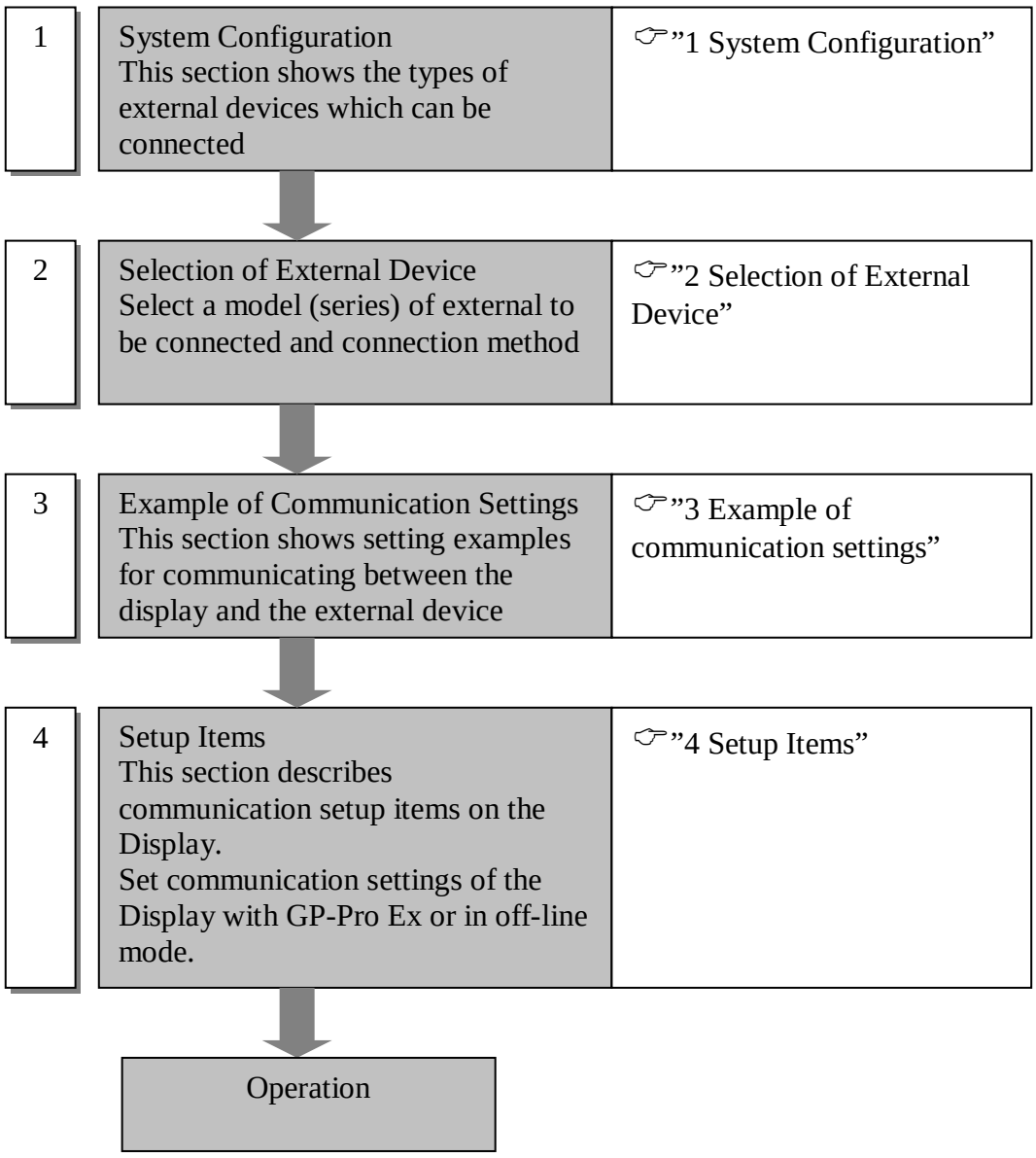
CoDeSys Automation Alliance

CoDeSys Ethernet 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

1.1 Supported Device/PLC

The following table lists system configurations for connecting some of CoDeSys Automation Alliance devices and the display.

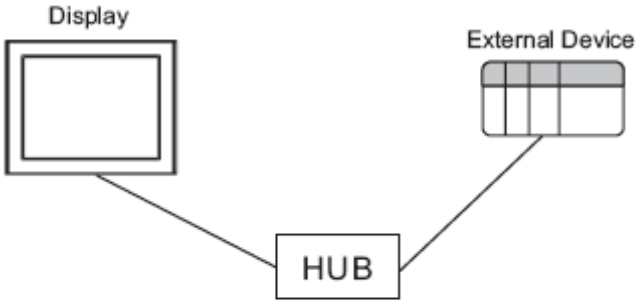
Series Name	CPU	Link I/F	Communication I/F	Comment	Setting Example
BOSCH Rexroth	Indra Control L20	X7E Ethernet Port	Ethernet Port	Level4 / Level2 (Route)	Example 1 Example 2 Example 4
	Indra Control L40	X7E Ethernet Port		Level4	Example 1 Example 2
	Indra Control PPC-R22	Ethernet Port			
WAGO	I/O System 750-841	Ethernet Port			
ELAU	PACDrive C200	Ethernet Port		Port 5000 Level4	
3S SoftPLC	Windows NT	Ethernet Port		Level4 / Level2 (Route)	Example 1 Example 2 Example 4
KEB	CombiControl C5	Ethernet Port		Level2	Example 3
Bachmann MX200 Series	MX213	ETH1 / ETH2		Level2 (Route)	Example 5

1.2 Connection configuration

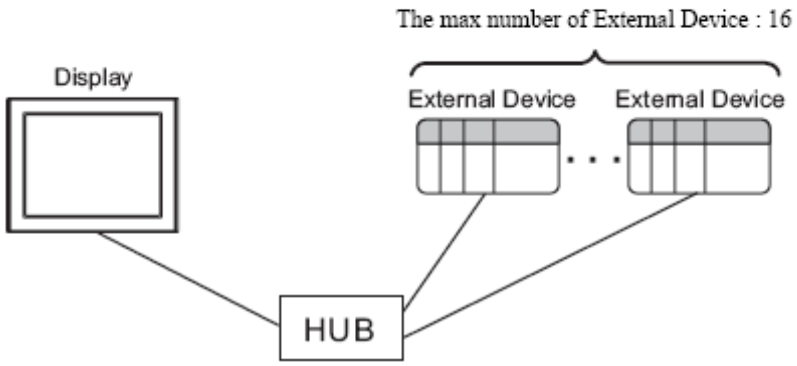
The system configuration for CoDeSys Automation Alliance devices and the display connected are shown as follows.

