High-performance, Vector Control Inverter

FRENIC-VG

For PROFINET-IRT Interface

Interface Card: OPC-VG1-PNET
Applicable Inverter: FRN□□VG1S-□□PN

Product Specifications

Applicable inverter ROM Version : H1 02□□ / H2 02□□

Detail description is omitted for the subjects described in the VG1S manuals.
Refer to the VG1S manual and catalog together with this specification document.
- FRENIC-VG USER'S MANUAL MHT286□
- Functional Vector Control Inverter FRENIC-VG Series MH659□
- External Dimensions SA5A0414

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a	2013-10-31	K.Oie/K.Sato T.Momozu	- Added description that this option requires the didicated inverter. - Changed o102 value 21 to 101 as a free mappable format. - Changed content of format of STW1 and ZTW1. - Revised other mistaken discription.
b	2013-12-27	K.Oie/K.Sato /M.Mochizuki	- Corrected Type of Inverter. - Changed title of this document as For PROFINET Interface. - Added description about condition of sychronization and data updating.
c	2016-10-07	Y.Meng/ K.Sato	- Added description about A-F and A-E alarm. - Added description about function codes related to PROFINET-IRT. - All revision are made based on latest UM.
d	2016-12-06	Y.Meng/ K.Sato M.Hanazawa	- 3-6,7,8,9 four new chapters are added from UM Chapter 6

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1. Overview

1-1 Overview

This specification document describes PROFINET-IRT Interface Card "OPC-VG1-PNET" for FRENIC-VG and applicable inverter "FRN☐☐VG1S-☐☐PN" . PROFINET-IRT communications on this product have the following features:

＜Features＞

1. Applicable with PROFINET-IRT and RT
2. In conformity to PROFIdrive

1-2 Special Instruction

(1) Option card which is prohibited to mount together with PROFINET-IRT Interface Card

You cannot mount the following option cards while PROFINET-IRT Interface Card is mounted on the inverter unit.

[Option card prohibited to mount together with PROFINET-IRT Interface Card]

- CC-Link interface card (Model: OPC-VG1-CCL) (Er-5 alarm occurs when mounted together)
- T-link Interface Card (Model: OPC-VG1-TL) (Er-5 alarm occurs when mounted together)
- PROFIBUS-DP interface card (Model: OPC-VG1-PDP) (This card cannot be mounted together with PROFINET-IRT Interface Card for the structural reason.)
- DeviceNet Interface Card (Model: OPC-VG1-DEV) (This card cannot be mounted together with PROFINET-IRT Interface Card for the structural reason.)

(2) Applicable Inverter

To use this option card requires a dedicated type and ROM version of inverter that mentioned below. Please Note that this option cannot be worked except applicable inverter below mentioned. You can confirm the ROM version on mentainace view in the keypad.

- Type of Inverter : FRN ☐☐VG1S-☐☐PN (☐will be any character or number)
- ROM Version : H1 02☐☐ / H2 02☐☐ (☐will be any value of 10 to FF)

2. General Specifications

Table 2.1 Hardware specifications

Item	Specification
Name	PROFINET-IRT interface card
Transmission mode	100BASE-TX
Baud rate	100Mbps
Cable length	100m / 1 segment
Number of words occupied for transmission	32 words max. (I area 16 words/ Q area 16 words)
Terminal/Bus cable	2 ports ／ PROFINET special cable
Status indicator LEDs	The indicator LEDs displays the status (communication status/error status) of the self-station.

(1) Appearance

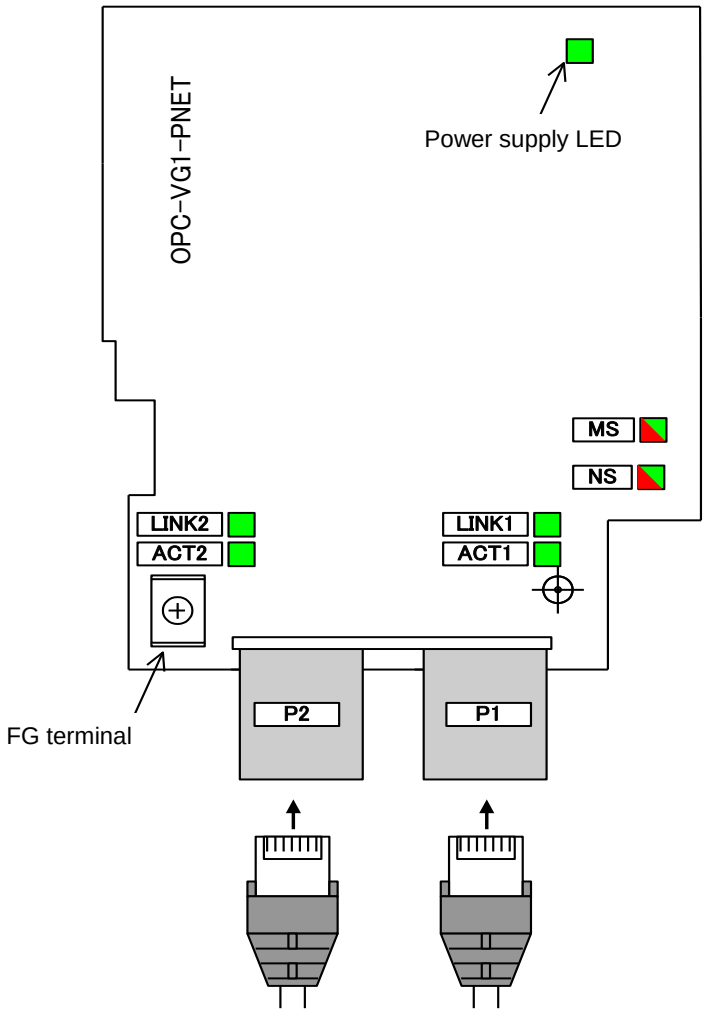


Figure 2-1 Apperance

(2) Status display LED

LEDs on the option card display the statuses of local stations.

Table 2-2 LED Display Statuses

Name	Color	Display	Status	Remarks
MS	Red/green	OFF	Resetting Interface Card CPU now	
		Red and green blink.	Initializing Interface Card CPU now	
		Red blinks. (1Hz)	PROFINET setting error	IP address error, etc.
		Red lights.	This card is failed or card is poorly inserted.	
		Green blinks. (1Hz)	Initializing connection with FRENIC-VG now	
		Green lights.	Normal operation	
NS	Red/green	OFF	No PROFINET communications	
		Red blinks. (2Hz)	Minor fault occurs in PROFINET communications .	When sending/receiving error occurs 6 times continuously.
		Red blinks. (1Hz)	Mismatched telegram between master and inverter.	It occurs when telegram set is different bitween PLC and o101 of the inverter.
		Red lights.	Serious fault occurs in PROFINETcommunications.	Master shuts down, etc.
		Green blinks.	Establishing PROFINET communications now. (PLC STOP)	
		Green lights.	Establishing PROFINET communications now. (PLC RUN)	
LINK1/2	Green	OFF	No Ethernet communications	
		Green lights.	Establising Ethernet communications now.	
ACT1/2	Green	OFF	No Ethernet sending/reception	
		Green lights.	Sending/receiving via Ethenet now.	
Power supply	Green	Green lights.	Interface of this card is ON.	

Table 2-3 Software Specifications

Item		Specifications
Data updating cycle		1ms(*1) min.
Data reflection delay (during synchronization with tact)		For 2-tact cycles (2ms delay for 1ms tact cycle)
Operation	Run command	Forward/Reverse rotation commands, alarm reset command X11 – X14 commands
	Speed /Torque command	1word data (Any function code can be allocated to Q area as other commands.)
	Operation running status output	Bit data, such as running, braking, torque limitation, and alarm relay output
		Any function code can be allocated to I area as output of motor speed (1word), torque current commands(1word), current returned position one-rotation data (2word), acceleration monitor (1 word, 2 words) or others.
Option function code		o30, o31, o101~o116, o122~o133, o160~o171
Protective function		Er-4: Network error (PROFINET communication error) (*2) ・Minor fault: The Er-4 alarm can be controlled with o30 or o31. ・Serious fault: Instantaneous alarm(Er-4) Ar-F ： Toggle fault error (*3) This error occurs when the 2 bit toggle signals [TGL1] and [TGL2】sent by PLC constantly have not been received over the time that set by H144. Ar-E ： PROFINET-IRT synchronize error This error occurs when synchronization between inverter control cycle and PROFINET-IRT sync signal cycle fails. It is usually caused by noise.

*1 The data update cycle depends on the carrier frequency setting and PROFINET communication. For details, refer to (3) and (4) mentioned below.

*2 For minor faults and serious faults, see “3-3 Protective Action”.

*3 For details of toggle signals and toggle fault error, please refer to description of [TGL1] and [TGL2] about E01~E13 code in “4.3 Function Code Details” of FRENIC-VG User’s Manual, unit type and function code “. In addition, it is necessary to make a program in PLC for generating ON / OFF pattern of [TGL1] and [TGL2] signal.

(3) Conditions required for synchronization of PROFINET-IRT

Connecting the card to the PROFINET-IRT makes it possible to synchronize the cycle of sync signal of PROFINET-IRT and the inverter control cycle. By doing this, the control timing of multiple inverters can be synchronized, making it easy to implement control that requires high-accuracy timing.

However, the processing that synchronizes the inverter control cycle and the E-SX bus tact cycle requires that the following conditions (1), (2) and (3) are satisfied all. If any condition is not satisfied, the cycle of sync and inverter control cycle will operate asynchronously. When the conditions are both satisfied, synchronization is performed automatically after PROFINET communication is established.

Table 2-4 Synchronization conditions

	Conditions
(1)	Connected by PROFINET-IRT High performance
(2)	Cycle of Sync of PROFINET is one of the follwing. 1ms, 2ms, 4ms
(3)	Inverter function code F26 is set as one of the following. In case of Unit type：4kHz, 8kHz(*1), In case of Stack type : 2kHz

*1 In case of MD (F80=3), F26 is set to 2kHz.

(4) Data Updating cycle

Table 2-5 Data updating cycle

Sync. Cycle of PROFINET-IRT	Inverter function code F26	Data updating cycle in VG(*3)	
1ms	2(*1), 4, 8	1ms	Synchronized
	3, 6, 12 to14	0.667ms or 1.334ms	The cycle is indeterminate because of not synchronized
	2(*2), 5, 10,11	0.8ms or 1.2ms	
2ms	2(*1), 4, 8	2ms	Synchronized
	3, 6, 12 to 14	1.334ms or 2ms	The cycle is indeterminate because of not synchronized
	2(*2), 5, 10,11	1.6ms or 2ms	
4ms	2(*1), 4, 8	4ms	Synchronized
	3, 6, 12 to 14	3.34ms or 4ms	The cycle is indeterminate because of not synchronized
	2(*2), 5, 10,11	3.6ms or 4ms	

*1 Only MD (F80=3) or Stack type

*2 Except MD or Unit type

*3 Except Operation command, Xterminals command, Status of operation and Y terminals states.

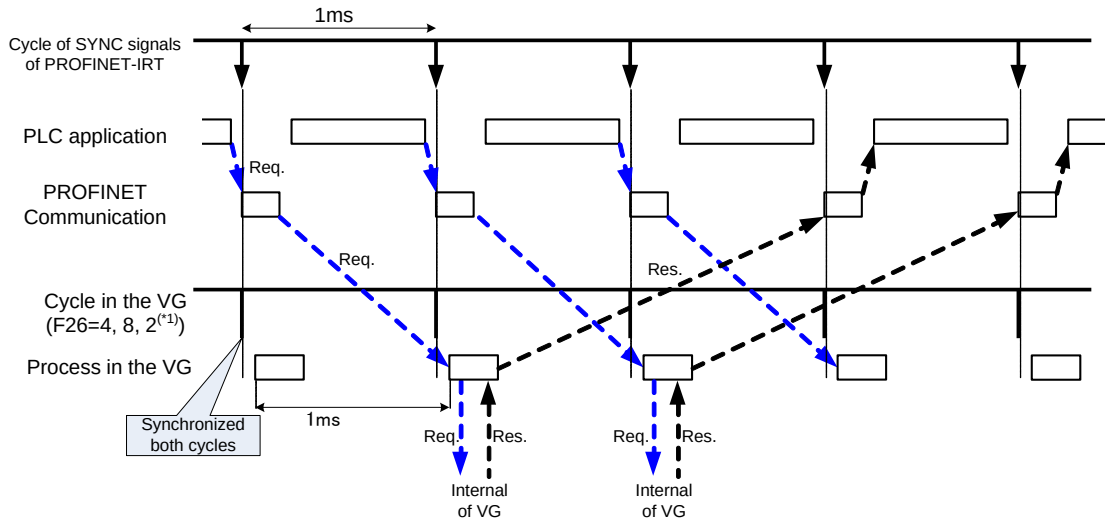


Figure 2-2 Timing chart in case of Synchronization (i.e 1ms sync.)

3. Detail Specifications

3-1 Basic Connection

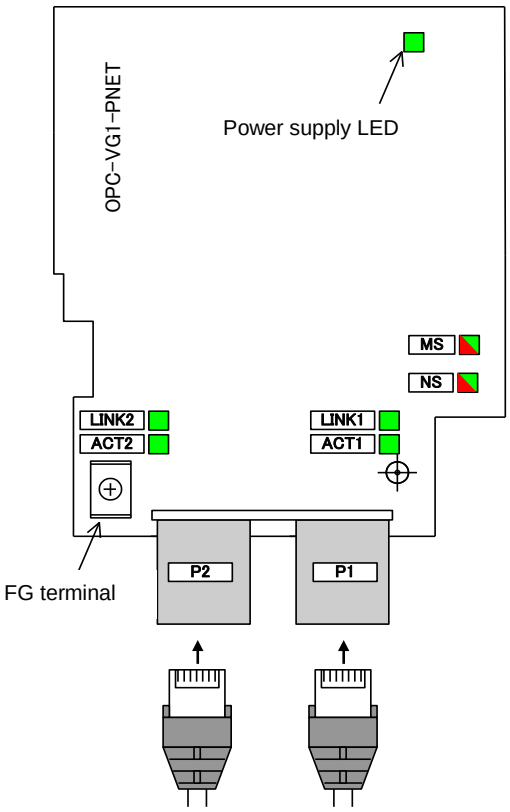


Figure 3-1 Connecting PROFINET Cable

With reference to "the attachment means of 6.1.4 incorporation form optional (OPC-VG1-☐☐)" of FRENIC-VG User's Manual (MHT286☐), perform wiring, work of the connection.

⚠WARNING
- Improper wiring causes an electric shock, fire or other disasters. Wiring must be performed by a qualified person. Before touching the electric circuits for wire connection after the power has been turned ON, turn OFF (open) the power breaker to prevent an electric shock. - Even if the breaker is turned OFF (open), the smoothing capacitor is still charged. So, you get an electric shock if you touch it. Confirm that the CHARGE indicator lamp for the inverter is OFF, and check the DC voltage of the inverter with a tester to see that it has dropped to or below the safe level.

⚠CAUTION
- Do not use the product if any part is damaged or missing. Injury or damage may result. - Improper operation during mounting or removal of the product may cause damage to it.

Observe the following precautions when connecting the product.

[Precautions about connection]

(1) Use the cable dedicated to PROFINET (for example, a PROFINET cable manufactured by Siemens)

(2) Before starting operation, confirm that the power for the PLC and for the inverter is turned OFF.

(3) To prevent malfunction of the inverter due to noise, keep the PROFINET cable at least 30 cm away from the main circuit wire and other power lines of the inverter, and do not place these wires together in a single duct.

(4) Connect the PROFINET cable to either of two Ethernet connectors (P1, P2). Cascade wiring is also available.

Example of basic connection diagram

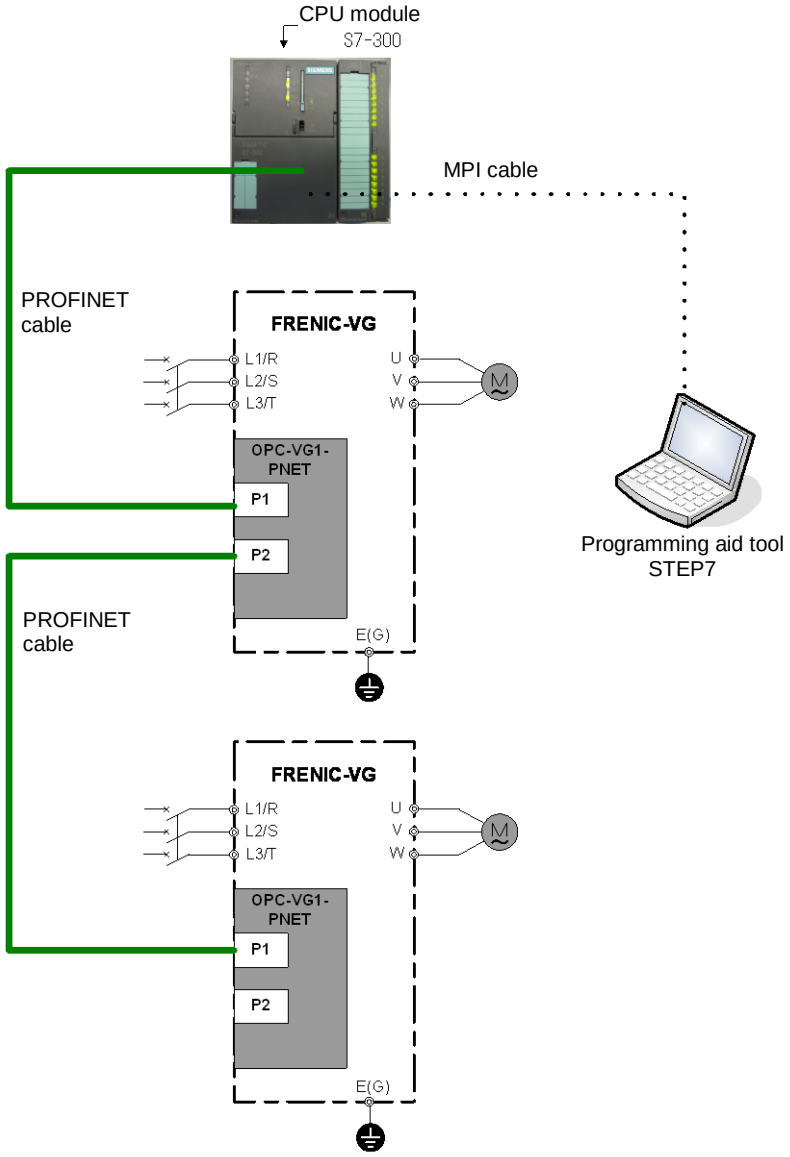


Figure 3-2 Example of basic connection diagram

3-2 Related function code

⚠WARNING
- If the data of a function code is incorrect, the system may fall into a dangerous status. Recheck data whenever you have finished setting or writing data. **An accident may occur.**

The list of the inverter function cords in conjunction with the PROFINET interface card is shown below.

