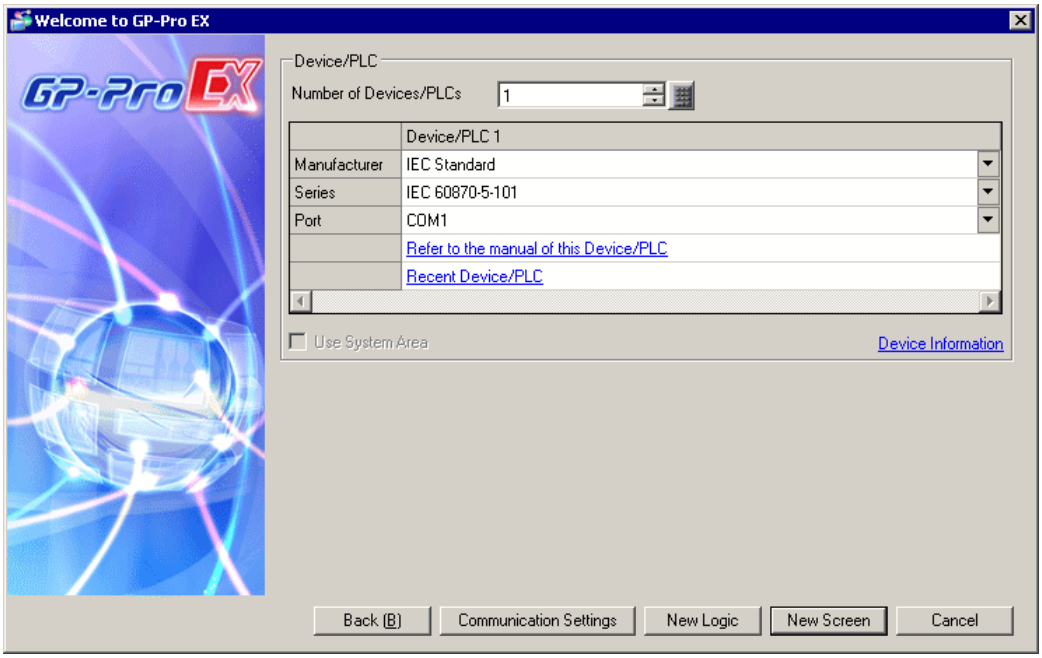
DIP Switch	Setting	Description
1	OFF	Reserved (always OFF)
2	ON	SIO type: RS-422/485
3	ON	
4	OFF	Output mode of SD (TXD) data: Always output
5	OFF	Terminal resistance (220 Ω) insertion to SD (TXD): None
6	OFF	Terminal resistance (220 Ω) insertion to RD (RXD): None
7	OFF	Short-circuit of SDA (TXA) and 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	

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 (220 Ω) insertion to SD (TXD): None
6	OFF	Terminal resistance (220 Ω) 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	

2. Selection of External Device

Select the External Device to be connected to the Display.



Setup Items	Setup Description
Manufacturer	Select the maker of the External Device to be connected. Select "IEC Standard"
Series	Select a model (series) of the External Device to be connected and connection method. Select "IEC 60870-5-101". Check the External Device which can be connected in system configuration. ☞"System Configuration"
Port	Select the Display port to be connected to the External Device. (Select COM1)

3. Example of Communication Setting

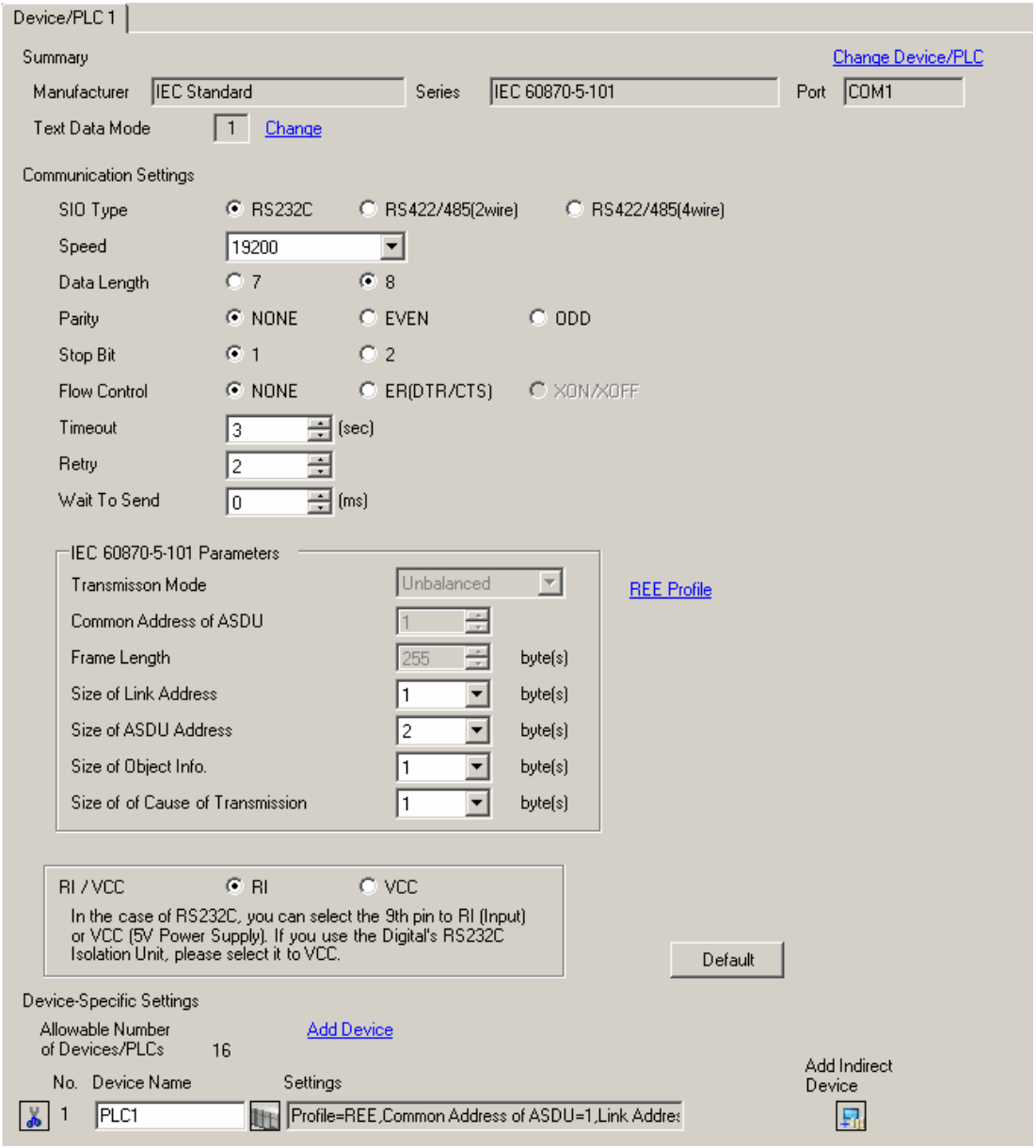
Examples of communication settings of the display and the external device recommended by Pro-face are shown.

3.1. Setting Example 1

■ Setting of GP-Pro EX

♦ Communication Settings

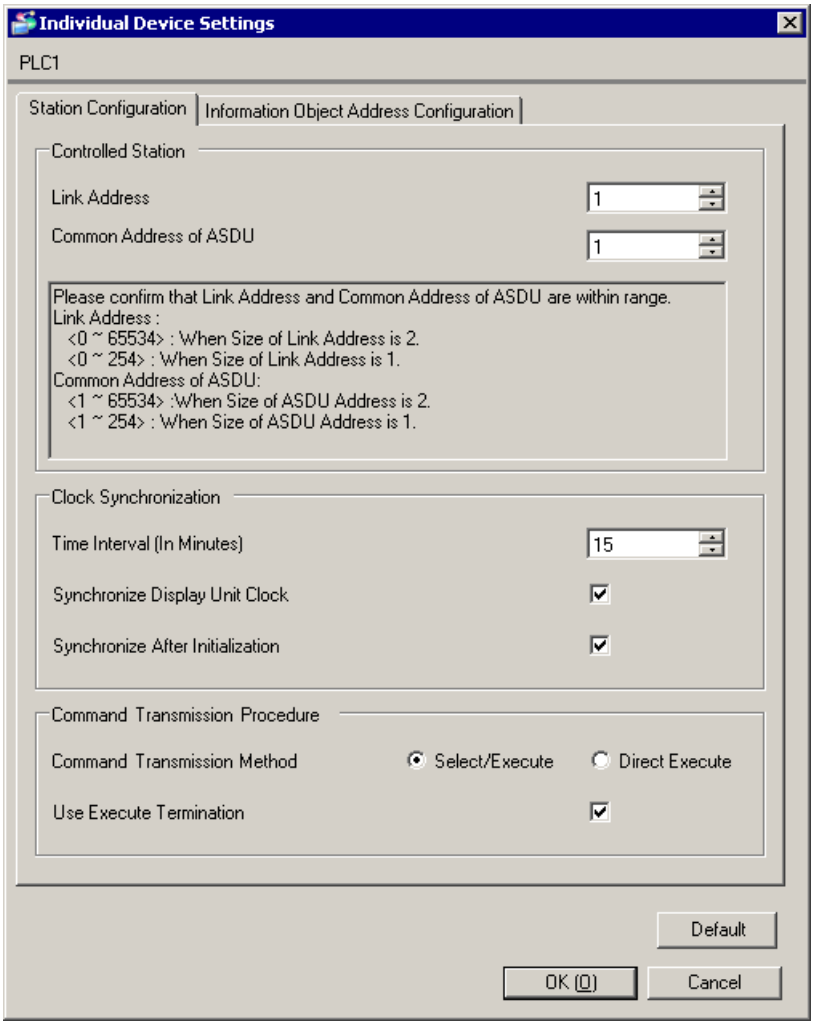
To display the setup screen, from the [Project] menu, point to [System Settings] and select [Device/PLC].
Please select REE Profile for TELVENT devices.