■ Connection Configuration

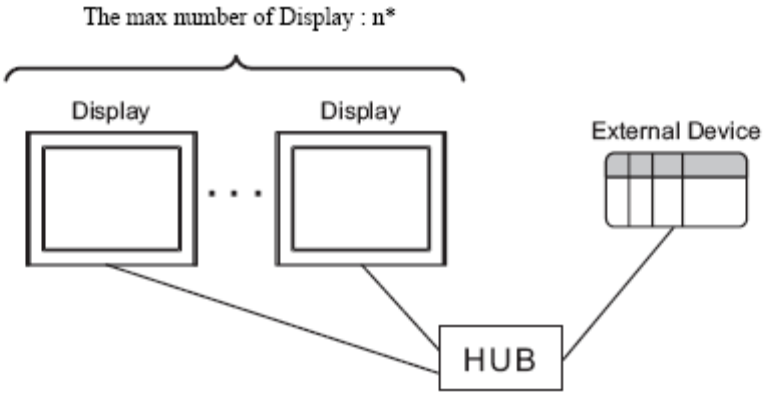
- 1:1 Connection



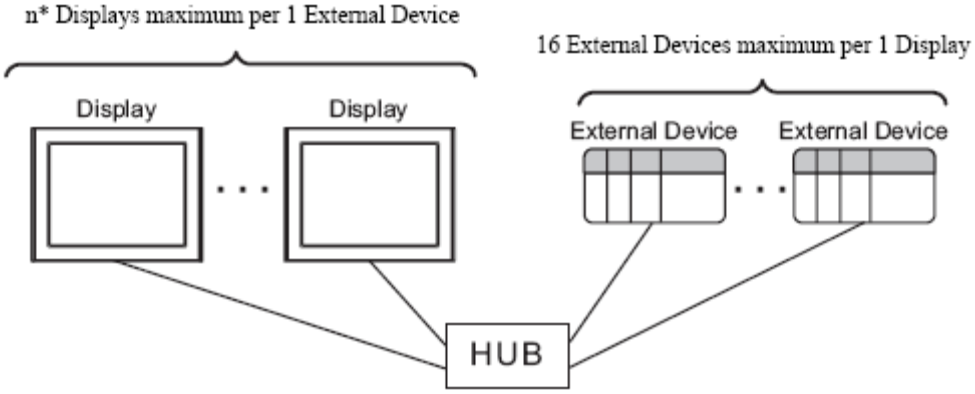
- 1:n Connection



- n:1 Connection



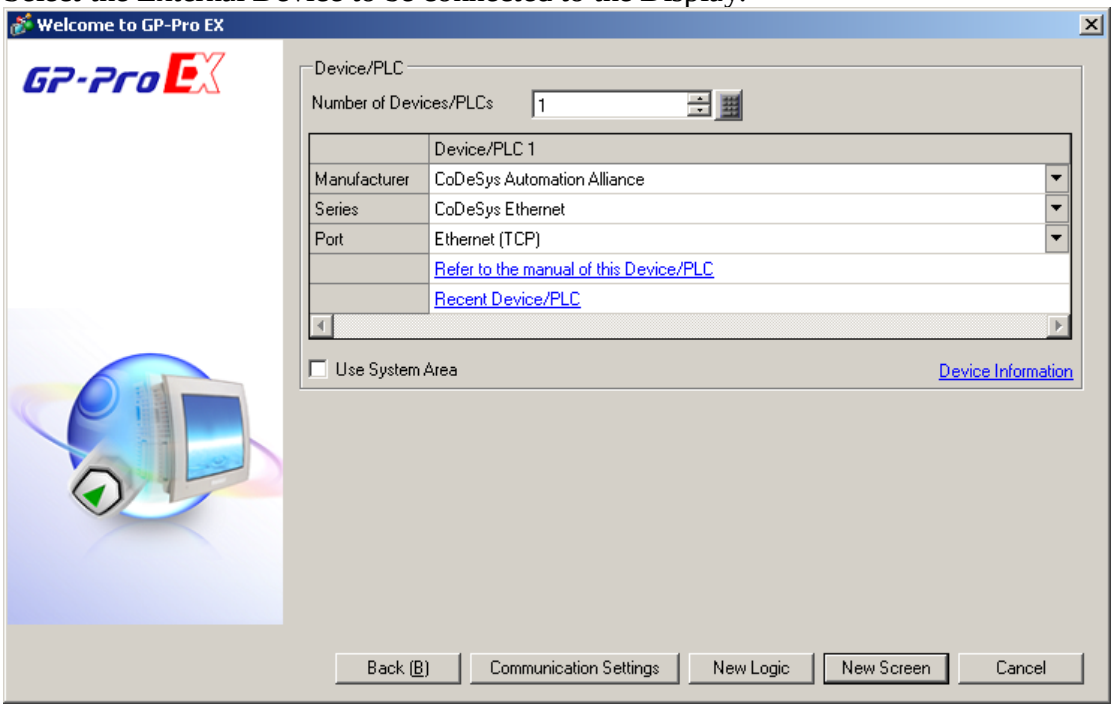
- n:mConnection



NOTE The number of connectable Displays depends on the External device. Please refer to the manual of External device for more details.

2 External Device Selection

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 "CoDeSys Automation Alliance"
Series	Select a model (series) of the External Device to be connected and connection method. Select "CoDeSys Ethernet". 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 Ethernet)
Use System Area	Check this option when you synchronize the system data area of the Display and the device (memory) of the External Device. When synchronized, you can use the ladder program of the External Device to switch the display or display the window on the Display. Cf. GP-Pro EX Reference Manual "LS Area (Direct Access Method Area)" This can be also set with GP-Pro EX or in off-line mode of the Display. Cf. GP-Pro EX Reference Manual "System Settings [Display Unit] - [System Area] Settings Guide" Cf. Maintenance/Troubleshooting Guide "Main Unit - System Area Settings"

3 Example of Communication Setting

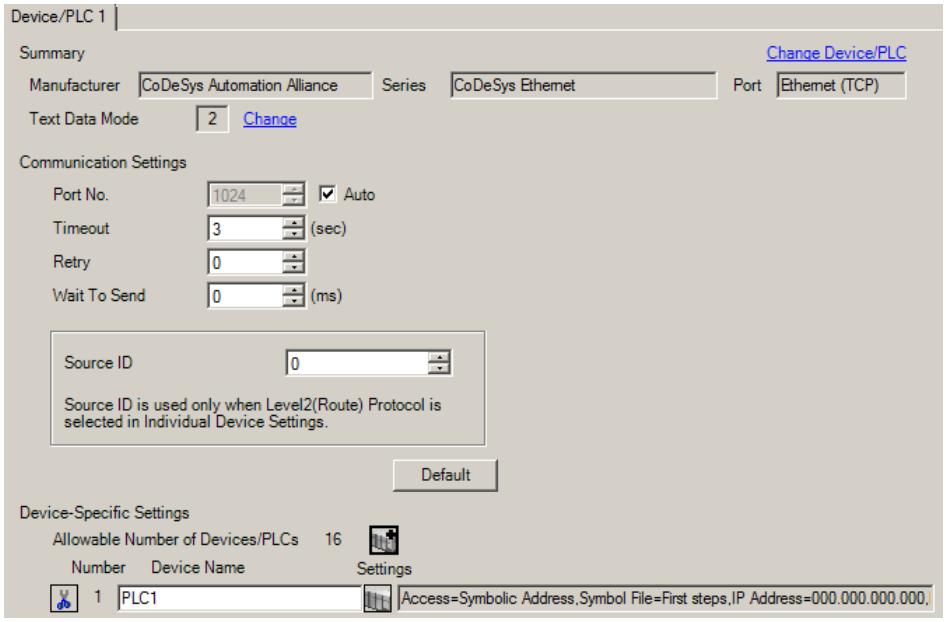
Examples of communication settings of the display and the external device recommended by Pro-face are shown.

3.1 Setting Example 1

- **Setting of GP-Pro EX**

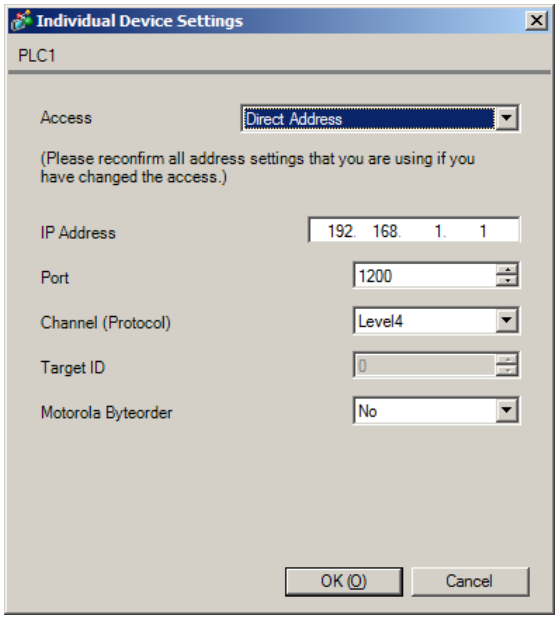
  - **Communication Settings**

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



  - **Device Settings**

    To display the setting screen, click  ([Setting]) of the External Device you want to set from [Device-Specific Settings] of [Device/PLC Settings].



- **Setting of External Device**

  Please refer to CoDeSys software and/or external Device user manual for more details about how to setup IP Address and port of External Device.

- **Notes**

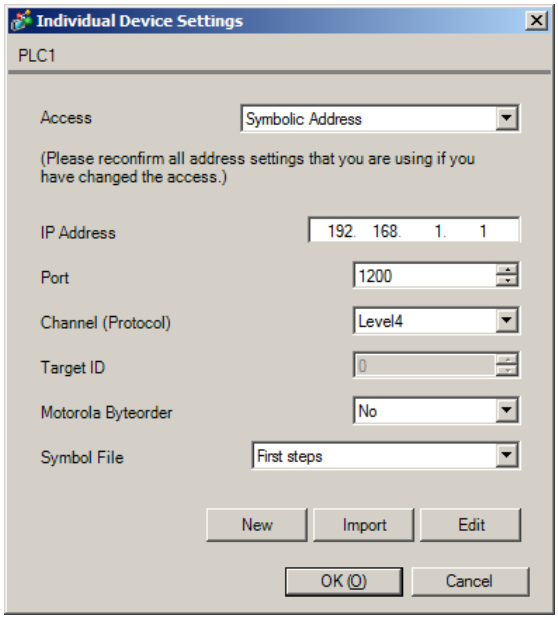
- Check with a network administrator about IP address. Do not set the duplicate IP address.
- Set IP address on the external device for IP address in the Device-Specific settings.
- You need to set IP address on the display in the off-line mode of the display.

3.2 Setting Example 2

- **Setting of GP-Pro EX**

  - **Communication Settings**
    Please refer to example 1.

  - **Device Settings**
    To display the setting screen, click  ([Setting]) of the External Device you want to set from [Device-Specific Settings] of [Device/PLC Settings].



  - **Setting of External Device**
    Please refer to CoDeSys software and/or external Device user manual for more details about how to setup IP Address and port of External Device.
    Please refer to chapter 6 for the details of symbol access settings.

