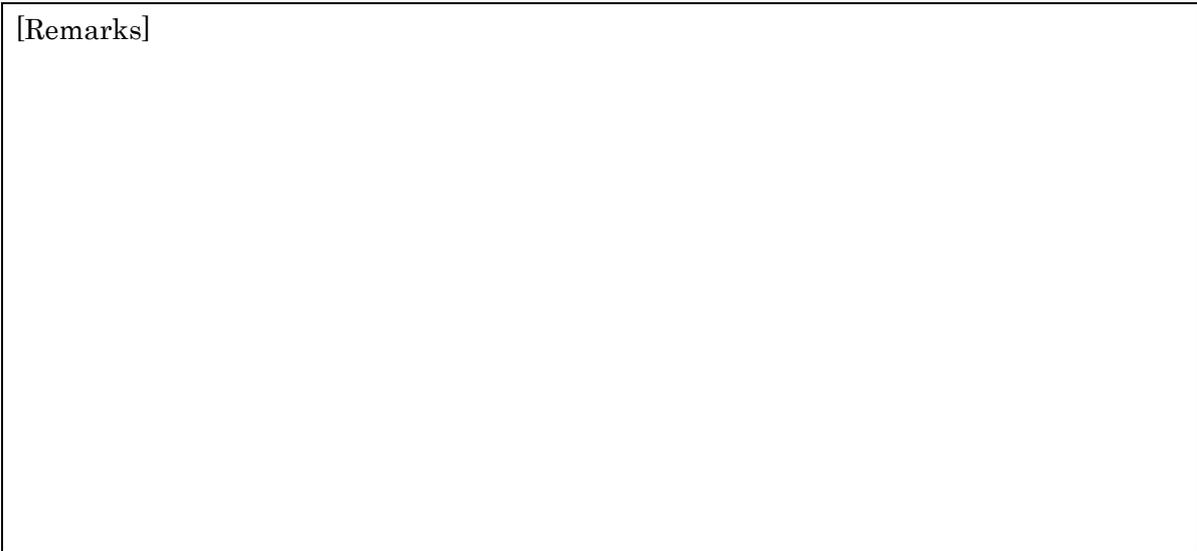# MELSEC QnA3E Provider

Mitsubishi Q series E71 QnA-compatible 3E frame

Version 1.1.3

User's guide

October 29, 2021

[Remarks]

[Revision History]

Version	Date	Content
1.0.0	2015-5-7	First edition
1.1.0	2016-2-3	Added VT, Elem, and Array for the option of CaoController::AddVariable method. Added the following character strings for the entry of VT option and Type option. Bool, I1, UI1, I2, UI2, I4, UI4, R4, R8, BSTR, Float, Double, String
1.1.1	2019-09-04	Bug fixed, param option.
1.1.2	2019-09-09	Added ASCII for the option of CaoController:AddController method.
1.1.3	2020-04-20	Bug fixed, AddVariable.
	2020-10-30	Added Appendix
	2021-10-29	Added a list of request destination unit I / O numbers and station numbers that can be specified. Corrected the notes of I1 and UI1 of VT item.

[Operation check model]

Model	Version	Notes
Q04UDVCPU		MELSEC Q-series
R02CPU		MELSEC iQ-R-series

Contents

1. Introduction

This is a user's guide for MELSEC QnA3E provider that is one of the CAO provider. MELSEC QnA3E provider is designed for MELSEC Q-series QnA-compatible 3E frames manufactured by Mitsubishi Electric Corporation.

MELSEC QnA3E provider establishes communication with an Ethernet communication unit of Mitsubishi's sequencer MELSEC Q-series through MC protocol.

2. Overview of provider

2.1. Overview

  MELSEC QnA3E provider is a CAO provider that absorbs dependence on an Ethernet communication unit, which is designed to communicate with Mitsubishi's sequencer. This provider also provides functions specified by CAO provider interface specification. The file format is DLL (Dynamic Link Library) and it is dynamically uploaded from the CAO engine. To use MELSEC QnA3E provider, you need to install ORiN2SDK, or, complete registration manually based on the following information.

Table 2-1 MELSEC QnA3E provider

File name	CaoProvMELSECQnA3E.dll
ProgID	CaoProv.MELSEC.QnA3E
Registry registration[1]	Regsvr32 CaoProvMELSECQnA3E.dll
Remove registry registration	Regsvr32 /u CaoProvMELSECQnA3E.dll

2.2. Precautions on Use

2.2.1. Connection with an Ethernet communication unit

  For the way of connection between a PC and an Ethernet communication unit, refer to the Ethernet communication unit user's manual from Mitsubishi Electric Corporation.

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[1] If the registry is installed by ORiN SDK, you do not need to register/delete it manually

2.3. Method and Property

2.3.1. CaoWorkspace::AddController method

In MELSEC QnA3E provider, initial processing for Ethernet communication will be executed once a Controller object is created. When establishing connection, specify a device with option character strings.