♦ Device Settings

To display the [Individual Device Settings] dialog box, from [Device-Specific Settings] in the [Device/PLC] window, select the external device and click [Settings] .

• Station Configuration

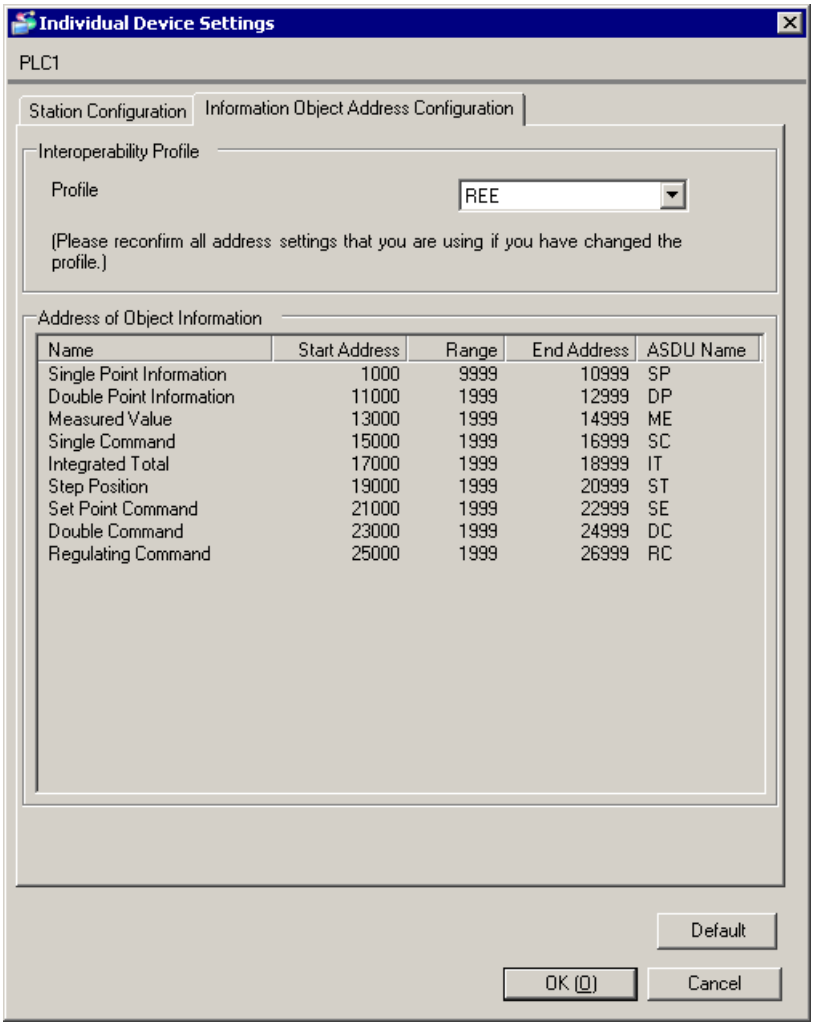


Please set the following configuration items as shown below.

Configuration items	Setting
Synchronize Display Unit Clock	ON
Synchronize After Initialization	ON
Command Transmission Method	Select /Execute
Use Execute Termination	ON

• Information Object Address Configuration

Please select REE profile for TELVENT devices.



■ External Device Settings

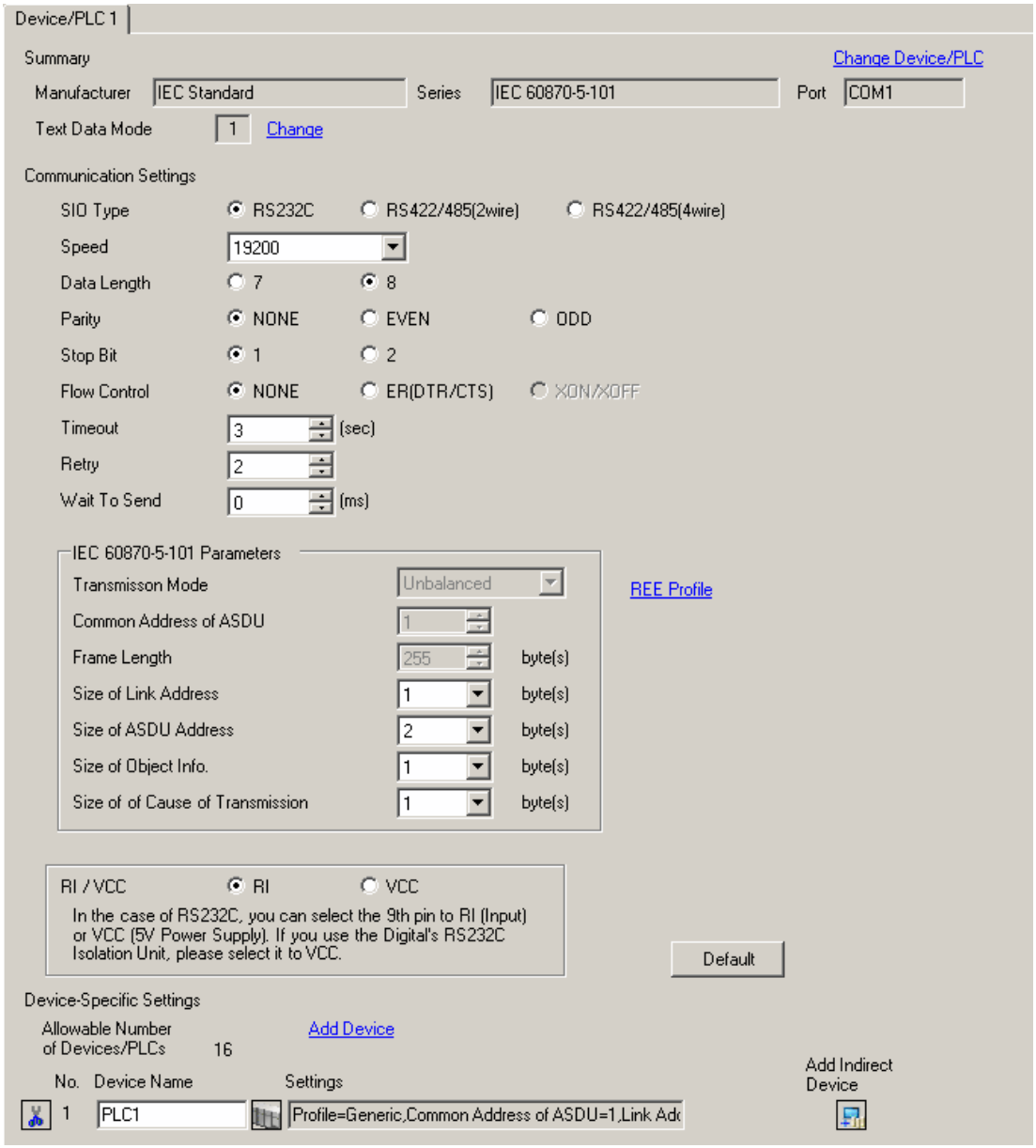
External Device settings vary depending on the device. Refer to your External Device manual for details.

3.2. Setting Example 2

■ Setting of GP-Pro EX

♦ Communication Settings

To display the setup screen, from the [Project] menu, point to [System Settings] and select [Device/PLC].