  - **Notes**

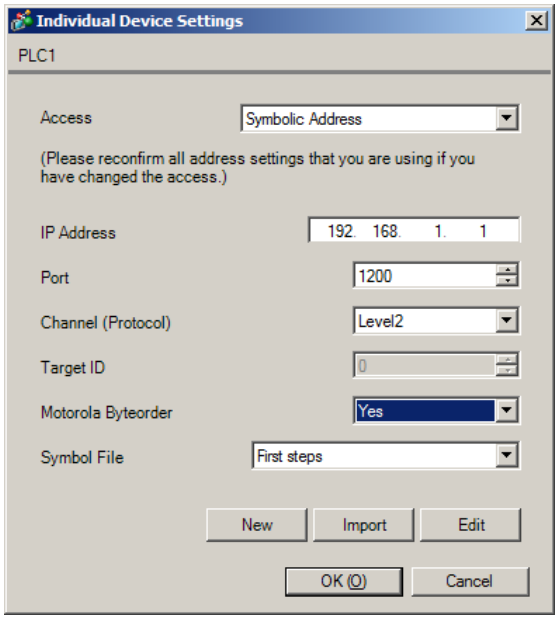
- Check with a network administrator about IP address. Do not set the duplicate IP address.
- Set IP address on the external device for IP address in the Device-Specific settings.
- You need to set IP address on the display in the off-line mode of the display.

3.3 Setting Example 3

- **Setting of GP-Pro EX**

  - **Communication Settings**
    Please refer to example 1.

  - **Device Settings**
    To display the setting screen, click  ([Setting]) of the External Device you want to set from [Device-Specific Settings] of [Device/PLC Settings].



  - **Setting of External Device**
    Please refer to CoDeSys software and/or external Device user manual for more details about how to setup IP Address and port of External Device.
    Please refer to chapter 6 for the details of symbol access settings.
    Please make sure that “Yes” is selected for [Motorola Byteorder].

  - **Notes**

- Check with a network administrator about IP address. Do not set the duplicate IP address.
- Set IP address on the external device for IP address in the Device-Specific settings.
- You need to set IP address on the display in the off-line mode of the display.

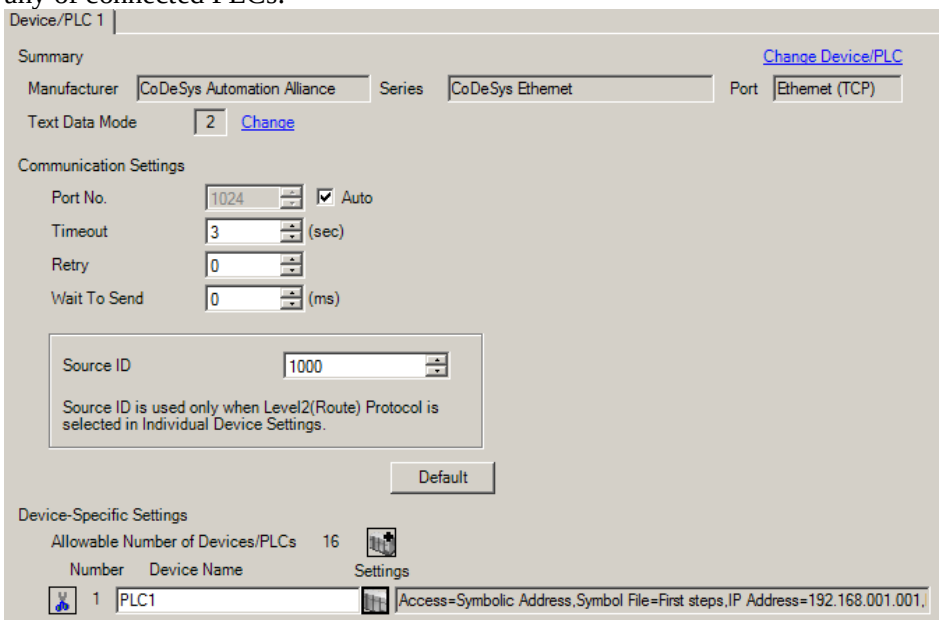
3.4 Setting Example 4

- **Setting of GP-Pro EX**

  - **Communication Settings**

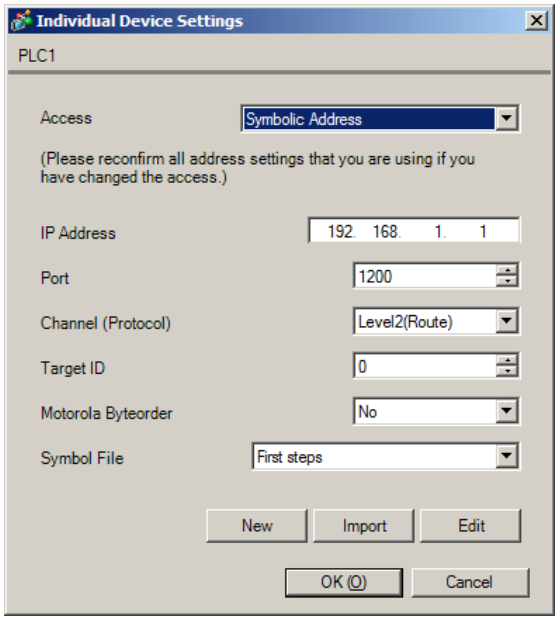
    To display the setting screen, select [Device/PLC Settings] from [System setting window] in workspace.

    Please make sure that [Source ID] is set to a value which is not used by [Target ID] of any of connected PLCs.



- **Device Settings**

To display the setting screen, click  ([Setting]) of the External Device you want to set from [Device-Specific Settings] of [Device/PLC Settings].



- **Setting of External Device**

Please refer to CoDeSys software and/or external Device user manual for more details about how to setup IP Address, port and target ID of External Device.
Please refer to chapter 6 for the details of symbol access settings.

- **Notes**

- Check with a network administrator about IP address. Do not set the duplicate IP address.
- Set IP address on the external device for IP address in the Device-Specific settings.
- You need to set IP address on the display in the off-line mode of the display.

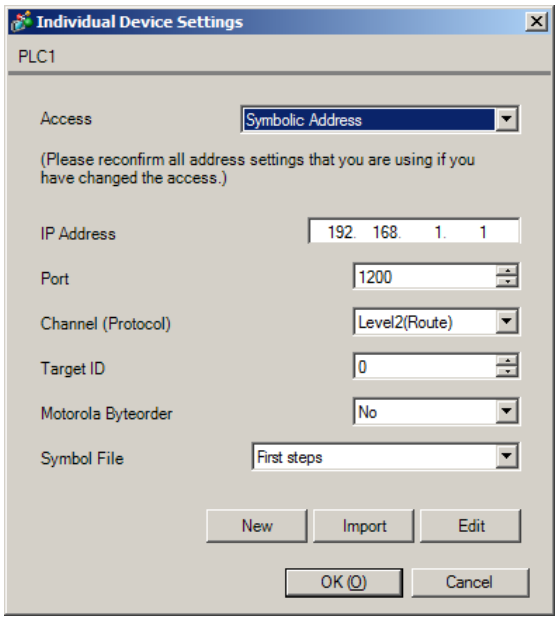
3.5 Setting Example 5

- **Setting of GP-Pro EX**

  - **Communication Settings**
    Please refer to example 4.

  - **Device Settings**

    To display the setting screen, click ([Setting]) of the External Device you want to set from [Device-Specific Settings] of [Device/PLC Settings].



  - **Setting of External Device**
    Use Bachmann M-PLC and Solution Center for communication setting.
    Please refer to CoDeSys software and/or external Device user manual for more details about how to setup IP Address and port of External Device.
    1. Use M-PLC to create a new project where symbol addresses and programs are defined and download it to the PLC
    2. Use Solution Center to activate [ARTISrvPort] of the downloaded M-PLC project and a port number to it. [ModuleIndex] of the M-PLC project displayed in Solution Center must correspond with [Target ID].
    3. If there are multiple M-PLC projects downloaded to the PLC, each M-PLC project needs to have its own [ARTISrvPort] and [ModuleIndex]. GP-Pro EX can configure only one M-PLC project per node. Please add as many PLCs as the number of M-PLC projects in [Communication Settings] and set [Port] and [Target ID] in [Individual Device Settings] dialog respectively.

  - **Notes**

- Check with a network administrator about IP address. Do not set the duplicate IP address.
- Set IP address on the external device for IP address in the Device-Specific settings.
- You need to set IP address on the display in the off-line mode of the display.

4 Setup Items

Set communication settings of the Display with GP-Pro Ex or in off-line mode of the Display.

The setting of each parameter must be identical to that of External Device.

"3 Example of Communication Setting" (page 7)

NOTE

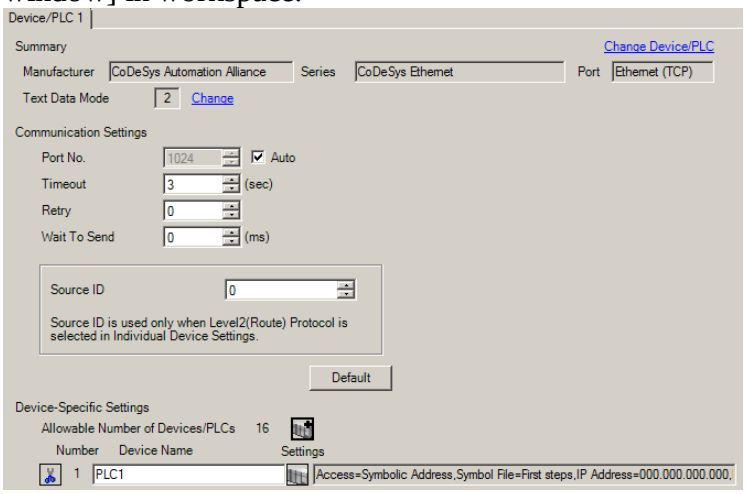
- Set the Display's IP address in off-line mode.