Syntax   AddController(<bstrCtrlName: BSTR>,<bstrProvName: BSTR>,

<bstrPcName: BSTR   >   [,<bstrOption: BSTR>])

bstrCtrlName	: [in] Controller name
bstrProvName	: [in] Provider name. Fixed value =" CaoProv.MELSEC.QnA3E".
bstrPcName	: [in] Machine name where provider operates
bstrOption	: [in] Option character string

Table 2-2 Option character string of CaoWorkspace::AddController

Option	Description
Conn=<connection parameter>	This option is not omittable. Set a communication format and its connection parameters.
ASCII=<True or False>	The communication data code is specified. False : binary communication True : ASCII communication (default : False)
Timeout=<value>	Set the timeout value in millisecond for TCP communication. (Default: 5000)

2.3.1.1. Conn option

The following shows connection parameter strings for Conn option.

"Conn= ETH: <IP Address>: <Port No>"

"Conn= TCP: <IP Address>: <Port No>"

<IP Address>	:	IP address. Example: "127.0.0.1","192.168.0.1"
<Port No>	:	TCP connection port number. Any port number can be assigned.

2.3.2. CaoController∷AddVariable method

Create a variable object that is used to obtain/set a target communication unit information.

Syntax   AddVariable(<bstrName: BSTR > [,<bstrOption: BSTR>])

　　　　bstrName　　　　　　　：[in] Variable name

　　　　bstrOption　　　：[in] Option character string

Table 2-3 Option character string of CaoController∷AddVariable

Option	Description
Param=<variable parameter>	Set parameters of variables
VT=<Variable type>	Specify the data type to input/output device memory.
Type=<Variable type>	Specify the data type to input/output device memory. Note) If both VT option and Type option are specified, the entry of VT option is prioritized.
Elem=<Element count>	Specify the element count. To specify with hexadecimal, use the following format. 0x[0-9,A-F]+, &H[0-9,A-F]+, [0-9,A-F]+H
Elements=<Element count>	Specify the element count with hexadecimal. Note) If both Elem option and Elements option are specified, the entry of Elem option is prioritized.
Array=<True or False>	Specify whether value is obtained as array type even if only one element is retrieved.

In this method, setting a device code at the top of the variable name will enable to access MELSEC (Q-series) through a target communication unit. [2]

<Device>：

　　　Bit device：　SM, X, Y, M, L, F, V, B, TS, TC, SS, SC, CS, CC, SB, S, DX, DY

　　　Word device：　SD, D, W, TN, SN, CN, SW, Z, R, ZR

<Address>：　= Variable's address where a device points to. To specify an address, use decimal value or hexadecimal value.

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[2] For details, refer to Mitsubishi's Ethernet communication protocol reference.

Table 2-4 Device list

Device		Device code	Type	Address specification
Special relay		SM	Bit	Decimal
Special register		SD	Word	Decimal
Input		X	Bit	Hexadecimal
Output		Y		Hexadecimal
Internal relay		M		Decimal
Latching relay		L		Decimal
Annunciator		F		Decimal
Edge relay		V		Decimal
Link relay		B		Hexadecimal
Data register		D	Word	Decimal
Link register		W		Hexadecimal
Timer	Contact	TS	Bit	Decimal
	Coil	TC		
	Current value	TN	Word	
Retentive timer	Contact	SS	Bit	Decimal
	Coil	SC		
	Current value	SN	Word	
Counter	Contact	CS	Bit	Decimal
	Coil	CC		
	Current value	CN	Word	
Link special relay		SB	Bit	Hexadecimal
Link special register		SW	Word	Hexadecimal
Step relay		S	Bit	Decimal
Direct input		DX	Bit	Hexadecimal
Direct output		DY		Hexadecimal
Index register		Z	Word	Decimal
File register		R	Word	Decimal
		ZR		Decimal

[Example]   "X0" , " Y1F", "D50" , "M350"

2.3.2.1. Param option

The following shows connection parameter strings of Param option. Parameters enclosed with square brackets ("[]") are omittable.

"Param=[<NetworkNo>: <PCNo>: < UnitIONo >: < UnitStationNo > [: <CPUTimer >]]"

< NetworkNo >   : Network number. Default: 00 $_H$

< PCNo >   : PC number. Default: FF $_H$

< UnitIONo >   : I/O number. Default: 03FF $_H$

< UnitStationNo >   : Station number. Default: 00 $_H$

< CPUTimer >   : CPU monitoring timeout. Default: 0000 $_H$ (Infinite)

[Example]   "X0", "Param = 00: FF: 03FF: 00: 0000"   Obtain the value of X0

Table 2-5 List of request destinations module I/O No that can be specified

	Access station of the other device	Request destination module I/O No specified by the other device
1	Control CPU	03D0$_H$
2	Standby CPU	03D1$_H$
3	A system CPU	03D2$_H$
4	B system CPU	03D3$_H$
5	Multi-CPU system No. 1	03E0$_H$
6	Multi-CPU system No. 2	03E1$_H$
7	Multi-CPU system No. 3	03E2$_H$
8	Multi-CPU system No. 4	03E3$_H$
9	Management CPU	03FF$_H$
10	Station C24 management CPU on multi-drop connection (Specify 1 to 9 above when accessing the CC-Link IE controller network, CC-Link IE field network, MELSECNET / H, MELSECNET / 10 connection station sequencer that goes through last)	0000$_H$~01FF$_H$