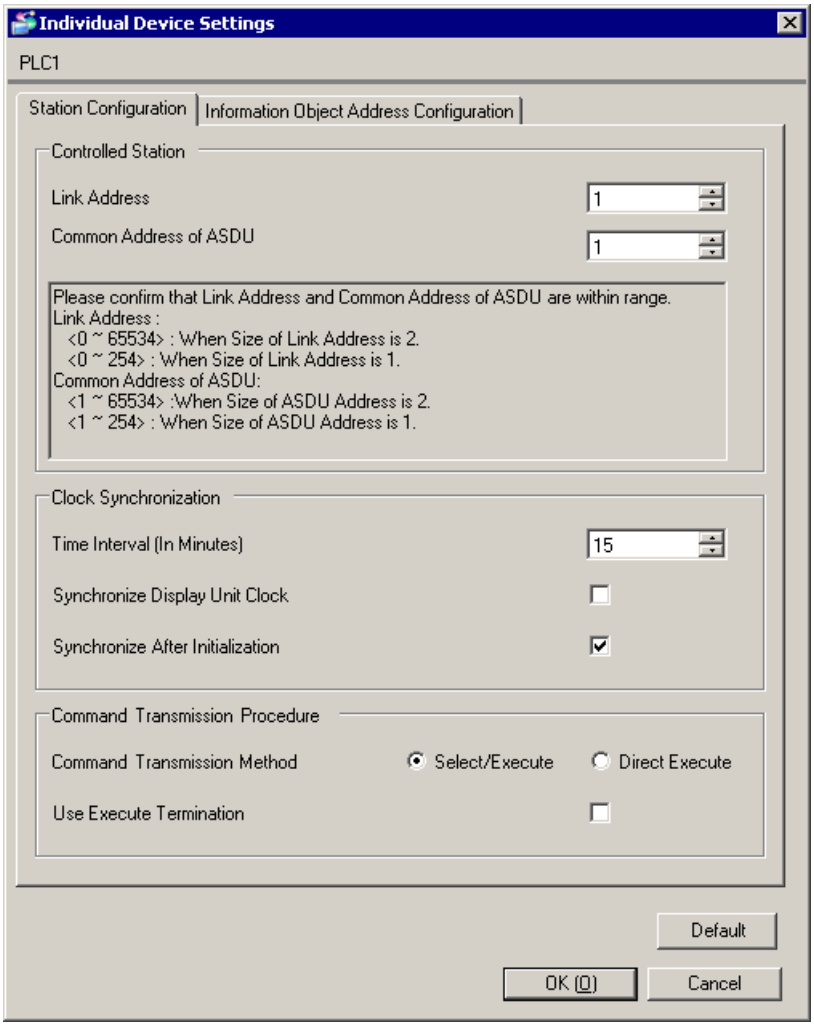
NOTE

- Please confirm that the following IEC 60870-5-101 parameters are configured according to PLC settings.
  - Size of Link Address
  - Size of ASDU Address
  - Size of Object Info.
  - Size of Cause of Transmission

♦ Device Settings

To display the [Individual Device Settings] dialog box, from [Device-Specific Settings] in the [Device/PLC] window, select the external device and click [Settings] .

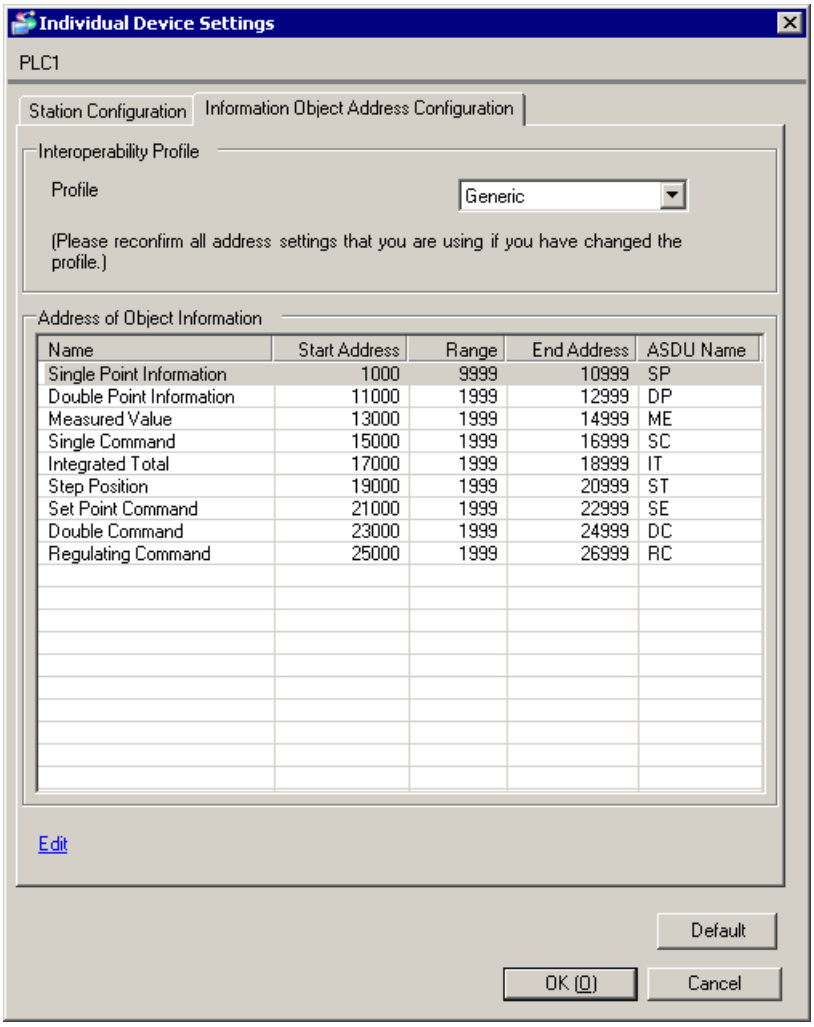
• Station Configuration



NOTE

- Please specify Command Transmission Method according to PLC settings.

- Information Object Address Configuration



NOTE

- Please specify correct ranges of objects according to PLC settings by selecting “Generic” profile.

■ External Device Settings

External Device settings vary depending on the device. Refer to your External Device manual for details.

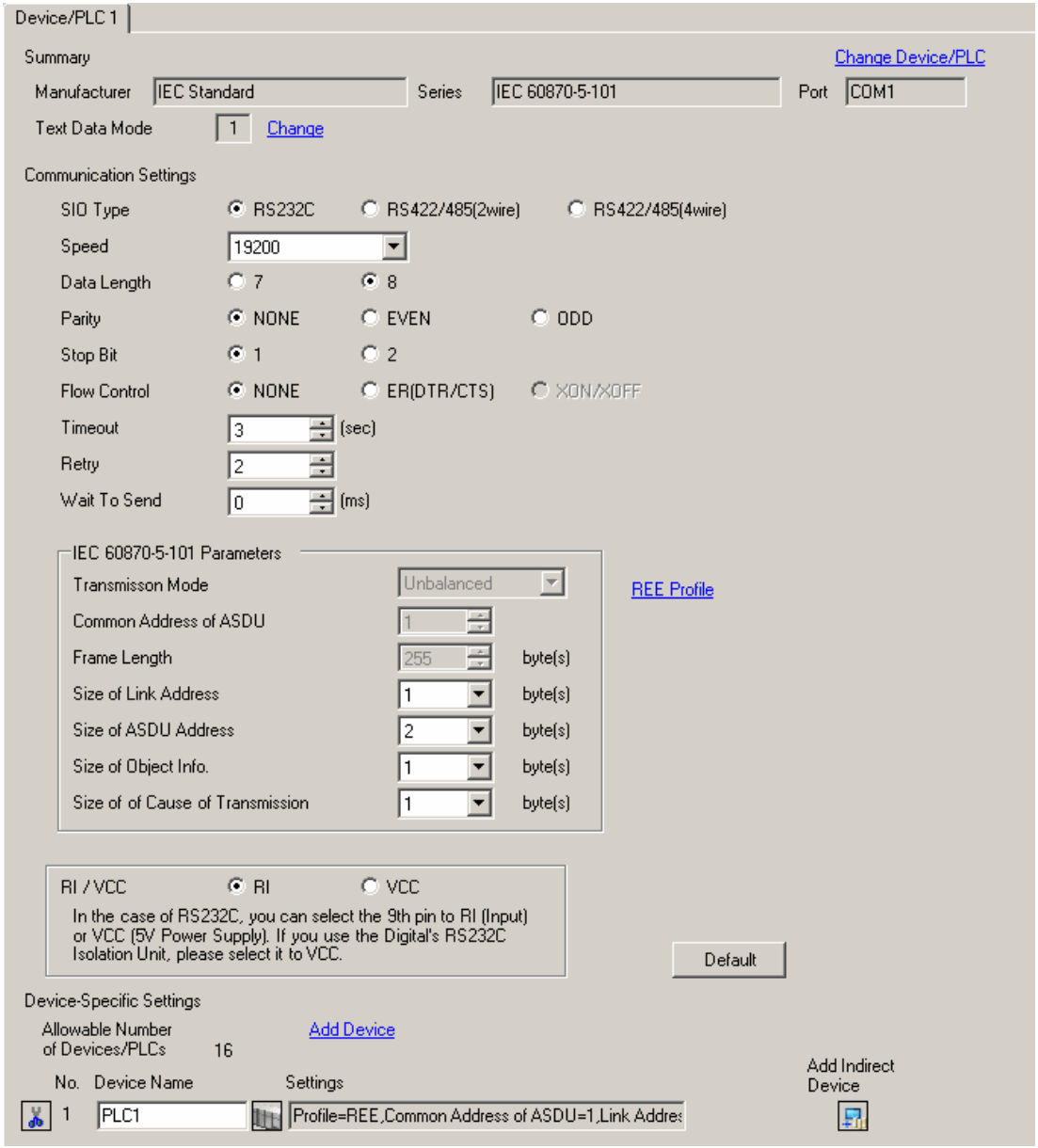
4. Setup Items

Setup the Display's communication settings in GP-Pro EX or in Display's offline mode. The setting of each parameter must match that of the External Device.