Table 3-1 Related function codes

No.	Function code name		Setting range	Change in running	Setting contents
	Name	Keypad display			
H30	Link function	LINK FUNC	0 to 3	✓	Set 3 :run command , speed command via PROFINET are valid
H107	Definition for ,minor fault 2	L-ALM 2	0000 to 1111	✓	Select the alarm operation when Er-4 occurs. Er-4 is indicated in 100-digit value. In the appropriate digit, 0: Alarm arises, 1: Minor fault (L-AL)
o30 (*1)	Link setting (Action on communication error)	MODE ON ER	0	-	Forced to stop immediately after a communication error(minor fault) occurs (Er-4 alarm: coast-to-stop)
			1		Continue timer-controlled operation after communication error (minor fault) occurs. (HOLD the run command from the previous communication in the status of communication error.) Forced to stop after timer setting period is over (Er-4 alarm: coast-to-stop) When communication is recovered within timer setting period, follow the communication command. However, forced to stop after timer setting period is over.
			2		Continue timer-controlled operation after communication error (minor fault) occurs. (HOLD the run command from the previous communication in the status of communication error.) Forced to stop after the setting period is over if the communication has not recovered. When communication is recovered within timer setting period, follow the communication command and return to normal operation.
			3		Continue operation even if a communication error (minor fault) occurs. Holding the last run command directed through communication in the communication error state. When communication is recovered, follow the communication command and return to normal operation.
o31 (*1)	Link setting (Action time on communication error)	TIMER TL	0.01 to 20.00s	-	Timer for the operation period [s] after a communication error. Effective when o30=1, 2
o101	Reflect all allocations	Enable allocation	0,1	-	By changing 0 to 1, reflect intermediate change of transfer format (o102) and PZD allocation setting (set in o122 or subsequent function codes to the master unit.) After setting to 1, return to 0.
o102 (*2)	Select PROFINET transmission format	Option function	1	-	Standard telegram1 (2 words +2 words)
			101		Free format (12 words +12 words + PCV)
			Other than above		Spare (Do not set here.) *Treat as o102=1

No.	Function code name		Setting range	Change in running	Setting contents
	Name	Keypad display			
o122 to o133(*2)	OUT area PZD allocation 1 to 12	Write code 1 to 12	0 to FFFF	-	Specify the function code to be allocated to the function code OUT area using RS485No. (Allocate the function code to be written.) (*3)
o160 to o171(*2)	IN area PZD allocation 1 to 12	Read code 1 to 12	0 to FFFF	-	Specify the function code to be allocated to the function code IN area using RS485No. (Allocate the function code to be written.) (*3)
F26	Carrier frequency	CAREER FRQ	2 to 15	-	Specify carrier frequency (inverter control cycle). Only when F26 = 4 or 8 that PROFINET-IRT tact cycle and inverter control cycle are possible to synchronize. In case of Stack type : 2kHz
H108	L-ALM object definition 3	L-ALM 3	0000 to 1111	✓	Select the alarm operation when Ar-E occurs. Ar-E is indicated in 1-digit value. In the appropriate digit, 0: Alarm arises, 1: Minor fault (L-AL)
E10 | E13	X11～X14 function selection	X11～X14 FUNC	**(*4)**	-	Select the function when X11～X14 terminal status is ON. When using X terminals to monitor toggle signals, please set any two X terminals as [TGL1] and [TGL2].
E15 | E27	Y terminals function selection	Y FUNC	**(*4)**	-	Select the function of terminals Y1~Y5 and Y11~Y18. When using Y terminals to confirm whether PROFINET-IRT is in tact synchronized status please set any Y terminal as [C-Do10].
o103 o104	IP address monitor 1, 2	BUS SET 3, 4	0000 to FFFF	✓	Monitor IP address (4byte). o103 displays upper 2byte and o104 displays lower 2 byte in hex. Example: On the occasion of o103=C0A8, o104=0002, it means that IP address is [0xC0.0xA8.0x00.0x02] in hex therefore [192.168.0.2] in decimal. (***5)**
o105 to o107	MAC address monitor 1~3	BUS SET 5~7	0000 to FFFF	✓	Monitor MAC address (6byte). o105 displays upper 2byte, o106 displays middle 2 byte and o107 displays lower 2 byte in hex. Example: On the occasion of o105=0040, o106=1A15, o107=3001 it means that MAC address is [00-40-1A-15-30-01].
o108 to o115	Device name monitor 1~8	BUS SET 8~15	0000 to FFFF	✓	Monitor device name (16 characters). Device name is displayed in ASCII code. From o108 to o115, each o code displays 2 words from beginning of device name. Example: On the occasion of o108=0x7667,o109=3100,o110~o115=0x0000,device name is [vg1]. But this monitor function does not work when o116 = 1 or 2.
o116	Device name edit mode	BUS SET 16	0	✓	Device name monitor mode o108~o115 monitor device name.
			1		Device name edit mode The value set in o108~o115 will be saved as new deice name when o116 is changed from 1 to 0 **(*6).** As long as o116=1, o108~o115 stop monitoring function.
			2		Device name all clear o108～o115 stop monitoring function. When o116 is changed from 2 to 0, device name will be cleared and o108~o115 will all be cleared as 0x0000(return to default status).

*1 For more information about o30, o31, please refer to “3-3-1-2 Operation Setting at occurrence of minor fault (o30, o31)”

*2 After changing o102, o122 to o133 or o160 to o171, you must set o101=1 or turn ON the inverter power supply again so as to reflect the setting details. If any one of these function codes is changed halfway, Y terminal function [AS-RDY]turns OFF and the system disables to send or receive transmission data until you set o101=1 or turn ON the inverter power supply again. (All the commands in OUT area are ignored and all the responses in IN area become 0.） By turning ON the inverter power supply, [AS-RDY]= ON and

communications using the updated function code allocation data can be restarted. For details on[AS-RDY], see section 3-5.

*3 For the function codes and measures for RS485No. refer to “4.2.3 Function Code List” of FRENIC-VG User’s Manual (MHT286□) “.

*4 For details please refer to “4.3 Function Code Details” of FRENIC-VG User’s Manual) “.

*5 IP address may be displayed as “0.0.0.0” on occasion that inverter fails to link to master device.

*6 Characters valid for displaying device name in o108～o115 are listed below. (Refer to table 3-2 ASCII Codes)

Alphabet "A"~"Z", "a"~"z" ASCII codes：0x41～0x5A，0x61～0x7A

Number "0"~"9" ASCII codes：0x30～0x39 (Can not be used at the beginning of device name)

Symbol "-" ASCIIcodes：0x2D(Can not be used at the beginning or the end of device name)

In addition, 0x00 is recognized as the end of device name (any character afterwards is invalid). If o108~o115 are set as invalid value, device name will remain unchanged when o116 is changed from 1 to 0.

Table 3-2 ASC II Codes (grey colr means valid)

10_H Digit / 01_H Digit	00_H	10_H	20_H	30_H	40_H	50_H	60_H	70_H
0_H	NUL	DLE	SP	0	@	P	`	p
1_H	SOH	DC1	!	1	A	Q	a	q
2_H	STX	DC2	"	2	B	R	b	r
3_H	ETX	DC3	#	3	C	S	c	s
4_H	EOT	DC4	$	4	D	T	d	t
5_H	ENQ	NAK	%	5	E	U	e	u
6_H	ACK	SYN	&	6	F	V	f	v
7_H	BEL	ETB	’	7	G	W	g	w
8_H	BS	CAN	（	8	H	X	h	x
9_H	HT	EM	）	9	I	Y	i	y
A_H	LF	SUB	*	:	J	Z	j	z
B_H	VT	ESC	＋	;	K	[	k	{
C_H	FF	FS	,	<	L	＼	l	|
D_H	CR	GS	－	=	M	]	m	}
E_H	SO	RS	.	>	N	^	n	~
F_H	SI	US	／	?	O	_	o	DEL

Example： "0" in ASCII code should be "30_H", and "1" in ASCII code should be "31_H".

3-3 Protective action

3-3-1 Minor fault and serious fault of the PROFINET communication

3-3-1-1 Factors of minor fault and serious fault (Er-4)

The PROFINET interface card triggers minor fault or serious fault depending on the fault level.

If a fault occurs, the inverter issues Er-4 "communication fault", and the motor coasts-to-stop. (*1)

*1 Depending on the setting of inverter function code H107, the operation can continue by displaying a generated fault as L-Fil. Refer to chapter 3-2 "Related function code".

Table 3-3 Factors of minor fault and serious fault (Er-4)

Item	Minor fault	Serious fault 1	Serious fault 2
Card LED status	MS ■ (green lights) NS ▲ (red blinks)	MS ■ (green lights) NS ■ (red lights)	MS ■ (red lights) NS □ (No lights)
Cause (*2)	- Data is temporarily damaged by applying noises to communication line.	- Master unit shuts down. (Broken wire detected, PLC power supply is shut off)	- Card hardware fault - Improperly installed card - Setting error
Resetting method	Reset after the cause of alarm has been cleared (automatically cleared upon recovery of communication). Or reset after H30 is 0,1or[LE]=OFF (*3)		Turn ON the power to the inverter again after the cause of the alarm has been cleared. (Not resettable until power OFF)
Control of fault status	The alarm can be controlled with the function code o30 and o31.	The alarm Er-4 is immediately issued when serious fault occurs.	
Keypad indication communication error code (*4)	1	2	3
Alarm subcord (*5)	01(hex)	02(hex)	04(hex)

*2 For a minor fault, Er-4 is issued when the command via PROFINET is enabled (when H30=2, 3 and [LE] =ON: for details, see the explanation of H30 in FRENIC-VG User's Manual (MHT286□)). For a serious fault 1, Er-4 is issued when the command via PROFINET is enabled and the run command via PROFINET is ON. For a serious fault 2, Er-4 is issued when an erroneous factor occurs, regardless of the above conditions.

*3 "Apply reset command" for minor fault and serious fault 1 means reset input to the inverter using any of the following methods:
- Enter RESET key on the keypad.
- Allocate abnormal reset [RST] when selecting X function and enter it as digital data.
- Reset alarm from PROFINET communications
  However, for a serious fault 1, you might have to reset the PROFINET master unit together with the alarm depending on the condition of the master unit.

*4 You can check the communication error codes for minor fault and serious fault on the communication status screen in Maintenance Information menu on the keypad. To see the communication status screen, click PRG key on the Operation Mode screen to change the screen to Menu. Then, move the arrow at the left end of the screen to “Maintenance” using ∧/∨ key and click FUNC DATA key. Then, click ∨ key three times to display the following screen. This error code presents the first factor that generates E1-4. When serious fault 1 occurs, a minor fault must have occurred in advance. When o30=0, this code presents a minor fault code even if it is serious fault 1.

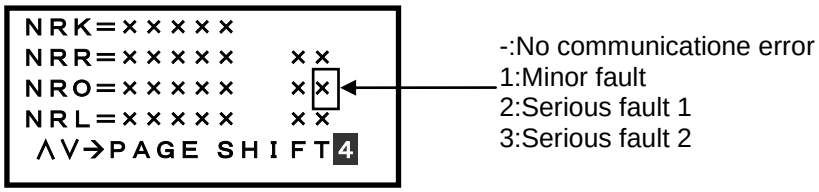


Figure 3-4 Communication error (E1-4) cord confirmation screen

*5 You can check the alarm sub code of E1-4 by selecting alarm history in Alarm Information program on the keypad. On the sub code check screen, click PRG key on the Operation Mode screen to change the screen to Menu. Then, move the arrow at the left end of the screen to “7. Alarm Information” using ∧/∨ key and click FUNC DATA key. Select the alarm you want to see from the list of the latest alarm and previous three alarms and click FUNC DATA key. Then, click ∧ key once to display the following screen. This sub code presents the first factor that generates E1-4. When serious fault 1 occurs, a minor fault must have occurred in advance. When o30=0, this code presents a minor fault code even if it is serious fault 1.

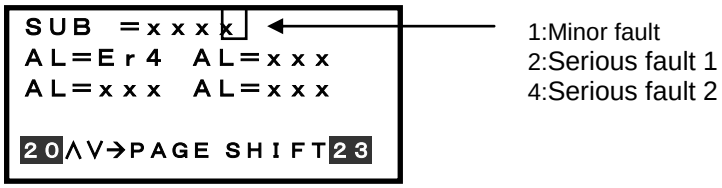


Figure 3-5 Subcord confirmation screen

3-3-1-2 Operation Setting at occurrence of minor fault (o30, o31)

This subsection describes how to control the Er-4 alarm using the inverter function codes o30, o31 when a communication error (in the state of minor fault) arises while applying an run command via PROFINET from PLC.

(1) o30 = 0 (Forced to stop immediately after a communication error (minor fault) occurs (Er-4 alarm: coast-to-stop))

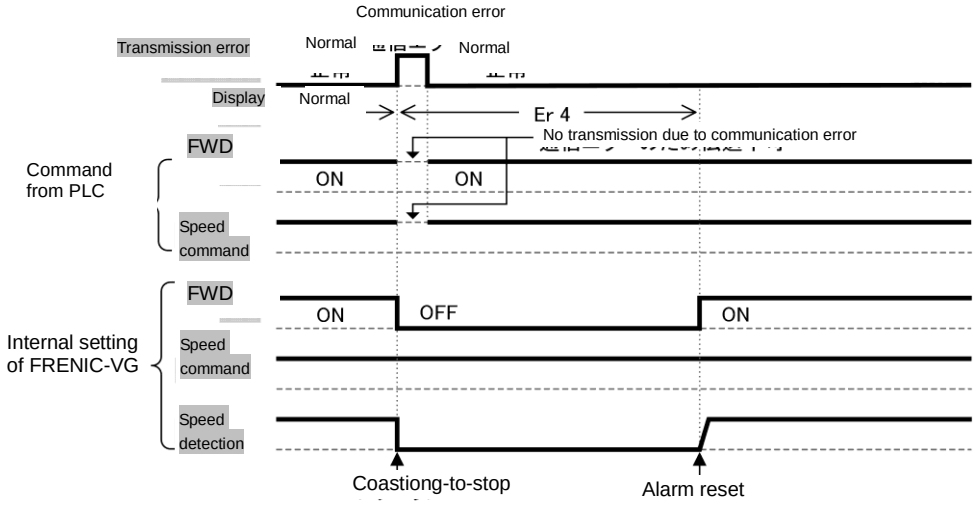


Figure 3-6

(2) o30 = 1, o31 = 5.0 (The mode to stop the inverter for five seconds after a communication error(minor fault).)

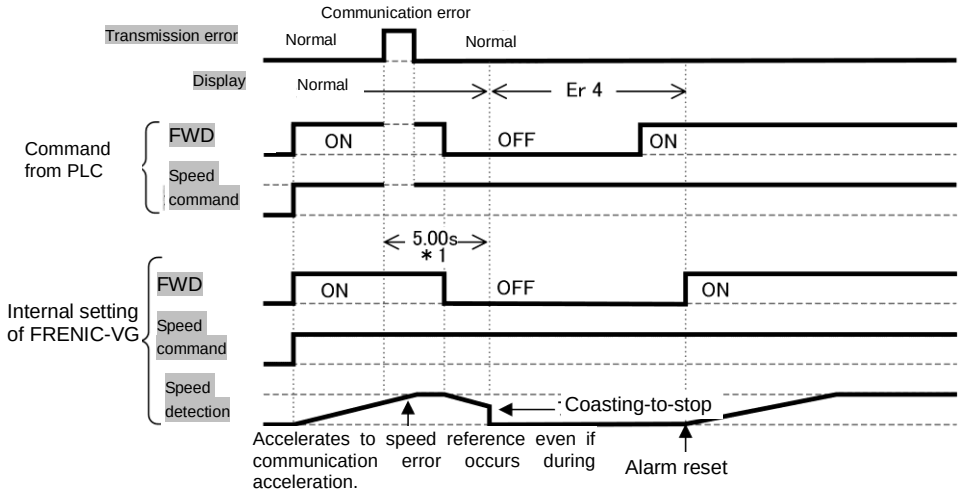


Figure 3-7

(3) o30 = 2, o31 = 5.0 (The communication does not recover from a communication error (minor fault) in five seconds and trips on Er 4.)

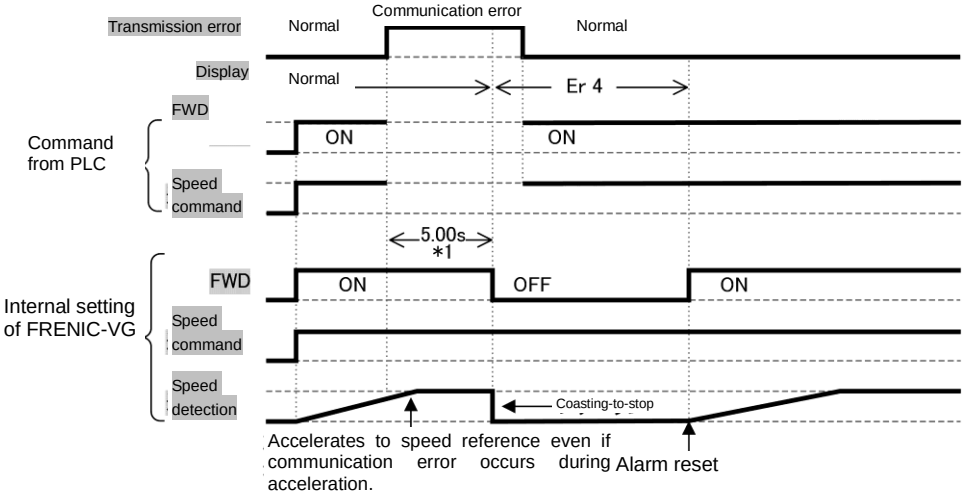


Figure 3-8

(4) o30 = 2, o31 = 5.0 (The communication recovers from a communication error (minor fault) in five seconds.)

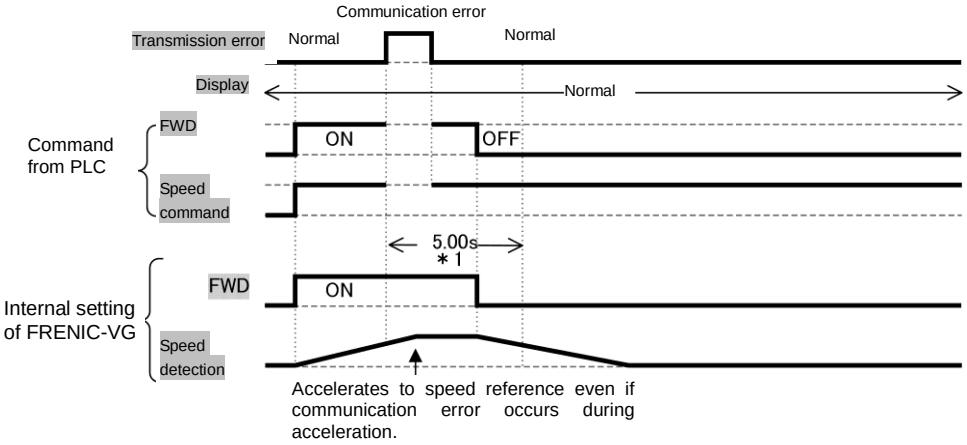


Figure 3-9

(5) o30 = 3, (Driving continuation)

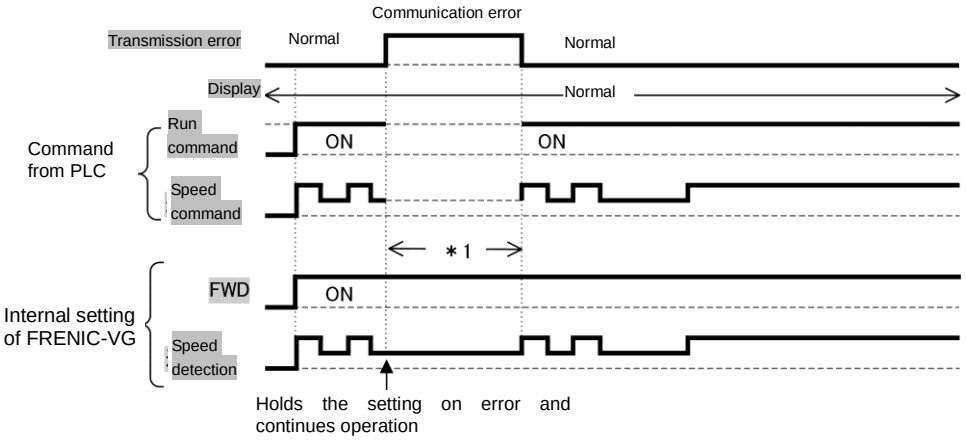


Figure 3-10

*1 During this period, the system retains the commands (run commands, speed commands or both) from communications at occurrence of communication error unless communications recover and new commands or settings are sent.

3-4 Communication Formats

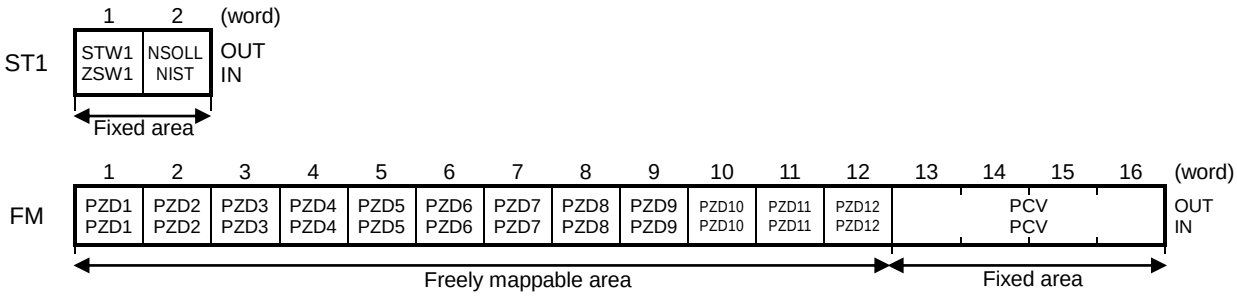
3-4-1 Applicable formats

You can select the following transmission formats using function code o102 “Select Transmission Format”.

Table 3-4 Applicable Transmission Formats

o102	Format name	Number of words occupied
1	Standard telegram 1(ST1)	OUT area: 2 words, IN area: 2 words
101	Freely mappable format (FM) (Manufacturer-specific telegram)	OUT area: 16 words, IN area: 16 words

* When you set any value other than above to o102, the system assumes o102=1.