Table 2-6 List of request destination unit station numbers that can be specified

	Access station of the other device	Request destination unit station number specified by the other device
1	Stations other than the following	00_H (0)
2	Stations on multi-drop connections (When accessing the CC-Link IE controller network, CC-Link IE field network, MELSECNET / H, and Q / L / QnA CPU of the MELSECNET / 10 connection station via the last, refer to 1 above)	$00_H \sim 1F_H$ (0~31)

2.3.2.2. VT option

This option specifies the point count for one element of respective I/O types (1 point = 1 bit). If this option is not specified, data types specified by Type option are set automatically. If both VT option and Type option are not specified, the default data type of a variable is applied. For example, if Bit device is specified for a variable, "Bit" will be the default value. If Word device is specified a variable, "Word" will be the default value.

Table 2-7   VT option list

Type	Data type	points/element	Description
Bit	VT_I2	1 point	Read/Write data for every one bit (one point) of data. Note) Available to bit device (X, Y, M, etc.) only.
Bool	VT_BOOL	1 point	Read/Write data for every one bit (one point) of data. Note) Available to bit device (X, Y, M, etc.) only.
I1	VT_I1	8 points	Read/Write data for every eight points. Note) In Elements option or Elem option, if you specify odd number for the element count, it is converted to an even number by adding eight points filled with 0. example) Variable name: X0 Option: VT = I1, Elem = 1 When assigning a value, all X8 to XF will be 0.
UI1	VT_UI1	8 points	Read/Write data for every eight points. Note) In Elements option or Elem option, if you specify odd number for the element count, it is converted to an even number by adding eight points filled with 0. example) Variable name: X0 Option: VT = UI1, Elem = 1 When assigning a value, all X8 to XF will be 0.
I2 Word	VT_I2	16 points	Read/Write data for every word unit (16 points) of data.
UI2	VT_UI2	16 points	Read/Write data for every 16 points.
I4	VT_I4	32 points	Read/Write data for every 32 points.
UI4	VT_UI4	32 points	Read/Write data for every 32 points.
R4 Float	VT_R4	32 points	Read/Write data for every 32 points.

| R8 Double | VT_R8 | 64 points | Read/Write data for every 64 points. |
| BSTR String | VT_BSTR | 8 points | Read/Write character strings of ASCII (one letter : 8-bit). Note) If the length of character strings you entered is shorter than that of elements specified by Elements option, the remaining points are filled with 0. |

"[VT=[<VT option character string>]]"

[Example] "X0", "VT = I2"   Reads and writes the values from X0 to XF as VT_I2 types.

2.3.2.3. Type option

  Just like VT option, this option specifies data types (not recommended). If both Type option and VT option are specified, VT option is prioritized.

2.3.2.4. Elem option

Specify the element count with Decimal or Hexadecimal type. To specify with Decimal, enter the desired element count as-is. To specify with Hexadecimal, enter the element count with the format of "0x[0-9, A-F]+, &H[0-9, A-F]+, " or with the format of "[0-9, A-F]+H". If this option is not specified, the element counts specified by Elements option will be set. If both Elem option and Elements option are not specified, the element count should be "1".

Table 2-8 Available range

VT option	Device type	Available range		
		Access station-1[3]	Access station-2[4]	Access station-3[5]
Bit, Bool	Bit device	1 ≦ Element count ≦	1 ≦ Element count ≦	1 ≦ Element count ≦

[3] "Access station-1" describes the access to one of the following stations.
① C24/E71-mounted station (own station)
② Q/LCPU station (other station) via Q/L series-compatible network system (CC-Link IE controller network, MELSECNET/H, MELSECNET/10, Ethernet) / Intelligent device station with CC-Link IE field network/MELSECNET/H remote I/O station
③ C24 of above ① and ②, and Q/LCPU station with multidrop connection.
[4] "Access station-2" describes the access to one of the following stations.
① Q/QnACPU station (other station) via QnA series-compatible network system (MELSECNET/10,Ethernet)/MELSECNET/10 remote I/O station
② C24 mounted on above ① and Q/QnACPU station with multidrop connection (other station)
③ QnACPU and Q/QnACPU station (other station) via network system (MELSECNET/H, MELSECNET/10, Ethernet)/ MELSECNET/H, MELSECNET/10 remote I/O station
[5] "Access station-3" describes the access to the station other than *7 or *8.
        [Example] Sequencer CPU other than Q/L/QnACPU stations (other station)