4.1. GP-Pro EX Setup Items

■ Communication Settings

To display the setup screen, from the [Project] menu, point to [System Settings] and select [Device/PLC].



Note:
Use the "REE Profile" link to set all the required communication parameters for communicating with SAITEL equipment.

Setup Items	Description	
SIO Type	Select “RS232”	
Speed	Select the communication speed. (Set 19200 Kbps)	
Data Length	Select “8”	
Parity	Select “NONE”	
Stop Bit	Select “1”	
Flow Control	Select “NONE”	
Timeout	Use an integer value from 1 to 127 to enter the time (second) for which the Display waits for the response from External Device.	
Retry	In case of no response from the External Device, use an integer from 0 to 255 to enter how many times the Display retransmits the command.	
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.	
IEC101 Related Parameters		
Transmission Mode	Please select according to REE Profile. [Click REE Profile to set all the values]	Only “Unbalanced Mode” is supported
Common Address of ASDU		
Frame Length		Fixed to 255.
Size of Link Address		
Size of ASDU Address		
Size of Object Information		
Size of Cause of Transmission		

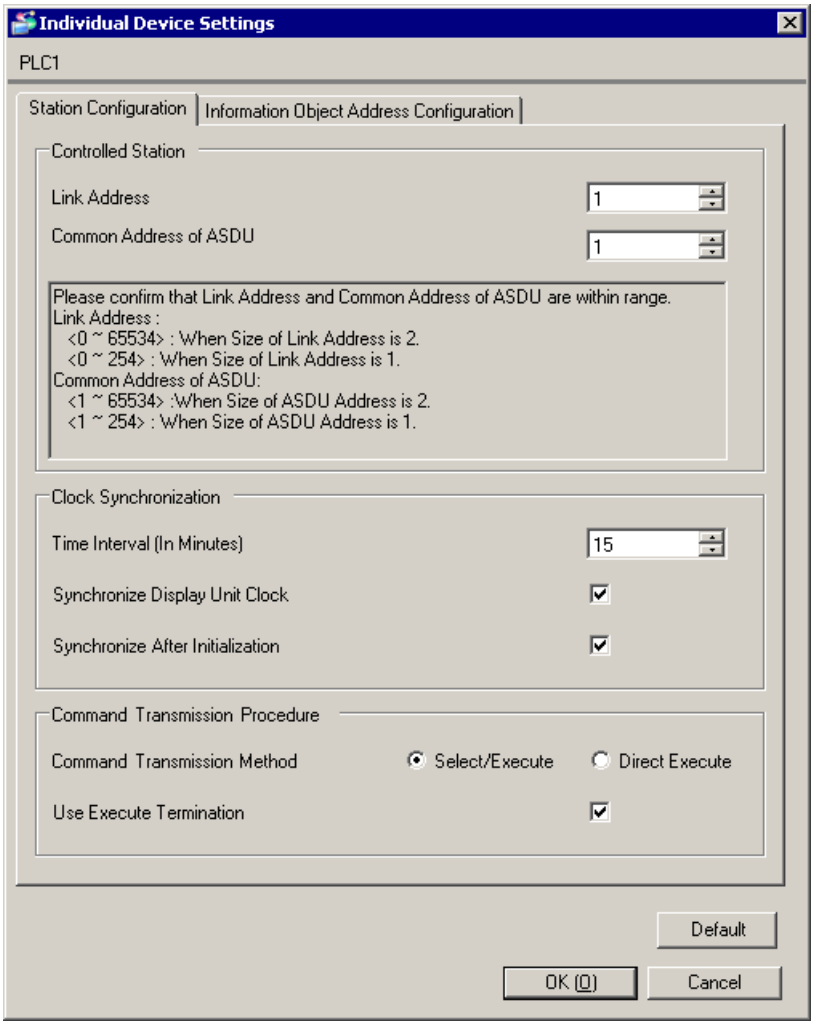
NOTE

- Refer to the GP-Pro EX Reference Manual for Indirect Device.
  Cf. GP-Pro EX Reference Manual "Changing the Device/PLC at Runtime (Indirect Device)"

■ Device Settings

To display the [Individual Device Settings] dialog box, from [Device-Specific Settings] in the [Device/PLC] window, select the external device and click [Settings] .

• Station Configuration

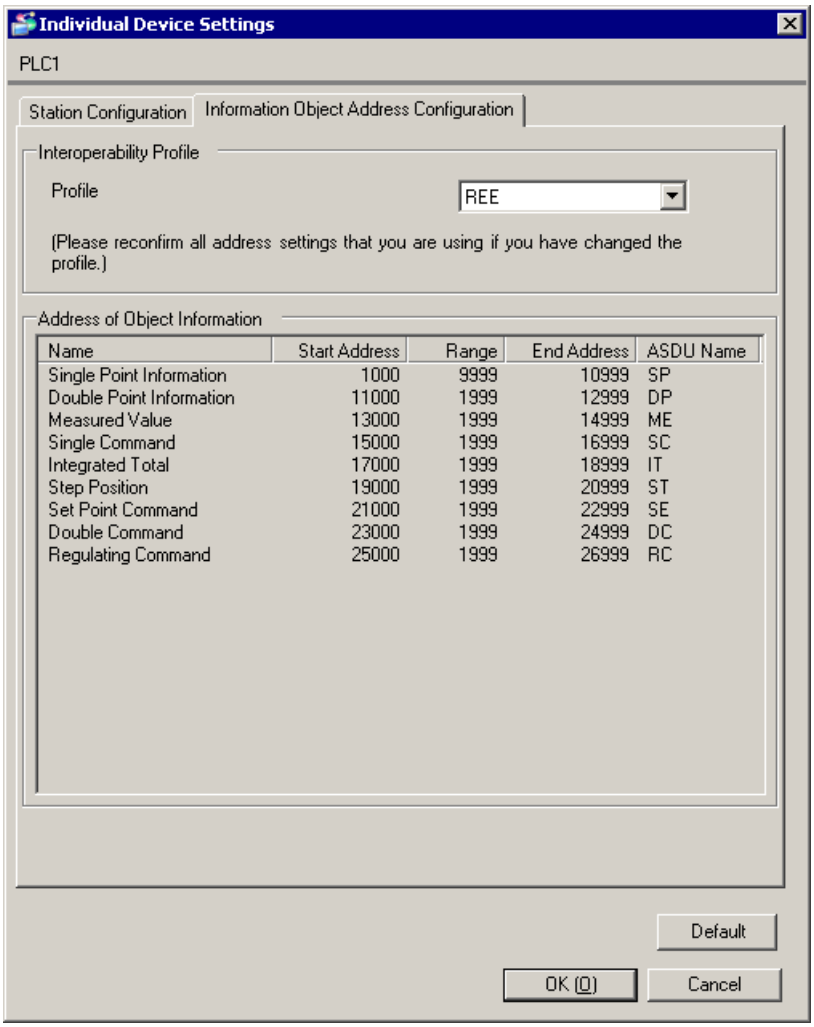


Setup Items	Description
Link Address	Set the Slave station Link Address here.
Common Address of ASDU	Set the slave station Common Address of ASDU
Time Interval (in Minutes)	Set the frequency to send “Clock Synchronization Command [CON 103]”
Synchronize Display Unit Clock	Check this to adjust the Display unit clock when PLC sends time for Clock Synchronize command
Synchronize After Initialization	Set whether clock synchronization must be followed after initialization
Command Transmission Method	Select Select / Execute or Direct Execute according to PLC settings
Use Execute Termination	Set whether the target PLC transmits “Activation Termination” after executing a command.

NOTE

- Please confirm that Link Address and Common Address of ASDU are within range of the values.

- Information Object Address Configuration:



NOTE

- Please refer to External Device user manual for more details about how to setup Link Address and other settings.
- When "REE" profile is selected, Address of object information is fixed.
- When "Generic" profile is selected, address of object information can be configured.