OUT	:	Output area (data direction PLC→VG）
IN	:	Input area (data direction VG→PLC)
STW1	:	Control word
ZSW1	:	Status word
NSOLL	:	Speed command value (Nmax=4000Hex)
NIST	:	Speed detection value (Nmax=4000Hex)
PZD1-12	:	Process data (You can change allocation using function code o122 to 133 or o160 to 171)
PCV	:	Read/write per parameter (Read/write function code)

3-4-2 Data format details

3-4-2-1 Standard telegram 1（o102=1）

	bit15	bit0
OUT area	STW1 control word	
(PLC→VG)	NSOLL_A speed command (Nmax=4000Hex)	
IN area	ZSW1 status word	
(VG→PLC)	NIST_A speed detection value (Nmax=4000hex)	

Figure 3-11 Standard Telegram 1 (ST1)

(1) STW1 control word

This area is used to issue run commands from PLC to the inverter.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	(bit)
b15	b14	b13	b12	b11	b10	b9	b7	b7	b6	b5	b4	b3	b2	b1	b0	

Table 3-5 Explanation of STW1

bit		False (0)	True (1)
b0	ON/OFF	Turn a run command OFF	Turn a run command ON
b1	ON2/OFF2	OFF2: Coast to a stop	ON2: Request the inverter to be ready for turning a run command ON (1)
b2	ON3/OFF3	OFF3: Stop command following the deceleration time specified by the function code H56	ON3: Request the inverter to be ready for turning a run command ON (2)
b3	Enable operation	Disable inverter operation	Enable inverter operation
b4	Enable Ramp generator	Fix speed command to 0	Enable the ramp frequency generator (RFG)
b5	Unfreeze Ramp generator	Freeze ramp generator (accelerator/decelerator). Fix speed command to the value at that time.	Unfreeze RFG command
b6	Enable setpoint	Disable	Enable ON-bit
b7	ALM RST	Do not reset alarm	Reset alarm (Resetting an alarm makes the communications card unready to turn a run command ON.)
b8, b9	-	-	-
b10	Enable PZD	Disable input of PCD, STW1 and NSOLL_A. Retain previous status.	Enable input of PCD, STW1 and NSOLL_A.
b11	Run direction	Run in the forward direction	Reverse direction
b12	X11	X11 terminal = OFF	X11 terminal = ON
b13	X12	X12 terminal = OFF	X12 terminal = ON
b14	X13	X13 terminal = OFF	X13 terminal = ON
b15	X14	X14 terminal = OFF	X14 terminal = ON

(2) ZSW1 status word

STW is a word area for monitoring the inverter's running status.

🕮 STW indicates the status transition of the PROFIdrive. The status transition details are shown in Figure 3-12.

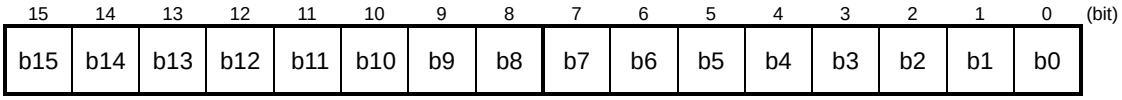
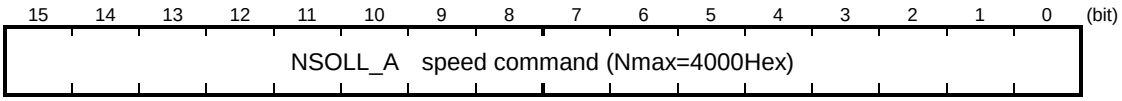


Table 3-6 Bit Definition in STW

bit		False (0)	True (1)
b0	Ready to switch ON	Not ready to turn a run command ON	Ready to turn a run command ON
b1	Ready to run	Not ready to run	Ready to run
b2	Running state	Running disabled	Running
b3	ALM	No inverter alarm	Inverter alarm activating now
b4	ON2/OFF2	OFF2: ON2 bit in CTW is "0"	ON2: ON2 bit in CTW is "1"
b5	ON3/OFF3	OFF3: ON3 bit in CTW is "0"	ON3: ON3 bit in CTW is "1"
b6	Run command ON inhibited	Ready to turn a run command ON (logical negation of bit0)	Not ready to turn a run command ON (logical negation of bit)
b7	-	-	-
b8	N-AR	Not reached to the specified speed	Reached to the specified speed
b9	R/L	Both speed command and run command from PROFIBUS are disabled. (H30=0)	Either speed command or run command from PROFIBUS-DP is enabled. (H30=1, 2, 3)
b10	N-DT1	Detected speed is less than the value set by inverter function code E39.	Detected speed is greater than the value set by inverter function code E39.
b11	SYNC	Not synchronized with PROFINET	Synchronized with PROFINET
b12	Y11	Y11 terminal = OFF	Y11 terminal = ON
b13	Y12	Y12 terminal = OFF	Y12 terminal = ON
b14	Y13	Y13 terminal = OFF	Y13 terminal = ON
b15	Y14	Y14 terminal = OFF	Y14 terminal = ON

(3) NSOLL_A speed command

This area issues speed commands from PLC. It is indicated as the value of ratio by setting the maximum speed F03 (r/min) of the inverter function code to 4000Hex.



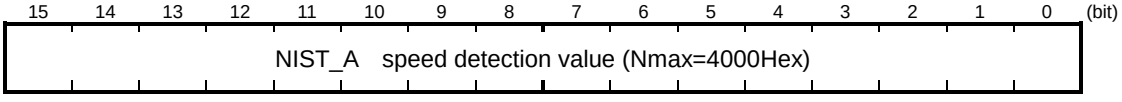
$$\text{NSOLL\_A} = \frac{\text{Speed command (r/min)}}{\text{Function code F03 (r/min)}} \times 4000\ \text{Hex}$$

or

$$\text{Speed command (r/min)} = \text{Function code F03 (r/min)} \times \frac{\text{NSOLL\_A}}{4000\ \text{Hex}}$$

(4) NIST_A speed detection value

This is a motor speed detection value. Like the speed command value, this is indicated as the value of ratio by setting the maximum speed F03 (r/min) of the inverter function code to 4000Hex.



$$\text{NIST\_A} = \frac{\text{Speed command (r/min)}}{\text{Function code F03 (r/min)}} \times 400\ \text{Hex}$$

or

$$\text{Speed command (r/min)} = \text{Function code F03 (r/min)} \times \frac{\text{NIST\_A}}{4000\ \text{Hex}}$$

Figure 3-12 shows a status transition diagram of the PROFIdrive profile. Immediately after the inverter is turned ON, the status first moves to S1 "Not ready to turn a run command ON." Bit manipulation in STW1 shifts the status to S2 "Ready to turn a run command ON," S3 "Ready to run" and finally S4 "Running" in sequence. In S4 state, the inverter enters the running state. Turning a run command OFF in S4 state shifts the status to S5 "Turn a run command OFF." After the motor stops, the status moves to S2 or S1 state.

Note In Figure 3-12, to simplify the description, values of Bit 4 to Bit 6 and Bit 10 in STW1 are always "1." If any one of these bit values is not "1," the inverter will not enter the running state even if the status transition properly proceeds.

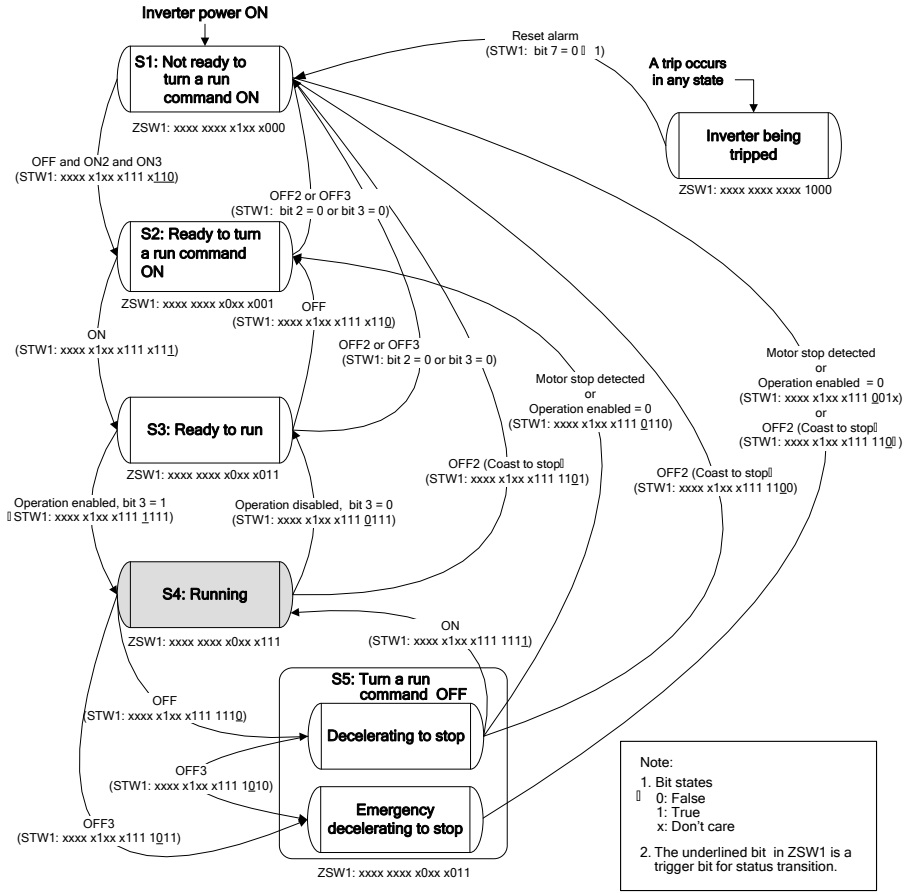


Figure 3-12 STW1/ ZSW1 Status Transition Diagram

3-4-2-1 Free allocation format（12W+12W+PCV4W）(o102=101)

	bit15	bit0
OUT area (PLC→VG)	PZD 1	
	PZD 2	
	PZD 3	
	PZD 4	
	PZD 5	
	PZD 6	
	PZD 7	
	PZD 8	
	PZD 9	
	PZD 10	
	PZD 11	
	PZD 12	
	PCV	(PCA)
	(IND)	
	(PVA)	
	(PVA)	
IN area (VG→PLC)	PZD 1	
	PZD 2	
	PZD 3	
	PZD 4	
	PZD 5	
	PZD 6	
	PZD 7	
	PZD 8	
	PZD 9	
	PZD 10	
	PZD 11	
	PZD 12	
	PCV	(PCA)
	(IND)	
	(PVA)	
	(PVA)	

Figure 3-13 Freely mappable Format (FM)

(1) PZD1-PZD12 Process Data 1-12

These settings always write to the function codes preset in o122 to 133 (OUT area). Also, the settings always monitor the function codes specified in o160 to 171 (IN area).

📖 For individual formats of the inverter function codes, see Chapter 4 “4.2 Function Code List” of FRENIC-VG User’s Manual.

Allocate the function code to each PZD by referring to the inverter function codes or PNU given below.

Table 3-7 Allocation of Function Codes to PCD1 to 12

Item	PZD	Function code	PNU	Remarks
OUT area (Function code is always written)	PZD1	o122	PNU915[0]	Specify the function code using 485No.
	PZD2	o123	PNU915[1]	
	PZD3	o124	PNU915[2]	
	PZD4	o125	PNU915[3]	
	PZD5	o126	PNU915[4]	
	PZD6	o127	PNU915[5]	
	PZD7	o128	PNU915[6]	
	PZD8	o129	PNU915[7]	
	PZD9	o130	PNU915[8]	
	PZD10	o131	PNU915[9]	
	PZD11	o132	PNU915[10]	
	PZD12	o133	PNU915[11]	
IN area (Function code is always monitored)	PZD1	o160	PNU916[0]	
	PZD2	o161	PNU916[1]	
	PZD3	o162	PNU916[2]	
	PZD4	o163	PNU916[3]	
	PZD5	o164	PNU916[4]	
	PZD6	o165	PNU916[5]	
	PZD7	o166	PNU916[6]	
	PZD8	o167	PNU916[7]	
	PZD9	o168	PNU916[8]	
	PZD10	o169	PNU916[9]	
	PZD11	o170	PNU916[10]	
	PZD12	o171	PNU916[11]	

📖 For the correspondence between the function code and 485No., see Chapter 4 “4.2 Function Code List” of FRENIC-VG User’s Manual.

You can also allocate the dedicated 485No. given in the list below to PZD besides those given in the above user’s manual.

Table 3-8 485No. Dedicated to the Card

485No.	Signal	Remarks
F001	STW1	Same as the signal for ST1
F002	NSOLL_A	
F101	ZSW1	
F102	NIST_A	

Note By allocating STW1 to OUT area PZD, the run command issued by the inverter function code S06 will be disabled. In the same manner, by allocating NSOLL_A, the speed command issued by the inverter function code S01 will be disabled.

Note After changing o122 to o171, set the function code o101 to 1 or turn ON the inverter power supply again so as to reflect the settings to the inverter.

Note When specifying the same function code to two or more OUT area PZD (o122 to o133), the allocation to the one having the largest o code number will be enabled and others are treated as no allocation.
（Ex.: When specifying the same function code to be written to o122 and o124, the function code is specified to o124 only and o122 is treated as no function code specified.） However, there is no restriction when allocating the same function code to two or more N area PZD (o160 to o171).

(2) Reading/writing PCV parameters

PCV is an area where parameters (inverter function codes and PNU) are read and written sporadically.

Because the PCV area is fixed, you cannot change the allocation.

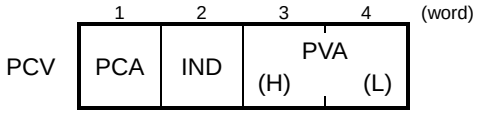
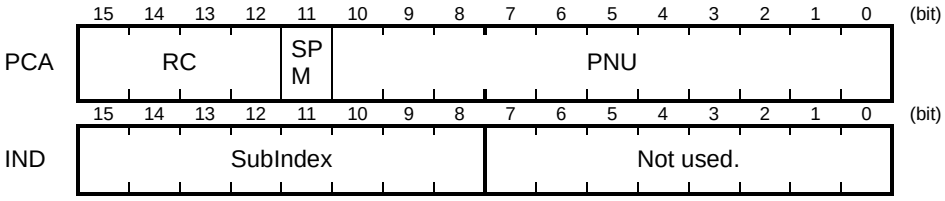


Figure 3-14 PCV Area Total Structure

(i) PCA and IND

These two word areas specify a parameter. Their structures are shown below.



RC:	Request code/response code (See Table 3-9)
SPM:	Not used. Fixed at "0."
PNU:	Specify 485No. high-order Byte or PNU number of the function code to be accessed.
SubIndex:	Specify 485No. low-order Byte or PNU allocation number of the function code to be accessed.

Table 3-9 RC Part

RC part	Request/response	Descriptions
0	Request (Master → Slave)	No request
1		Read parameter value
2		Write parameter value in word
3 to 5		Not used.
6		Read array parameter value
7		Write array parameter in array word
8		Not used.
9		Read element count of array parameter
10 to 15		Not used.
0	Response (Slave → Master)	No response
1		Parameter value in word sent normally
2, 3		Not used.
4		Parameter value in array word sent normally
5		Not used.
6		Normal response to the request of array element count
7		Transmission error (Error code stored in PVA)*1
8 to 15		Not used.

*1 For error codes and information, see Table 3-10.

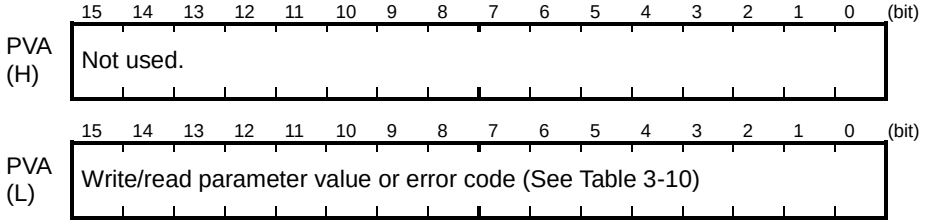
Table 3-10 List of Error Codes for Parameter Access Errors

RC part	Error code stored in PVA word	Error information
7	0	Nonexistent parameter specified
	1	Inhibited to write the parameter value
	2	Specified parameter value out of range
	3	Invalid Subindex specified
	11	Parameter write-inhibited error during inverter running or digital input terminal (for run command) being ON
	17	Read process not executable
	104	Busy error during parameter writing

(ii) PVA word area

PVA is a two-word area that represents write/read parameter values. The communications card uses the lower one word (the fourth word counted from the PCV word head).

To write a parameter value into an inverter (slave node), enter the value to the master node and send the word to the slave. To read a parameter value, refer to this area of the slave node in response to the previous request. If a parameter access error occurs (Response to RC part is "7"), the slave node outputs an error code (Table 3-10) to this area and returns the response to the master node.



(iii) Accessing inverter function code and PNU

1. Specify 485No. or PNU number of the function code to access PNU area.
2. Specify how to access the specified parameter, for example, Write or Read, in the RC area. For details about the RC area, see Table 3-9.
3. To write a parameter value, enter the write data into the PVA lower area and send the word to the salve node. To read a parameter value from the slave, refer to the PVA lower area in the response from the slave node. If a parameter access error occurs, the RC part of the response is filled with "7" and the PVA area contains one of the error codes listed in Table 3-10.

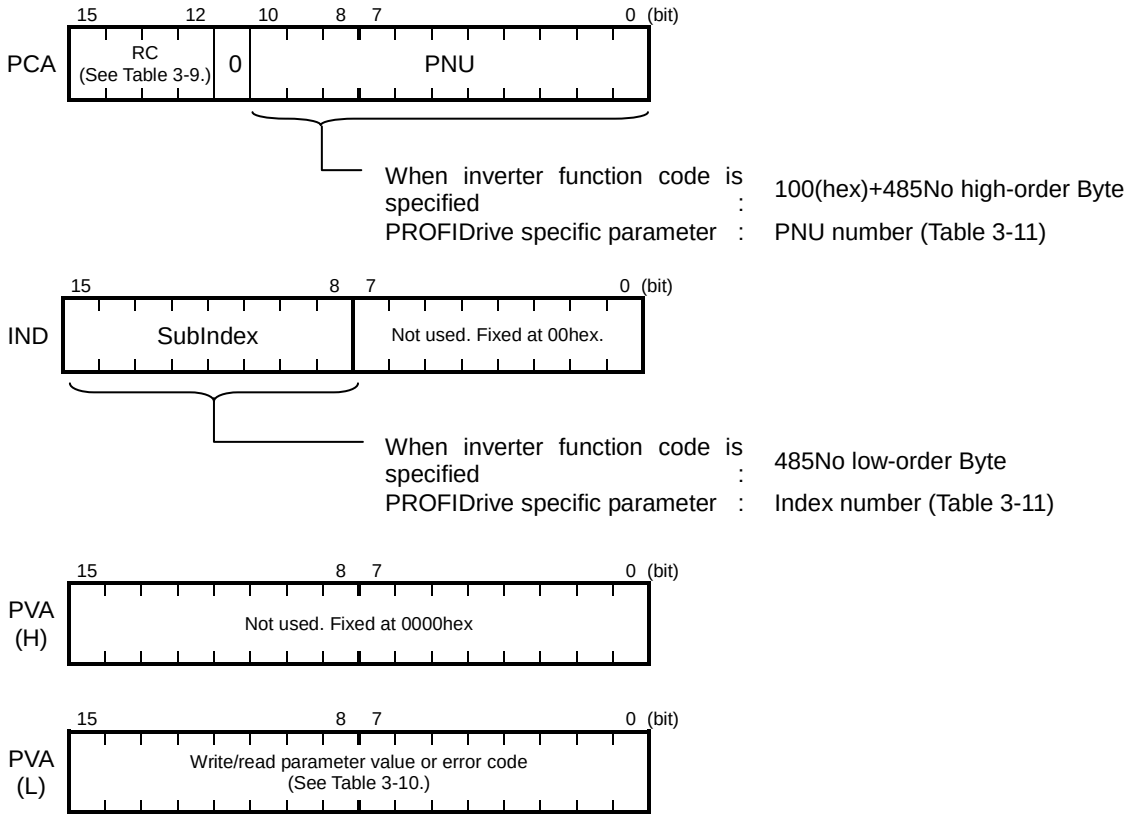


Figure 3-14 How to Access Parameters

(iv) PROFIdrive specific parameters

Table 3-11 shows the PROFIBUS specific parameters supported by this card.