		7168	3584	160
I1, UI1, BSTR, String	Bit device	1 ≦ Element count ≦ 1920	1 ≦ Element count ≦ 960	1 ≦ Element count ≦ 20
	Word device	1 ≦ Element count ≦ 1920	1 ≦ Element count ≦ 960	1 ≦ Element count ≦ 128
I2, UI2, Word	Bit device	1 ≦ Element count ≦ 960	1 ≦ Element count ≦ 480	1 ≦ Element count ≦ 10
	Word device	1 ≦ Element count ≦ 960	1 ≦ Element count ≦ 480	1 ≦ Element count ≦ 64
I4, UI4, R4, Float	Bit device	1 ≦ Element count ≦ 480	1 ≦ Element count ≦ 240	1 ≦ Element count ≦ 5
	Word device	1 ≦ Element count ≦ 480	1 ≦ Element count ≦ 240	1 ≦ Element count ≦ 32
R8, Double	Bit device	1 ≦ Element count ≦ 240	1 ≦ Element count ≦ 120	1 ≦ Element count ≦ 2
	Word device	1 ≦ Element count ≦ 240	1 ≦ Element count ≦ 120	1 ≦ Element count ≦ 16

"[Elem =[<Element count>]]"

(Example) "X0", "Elem = 5"   Retrieve the values of X0 to X4 as Bit value
(Example) "D10", "Elem = 0x10"   Retrieve the values of D10 to D25 as Word value
(Example) "D10", "Elem = &H10"   Retrieve the values of D10 to D25 as Word value
(Example) "D10", "Elem = 10H"   Retrieve the values of D10 to D25 as Word value
(Example) "M100", "Type = Word, Elem = 2"   Retrieve the values of X100 to X131 by Word-unit

2.3.2.5. Elements option

Just like Elem option, this option specifies the element count (not recommended). In Elements option,   specify the element count with Hexadecimal. If both Elements option and Elem option are specified, Elem option is prioritized

2.3.2.6. Array option

  This option specifies whether the read value is retrieved as array type, when all of the following conditions are satisfied:

        1) The entry of Enum option is 1.

        2) The entry of VT option is other than BSTR, or the entry of Type option is other than

String.

If this option is True, the read value is retrieved as array type. If this option is False, the read value is retrieved as the specified data type. This will be False if there is no entry.

"[Array=[< True or False >]]"

(Example) "X0", "VT=BOOL , Elem = 1, Array=True"   Retrieve the value of X0 as a BOOL type array.

(Example) "X0", "VT=BOOL , Elem = 1, Array=False"   Retrieve the value of X0 as BOOL type.

2.4. Error code

In MELSEC QnA3E provider, specific error codes shown below are defined. For about ORiN2 common errors, refer to the chapter of the error code on "ORiN2 programming guide".

<p align="center">Table 2-9 Specific error code list</p>

Error name	Error number	Description
Sum check error	0x80100100	Sum check error is detected.
Unit error	0x8010xxxx	If an error occurs in the Ethernet communication unit, an original error code of the Ethernet communication unit will be set to the "xxxx" area and returned. For details about error codes, refer to the manual of the Ethernet communication unit.
Communication error (format error)	0x80110000	It returns when the response packet is outside assumption. This error code returns when the communication data code is different from the setting of PLC.

2.5. Sample program

The following shows sample programs with MELSEC QnA3E provider and Visual C#. Sample programs are stored in the following folder.

"<ORiN2 SDK installed folder> /CAO/ProviderLib/Mitsubishi/MELSEC/QnA3E/SAMPLES/ QnA3ESample"

3. Appendix

3.1. Other station access

The Mitsubishi Electric Q series programmable controller can access other stations (acquire/write slave PLC values via the master PLC). This section explains the setting procedure for accessing other stations using the configuration shown in Figure 3-1 as an example. It is assumed that the parent/child PLC-PLCs are connected by a general-purpose Ethernet. Be sure to use Ethernet unit when connecting. Cannot be accessed through the built-in Ethernet unit. Use a hub or crossover cable to connect Ethernet units.
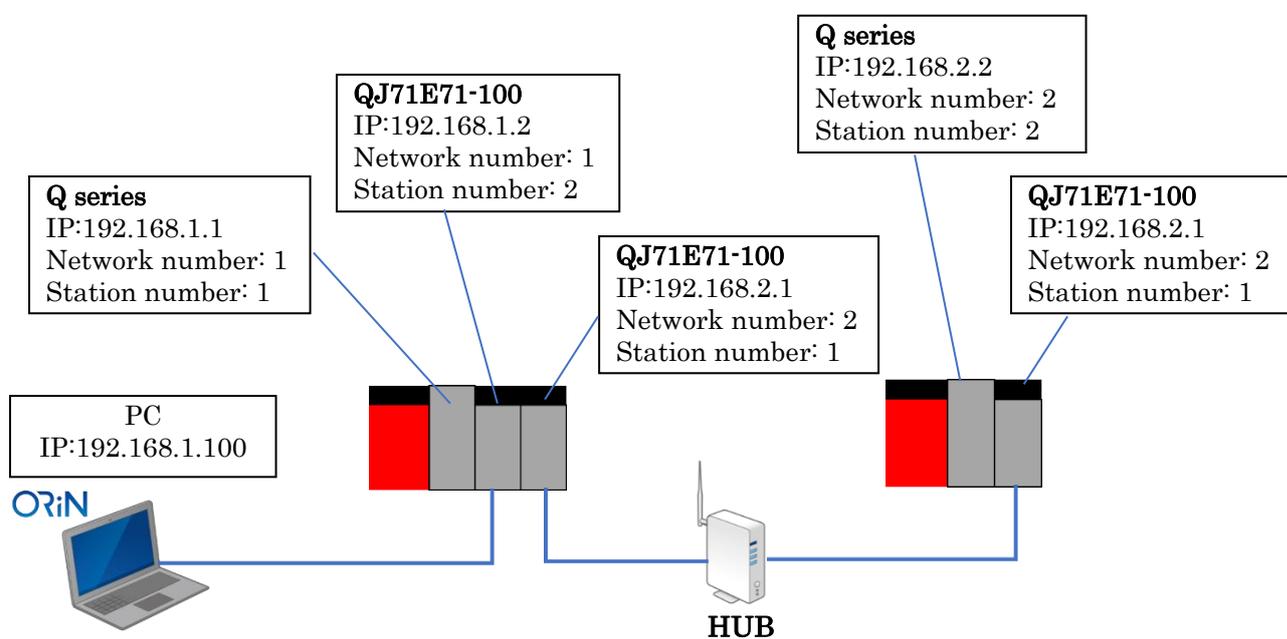
Figure 3-1 Configuration Diagram