  Cf. Maintenance/Troubleshooting Manual "2.5 Ethernet Settings"

4.1 Setup Items in GP-Pro EX

4.1.1 Communication Settings

To Display the setting screen, select [Device/PLC Settings] from [System setting window] in workspace.

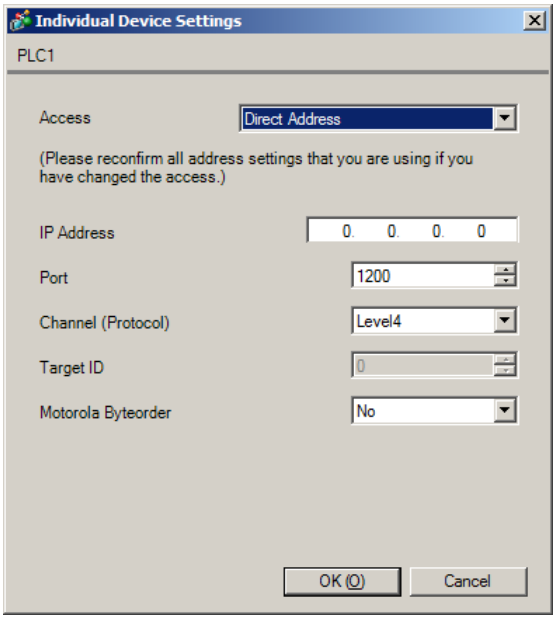


Setup Items	Setup Description
Port No.	Use an integer from 1024 to 65535 to enter the port number of the Display. When you check the option of [Auto Assign], the port number will be automatically set.
Timeout	Use an integer from 1 to 127 to enter the time (s) for which the Display waits for the response from the External Device.
Retry	If there is 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 the amount of standby time (ms) the Display counts from the time it receives a packet to the time it transmits the next packet.
Source ID	Use an integer from 0 to 4294967295. This setting parameter is used only with relation to PLCs with level 2 route protocol configured via [Individual Device Settings]

4.1.2 Device Setting (Access = Direct Address)

To display the setting screen, click  ([Setting]) of the External Device you want to set from [Device-Specific Settings] of [Device/PLC Settings].

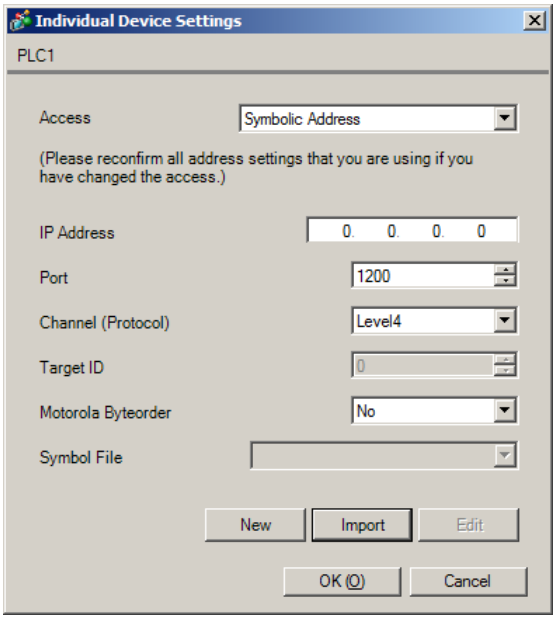
When connecting multiple External Devices, you can click from  [Device-Specific Settings] of [Device/PLC Settings] to add the External Device which is available to set.



Setup Items	Description
Access	Select either [Direct Address] or [Symbol Address]
IP Address	Set IP Address of the External Device
Port	Set Ethernet port of the External Device
Channel (Protocol)	Select the communication protocol that the PLC supports among [Level4] [Level2] [Level2 Route]
Target ID	Set the target ID of the PLC or an application unit within the PLC. Only relevant if the PLC uses [Level2] protocol.
Motorola Byteorder	Select Motorola Byteorder of the External Device

4.1.3 Device Setting (Access = Symbol Address)

When “3S CoDeSys Symbol” type is selected as Series, Symbol File, “New”, “Import” & “Edit” buttons are displayed.



Setup Items	Description
Symbol File	Select the symbol file to be used for the PLC. NOTE: No symbol file is available for a newly created project. Symbol files can be added via [New] or [Import].
New	Creates an empty symbol file and opens [Symbol List] dialog. (See 6.3.2)
Import	Opens [Select Symbols] dialog. (See 6.3.3)
Edit	Opens [Symbol List] dialog with loading the currently selected symbol file (See 6.3.2)

NOTE Please make sure the above settings match with “Online – Communication Parameters” of Device/PLC programming software, otherwise communication error will occur.

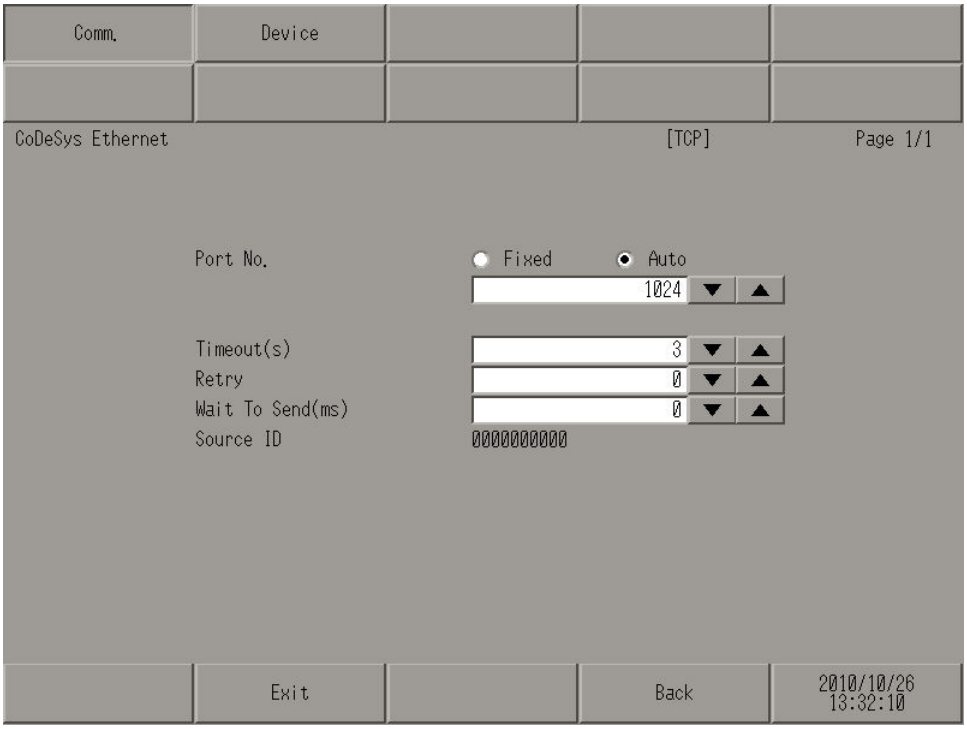
4.2 Settings in Off-Line Mode

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

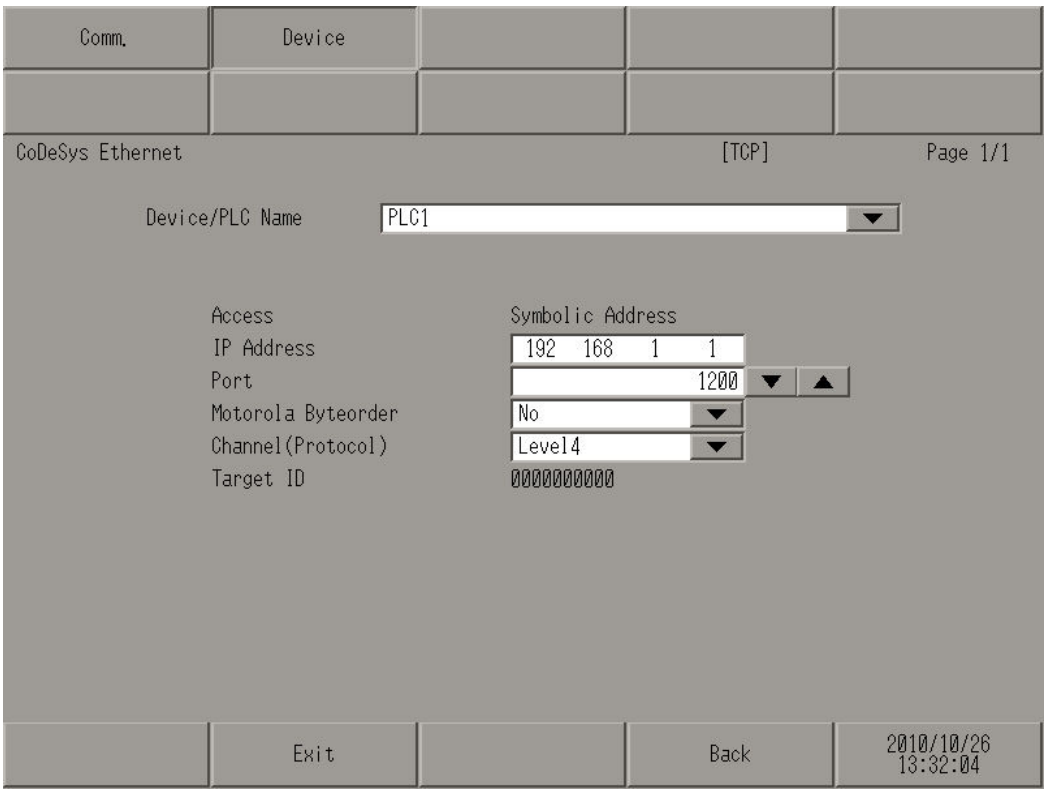
To display the setting screen, touch [Device/PLC Settings] from [Peripheral Equipment Settings] in the off-line mode. Touch the External Device you want to set from the displayed list.