Table 3-11 List of PROFIdrive Specific Parameters

PNU	Index	Description	Range	R/W	Remarks
915	0 to 11	Function code allocation to OUT area PZD1 to 12	0000 to FFFFHex	R/W	Same as for o122 to o133
916	0 to 11	Function code allocation to IN area PZD1 to 12	0000 to FFFFHex	R/W	Same as for o160 to o171
922	None	Select telegram (ReadOnly)	1, 21	R	Same as for o102
930	None	Operation mode	1	R	Fixed 1
944	None	Error occurrence count (inverter alarm count)	0 to 65535	R	
947	0	Alarm history (latest alarm or current alarm)	0 to 65535	R	Fuji Electric alarm code Response in format
	1	Alarm history (previous alarm)	0~65535	R	
	2	Alarm history (alarm 2 times before)	0 to 65535	R	
	3	Alarm history (alarm 3 times before)	0 to 65535	R	
965	None	PROFIdrive version	4	R	PROFIdrive V4 is indicated.

3-5 Operation when Transmission Format or PZD Allocation Is Changed Halfway

3-5-1 Restrictions when transmission format or PZD allocation is changed halfway

When any one of the following function keys is changed halfway, the system assumes that the transmission format is not determined and sets Y terminal function [AS-RDY]=OFF and operates with restrictions given in Table 3-12:

- o102 transmission format
- PZD allocation to OUT area from o122 to o133 and PZD allocation (*1) to IN area from o160 to o171

Even if you return the value to the original one after changing it once, the system assumes that the value is still changed and operates with restrictions.

* 1 A transmission format where PZD area does not exist (ST1) is excluded from the above condition.

Table 3-12 Restriction Operation when Function Code Allocation Is Changed Halfway (during[AS-RDY]=OFF)

Restriction during [AS-RDY]=OFF		Remarks
Free allocation format (FM1) (o102=101)	IN area: Set all response data to be read from function code to 0.	
Standard telegram 1(ST1) (o102=1)	OUT area: Ignore all command data to be written to function code.	For ST1, restriction occurs only when o102 is changed halfway.

3-5-2 Resetting restriction and checking transmission format determination status

You can reset the restriction by executing any one of the following actions:

- Set 1 to function code o101.
- Turn ON the inverter main power supply again.

After the above operations, the transmission format and PZD allocation details are checked and Y terminal function is set as [AS-RDY]=ON.

You can check [AS-RDY] signal using the method given in Table 3-12.

Table 3-13 Checking Transmission Format Determination Status Signal [AS-RDY]

Check method	Operation
Y terminal function [AS-RDY]	Determining the function code allocation now. [AS-RDY] *1 [AS-RDY]= ON : Determining function code allocation details now (without restriction) [AS-RDY]= OFF: Function code allocation details not determined (with restriction given in Table 3-13)
Function code M143	M143 bit0=1 : [AS-RDY]= ON *2 M143 bit0=0 : [AS-RDY]= OFF

*1 To allocate [AS-RDY]to Y terminal , select “64:AS-RDY” from “Select Y function from function codes E15 to E27 “.

*2 Even if [AS-RDY] is not allocated to Y terminal, you can check the status by monitoring M143.

3-6 Procedure for connecting PROFINET-RT communication

The procedure for connecting PROFINET-RT communication between master device and inverters is described in this chapter.

In this chapter, the most universal PROFINET master device -- SIEMENS's PLC and setup tool " SIMATIC STEP7 (omit as STEP7) " are used as examples for explaining how to setup option card. And the version of STEP7 is v5.5 SP2.

Note This document is for explaining connection of PROFINET communication between Fuji inverters and master device, therefore instruction of basic operation of STEP7 is not included. If there is any question about technical terms or operation method of STEP7, please refer to user's mannual of SIEMENS STEP7 or directly contact SIEMENS.

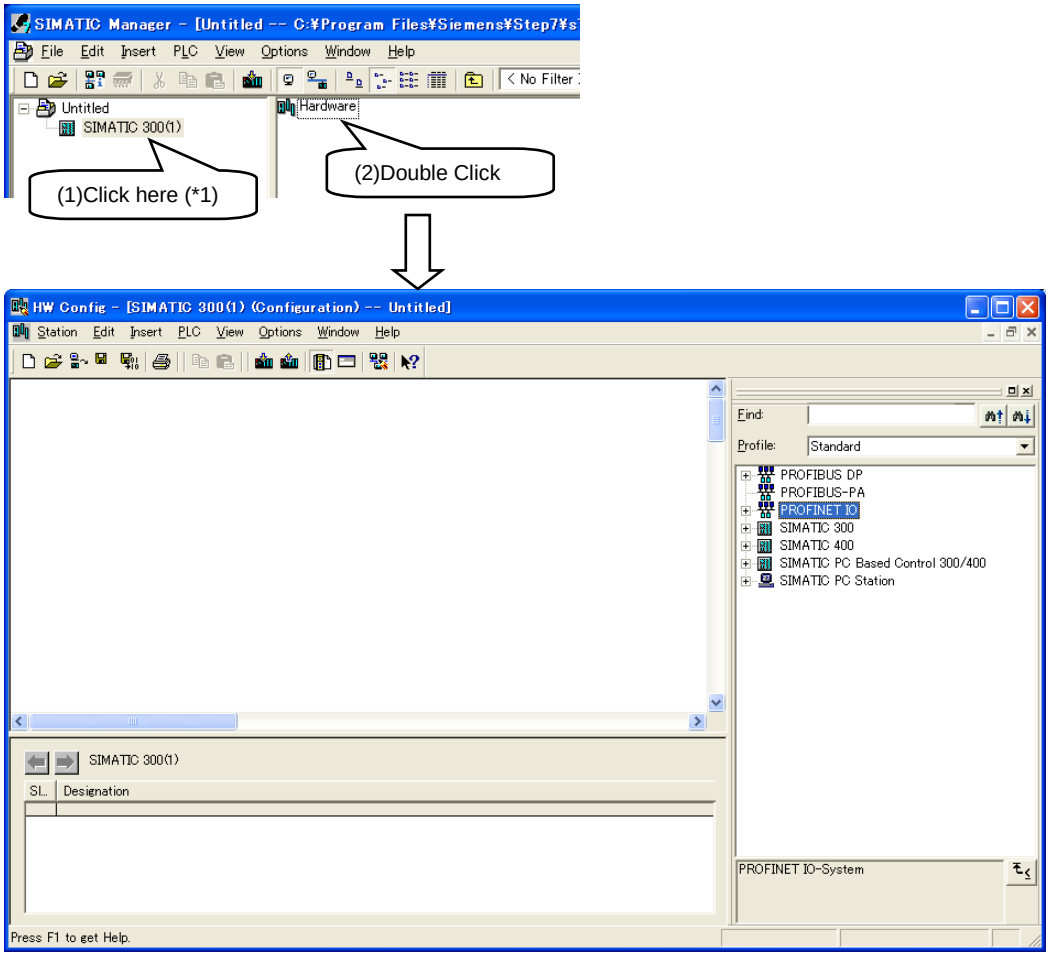
Note The GSD file is necessary for the following setup, and it can be downloaded from the URL below.(Registration as a member is necessary(Free)).

URL: https://felib.fujielectric.co.jp/download/index.htm

Search for "OPC-VG1-PNET" with the search box in the bottom right after entering the page above.

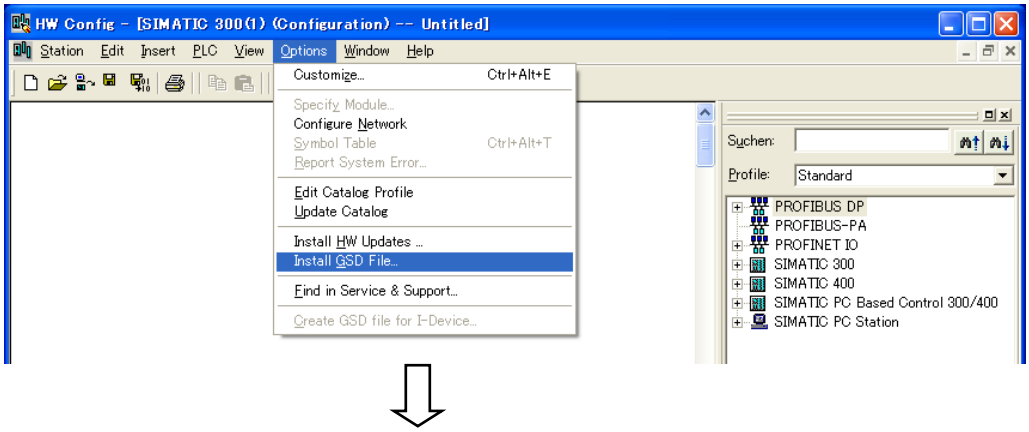
3-6-1 Configuration of PROFINET master device on STEP7

(1) Open HW Config with SIMATIC Manager in STEP7.

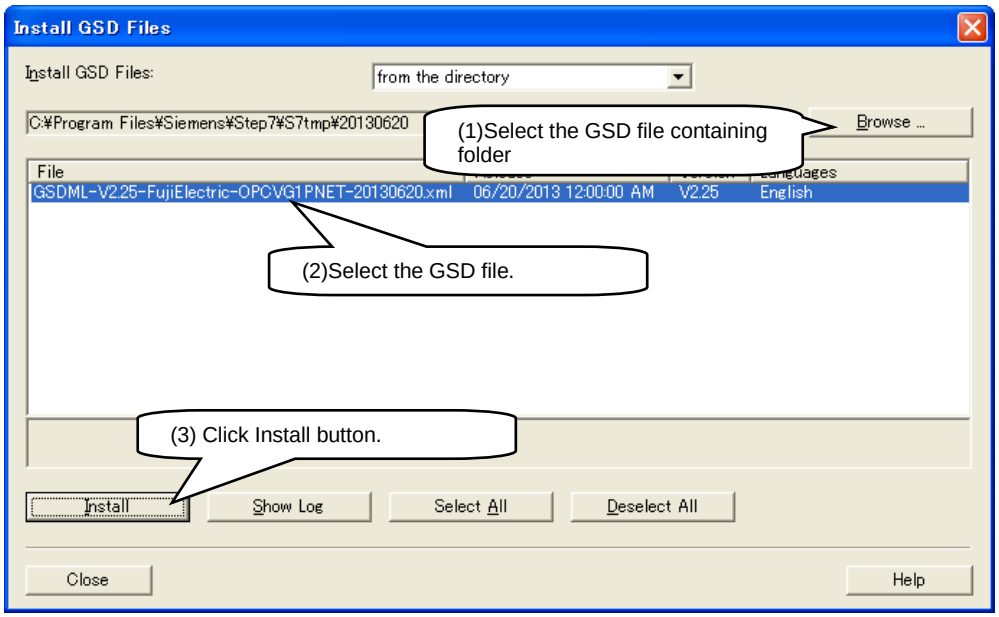


(*1) For how to enter the interface in SIMATIC Manager as shown in figre above, please refer to user's manual of STEP7 provided by SIEMENS.

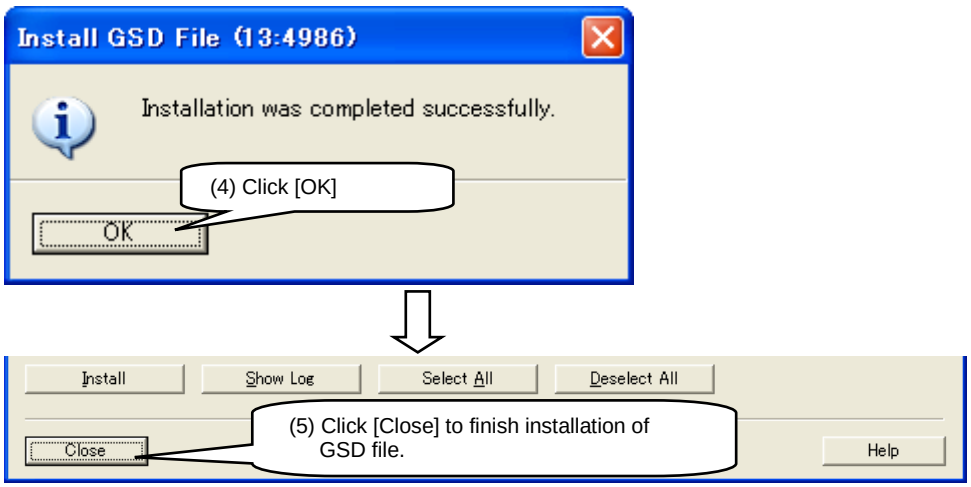
(2) Install the GSD file for OPC-VG1-PNET.
Select [Options] -> [Install GSD File] in menu.



Use the [Browse] to select the folder containing GSD file, and select the GSD file, finally click the [Install] button.

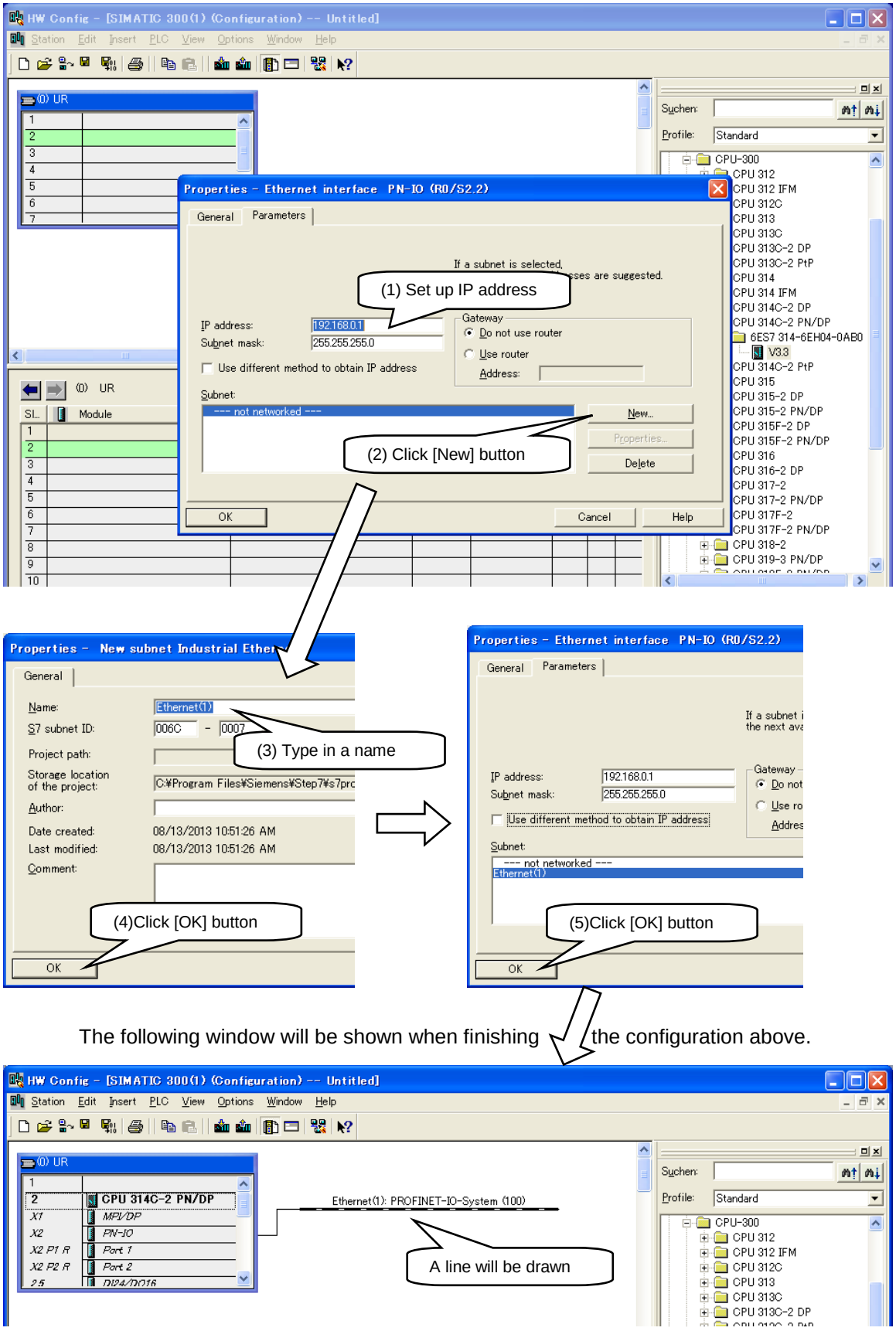


The following message box will be shown if succeeded. Click [OK] and then click [Close] in “Install GSD Files” window.



(3) Configuration of PROFINET master interface

After inserting the CPU, the configuration window in the figure below (*2) will be shown and IP address of master device can be set up.

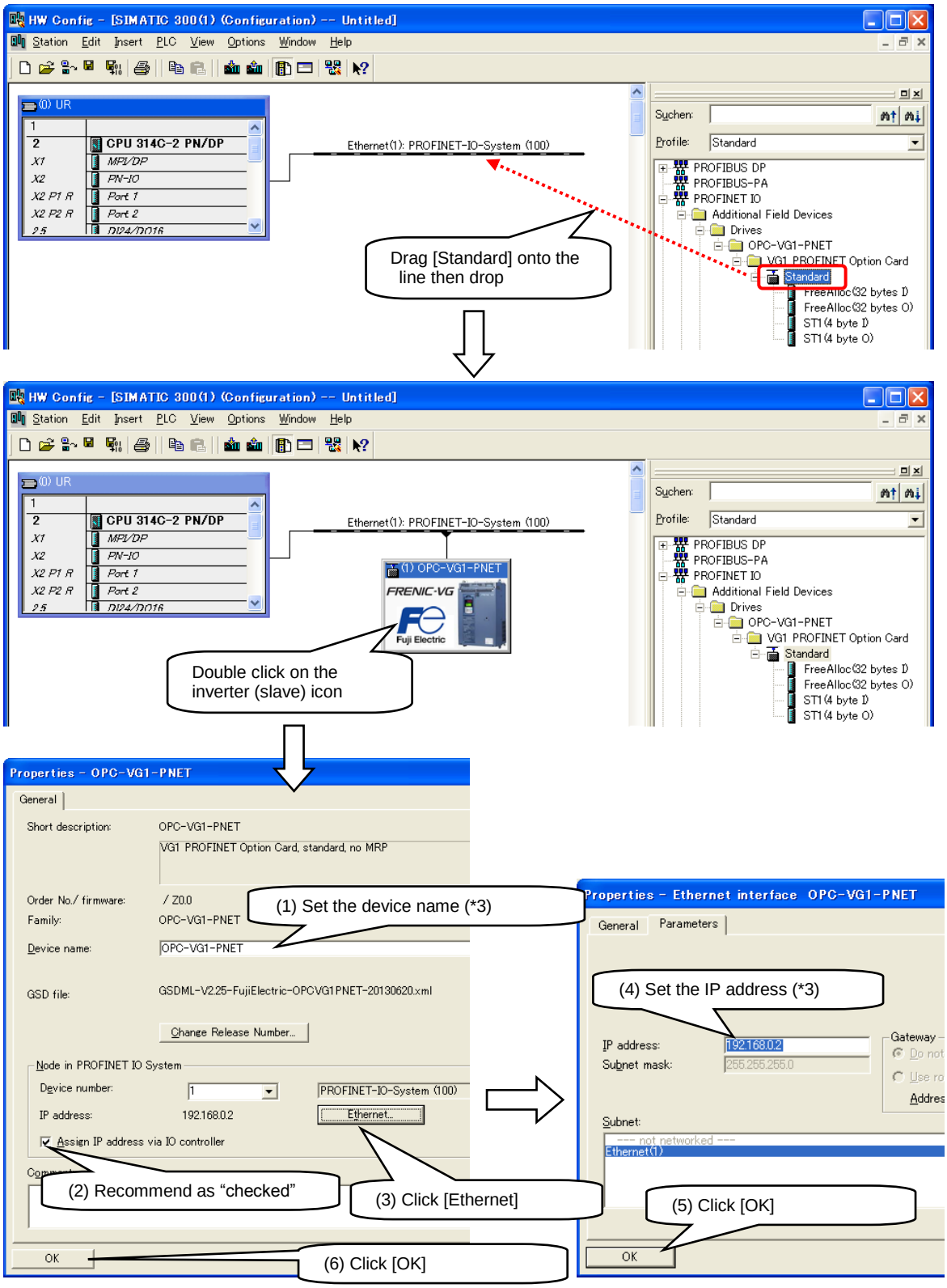


The following window will be shown when finishing the configuration above.

(*2) For how to insert the CPU please refer to user's manual of STEP7 provided by SIEMENS. According to the model of CPU it is possible that no window will emerge after inserting the CPU. In this case please contact SIEMENS.