3.1.1. Setting the parent PLC

3.1.1.1. Setting of built-in Ethernet unit

① to ④ in Figure 3-2 show the setting steps of the built-in Ethernet module.

    ① After connecting the PLC, click "PLC Parameter" on the navigation tree menu.

    ② Enter the IP address and subnet mask on the Q Parameter Setting screen.

    ③ Open MELSOFT Connection Extended Setting.

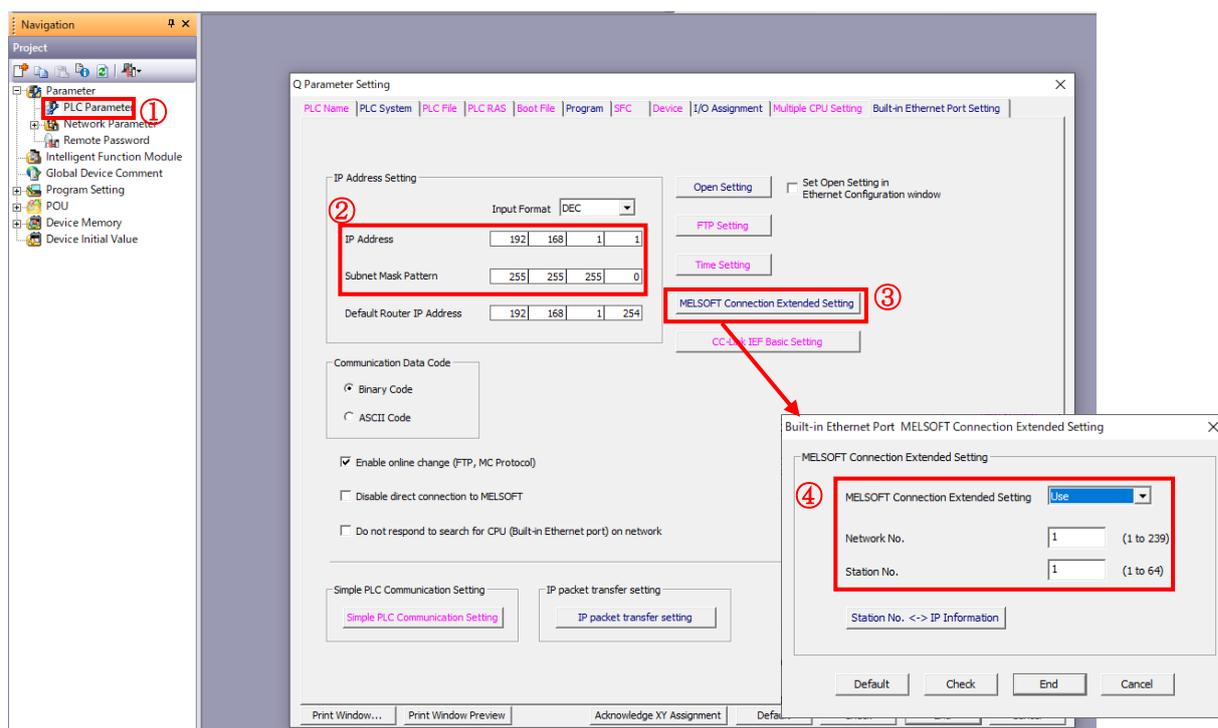   ④ Select "MELSOFT Connection Extended Setting: Use" and enter the network number and station number.

Figure 3-2 Built-in Ethernet module parameter setting (main PLCs)

3.1.1.2. Expansion Ethernet Unit 1 Setting

① to ④ in Figure 3-3 show the setting procedures of the extended Ethernet unit 1.

① From the navigation tree menu, click Ethernet/CC IE/MELSECNET.