Setup Items	Description
Port No	Set the Port No. of the Display. Select either [Fixed] or [Auto]. When you select [Fixed], use an integer from 1024 to 65535 to enter the port No. of the Display. When you select [Auto], the port No. will be automatically assigned regardless of the entered value.
Timeout(s)	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, use an integer from 0 to 255 to enter how many times the Display retransmits the command.
Wait To Send (ms)	Use an integer from 0 to 255 to enter standby time (ms) for the Display from receiving packets to transmitting next commands.
Source ID	Display the source ID. It is used only with relation to PLCs with level 2 route protocol configured via [Individual Device Settings]

■ Device Setting

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 Settings].



Setup Items	Description
Access	Display the selected access method. The value is either [Direct Address] or [Symbol Address].
IP Address	Set IP Address of the External Device
Port	Set Ethernet port of the External Device
Channel (Protocol)	Select the communication protocol that the PLC supports among [Level4] [Level2] [Level2 Route]
Target ID	Display the target ID of the PLC or an application unit within the PLC. Only relevant if the PLC uses [Level2] protocol.
Motorola Byteorder	Select Motorola Byteorder of the External Device

5 Supported Device Address

5.1 Direct Access

The following table shows the range of supported device addresses in direct access.

This address can be specified as system data area.

Device	Bit Address	Word Address	32bits
Input	%IX00000.00 ~ %IX65535.15	%IW00000 ~ %IW65535	L/H
Output	%QX00000.00 ~ %QX65535.15	%QW00000 ~ %QW65535	
Marker	%MX00000.00 ~ %MX65535.15	%MW00000 ~ %MW65535	

NOTE

- Please refer to the GP-Pro EX Reference Manual for system data area.

  Cf. GP-Pro EXReference Manual "Appendix 1.4 LS Area (Direct Access Method)"

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

  ☞ "Manual Symbols and Terminology"

5.2 Symbol Access

The following table shows the range of supported device addresses in symbol access.

 This address can be specified as system data area.

Device		Bit Address	Word Address	32 Bits	Remarks
BOOL	Single	<SYMNAME>	-	-	*1 *6
	1D Array	<SYMNAME>[xl] ~ <SYMNAME>[xh]			
	2D Array	<SYMNAME>[xl,yl] ~ <SYMNAME>[xh,yh]			
	3D Array	<SYMNAME>[xl,yl,zl] ~ <SYMNAME>[xh,yh,zh]			
BYTE SINT USINT	Single	<SYMNAME>.00 ~ <SYMNAME>.07	<SYMNAME>	L/H	*1 *2
	1D Array	<SYMNAME>[xl].00 ~ <SYMNAME>[xh].07	<SYMNAME>[xl] ~ <SYMNAME>[xh]		
	2D Array	<SYMNAME>[xl,yl].00 ~ <SYMNAME>[xh,yh].07	<SYMNAME>[xl,yl] ~ <SYMNAME>[xh,yh]		
	3D Array	<SYMNAME>[xl,yl,zl].00 ~ <SYMNAME>[xh,yh,zh].07	<SYMNAME>[xl,yl,zl] ~ <SYMNAME>[xh,yh,zh]		
INT UINT WORD	Single	<SYMNAME>.00 ~ <SYMNAME>.15	<SYMNAME>	L/H	*1*3
	1D Array	<SYMNAME>[xl].00 ~ <SYMNAME>[xh].15	<SYMNAME>[xl] ~ <SYMNAME>[xh]		
	2D Array	<SYMNAME>[xl,yl].00 ~ <SYMNAME>[xh,yh].15	<SYMNAME>[xl,yl] ~ <SYMNAME>[xh,yh]		
	3D Array	<SYMNAME>[xl,yl,zl].00 ~ <SYMNAME>[xh,yh,zh].15	<SYMNAME>[xl,yl,zl] ~ <SYMNAME>[xh,yh,zh]		
ENUM	Single	-	<SYMNAME>		*1
	1D Array		<SYMNAME>[xl] ~ <SYMNAME>[xh]		
	2D Array		<SYMNAME>[xl,yl] ~ <SYMNAME>[xh,yh]		
	3D Array		<SYMNAME>[xl,yl,zl] ~ <SYMNAME>[xh,yh,zh]		
DINT DWORD UDINT	Single	<SYMNAME>.00 ~ <SYMNAME>.31	<SYMNAME>	-	*1
	1D Array	<SYMNAME>[xl].00 ~ <SYMNAME>[xh].31	<SYMNAME>[xl] ~ <SYMNAME>[xh]		
	2D Array	<SYMNAME>[xl,yl].00 ~ <SYMNAME>[xh,yh].31	<SYMNAME>[xl,yl] ~ <SYMNAME>[xh,yh]		
	3D Array	<SYMNAME>[xl,yl,zl].00 ~ <SYMNAME>[xh,yh,zh].31	<SYMNAME>[xl,yl,zl] ~ <SYMNAME>[xh,yh,zh]		
DATE DT POINTER REAL TIME TOD	Single	-	<SYMNAME>	-	*1
	1D Array		<SYMNAME>[xl] ~ <SYMNAME>[xh]		
	2D Array		<SYMNAME>[xl,yl] ~ <SYMNAME>[xh,yh]		
	3D Array		<SYMNAME>[xl,yl,zl] ~ <SYMNAME>[xh,yh,zh]		
LWORD LINT ULINT	Single	<SYMNAME>.00 ~ <SYMNAME>.31	<SYMNAME>	-	*1*5
	1D Array	<SYMNAME>[xl].00 ~ <SYMNAME>[xh].31	<SYMNAME>[xl] ~ <SYMNAME>[xh]		
	2D Array	<SYMNAME>[xl,yl].00 ~ <SYMNAME>[xh,yh].31	<SYMNAME>[xl,yl] ~ <SYMNAME>[xh,yh]		
	3D Array	<SYMNAME>[xl,yl,zl].00 ~ <SYMNAME>[xh,yh,zh].31	<SYMNAME>[xl,yl,zl] ~ <SYMNAME>[xh,yh,zh]		
LREAL	Single	-	<SYMNAME>	-	*1*5
	1D Array		<SYMNAME>[xl] ~ <SYMNAME>[xh]		
	2D Array		<SYMNAME>[xl,yl] ~ <SYMNAME>[xh,yh]		
	3D Array		<SYMNAME>[xl,yl,zl] ~ <SYMNAME>[xh,yh,zh]		

STRING	Single	-	<SYMNAME>	-	*1*4
	1D Array		<SYMNAME>[xl] ~ <SYMNAME>[xh]		
	2D Array		<SYMNAME>[xl,yl] ~ <SYMNAME>[xh,yh]		
	3D Array		<SYMNAME>[xl,yl,zl] ~ <SYMNAME>[xh,yh,zh]		

"xl"	1st Dimension Lower Range	Negative range not supported Lower range is '0' or upper
"xh"	1st Dimension Upper Range	
'yl'	2nd Dimension Lower Range	Negative range not supported Lower range is '0' or upper
'yh'	2nd Dimension Upper Range	
'zl'	3rd Dimension Lower Range	Negative range not supported Lower range is '0' or upper
'zh'	3rd Dimension Upper Range	

*1 - <SYMNAME>: Symbol Name including structure name in case of structure. The maximum number of characters for Symbol Name is 255 including delimiters and element number. The maximum number of characters when using D-Script is limited to 54.
Example:

BOOL type single symbol	"BOOLSYMBOL"
BOOL type 1D Array	"BOOL1D[10]
WORD type 2D Array	"WORD2D[10,10]
UDINT type 3D Array	"UDINT3D[0,1,2]
STRING in User Defined Structure [STRUCT001]	"STRUCT001.STRINGSYM"

- You cannot start names with any of the following text:
  LS, USR, SCR, PRT

*2 – Handled as 8 bit devices in the External Device, but as 16-bit devices in GP-Pro EX. Upper byte is set to 0 in GP-Pro EX.
*3 - By default, 16 words are used for the system data area. If you want to use less than 16 words, first you need to map an array tag greater than 16 words and define the items for the system data area.
*4 - Parts for which a STRING device is set do not support the Duplicate - Automatically Increment Address feature. Specify the STRING length / 2 as offset to duplicate when ARRAY of STRING. Last character of a STRING can not be displayed / changed if STRING size is odd number of characters.