(4) Installation of interface card, setup of device name and IP address

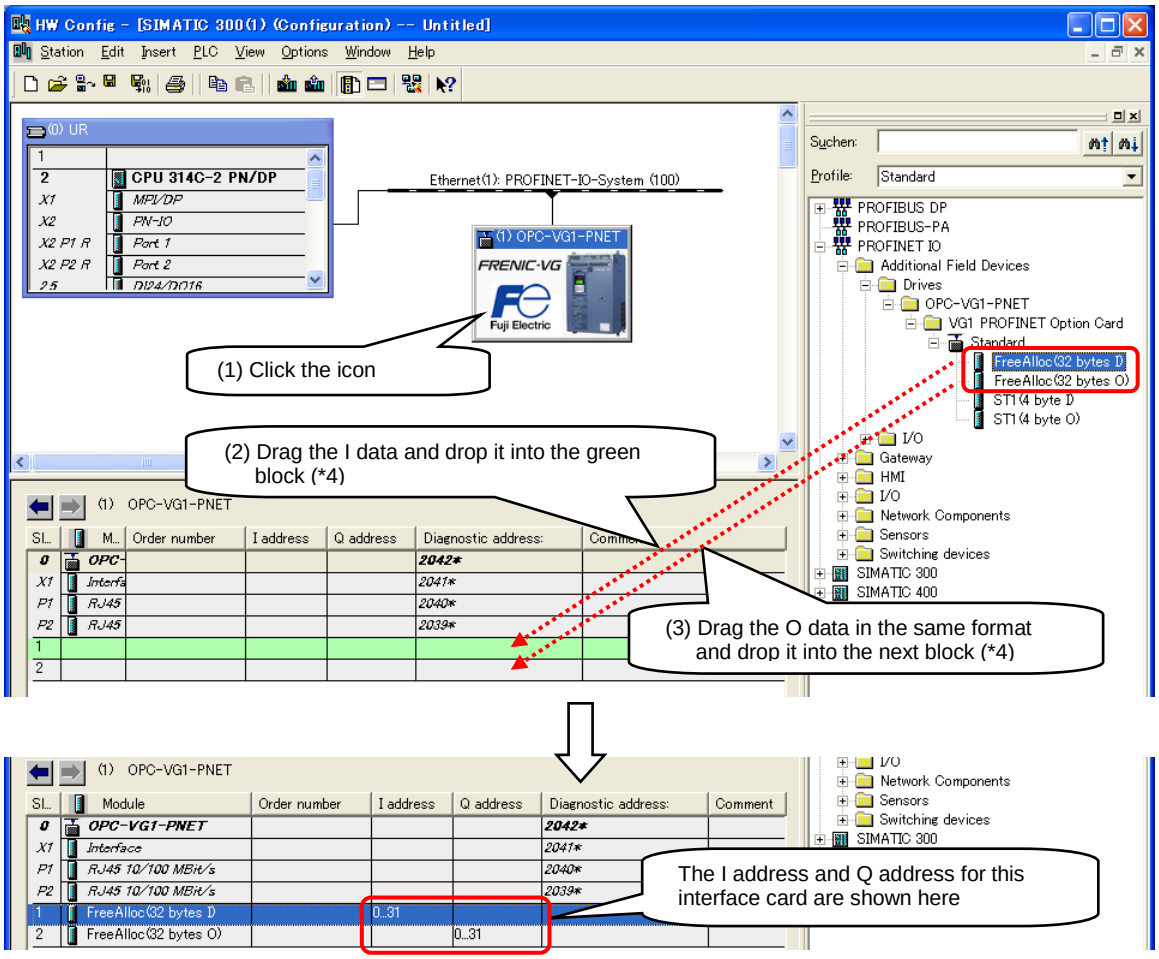
Drag [Standard] from the tree on the right side of the screen below “PROFINET IO > Additional Field Devices > Drives > OPC-VG1-PNET > VG1 PROFINET Option Card” and drop it onto the line as shown in figure below.



(*3) Make sure that device name and IP address are set as the same with [3-6-2 Configuration of interface card on STEP7].

(5) Configuration of transmission format

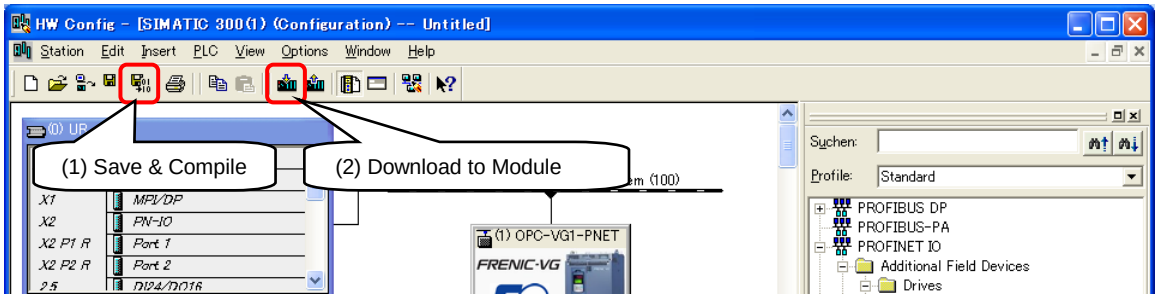
The transmission format for communication between PLC and interface card can be selected. Drag items under [Standard] in the tree on the right side of the screen, and drop them in green block on the bottom side of the screen. Make sure both I and O of the format are set.



(*4) Make sure the transmission format here is configured as the same with the format on interface card side (function code o102).

(6) Download the project to PLC

Click [Save & Compile] botton and then click [Download to Module] button to download this configuration to PLC.

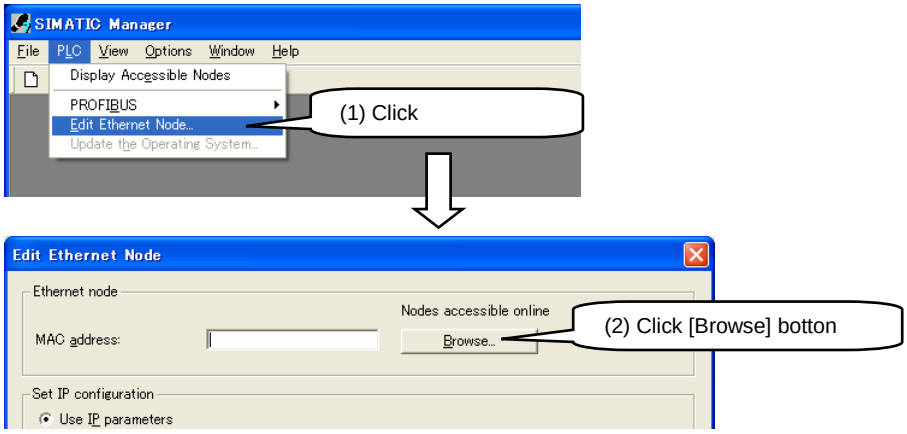


By far the configuration of PROFINET master device on STEP7 is finished.

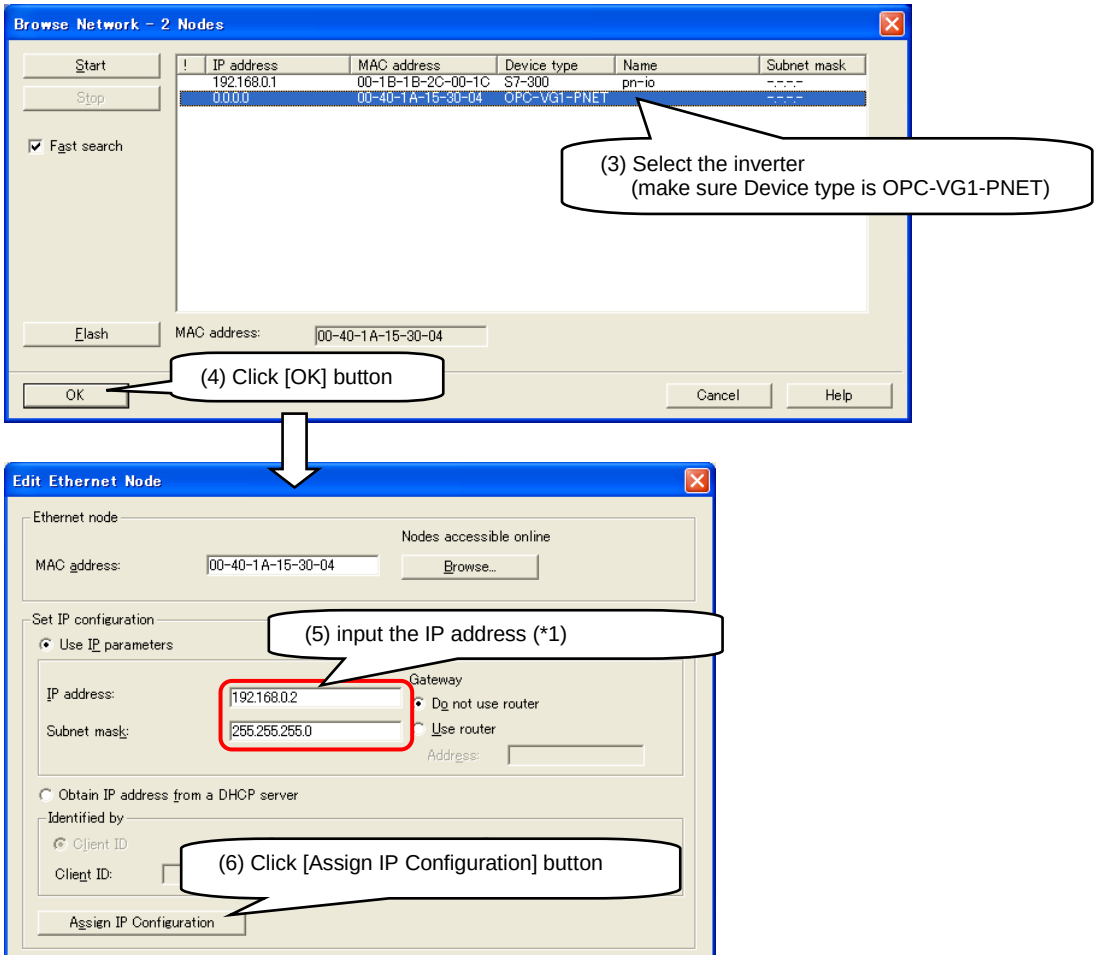
3-6-2 Configuration of interface card on STEP7

This chapter describes how to set device name and IP address of interface card on STEP7. Please connect the interface card with PROFINET cable and power on the inverter before configuration.

(1) Click [PLC > Edit Ethernet Node] in SIMATIC Manager's menu on STEP7.

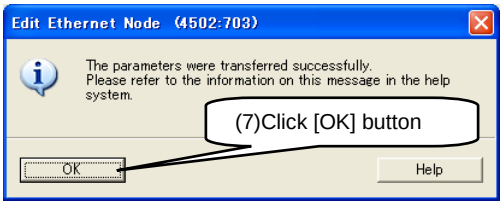


After clicking [Browse] button, all nodes connected to Ethernet are shown.

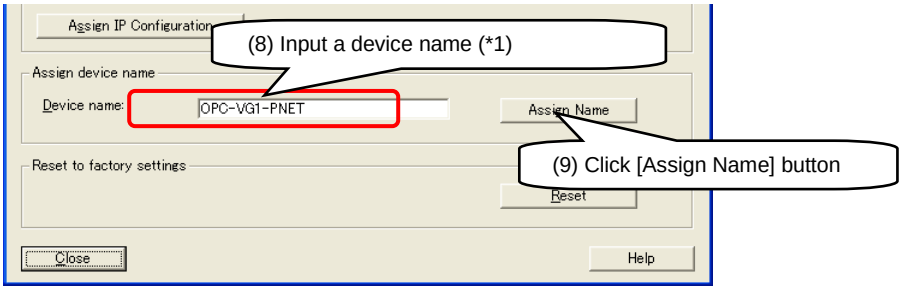


(*1) Make sure that device name and IP address are set as the same with Configuration of PROFINET master device.

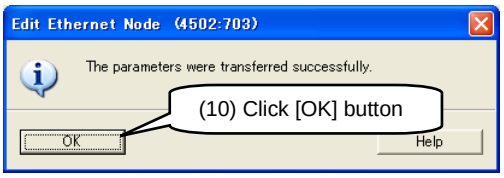
The window below will emerge after finishing IP address configuration of interface card.



Set the device name after returning from [Edit Ethernet Node] window.



The window below will emerge after the device name of interface card is set.



By far the configuration of interface card on STEP7 is completed.

3-6-3 Configuration of inverter function codes

(1) Set the relevant inverter function codes

The transmission format of interface card is set by inverter function code o102 (table below). Make sure this format is set as same with the one on STEP7.

Table 3-14 Setting of function code o102

Function code	Name	Description	Default
o102	PROFINET transmission format	1 : Standard Telegram 1 (ST1) (2word+2word)	0
		101 : Free Management format (FM1) (12word+12word+PCV)	
		Other : same as o102=1	

For setting of function codes other than o102 please refer to relevant instructions.

(2) Activate the setting

To activate the setting of inverter function codes, it is necessary to set o101 from 0 to 1 or restart the inverter power. After the setting of function codes are activated, with PLC power on and the PROFINET cable connected correctly, PROFINET communication will be established therefore the LED MS and NS on interface card will turn green.

3-7 Synchronization between PROFINET-IRT and inverter control cycle

3-7-1 Necessary conditions for synchronization

By using this interface card to connect with PROFINET, synchronization between PROFINET-IRT signal and inverter control cycle become possible. Therefore it is possible to synchronize multiple inverters and is especially helpful for accurate timing control.

Meanwhile to achieve the synchronization between PROFINET signal and inverter control cycle, conditions (1)～(3) below are necessary. With all three conditions met, syunchronization process will run automatically after PROFINET communication is established. If any of the three conditions is not met, synchronization can not be achieved.

Table 3-15 Conditions for PROFINET synchronization

	Necessary conditions
Condition (1)	[RT Class] = IRT and [IRT Option] = High performance (*1)
Condition (2)	The cycle of PROFINET signal should be one of these: 1ms, 2ms, 4ms
Condition (3)	Inverter function code F26 [carrier frequency] should be set as one of these: ・Unit type HD or LD : 4kHz, 8kHz ・Unit type MD : 2kHz, 4kHz ・Stack type MD or LD : arbitrary (automatically fixed as 2kHz)

(*1)For details of setting method please refer to [3-7-4 PROFINET-IRT configuration on STEP7].

3-7-2 Confirmation of synchronization

The status of PROFINET synchronization can be checked with following methods.

Table 3-16 Confirmation of PROFINET synchronization

Methods	Results
Y Terminal function [C-Do10]	If synchronized : [C-Do10] = ON (*1)
Function code M142	If synchronized : M142 (bit0) = 1 (*2)

(*1) For how to set Y terminal function as [C-Do10] please refer to Chapter 4 [4.3 Details of function codes] in [FRENIC-VG User's Manual, Unit type・Function code].

(*2) M142 can be checked at keypad display without setting Y terminal functions.

3-7-3 Alarm of synchronization failure (Al-E)

If the synchronization between PROFINET signal and inverter control cycle is interrupted by noise or other problems after it is established, inverter will perform as follow.

Table 3-17 Performance when out of synchronization

Cause	Performance
Out of synchronization	Al-E (sub code 1) (*1) (*2) will occur as alarm of PROFINET synchronization failure Try to re-synchronize automatically and once synchronization is established again Al-E alarm can be reset.

(*1) If inverter function code F26 is changed during synchronized, it may cause synchronization failure but in this case Al-E alarm will not occur.

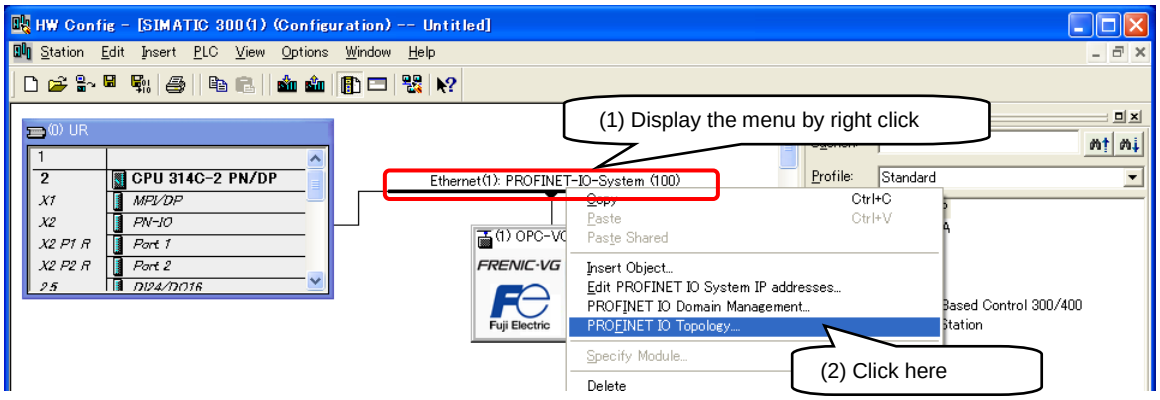
(*2) It is possible to set synchronization failure as a light alarm by using inverter function code H108, therefore it can carry on running with a L-Al display. For details please refer to Chapter 4 [4.3 Details of function codes] in [FRENIC-VG User's Manual, Unit type・Function code].

3-7-4 PROFINET-IRT configuration on STEP7

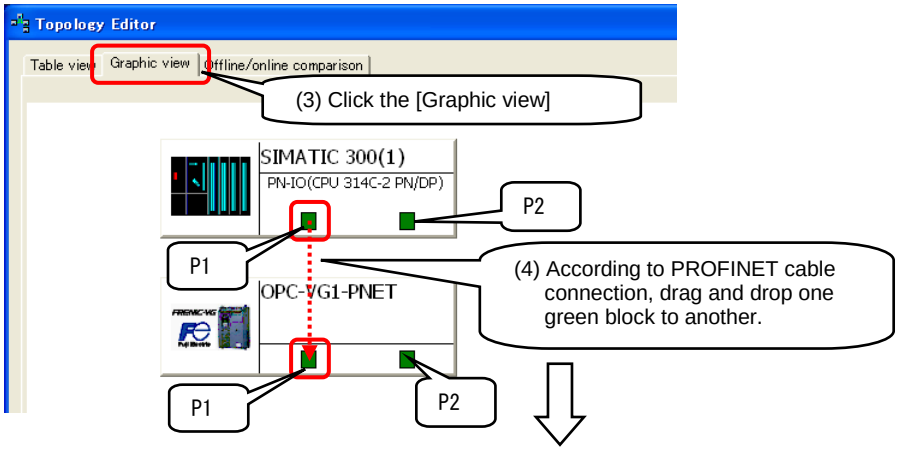
This chapter describes how to setup PROFINET-IRT on STEP7. Please carry out the following configuration after [3-6-1 Configuration of PROFINET master device on STEP7] is finished.

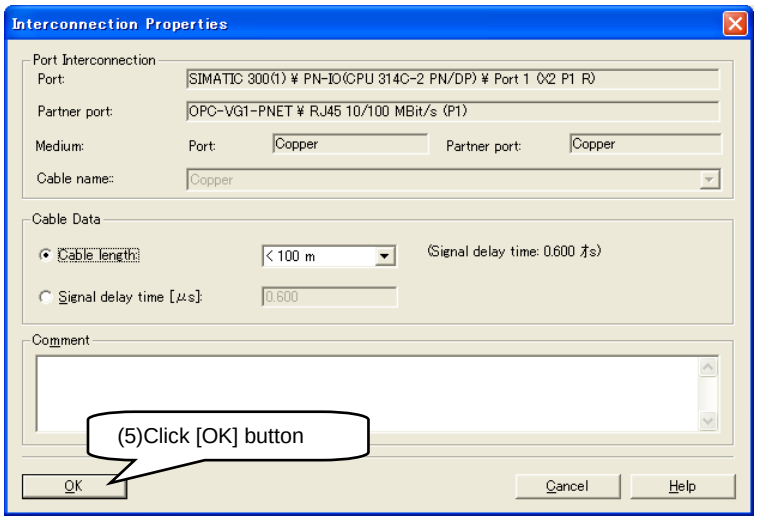
Note The following description is merely one example of the PROFINET-IRT configuration and in fact the display and setting method may be different according to master device. For details of setting method, OB and SFC please refer to STEP7 user's manual or contact SIEMENS directly.

(1) Run [PROFINET IO Topology] from PROFINET-IO-System menu in HW Config.