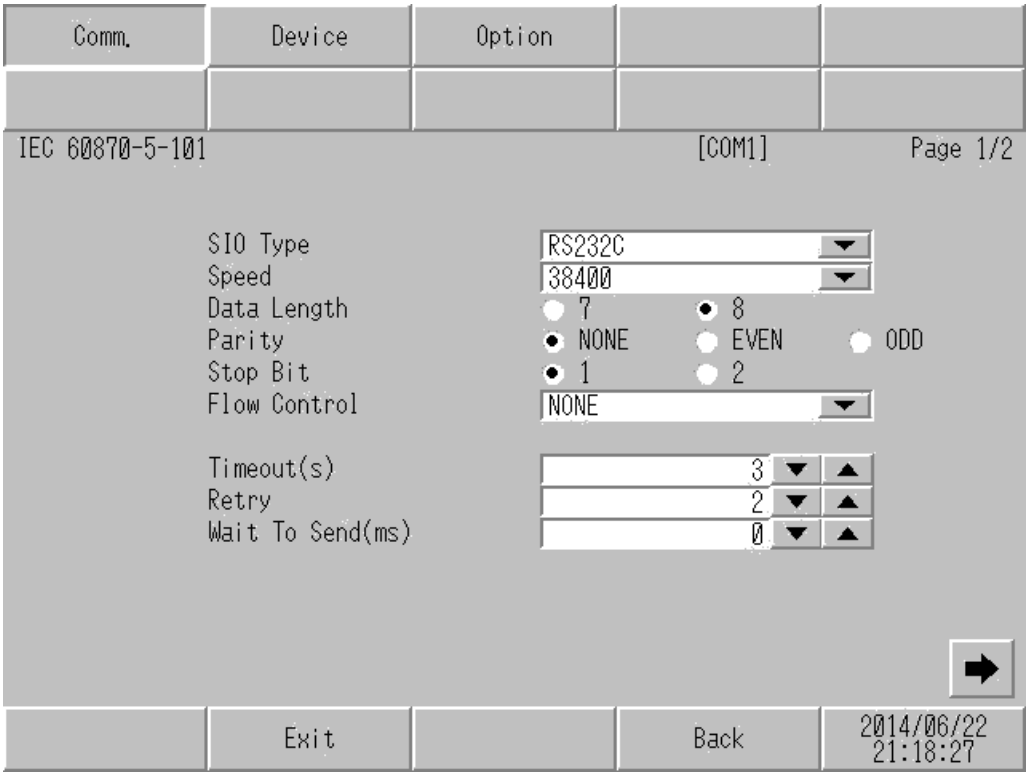
4.2. Setup Items in Offline Mode

NOTE

- Refer to the Maintenance/Troubleshooting guide for information on how to enter offline mode or about the operation.
  Cf. Maintenance/Troubleshooting Guide "Offline Mode"

■ Communication Settings

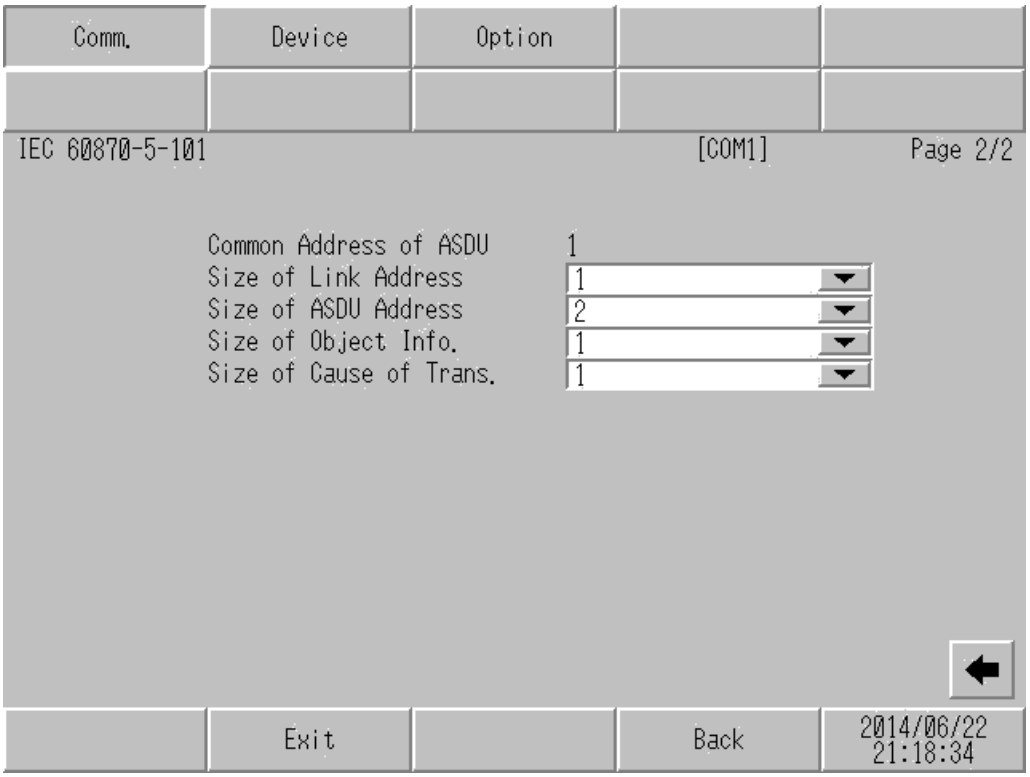
To display the setting screen, touch [Device/PLC Settings] from [Peripheral Equipment Settings] in the off-line mode. Touch the External Device you want to set from the displayed list.



Setup Items	Setup Descriptions
SIO Type	Select the SIO Type to communicate with External Device **IMPORTANT** To make the communication settings correctly, confirm the serial interface specifications of Display unit for [SIO Type]. We cannot guarantee the operation if a communication type that the serial interface does not support is specified. For details concerning the serial interface specifications, refer to the manual for Display unit.
Speed	Select the communication speed between the External Device and the Display.
Data Length	Select data length.
Parity	Select how to check parity.
Stop Bit	Select a Stop bit length

Setup Items	Setup Descriptions
Flow Control	Select the communication control method to prevent overflow of transmission and reception data.
Timeout	Use an integer from 1 to 127 to enter the time (s) for which the Display waits for the response from the External Device.
Retry	In case of no response from the External Device, enter how many times the Display retransmits the command, from "0 to 255".
Wait To Send	Enter the standby time (ms) from when the Display receives packets until it transmits the next command,

♦ IEC 60870-5-101 Parameters:



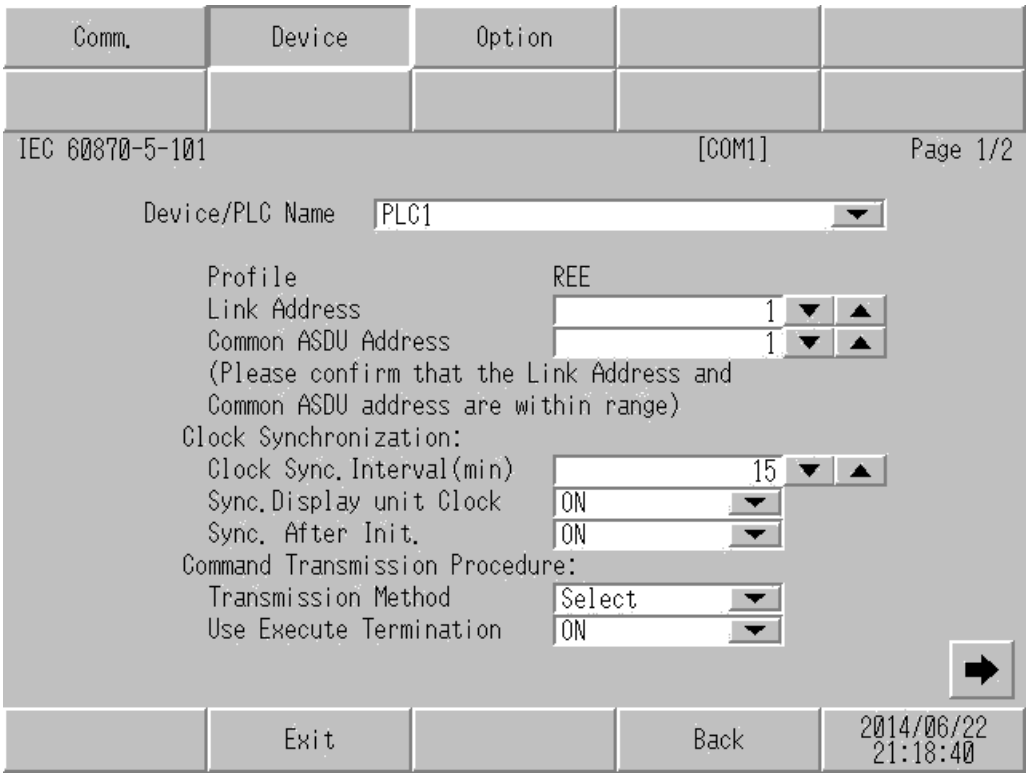
Setup Items	Setup Descriptions
Common Address of ASDU	Displays Common Address of ASDU.
Size of Link Address	Select the Link Address Size. [1 or 2 Bytes]
Size of ASDU Address	Select the size of ASDU Address [1 or 2 Bytes]
Size of Object Information	Select the Size of Object Information address[1 or 2 or 3 Bytes]
Size of Cause of Transmission	Select the Size of Cause of Transmission [1 or 2 Bytes]