*5 – Handled as 64 bit devices in the External Device, but as 32-bit devices in GP-Pro EX. Upper 32 bit information is discarded in GP-Pro EX.

NOTE

- Please make sure at least one WORD type symbol exists in the project.
- This driver cannot use the array of structure.

6 Symbol access settings

6.1 Overview

This chapter will first explain the steps to import symbols from PLC projects step by step, and the individual configuration dialogs for symbol access will be explained.

6.2 Step by step guide to use symbol addresses in GP-Pro EX

1) Scope

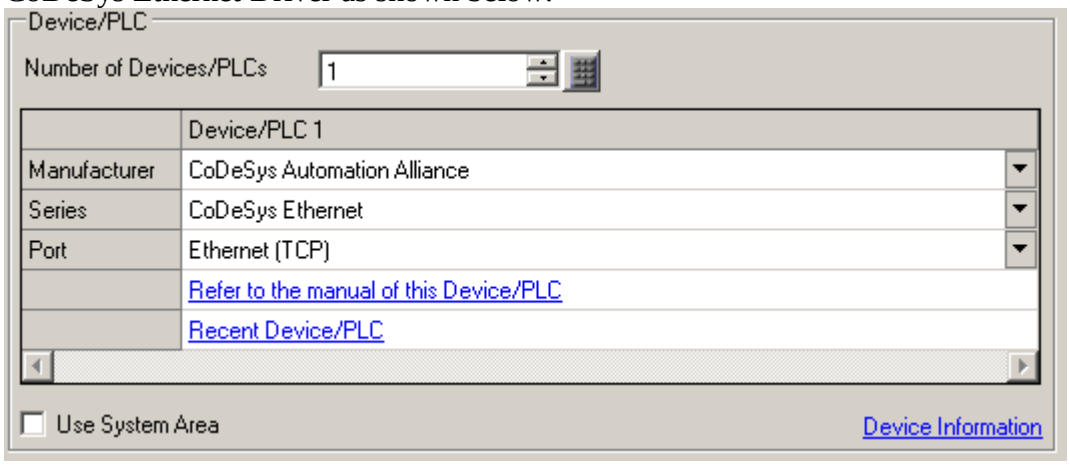
This section explains the step by step procedure to import symbols from PLC Project. Note: “First Steps.pro” from sample project in CoDeSys Programming Software used here as PLC Project.

2) Prepare PLC Project

a. From CoDeSys Programming environment, select menu [File] ➔ [Open] to open a PLC project.
b. Select [Options] from [Project] to open [Options] dialog.
c. In the dialog, select [Symbol configuration].
d. Check [Dump XML symbol table].
e. Select [Configure symbol file …] to open [Set object attributes] dialog.
f. In the dialog, check [Export variables of object] for every variable list of which symbols need to be exported.
g. From menu [Project] select [Rebuild All] and build the project.

3) Prepare GP-Pro EX Project

a) In GP-Pro EX, create a new project. In [Device/PLC] selection, select CoDeSys Ethernet Driver as shown below.

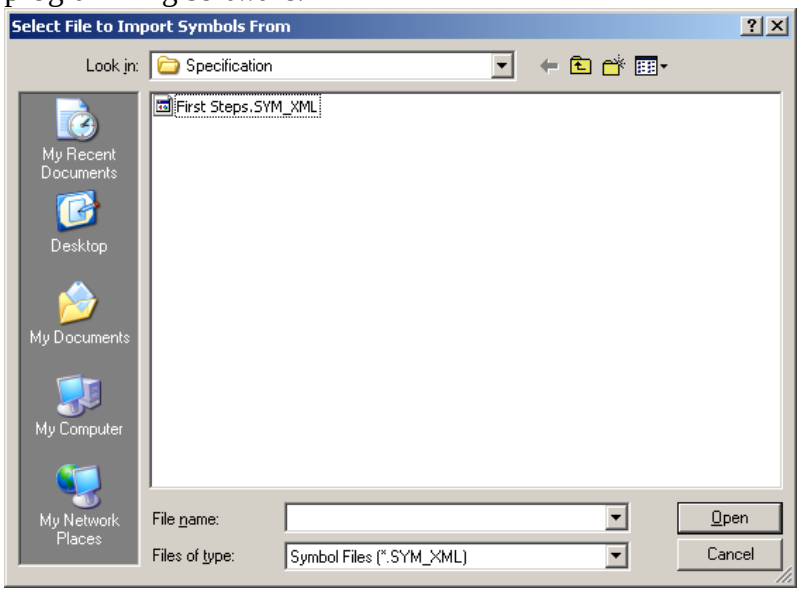


b) From [Device-Specific Settings], select [Individual Device Settings].

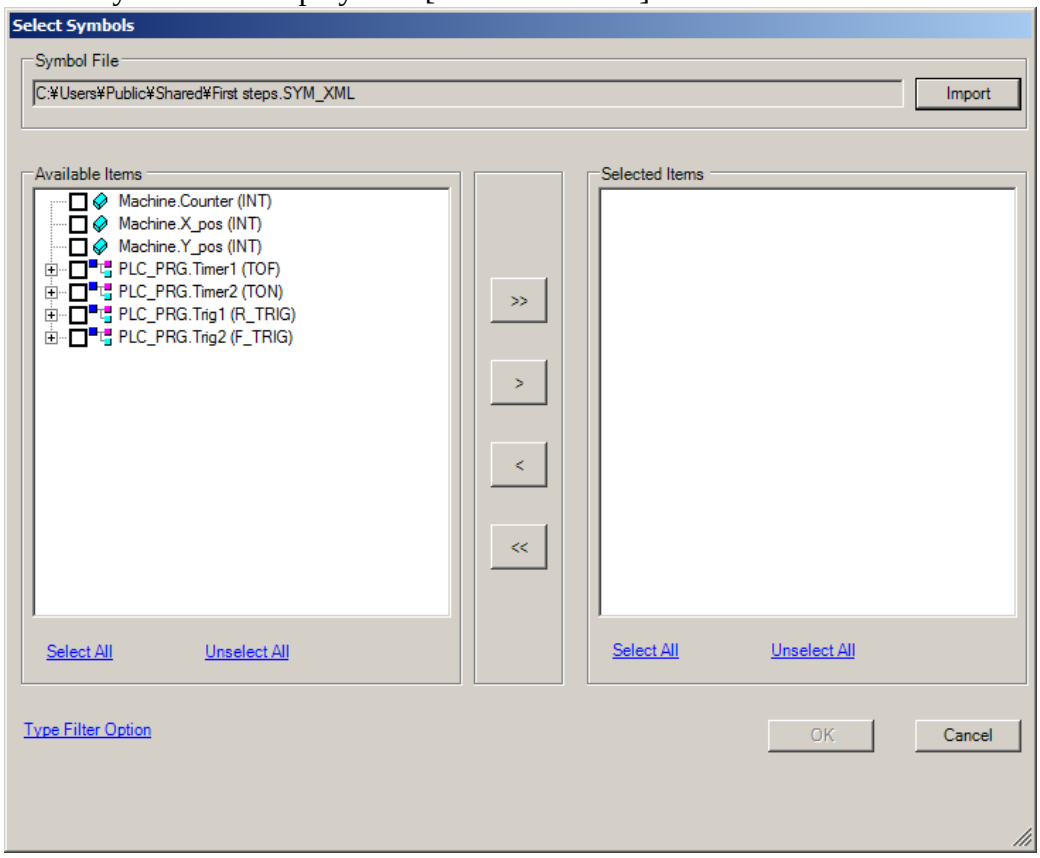
c) Select [Symbolic Address] as access method.

d) Click [Import] button and click again [Import] button in Symbol Selection Dialog.

4) Import Symbols
   a) Select the symbol file (*.SYM_XML) saved in the PLC project by the PLC programming software.



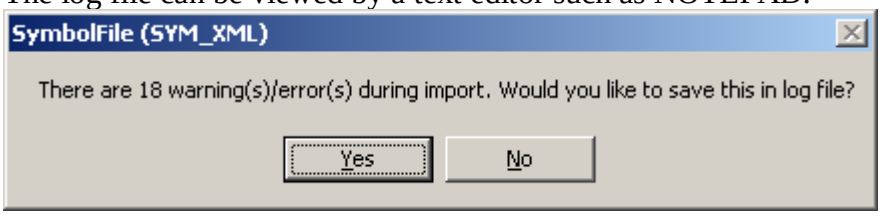
   b) All the symbols are displayed in [Available Items].



c) By clicking >> (copy all), or > (copy checked) buttons, symbols can be copied to [Selected Items]. By clicking on the check box next to each symbol, individual symbols can be selected. Selected symbols are shown in red.