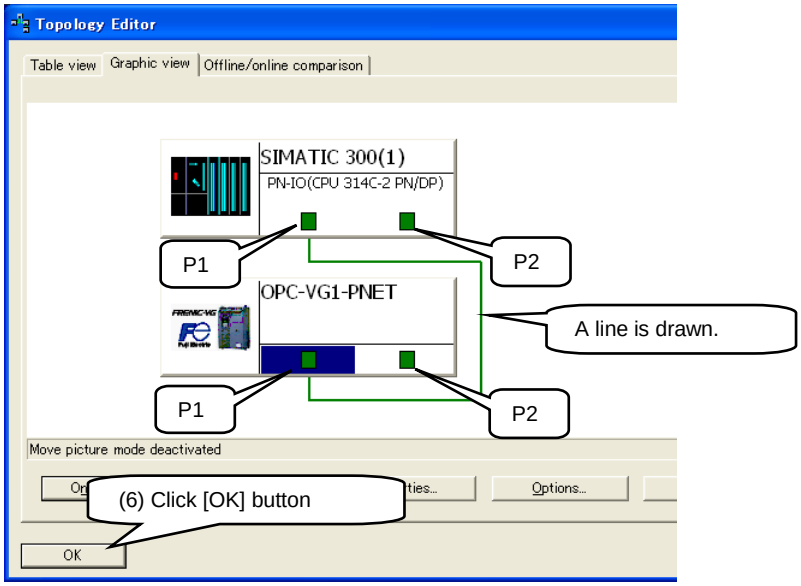


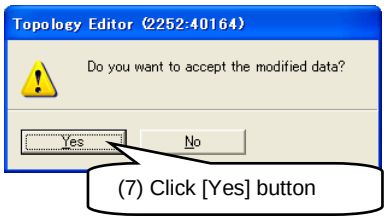
Setup the topology in [Graphic view] tab of [Topology Editor]. Make sure the configuration match the actual PROFINET cable connection.



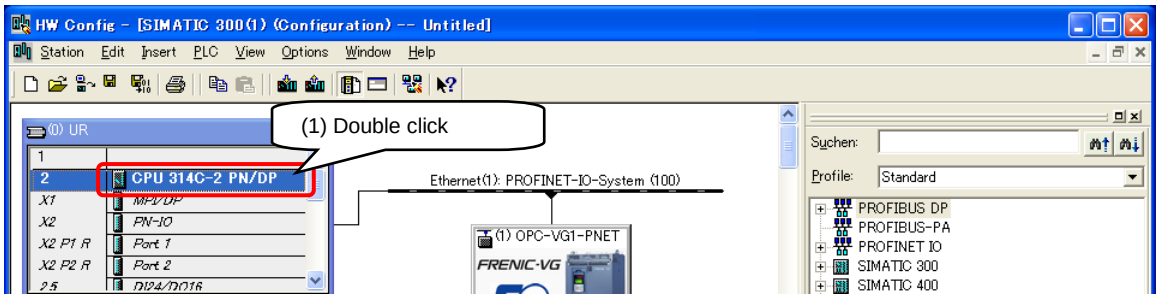


The figure below is an example of P1 of PLC connected to interface card P1.

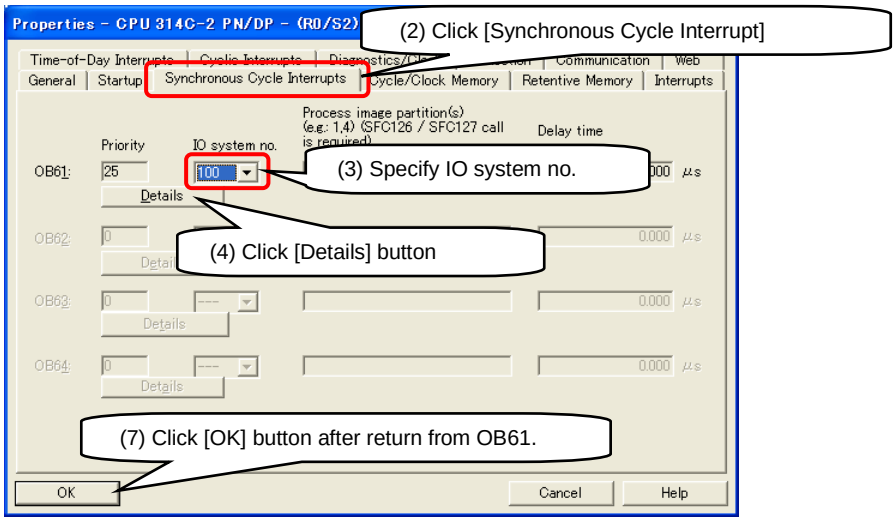




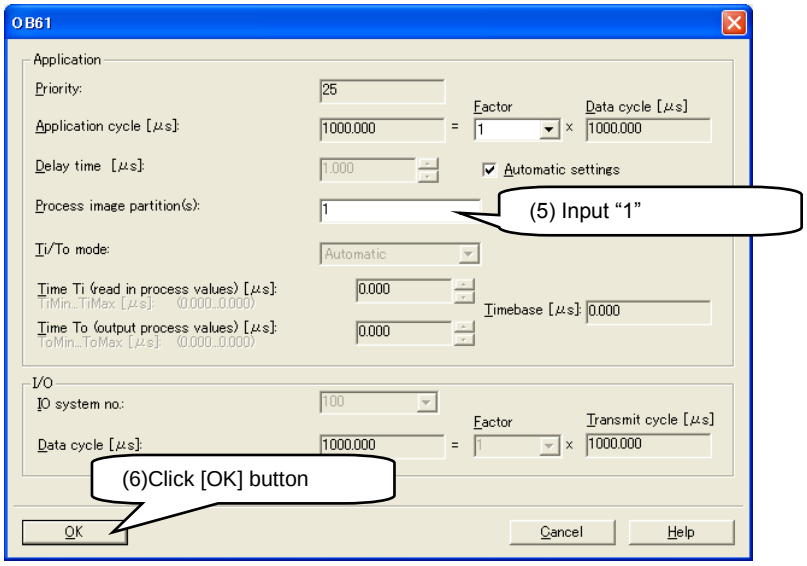
(2) Change property of master device.



Select [Synchronous Cycle Interrupts] tab and specify the IO system no. for OB61, then click [detail] button.

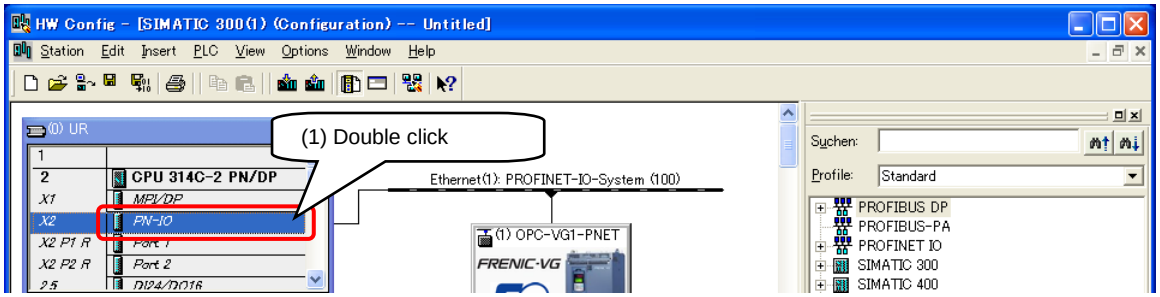


Input 1 into [Process image partition(s)] and click [OK] button in OB61 window.

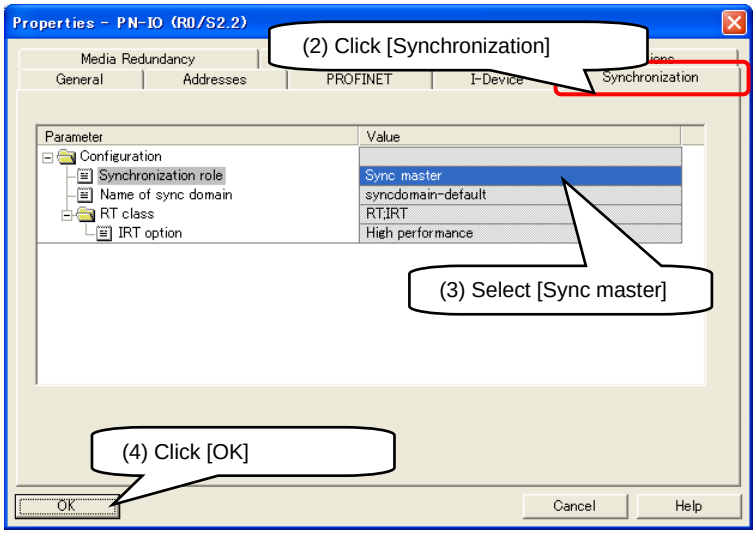


Click [OK] again after returning to Properties window.

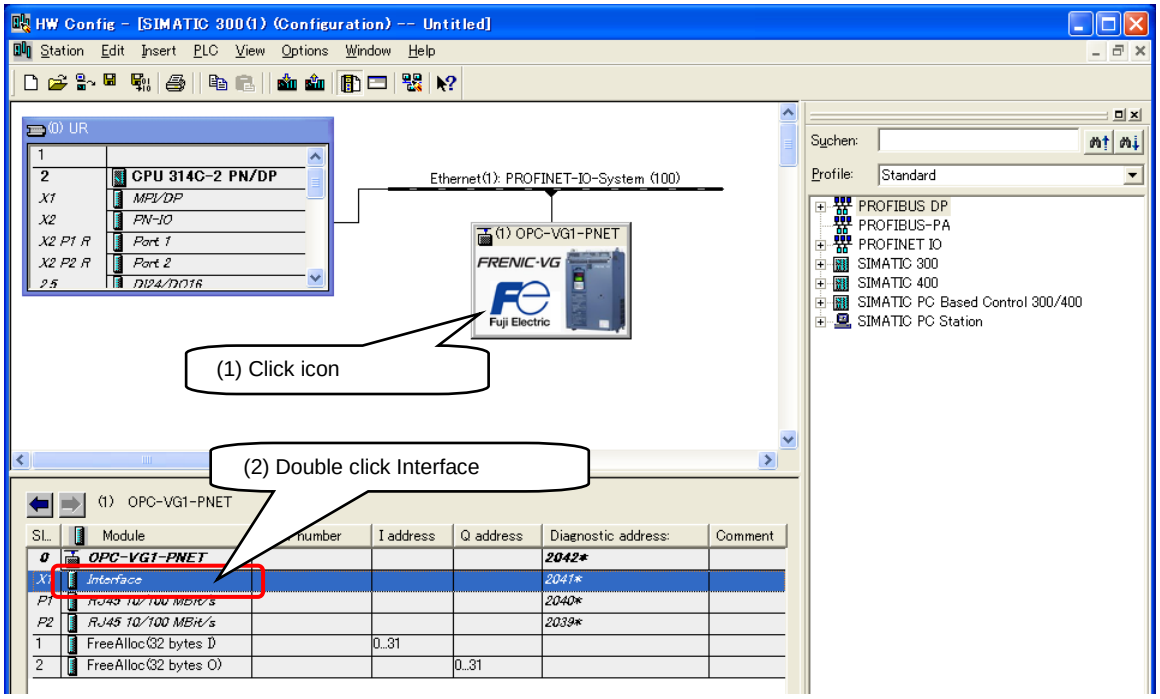
(3) Change the property for PROFINET communication of master device.



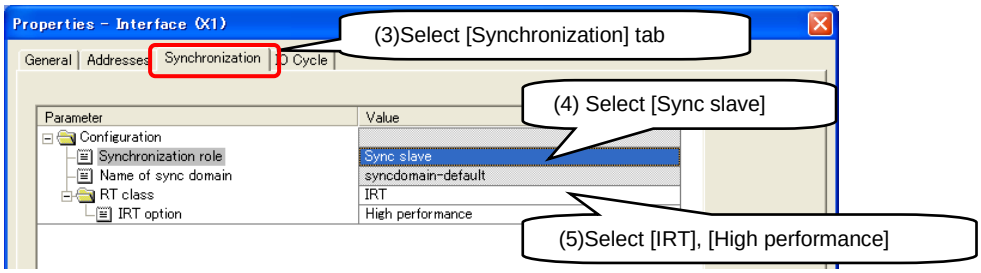
Select [Synchronization] tab, and specify [Synchronization role] as [Sync master] then click [OK].



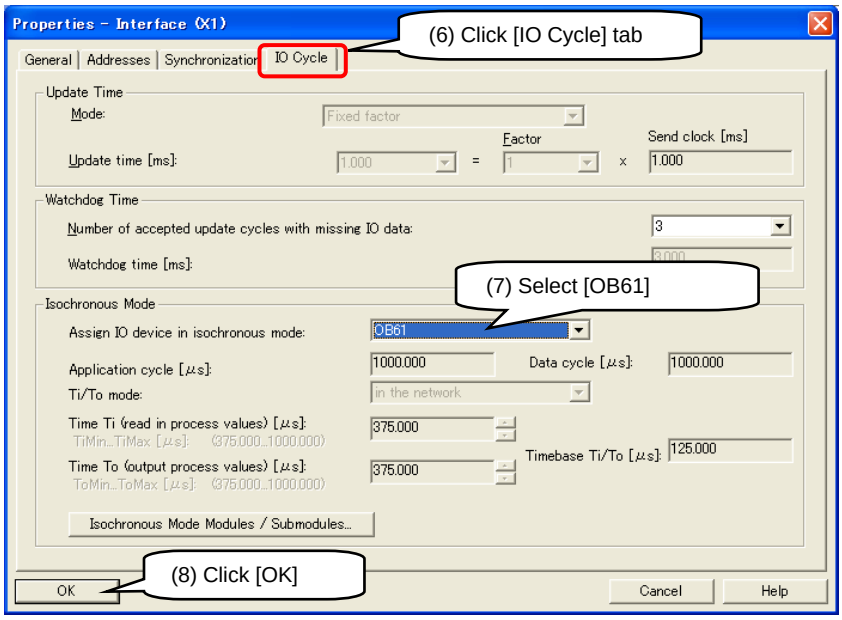
(4) Change property of inverter PROFINET communication.



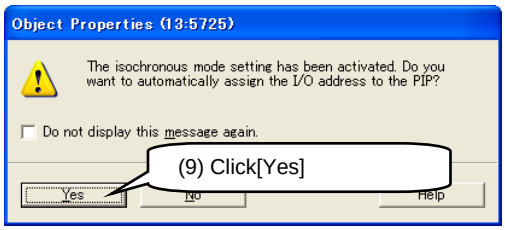
Select [Synchronization] tab and do the following configuration:
Synchronization role = Sync slave, RT class = IRT, IRT option = High performance



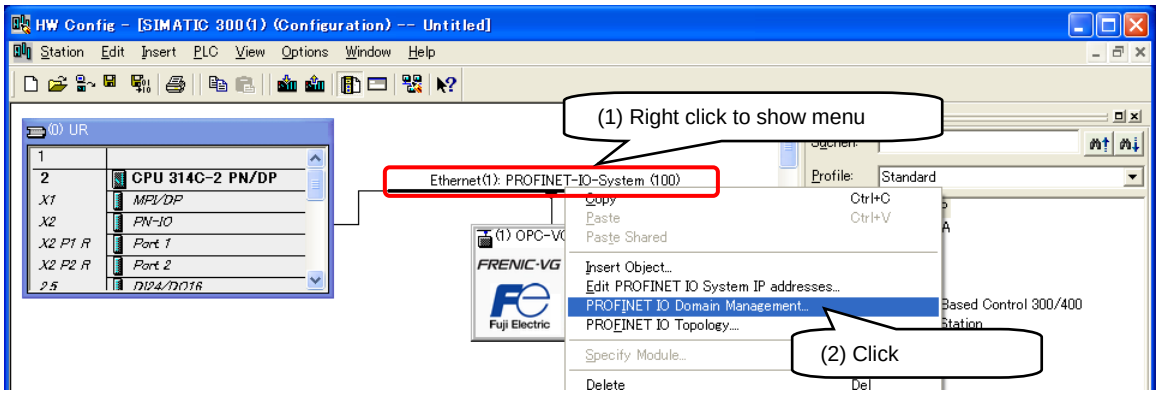
Select [IO Cycle] tab, specify [Assign IO device in isochronous mode] as [OB61] and then click [OK].



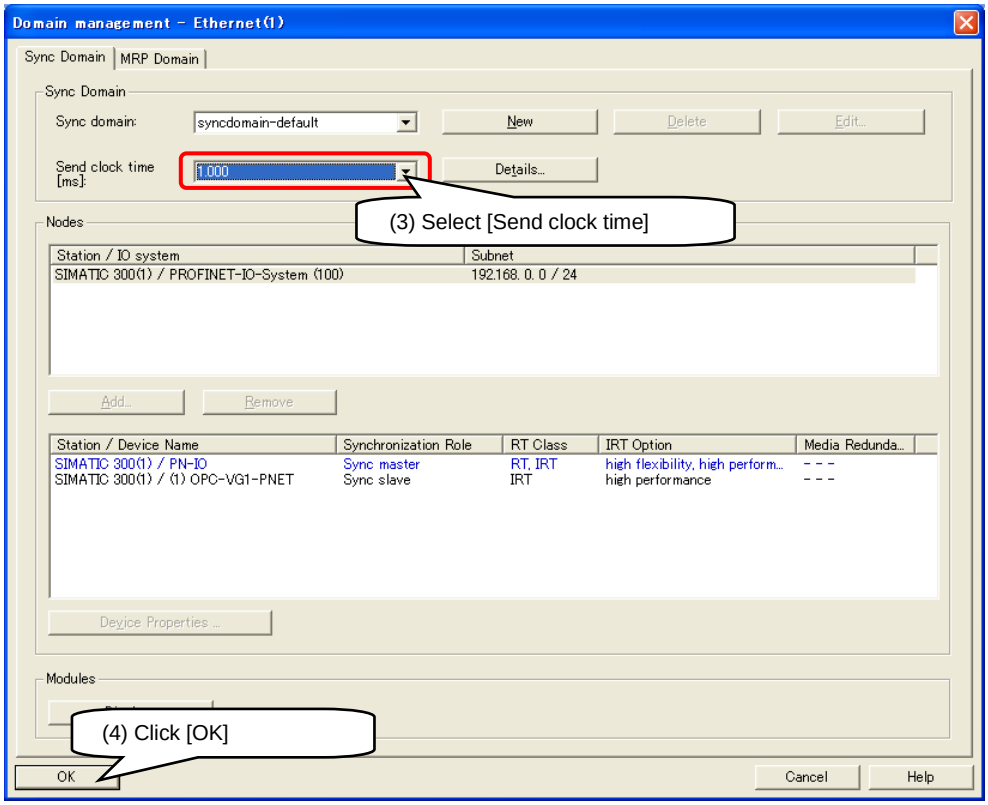
Click [Yes] button if the following window emerges.



(5) Click [PROFINET IO Domain Management] in the menu of [PROFINET-IO-System].

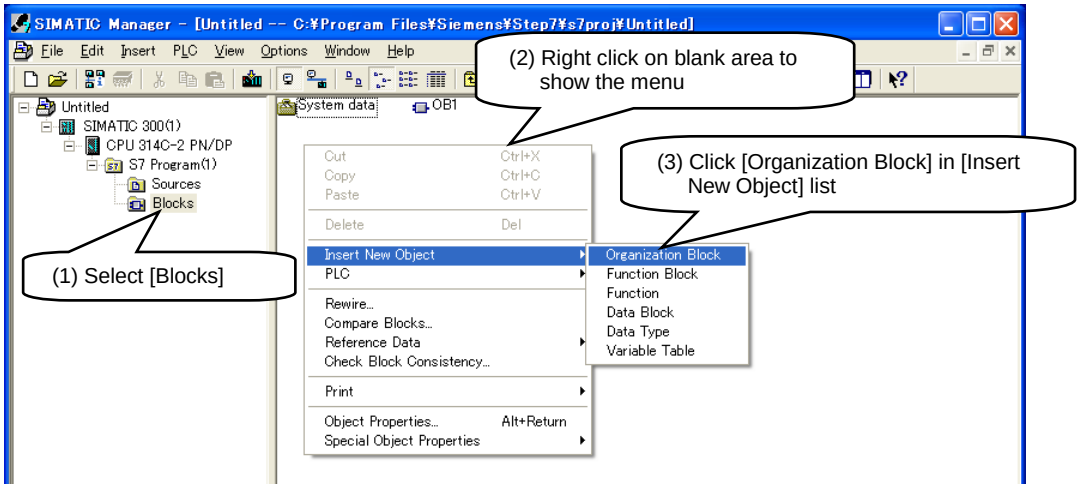


Select [Send clock time] in [Domain management] window and then click [OK].