IMPORTANT

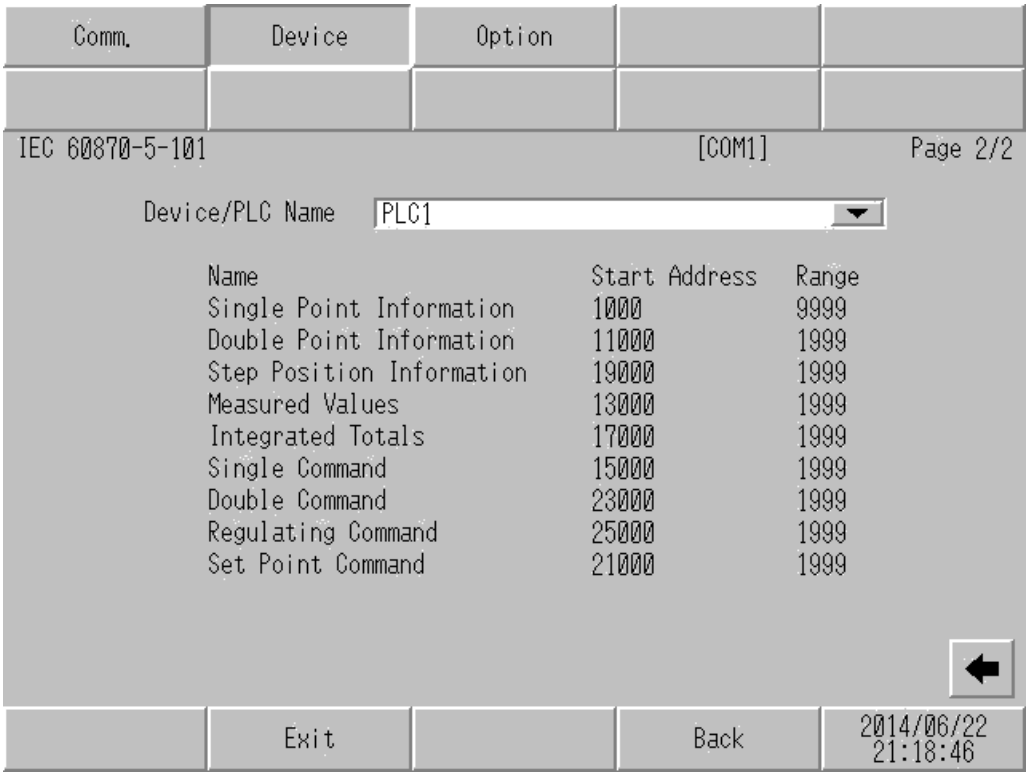
Please select IEC60870-5-101 specific parameters according to the External Device/PLC. If the setting does not match, communication error happens.

■ Device Settings

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 [Device].



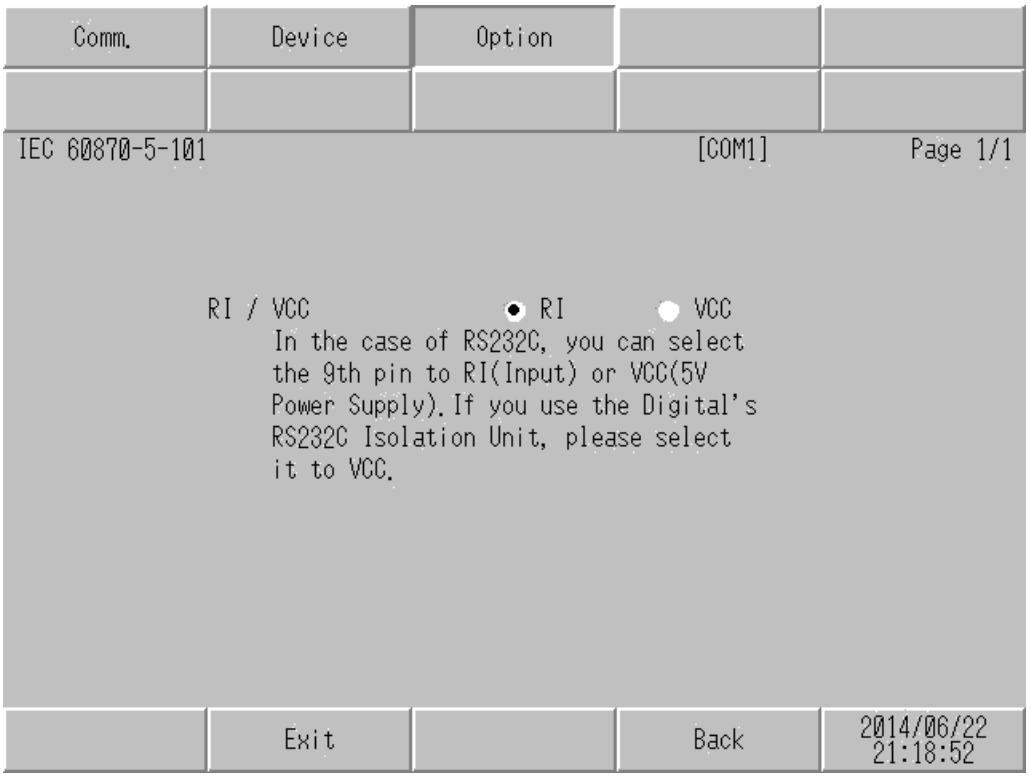
Setup Items	Setup Descriptions
Profile	Displays selected profile.
Link Address	Select the Link Address of the External Device/PLC
Common ASDU	Address Select the Common ASDU Address of the External Device/PLC
Clock Sync.Interval	Select the Time Interval (in minutes) to send Clock Synchronization command.
Sync. Display unit	Clock Select to adjust Display unit clock when Time data received from External Device/PLC.
Sync. After Init.	Set whether clock synchronization must be followed after initialization
Transmission Method	Set the command transmission sequence to use from the following options. • Select /Execute • Direct Execute
Use Execute Termination	Set whether the target PLC transmits “Activation Termination” after executing a command.



Setup Items	Setup Descriptions
Name	Displays Address Object Information Name
Start Address	Displays Address Object Information Start Address
Range	Displays Address Object Information Range.

■ Option

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 Descriptions
RI/VCC	You can switch between RI/VCC on the 9th pin when you select RS-232C for SIO type. To connect to the IPC, you need to switch between RI/5V using the IPC selector switch. Refer to your IPC manual for details.

NOTE

- GP-4100 series, GP-4*01TM, GP-Rear Module, LT-4*01TM and LT-Rear Module do not have the [Option] setting in the offline mode.

5. Cable Diagrams

The following cable diagrams may be different from cable diagrams recommended by External Device Manufacturer. 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 grounded according to your country's applicable standard.
  Refer to your External Device manual for details.
- SG and FG are connected inside the Display. When connecting the External Device to 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.
- The connector type or signal name may vary depending on the External Device.
  Connect correctly corresponding to the External Device interface specifications.

5.1. Cable Diagram 1

Display (Connection Port)	Cable		Remarks
GP3000 (COM1) GP4000*1 (COM1) SP5000*2 (COM1/2) SP-5B00 (COM1) ST (COM1) LT3000 (COM1) IPC*3 PC/AT	1A	User created cable	The cable length must be 15m maximum.
GP-4105 (COM1) GP-4115T (COM1) GP-4115T3 (COM1)	1B	User created cable	The cable length must be 15m maximum.
LT-4*01TM (COM1) LT-Rear Module (COM1)	1C	RJ45 RS-232C Cable (5m) by Pro-face PFXZLMCBRJR21	The cable length must be 5m maximum.