② Select "Network type: Ethernet" in Unit 1 settings, and enter the network number and station number.
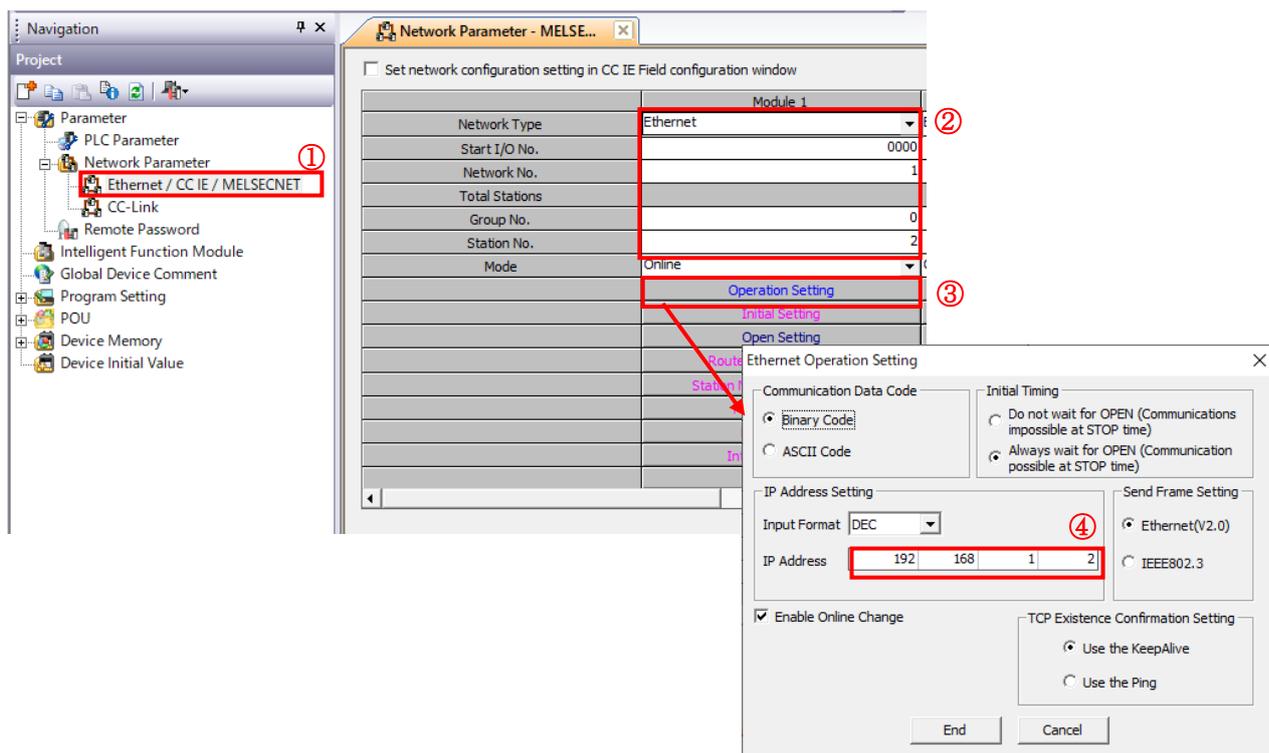
③ Opens the Operation Setting.

④ Enter the IP address.

Figure 3-3 Extended Ethernet unit 1 parameter setting

3.1.1.3. Expansion Ethernet Unit 2 setting

　① to ⑤ in Figure 3-4 show the setting steps of Expansion Ethernet Unit 2. The procedure for displaying the setting screen is the same as step ① of 3.1.1.2.3.1.1.2

　　　① Select "Network type: Ethernet" in Unit 2 settings, and enter the network number and station number.

　　　② Opens the Operation Setting.

　　　③ Enter the IP address.

　　　④ Open the Station No. <->IP Information.