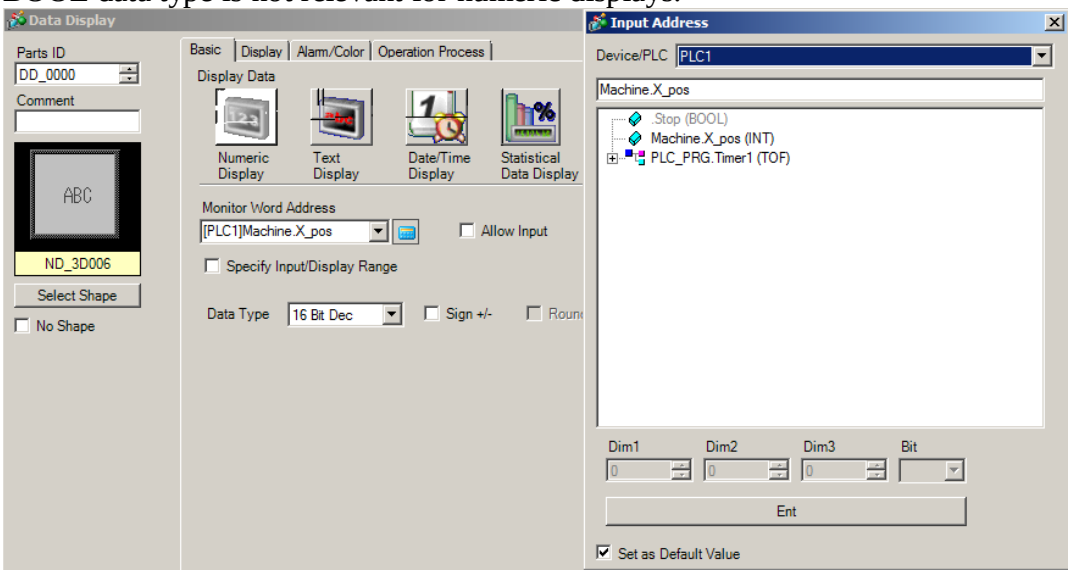
d) After the selection of symbol, close the dialog with [OK] button.
(Note: All symbols are selected to import in GP-Pro EX in this example.)

e) If any warning or error has occurred during import, the following message will be shown so that the warning and/or error message can be saved into a log file. The log file can be viewed by a text editor such as NOTEPAD.

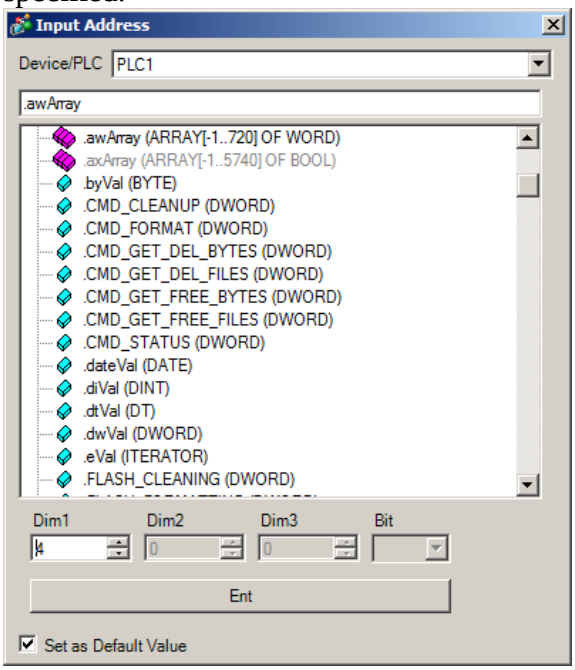


5) Use Symbols in screen parts

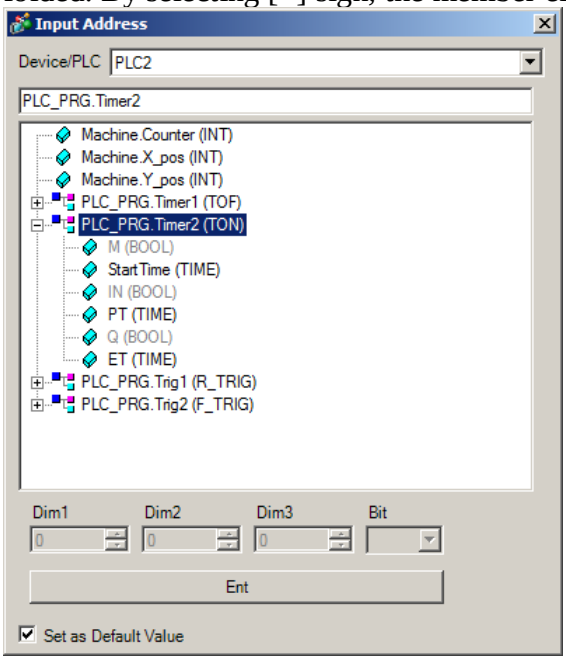
a. In Address dialog, these available symbols are displayed for use it in Screen data. Symbols irrelevant for the current screen part are grayed out. (For example, BOOL data type is not relevant for numeric displays.



b. When a symbol of an array type is selected, indexes of each dimension need to be specified.



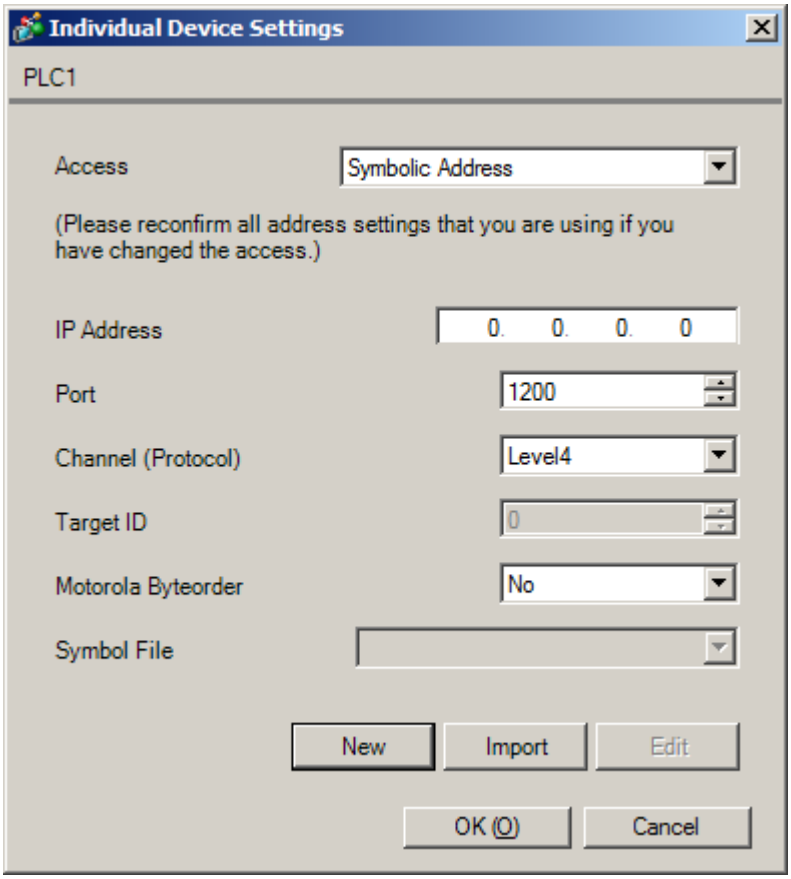
c. A user-defined data type is displayed with having its internal member elements folded. By selecting [+] sign, the member elements can be expanded.



6.3 Description of setting dialogs

6.3.1 Individual Device Settings

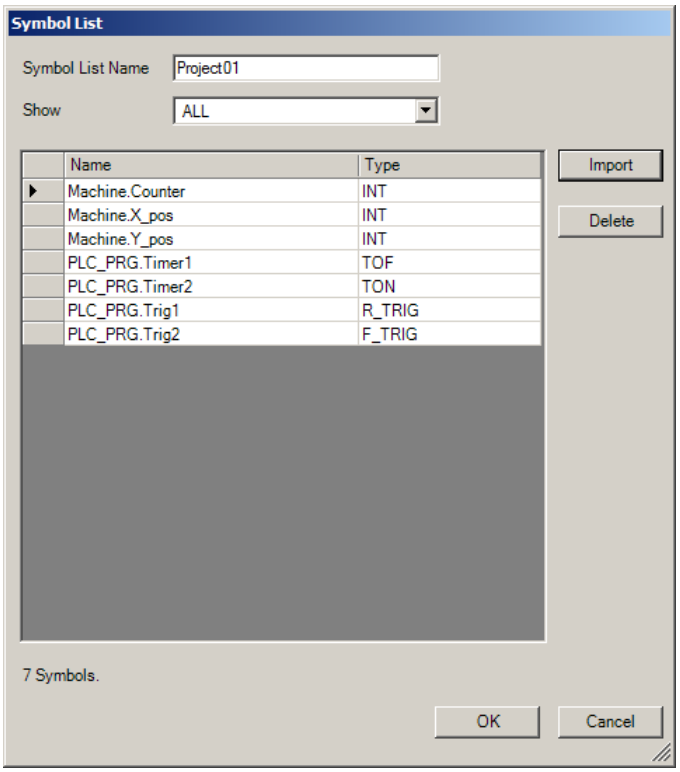
The symbol addresses to be used in GP-Pro EX need to be registered. Via [Individual Device Settings] a new symbol file can be created import symbols from PLC projects.