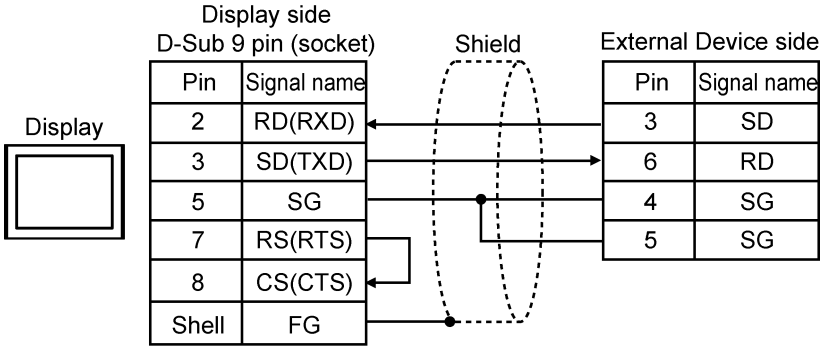
*1 All GP4000 models except GP-4100 series and GP-4203T

*2 Except SP-5B00

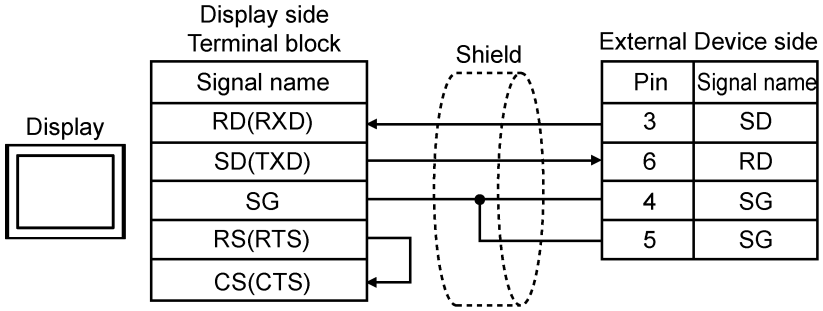
*3 Only the COM port which can communicate by RS-232C can be used.

☞ ■IPC COM Port (page 4)

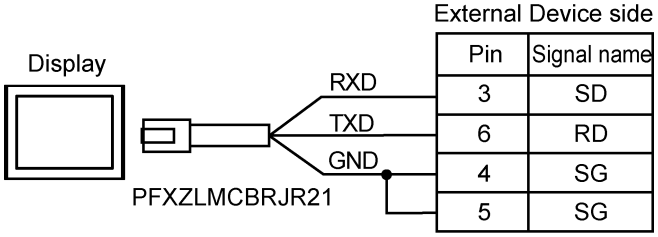
1A)



1B)



1C)



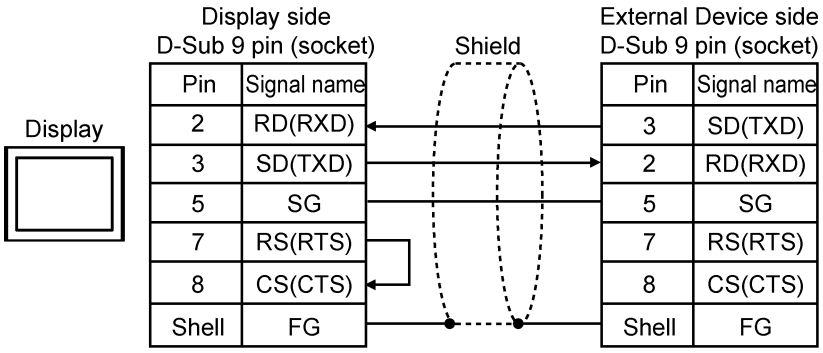
5.2. Cable Diagram 2

Display (Connection Port)	Cable		Remarks
GP3000 (COM1) GP4000*1 (COM1) SP5000*2 (COM1/2) SP-5B00 (COM1) ST (COM1) LT3000 (COM1) IPC*2 PC/AT	2A	User created cable	The cable length must be 15m maximum.
GP-4105 (COM1) GP-4115T (COM1) GP-4115T3 (COM1)	2B	User created cable	The cable length must be 15m maximum.
LT-4*01TM (COM1) LT-Rear Module (COM1)	2C	RJ45 RS-232C Cable (5m) by Pro-face PFXZLMCBRJR21	The cable length must be 5m maximum.

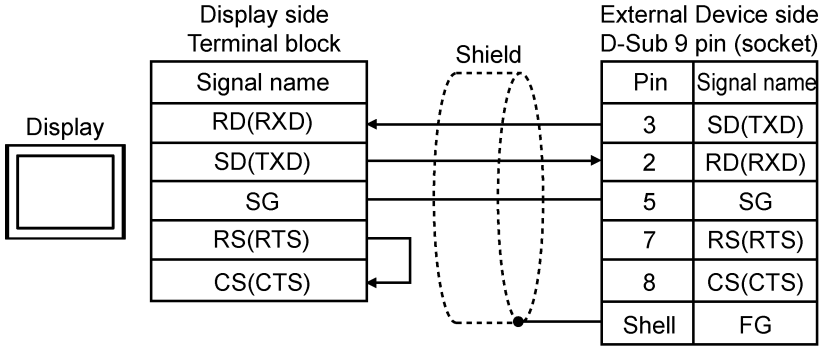
*1 All GP4000 models except GP-4100 series and GP-4203T
*2 Except SP-5B00
*3 Only the COM port which can communicate by RS-232C can be used.

☞ ■IPC COM Port (page 4)

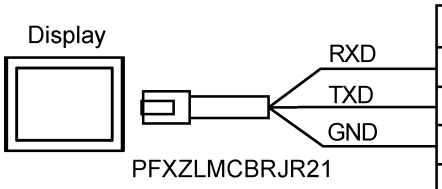
2A)



2B)



2C)



External Device side
D-Sub 9 pin (socket)

Pin	Signal name
3	SD(TXD)
2	RD(RXD)
5	SG
7	RS(RTS)
8	CS(CTS)
Shell	FG

6. Supported Device Address

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

NOTE

- When use any address range, set the [Generic] in [Information Object Address Configuration] tab - [profile] of [Individual Device Settings].

Device Name	Description	Range	Note
SP	Single Point Information	1000 ~ 10999	Read only
DP	Double-Point Information	11000 ~ 12999	Read only
ME	Measured Value	13000 ~ 14999	Read only
SC	Single Command	15000 ~ 16999	Write only
IT	Integrated Totals	17000 ~ 18999	Read only
ST	Step Position Information	19000 ~ 20999	Read only
SE	Set Point Command	21000 ~ 22999	Write only
DC	Double Command	23000 ~ 24999	Write only
RC	Regulating Step Command	25000 ~ 26999	Write only

Each device consists of several sub category and elements. The following table lists the sub category and elements for each Device group

Device Name	Sub Category / Element		Description	Note
	Category	Element		
SP	SIQ	SPI	Single Point Information 0: OFF 1: ON	*1
		BL	0: Not Blocked 1: Blocked	*1
		SB	0: Not Substituted 1: Substituted	*1
		NT	0: Topical 1: Not Topical	*1
		IV	0: Valid 1: Invalid	*1
	TIME	IV	Valid	*1
		SU	Summer Time	*1
		MSEC	Milliseconds	*2
		MIN	Minute	*2
		HOUR	Hour	*2
		DAY	Day	*2
		MONTH	Month	*2
		YEAR	Year	*2
DP	DIQ	BL	Blocked / Not Blocked	*1
		SB	Substituted / Not Substituted	*1
		NT	Topical / Not Topical	*1
		IV	Valid / Invalid	*1
		DPI	Double Point Information	*2

Device Name	Sub Category / Element		Description	Note
	Category	Element		
DP	TIME	IV	Valid	*1
		SU	Summer Time	*1
		MSEC	Milliseconds	*2
		MIN	Minute	*2
		HOUR	Hour	*2
		DAY	Day	*2
		MONTH	Month	*2
		YEAR	Year	*2
ST	VTI	T	Transient	*1
		VAL	Value	*2
	QDS	OV	Overflow / No Overflow	*1
		BL	Blocked / Not Blocked	*1
		SB	Substituted / Not Substituted	*1
		NT	Topical / Not Topical	*1
		IV	Valid / Invalid	*1
	TIME	IV	Valid	*1
		SU	Summer Time	*1
		MSEC	Milliseconds	*2
		MIN	Minute	*2
		HOUR	Hour	*2
		DAY	Day	*2
		MONTH	Month	*2
		YEAR	Year	*2
ME	QDS	OV	Overflow / No Overflow	*1
		BL	Blocked / Not Blocked	*1
		SB	Substituted / Not Substituted	*1
		NT	Topical / Not Topical	*1
		IV	Valid / Invalid	*1
	VA	VAL	Measured Value	*2
	TIME	IV	Valid	*1
		SU	Summer Time	*1
		MSEC	Milliseconds	*2
		MIN	Minute	*2
		HOUR	Hour	*2
		DAY	Day	*2
		MONTH	Month	*2
		YEAR	Year	*2
IT	BCR	VAL	Counter value	*2
		SQ	Sequence	*2
		CY	(Carry) Counter Overflow / No Overflow	*1
		CA	Counter Adjusted / Not Adjusted	*1
		IV	Counter value Valid / Invalid	*1
	TIME	IV	Valid	*1
		SU	Summer Time	*1
		MSEC	Milliseconds	*2
		MIN	Minute	*2
		HOUR	Hour	*2
		DAY	Day	*2
		MONTH	Month	*2
		YEAR	Year	*2
SC	SCO	SCS	Single command state	*1
DC	DCO	DCS	Double command state	*2
RC	RCO	RCS	Regulating step command state	*2
SE	VA	VAL	Value (Normalized / Scaled / short floating point)	*2

*1 Bit Address Only
*2 Word Address Only

7. Error Messages

Error messages are displayed on the screen of the Display 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 Message	Displays messages related to an error that has occurred
Error occurrence Area	Displays the device address of the External device where an error has occurred or error codes received from the External Device.