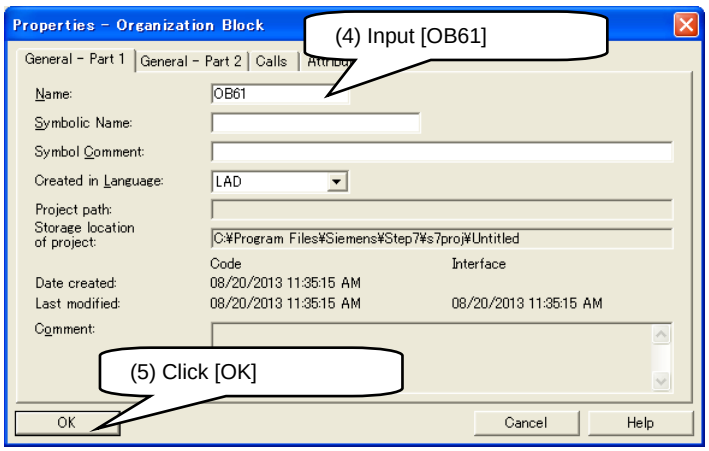


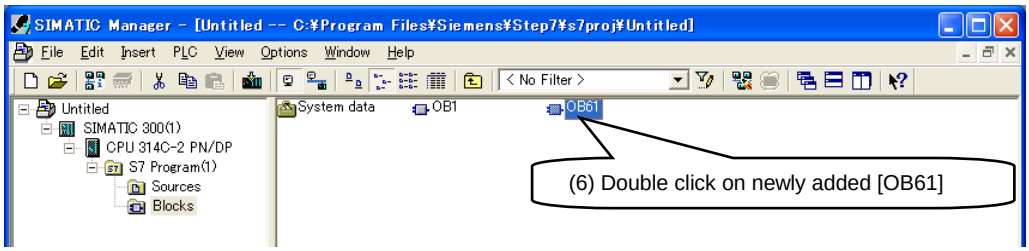
Finally perform [Save&Compile] and [Download to Module] following the procedure described in [3-6-1 Configuration of PROFINET master device on STEP7].

(6) Insert [OB61].

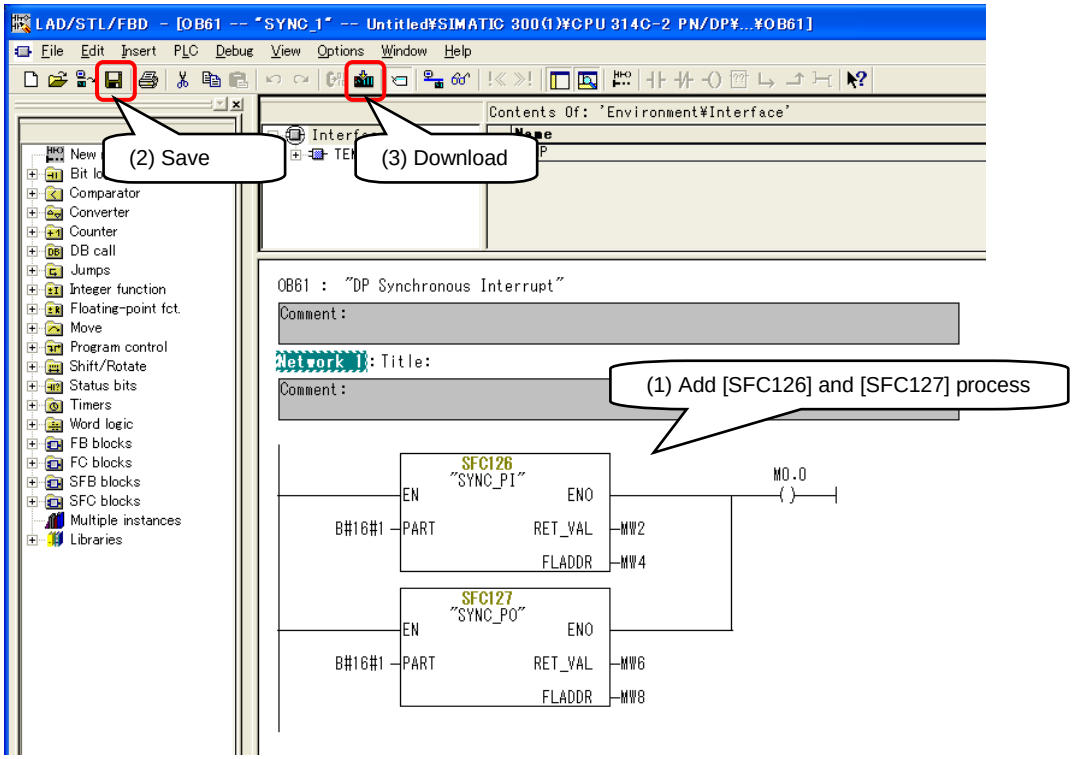


Input [OB61] into [Name] column and then click [OK].





Add SFC126 and SFC127 process to renew PIP1 in [OB61] and then click [Save]. After that please click [Download] to download newly created [OB61] into the PLC.



By far all the configuration has been completed.

For details of setting metheds and SFC please refer to STEP7 user's manual from SIEMENS or directly contact SIEMENS.

3-8 Asynchronous communication

3-8-1 Overview of asynchronous communication

Data interchange of inverter function codes and parameters of PROFIdrive can be performed with asynchronous communication.

The flowchart of asynchronous communication is shown as in Figure 3-15. Master sends the [Write request] (parameter access request data) to slave, and slave replies with [Write response].Then master sends [Read request] and slave replies with response data of parameter access in [Read response].

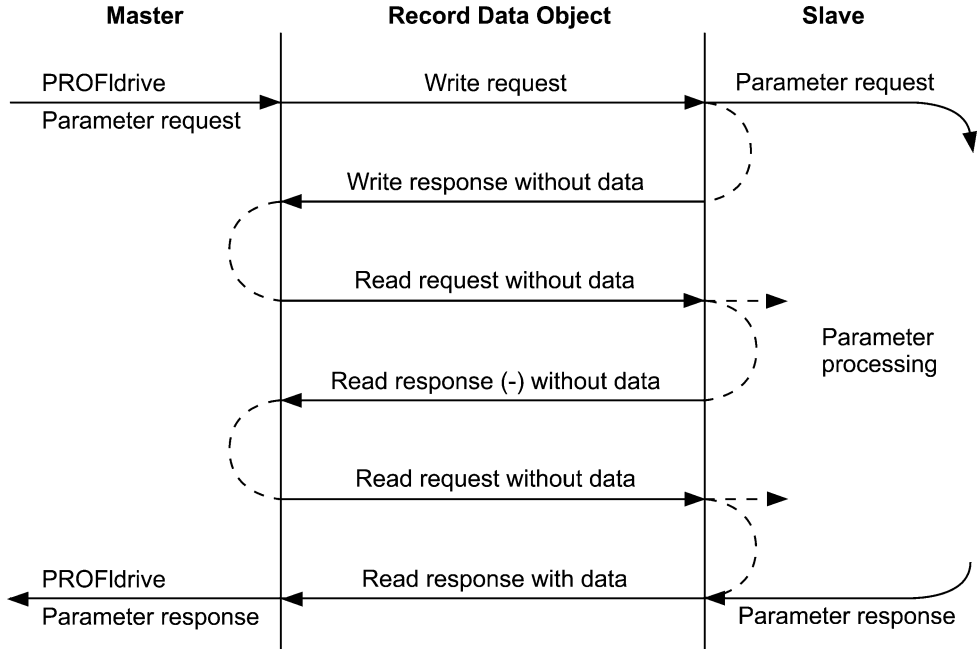


Figure 3-15 Flowchart of asynchronous communication

Note When writing function codes or PNU with asynchronous communication, all written data is saved in inverter internal RAM instead of nonvolatile memory (EEPROM). Therefore data will be ereased if inverter is powered off. To save those data it is recommended to set function code H02 = 0 -> 1 to perform [all save] so that all data in RAM will be saved into EEPROM.

3-8-2 Asynchronous communication through STEP7

Asynchronous communication can be achieved by using SFB52 and SFB53 in STEP7.

Note This description is for communication between PROFIBUS master and Fuji inverters. For details of SFB52 and SFB53 please refer to STEP7 user's manual or directly contact SIEMENS.

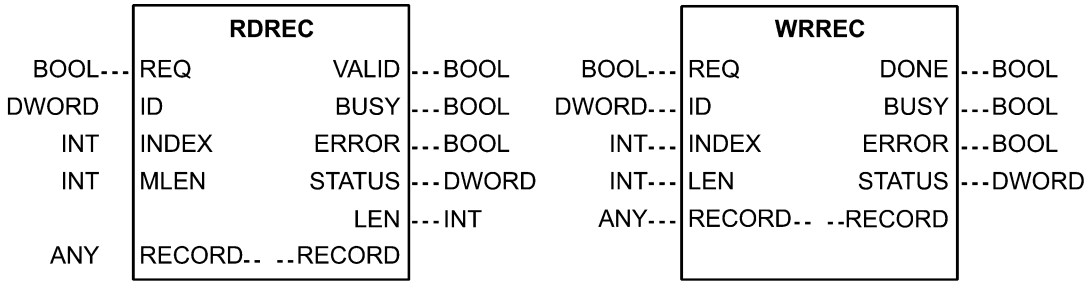


Figure 3-16 SFB52(RDREC)と SFB53(WRREC)

(1) SFB53(WRREC)

SFB53(WRREC) can be used to send [Write request]. Please specify [INDEX] as [0xB02E] when trying to access parameters of Fuji inverter. As the result of [Write request], set parameter access request data will be set into RECORD (refer to following table).

Table 3-18 Parameter access request data

Field	Size	Set range		Remark
		Function code access	PROFIdrive parameter access	
Request No.	Byte	1～255		
Request ID	Byte	0x01:Read parameter 0x02:Write parameter		
DO-ID	Byte	1		fixed as 1
Parameter number	Byte	1		fixed as 1
Parameter property	Byte	0x10：parameter value		
Array element number	Byte	1		fixed as 1
Parameter No.	Word	485No.Upper byte ＋0x0100	PNU No.	
Subindex	Word	485No.lower byte	Subindex	
Format (*1)	Byte	0x42:WORD		
Write data number (*1)	Byte	1		fixed as 1
Write data (*1)	Word	According to parameter		

(*1) Necessary only when Request ID = 0x02 (performing parameter write).

(2) SFB52(RDREC)

SFB52(RDREC) can be used to send [Read request]. Please specify [INDEX] as [0xB02E] when trying to access parameters of Fuji inverter. As the result of [Read response], set parameter access response data will be set into RECORD (refer to following table).

Table 3-19 Parameter access response data

Field	Size	Range	Remark
Response No.	Byte	1～255	Return request No.
Response ID	Byte	0x01: Read parameter OK 0x02: Write parameter OK 0x81: Read parameter NAK 0x82: Write parameter NAK	
DO-ID	Byte	1	
Parameter Number	Byte	0, 1	
Format (*1)	Byte	0x42: WORD 0x44: Error No.	
Read data number (*1)	Byte	1	
Read data (*1)	Word	Parameter value or error No.(Table 3-20)	

(*1) Necessary only when Request ID ≠ 0x02 (performing parameter read).

Table 3-20 Error No.

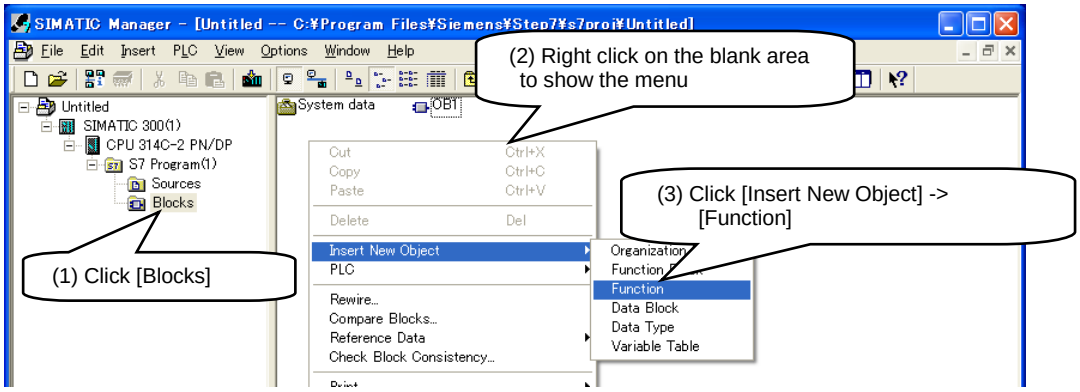
Error No.	Information
0	Specified parameter does not exist
1	Unable to write parameter
2	Parameter is out of range
3	Specified SubIndex is invalid
4	Subindex has been specified in non-array parameter
11	Unable to write parameter during running
104	Busy error during writing a parameter

3-8-3 Application example of asynchronous communication through STEP7

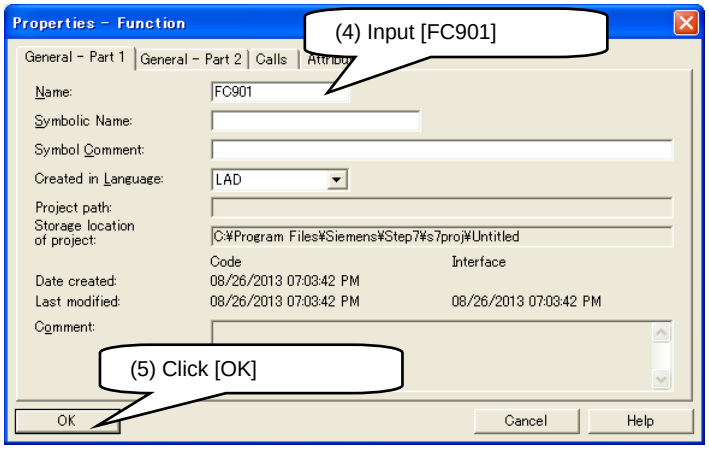
Application example of asynchronous communication by using SFB52 and SFB53 of STEP7 is described in this chapter. Please carry out the following configurations after [3-6-1 Configuration of PROFINET master device on STEP7] is completed.

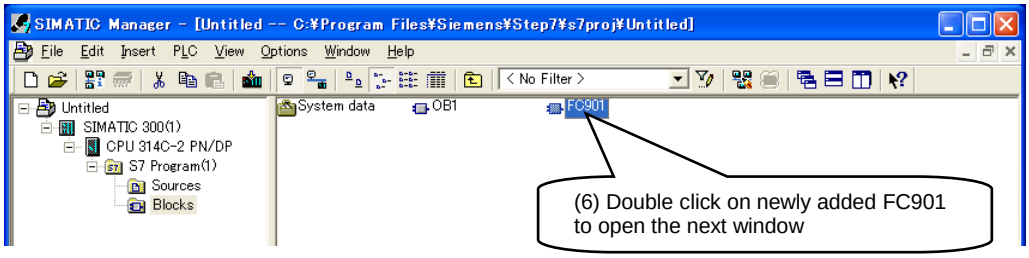
Note This description is for communication between PROFIBUS master and Fuji inverters. For details of SFB52 and SFB53 please refer to STEP7 user's manual or directly contact SIEMENS.

(1) Insert a [Function] into the asynchronous communication.

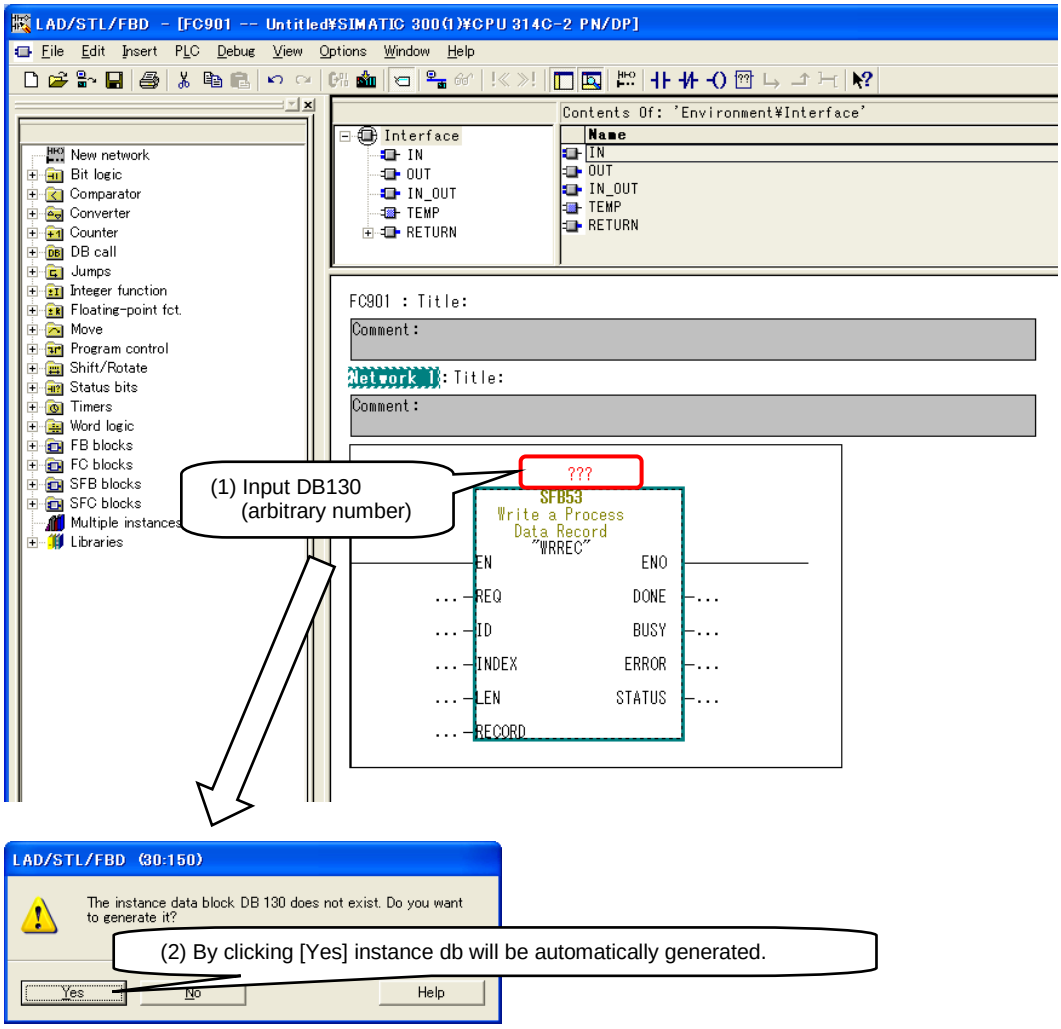


Type in " FC + arbitraty number " (For example FC901) in Name block then click [OK].

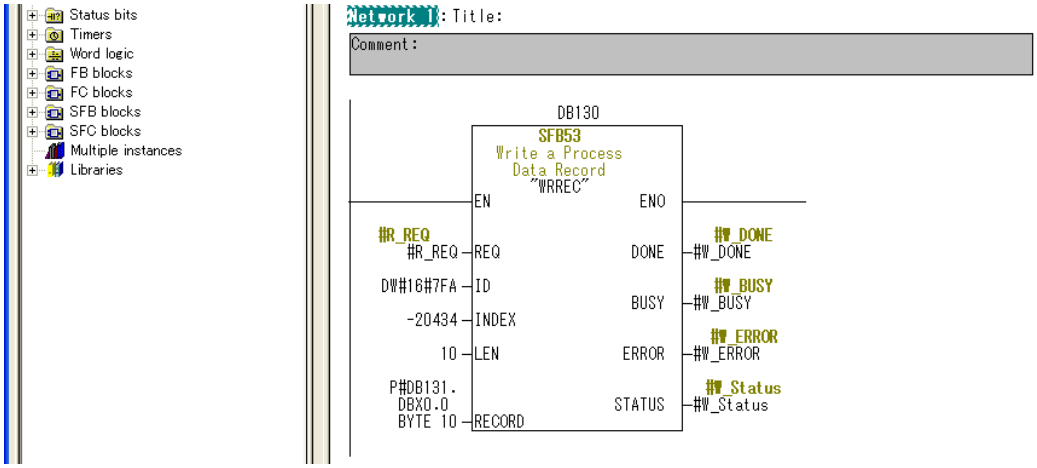




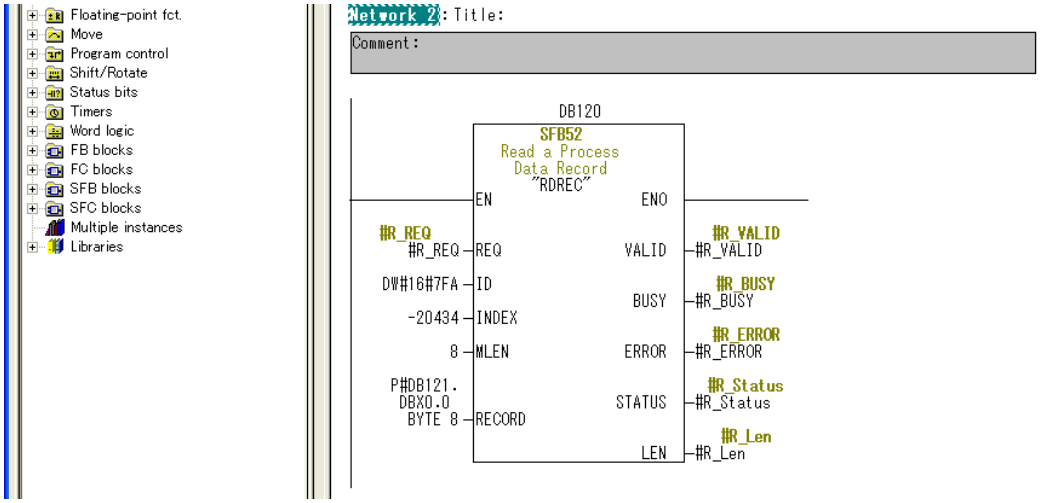
(2) Add SFB53 to FC901, and setup Instance DB (automatically).