　　　⑤ Select " Station No. <->IP Information System: Table Change System" and enter the Network No. and Station No. and IP address of the extended Ethernet unit of the subsidiary PLC.
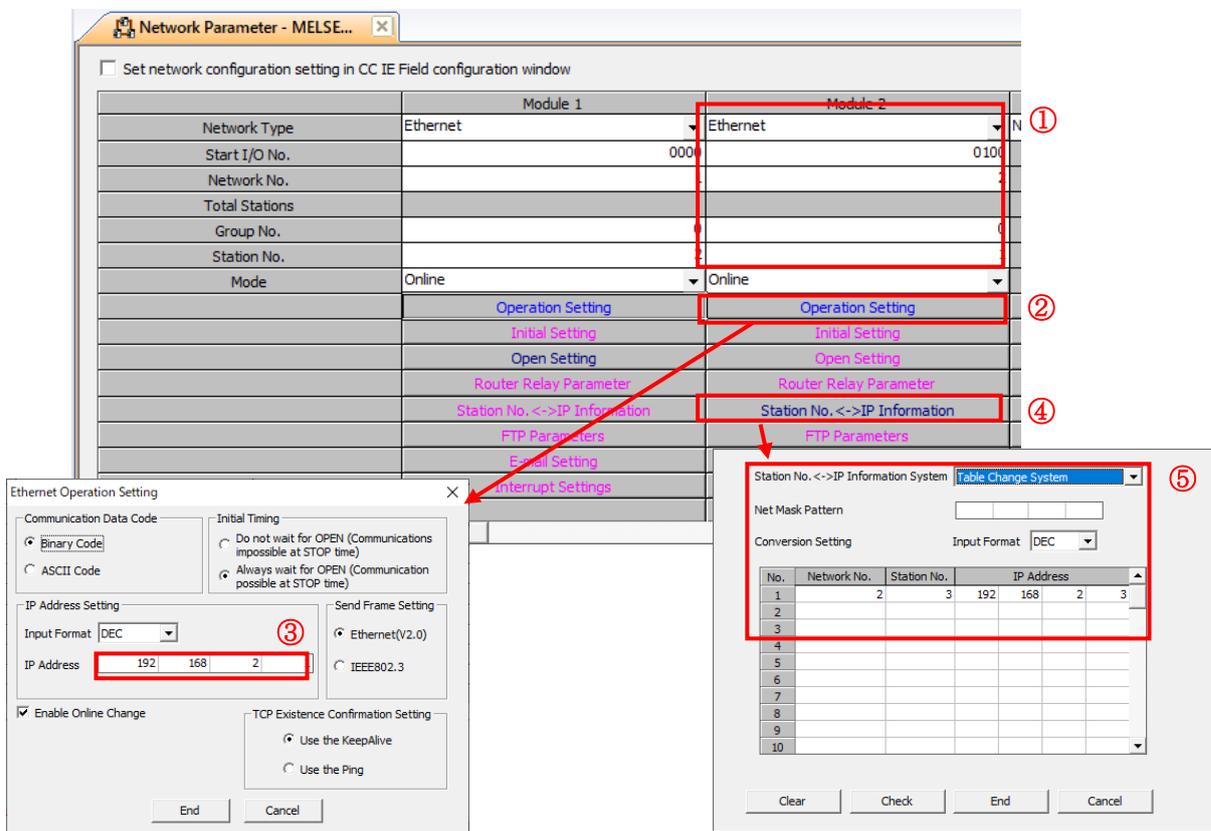

Figure 3-4 Extended Ethernet unit 2 parameter setting

3.1.2. Setting of child PLC

3.1.2.1. Setting of built-in Ethernet unit

① to ④ in Figure 3-5 show the setting procedures of the built-in Ethernet module.

　① After connecting the PLC, click "PLC Parameter" on the navigation tree menu.

　② Enter the IP address and subnet mask on the Q Parameter Setting screen.

　③ Open MELSOFT Connection Extended Setting.

　④ Select "MELSOFT Connection Extended Setting: Use" and enter the network number and station number.
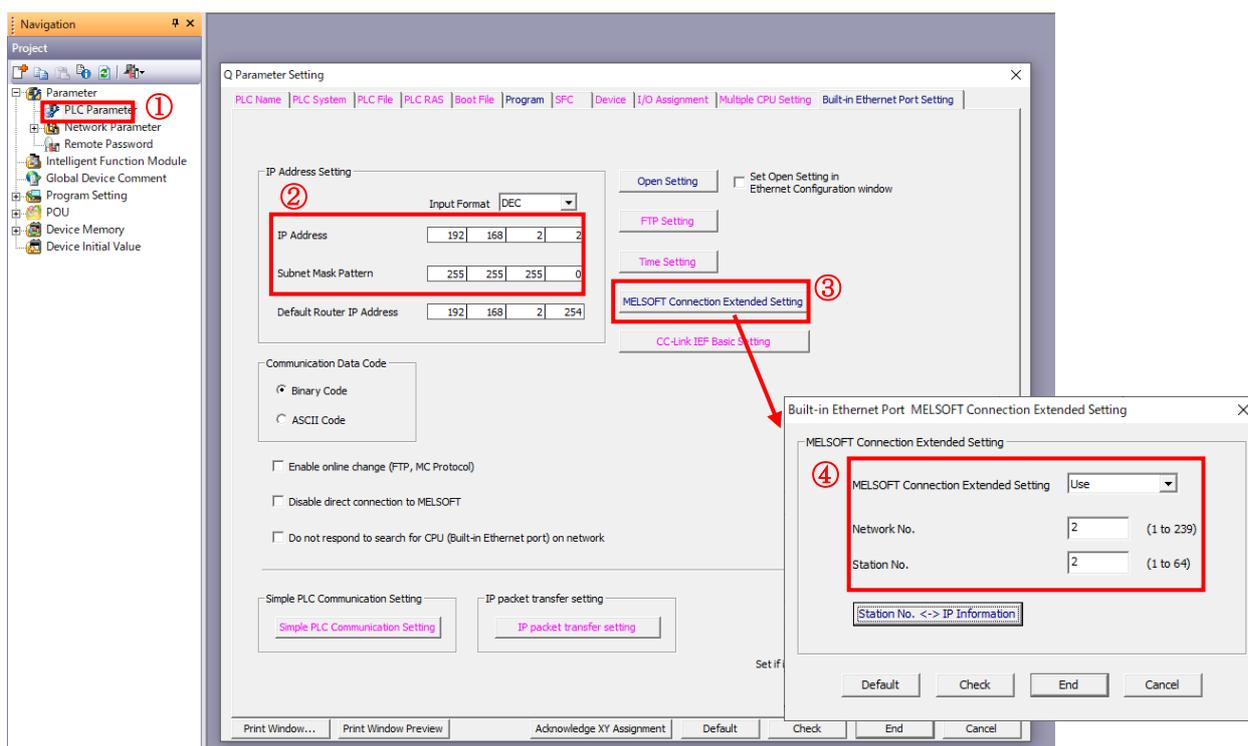