Example of an Error Message:

"RHAA035: PLC1: Error has been responded for device write command (Error Code: 2[02H])"

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.

Error Messages specific to the External Device

Error No	Error Message	Description
RHxx128	(Node Name): NACK: message not accepted. Link busy	PLC sends NACK for Displays request.
RHxx129	(Node Name): Link service not functioning	PLC replied this for Display request in Control byte [Function Code]
RHxx130	(Node Name): Link service not implemented	PLC replied this for Display request in Control byte [Function Code]
RHxx131	Configured object information range is too large. Please reduce the range	Insufficient memory to allocate the specified device address ranges.
RHxx132	(Node Name): Command confirmation timed out.	PLC does not reply to commands. Please check communication settings.
RHxx133	(Node Name):Initialization procedure timed out.	PLC does not respond to interrogation command. Please check communication settings.

8. Interoperability list

8.1. Network configuration

☐ Point-to-point
☐ Multiple point to point
☐ Redundant lines
■ Multi-point-party line
☐ Multi point star

8.2. Physical layer

Transmission speed (control direction)

Unbalanced interchange circuit V.24/V.28 standard	Unbalanced interface circuit V.24/V.28 Recommended if > 1200 bit/s	Balanced interchange circuit X.24/X.27	
☐ 100 bit/s	■ 2400 bit/s	☐ 2400 bit/s	☐ 56000 bit/s
☐ 200 bit/s	■ 4800 bit/s	☐ 4800 bit/s	☐ 4000 bit/s
☐ 300 bit/s	■ 9600 bit/s	☐ 9600 bit/s	
☐ 600 bit/s	■ 19200 bit/s*	☐ 19200 bit/s	
☐ 1200 bit/s		☐ 38400 bit/s	

* not defined in 870-5-101

Transmission speed (monitor direction)

Unbalanced interchange circuit V.24/V.28 standard	Unbalanced interface circuit V.24/V.28 Recommended if > 1200 bit/s	Balanced interchange circuit X.24/X.27	
☐ 100 bit/s	■ 2400 bit/s	☐ 2400 bit/s	☐ 56000 bit/s
☐ 200 bit/s	■ 4800 bit/s	☐ 4800 bit/s	☐ 4000 bit/s
☐ 300 bit/s	■ 9600 bit/s	☐ 9600 bit/s	
☐ 600 bit/s	■ 19200 bit/s*	☐ 19200 bit/s	
☐ 1200 bit/s		☐ 38400 bit/s	

* not defined in 870-5-101

8.3. Link layer

Frame format FT1.2, single character 1 and the fixed timeout interval are used exclusively in this companion standard.

Link transmission

☐ Balanced transmission

■ Unbalanced transmission

Frame length

255 Maximum length L (number of octets)

Address field of the link

☐ Not present (balanced only)

■ One octet

■ Two octets

☐ Structured

■ Unstructured

8.4. Application layer

Common address of ASDU

■ One octet

■ Two octets

Information object address

■ One octet

■ Two octets

■ Three octets

■ Structured

☐ Unstructured

Cause of transmission

■ One octet

■ Two octets (with originator address)

8.5. ASDUs

Process information in monitor direction	Short name
■ <1> := Single-point information	M_SP_NA_1
□ <2> := Single-point information with time tag	M_SP_TA_1
■ <3> := Double-point information	M_DP_NA_1
□ <4> := Double-point information with time tag	M_DP_TA_1
■ <5> := Step position information	M_ST_NA_1
□ <6> := Step position information with time tag	M_ST_TA_1
□ <7> := Bitstring of 32 bit	M_BO_NA_1
□ <8> := Bitstring of 32 bit with time tag	M_BO_TA_1
□ <9> := Measured value, normalized value	M_ME_NA_1
□ <10> := Measured value, normalized value with time tag	M_ME_TA_1
■ <11> := Measured value, scaled value	M_ME_NB_1
□ <12> := Measured value, scaled value with time tag	M_ME_TB_1
□ <13> := Measured value, short floating point value	M_ME_NC_1
□ <14> := Measured value, short floating point value with time tag	M_ME_TC_1
■ <15> := Integrated totals	M_IT_NA_1
□ <16> := Integrated totals with time tag	M_IT_TA_1
□ <17> := Event of protection equipment with time tag	M_EP_TA_1
□ <18> := Packed start events of protection equipment with time tag	M_EP_TB_1
□ <19> := Packed output circuit information of protection equipment with time tag	M_EP_TC_1
□ <20> := Packed single-point information with status change detection	M_PS_NA_1
□ <21> := Measured value, normalized value without quality descriptor	M_ME_ND_1
■ <30> := Single-point information with time tag CP56Time2a	M_SP_TB_1
■ <31> := Double-point information with time tag CP56Time2a	M_DP_TB_1
■ <32> := Step position information with time tag CP56Time2a	M_ST_TB_1
□ <33> := Bitstring of 32 bit with time tag CP56Time2a	M_BO_TB_1
□ <34> := Measured value, normalized value with time tag CP56Time2a	M_ME_TD_1
□ <35> := Measured value, scaled value with time tag CP56Time2a	M_ME_TE_1
□ <36> := Measured value, short floating point value with time tag CP56Time2a	M_ME_TF_1
□ <37> := Integrated totals with time tag CP56Time2a	M_IT_TB_1
□ <38> := Event of protection equipment with time tag CP56Time2a	M_EP_TD_1
□ <39> := Packed start events of protection equipment with time tag CP56Time2a	M_EP_TE_1
□ <40> := Packed output circuit information of protection equipment with time tag CP56Time2a	M_EP_TF_1

Process information in control direction

■ <45> := Single command	C_SC_NA_1
■ <46> := Double command	C_DC_NA_1
■ <47> := Regulating step command	C_RC_NA_1
■ <48> := Set point command, normalized value	C_SE_NA_1
□ <49> := Set point command, scaled value	C_SE_NB_1
□ <50> := Set point command, short floating point value	C_SE_NC_1
□ <51> := Bitstring of 32 bit	C_BO_NA_1

System information in monitor direction

□ <70> := End of initialization	M_EI_NA_1

System information in control direction

□ <100>:= Interrogation command	C_IC_NA_1
□ <101>:= Counter interrogation command	C_CI_NA_1
□ <102>:= Read command	C_RD_NA_1
□ <103>:= Clock synchronization command	C_CS_NA_1
□ <104>:= Test command	C_TS_NA_1
□ <105>:= Reset process command	C_RP_NA_1
□ <106>:= Delay acquisition command	C_CD_NA_1
□ <107>:= Test command with time tag CP56Time2a	C_TS_TA_1

Parameter in control direction

□ <110>:= Parameter of measured value, normalized value	P_ME_NA_1
□ <111>:= Parameter of measured value, scaled value	P_ME_NB_1
□ <112>:= Parameter of measured value, short floating point value	P_ME_NC_1
□ <113>:= Parameter activation	P_AC_NA_1

File transfer

□ <120>:= File ready	F_FR_NA_1
□ <121>:= Section ready	F_SR_NA_1
□ <122>:= Call directory, select file, call file, call section	F_SC_NA_1
□ <123>:= Last section, last segment	F_LS_NA_1
□ <124>:= Ack file, ack section	F_AF_NA_1
□ <125>:= Segment	F_SG_NA_1
□ <126>:= Directory {blank or X, only available in monitor (standard) direction}	F_DR_TA_1

8.6. Basic application functions

Station initialization

■ Remote initialization

Cyclic data transmission

□ Cyclic data transmission

Read procedure

□ Read procedure

General interrogation

■ Global

Clock synchronization

□ Global

Command transmission

□ Direct command transmission
□ Direct set point transmission
■ Select and execute command
■ Select and execute set point
□ C_SE ACTTERM used

■ No additional definition
□ Short pulse duration (duration determined by a system parameter)
□ Long pulse duration (duration determined by a system parameter)
□ Persistent output

Transmission of integrated totals

□ Counter request
□ General request counter
□ Counter freeze without reset
□ Counter freeze with reset

Parameter loading

□ Threshold value
□ Smoothing factor
□ Low limit for transmission of measured value
□ High limit for transmission of measured

Parameter activation

□ Act/deact of persistent cyclic or periodic transmission of the addressed object

Test procedure

□ Test procedure

File transfer

File transfer in monitor direction
□ Transparent file
□ Transmission of disturbance data of protection equipment
□ Transmission of sequences of events
□ Transmission of sequences of recorded analogue values

File transfer in control direction
□ Transparent file

Background scan
□ Background scan

Acquisition of transmission delay
□ Acquisition of transmission delay