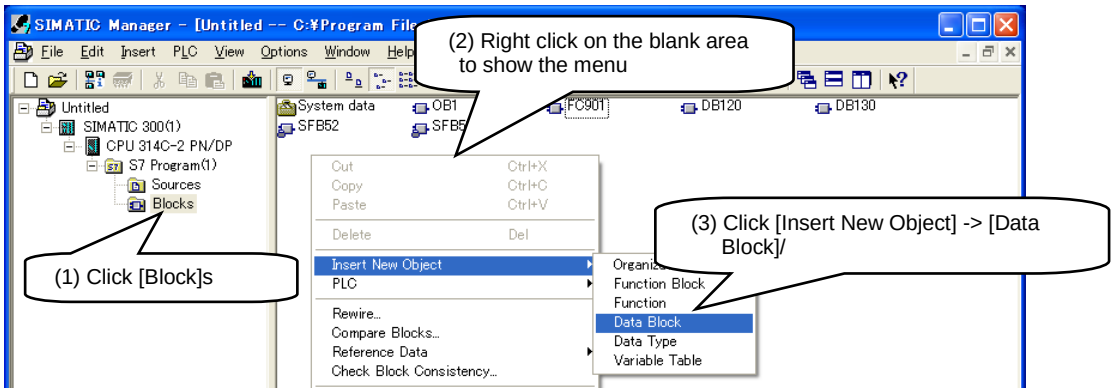
Setup the input/output of SFB53. Set [INDEX] as 0xB02E(-20434), and [RECORD] as parameter access request data(for example DB131). And set [ID] as Slot0 address of inverter (which can be checked in HWConfig).



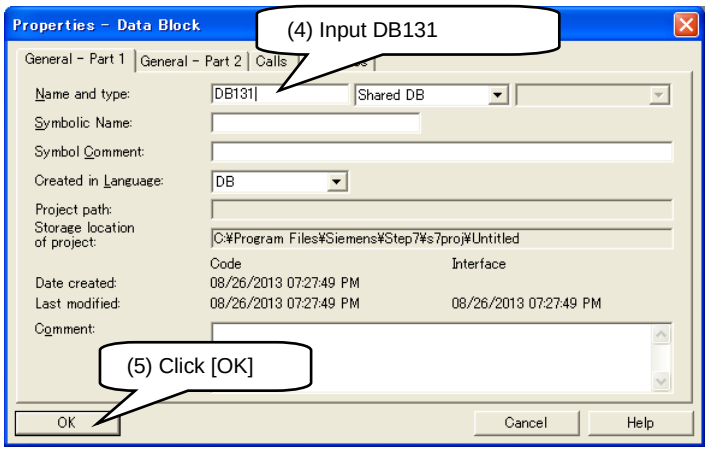
(3) Add SFB52 and setup the Instance DB in the same way with SFB53.



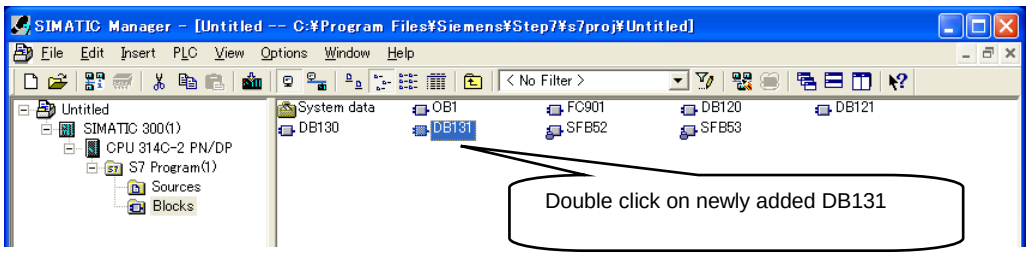
(4) Add DB131 for parameter access request data and DB121 for response data.



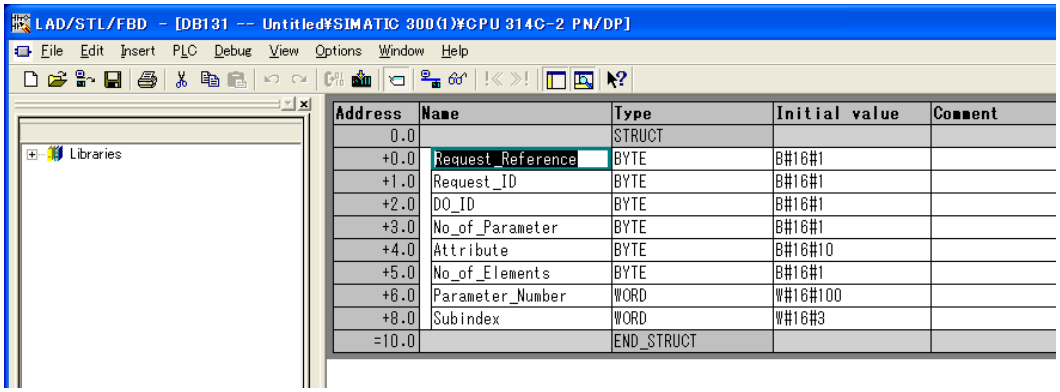
Type in the DB name (For example DB131) specified by RECORD of SFB53 in Name block then click [OK]. Then add the DB (For example DB121) specified by RECORD of SFB52 in the same procedure.



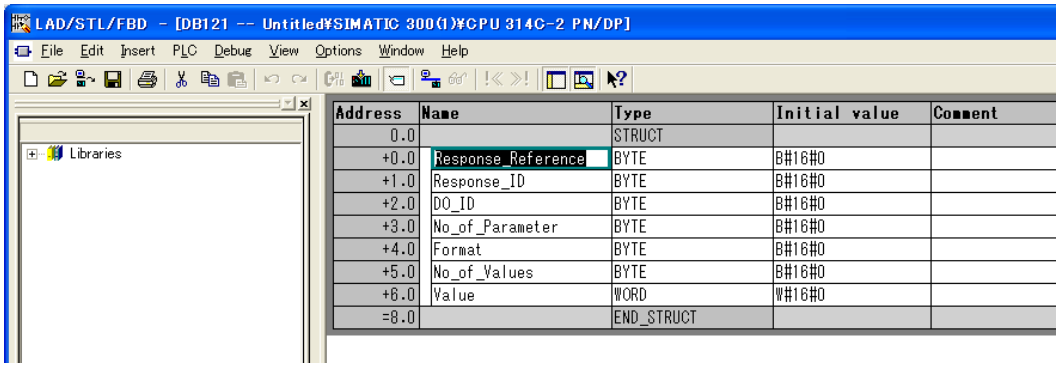
Setup the definition and value of parameter access request data for DB131.



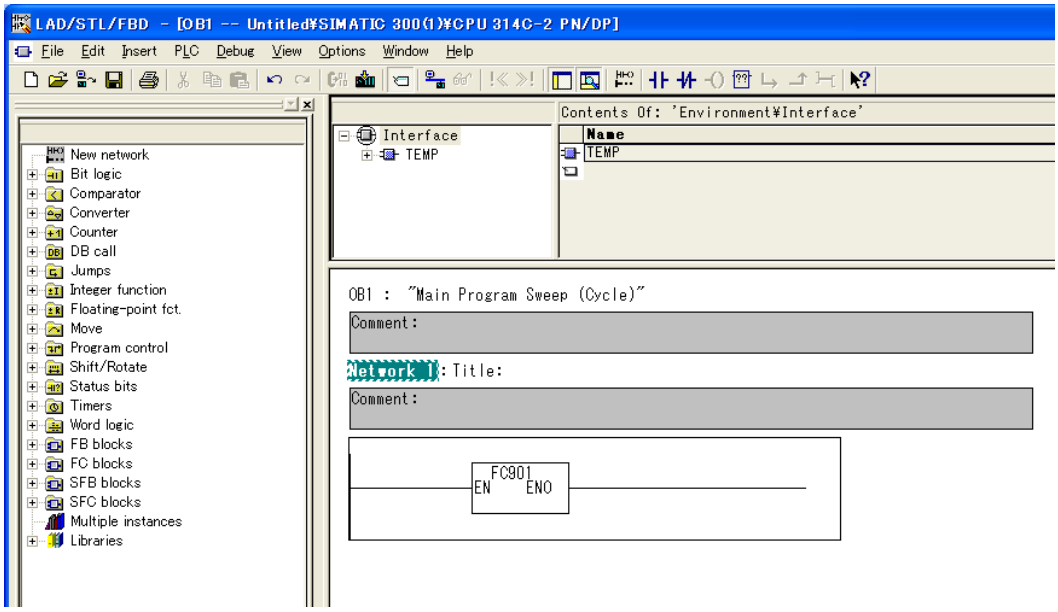
Here is an example of setting request reference of function code F03.



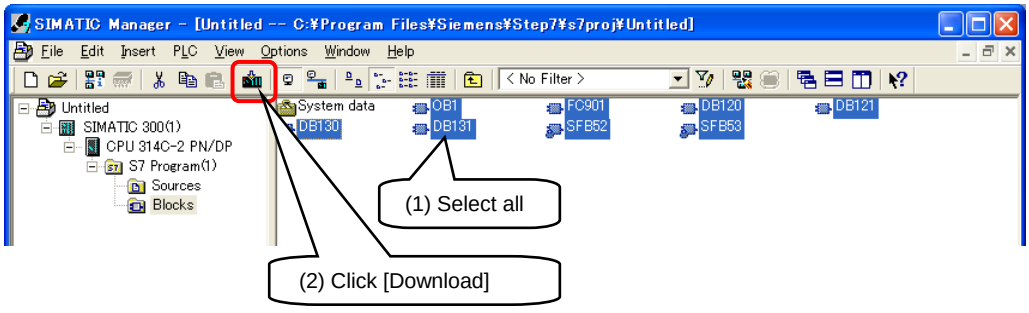
DB121 is defined as parameter access response reference.



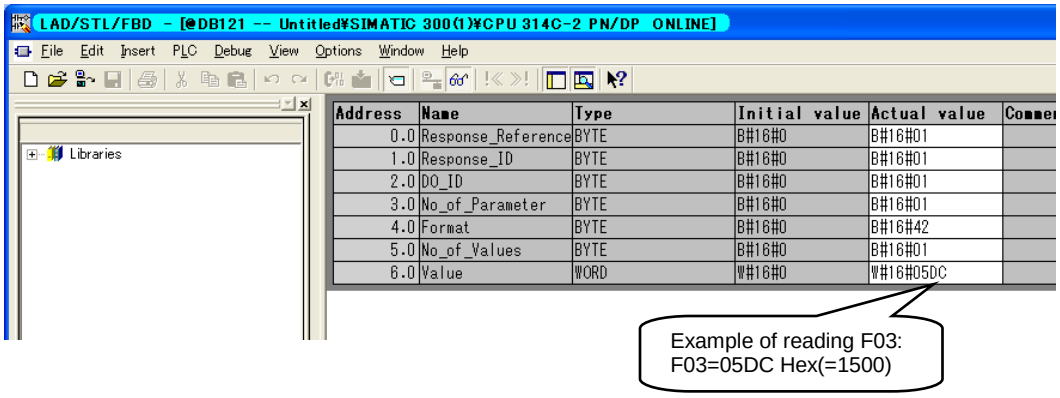
(5) Add FC901 so that it can be processed in OB1.



Download all the blocks that have been changed or newly added into PLC.



Firstly SFB53 is processed (REQ=M30.0=true), then SFB52 is processed (REQ=M20.0=true), threrby function code F03 is read and the response data being read is set into DB121.



3-9 Notes for exchanging interface cards

3-9-1 Notes for exchanging interface cards

The IP address and device name of the card are saved in nonvolatile memory inside. When exchanging interface card mounted in inverter, the IP address and device name change too. Therefore when a malfunction happens on the interface card and it needs to be exchanged, make sure the IP address and device name of interface card are set as the same with those in PLC. To make this exchange job easier, it is recommended to activate the IP address auto assignment function in PLC. The procedure is described later in this chapter.

Note By using the function described below (IP address auto assignment function in PLC), PLC will automatically assign the former setting information into the new interface card during the card exchange. As a result, system can function normally right after the exchange which makes the field installation work much easier. Therefore it is strongly recommended to activate this function (for both PROFINET-RT/IRT).

Note It is also recommended to record the IP address and device name after the setting to make the exchange job easier.

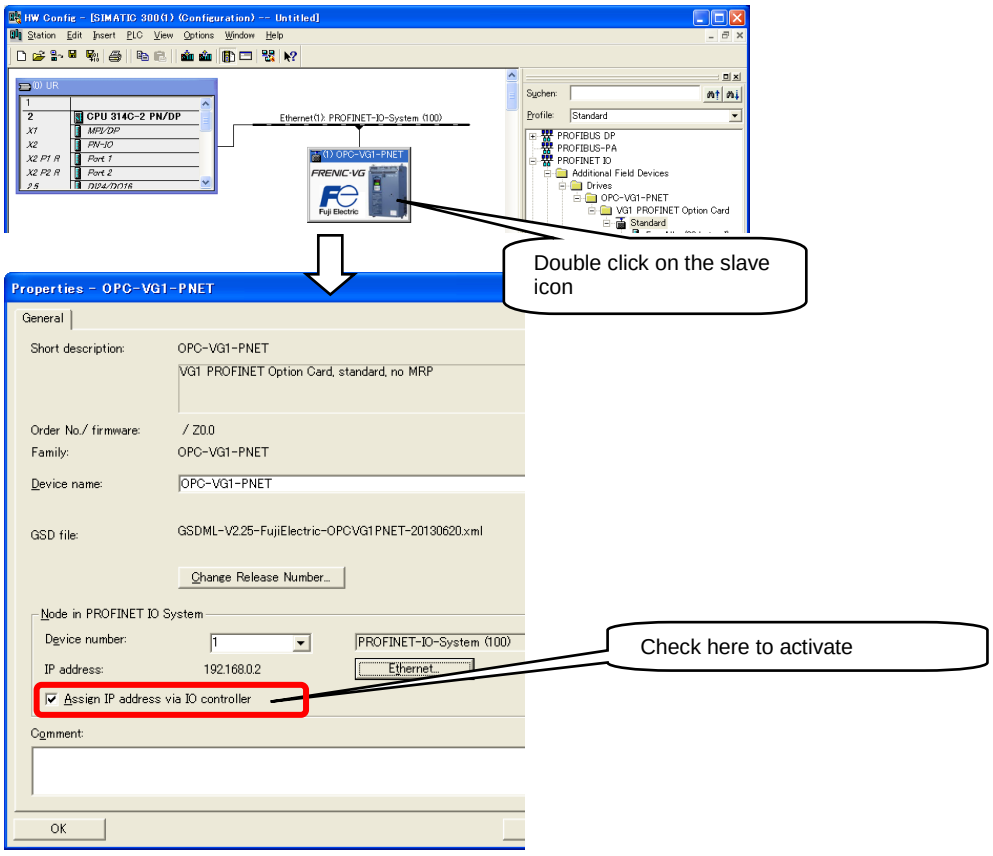
3-9-2 Procedure to activate auto assignment function

(1) Setting in PLC

Please carry out step ① and ② to activate auto assignment function.

① Activate [Assign IP address via IO controller]

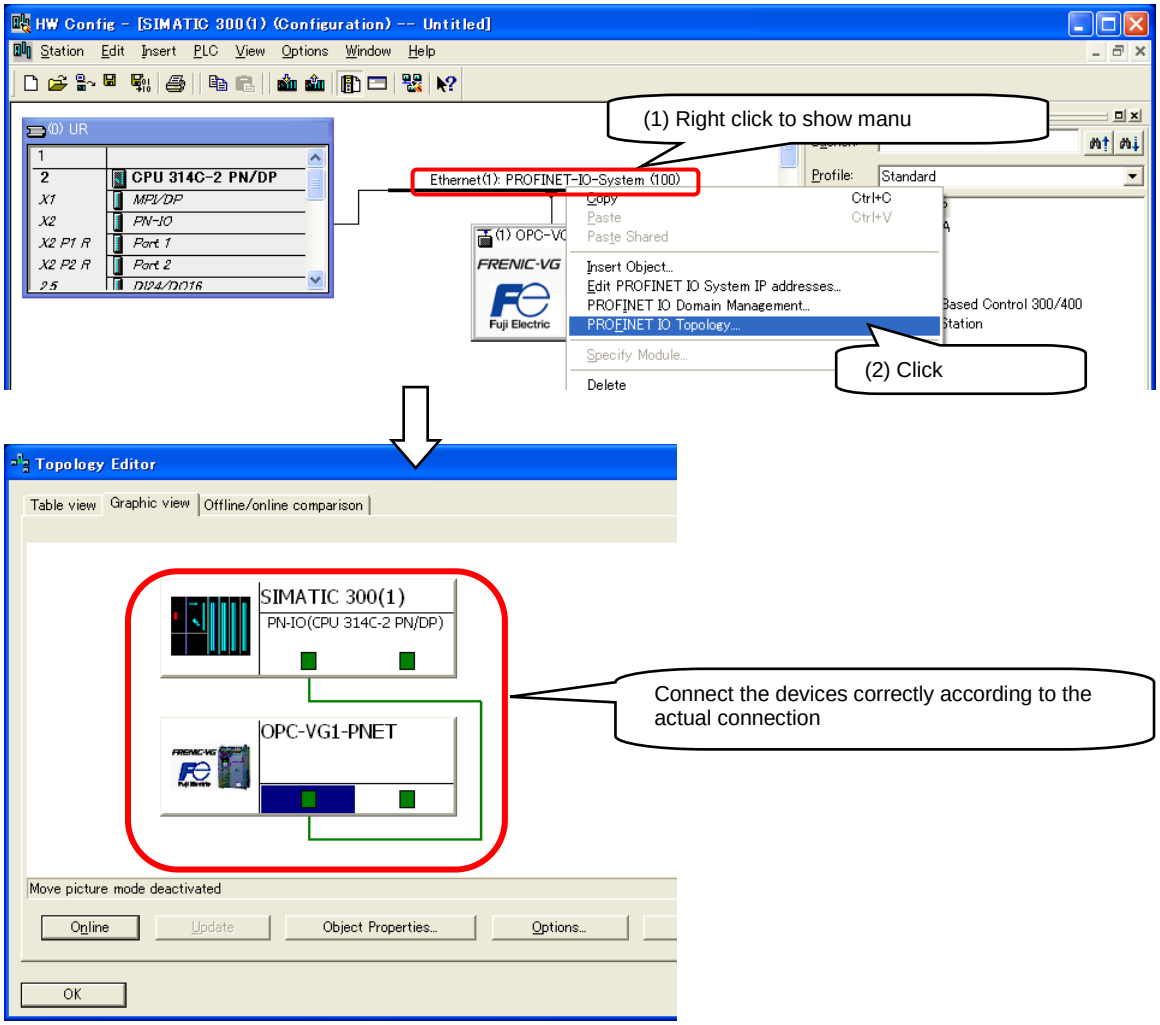
Please carry out following steps in HW Config.



For procedures to move into the window above please refer to [3-6-1 Configuration of PROFINET master device on STEP7].

② Configuration of PROFINET IO Topology

Move into the configuration window by carring out following steps in HW Config.



📖 To move into the window above please refer to [3-7-4 PROFINET-IRT configuration on STEP7].

(2) Configuration of inverters

To activate auto assignment function the following procedures are necessary.

① Clear the device name

In default status the device name is empty (0). In the case that device name has already been set pleas carry out the following preocedure to clear the device name.
Change the function code o116 from [0] to [2] then to [0] again.

Futhermore there is no need to clear IP address.

By carrying out operations above auto assignment function will be activated.

In case that interface card has to be replaced, the IP address and device name will be automatically assigned by PLC when PROFINET communication is established, therefore system can function normally like before.