Setup Items	Description
Symbol File	Displays the name of the symbol file currently in use by the selected node.
New	Creates an empty symbol list and opens it in [Symbol List] dialog.
Import	Opens [Select Symbols] dialog where more symbols can be imported into the current symbol file from another.
Edit	Opens [Symbol List] dialog with the symbols currently loaded.

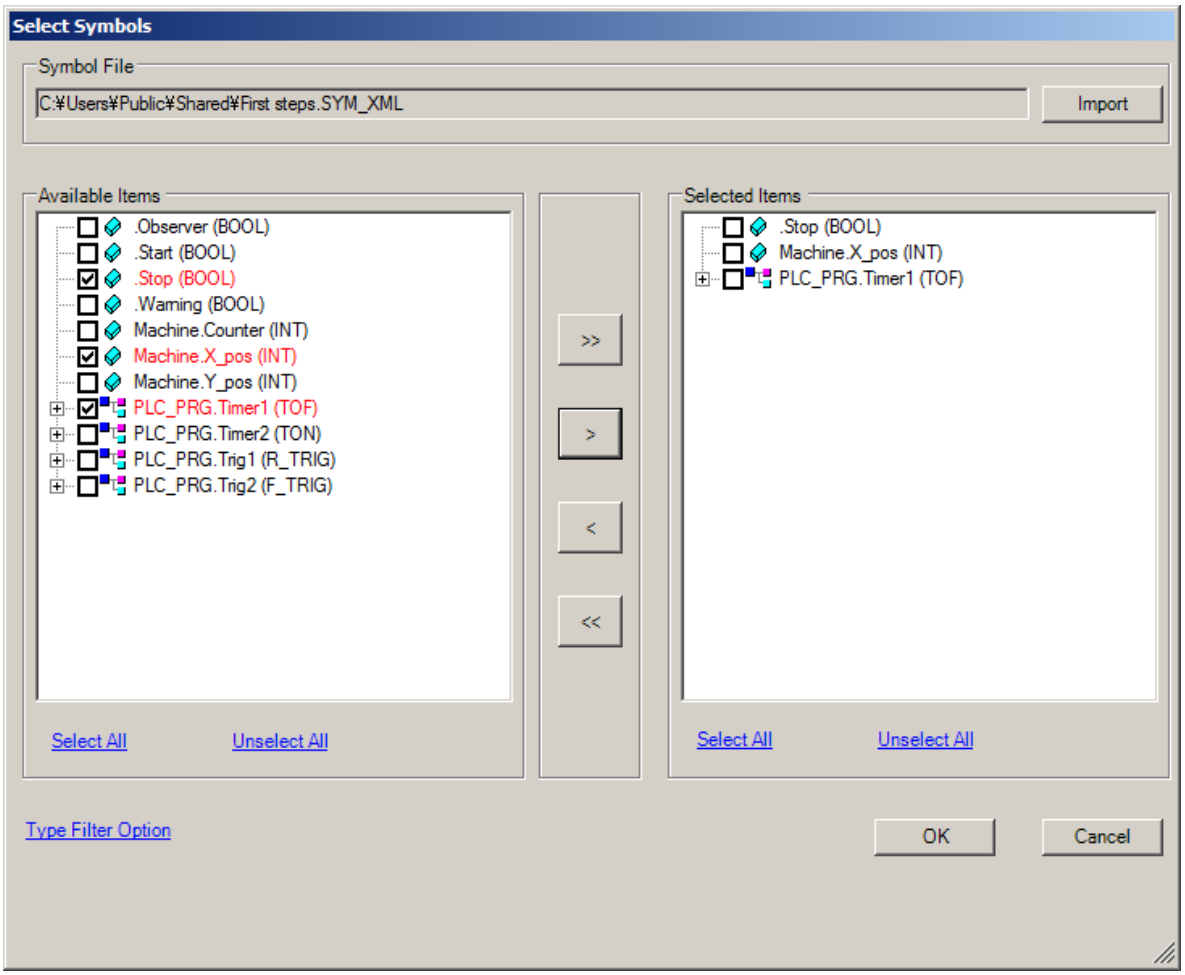
6.3.2 Symbol List

The following dialog can be opened via [Import] button on [Symbol List] or [Individual Device Settings] dialog.



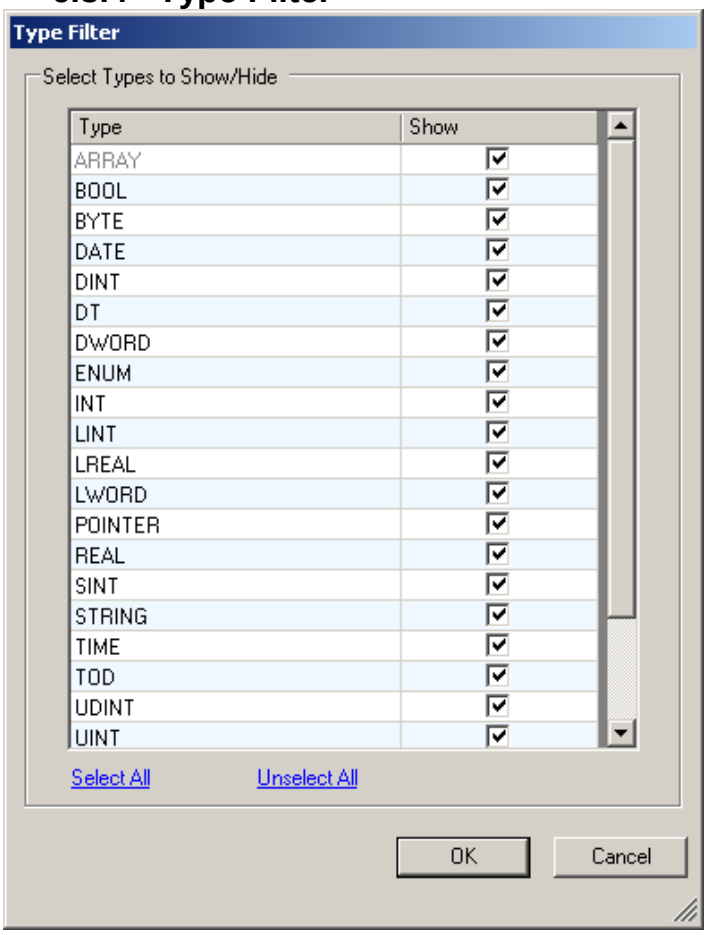
Setup Items	Description
Symbol List Name	Shows the name of the currently selected symbol file.
Show	Selects the data type of the symbol addresses to be displayed. All the symbol addresses of the type other than selected will be hidden. If “ALL” has been selected, all the symbol addresses will be displayed.
Import	Opens [Select Symbols] dialog to import additional symbol addresses into the current symbol list.
Delete	Removes the selected symbol address from the symbol list.

6.3.3 Select Symbols



Setup Items	Description
Symbol File	Displays the symbol file (*.SYM_SML) selected previously.
Import	Opens a dialog to select a symbol file (*.SYM_SML).
Available Items	Displays the symbols in the selected symbol file.
Selected Items	Displays the selected symbols to be stored in GP-Pro EX.
>> (Copy all)	Adds all the displayed symbols to the list of selected items.
> (Copy checked items)	Adds only the checked symbols to the list of selected items.
< (Remove checked items)	Removes only the checked symbols from the list of selected items.
<< (Remove all)	Removes all the symbols from the list of selected items.
Select All	Sets checks to all the displayed symbols.
Unselect All	Removes the checks from all the displayed symbols.
Type Filter Option	Opens [Type Filter] dialog to configure the symbol type filter. (See 6.3.4) When large amount of symbols are used in PLC project, and only WORD symbols are needed in GPPPRO EX project, user can set the type filter to display only WORD type symbols.

6.3.4 Type Filter



Setup Items	Description
Select All	Sets checks to all the displayed data types.
Unselect All	Removes the checks from all the displayed types.
Type	Data type
Show	Sets the visibility of the symbols of the data type in [Select Symbols] dialog (see 6.3.3).

7 Device Code and Address Code

Use device code and address code when you select "Device Type & Address" for the address type in data displays.

Device	Device Name	Device Code
Input	%I	0x0080
Output	%Q	0x0081
Marker	%M	0x0083

NOTE When [Symbol Address] is selected for [Access] the device code and address code must not be used.

8 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	Requirements
No.	Error No.
Device Name	Name of the External Device where error occurs. Device name is a title of the External Device set with GP-Pro EX.(Initial value[PLC1])
Error Message	Displays messages related to the error which occurs.
Error Occurrence Area	Displays IP address or device address of the External Device where error occurs, or error codes received from the External Device. NOTE • IP address is displayed such as "IP address(Decimal): MAC address(Hex)". • Device address is displayed such as "Address: Device address". • Received error codes are displayed such as "[Hex]".

Display Examples of Error Messages
“RHAA065:PLC1: TCP connection open error (IP Address: 192.168.1.1)”

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.