Figure 3-5 Built-in Ethernet module parameter setting (Child PLCs)

3.1.2.2. Expansion Ethernet Unit Settings

① to ④ in Figure 3-6 show the setting steps of Expansion Ethrenet Unit 1.

① From the navigation tree menu, click Ethernet/CC IE/MELSECNET.

② Select "Network type: Ethernet" in Unit 1 settings, and enter the network number and station number.

③ Opens the Operation Setting.
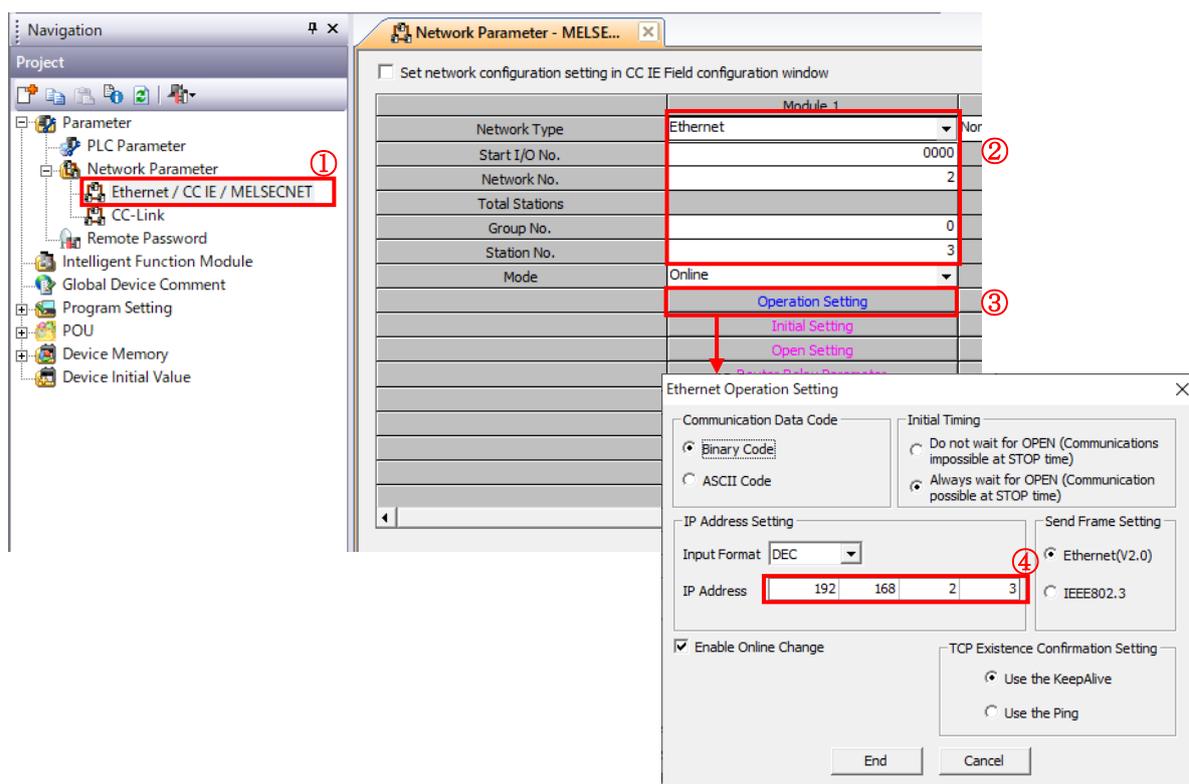
④ Enter the IP address.

Figure 3-6 Extension Ethernet unit settings (Child PLCs)

3.1.3. Connection parameter setting

To access other stations, set the following parameters when creating variable objects.

"Param=

<network number>:<PC number>:<request destination unit I/O number>:<request destination
  unit station number>[:<CPU monitoring timer>]"

<div style="margin-left:2em">

<Network number>   : The network number of the child PLC (in hexadecimal).

<PC number>   : station number (in 16th decile) of the child PLC.

<Request destination unit I/O number>   : 03FF (Management CPU)

<Request destination module station number>   : 00 (Non-multidrop connection).

<CPU Monitoring Timer>   : Optional.

</div>

(Examples) "X0", "Param = 02:03:03FF:00:0000" Gets the X0 values for PLCs with network
number 2 and network number 3